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NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

ORGAN PIPE CACTUS NATIONAL MONUMENT

December 1994

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NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

ORGAN PIPE CACTUS NATIONAL MONUMENT

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RGAN PIPE CACTUS NATIONAL MONUMENT
Natural and Cultural Resources Management Plan

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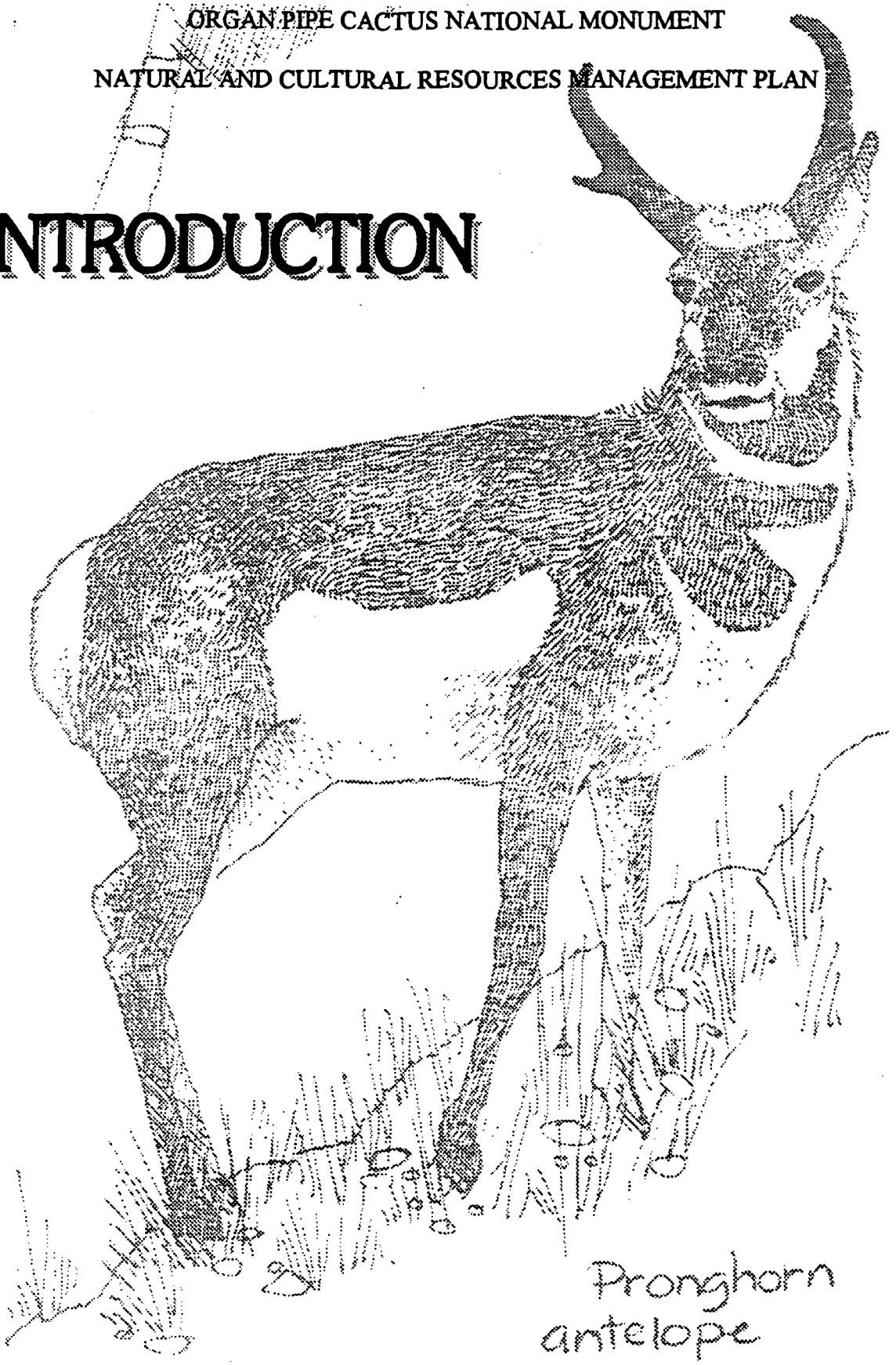
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INTRODUCTION



I. INTRODUCTION

This Natural and Cultural Resources Management Plan (RMP) is a revision of the original 1977 plan, including the environmental assessment (NPS 1977) and subsequent updates. This revision was developed and written by an interdisciplinary team of natural and cultural resources professionals.

The plan was prepared in conjunction with other monument documents in order to be consistent with both the legislative purposes for establishment and with other operation plans. The primary accompanying monument documents include the Land Protection Plan (NPS 1985), the Statement for Management (NPS 1987), and the Water Resources Management Plan (NPS 1992). Other relevant documents include: NPS Management Policies (NPS 1988), NPS-28 Guideline: Cultural Resources Management (NPS 1985); NPS-77 Guideline: Natural Resources Management (NPS 1991) and NPS-75 Guideline: Natural Resources Inventory and Monitoring Guideline (NPS 1992).

The RMP, in conjunction with other planning documents and directives, guides the resources management program at Organ Pipe Cactus National Monument (ORPI). The plan identifies resources issues and threats and proposes actions needed to address each issue.

I.A. Organ Pipe Cactus National Monument

Organ Pipe Cactus National Monument was established by Presidential Proclamation No. 2232 on April 13, 1937. The proclamation states that since "certain lands in the State of Arizona contain historic landmarks, and have situated thereon various objects of historic and scientific interest," it is therefore "in the public interest to reserve such lands as a national monument, to be known as Organ Pipe Cactus National Monument..." Refer to the vicinity map of Organ Pipe Cactus National Monument (Figure 1) for site location.

The Proclamation also included Organ Pipe Cactus National Monument as a unit of the National Park System. The general statutes that guide National Park Service land management are applicable at Organ Pipe Cactus National Monument. Among the most important of these are the National Park Service Organic Act (16 U.S.C. sec 1 et seq.) and the Act for Administration (16 U.S.C. 1a-1). These two acts also give the Secretary of Interior the authority to promulgate rules and regulations to effectively manage the National Park System.

Through the National Park Service Organic Act, Congress set forth the purpose of the National Park System: "To conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and such means as will leave them unimpaired for the enjoyment of future generations..." (16 U.S.C. sec 1)

The monument was established as a Biosphere reserve on October 26, 1976. Biosphere reserves are set aside by the Man and the Biosphere Programme, which is an international program of scientific cooperation dealing with human/environmental interactions throughout all of the geographic and climatic areas of the world. As of 1990, there were more than 285 biosphere reserves worldwide, of which 46 were in the United States (DOS 1990). The purpose of these biosphere reserves is to establish a network of protected samples of the world's major ecosystem types. Each reserve is devoted both to the conservation of nature and to scientific research, and provides a standard against which human impact on the environment can be measured.

On November 10, 1978, Public Law 95-625 designated within the monument 312,600 acres as wilderness and 1240 acres as potential wilderness. Wilderness is an area "...where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain..." and "...which is protected and managed so as to preserve its natural conditions..."(P.L. 88-577). Approximately 95% of the monument is included in the Organ Pipe Cactus Wilderness. Management of this area must comply with the Wilderness Act of 1966 and NPS wilderness management policies. National Park Service Management Policies (USDI,

NPS 1988) state "Wherever a wilderness area is designated within a park, the preservation of wilderness character and resources becomes an additional statutory purpose of the park."

I.A.1. Monument Purposes

Based on the establishing proclamation, biosphere reserve, and wilderness designations, the following purposes were identified for Organ Pipe Cactus National Monument in the General Management Plan (GMP) Briefing Package (NPS 1990):

- Perpetuate for future generations a representative sample of the natural and cultural resources of the Sonoran Desert and provide for public understanding, use and enjoyment of same.

- Serve as a natural laboratory for understanding and managing Sonoran Desert ecosystems.

- Serve as a baseline indicator against which environmental changes can be identified.

- Preserve for future use and enjoyment the character and values of designated wilderness within the monument.

I.A.2. Summary of the Significant Resource Values of Organ Pipe Cactus National Monument

The GMP Briefing Package identifies the following significant resources:

- Globally significant, pristine Sonoran Desert ecosystem that has been continuously researched for fifty years and has been designated a Biosphere Reserve under the International Man and the Biosphere Programme.

- The most pristine and biologically diverse area of the Sonoran Desert occurring within the United States.

- A protected ecosystem providing habitat for highly diverse flora and fauna, including threatened or endangered plant and animal species or species of special concern.

- A protected natural area, with wilderness character, that provides opportunities for solitude and primitive recreation, enjoying the night sky and spiritual replenishment in a Sonoran Desert setting.

- Expansive vistas of pristine Sonoran Desert landscapes, including such elements as dramatic mountains and plains, eroding bajadas and alluvial fans, and magnificent specimens of columnar cacti.

- Cultural resources that reflect long, widespread, and diverse occupations by Native American, Spanish, and Anglo groups.

- The interaction of three cultures within the monument is geographically and internationally significant.

I.A.3. Resources Management Objectives

I.A.3.a. Natural Resources

- Establish and maintain baseline data on the condition of Sonoran Desert ecosystems.

- Achieve, for effective protection, sufficient scientific understanding of Sonoran Desert ecosystems.

- Restore and preserve intact a significant and representative portion of the Sonoran Desert ecosystem.

- Increase, to the extent feasible, the land area within the monument that qualifies for wilderness designation.

I.A.3.b. Cultural Resources

- Recognize the significance and importance of the full continuum of cultural resources within the monument in the context of natural resources.

• Achieve, for effective protection, sufficient understanding of the monument's cultural resources.

I.B. The Resources Management Planning Process

National Park Service policies require that each unit of the National Park System develop and implement a land and water use management plan, called the General Management Plan (GMP). Work on Organ Pipe's GMP and associated the Environmental Impact Statement was initiated in 1988. The GMP provides the National Park Service with the overall basis for managing the monument's resources, uses and facilities. Included are specific provisions for addressing: public outdoor recreation benefits; preservation of scenic, scientific, and historic features contributing to public enjoyment; and such use of natural resources as is consistent with, and does not significantly impair, public recreation and protection of scenic, scientific, and historic features contributing to public enjoyment.

More specific plans must be developed to address specific resources needs when warranted. The Natural and Cultural Resources Management Plan (RMP) documents a park's natural and cultural resources, describes and evaluates its current resources management activities and prescribes an action program based on legislative and executive mandates, NPS management policies, management zoning and other provisions of related planning documents. The RMP is a required document. It is both a long-range plan and one of the fundamental tools used in preparing budgets and allocating money and staff to parks. According to RMP Guidelines (NPS 1989) the document must:

• Summarize the resource values and purposes of the park.

• Analyze the significance of resource management needs and problems and rank them in importance.

• Propose specific actions, including dollars and FTEs, for dealing with the most important and urgent needs and problems.

• Present a multi-year program to achieve measurable progress in accomplishing the proposed actions.

• Identify and program scientific research to support management actions;

• Provide for an annual review and recording of accomplishments to measure the effectiveness of actions.

• Provide the forum for an interdisciplinary approach to the park's resources management issues.

• Provide for the transfer of information on the park's resources management program to the park staff and public.

In 1977, the first Natural and Cultural Resources Management Plan was developed for Organ Pipe Cactus National Monument. This plan has been updated and amended as appropriate. New systemwide standards were developed for Resources Management Plan Revisions in 1987, with which all parks must comply. This revision represents a significant modification of the original RMP. In conjunction with the RMP revision, a Water Resources Management Plan (WRMP) for Organ Pipe was developed and approved in 1992. The plan provides management with alternatives to guide the protection, conservation, use, and management of water resources.

I.C. Land Status, Uses, and Planning Relationships

The monument is operated under the Management Policies of the Executive Branch of the United States Government and is administered by the National Park Service. It contains about 516 square miles or 330,689 acres. Preserving elements of the Sonoran Desert, it is situated approximately 150 miles southwest of Phoenix and approximately 150 miles west of Tucson, in Pima County, Arizona's 2nd Congressional District.

Most of the land in the monument meets the criteria for natural zone designation. Minor areas fall into either development or special use zones. Land within the monument is classified as follows:

- Natural Zone. Land in this zone is unaltered or largely unaltered and is returning to a natural state. Minor visitor use facilities, historic remains, and management facilities are contained in this general zone. The wilderness subzone accounts for the majority of these lands and constitutes approximately 95 percent of the monument's acreage. The subzones are:

  - Natural Environment Subzone. (14,551 acres) This subzone includes the lands between wilderness units, along the international boundary, and outside the developed area. It is managed to maintain natural resources and to provide visitor access to and enjoyment of those features.

  - Wilderness Subzone. (313,840 acres) This subzone includes 312,600 acres of land designated as wilderness in November, 1978, as well as 1240 acres of potential wilderness, which is being managed as wilderness. Lands in this subzone are managed in accordance with all wilderness legislation.

  - Historic Zone. Those sites which are on the National Register of Historic Places or have pending nominations to the National Register are in this zone. The sites lie in either the wilderness or natural environment subzones and are included in the acreage of those subzones.

- Development Zone. (520 acres) This zone covers the main visitor use area, support facilities, and the existing development area at Lukeville. State Highway 85 lies within the zone.

- Special Use Zone. This zone covers lands which are inholdings and supports uses not normally found in a natural area. It contains three subzones:

  - Private Development Subzone. (65 acres) This subzone includes lands in Lukeville. Lukeville lands are intensively developed to serve visitors and local residents in Mexico.

  - State Lands Subzone. This subzone includes two school sections: Section 2, R5W, T18S, and Section 36, R7W, T14S. This subzone's 1280 acreage is included in the Natural Zone.

  - U.S. Customs and Immigration Reserve Subzone. (8 acres) The border station and support facilities located in Lukeville are in this zone.

The monument shares a thirty mile common boundary with the state of Sonora, Mexico, to the south. The majority of the adjacent Mexican land is undergoing intensive agricultural development and urbanization. Groundwater to irrigate crops in the Sonoyta Valley is being pumped out of the aquifer at 2.5 times the recharge rate (Brown 1988). This aquifer is shared by the monument, and the subsequent lowering of the water table poses a major threat to its natural resources.

To the west and northwest, a 26 mile border is shared with the Cabeza Prieta National Wildlife Refuge. The refuge is administered by the United States Fish and Wildlife Service. Approximately 860,000 acres of Sonoran Desert are encompassed in the refuge; 93% of which is designated as wilderness. Over 95% of the refuge is within the boundaries of the Barry M. Goldwater Air Force Range. Many low flying aircraft transit the refuge on their way to air-to-air bombing and gunnery

ranges located to the north of the refuge. A Natural Resources Management Plan for the range was developed in 1986, with a stated goal of protection of environmental values. Implementation of this goal consists of managing the natural environment of the range as a reserve in which natural processes prevail. All applicable federal, state, and county laws, regulations, and ordinances are enforced on the refuge.

The Tohono O'odham Reservation borders the east and extreme northeast for approximately 33 miles. Overall, the reservation encompasses 2.8 million acres. Approximately 16,531 tribal members live on the reservation, scattered throughout several villages (AZ Dept. of Commerce 1988). The policy of the Bureau of Indian Affairs Tohono O'odham Agency is one of tribal self-determination and full tribal involvement in all phases of natural and human resources development on the reservation.

To the north, the monument shares a twelve mile boundary with the Bureau of Land Management (BLM). This land is primarily used for livestock grazing.

It is envisioned that the GMP will provide direction for dealing with adjacent land issues, including water resources concerns. A major goal of the GMP is to incorporate the Man and the Biosphere philosophy into most management concerns. This involves recognizing that problems such as the water drawdown in the Sonoyta Valley aquifer are issues which affect both the monument and Mexico, and that cooperation and understanding are paramount to deriving solutions.

I.D. Identification of Resources Issues

As with many other national park areas, the greatest threats to the resources of Organ Pipe Cactus National Monument are a result of the effects of development on adjacent lands. The primary resources management concern is the continued urbanization and agricultural development occurring near the southern boundary, in the neighboring state of Sonora, Mexico. Of concern to management is the effect on native plants and animals of herbicide and pesticide drift, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. A primary concern is that continued or increased pumping in Mexico may lower the groundwater table. It may also reduce the hydrostatic pressure at certain locations within the monument, such as at Quitobaquito, where an endangered species, the Quitobaquito desert pupfish (*Cyprinodon macularius eremus*), occurs. As of 1988, there were approximately 22,455 irrigated acres in production in the Sonoyta Valley, supported by 165 wells. Annual groundwater pumpage is approximately 83,160 acre feet, which is 2.5 times the aquifer recharge rate. Although there now exists a moratorium on the drilling of new wells, current wells are pumping at 50% below their potential capacity of 191,000 acre feet (Brown 1988).

Issues relating to water resources include alteration of natural flow regimes and groundwater levels, degradation of park water quality, floodplain management and wetlands protection, water rights, and related resources issues, such as accelerated erosion.

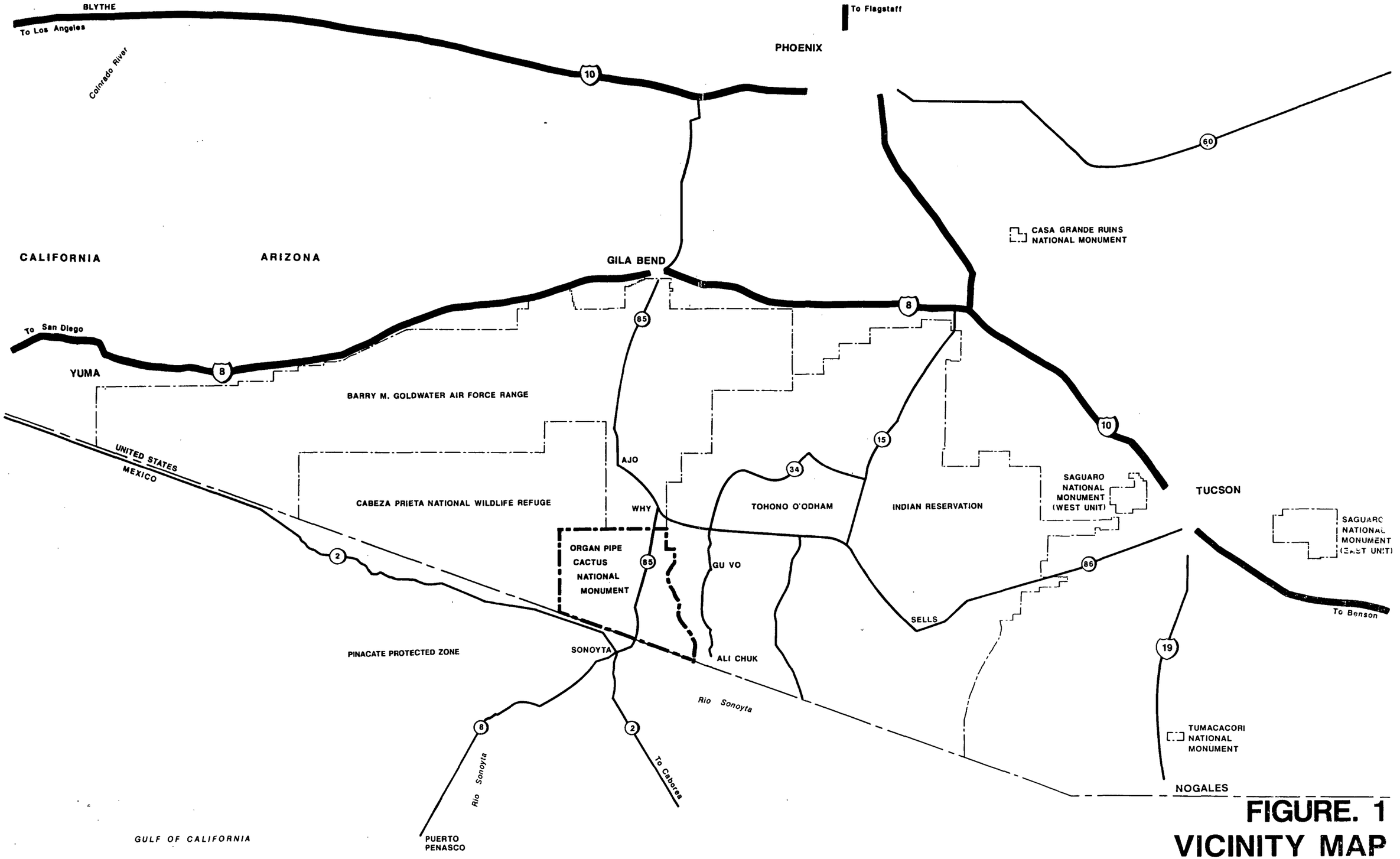
Although a research database exists for the monument, there is still a lack of basic data necessary to fully understand park resources and related threats. In addition, other pressing concerns include the protection of threatened, endangered, and rare plant and animal species and communities, air quality management, evaluation of visitor use impacts and limits, monitoring of ecosystem health, protection and management of wilderness, abandoned mine lands mitigation, control of trespass livestock and revegetation of impacted sites.

Natural, cultural and integrated resources issues affecting Organ Pipe Cactus National Monument have been identified. In this plan, issues are grouped into seventeen subject areas. Background information concerning these issues is presented in Section III, Resources Management Programs.

Program areas and project statement number sequences are presented in Table I.

TABLE I. PROGRAM AREAS/PROJECT STATEMENT NUMBERS

PROGRAM AREA	SUBJECT	PROJECT STATEMENT NUMBERS
Vegetation Management	Natural	N: 001 - 049
Wildlife Management	Natural	N: 050 - 099
Natural Resources Inventorying and Monitoring	Natural	N: 100 - 199
Water Resources	Natural	N: 200 - 249
Threatened, Endangered and Sensitive Species	Natural	N: 250 - 299
Air Resources	Natural	N: 300 - 349
Archeology	Cultural	C: 001 - 049
Historic Resources	Cultural	C: 050 - 099
Program Administration	Integrated	I: 001 - 049
Information Management	Integrated	I: 050 - 099
Integrated Pest Management	Integrated	I: 100 - 149
Fire Management	Integrated	I: 150 - 199
Wilderness Management	Integrated	I: 200 - 249
Abandoned Mine Lands	Integrated	I: 250 - 299
Aircraft Management	Integrated	I: 300 - 349
Man and the Biosphere Program	Integrated	I: 350 - 399
Museum/Archives/Library	Integrated	I: 400 - 449
Other	Integrated	I: 450 - 499



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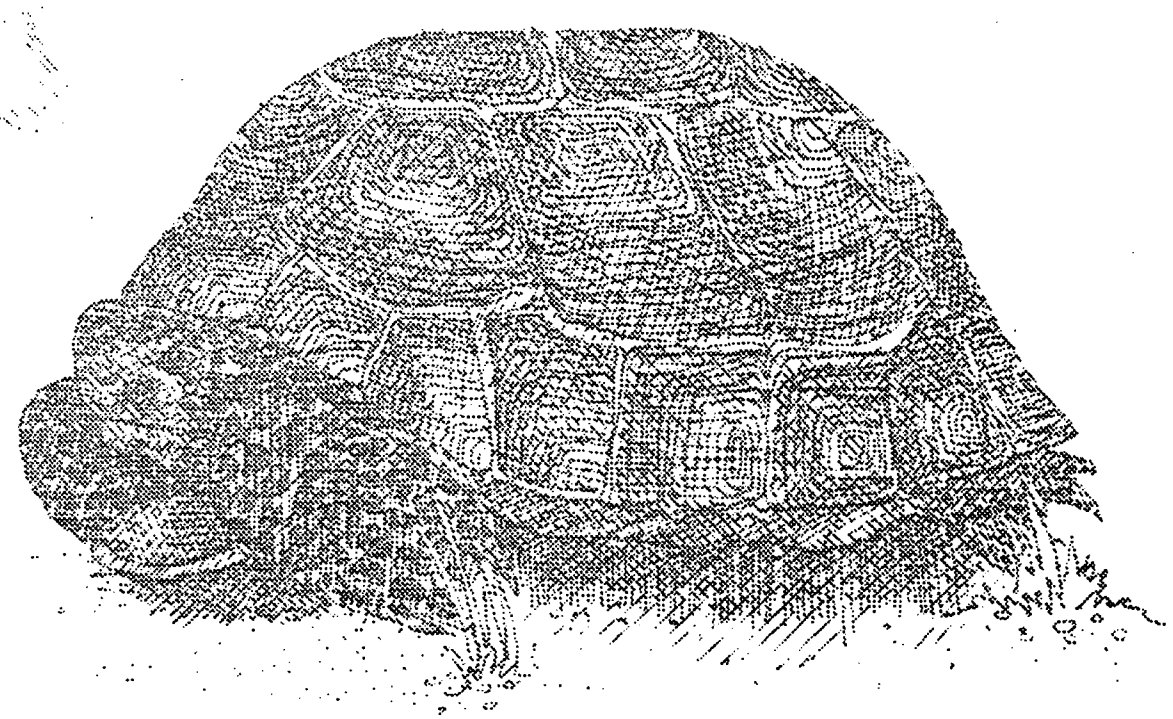
FIGURE. 1
VICINITY MAP
ORGAN PIPE CACTUS
NATIONAL MONUMENT, ARIZONA
U.S. DEPARTMENT OF THE INTEIOR / NATIONAL PARK SERVICE

ON MICROFILM

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

THE NATURAL AND CULTURAL RESOURCES ENVIRONMENT



desert tortoise

II. THE NATURAL AND CULTURAL RESOURCES ENVIRONMENT

II.A. Introduction

The Sonoran Desert, which covers approximately 76.4 million acres, contains one of the world's largest inventories of desert flora and fauna. Although Organ Pipe Cactus National Monument encompasses only a small portion of this vast desert, it preserves many elements of that ecosystem.

II.B. Description of the Area

II.B.1. Climate

Organ Pipe Cactus is one of the driest of all National Park Service areas. It is characterized by relatively little rainfall, high summer temperatures, intense solar radiation, low humidity and high evaporation. The proximity of the Gulf of California, the Pacific Ocean and the Gulf of Mexico, and the distribution of high mountain barriers in the region, influence the amount, apportionment and seasonality of rainfall. Average rainfall recorded at monument headquarters is nine inches a year, but this total varies with location. The Ajo Mountains, for example, in the east, receive up to twenty inches a year, and the western portion of the monument may receive less than nine inches. Precipitation is distributed biannually, with frontal Pacific storms occurring in late winter and early spring, and local and occasionally violent convectional storms occurring in late summer. The summer monsoon precipitation is usually very intense, localized and of short duration, resulting in flash floods. Precipitation during the winter is not as dependable, and is usually typified by gentle wide-spread rains of a much longer duration.

II.B.2. Topography and Geology

The monument lies within the Basin and Range Geologic Province, which extends from northwest Mexico to southeast Oregon, and from the Colorado Plateau and Sierra Madre on the east, to the Sierra Nevada on the west. The Basin and Range is named for its numerous elongated mountain ranges alternating with wide alluvial valleys. The geology and topography of the monument is typical of the Basin and Range. The variability that is seen from range to range is attributable to differences in the kinds of rock that were uplifted, the extent of uplift and the amount of erosion that has occurred.

II.B.3. Flora

Approximately 550 species of vascular plants are found within the boundaries of Organ Pipe Cactus National Monument. This number includes both perennial and annual plant species. Approximately 11.6% (64 species) are non-native plants (Felger 1990). Two distinct subdivisions of the Sonoran desert and their associated vegetative communities are represented.

The highly diverse Arizona Upland subdivision embraces the greater eastern portion of the monument. Flora of this subdivision includes the mixed cactus/palo verde community found on the bajadas or low-lying gravel slopes. Here cacti such as the giant saguaro (*Carnegiea gigantea*) and organ pipe cactus (*Stenocereus thurberi*) dominate the landscape. The prevalent tree species is the foothill palo verde (*Cercidium microphyllum*). In the higher elevations of the Ajo Mountains, the jojoba/evergreen scrubland community occurs. Here, where rainfall is more abundant, plants such as jojoba (*Simmondsia chinensis*), agave (*Agave deserti*) and one-seed juniper (*Juniperus monosperma*) are found.

The Colorado Lowland subdivision is best represented in the western portion of the monument. The creosote bush/bursage community best characterizes this subdivision. Creosote bush (*Larrea tridentata*), triangle-leaf bursage (*Ambrosia deltoidea*) and white bursage (*A. dumosa*) are well represented in the Valley of the Ajo and Growler Valley. Mixed shrub communities of brittlebush (*Encelia farinosa*), triangle-leaf bursage and foothill palo verde are found throughout the Bates, Puerto Blanco, Sonoyta and Diablo Mountains, as well as the Cipriano and Quitobaquito Hills. Along

the south boundary, where the soil is highly alkaline, saltbush (*Atriplex sp.*) communities thrive.

A few species of plants, representative of a third subdivision of the Sonoran Desert, the Central Gulf Coast, can also be found in Organ Pipe. Many of these are rarely found elsewhere in the United States, and are at the northern extreme of their range here. They are thus very sensitive to changes in climate. Included are the senita cactus (*Lophocereus schottii*) and ashy jatropha (*Jatropha cinerea*), both of whom have the only known U.S. population here, within the monument.

II.B.4. Fauna

As with the flora, the fauna of Organ Pipe Cactus National Monument is highly diverse. Approximately 55 species of mammals, four species of amphibians, 43 species of reptiles and one species of fish occur here. In addition, observations of over 260 bird species have been recorded. Of these species, 58 are known to breed and an additional five are suspected of breeding.

II.B.5. Water Resources

Sources of surface water are very limited, as is to be expected in such an arid land. No perennial streams or rivers exist within the monument. Ephemeral flow occurs for brief periods as a result of locally heavy summer rainstorms or rare regional storms. Runoff quickly infiltrates into the stream beds in the bajadas, and thus only very rarely do large storms provide sufficient runoff for water to flow long distances down washes.

There are eleven springs within the monument, three of which are perennial. The largest is Quitobaquito, which discharges nearly 30 to 35 gallons per minute. It is the only spring whose flow is sufficient to create a large body of open water nearby, known as Quitobaquito Pond. Other sources of surface water include tinajas or rock catchments.

The full extent of groundwater resources is not known. On-going research is emphasizing defining aquifer boundaries, capacities, depletion and recharge rates.

II.B.6. Adjacent Land Uses

The Cabeza Prieta National Wildlife Refuge borders the monument on the west and northwest corner. The refuge encompasses 860,000 acres of Sonoran Desert environment, of which 93% is designated wilderness. It is the third largest National Wildlife Refuge in the lower 48 states, and it has by far the largest wilderness area (Schumacher 1992). The refuge is home to the desert bighorn sheep and the endangered Sonoran pronghorn. Other notable wildlife species include the white-winged dove, desert tortoise, Gila monster, desert kit fox and a variety of other bird, mammal and reptile life.

Of special interest and historical value are the remnants of early-day travel through the area by people seeking their fortunes in gold and other minerals in nearby California. The pathways of the Camino del Diablo and Yuma-Caborca Trail cross the refuge, traveling through country that is, for all purposes, the same as it was over 400 years ago. This trail is important in national history and portions of it are on the National Register of Historic Places.

Numerous low flying aircraft transit the refuge on their way to air-to-air bombing and gunnery ranges located to the north. The airspace above the refuge is also used to practice aerial gunnery on towed targets. When the air-to-air range is active, all public entry to the refuge under this airspace is prohibited. This area has been used as a gunnery range since 1941 and was used as a bombing range during the World War II era. Many types of ordinance remain, some buried, and some on the surface.

All applicable federal, state and county laws, regulations and ordinances are enforced on the refuge.

With the exception of impacted areas reserved for agency operations, military targets, and roads and

structures; the natural environment of the range is generally of excellent quality. For much of the range, however, this condition is principally an indirect consequence of military restrictions on access. Reliance on indirect protection is not sufficient to insure that resources are properly managed. The natural resource management goal is to protect environmental values, and consists of managing the natural environment of the range as a reserve in which natural processes prevail.

The Tohono O'odham Nation borders the monument on the east and northeast corner. The O'odham people traditionally depend on natural resources for housing needs and subsistence hunting for food. Utilization of natural resources is critical to their life-style and standard of living. Cattle and horses are pastured extensively in an open range situation. Heavy concentrations of livestock have resulted in overgrazing of vegetation near water sources and other locations.

The Bureau of Land Management administers land along the remaining portion of the northern border. Livestock grazing is the major economic use made of these resources.

The United States of Mexico borders the southern boundary. Nearly all of the Mexican land adjacent to the monument is undergoing intensive agricultural development and urbanization. This process was dramatically increased in 1984 with the introduction and installation of a 2400 Kv hydroelectric transmission line from Hermosillo, Sonora, Mexico. Over 200 wells with capacities of 1400 gal/min draw groundwater from the Sonoyta river basin. The dropping water table, coupled with biocide drift from aerial spraying of crops, and the introduction of agricultural exotics, pose a major threat to the monument's natural resources. The housing subsistence needs of the expanding human population further threaten the natural and cultural resources of the park.

Additionally, foot traffic from illegal aliens impacts the monument's resources in the form of illegal campfires and fire rings, trash, and cutting of unauthorized trails, along with occasional wildland and structural fires. The trend indicates that this situation will increase in intensity and severity.

In 1993, the Mexican federal government designated two biosphere reserves covering over 1.7 million hectares, in the northern Sonoran Desert region. The International Sonoran Desert Alliance, a recently incorporated tri-national and tri-cultural organization, is seeking to promote cooperative protection of resources, ecologically sound economic development, and improved responsiveness of public policy to local needs, and is applying research and local indigenous knowledge to issues and needs in the region (Partners in Parks, 1993).

Probably the biggest opportunity and challenge to the region is the passage of the North American Free Trade Agreement (NAFTA). While all of the ramifications of the North American Free Trade Agreement will not be known until the agreement is fully implemented, some of the earlier impacts and more significant consequences can be anticipated.

Potential implementation of NAFTA provides a strong catalyst for regional planning to accommodate anticipated needs for highway improvements, industrial and residential development and tourist services in ways that enhance the well-being of the region's people without degrading the health and diversity of its ecosystems. This rural region lacks an effective governmental framework for coordinating economic development and environmental protection (Partners in Parks, 1993).

The National Park Service is very concerned about commercial truck traffic in the monument. Integral to increased commercial truck traffic are the ancillary facilities required, such as an agricultural port of entry, including warehouses, livestock quarantine containment yards, truck parking and queuing areas, and physical inspection and traffic control facilities. These facilities would all require a support network, such as administrative and management support, maintenance facilities and employee housing (Smith 1993).

II.C. Natural Resources/Natural Resource Baselines

II.C.1. Vegetation

The known flora prior to 1991 consisted of 522 plant species in 325 genera and 87 families (Bowers 1980). Surveys in the late 1980's added 54 species to the known flora (Pinkava et al. 1991), bringing the total to 574 vascular plant species.

The flora of Organ Pipe Cactus National Monument is relatively diverse for the Sonoran Desert, due to a combination of geographic and topographic features. The rugged topography and variable habitats of the Ajo Mountains facilitate the presence of relatively mesic species. The proximity to the Mojave Desert provides for the inclusion of plant components from that environment, and relatively frost-free zones have facilitated the northward expansion of several tropical and/or frost sensitive species. Many plant species are thus rare and/or have their geographic range limits within the monument. This is due in part to north-south temperature regimes and east-west precipitation regimes. Rarity of several plant species is also exacerbated by ongoing urbanization and agricultural development in Mexico. Populations in Mexico, where protection for rare plant species is minimal or lacking, may be especially impacted. Moreover, many of these species may be at risk of extinction or drastic population declines in parts of their geographic range due to their rarity and/or human-related impacts (Ruffner 1990).

In 1980, a monument-wide survey of existing vegetation, as well as a review of the literature pertinent to botanical resources, was completed. Twenty-nine vegetation associations using the Brown, Lowe and Pase (1979) classification system were identified and described. All but six of these associations were desert scrub types; the remaining six were temperate scrubland and marshland (Warren 1981).

Although there has apparently been little change in the dominant plant species as a whole over the past 100 years, localized changes have been observed by Schultz (1966) and Steenberg and Warren (1977). Schultz (1966) noted vegetation changes in areas of heavy concentration and suggests that they are partially or wholly due to overgrazing. Steenberg and Warren found that damage to plant communities from overgrazing and trampling by cattle was greatest at watering sites and decreased with distance from areas of cattle concentration (Steenberg and Warren 1977).

II.C.1.a. Special Status Plants

In 1990, based on extensive field searches and discussions with botanists familiar with monument flora, 44 plant species were placed into three categories as follows: 1) critical, 2) sensitive, and 3) species of interest which should be deleted from all special status lists. Seventeen species were placed in the critical category based on their vulnerability to drastic population decreases and/or extirpation in the monument due to natural catastrophes. Ten species were listed as sensitive due to their proneness to unpredictable population fluctuations, although it is extremely unlikely that extirpation will occur from Organ Pipe Cactus or the surrounding area. Seventeen species, formerly on the monument's red list, were recommended for deletion from special status because they are not subject to threats, either in the monument or surrounding areas (Ruffner 1990).

II.C.1.b. Non-Native Vegetation

The vascular (or seed) flora of Organ Pipe Cactus National Monument contains remarkably few species of non-native plants. A low percentage of non-natives indicates that the habitat is in a relatively natural state, and as such, can be used as an index for the condition of the vegetation (Felger 1990).

A survey in the late 1980s found that there were 64 potentially non-native species. This represents 11.6% of the flora. This may be too high and thus misleading for a number of reasons. Some supposedly non-natives may actually be native; a few are present but are not reproducing; and a number of them are not expected to persist in Organ Pipe Cactus without continued immigration from adjacent disturbed habitats in Sonora, Mexico. A non-native flora count falling between 5% and 10% of the total flora speaks of a very healthy habitat, one which is indeed rare for the end of the 20th century (Felger 1990).

The 64 species of potentially non-natives can be placed into six categories, as follows:

- Supposedly non-native but possibly native species.
- Non-native species recorded in the monument but apparently no longer present.
- Introduced, purposely planted perennial plants persisting, but not capable of reproducing or propagating themselves.
- Potentially colonizing or invading species occurring in adjacent regions but undocumented in the monument.
- Documented immigrant species that are well-established and have become thoroughly invading.
- Plants that have clearly become colonizing and documentation is available.

Most of the non-native plants in the monument seem relatively benign and probably present little or no potential for negative impact. Four species are cause for considerable concern, however, and include: foxtail brome (*Bromus rubens*), lehmann lovegrass (*Eragrostis lehmanniana*), buffelgrass (*Pennisetum ciliare*), and fountain grass (*P. setaceum*). The two *Pennisetum* species warrant immediate management decisions. The source of the most insidious non-native plants is the Soil Conservation Service at the USDA Plant Materials Center, which has purposely introduced exotic grasses to the area to serve as range forage species (Felger 1990).

II.C.1.c. Quitobaquito Vegetation

Due to a dependable supply of fresh water in an arid region, Quitobaquito and its associated springs have long been a crossroads of human activity. These same factors have made it a center of biological change and diversity. The vascular plant flora includes 271 species in 198 genera and 63 families; in addition a number of plants were formerly cultivated at this desert oasis. The Quitobaquito region supports approximately 45% of the total flora of the monument, although it comprises only 3.5% of the area. Thirty-five species are wetland plants. Thirty-three species are non-native. The flora of the Quitobaquito region is dynamic: major vegetational and floristic changes have occurred due to human influences (Felger et al. 1992).

II.C.2. Wildlife

II.C.2.a. Mammals

Fifty-five species of mammals are known to occur in the monument, with an additional seven suspected. Dr. E.L. Cockrum, University of Arizona, summarized known information on the mammals of Organ Pipe Cactus National Monument in a 1986 Cooperative Park Studies Unit, University of Arizona, Special Report. The following summary is derived primarily from Dr. Cockrum's report.

The earliest records of sampling for mammals appears to have been the 1894 collections of Holzner and Mearns made near the Mexican towns of Sonoyta and Santo Domingo, and in the vicinity of Quitobaquito. In 1934, collections were made

by persons from the Museum of Vertebrate Zoology, University of California, Berkeley (MUZ). In 1932 and 1937, a few specimens were taken from the monument by Dr. Walter P. Taylor and other members of the US Biological Survey (BS).

In 1939, Lawrence M. Huey of the San Diego Society of Natural History carried out field work that resulted in the first formal attempt to evaluate the vertebrate fauna of Organ Pipe (Huey 1942). In his study, Huey listed 31 species and subspecies of mammals. Denny G. Constantine collected some material in 1945 and 1946. His voucher material is deposited in both the Los Angeles County Museum (LACM) and at the monument. Since that time, some detailed studies have been made of a few species, especially bighorn sheep (*Ovis canadensis*) (Coss 1964; Carrico 1969; Douglas 1970), white-tail deer (*Odocoileus virginianus*) (Henry and Sowls 1980), white-throated wood rat (*Neotoma albigula*) (Olsen 1970), and various bat species (Howell 1980; Cockrum 1981; Dalton 1993). Some detailed estimates of rodent populations have also been done (Steenberg and Warren 1977; Warren 1992; Petryszyn 1991).

In 1988, as part of a monument-wide ecological inventorying and monitoring effort, a study was funded, entitled: "Inventory and Assessment: Special Status Mammals." This study, conducted by Dr. Yar Petryszyn, was designed to provide information about both nocturnal rodent species distribution, and the relative abundance of monument mammals. Criteria were established for selection of nocturnal rodent indicator species and a long-term monitoring protocol was developed. Since 1991, monument resources management staff have implemented the monitoring protocol for nocturnal rodents that was developed in the study. Data has been evaluated and reviewed annually by the original researchers. (USDI, NPS 1993, 1994).

In 1993, a study to evaluate the status of monument bat populations was conducted by Dr. Yar Petryszyn and Dr. Virginia and David Dalton. Long-term monitoring protocols were developed for both general bat populations and the maternity colony of the endangered bat species *Leptonycteris curasoae*. In 1994, monument staff implemented the protocol for general bat censusing.

II.C.2.a.i. Insectivora

The only species of Insectivora known to occur in Organ Pipe is the desert shrew (*Notiosorex crawfordi*), which was first recorded in the monument in 1975 at Quitobaquito (Henderson 1975). This was the first record of this tiny animal from anywhere in the general region. Three more were taken at Quitobaquito in a can pitfall buried in the ground in August 1983. The population at Quitobaquito is probably currently isolated from others (Petryszyn and Cockrum 1990). A desert shrew was also taken in a pitfall in Alamo Canyon in 1986 (Petryszyn and Russ 1991) and one was caught in an insect sticky trap at the monument visitor center in 1992. The desert shrew is usually an inhabitant of desert grassland and oak-woodland areas. Only rarely is it found in the low desert. There it generally occurs in riparian habitats (Petryszyn and Cockrum 1990).

II.C.2.a.ii. Bats

Fourteen species of bats, representing three families and eleven genera, are known to occur in Organ Pipe Cactus National Monument. Included is the largest maternity colony in the United States of the federally listed endangered species, the lesser long-nosed bat (*Leptonycteris curasoae*). In addition, two category 2 species, the California leafnose bat (*Macrotus californicus*) and Underwood's mastiff bat (*Eumops underwoodi*), are also found in the monument.

Huey (1942) recorded three species of bat in his vertebrate faunal survey of the monument. A monument checklist in 1978 identified six confirmed and three probable species. Cockrum (1981) listed twelve confirmed and five suspected species. Interestingly, however, the update to the monument's mammals, amphibians and reptiles checklist in 1985 listed only nine species confirmed and six suspected. Cockrum and Petryszyn (1986)

listed twelve actual and eight probable. The 1991 update to the monument's checklist of mammals, amphibians and reptiles listed twelve actual and five probable. A bat monitoring protocol developed by Dr. Yar Petryszyn (1994) listed thirteen known species and seven probable. An individual Mexican long-tongued bat (*Choeronycteris mexicana*) netted in Alamo Canyon in June 1994, brought the total of confirmed bat species in the monument to fourteen.

Of the fourteen species, two are nectar/fruit eaters and the others are insect eaters. As consumers of tremendous numbers of insects, bats become good indicators of the health of the food chain. Most insects are primary consumers, thus channeling and possibly concentrating any environmental contaminants. With the great number of insects that bats eat, these contaminants may be further concentrated in bats to their detriment (Petryszyn 1994). Seasonal occurrence, types of day roosts, types of night roosts, food habitats and water requirements are the major factors which must be considered in making meaningful decisions about the management of bat populations (Cockrum 1981).

II.C.2.a.iii. Hares and Rabbits

Three species, representing one family and two genera, of the order Lagamorpha occur within Organ Pipe Cactus National Monument. These include the desert cottontail (*Sylvilagus audubonii*), antelope jackrabbit (*Lepus alleni*) and blacktail jackrabbit (*Lepus californicus*). All species checklists from Huey (1942) to the present have identified these species for the monument, with no others suspected.

The desert cottontail is widespread throughout the monument. Huey (1942) reported this species as fairly common along wooded washes. Nelson (1909) reported it at Quitobaquito. Cockrum (1986) noted that they are common at Organ Pipe Cactus. Petryszyn and Russ (1991), while assessing the status of nocturnal rodents, observed that the desert cottontail appeared to prefer the more densely vegetated areas.

The Organ Pipe Cactus National Monument is on the western edge of the range of the antelope jackrabbit. This species is the largest rabbit in the Western Hemisphere (Cockrum and Petryszyn 1992). Huey (1942) reported that, in 1939, "both Mr. Gray and Jose Juan, the Papago Indian living near Quitobaquito, informed the writer that these large rabbits were common a few years ago but lately and almost disappeared, due, no doubt, to rabbit plague." Cockrum (1986) noted that areas where these animals are commonly seen are in Lukeville and near the north border of the monument, between Armenta Well and Highway 85. Petryszyn and Russ (1991) reported that at Armenta Ranch there appeared to be an unusually large number of *L. alleni* present. On one occasion, seven of these animals were seen simultaneously. Droppings and white urine spots from these jackrabbits were prevalent throughout the area.

Huey (1942) reported that the blacktail jackrabbit was found over the greater part of the plains and valley floors of the monument. Cockrum (1986) noted that these jackrabbits were seen frequently in different areas of the monument. Petryszyn and Russ (1991) noted that the species is found in several locations throughout the monument.

II.C.2.a.iv. Rodents

Nineteen species, from four families and eleven genera, of rodents occur within the monument with one additional species suspected. The two dominant families of Sonoran Desert nocturnal rodents are the Heteromyidae and the Cricetidae. The heteromyids, consisting of pocket mice (*Chaetodipus* and *Perognathus sp.*) and kangaroo rats (*Dipodomys sp.*), are the most desert adapted group. They depend on seeds deposited on and in the soil for nutrients and to metabolically fill much of their water needs. The cricetids, on the other hand, need free water from "greenery" to exist in the desert. The three members of the rodent family Sciuridae, the squirrels, which occur in Organ Pipe are all diurnal (Petryszyn and Russ 1991). One member of the Geomyidae, the pocket gophers, also occurs in the monument.

Huey (1942) recorded fifteen species of rodents in his vertebrate faunal survey of the monument. A monument checklist in 1978 identified fifteen confirmed and three probable species, and in 1985, seventeen confirmed and two suspected species were listed. Cockrum and Petryszyn (1986) listed twelve actual and eight probable species. The list they put together, however, was assembled in 1984. The 1991 update to the monument's checklist of mammals, amphibians and reptiles listed nineteen actual and two probable species occurring.

Petryszyn and Russ (1991), in assessing the status of nocturnal rodents, provided a detailed description of their observations. The following is taken primarily from their report and monitoring protocol.

The monument can be divided into three broad habitat types: mountain canyons, small hills areas and bajada/desert floor. Each has its own unique topography and plant composition and unique nocturnal rodent densities and species compositions. The packrat overwhelmingly dominates the densely vegetated mountain canyons, a dominance shared with its smaller cousin, the cactus mouse. In the small hills and bajada/desert floor areas, cricitid occurrence is much more sporadic and sparse. Only in the heavily "wooded" areas of major springs do cricetids again dominate.

On the other hand, the bajadas and valley floors are less generous to the cricitids, but provide good habitat for the heteromyids. In these "flatlands" a complete reversal in which group is dominant is seen. Although the cricetids accounted for 92% of the nocturnal rodent biomass on the mountain canyon sites, they contributed only 10% of the biomass on the bajada and valley floor sites. In these areas of more open habitat, the heteromyids are in their element, and they contribute 90% of the biomass.

The small hill sites are an interesting mix, distinguished by a balance between the cricetids and heteromyids. Taken as a whole, the biomass of this "habitat type" is split (41% cricetids and 59% heteromyids). Considering the integration of hills, drainages, and relatively flat aprons at the base of hills, this melding of diverse rodent species is not surprising.

Monument resources management staff have been monitoring nocturnal rodent populations at several study sites since 1991, utilizing capture, mark, release and recapture techniques, as prescribed by Petryszyn and Russ (1991). The status of rodent populations has a broad application in that it is indicative of the general health of the environment. Being primary consumers as well as the prey base for many predators (snakes, raptors and a number of large mammals), rodent populations rapidly react to changes in available food resources and, in turn, influence the population numbers and health of the animals which depend on them as a food source.

II.2.a.v. Carnivores

Thirteen species, representing four families and twelve genera, of carnivores are known to occur in Organ Pipe Cactus National Monument.

Huey (1942) recorded six species of carnivores in his vertebrate faunal survey of the monument. A monument checklist in 1978 identified five confirmed and eight probable species, and the update in 1985 listed thirteen confirmed and two probable species. The 1991 update to the monument's checklist of mammals, amphibians and reptiles listed thirteen actual and two probable species.

Three members from the family Canidae are found within the monument. These include the coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*) and kit fox (*Vulpes macrotis*). Huey (1942) reported that in 1939, coyotes were common throughout the monument. Cockrum (1986) noted that coyotes are relatively common over most of the monument, and they are probably the most abundant carnivore present. Huey (1942) reported gray foxes to be common in the neighborhood of the mountain ranges, and numerous sight records are on file. Cockrum

(1986) reported that the gray fox seemed to occur throughout the monument. They are probably more common than kit foxes, but are not nearly as numerous as coyotes. Kit foxes probably occur in limited numbers over most of the monument.

Two members of the family Felidae, including the bobcat (*Felis rufus*) and mountain lion (*Felis concolor*) are known from the monument. In 1938, the National Park Service estimated the total monument population of bobcats to be 25, and in 1939, the total mountain lion population as four. Cockrum (1986) reported that the bobcat is a fairly common predator throughout the monument and that a few mountain lions are also present. Since mountain lions have a large home range and hunting territory, several sightings may be attributable to a single individual.

Representatives from two other families, the Procyonidae and Mustelidae occur in the monument. These include four species of skunks (*Conepatus mesoleucus, Mephitis macroura, Spilogale gracilis* and *Mephitis*), badger (*Taxidea taxus*), coati (*Nasua*), raccoon (*Procyon lotor*) and ringtail (*Bassariscus astutus*). All of these species, with the possible exception of the badger, are rare within the monument.

II.C.2.a.vi. Even-Toed Hoofed Mammals

Five species, representing four families and four genera, of even-toed hoofed mammals are known to occur in Organ Pipe Cactus National Monument. These include the desert bighorn (*Ovis canadensis mexicana*), javelina (*Tayassu tajacu*), mule deer (*Odocoileus hemionus*), whitetail deer (*Odocoileus virginianus couesi*) and the endangered Sonoran pronghorn (*Antilocapra americana sonoriensis*).

Huey (1942) recorded four species from the order Antiodactyla in his vertebrate faunal survey of the monument. A monument checklist in 1978 identified five confirmed and no probable species. All subsequent checklist updates have reiterated this total.

The Sonoran pronghorn is an endangered subspecies, with a limited distribution in southwestern Arizona and in northwestern Sonora, Mexico. Total population estimates have varied from between 50-150 individuals in the United States and between 100-150 individuals in Mexico. The known distribution of the subspecies within the United States is in Organ Pipe Cactus National Monument and on the Barry M. Goldwater Range, primarily within the boundaries of the Cabeza Prieta National Wildlife Refuge. At any one time, probably no more than fifteen to twenty individuals are within the monument. The vast majority of observations are in the Growler Valley portion of the monument.

Local belief is that a dense bighorn population existed in the vicinity of the monument prior to the turn of the century, but shortly thereafter disease caused a wholesale die-off. One factor which might have precipitated a population decline at that time was greatly increased hunting pressure with modern rifles. Several mining camps flourished within present monument boundaries, and armed prospectors combed the hills with an eye for both minerals and camp meat. Local people also tell of intensive hunting in the monument area during the depression years (Coss, 1964).

One of the earliest observation records was from Mearns in 1907, noting use at Quitobaquito. Huey (1942) recorded observations from the Ajo Mountains and from peaks north of Rancho Bonito.

Studies in 1962 and 1963 concluded that the monument had a mature bighorn population that was healthy and dynamic. A rough estimate of between 70 and 100 sheep was given. A status report to the Desert Bighorn Council in 1969 indicated that bighorn can be found in all mountainous and hilly terrain areas of the monument, with the Ajo Mountains having the largest number. It was estimated that between 75 and 100 sheep were present in the monument. In the Environmental Statement (1975) for the proposed wilderness within the monument it was noted that disease, endo- and exto-parasites, domestic livestock, and humans had increasingly

encroached upon the habitat of the desert bighorn sheep of southern Arizona and northwestern Sonora, México; the numbers of desert bighorn had been reduced to the point where their survival was uncertain, even in the mountainous remote sections of the monument's wilderness.

A study of Coues white-tailed deer, undertaken from June 1976 to July 1978, examined interspecific competition between white-tailed deer and other competitors, including bighorn sheep. Although there is extensive range overlap between bighorn sheep and white-tailed deer in the Ajo Mountains, observations of deer-bighorn interactions were rare. Both species are at such low densities that they rarely encounter each other, except during the dry season when both frequent the same waterholes (Henry, R.S. and Sowls, L.K., 1980).

The total whitetail deer population for the monument was estimated at between six and twelve individuals, located in the Ajo Mountains. Only rarely are they spotted at lower elevations. Mule deer, however, have been sighted many times. A National Park Service census reported fifty mule deer on the monument for each of the two years 1938 and 1939. The observation file at headquarters contains many recent records (Cockrum 1986).

Javelina have been observed throughout the monument. Mearns (1907) reported that in 1894 they found no javelina west of Santo Domingo, Sonora. Huey (1942) reported that, in 1939, javelina were common over the more level portions of the monument. Petryszyn and Russ (1991) reported a great deal of javelina evidence throughout the monument, and indicated that the population may be increasing.

II.C.2.b. Birds

Dr. R. Roy Johnson, National Park Service, summarized known information on the birds of Organ Pipe in a 1990 Cooperative Park Studies Unit, University of Arizona, Technical Report. The following summary is derived primarily from Dr. Johnson's report.

Organ Pipe Cactus National Monument contains one of the highest concentrations of avian species in the Sonoran Desert for an area of its size. Approximately 260 species of birds have been recorded within the 516 square miles of the monument. This diversity is due to a combination of factors, including: a relatively large number of habitat types; the presence of open, standing water sources which attract migrants; and the monument's proximity to a major migratory route along the Gulf of California, which accounts for the large number of vagrant species recorded.

The diversity of habitat types at the monument contributes significantly to the diversity of its birdlife. From almost 5,000 feet at the top of Ajo Range to approximately 1,000 feet near Hocker Well in the extreme southwest corner of the monument, the variety of landforms includes rugged desert mountain ranges, lush and shaded mountain canyons, gentle bajadas, flat alluvial plains, rolling rocky hills, and large dry stream courses. Vegetation types develop in response to these elevational and topographic changes. A vegetation map of the monument, produced by Warren et al. (1981) of the Office of Arid Land Studies (OALS), indicates the vegetative associations which are available to birds.

The composition of the approximately 260 recorded bird species constantly changes on an annual basis, as only 36 species are present year round (permanent residents). The remaining species are either migratory, occur in winter or summer only, or are vagrant birds. In addition to the permanent residents, the 22 summer residents may breed as well, for a total of 58 probable breeders within monument boundaries. Although it is assumed that the species staying through the summer are breeding, nests for some of these have not been found. Over sixty species occur as spring and fall migrants, being present for only short periods of time. Another fifty species are vagrants, or those that are far from their normal range and have been seen fewer than five times. The remainder are

winter visitors which may also be seen during migration.

Knowledge of the birds of the monument has been gained through a number of major ornithological investigations. The first was done by Lawrence Huey (1942). He prepared an annotated checklist of the 145 species he encountered during his survey of monument vertebrates. He also presented information on the distribution and ecology of selected birds. Allan Phillips and Warren Pulich (1948) visited the Ajo Range, and with the help of A.J. Van Rossem, reported on breeding birds. A comprehensive analysis of breeding birds of the monument, including their ecology and general habitat relationships, was provided by Max Hensley (1954). The primary paper outlined in detail the avian communities present in each major habitat type. Data was presented on relative population densities, breeding densities, species composition, and the availability of food resources. Hensley (1959) later published information on the breeding biology of sixteen species, based on information collected during his field work for the 1954 paper.

For 45 years, from the establishment of the monument to the present, resident park naturalists and rangers have recorded bird observations. These are maintained in a permanent file at monument headquarters. This file contains the majority of information concerning avian occurrence and distribution.

Ornithological investigations since the work of Hensley are limited to notes on distribution and ecology (Cole and Whiteside 1965, Beck et al. 1973, Inouye et al. 1981). An important source of information in the last two decades is the Audubon Field Notes, now published under the title of American Birds. These articles on seasonal bird occurrence, especially in the late 1960's and early 1970's, contain many references to the monument, largely due to the efforts of Richard Cunningham, monument naturalist. The annual Audubon Christmas Bird Count reports are also contained in the Audubon Field Notes. These counts have been conducted nearly every year since 1965. An additional count, the "Ajo Mountains" count, was conducted only twice and then dropped. The Christmas Counts provide valuable comparative indices on an annual basis for the relative densities of birds wintering in the monument.

The Birds of Organ Pipe Cactus National Monument (Wilt 1976) is an annotated checklist written for laymen, compiled from ornithological investigations, bird observations, and Audubon Field Notes or American Birds references. Also included was a short description of generalized habitats available to birds and hints on where to find certain species. The current field checklist available is a "Checklist of Birds, Organ Pipe Cactus National Monument" (Organ Pipe Cactus National Monument 1987).

The National Breeding Bird Survey, sponsored by the U.S. Fish and Wildlife Service, compares annual breeding bird densities and diversities in a study area along the road between Lukeville and Quitobaquito. Scott Mills performed the survey from 1975 to 1980. The Cooperative National Park Resources Studies Unit at the University of Arizona (CPSU/UA) has conducted the survey since 1981.

Gary Nabhan and others associated with the Office of Arid Lands Studies at the University of Arizona, as well as Amado Rea, of the San Diego Natural History Museum, have compared the density and diversity of birds at Quitobaquito Springs to that of Quitovac, a sister desert oasis some thirty miles to the south in Sonora, Mexico (Nabhan et al. 1982). Differences in avian use between the areas are compared to different cultural histories and management objectives of each site.

The overall use of water sources by birds is the subject of a preliminary study to be conducted by CPSU/UA scientists. The occurrence, distribution, and ecology of birds at both natural and artificial water sources are being compared in such a way as to indicate the relative importance of each.

In 1987, as part of the Sensitive Ecosystems Program, a study entitled, "Inventory and Assessment: Special Status Birds" was initiated. The study was to evaluate the status of avian

species and to develop a protocol to evaluate bird populations over time. A draft final report and monitoring protocol were submitted, but never approved or finalized. The protocol was designed to obtain information on the relative abundance of all breeding birds at several study sites during breeding and non-breeding periods (Johnson 1991). The principal investigator did not complete the project and is no longer associated with the study. Since 1991, monument resources management staff have implemented the draft monitoring protocol for birds that was developed in the ecology study (NPS 1993, 1994).

The birds of the monument are representative of avian populations in a relatively undisturbed natural area. Nevertheless, natural area status has not insulated the bird community from change, both from within and without. Two exotic species, the starling and house sparrow, have invaded the monument within this century and have begun to breed in areas disturbed by man's activities. The native great-tailed grackle and red-eyed cowbird have expanded their range as well, and now breed in or near the monument. The California condor, formerly a visitor of uncertain status to the region and probably to the monument (although positive documentation is lacking), no longer occurs in Arizona. The establishment of artificial water sources adjacent to the monument may be affecting the local abundance, ecology, and movement of water-dependent desert birds. These primarily include Gambel's quail, mourning and white-winged doves, and house finch. Other birds may be influenced by these artificial water sources as well. Migratory shorebirds that formerly frequented the shores of Quitobaquito Pond during migration are no longer present due to management practices which have reduced the extent of open, pond-fringe habitat.

II.C.2.c. Herptofauna

Dr. Charles H. Lowe summarized known information on the herptofauna of Organ Pipe in a 1990 report entitled "A 50 Year Summary for the Herptofauna of Organ Pipe Cactus National Monument (Assessment of Scientific Information and Activities)," as well as in a 1991 report entitled "Ecology of Amphibians and Reptiles of Organ Pipe Cactus National Monument." The following summary is derived primarily from Dr. Lowe's reports.

The herptofauna is a rich Sonoran Desert herptofauna that is strongly dominated by lizard and snake species. There are sixteen lizard species (twelve genera in three families), 25 snake species (seventeen genera in four families), and two species of turtles (two genera in two families). There are four amphibian species, all toads (two genera in two families). This fauna includes: 1) true (or obligate desert species; 2) desert-included species with broad ecological distributions both in and outside of the desert; and 3) two riparian species: a garter snake and a mud-turtle, both of which are widespread in mesic Sonoran Desert riparian habitats.

The preponderance of species, at Organ Pipe Cactus as elsewhere in the Sonoran Desert, is evolutionarily derived from ancestors in thornscrub and thornforest to the south, as is true for the flora (Sxelrod 1979). A much smaller faunal element is of a more northerly grassland and woodland derivation.

Many of the monument species are desert-included species which occur today as important components of thornscrub and thornforest environments. This is especially true of those that are prominent in xeroriparian and rocky canyon habitats in the Arizona Upland Sonoran desertscrub community, and on the higher rock slopes. A smaller herptofaunal element of true desert species has affinities with the Lower Colorado Sonoran desertscrub communities, entering the monument from the west and north, and the still more westerly Mojave Desert. These species are characteristic of the valley bottoms and the relatively dry desert rockpiles.

The first modern investigator of the Organ Pipe Cactus National Monument areas was herpetologist Howard K Gloyd (1932, 1937). During the summers of 1930 and 1931, he traveled to Arizona

from the University of Michigan for the purpose of a herpetological survey of the southern part of Arizona.

In 1939, mammalogist Laurence Huey of the San Diego Society of Natural History was invited by the National Park Service to make a vertebrate faunal survey of the monument. He reported on specimens collected of four anurans, the desert tortoise, twelve lizards and seven snakes, for a total of 24 species. Huey's specimen vouchers were identified by herpetologist Laurence M. Klauber at the San Diego Natural History Museum, San Diego, California.

Ten years later, during the spring and summer of 1949, Max Hensley, then an ornithologist graduate student, collect a series of snakes on the monument, primarily by road collecting on the Ajo-Sonoyta Highway. Hensley's taxon vouchers were deposited in the University of Illinois, Museum of Natural History, Urbana, Illinois.

In 1950, Dr. Charles H. Lowe and then Superintendent William Supernaugh, began a joint on-site field effort directed toward developing a checklist for the amphibians and reptiles (Lowe and Supernaugh 1953).

In 1963, one of several monument checklists was prepared by Steenbergh and Hoy. The 1963 type list and format became the 1966 mimeo edition of the ORPI staff list (from which the 1978 printed list was prepared).

During the 1960's and 1970's several persons contributed typed lists and other information for Organ Pipe amphibian and reptile species. These included staff members Warren Steenbergh and Wilton Hoy during the 1960's and Terry Peters during the 1970's. Other contributors included Kathleen Beargie of the University of Colorado, Otis Bronson of Tucson, John Cross of the University of Arizona, Merrit Keasey of the Arizona-Sonora Desert Museum, H. F. Lunsford of Simi, California, C. J. McCoy of the Carnegie Museum and Richard Vogt of the University of Arizona.

In 1982-83, Dr. Charles H. Lowe worked with monument staff on the herpetological records and collections. Research by Dr. Lowe and Philip Rosen in the mid 1980's focused on the herptofauna, primarily the Sonoran mud turtle (*Kinosternon sonoriense*), of the Quitobaquito area.

In 1988, as part of a monument-wide ecological inventorying and monitoring effort, a study was funded, entitled: "Ecology of Amphibians and Reptiles of Organ Pipe Cactus National Monument." The principal investigator for the project was Dr. Lowe. The study was designed to provide information about reptile and amphibian species occurrence, distribution, and relative abundance, emphasizing lizard species, and was conducted primarily at several permanent research sites. Criteria were established and lizard species were selected to monitor as indicators of monument herptofauna health in the long-term monitoring effort. The monument's herp "Red List" was reviewed and evaluated. As part of the work, a new checklist was prepared (Lowe and Rosen, 1990).

As a result of the ecology study, several herpetological research needs were identified and implemented, including "Ecology of the Mexican Rosy Boa and Ajo Mountain Whipsnake in a Desert Rockpile Snake Community", "Ecology of Sonoran Desert Snakes", "Status and Conservation of the Rio Sonoyta Mud Turtle" and "Ecology of the Organ Pipe Shovel-nosed Snake and Maricopa Leaf-nosed Snake." Principal investigators for all of the projects are Dr. Charles H. Lowe and Philip Rosen.

Since 1991, monument resources management staff have implemented the monitoring protocol for lizards that was developed in the ecology study. Data has been evaluated and reviewed annually by the original researchers. (USDI, NPS 1993, 1994).

II.C.2.c.i. Anurans

Four of the five anuran species that occur within the monument are abundant, breed successfully, and have probably benefitted indirectly from human

economic activities on monument lands. A fifth species, the Sonoran green toad, (*Bufo retiformis*), occurs locally primarily to the north of the monument and may not breed on the monument.

The anurans are closely tied to permanent or temporary surface water that is long-lasting enough to allow their eggs to hatch and produce term larvae (tadpoles). As little as ten days may be required for the desert spadefoot (Scaphiopus couchii), with a longer period required for the true toads (genus *Bufo*). Each of the four anurans known to breed at Organ Pipe Cactus has a substantial geographic range that extends to the north, south, east and west of the monument area.

Each anuran species breeding at Organ Pipe Cactus has a unique pattern of habitat occurrence. The widest habitat selection is seen in the largest species, the large Sonoran desert toad (Bufo alvarius). This is the most widespread of the four species, occurring in mountain canyons, on the bajadas and on the valley bottom floodplains. The desert spadefoot is also widespread and abundant on bajadas and the valley bottom, especially in the eastern half of the monument. The red-spotted toad (Bufo punctatus) is abundant on rock slopes and upper bajadas throughout the eastern half of the monument, and around Quitobaquito and Bates Well. The Great Plains toad (Bufo cognatus) occurs in modest or low abundance at localities in the eastern half of the monument, and also occurs at Quitobaquito.

The distribution of anurans in Growler Valley, Cipriano Hills and the Bates Mountains areas, as well as in other western parts of the monument, remains poorly known. Each of the four species known to breed elsewhere in the monument is also suspected of doing so in these areas.

The anurans, as a whole, are not abundant at Organ Pipe Cactus, in comparison to the larger numbers observed to the east in areas of the Arizona Upland Sonoran Desert that receive more summer rainfall. Natural charcos that would have originally supported anurans in the valleys are rare at Organ Pipe; and some of those that existed were augmented by ranchers, especially at Dos Lomitas, and possibly along Route 85, between Alamo Canyon and the north boundary.

A striking number of breeding sites, especially the important ones with large breeding choruses, are human-made or human-modified. The major breeding areas in both the Sonoyta Valley (Mexican agricultural fields, an abandoned tank at Dos Lomitas, Lukeville, the Tiger Cage, headquarters residence area, campground sewage lagoon) and the Valley of the Ajo (abandoned tanks along Route 85, North Boundary Tank, tanks at Why, AZ) are all man-made habitats. Thus, with the exception of Growler Canyon, all of the known or suspected primary anuran breeding sites in valley habitats are human-made.

Some of the tanks where anurans breed have been constructed at areas that were natural depressions on the desert floor, usually associated with major washes. Undoubtedly, some were important anuran breeding sites originally. The current anuran populations of the monument valleys have been enhanced, and even expanded, as a result of recent human activity.

Prior to these unintended human improvements to anuran breeding sites, the monument species bred successfully in smaller numbers at temporary pools along major washways. This may still be observed at an easily reached site about 150 meters east of Route 85 on Cherioni Wash. Prior to human modification, the largest and most consistent breeding sites in valley habitats were undoubtedly at Growler Canyon, Aguajita Spring, and the spring system along the west face of the Quitobaquito Hills.

Quitobaquito Springs was previously a major anuran center. In 1937, Huey (1939) collected four Great Plains toads there. This was the last report for this species at Quitobaquito, in irrigated fields. During the 1950's, but not since, large numbers of red-spotted and Sonoran Desert toads were observed to breed successfully in the pond margins and environs. Desert spadefoot also bred in numbers in the area. Successive alterations of the

aquatic habitat at Quitobaquito have worsened conditions for anurans, until today, when there are essentially no fish-free areas at Quitobaquito where anuran eggs and larvae can survive.

Small scoured pools such as those found on the uneroded areas around Armenta Ranch are widespread at Organ Pipe, and support small numbers of breeders. These sites dry more quickly than the deeper-water tanks, including the abandoned tanks, and are vulnerable to potentially destructive flash-flooding. They undoubtedly support modest numbers of anurans, with successful breeding in years of exceptionally frequent and relatively evenly-distributed summer rainfall.

Today, natural breeding areas of anurans are also located in the mountain canyons, where tinajas and ephemeral springs exist. Observations have been made in the North and South Forks of Alamo Canyon, and at Bull Pasture. It is certain that anurans breed successfully in natural tinajas elsewhere in the Ajo Mountains, Diablo Canyon, near Pinkley Peak, and in Kino Pass, and it is very likely that they breed successfully at other tinajas as well.

II.C.2.c.ii. Lizards and Snakes

Patterns of habitat use for squamatas at Organ Pipe are the basis for evaluating the distribution and abundance of species in and near the monument. Warren et al. (1981) have provided identification of 29 Organ Pipe vegetation associations digitized to the third and fourth decimal in the classification system of Brown, Lowe, and Pase (1979). The vegetation associations described by Warren et al. correspond to habitat use patterns of the lizards and snakes. Each lizard and snake species will use one or, in almost every case, two or more of these vegetation associations. Although it is possible to discuss each reptile species in relation to each vegetation association, such exercises tend to obscure the more meaningful, general habitat patterns inclusive of substratum and other edaphic characteristics.

The most important habitat boundary for lizard and snake species at Organ Pipe is at the rockslope-bajada interface, with major species and genus turnover. Despite the presence of several relatively specialized desert species in valley habitats, there is a clear and very strong parallelism to community structure for both lizards and snakes across this interface.

Most of the true (or obligate), desert species of lizards and snakes at the monument are characteristic of fine-textured soils in valley bottom fill and dune field environments that are found within the Lower Colorado Valley Sonoran Desert. Only two true desert species - the common chuckwalla (*Sauromalus obesus)* and the speckled rattlesnake (*Crotalus mitchelli*), are obligate rock-dwellers. In contrast, many desert-included species are obligate rock or canyon dwellers at Organ Pipe, such as *Crotaphytus collaris*, *Sceloporus clarkii*, *Crotalus molossus*, *Trimorphonodon biscutatus*, and others.

Across the bajada-valley bottom ecotone, species transitions are strongly characterized by intrageneric replacements. Species characteristics of valley bottom, Lower Colorado Valley Sonoran Desert habitats, are also characteristics of the Mojave Desert. In contrast, species transitions at the rockslope-bajada interface are marked by ecological equivalency between congeners or between phyllogenetically distant genera. Many of the rockslope and mountain canyon species are thornforest and thornscrub derived species, as are bajada species that are strongly prominent high on the bajada--such as *Rhinocheilus lecontei*, *Chionactis palarostris*, and *Phyllorhynchus browni*.

• Lizards. Compared to lizard communities in other subdivisions of the North American Desert (Chihuahuan, Mojave, Great Basin), the lizard assemblages in the Sonoran Desert are species rich, with as many as fourteen species per site. On the other hand, compared to other subtropical deserts in Africa and Australia that may have 42 or more species per site (Pianka, 1986), the relatively tiny Sonoran Desert is, in that context, species-poor.

Lizards are abundant almost everywhere at Organ Pipe Cactus National Monument. Most of these lizards are primarily insectivorous and may play an important role in the community as regulators of secondary production. They are also important prey for several species of snakes.

It is evident that each of the sixteen lizard species occurring at Organ Pipe is thriving, and none appear to have clearly suffered man-caused population declines. Highway mortality, although numerically substantial, is far too low to pose a threat to monument lizards at this time. Collecting for personal possession occurs, but is also of little population consequence.

•Snakes. The Sonoran Desert snake assemblage is unusually rich when judged against other subtropical desert snake assemblages (Pianka, 1986). Snakes are a major component of the vertebrate-eating guild; it is likely that they are the most important predators of lizards and small rodents in the desert. Their impact on prey populations is substantial enough to produce intraspecific competition among snake species, and between snakes and the larger endothermic predators such as raptors and canids.

The snake populations at Organ Pipe appear to be healthy. Snakes occur at population densities less than an order of magnitude below those of most lizard species. Therefore, small losses that are insignificant for lizard populations may be serious for snakes. Four species of snakes appear to have experienced substantial population declines over the past five decades. These include the spotted leafnosed snake (*Phyllorhynchus decurtatus*), the saddled leafnosed snake (*P. browni*), the glossy snake (*Arizona elegans*) and the sidewinder rattlesnake (*Crotalus cerastes*).

II.C.2.c.iii. Turtles

The desert tortoise *(Gopherus agassizii)* occupies generally rocky environments that characterize its rockpile, upper bajada, and arroyo habitat at Organ Pipe, and occurs on all of the major rockpiles at the monument. It is primarily surface-active during the period of summer rains from June-July, into October. A total of 49 live tortoises were located during a 1987-1990 herpetofaunal survey, as were 29 tortoise shells and parts (remains). The mortality, as indicated by the remains, was relatively high, but not the highest in Arizona populations studied during the same time frame. The failure of rains, culminating in the drought and heat of 1989, apparently stressed tortoise populations in many parts of the desert, including Organ Pipe. This appears to be a natural process and not a cause for concern. The monument supports healthy, though not remarkably large or dense, populations of the desert tortoise, including juveniles. The desert tortoise may be vulnerable to being collected, picked up, or otherwise mistreated by people.

The single native aquatic turtle at Organ Pipe is the Sonoran mud turtle *(Kinosternon sonoriense)*. It is represented by the subspecies *K. s. longifemorale* (Rio Sonoyta mud turtle) that is endemic to Quitobaquito and the Rio Sonoyta. Desert populations of the Sonoran mud turtle may be threatened throughout their natural range in the United States. It retains its strongholds in basins along the Mogollon Rim and White Mountains and in the perennial waters of grasslands and woodlands of southeastern Arizona and northeastern Sonora.

A single, mating pair of a second species, the yellow mud turtle *(Kinosternon flavescens)* was collected at Quitobaquito in 1955. It has not been reported before or since, and the 1955 records may represent an introduction. Typically, it occurs in seasonally dry--not perennial--ponds, especially on the Tohono O'odham Reservation. Other introduced turtles that have been removed from Quitobaquito are the painted turtle *(Chrysemys picta)* and the slider *(Trachemys scripta)*.

The Sonoran mud turtle was formerly abundant at Quitobaquito but has been declining since at least the 1970's. This trend has continued into the 1990's, although spurts of reproduction have been observed in association with years of good rainfall. A disproportionate number of inexplicably dead

mud turtles have been observed at Quitobaquito, suggesting that adult survivorship is adversely affected in some way not normally seen in this species. Pesticides, poor water quality, disease, and starvation are possible causes. Visitors may also collect turtles at Quitobaquito and remove them from the monument.

The only other populations of this subspecies are in the Rio Sonoyta where they currently receive no protection. They are at least occasionally sold in a pet store in Sonoyta. A large population near the highway bridge in the town of Sonoyta was reduced and possibly eliminated between 1987 and 1989. In 1983, mud turtles were moderately abundant in the perennial reach south of Quitobaquito, and in 1986, they were seen in abundance on the eastern edge of Sonoyta. The population status in Rio Sonoyta must be considered insecure, at least until a thorough survey is made.

II.C.2.d. Fish

One species of fish is known to occur at the monument. This is the Quitobaquito desert pupfish (*Cyprinodon macularius eremus*). The species inhabits the pond and spring outflows at Quitobaquito. At this time, the species is federally listed as endangered.

II.C.2.e. Invertebrates

Dr. Kenneth J. Kingsley summarized known information on the invertebrates of Organ Pipe in a 1992 report entitled "Invertebrates of Organ Pipe Cactus National Monument." The following summary is derived primarily from Dr. Kingsley's report.

Investigations of invertebrates have been taking place at Organ Pipe Cactus National Monument since at least 1940. Most of these have focused on either specific taxonomic groups of invertebrates, or on specific locations, especially the Quitobaquito Springs area.

On April 19 and 20, 1942, a party of entomologists studying butterflies visited Alamo Canyon (Garth 1944). They listed 21 species present.

Ball et al. (1942) cited specimens and records from the monument in their monograph on the Orthoptera of Arizona.

In 1949, Byars reported on the first known record of the Mexican leaf-cutting ant (Atta mexicana Hymenoptera: Formicidae) in the United States (Byars 1949). This ant has subsequently been studied in considerable depth by A.C. Mintzer, who has several papers that are in press or preparation. He is also continuing his research.

In 1952, W.S. Creighton visited the monument from March 12 - 30. He collected and observed ants throughout much of the monument, and wrote a report which is in the monument's files.

Cole and Whiteside (1965) published an account of a study of the aquatic fauna of Quitobaquito pond. This included insects, crustaceans, and snails.

Miller (1966) investigated snails in the monument and described a new subspecies, *Sonorella baboquivariensis cossi*, from the Ajo Mountains. His snail records were also incorporated into a book on the mollusks of Arizona (Bequarert and Miller 1973).

Werner (1966) cited specimens of meloid beetles from the monument, but for most species did not include information on when or where they were collected.

Fellows and Heed (1972) studied factors affecting host plant selection for *Drosophila* species (*Diptera*: Drosophilidae) in rotting cacti. They supplemented their field studies with laboratory studies.

Kircher (1972) conducted chemical studies of organ pipe cactus and related them to the maturation of *Drosophila nigrospiracula*.

In 1977, Mehlhop and Scott studied seed-harvesting ants in the Cabeza Prieta National Wildlife Refuge, near the western boundary of the monument (Mehlhop and Scott 1983).

Landye (1981) reported on a new snail, which since has been named *Tryonia quitobaquitae,* and is listed by the US Fish and Wildlife Service as a Category 2 endangered species.

Kingsley et al. (1987) and Kingsley and Bailowitz (1987) reported on studies of arthropods found at Quitobaquito in 1983 and 1984. Bailowitz (1985) reported on the biology of *Ascia howarthi* (Lepidoptera: Pieridae) which he found at Aguajita Wash and Quitobaquito.

Hall et al. (1988) reported on insects found in packrat middens from the late Quaternary period in the Ajo Mountains. These were contrasted with insects found in Alamo Canyon from March to November, 1987.

Larsen (n.d.) reported on aquatic bugs and beetles collected from 1980 through 1982. He included natural rock catchments, artificial ponds, Dripping Springs, Quitobaquito, and artificial stock tanks.

An on-going study, of honeybees (*Apis mellifera*), initiated in 1988, has been undertaken by scientists affiliated with the US Department of Agriculture, Carl Hayden Bee Research Laboratory. This study detected the arrival of Africanized honeybees in 1994.

A study to identify the presence of invertebrates in Organ Pipe was initiated in 1987 as part of the Sensitive Ecosystems Program. This study examined the distribution and ecology of invertebrates in Organ Pipe Cactus National Monument (Kingsley 1991). The study focused primarily on sixteen designated research sites. Macroinvertebrates, primarily arthropods, were collected and observed over a period of three years. Over 5,000 records and 4,200 specimens were made. More than 1,000 taxa were recorded. Most taxa were rare, with 439 being recorded only once. Only fifty taxa were recorded more than ten times each.

The most important factor influencing invertebrate populations appears to be weather. The period of the Kingsley study was marked by drought and higher than normal temperatures. The effects of weather were apparently so profound as to override any other factors and limit conclusions that could be drawn from data. The only known significant problem involving invertebrates is the arrival of the strain of honey bee (*Apis mellifera*) known as the "Africanized" bee. The strain is expected to have important but unpredictable impacts on visitor safety, resources management, and aspects of plant and animal ecology.

II.C.2.f. Special Status Wildlife

The following wildlife species are currently considered special status due to federal listing and evaluation status:

Endangered

- Lesser Long-Nosed Bat
  Leptonycteris curasoae
- Sonoran Pronghorn
  Antilocapra americana sonoriensis
- Peregrine Falcon
  Falco peregrinus anatum
- Brown Pelican
  Pelecanus occidentalis
- Quitobaquito Desert Pupfish
  Cyprinodon macularius eremus

Category 1

- Cactus Ferruginous Pygmy Owl
  Glaucidium brasilianum cactorum

Category 2

- California Leafnose Bat
  Macrotus californicus
- Underwood's Mastiff Bat
  Eumops underwoodi
- Desert Tortoise

Gopherus agassizii
- Chuckwalla
  Sauromalus obesus
- Rosy Boa
  Lichanura trivirgata
- Swainson's Hawk
  Buteo swainsoni
- Ferruginous Hawk
  Buteo regalis
- Loggerhead Shrike
  Lanius ludovicianus
- White-faced Ibis
  Plegadis chihi
- Quitobaquito Snail
  Tryonia quitobaquitae

II.C.3. Water Resources

Sources of surface waters are very limited, as is to be expected in such an arid land. No perennial streams or rivers exist within the monument. Ephemeral flow occurs for brief periods as a result of locally heavy summer rainstorms or rare regional storms. Runoff quickly infiltrates into the stream beds in the bajadas, and thus only very rarely do large storms provide sufficient runoff for water to flow long distances down washes.

Bryan Brown et al., summarized information on water resources of the monument in a 1983 report, entitled "An Inventory of Surface Water Resources at Organ Pipe Cactus National Monument." The following summary is derived primarily from B. Brown's report.

Water is a critical factor in the Sonoran Desert. The location of reliable water sources has always been of vital importance to both man and wildlife. Early explorers and travelers in the region usually noted the location of any such sources which they encountered. The first reference to the water resources of the monument was made by Eusebio Kino, a Jesuit priest, in 1698 (Bolton 1960). He briefly mentioned a visit to the Quitobaquito Springs, describing the area as "...a good place called San Serguio." The name "San Serguio" was not used for Quitobaquito after the Kino era (Hoy 1969). Quitobaquito later became an important frontier watering stop for travelers along the Camino del Diablo, or the Devil's Highway, which led from Caborca, Sonora, Mexico to Yuma, Arizona, along the Arizona-Sonora border (McGee 1901). William Hornaday (1908), on his expedition to explore the Pinacate region of northwestern Sonora, passed through what is now the monument and stopped at Quitobaquito. Carl Lumholtz (1912) also visited Quitobaquito Springs during his travels in the Papago country of Arizona and Sonora.

The presence of water sources has been vital to the occupation and settlement of the region covered by the monument from prehistoric times to the present (Greene 1977). Although Quitobaquito Springs was the only water source within the monument mentioned in the early literature, other sources were probably known to the cattlemen and miners who settled the area during the period between 1910 and 1920. Water sources, which are found at and which inevitably determined the location of every ranch site, include springs, ponds, wells and tanks. Through time they have been the requisite criterion for human occupancy of the Sonoran Desert. Without water, the development of the principal regional economies--cattle, ranching and mining--could not have occurred.

Cattle were grazed at the monument from approximately 1915 to 1978. In 1978, the grazing permits terminated and all cattle were removed. During the period of grazing, ranchers increased the usefulness of the range to cattle by creating artificial watering sources. A number of wells were drilled and stock tanks (supplied by pumping or haulage) were altered or improved, both by stockmen and the National Park Service (Brown and Johnson 1983).

With the publication of Kirk Bryan's Routes to Desert Watering Places in the Papago Country, Arizona (1922) and The Papago Country, Arizona: A Geographic, Geologic, and Hydrologic Reconnaissance with a Guide to Desert Watering Places (1925), a great deal of information on the monument water resources became available for the first time. Bryan located and described Aguajita,

Bull Pasture, and Dripping Springs, and gave an analysis of the hydrology of Quitobaquito Springs. Several wells existing within the monument at that time were mentioned, including Alamo, Bates, and Blankenship wells. Important water sources adjacent to the monument were also identified, including Barajita Well, Menger's Dam, and the Sonoyta River.

With the establishment of Organ Pipe Cactus National Monument in 1937, the National Park Service initiated several groundwater studies. These studies were undertaken to identify ways of providing a dependable domestic water supply for the monument and to learn more about the local water resources. Gould (1938) and Maxwell (1940) studied the sources of groundwater at the monument and gave locations for several springs and wells. McDougall (1939) and Peterson (1942) commented on the relationship between wildlife and water sources. Coates (1951) also made a brief survey of groundwater conditions, and described known wells and springs.

Other investigations on water resources rapidly followed. Early biologists made note of water sources that were valuable to wildlife, including the first mention of tinajas, or rock tanks (Huey 1942, Hensley 1954). The availability of groundwater in the Molenitus area of the Papago Indian Reservation was examined by Heindl (1958). An ecological reconnaissance of Quitobaquito Springs (Cole and Whiteside 1965) described limnological and physicochemical features as well as the flora and fauna of the ponds. The Bureau of Land Management identified several artificial and natural water sources that were being used by cattle (Schultz 1966, Schultz et al. 1971). Steenbergh (1969) identified certain ecological problems at Quitobaquito Springs. An interim management plan, based on his report, was subsequently prepared for the area (National Park Service 1979).

Concern regarding the withdrawal of groundwater for irrigation purposes in Mexico along the international boundary prompted monument officials to request assistance from the Water Resources Division of the National Park Service's Western Regional Office in 1971. In response, regional personnel began a water resources inventory of all springs and wells in 1972. Updating of this inventory has continued on a yearly basis. As a continuation of this assistance, the Western Regional Office, in cooperation with the U.S. Geological Survey, studied the effects of groundwater pumping in Mexico on groundwater conditions in the Quitobaquito area and the Sonoyta Valley (Anderson and Laney 1978, Anderson and White 1978).

Maps showing groundwater conditions in southern Arizona and giving data on a few springs and wells in the monument were published by the U.S. Geological Survey (Leake and Clay 1979). Henry and Sowls (1980), as a portion of their study of the white-tailed deer (Odocoileus virginianus) in the Ajo Range, indicated the locations of important waterholes in that area. This included not only the traditional water sources such as stock tanks and wells, but most of the larger tinajas as well. The longevity of tinajas was also discussed. In the fall of 1981, the Western Regional Office of the National Park Service funded a monitoring program to be carried out by the U.S. Geological Survey (USGS) which established a continuously recording gauging station to monitor the spring flow at Quitobaquito, in conjunction with two recording rain gauges. The program also included monitoring water levels in existing wells along the international boundary and collecting stream runoff data on a drainage near Quitobaquito. In 1988, three monitoring wells were dug along the southern boundary and were equipped with continuous recorders. Recorders were in operation for three years and then funding was discontinued for this and other USGS monitoring.

In addition to the aforementioned studies, National Park Service personnel have systematically gathered information on water resources during the past three decades. From the mid-1960's through the present, the monument staff has compiled miscellaneous observations of water resources. These observations have been incorporated into two unpublished water source handbooks. These handbooks outline the occurrence of some artificial

and natural water sources by quadrangle location, and give some information on the history, flow rates, development, and seasonal water level fluctuations. In 1992, monument resources staff inventoried and photographed all known tinajas.

The aforementioned well and spring inventory efforts by the Western Regional Office, detail these sources on U.S. Geological Survey well and spring site forms. These forms contain information on the following: location, water levels or flow rate, physical aspects of the source, field specific conductance, and photographs. Maps indicating the locations of these sources described in NPS regional files have also been prepared. These maps are available in the Regional Office and copies are on file at the monument.

In 1988, a National Park Service sponsored research project was awarded to Great Western Research to investigate agricultural and urban development in the Sonoyta Valley. Research included identifying the acres of land in production, type and quantity of crops, number of wells and their capacity, and annual water drawdown in the Sonoyta Valley. The study was amended to continue through 1990.

Irrigated agriculture, on a large scale, is relatively new to the Sonoyta Valley. Agricultural activities in the Sonoyta Valley consisted primarily of cattle ranching and subsistence farming as late as the early 1950's. The only lands actively farmed were located adjacent to the stream banks, and were irrigated only from the sporadic flow of the Sonoyta River. Lack of water storage facilities and distribution systems limited the irrigated area to about 250 acres. Crop production was primarily for the subsistence of local residents who also maintained small areas of pasture lands for livestock.

The first deep wells were installed in 1952, to the east of the town of Sonoyta. Development of groundwater resources progressed slowly throughout the 1950's and early 1960's, as local landowners had to rely upon their own resources to install irrigation and livestock wells. In 1966, the Mexican government began a limited-scale program to encourage and subsidize the development of land and water resources throughout northern Sonora, including the Sonoyta Valley. Government support of agricultural development greatly increased in the early 1970's. From 1973 to 1983, the number of wells increased from 112 to 290, and the pumping capacity went up from 14,465 gpm to 213,203 gpm.

Today, agricultural land ownership in the Sonoyta Valley is divided between cooperative farms called ejidos (50%) and private ownership (50%). The Mexican government subsidizes the development of land and water resources throughout northern Sonora. The program is administered by the Secretaria de Agricultura y Recursos Hidraulicos (SARH) with an office located in Sonoyta. A moratorium is currently in effect to limit the land developed for irrigated agriculture to the present 32,000 acres (of which 60%-70% currently is being farmed).

Groundwater withdrawals were approximately equal to the recharge rate in 1978, and began to exceed groundwater recharge in 1979. Although net depletion of the aquifer has steadily increased since 1979 to a maximum of 55,025 acre-feet in 1987, the cropped area has remained relatively constant since 1981. The Mexican government is fully aware of the overdraft situation of the aquifer and has placed a moratorium on the drilling of new wells. Although moratoriums are currently in effect, a considerable increase in groundwater withdrawals could occur without the development of new water and land resources, due to the existing excess capacity in pumping and developed agricultural lands. Nevertheless, under existing conditions, annual groundwater withdrawals will still be approximately 2.5 times the annual rate of recharge and the depth to water will continue to increase in the near future (Brown 1988).

This has raised concerns about the possible affects on flora and fauna found in the monument. A primary concern is that continued or increased pumping in Mexico may lower the groundwater table, and may also reduce hydrostatic pressure at

certain locations within the monument, such as at Quitobaquito, Burro and Williams Springs.

The full extent of the Organ Pipe Cactus groundwater resources is not well understood. Research is currently being conducted to define aquifer boundaries and capacities, and rates of recharge and depletion. It is known that springs in the monument are fed by aquifers which are located very near agricultural pumping in Mexico, and that areas of riparian vegetation are dependent on shallow groundwater for their continued existence.

II.C.3.a. Surface Water Resources

II.C.3.a.i. Tinajas

Tinajas, or natural bedrock depressions, constitute the most numerous and widespread source of surface water within Organ Pipe Cactus National Monument. There are 58 known tinajas, occurring in the greatest numbers in the Ajo Mountains (35), and more scattered in the Bates (15), and Puerto Blanco (8) Mountains. Tinaja densities range from 0.35 tinajas/km2 in the Ajo Range to 0.14 tinajas/km2 in the Puerto Blanco Mountains. Water in tinajas constitute an important resource to arid lands fauna. The longevity of water in tinajas is affected by the size and runoff characteristics of the watershed draining to the tinaja, the volume of the catchment, the amount of shade received, and the permeability of the bedrock (Brown and Johnson 1983).

There is only one known perennial tinaja in the monument. Intermittent tinajas are probably the most important water sources in the dry mountains, as they are fairly numerous, widespread, and hold water for several weeks or months following significant precipitation. Ephemeral tinajas, or those that hold water for only a few days, are not reliable enough to be of much importance for most wildlife species (Brown and Johnson 1983).

II.C.3.a.ii. Springs

There are eleven springs within the boundaries of the monument, three of which are perennial and eight intermittent. Of the eleven springs, eight are located at or near Quitobaquito Springs, in the extreme southwestern corner of the monument, two are located in the Ajo Range, and one is found in the Puerto Blanco Mountains. There are no known springs in the Bates Mountains. The three perennial springs occur entirely in the southwestern corner of the monument, either in the Quitobaquito area or in the Puerto Blanco Mountains. Quitobaquito is one of the largest spring-fed oasis situations in the Sonoran Desert, surpassed in volume and size only by Quitovac in Sonora, Mexico (Johnson 1981).

II.C.3.a.iii. Quitobaquito Pond

Andrew Dorsey dug this pond and built a dam to hold the water in 1860 (Greene 1977). The flow of the two largest perennial springs at Quitobaquito has been diverted to the pond, which measures approximately 200 feet wide by 260 feet long and averages 4.8 feet deep. A 700 ft. open channel from the southeast spring to the pond was constructed in 1989. The channel and pond provide habitat for the endangered species of desert pupfish (*Cyprinodon macularius eremus*). In addition, the pond provides habitat for the Sonoran mud turtle (*Kinosternon sonoriense*), and numerous species of avifauna and invertebrates. The spring and pond at Quitobaquito together form the largest surface water resource in the monument (Johnson 1981).

II.C.4. Soils

Organ Pipe Cactus National Monument is one of the few monuments in the country to have a modern soil survey map (3rd Order) and report completed and published (Post 1990). This report was published in December 1972, by the United States Department of Agriculture Soil Conservation Service (SCS) in cooperation with the National Park Service and the Arizona Agricultural Experiment station. The field work and report was completed by Earl Chamberlin, SCS Soil Scientist. In addition to this report, the data is available digitally, and was created using SCS maps. The

digitization was completed by the Advanced Resources Technology Lab, University of Arizona, in 1993.

Research and resources management involving soils has been minimal. Most efforts have focused on assessing and mitigating erosion (Marsh 1980, Marsh 1981, Brown 1989). Recent work (Simpson 1991, Parker in press) has focused on soils, geomorphology and vegetation patterns along alluvial fans.

Chamberlin (1972) identified twelve soil series, comprised of 23 mapping units, for the monument. Included are the following series, mapping units and percentage coverages in the monument:

•Ajo Series
- Ahb-Ajo very cobbly sandy loam, 2-5% slopes. Total: 1%.
- AkB-Ajo very gravelly loam, 1-5% slopes. Total: 2.8%.
- An-Antho fine sandy loam. Total: 4.7%.
- Ao-Antho soils, very gravelly variant. Total: .4%.

•Cherioni Series
- Chb-Cherioni gravelly very fine sandy lam, 0-8% slopes. Total: 3.9%.

•Cipriano Series
- Cp-Cipriano gravelly loam. Total: 3.2%.

•Gachado Series
- GaB-Gachado very cobbly loam, 2-8% slopes. Total: .5%.

•Gilman Series
- Gb-Gilman very fine sandy loam. Total: 8%.
- Gm-Gilman very fine sandy loam, saline. Total: .6%.

•Growler Series
- Gr-Growler-Antho complex. Total: 4.4%.

•Gunsight Series
- GuA-Gunsight very gravelly loam, 0-2% slopes. Total: 3.2%.
- GuC-Gunsight very gravelly loam, 2-15% slopes. Total: 17.6%.

•Harqua Series
- HaA-Harqua very gravelly loam, 0-3% slopes. Total: .2%.
- HbB-Harqua very cobbly loam, 0-8% slopes. Total: .2%.
- Hc-Harqua-Gunsight complex. Total: 10.3%.

•Laveen Series
- La-Laveen loam. Total: .5%.

•Lomita Series
- LoE-Lomitas very stony loam, 8-40% slopes. Total: 10%.

•Perryville Series
- PeB-Perryville very cobbly fine sandy loam, 0-8% slopes. Total: .6%.

•Rillito Series
- Ra-Rillito gravelly sandy loam. Total: 6.7%.
- Rk-Rock land. Total: 9.1%.
- Ro-Rock outcrop. Total: 1.7%.
- St-Stony land-rock outcrop association. Total: 6.6%.
- To-Torrifluvents. Total: 3.8%.

Major soil degradation has occurred in the past on much of the rangelands of southern Arizona. The major form of degradation has been through soil erosion, and this has significantly changed the upper soil horizon(s). Many areas now have concentrations of coarse fragments on the soil surface, left to accumulate as the smaller sand, silt and clay soil particles have eroded away. These changes in soil composition affect the soil moisture-temperature and other characteristics of soil, which in turn affect vegetation (Post 1990).

In the monument, anthropogenic erosion is evident in the vicinity of historic ranch sites where soils are of fine texture and where cattle trampling and grazing pressure was the strongest. Erosion problems are most severe at Dos Lomitas and Armenta Ranches, where a total of 170 acres are affected. Widespread and persistent erosion from

wind and water has occurred in these areas, and has resulted in permanent loss of soil fertility and infiltration capacity, as well as changes in the vegetation communities.

II.C.5. Geologic Resources

Monument topography typifies that of the Basin and Range physiographic province of the western and southwestern United States and northern Mexico (Thornbury 1965). Wide, nearly level valleys and basins separate abrupt north-south trending mountain ranges. The mountains of the region are relatively barren with veneers of talus and rock debris.

A geologic excursion through Organ Pipe Cactus National Monument provides an opportunity to study rock types and landscapes suggesting types of mountain-building processes (Brown 1992). The Ajo and Bates Mountains, as well as the mountains of the surrounding region, were built by large-scale block faulting that resulted in a topography of ridges with deep valleys between. These structural valleys between mountain ranges, including the Sonoyta and Growler Valleys, Valley of the Ajo, and La Abra Plain, are partly filled with debris deposited from sheet erosion and ephemeral streams.

Formal geologic projects within the monument are relatively few and have been conducted on an infrequent basis (Werrell 1990). References regarding the monument begin with the works of Kirk Bryan (1920-25). Bryan's papers discuss both the geology and hydrology of the area, mostly in general terms, although some detailed work was conducted at specific sites. An introduction to the geology of selected areas within the monument was prepared by Butler and Lewis (1940). The first geologic mapping of the entire area was accomplished in 1960 by Wilson, Moore and O'Haire. In 1974, Jones studied the volcanics of the Ajo Mountain Range, thereby completing the first detailed geologic work of the monument. Brown (1992) prepared an Interpretive Geologic Map of the Mount Ajo Quadrangle.

The U.S. Geological Survey (USGS) completed field work on a geologic mapping project for the part of Arizona that includes the monument. Lack of funding prevented completion of the work. Andrea Eddy (1985, 1987, 1988) was involved in geologic research at the monument in the 1980s and continued efforts towards the production of a 1:62,500-scale geologic map. Collaboration between Eddy and monument resources management staff in 1994 brought the geologic map project to completion, including the preparation of a digital database.

II.D. Cultural Resources

II.D.1. Cultural Resources - Archeology

Slightly over 9,000 acres of the monument, or approximately 2.5%, have been archaeologically surveyed. The majority of the survey work was done between 1989 and 1991, when a stratified intensive sample survey was conducted in areas of projected high and low site occurrence probability. In addition, a number of small scale surveys associated with construction projects were conducted. A total of 181 sites, represented by 187 field loci, were intensively recorded, and another 65 sites were identified but not recorded. Prior to 1991, 207 archeological sites had been identified by broad scale reconnaissance surveys, clearance surveys associated with construction projects, and a survey of the east boundary on the crest of the Ajo Mountains. Adequate site records exist for only 45 of these sites, however. Over forty sites identified during these early surveys do not have any site records to assess cultural and temporal affiliation.

II.D.1.a. Description

Cultural remains in the vicinity of the monument document at least 12,000 years of occupation in the Sonoran Desert. Throughout this time period, the area represents a unique history of desert adaptation and transition zones of interaction between various cultural groups. For much of this time, Organ Pipe was witness to the movement and communication of people traveling between the

desert and the Gulf of California. By A.D. 900, Organ Pipe played a key role in the shell trade and interaction network. Current research indicates that obsidian may have been another key resource which was collected and traded.

The Malpais industry (40,000 B.C.--18,000 B.C.) may represent the earliest cultural assemblage identified in southwestern Arizona and northern Mexico (Hayden 1976). The Malpais complex is known primarily from the Sierra Pinacate region southwest of Organ Pipe. The complex includes a chopper-scraper industry, worked shell assemblages, cleared areas (sleeping circles), trails, and intaglios. Malpais remains have not been identified within Organ Pipe, however the monument has the potential to contain Malpais remains.

The Paleoindian period (10,000--8,500 B.C.), which is the oldest generally accepted age for human occupation in North America, is represented in southwestern Arizona by Clovis big-game hunters and the southeastern aspect of the San Dieguito lithic industry (Roger 1958), which includes the Ventana complex (Haury 1950). Ezell (1954) recovered a fluted Clovis point in Cabeza Prieta just northwest of the monument's boundary. Clovis points have been recovered throughout southeastern Arizona and northern Mexico, and commonly associated mammoth remains and tools were recovered as recently as 1989 at Quitovac, Sonora, Mexico. Based on this data, it is believed that Clovis remains are present, but have not as yet been identified within the monument. Stone tools representing the San Dieguito I complex, dated to 9,000 BC, have been identified by Julian Hayden (personal communication) in the Quitobaquito region. These unrecorded sites represent the eastern-most extent of the San Dieguito culture.

The Archaic period (8,500 B.C.--A.D.300) in southwestern Arizona, is known primarily from stratified deposits at Ventana Cave (Haury et al. 1950), the Sierra Pinacate (Hayden 1965, 1967, 1976), and the Lower Colorado region (Rogers 1939). Ezell's Organ Pipe survey identified an unspecified number of Archaic period sites, suggesting cultural affiliation and overlap between two Archaic traditions: the Amargosa and Cochise. Archaic period use of the Quitobaquito region has been reported by Teague (1977), but it is not known whether those sites are of Early, Middle, or Late Archaic. Recently, an intensive sample survey has identified clusters of Early (8,500-4,800 B.C.), Middle (4,800-1,500 B.C.), and Late Archaic (1,500 B.C.-A.D.300) sites in the Alamo Wash, Canyon Diablo-Wild Horse Tank, Dos Lomitas, Senita Basin, and Pozo Nuevo areas. The majority of these sites are "fragile pattern areas" (Hayden 1965), or surface scatters of chipped stone tools, flakes, roasting features, and sleeping circles (cleared areas) which represent base camps, stone tool manufacturing locations, and resource procurement and processing sites. Stratified Archaic deposits have been identified in a number of rock shelters that have not been recorded. Quarries and possibly some trails that were first used during the Archaic period continued in use until historic times. Archaic period rock art sites have been identified in Growler Wash. Analysis of obsidian flakes and tools from Archaic sites indicate that Los Vidrios, in the Sierra Pinacate; Sauceda, north of Organ Pipe; Superior, in central Arizona; and an unknown location, are the sources of the obsidian raw material found at sites in the monument.

The Prehistoric Ceramic Period (A.D. 300-1450) occupation of Organ Pipe is represented by Hohokam, Patayan, and Trincheras populations. Dates for the ceramic period occupation are based on absolute dates from other areas, primarily the Gila-Salt and Tucson basins. Many of the prehistoric ceramic period sites contain roasting pits with the potential to obtain suitable samples for radiocarbon dating. Prehistoric ceramic period sites include temporary camps, shell ornament manufacturing sites, limited activity sites associated with resource procurement, processing, and preparation, small villages with canals, and a large Hohokam community with reservoir. Absolute dates from these sites could be used to develop a regional chronology.

Hohokam use of the area began during the Pioneer Period (A.D. 300-775), with the occurrence of isolated sherds that are frequently associated with trails. Colonial Period (A.D. 775-975) use of the monument is indicated by small sites, probably temporary camps, containing ceramics and shell manufacturing debris. Trading of finished shell products and affiliation with Hohokam populations in the Salt-Gila Basin core area is indicated. The Sedentary Period (A.D. 975-1150) marks a period of transition and growth for Hohokam populations within the monument, during which a Hohokam sequence, separate from the Salt-Gila and Tucson Basin, was firmly established. Large sites, including small villages, were founded and shell trade with the Salt-Gila Basin increased and was also initiated with the Tucson Basin population. The most striking changes occurred during the Classic Period (A.D. 1175-1400), when large Hohokam communities (in excess of 200 acres), with reservoirs and satellite villages with canals, were established. These sites continue to have large amounts of shell manufacturing debris and obsidian, suggesting that these continued to be important trade items. Changes in political alliances and trading networks are indicated by a total absence of ceramics from the Salt-Gila Region and an overwhelming presence of ceramics from Tucson Basin Hohokam sites. Patayan ceramics from the Lower Colorado area and Trincheras ceramics from northern Sonora, Mexico, indicate further changes in the trade and exchange network. The occurrence of Salado Polychromes suggests that Organ Pipe Hohokam populations also participated in the Salado Regional system, but the extent of participation is currently unknown. The recently identified Post-Classic Period (A.D. 1400-1450) may also be represented at a number of these large sites.

Patayan sites (post-A.D. 700) and isolated vessels are present primarily in the western portion of the monument. Patayan populations lived primarily along the Lower Colorado River, but used the Organ Pipe area beginning around A.D. 975 and into historic times. Trincheras culture sites (A.D. 200-1450) and ceramics have been identified throughout the Organ Pipe area. Trincheras culture populations lived in northern Sonora, Mexico, primarily in the Altar Valley. The presence of Trincheras limited activity sites and Trincheras ceramics at Hohokam sites represent the western-most extent of the Trincheras culture and indicates use of the monument between A.D. 800-1400.

The Protohistoric Period (A.D. 1450-1700) is not well known from any region of Arizona. The cultural affiliation of Protohistoric groups in the Organ Pipe area is currently undetermined. Recent surveys have identified a number of sites and components of sites throughout the monument which were occupied during the Protohistoric period. At least two of the Protohistoric sites have the potential to yield absolute dates from roasting pits.

II.D.1.b. Archeological Investigations

McGuire and Schiffer (1982) prepared a Class I overview of southwestern Arizona, including the Organ Pipe area, for the U.S. Bureau of Land Management. This report documents all the reconnaissance and contract-related surveys and excavations that had been completed by 1980. Survey and excavation projects conducted in the vicinity of Organ Pipe, and pertinent to the archaeology of the region, are listed and discussed in McGuire and Schiffer (1982).

A check of the site survey files at the Western Archeological and Conservation Center (WACC) and the Arizona State Museum was conducted prior to the 1989 through 1991 field work. These records reveal two periods of archeological surveying in the monument. The first period, from the late-1920s to mid-1970s is represented by reconnaissance surveys conducted by Frank Midvale of Gila Pueblo, Emil Haury of the University of Arizona, Paul Ezell of the National Park Service, Bernard Fontana of the Arizona State Museum, and Alice Hunt, archeologist. The second period of work, from the mid-1970s to present, is a result, in large part, of environmental laws enacted to preserve and protect archeological resources.

The earliest archeological reconnaissance in the Organ Pipe area was conducted in 1929 by Frank Midvale. He surveyed some areas in southern Arizona and northern Sonora, Mexico, to delineate the distribution of the Red-on-buff (Hohokam) Culture. Midvale recorded at least five sites within the present monument boundaries. The exact locations of most sites are not known because they were not plotted on maps. The locational information in the Gila Pueblo notes is lacking sufficient detail to accurately plot the sites (Arizona State Museum Archives). Sites recorded by Gila Pueblo but not relocated during the 1989 - 1991 survey include twelve caves in the vicinity of Dripping Springs, two caves at the northern end of the Ajo Mountains, and a Hohokam village somewhere in the Ajo Valley. One site re-recorded during the present survey, AZ Z:13:1(ASM), was first recorded as I:13:4 and I:13:5 (GP). Midvale recorded the site as a village with two trash mounds and a "sun temple" (reservoir). The "sun temple" was described as a stadium-like feature standing five feet above the surrounding ground surface. The mounds were reported to stand two feet above the ground surface. Midvale noted the presence of Hohokam red-on-buff, a Papaguerian variety of red-on-brown, and Salado polychrome pottery, metates, manos, obsidian, and a large quantity of shell. Midvale recorded another very large Hohokam site on the Cabeza Prieta National Wildlife Refuge. Referred to as Lost City, H:1:1 and H:1:2 (GP), AZ Y:16:1 (ASM), this site contains one or two "sun temples" along with Hohokam red-on-buff and red-on-brown pottery, Salado polychrome, chipped and ground stone, roasting features, and a large amount of shell. Midvale also recorded a cerro de trincheras fortified site, I:14:3 (GP), approximately nine miles east of Gunsight, Arizona, on the Tohono O'odham Reservation. All field notes, artifacts, and photographs from this survey are curated at the Arizona State Museum.

A reconnaissance survey of the Cabeza Prieta Wildlife Refuge and surrounding area by Fontana (1965) reported on 33 sites, three of them in Organ Pipe. Fontana made notes on the historic Growler Mine site, AZ Z:13:38 (ASM), which the National Park Service had recently bulldozed. Artifacts were found in the areas where buildings had once stood. He also recorded Jose Juan Temporale, AZ Y:16:6 (ASM), and Jose Juan Hill, AZ Y:16:7 (ASM) along the western boundary of the monument. Prehistoric and historic artifacts were identified at Jose Juan Hill.

During the early 1970s, Alice and Charles Hunt (ORPI 1972) spent their winters at Organ Pipe and noted the presence of forty archeological sites. Alice, an archeologist, and Charles, a geologist, had conducted a reconnaissance survey and geological assessment of the Death Valley salt pans (Hunt 1960). Unfortunately, the site records and locational information for sites recorded in Organ Pipe are insufficient to relocate the sites or assign permanent site numbers.

The majority of survey and monitoring projects completed since 1975 have been small-scale surveys associated with the placement of underground utilities and construction activities related to employee housing and the visitor center. The majority of these surveys did not locate archeological sites, although isolated artifacts and/or features were identified. A number of surveys related to construction projects, land exchanges, and evaluations of National Register eligibility have resulted in the identification of cultural resources.

Several surveys have been conducted in and around the Quitobaquito and Aguajita Wash region (ORPI 1977B, 1977C, 1977D, 1978A, 1979B, 1979C, 1980B, 1985A, 1988A, 1990E, 1991D), resulting in the identification of prehistoric and historic cultural resources. Severe deterioration of the Hia C`ed O'odham graves at the Quitobaquito cemetery led to a unique collaborative effort among the National Park Service, archeologists, and the Hia C'ed O'odham people. Collapsed wooden superstructures over the graves were placed in the burial pits and metal grates and rocks were placed over the graves to protect them. The cemetery was mapped and the location and orientation of the graves was recorded. Finally, two oral history projects were conducted to document the

genealogies of those buried in the cemetery, as well as the historic Hia C'ed O'odham ways of life (Anderson, Bell, Stewart 1982, Anderson, Bell, Stewart 1980, Zepeda 1985).

In 1980 (Mallouf 1980), a 30-mile linear survey of the crest of the Ajo and Sierra de Santa Rosa Mountains was conducted prior to the construction of a fence between the monument and the Tohono O'odham Reservation. The potential for the presence of cultural resources was deemed to be low, due to the ruggedness of the terrain. To the archeologist's surprise, 51 sites were recorded, 44 of which are located within the monument. The sites represent prehistoric and early historic use of the relatively flat saddles along the Ajo crest and a number of small rockshelters. Recently discovered archival records of Frank Midvale indicate that he may have recorded some of these rock shelters in 1929.

During the parkwide survey at Organ Pipe, which took place in 1989 through 1991, a number of small-scale surveys were conducted in association with various construction projects and a land exchange. Three projects (ORPI 1989E, 1990E, and 1991E), resulted in the identification and recording of four prehistoric sites and one historic archeological site.

II.D.2. Historic Resources

Organ Pipe Cactus has an abundance of historic resources. The historic period may have arrived here as early as 1540 A.D. with the first Spanish entrada into the area, and extended through the recent era of ranching, mining and National Park Service administration (Bradt 1980, Greene 1977, Hoy 1970, Warren and Hoy 1990). The historic era, and more specifically the last two centuries, probably represents the period of most profound changes in the cultural and natural environments in the region that have occurred since the end of the Pleistocene Epoch about 10,000 years ago.

Many historic resources in the monument are distinctive, considering the remoteness of the area and the various cultural and natural environmental interactions that have transpired through time. The significance of historic sites inside the monument will probably increase as time passes, primarily because few similar sites survive and are preserved and protected outside the monument. Even inside the monument where efforts are made to preserve and protect cultural resources, some structures and sites are being damaged through vandalism, theft and weathering. Additional actions need to be developed and maintained to monitor, protect and maintain cultural resources.

Much of the information accumulated through past research on historic resources was superficial and some records contain errors. There are errors and omissions on several maps in Historic Structures Reports routinely used for management purposes; these problems need to be corrected.

Organ Pipe Cactus's historic resources include archeological sites, isolated objects, roads and trails, hand dug water wells, ranches and associated facilities, prospects and mines, cemeteries, ruins, structures, cultural landscapes and areas held sacred by nearby Native American people. Many past historic activities have left lasting traces on the cultural and natural landscapes of the monument.

The Native American and Spanish dominated the historic period of this land until 1821 when Mexico won independence from Spain. After 1821, ranching and prospecting activities began to increase; however, non-native development and settlement of the area did not begin to expand rapidly until the Gadsden Purchase of 1853, when the United States gained ownership of the land. The most drastic changes in the natural landscape have probably occurred within the past 125 years, and were due to cultural changes made possible by the technological innovations of the Industrial Revolution. Without windmills for extracting groundwater and heavy equipment for mining, as well as technology to allow for transportation and road building in this hostile environment, the rapid expansion of mining and overgrazing that took place here would not have been possible.

Native American, European and Mexican explorers, entrepreneurs, prospectors, ranchers, farmers, bandits and revolutionary groups, as well as various governmental operations, have all left their marks on the landscape. The elimination of mining and cattle grazing inside monument boundaries in the late 1970's terminated two of the most disfiguring activities that affected natural and cultural resources. The prohibition of the traditional land uses of mining and ranching has ensured that remnants of their history and the influences they had on the resources here will increase in historical significance as time passes.

Remains of several old mines and ranch developments are excellent educational assets that are preserved and interpreted for the public. Additional sites are being protected and preserved for their scientific and cultural values. Some of the most significant sites are included, or have been nominated for inclusion in, the National Register of Historic Places (NRHP). Additional historic resources, including roads, trails, and perhaps landscapes, will have to be evaluated in the future for eligibility to the NRHP.

Organ Pipe Cactus has seven historic sites listed in the NRHP, an additional two have been nominated, and as least another six have been evaluated and determined not eligible for nomination to the NRHP at this time. Historic structures are present at five of the seven sites listed. These sites are of local or regional significance. Most sites having prehistoric or historic structures that are potentially eligible for, or are currently listed in the NRHP, are included on the NPS List of Classified Structures (LCS).

The monument's 1988 LCS contains eleven sites, some of which have multiple structures. The Organ Pipe Cactus LCS is currently being revised, and will be expanded to include individual structures as opposed to simply listing entire sites.

A summary of some of the more important historical sites located in the monument is provided below.

II.D.2.a. Bates Well

Bates Well has been a site of human habitation in the Sonoran Desert for centuries. Various indigenous peoples occupied this area, located between the Bates and Growler mountain ranges, and it harbors considerable archeological resources. In the late nineteenth century, Bates Well became the nucleus of settlement in a region of increasing prospecting activity. It also served as a crossroads point for numerous roads and trails through the desert.

During the 1880's and 1890's, Bates Well became a paramount water source in the area. It served as an important intersection for the old east-west Tucson-Yuma road and the north-south route between Ajo, Arizona, and Sonotya, Mexico. In 1909, there was a store at Bates Well, where several Americans resided. A settler named Reuben Daniels came there in 1913 and began a ranching operation, which he sold to Samuel and John McDaniels in 1917. They in turn sold the business in 1920 because of constant drought. Eventually, Bates Well was acquired by Robert Louis Gray, who came to dominate the ranching industry in the desert border country below Ajo. His son, Henry, moved to Bates Well, and lived in a frame house hauled onto the site from the Growler Mine until his death in 1977.

Today, the site is being nominated to the National Register of Historic Places. It consists of buildings and corrals associated primarily with Henry Gray's occupation of the area.

II.D.2.b. Bull Pasture

Bull Pasture is a large grassy basin located at an altitude of about 3,100 feet in the Ajo Mountains, near the eastern boundary of the monument. The area is a significant location identified with prehistoric occupation and with the early cattle ranching industry in the Arizona border country. Is was also the site of military occupation by armed Mexican refugees and of a post for American troops during the Mexican border crisis period

from 1915 to 1917. Today the site is listed on the National Register of Historic Places.

II.D.2.c. Dos Lomitas (Blankenship) Ranch

The Dos Lomitas Ranch symbolizes the early occupation and settlement of southern Arizona along the international border by American citizens. It also represents the beginning of a relatively large cattle-grazing industry in the Sonoran Desert. The ranch house evokes a Pueblo style of architecture that, with the rest of the ranch, fits in with a frontier border style noted for its use of miscellaneous materials at hand.

Sometime around 1915, Lonald Blankenship dug a well at this location, on the public domain, and brought in several hundred head of cattle. He lived in a one-room adobe house which was destroyed by a flash flood. In 1919, Blankenship sold his water rights and improvements to Robert Louis Gray, of Benson, Arizona, who built a new ranch house, the structure which is present today. He named it Dos Lomitas, after the two low hills located nearby.

Gray developed a substantial industry centered around the Dos Lomitas Ranch and ranged his cattle all over the region. Three of Gray's sons, Henry, Jack and Robert, Jr., eventually became partners with their father in the operation. After the creation of Organ Pipe Cactus National Monument in 1937, the Gray partnership succeeded in obtaining renewable grazing privileges on the land their livestock had traditionally roamed. In all, the Grays ranched the land for fifty-six years. Robert L. Gray, Sr., died in 1962, and all three of his sons died in 1975 and 1976, thus ending the ranching industry in Organ Pipe Cactus National Monument.

Today, the site is on the National Register of Historic Places. This site, like Gachado Line Camp, suffers from vandalism. In 1989, the ramada collapsed and had to be rebuilt. Many of the mesquite logs making up the corral have been stolen, as has the old windmill that stood at the site.

II.D.2.d. Gachado Line Camp

Gachado Well and Line Camp is a feature representative of the development of the ranching industry in southwestern Arizona early in the twentieth century. Gachado also provides an exemplary model of a frontier style of architecture unique to the border region.

Gachado Well was named for a gnarled old mesquite tree that once stood near the corner of the corral. The tree had one conspicuously long limb bent at an angle, hence the word gachada meaning "bent" (Hoy 1970). The well was dug by Lonald Blankenship, between 1916 and 1920. The well is possibly located on the site of a spring, for O'odham people claim to have obtained water at Gachado for centuries before the well was placed there.

In 1919, Blankenship sold his water rights and improvements to Robert Louis Gray. Gray and his sons ran several hundred head of cattle in the immediate vicinity of the border, and during the 1930's, Gray built an adobe house and corral at Gachado Well. His sons, Henry and Robert, Jr., lived for a short time in the house. In later years, it served as a line camp where cowboys stayed while attending the cattle. The Gray's business lasted from the 1920's through 1976. During this period, Gachado Well and Line Camp played an important role in the burgeoning ranching industry.

Today, the site is listed on the National Register of Historic Places. The area is preserved as required, within funding limitations, with a priority as the most significant line camp representative of the ranching era in the monument. The most significant threat to the resource is vandalism, primarily from Mexico.

II.D.2.e. Growler Mine Area

Growler Mine and its vicinity represent one of the earliest and most intensively worked copper areas in the border country south of Ajo, Arizona. The Growler mine was one of the first mines opened in

the region, and became a reliable producer of high grade copper ore early in the twentieth century.

Growler Mine was named by Frederick Wall for his friend John Growler sometime in the late 1800's. Occupation of the site occurred quickly following the discovery of rich copper deposits, and by the 1890s, there was a small community nearby called Growler Camp. Mining began on a small scale and blossomed early in the twentieth century. A claim on the Big Growler Mine was filed in 1897 by John W. Wise and S. B. Wellington. After 1900, the Growler changed hands repeatedly. Productivity peaked in 1916, and in the following year, the Growler was closed. From then on, various lessees worked the area until 1928. In 1956 and 1957, the patented claims were turned over to the National Park Service. Today the site is listed on the National Register of Historic Places.

II.D.2.f. Milton Mine

Milton Mine is a surface mine located 4.5 miles north of the Mexican border in the southernmost fringe of the Puerto Blanco Mountains. The Milton Mine exemplifies a low-budget form of surface mining that was common in the Arizona-Mexico country early in the twentieth century. Throughout its existence, the Milton Mine has produced gold and copper ore in very small quantities. The mine was named after its discoverer, Jefferson Davis Milton, who located it while serving as an immigration agent in the border region. Today the site is listed on the National Register of Historic Places.

II.D.2.g. Quitobaquito

Situated approximately 200 yards to the north of the international boundary with Mexico, Quitobaquito is an oasis in the Sonoran Desert. It is a spot of lush riparian growth and is one of the few authentic desert oases on the North American continent. Natural springs flow into a man-made channel and pond, which are habitat for an endangered species of desert pupfish. A foot trail partially encircles the pond. About 150 yards to the north of the pond, there is a rise where the grave of Jose Lorenzo Sestier, a Frenchman who died in 1900, is located. Razed habitation sites and that of a general store are also close to the pond, but they are unmarked, and are perhaps recognized only by those familiar with the rich ethnic history of Quitobaquito, which has been occupied by various groups from prehistoric times through the historic period.

The Quitobaquito region is the oldest continuously occupied area within Organ Pipe Cactus National Monument. Julian Hayden (personal communication) indicates that San Dieguito artifacts have been noted in association with extinct springs on the slopes above the present day springs. Survey of this area by Paul Ezell in 1951 resulted in the identification of SON B:4:1(ASM). This site number appears to refer to unprovenienced artifacts collected from the Quitobaquito basin and adjacent areas (Teague 1977). Archeological survey of the Quitobaquito Basin was conducted by Lynn Teague of the Arizona State Museum in 1977. Nine prehistoric and historic loci were identified which were recorded as seven separate sites. Three sites, SON B:4:9, 11, and 13(ASM) were identified as prehistoric. Son B:4:9(ASM) is a multi-component artifact scatter containing ceramics, chipped and ground stone, and fire-cracked rock clusters. The earliest component indicates use of the area from the early to late Archaic period. Prehistoric ceramic period evidence also indicates use by the Hohokam from A.D. 900-1000; and finally, historic period use by Hia C-ed O'odham is indicated. This site has been partially destroyed by the parking lot. The site does, however, have the potential to yield significant information. Site maps and collections need to be conducted for this site and the San Dieguito site identified by Hayden.

Survey of 500 acres from the crest of the Quitobaquito Hills east to Aguajita Wash resulted in the recording of eight sites and identification of several trail segments and a portion of an historic wagon trail. Sites east of the spring include prehistoric artifact scatters, quarry and associated workshops, and multiple fire-cracked rock clusters with associated chipped stone artifacts. Isolated

artifacts identified in the passes confirm use of the area from the Archaic through Historic period. Prehistoric ceramics include Hohokam red-on-buff and red-on-brown, Trincheras purple-on-red, and Lower Colorado buff wares.

Son B:4:16(ASM) was recorded during the ORPI 1989 D survey. The site is an extensive artifact scatter of ceramics, chipped and ground stone, and eight fire-cracked rock clusters. Three discrete activity loci were identified with the site. The presence of Trincheras purple-on-red suggests cultural affiliation with the Trincheras culture. Additionally, a chipping station with a high density of obsidian nodules and flakes was identified. The presence of high densities of obsidian is consistent with information from sites in the Dos Lomitas area which show cultural affiliation with the Trincheras culture.

II.D.2.h. Victoria Mine

Of all of the mining properties within Organ Pipe Cactus National Monument, the Victoria Mine was one of the most singularly successful and most historic. This silver, lead, and gold producer possesses a colorful past dating from the period of the first American settlement in the border region.

The earliest history of Victoria Mine is obscure. One account holds that the surface vein was discovered by an American sometime around 1880, while another states that Spaniards mined the site centuries ago. Cipriano Ortega, a border outlaw turned entrepreneur, acquired the site around 1880 and called it "La Americana," probably because of its position north of the border. Ortega reportedly extracted large quantities of silver ore before abandoning the site. In 1899, Mikul G. Levy obtained the mine and renamed it the Victoria after the wife of one of his helpers. Levy operated the mine intermittently over the next four decades.

In the course of his enterprise at Victoria, Levy reopened the shaft and prepared to extend it, but shortly before 1910, he encountered water and was forced to close down temporarily. To meet operating costs, he sold shares in the Victoria and filed other claims in the vicinity of the mine. In 1924, Levy's holdings were incorporated in the Victoria Mining and Smelting Company. In the 1930s, the claims at Victoria were leased to independent developers. One group left the scene in 1936, finding it difficult to penetrate beyond the water level in the original shaft. Three years later, Levy hired a caretaker to watch the mine, which was not worked again until after his death in 1941. Since then, numerous persons have worked the Victoria Mine with little success. Today the site is listed on the National Register of Historic Places.

II.D.2.i. Montezuma's Head

Montezuma's Head is a sacred site of the Tohono O'odham People and is now on the National Register of Historic Places as a traditional cultural property.

It is a distinctive rock formation of the Ajo Mountains which is readily apparent while driving south upon entering the monument. Montezuma is another name for I'itoi, a very important Tohono O'odham god. Tohono O'odham people visit Montezuma's Head to worship I'itoi.

I'itoi is associated with the creation of the Tohono O'odham people (also known as Papago) and Hia-Ced O'odham (also known as Sand Papago) who now live within the Tohono O'odham Nation to the east of the Ajo Mountains. Montezuma's Head probably has not changed much from time immemorial or the dawn of time in Tohono O'odham and Hia-Ced O'odham terms, which is the initial period of I'itoi. That was when I'itoi was frequenting the place of Montezuma's Head and two other important sacred sites in the Sonoran Desert, helping humans become established on earth. The god I'itoi figures prominently along with Jewed Makai, or Earth Maker, who is the supreme deity in the creation of the Tohono O'odham and Hia-Ced O'odham.

In the words of a 1993 resolution of the Hickiwan District of the Tohono O'odham Nation, Montezuma's Head is a sacred rock formation from

time immemorial that continues to be "a major religious site of the Tohono O'odham people, a location [in the Ajo Mountains within present-day Organ Pipe Cactus National Monument] where the Tohono O'odham have traditionally carried out [and still do] cultural practices important in maintaining their historical identity."

II.D.3. Cultural Context/Theme

II.D.3.a. Archeology

The following themes are represented in Organ Pipe National Monument:

- The Earliest Inhabitants (I.A.)
  - Archaic Adaptations of the Southwest (10)

- Post-Archaic and Pre-Contact Developments (I.B.)
  - Southwestern Farmers (8.)

- Prehistoric Archeology: Topical Facets (I.C.)
  - Prehistoric Architecture/Shelter/Housing (1.)
  - Prehistoric Technology (2.)
  - Prehistoric Social and Political Organization (3.)
  - Prehistoric Arts/Handicrafts (5.)
  - Prehistoric Diet (7.)
  - Prehistoric Trade (8.)
  - Prehistoric Religion, Ideology, and Ceremonialism (10.)
  - Prehistoric Settlements and Settlement
  - Patterns (12.)
  - Prehistoric Horticulture (16.)
  - Prehistoric Demographics (18.)

- Ethnohistory of Indigenous American Populations (I.D.)
  - Native Adaptations to Southwestern Environments (1.a.)
  - Prehistoric Culture Change (19.)

II.D.3.b. Historic

- European Colonial Exploration and Settlement (II.)
  - Spanish Exploration and Settlement (A.)
  - Southwest (3.)
  - Westward Expansion of The British Colonies and the United States, 1763-1898 (X.)
  - The Mining Frontier (E.)
  - Southwest: Arizona and New Mexico (3.)

II.E. Integration of Natural and Cultural Resources

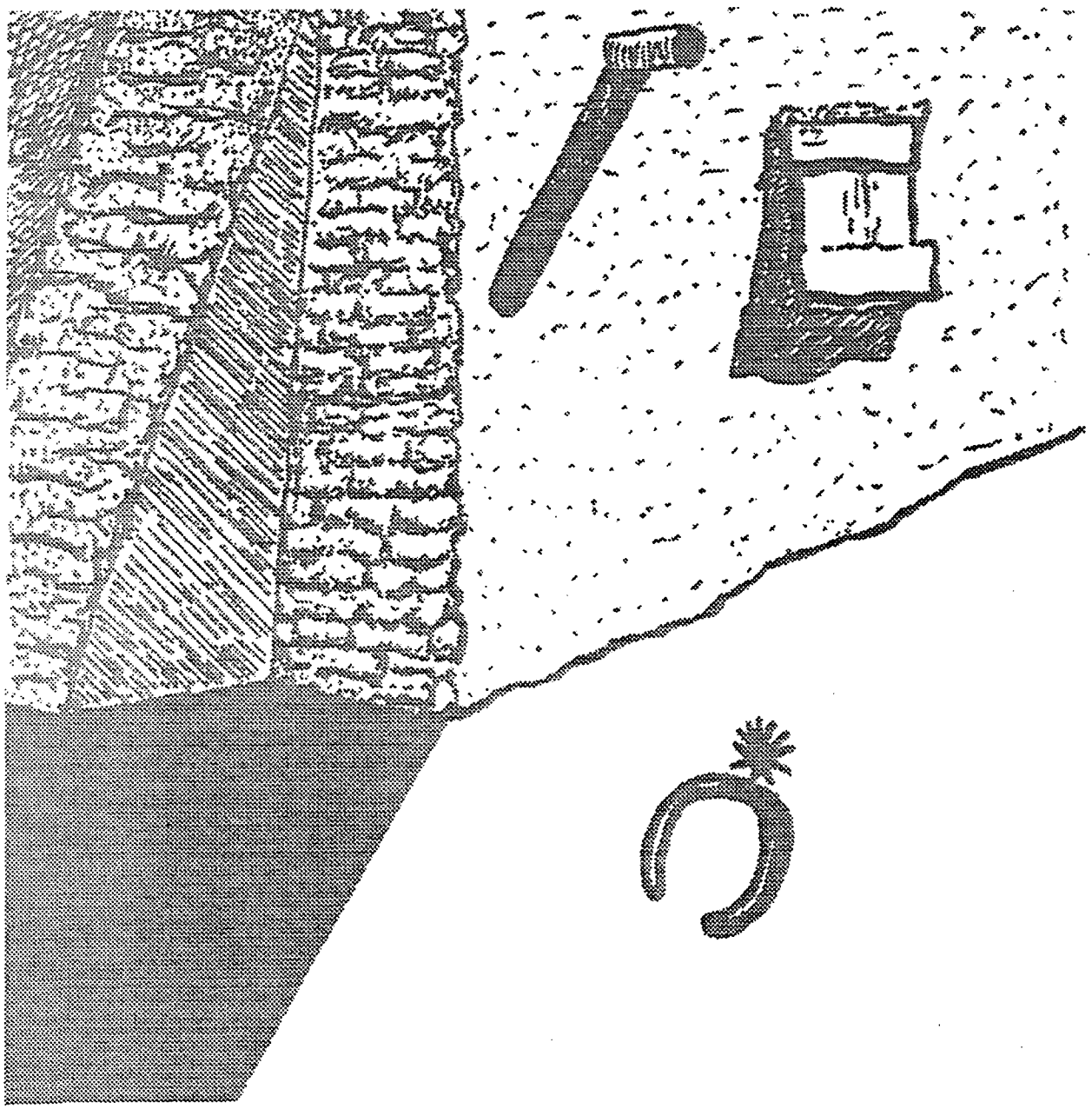
There is a strong complementary relationship between natural and cultural research, particularly in archeology. A full knowledge of the environment is essential for interpretation of archeological remains and their change through time. Modern climatic records, plant and animal distributions, water sources, soils, geology and landforms are an important baseline for designing archeological research and interpreting the results. Likewise, archeological research has high potential for contributing data to natural resources research, by which ecological change through the last 12,000 years may be traced and compared to the modern environment. Archeological sites, for instance, may contain evidence of datable changes in plant and animal populations, water tables and landforms.

Distributional changes, and changes in functional site types, often reflect environmental changes in the Sonoran Desert. Continuous interaction between natural and cultural researchers and resources managers is essential for effective resources management and research.

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

RESEARCH AND RESOURCES MANAGEMENT PROGRAMS



III. RESEARCH AND RESOURCES MANAGEMENT PROGRAMS
(Overview of Current Program and Needs)

III.A. Introduction

In this Resources Management Plan, the natural and cultural resources management and research programs are arranged into specific subject areas for natural, cultural, and integrated programs. For each subject there are the following:

1) General overview of the subject area;

2) Discussion of National Park Service Policy and Program Objectives;

3) Overview of the monument's current program in this subject area;

4) Discussion of current issues facing the monument and identification of proposed actions.

The current and future programs are the substance of the project statements, presented in Section IV. The program topics for Organ Pipe Cactus, in order of appearance are:

1) **Natural:** Vegetation management, wildlife management, natural resource inventorying and monitoring, water resources, threatened, endangered and sensitive species and air resources.

2) **Cultural:** Archeology and historic resources.

3) **Integrated:** Natural and cultural resources management and research administration and planning, information/data management, integrated pest management, wildland fire, wilderness management, abandoned mine lands, aircraft management, Man and the Biosphere program, museum/library/archives and other.

III.B. Program Responsibility

The Division of Resources Management and Research is responsible to the Superintendent for the planning, direction, coordination and implementation of the monument's Natural and Cultural Resources Management and Research Program.

Division of Resources Management and Research

The Division of Resources Management and Research is one of three divisions within the monument's organizational structure. Other divisions include the Division of Visitor Protection and Interpretation and the Division of Maintenance. All three divisions have chiefs whom report directly to the Superintendent. Administration is coordinated directly from the Superintendent's office.

The function of the Division of Resources Management and Research is to administer and manage natural and cultural resources management and research activities, including:

- Natural and Cultural Resources Program Management and Administration
- Research Program Management and Administration
- Natural Resources Inventorying and Monitoring
- Geographic Information Systems (GIS)
- Global Climate Change Program (GCCP)
- Threatened, Endangered and Sensitive Species Program
- Non-Native Species Control
- Backcountry/Wilderness Management
- Man and the Biosphere Program
- Integrated Pest Management
- Vegetation Management
- Wildlife Management
- Cultural Resources - Historic Sites
- Cultural Resources - Archeology
- Resources Management/Research Computer and Information Management
- Air Quality

- Water Resources: Quality and Quantity
- Sonoran Desert Biosphere Reserve Center
- Monument Museum/Archives/Library
- Volunteer-In-Parks (RM)
- Boundary Fence Inspections
- Abandoned Mine Lands Program
- Erosion Mitigation and Control

III.C. Vegetation Management

III.C.1. Overview

Vegetation management varies in the National Park Service depending on the park unit. It can entail maintaining cultivated landscapes in historical sites or promoting ecological processes in wilderness. To manage vegetation appropriately in a given area, it is important to clearly define management objectives and to develop an ecologically sound strategy for achieving the objectives. Vegetation management should be integrated into all aspects of park operations and planning.

III.C.2. National Park Service Policy and Program Objectives

Authority to manage vegetation within the National Park Service is derived from: 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use which leaves the resources unimpaired, 2) the General Authorities Act (1970), which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities would be undertaken to derogate park values, except where legally authorized. Additional authorities are the Endangered Species Act and National Environmental Policy Act. Cultural landscapes are also protected under several laws relating to historic preservation, including the 1935 Historic Sites Act, 1966 National Historic Preservation Act and the 1979 Archeological Resources Protection Act. The Code of Federal Regulations (CFR) also applies, and state and county laws may be relevant.

Parks must operate a vegetation program relevant to the diversity, magnitude, and complexity of their plant resources. The policy and objectives as stated in NPS Management Policies and reiterated in the NPS-77 guideline are:

The National Park Service will seek to perpetuate native plant life as part of natural ecosystems. Landscapes and plants may be manipulated only when necessary to achieve appropriate management objectives. These objectives will vary according to management zones. To the maximum extent possible, plantings in all zones will consist of species that are native to the park or that are historically appropriate for the period or event commemorated. Only native species will be allowed in natural zones. Uses of exotic species in other zones will conform to the exotic species policy. In any zone, landscapes and plants may be manipulated to maintain habitat for threatened or endangered species, but in natural zones, only native plants may be used if additional plantings are done, and manipulation of existing plants will be carried out in a manner designed to restore or enhance the functioning of the plant and animal community of which the endangered species is a natural part (4:8).

III.C.3. Organ Pipe Cactus National Monument Current Program

The emphasis of the monument's vegetation program has been on research, control of non-native vegetation and revegetation of disturbed areas. Plant voucher species date from the mid-1800's to the present. Research efforts have focused on plant inventories, special status vegetation, and plant community studies assessing land use impacts, primarily cattle grazing. Control of non-native vegetation has been restricted primarily to tamarisk (*Tamarix chinensis*) and exotic trees in the residential area. In recent years, revegetation and restoration of impacted areas to a natural state have comprised a major portion of the vegetation management program. In 1978, 95% of

Organ Pipe Cactus National Monument was designated as wilderness, resulting in the closure of approximately 85 miles of primitive roads. The roads, however, were still plainly visible from developed roads and were frequently used by park visitors, despite adequate signing and location removal from maps. Revegetating the entrances and exits was seen as a viable alternative for disguising these roads.

The Resources Management Division began growing native plants in a makeshift nursery near monument headquarters in 1979. There was little literature available on growing desert plants in a nursery and the project was largely done through trial and error for the first few years. Attempts were made to grow numerous species of shrubs, trees, and cacti from both seed and cuttings. Initially, roads were revegetated with drought resistant plants which were easy to grow in the nursery and which required little care once transplanted. These included ocotillo (*Fouquieria splendens*) and various species of cacti. The survival rate was reasonably high, but a linear strip of cacti in an area of desert dominated by creosote bush (*Larrea tridentata*) or other shrubs did little to camouflage the roads. Clearly it was necessary to revegetate the roads with the dominant vegetation of the surrounding area. Fortunately, the trial and error method used in the nursery paid off fairly quickly, and resulted in successful methods for growing creosote bush and many other plants from seed. Using present methods, only three roads a year can be revegetated, due mainly to the labor involved in weekly watering.

During the summer of 1988, a new nursery and greenhouse complex was completed at the Sonoran Desert Biosphere Reserve Center, located near monument headquarters. The solar heated greenhouse is equipped with an automatic mist system and the shade area of the nursery is equipped with an automatic drip irrigation system. A new record keeping system was implemented during the winter of 1988, which allows for statistical analyses of the effectiveness of the various soil mixtures, seed treatments, fertilizers, and other variables. In addition, in 1988, the revegetation program expanded beyond just revegetating abandoned roads. Nursery grown plants have been used to stabilize soil in erosion areas, as well as to reclaim other disturbed areas.

Efforts since 1989 and 1990 concentrated on both the revegetation of abandoned roadways and other disturbed areas, including three monitoring well sites on the monument's southern boundary. In addition, due to construction in the headquarters/residential area, many plants were salvaged and placed in holding areas for future planting. Other efforts included conducting an assessment of all past revegetation sites, primarily abandoned roadways, and inventorying and removing non-native vegetation in the residential area.

In FY 1992, two volunteers and one temporary employee were recruited to oversee revegetation efforts, including restoring an abandoned campground, landscaping at the Sonoran Desert Biosphere Reserve Center and starting plants for revegetation efforts in FY 1993 associated with the Ajo Mountain Drive Construction Project. In FY 1993 and 1994 revegetation efforts have focused on revegetation along the Ajo Mountain Drive.

The revegetation program continues to grow annually. Besides several years of work yet to be accomplished on restoring abandoned roadways, revegetation efforts continue to become a necessity for many other projects requiring plant salvage and restoration.

In the past two years, three major construction projects required the majority of nursery/greenhouse space and volunteer/staff personnel time. These were projects that were unanticipated the preceding year. Although revegetation costs are often covered as part of specific construction projects, assistance is needed to maintain the minimal program and to accomplish previously identified projects

III.C.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N06 Disruption of Native Plant Communities
N24 Other Issues

Implement and Manage Vegetation Management Program
Project Statement No.: ORPI-N-001

Issue: A commitment of staff and funding is needed to implement and manage the monument's vegetation management program. Management is required for extensive monument programs including revegetation of disturbed sites, non-native species control, sensitive species monitoring and general vegetation community research. Without the necessary permanent infrastructure, these programs cannot be implemented effectively or efficiently.

Proposed Action: A permanent coordinator to manage and implement the vegetation management program will be established. Responsibilities will include coordinating and supervising revegetation projects, operation of a native plants nursery, threatened and endangered species management, long-term plant monitoring to determine ecosystem health, independent and contracted research programs and overall vegetation monitoring. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the vegetation program.

Develop a Vegetation Management Plan
Project Statement No.: ORPI-N-002

Issue: A plan needs to be developed that will guide vegetation management programs at Organ Pipe Cactus National Monument. No such plan is currently being developed or in effect.

Proposed Action: A plan will be developed to address vegetation management issues and guide implementation of programs such as revegetation and plant community restoration in natural areas, landscaping in development areas, sensitive plant species management, non-native plant species control, hazardous tree management, preserving cultivars of historical significance and outlining the role of interpretation in vegetation management programs. The final Vegetation Management Plan (VMP) will be an addendum to the Natural and Cultural Resources Management Plan (RMP). Project statements from the VMP will be integrated wholly into the RMP for both informational and programming purposes.

Evaluate Effectiveness of and Develop Standards for the Revegetation Program
Project Statement No.: ORPI-N-003

Issue: The overall effectiveness of the monument's revegetation program is unknown. An assessment is needed to fully evaluate past revegetation projects, to establish standard operating procedures for propagation and monitoring and to develop guidelines to direct future revegetation activities.

Proposed Action: Past revegetation sites will be evaluated based on existing documentation. Plant status, soil conditions, climate data, hydrology, species type, topography, slope and aspect will be factored into the evaluation of revegetation success. Comparable sites with variable techniques will be examined. Test plots will be set up to compare volunteer plant recruitment and establishment against plots using nursery grown transplants. Transplant variables tested will include: type of plant, watering regime, treatments such as fertilizing and mulching, container size, etc. For the plots testing natural recruitment, various site preparations will be used, such as soil scalping, or plowing in severely compacted areas, along with artificial placement of nurse objects, and soil surface erosion control structures. Statistical analyses will be performed comparing various revegetation methods and will include cost through plant establishment.

Revegetate Abandoned Road Portals
Project Statement No.: ORPI-N-004

Issue: Several abandoned road portals are visible from primary visitor scenic drives and roadways, leading to vehicular traffic into areas of designated

wilderness, and disrupting recovery of natural ecosystems.

Proposed Action: A program will be developed to complete the work initiated on the revegetation of abandoned road portals. Sites previously restored will be reevaluated, and necessary maintenance will be accomplished. This will include both soil conditioning and plant replacement. Portals not yet revegetated will be completed, using both established and experimental techniques.

Develop and Implement a Site Restoration Program for the Dowling Ranch and the Stack Property
Project Statement No: ORPI-N-005

Issue: Approximately 160 acres of newly acquired land within the monument has been significantly impacted by past use. Action is needed to evaluate the condition of the land and to establish a program of site rehabilitation and restoration.

Proposed Action: A full evaluation of these newly acquired lands will be conducted. This evaluation will include examining the extent of human-induced impacts, as well as an investigation of the cultural resources of the sites. Based on this evaluation, a plan for the restoration of these sites will be developed and implemented.

Develop and Implement a Program to Manage Hazardous Trees
Project Statement No: ORPI-N-006

Issue: Certain vegetation types, due to their size, type and/or condition, pose hazards to visitor safety. As defined by the Western Region Directive WR-093 and 1993 Guidelines for Managing Hazardous Trees a "hazardous tree" is any tree, cactus, palm, or other large vascular plant, either alive or dead, which due to outwardly visible defects could fall down (in part or in entirety) and strike a person or property within any designated portion of a development zone (NPS 1993).

Proposed Action: A program will be developed to manage hazardous trees in the monument. The program will be in compliance with Western Region Directive #WR-093 and will balance safety risks with minimal intrusion into the natural setting of the area.

Monitor and Mitigate Woodcutting
Project Statement No.: ORPI-N-007

Issue: Woodcutting of tree species, such as ironwood and mesquite along the southern boundary of Organ Pipe Cactus National Monument and in adjacent Sonora, Mexico, threatens both these resources and the myriad of plant and animal species dependent on them. Ironwood is a keystone species in the Sonoran Desert, playing a major role in nitrogen, water dynamics and habitat structure within the desert and desert wash communities (Suzán Azpiri 1992). Preliminary surveys indicate that more than 160 plant species, including six threatened succulents, depend upon legumes such as ironwood and mesquite for their germination in the Sonoran Desert. Endangered wildlife species also depend upon these two legumes for shelter and forage (Nabhan and Plotkin 1994).

Proposed Action: An expanded program to monitor and mitigate the impacts of woodcutting will be developed and implemented. Components of the program will include the establishment of permanent monitoring sites, expanded interpretative efforts within and outside the monument and a concerted effort to work on the issue with Mexican neighbors.

III.D. Wildlife Management

III.D.1. Overview

A great diversity of native wildlife is found in Organ Pipe Cactus National Monument, including numerous vertebrate and invertebrate species. Managing these natives requires both systems management, involving broad programs affecting many animals., and interrelated with other park programs, and population management, dealing

with specific animal management practices. Activities that are external and internal to the park need to be assessed for effects on species and habitat. Wildlife management needs to be integrated into all aspects of park operations and planning.

III.D.2. National Park Service Policy and Program Objectives

The authorities to manage wildlife include: 1) the Organic Act (1916), which directs protection and preservation of natural and cultural resources while providing for public use which leaves the resources unimpaired, 2) the General Authorities Act (1970), which declared that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, and 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities be undertaken to degrade park values, except where legally authorized. Some federal statues which pertain to native animal management are the Bald and Golden Eagle Protection Act (1940 and amendments); Endangered Species Act (1973); Federal Environmental Pesticide Act; Federal Insecticide, Fungicide and Rodenticide Act; Lacey Act (1900); Migratory Bird Treaty Act (1918); and National Environmental Policy Act (1969). Regulations in 36 CFR specifically address preservation of native wildlife. Several international treaties directly or indirectly affect management of native wildlife, and the NPS can enter into agreements with state, local, and federal agencies to manage animals outside of parks. The policy and objectives as stated in NPS Management Policies and reiterated in the NPS-77 guideline are:

The National Park Service will seek to perpetuate the native animal life as part of the natural ecosystem of parks. Superintendents will develop agreements with other federal, state, and local agencies, Native American authorities, and private landowners where appropriate to coordinate plant and animal management activities. Superintendents will seek the cooperation of others in minimizing the impacts of outside influences...and other means of preserving and protecting park resources.

Native animal populations will be protected against harvest [except under certain specified conditions], removal, destruction, harassment, or harm through human action. Natural processes will be relied on to control populations of native species to the greatest extent possible. Unnatural concentrations of native species caused by human activities may be controlled if the activities causing the concentration cannot be controlled. Animal populations or individuals will be controlled in natural, cultural, and development zones when they present a direct threat to visitor safety and health, and in cultural and development zones when necessary to protect property or landscaped areas. The NPS will consult, as appropriate, with other federal land managing agencies, the US Fish and Wildlife Service, state agencies, Native American authorities, and others regarding programs to control populations of fish and wildlife, research programs involving the taking of fish and resident wildlife, and cooperative studies and plans to guide public hunting outside park boundaries.

Parks having native migratory species will ensure the preservation of their populations and their habitats inside the park and will cooperate wherever possible with others to ensure the preservation of their populations and habitats outside the park. Hunting and trapping of wildlife will be allowed only in parks where such use is specifically authorized. In areas set aside with legal authorization for hunting, trapping, fishing, subsistence use, or other harvest of native wildlife, the NPS will still seek to perpetuate native animal life and to protect the integrity of natural ecosystems.

The NPS will strive to protect the full range of genetic types native to plant and animal populations in the parks by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity. When individual plants or animals must be removed for any reason - hunting, fishing, pest management, or culling to reduce excess populations resulting from human

activities - the NPS will consider the need to maintain appropriate levels of genetic diversity in the residual park populations. The NPS will strive to restore native species to parks wherever all the following criteria can be met: Adequate habitat to support the species [at viable population level] either exists or can reasonably be restored...The species does not...pose a serious threat to [humans]...The [restored population] most nearly approximates the extirpated subspecies or race...The species disappeared...as a direct or indirect result of human-induced change. The [restoration] of native...animals will be accomplished using organisms taken from populations as closely related genetically and ecologically as possible to the park populations.

Native pests will be allowed to function unimpeded except where control is desirable to prevent the loss of the host or host-dependent species from the ecosystem; to prevent outbreaks of the pest from spreading...outside the park; to conserve threatened, endangered, or unique plant specimens or communities; to preserve, maintain, or restore the historical integrity of cultural resources; to conserve and protect plants and animals in developed zones; to manage a human health hazard as defined by the Centers for Disease Control or to protect against a significant threat to public safety.

III.D.3. Organ Pipe Cactus National Monument Current Program

The emphasis of the monument's wildlife program has been on research, control of non-native animals and on ecological inventorying and monitoring. All of these activities will be discussed further in the threatened, endangered and sensitive species, integrated pest management and natural resources inventorying and monitoring sections.

III.D.4. Organ Pipe Cactus National Monument Issues and Proposed Alternatives

SERVICEWIDE ISSUES:

N20 Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

Develop a Wildlife Management Plan
Project Statement No.: ORPI-N-050

Issue: A plan must be developed that will guide wildlife management programs at Organ Pipe Cactus National Monument. No such plan is currently being developed or in effect. A Wildlife Management Plan (WMP) is needed to assist in the implementation of programs.

Proposed Action: A plan will be developed to address wildlife management issues and guide implementation of programs such as biological diversity, genetic diversity, mitigate management practices adjacent to parks that have negative impacts on wildlife, non-native animal species control, analyze effects of historic animal management practices, population management, outlining the role of interpretation in wildlife management programs and procedures for scientific specimen collecting. The final Wildlife Management Plan will be an addendum to the RMP. Project statements from the WMP will be integrated wholly into the RMP for both informational and programming purposes.

Implement and Manage Wildlife Management Program
Project Statement No.: ORPI-N-051

Issue: A commitment of staff and funding is needed to implement and manage the monument's wildlife management program. Management is required for extensive monument programs. Without the necessary permanent infrastructure, these programs cannot be implemented effectively or efficiently.

Proposed Action: A permanent coordinator position to manage and implement the wildlife management program will be established. Responsibilities will include coordinating scientific research projects, non-native animal control, threatened, endangered and sensitive species

management, long-term wildlife monitoring to determine ecosystem health, and overall wildlife assessments and management. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the wildlife management program.

III.E. Natural Resources Inventorying and Monitoring

III.E.1. Overview

Knowing the condition of natural resources within the National Park System is fundamental to the Service's ability to protect and manage parks. Based on legal mandates and National Park Service (NPS) policy, the major goals of the Servicewide Inventory and Monitoring (I&M) program are: to inventory the natural resources and park ecosystems under NPS stewardship to determine their nature and status; to monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments; and to integrate natural resources inventory and monitoring information into NPS planning, management, and decision making. Other goals include establishing natural resources inventory and monitoring as a standard practice throughout the NPS and forming partnerships with other natural resources agencies in order to pursue common goals and objectives. (NPS-75 1992).

III.E.2. National Park Service Policy and Program Objectives

The need to know the condition of natural resources (i.e., the status of resources compared to a set reference) on a continuing basis in national parks was recognized and developed in public law as early as 1872. Executive proclamations and orders clarify and further the intent of these laws. The natural resource mission of the NPS is to provide the American people with "the opportunity to enjoy and benefit from natural environments evolving through natural processes minimally influenced by human actions." (NPS Management Policies, Chapter 4: 1, 1988). The National Environmental Policy Act of 1969 requires certain knowledge of resource conditions to direct and evaluate effects of management actions. The Forest and Rangeland Renewable Resources Planning Acts of 1974 and 1976 also express Congressional insistence on inventory and monitoring of natural resources on all public lands in the United States. Several other federal laws and executive orders also provide legal direction and support for expending funds to determine the condition of natural resources in parks (e.g., Endangered Species Act, 1973, amended 1982; Fish and Wildlife Coordination Acts, 1958 and 1980; Migratory Bird Treaty Act, 1974; Clean Water Act (33 USC 1251 et seq.); Executive Order 11900 (Protection of Wetlands); and the Clean Air Act (42 USC 7401 et seq.) 1963, amended 1977, 1991).

The management policy of the NPS reflects these legal mandates and directs that management be based on knowledge of resources and their conditions. The National Park Service has an obligation to manage the natural resources of the national park system to maintain and perpetuate their inherent integrity." (NPS Management Policies, Chapter 4: 1, 1988). NPS policy also states that "a program of natural and social science research will be conducted to support NPS staff in carrying out the mission of the National Park Service by providing an accurate scientific basis for planning, development and management decisions." (NPS Management Policies, Chapter 4:2, 1988).

NPS policy further states that "The National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments." (NPS Management Policies, Chapter 4:4, 1988).

Thus, NPS policy requires that park managers know the nature and condition of the natural resources under their stewardship, have the means to detect and document changes in those resources, and understand the forces driving the changes, in

order to fulfill the NPS mission of conserving parks unimpaired. Natural resources inventories assist in determining what resources are in trust. Monitoring is indispensable in determining desired resource conditions; in diagnosing human impacts; in directing management intervention; and for measuring the subsequent success or failure of that intervention.

Park management is directed to integrate scientifically valid resource inventories, monitoring, research, and restoration. These interdependent activities are required for conservation of unimpaired parks (NPS Management Policies, Chapter 4, 1988). Besides their utility in determining natural conditions and detecting ecological problems, the long-term data sets also may be used to detect correlations and pose research hypotheses to establish causal relationships, to evaluate the effects of management activities, to determine compliance with emission and discharge standards and regulations, and to develop and evaluate mitigation of specific anthropic perturbations. Although inventory and monitoring will help frame and focus research questions, studies specifically designed to determine, regulate, or mitigate impacts of known environmental perturbations are beyond the scope of the natural resource inventory and monitoring as addressed by NPS guidelines (see NPS-77; Natural Resources Management Guideline, 1991).

III.E.3. Organ Pipe Cactus National Monument Current Program

Sensitive Ecosystems Program

Modern land managers have a paramount responsibility to know both the condition of the natural resources they are charged with managing, and to what extent mankind's activities affect them. The National Environmental Policy Act of 1969 requires a certain knowledge of natural resources to direct management actions and to evaluate their efficacy. In fact, through Forest and Rangeland Renewable Resource Planning Acts of 1974 and 1976, all federal lands are required to inventory and monitor their natural resources.

It was these legal mandates that were in mind when in September 1986, an international panel of scientists and managers met to plan the development of a program to both assess ecosystem conditions at Organ Pipe Cactus National Monument and to monitor ecosystem components through the future. The step down planning technique was used to efficiently organize the management goals and objectives of this program, entitled the Sensitive Ecosystems Program (SEP). During this meeting, 22 research projects were identified and prioritized.

As a result of the Sensitive Ecosystems Program, Organ Pipe Cactus National Monument has the framework for one of the most extensive NPS ecological research and inventorying and monitoring programs. Through this program, baseline data and monitoring protocols have been provided by scientists for park reptiles, amphibians, small mammal populations, avifauna, terrestrial invertebrates, special status plants, non-native vegetation, endangered species, climate, air quality, groundwater monitoring, land-use trends on property adjacent to the monument and vegetation structure and diversity in natural communities.

A summary of SEP progress to date is as follows:

Land Use Trends Surrounding Organ Pipe Cactus National Monument (Brown 1988)

In this study, the current land and water uses of lands adjacent to the monument were evaluated. The emphasis of the research was placed on the Rio Sonoyta Valley, in Sonora, Mexico. For this region, the following were determined: 1) acreage in agricultural production, 2) the types of crops being raised and their associated acreage, and 3) annual groundwater pumpage rates. Additionally, the Principal Investigator projected future land usage and identified and examined factors which indicate increased agricultural development.

The long-term bi-annual monitoring protocol consists of photodocumenting sections of the Sonoyta Valley to determine land use changes. Relations initiated and developed by the Principal

Investigator with resource management agency officials in Mexico have provided for the on-going exchange of groundwater information and other natural resource information between monument resources management personnel and resource officials in Mexico.

Special Status Birds of Organ Pipe Cactus National Monument (Johnson 1992)

This study was designed to provide information about the distribution and relative abundance of the monument's birds, with special emphasis on the breeding birds in the vicinity of permanent study sites. Research focused on establishing criteria for selecting species to be monitored in a long term monitoring program, and designing a monitoring protocol that would guide resource management staff in this effort.

Ecology of Invertebrates at Organ Pipe Cactus National Monument (Kingsley 1991)

This study attempted to determine the important invertebrate species in the monument ecosystem, focusing on the 16 permanent study sites. Approximately 4200 invertebrate specimens were added to the monument's invertebrate collection.

Ecology of Amphibians and Reptiles of Organ Pipe Cactus National Monument (Lowe 1992)

This study was designed to provide information about reptile and amphibian species' occurrence, distribution, and relative abundance, emphasizing species on the 16 permanent research sites. Criteria were established and lizard species were selected to be monitored as indicators of monument herpetofauna health. The herptofauna "Red List" was reviewed and evaluated.

Alien Plant Threats to Organ Pipe Cactus National Monument (Felger 1990)

Sixty-two species of vascular plants, located in or adjacent to the monument, have been identified as being possibly non-native. This represents about 11% of the park flora and may be an over estimation, since: 1) some "non-natives" may actually be native, 2) some species are present but are not reproducing, and 3) some are in adjacent Sonora, but have not been seen in the monument.

It was determined that one of the greatest non-native plant threats to the monument ecosystem is the continued introduction on adjacent lands of arid-adapted Old World grasses, by the US Department of Agriculture Soil Conservation Service.

Special Status Mammals of Organ Pipe Cactus National Monument (Petryszyn 1992)

This study was designed to provide information about species distribution and relative abundance of mammals. The mammals section of the monument's "Red List" was reviewed and evaluated. Criteria were established for selection of mammal indicator species, and nocturnal rodents were selected to be monitored over the long-term.

Special Status Plants of Organ Pipe Cactus National Monument (Ruffner 1990)

This project made a detailed study of 17 plant species of concern, including determining regional distribution, abundance, and factors that limit distribution. In addition, assessments of impacts and threats, and recommendations for management were made for each of the 17 plants. The monument's "Red List" was reviewed and revised, and "Status Unknown" plants from the flora list were investigated. Monitoring protocols were designed for four of the 17 plants.

Recovery of Organ Pipe Cactus National Monument Ecosystems Since Termination of Cattle Grazing (Warren 1992)

In 1977, shortly before the removal of cattle from the monument, vegetation plots and photo points were established to gather baseline data on ecosystem recovery responsive to the removal of cattle. The objectives of this study were to reread these existing vegetation plots, and re-photograph the photo points. In addition, nocturnal rodent populations were re-sampled on the monitoring

plots, and relationships between the distribution of rodents and the amount of vegetative cover were established.

Climatological Monitoring

Nine automated weather stations were assembled and located in the close vicinity of SEP study sites. Most stations record air temperature at two different heights, relative humidity, precipitation, and wind speed and direction. Two stations also record soil temperature, and three stations record solar radiation. Programs were written to facilitate the monthly downloading of weather data into computers. Programs were also written to generate monthly summary reports from downloaded weather data.

Community Patterns on the Boundaries of Organ Pipe Cactus National Monument (Schonewald-Cox 1989)

The objectives of this study are to examine and document plant community patterns along the boundary, to determine the cross-boundary effects of changes outside the monument on plant communities inside the monument. Patterns of plant community composition and distribution within two kilometers of all boundaries of the monument were examined. Vegetation maps were made to complement the existing vegetation maps. Permanent study plots were established to compare community composition and structure on either side of the boundary.

Vegetation Structure and Diversity in Natural Communities in Organ Pipe Cactus National Monument (Lowe 1992)

This project focuses on collecting information on vegetation structure and diversity rather than on plant population dynamics, plant growth, phenology, productivity, plant interactions, etc. The parameters measured have been presence, density, frequency, coverage, and diversity for all perennial plants on one-tenth hectare permanent quadrats located at each SEP study site. The same parameters have been measured for ephemeral plants species on 1 square meter quadrats.

Quantitative data from this study and the resulting monitoring protocols provide 1) inter-site variation in composition, structure, and diversity, and 2) intra-site change in composition, structure, and diversity of plant species.

Agreements Affecting Natural Resource Management at Organ Pipe Cactus National Monument (Nagel 1989)

In this project, the Principal Investigator compiled the treaties, legal agreements, and memoranda of understanding made between federal and state governments, and/or between governments and private organizations, that affect the management of natural resources in and around the monument, and provided a mechanism for keeping this information current. Also provided were contact protocols and a current list of contacts within the governments, agencies, and organizations which affect policies and resource management activities.

Present Status

The initial research phase of SEP is coming to a close. In summary, this phase of the program was designed to establish accounts of monument natural resources, including but not limited to, presence, abundance, distribution, and condition of these resources. Part of this research phase also analyzed past, present, and future land use trends surrounding Organ Pipe Cactus National Monument and indicated associated impacts to the monument's natural resources. By scientific experimentation, researchers were responsible for developing methodologies, tools, and step-by-step instructions for long-term monitoring of identified components that are seen as being the "vital signs" of the monument ecosystem.

III.E.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

After six years of preliminary baseline research acquired as part of the Sensitive Ecosystems Program, the next identified step in this ecological

assessment program is the initiation of the integration and synthesis of research results. Specific tasks which will be initiated as part of on-going SEP integration and synthesis are: 1) critique of final research reports and monitoring protocols; 2) establishment of standard criteria to evaluate ecosystem conditions; 3) development of a standardized database management system, incorporating geographic information systems; 4) preparation of a unified reporting system; 5) development and testing of a training curriculum for monitoring staff; 6) assessment of collected monitoring data; 7) establishment of evaluation protocols for the program; and 8) evaluation of program elements for transferability to other SOAR parks.

Ecological monitoring protocols intended to develop a better understanding and knowledge of monument ecosystems will be implemented at 18 study areas. Sites range in size from 2.1 hectares to 160 hectares. These sites represent the diversity of monument ecosystems, as well as areas of special concern, such as sites near adjacent land development or those locations impacted by past adverse uses. Monitoring will not be limited to the identified 18 locations, but will also include special sites, such as endangered species habitat areas, areas of known non-native plant invasions and development sites in Mexico. Protocols will be implemented according to criteria established by Principal Investigators and recommended by the SEP Advisory Team.

Elements included in the monitoring and protection program include assessing the populations of small mammals, birds, reptiles, amphibians, climate, non-native plants, and vegetation communities within the 18 study sites, using established protocols. All data will be summarized and reviewed annually and presented in bound reports. Standard databases will be used to store data and reports will be presented in standardized format. Linkages with Geographic Information Systems will be made and data will be reviewed and evaluated in relation to previous years' assessments. Trends will be identified and management actions recommended based on monitoring results.

This program will provide a comprehensive and effective means for evaluating and managing natural resources, which can then be extrapolated to other NPS areas.

SERVICEWIDE ISSUES:

N20 Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

Direct Natural Resources Inventorying and Monitoring Program
Project Statement No.: ORPI-N-100

Issue: Direction and guidance is needed to effectively steer the Organ Pipe Cactus National Monument's natural resources inventorying and monitoring program into the next phase of program integration and synthesis. After seven years of baseline research and initial monitoring protocol implementation, a review and evaluation of significant components is necessary to validate and properly direct the future course of the overall program.

Proposed Action: A science advisory committee will be established to serve as a steering group to guide the direction of the program. Specific tasks to be initiated will include an examination of final research reports and monitoring protocols, an evaluation of monitoring sites and ecosystem components, an assessment of data and information management needs and an evaluation of program elements for transferability to other arid areas.

Manage Natural Resources Monitoring Program
Project Statement No.: ORPI-N-101

Issue: A commitment of staff and funding is required to fully manage the monument's natural resources monitoring program. Several years of baseline research has yielded an array of monitoring protocols for use in evaluating the health of the monument ecosystem. To properly implement the program, it is necessary for an

effective management and administrative infrastructure to be in place.

Proposed Action: A permanent coordinator position will be established to manage the natural resources monitoring program. The coordinator will provide the management infrastructure necessary to successfully implement and carry-out the natural resources monitoring program.

Develop Database Management System for Natural Resources Monitoring and Research Program
Project Statement No.: ORPI-N-102

Issue: A database management system is needed to manage, analyze, interpret and archive large natural resources monitoring data sets. Baseline research and natural resources monitoring has generated extensive data sets requiring a sophisticated data management system to properly utilize and integrate information. Linkages among databases are essential to promoting an understanding of the relationships among resources and identifying long-term trends and thresholds.

Proposed Action: An evaluation will be made of the current natural resources monitoring and research program and the type of data collected. Current methods of data storage and retrieval will be evaluated. An action program will be developed and implemented, outlining the desired requirements, including database integration and geographic information system linkage.

Prepare and Publish Natural Resources Monitoring Handbook and Video
Project Statement No.: ORPI-N-103

Issue: Several completed natural resources monitoring protocols need to be compiled and edited. These protocols illustrate the mechanics of the overall program and provide step-by-step instructions for implementation and data analysis and management. Monitoring protocols, however, are currently scattered within separate documents and are not available as one unified handbook. In addition, an illustrative means of instructing new resources management personnel in protocol implementation is needed. The written protocols themselves have proven incapable of providing the graphic detail necessary to understand the ecological components of some of the protocols.

Proposed Action: Monitoring protocols will be reviewed and the format standardized. In addition, all protocols will be consolidated into one handbook. The handbook will be enhanced with graphics which illustrate procedures and techniques. Using the handbook as a source, a descriptive training video will be prepared, providing detailed information on protocol implementation and data management.

Replace and Supplement Climate Monitoring Equipment
Project Statement No.: ORPI-N-104

Issue: Automated weather station equipment established at natural resource monitoring sites in 1987 and 1988 has begun to breakdown and exhibits frequent recording malfunctions. Exposure to extreme high temperatures, coupled with constant use, has contributed to the equipment's deterioration. There are also two additional monitoring sites which require the initial installation of climate stations. The climate data gathered at these stations is a critical component of both the monument's natural resource monitoring and research programs. Present equipment must be replaced and a program of cyclic replacement must be established for the future.

Proposed Action: Monitoring equipment at all climate stations will be replaced with new updated equipment and a program of cyclic replacement will be established. Equipment will be selected based on compatibility with existing data sets, durability in the field and a cost/benefit analysis. Potentials such as greater memory capabilities, user friendly software and transmission down-loading will be evaluated.

Map Natural Resources Monitoring Study Sites
Project Statement No.: ORPI-N-105

Issue: Accurate high resolution base maps are needed for all natural resource monitoring study sites. Maps must include the locations of all permanent plots which contain mammal grids, lizard and bird transects, perennial vegetation quadrats and the locations of monitored individuals of sensitive plant species. In addition, topography and man-made features such as General Land Office (G.L.O). survey markers and other geographic features will be included.

Proposed Action: All natural resources monitoring study sites will be mapped using global positioning system technology. Research transects, plots and grids will also be mapped. Pursuing this alternative will allow natural resources monitoring field work to progress more efficiently. In addition, the ability to conduct ecological modeling using natural resources monitoring data sets will be facilitated by the availability of high resolution digital maps.

Publish and Distribute Natural Resources Inventory and Assessment Final Reports
Project Statement No.: ORPI-N-106

Issue: Several completed natural resources inventory and assessment reports need to be edited, published and distributed. These reports provide the baseline from which existing ecological monitoring protocols have been developed. Final reports need to be available for scientific review and information, public awareness and program evaluation.

Proposed Action: The backlog of approved final reports will be edited, published and distributed to identified universities, researchers and other sources. The result will be to enhance the overall monitoring program by providing access to results and conclusions.

Develop an Avian Monitoring Protocol
Project Statement No.: ORPI-N-107

Issue: A monitoring protocol is needed for avian species in the monument. The status and role of avian populations are considered a vital link in the overall assessment of the monument ecosystem. Without this information, a critical integrative component will be missing in the monument's monitoring program. As part of the monument's natural resources inventorying and monitoring effort, the Sensitive Ecosystems Program, a study was initiated in 1988 to evaluate the status of avian species and to develop a protocol to evaluate bird populations over time. A draft final report and monitoring protocol was submitted, but never approved or finalized. Concerns have been expressed about the methodology and the usefulness of data collected from this draft protocol. The Principal Investigator did not complete the project and is no longer associated with the study.

Proposed Action: A thorough evaluation of all work to date will be completed. The existing draft final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of avian populations. The results of this alternative will be to provide the apparatus and sequence for developing an effective and useful monitoring tool.

Develop a Terrestrial Invertebrate Monitoring Protocol
Project Statement No.: ORPI-N-108

Issue: A monitoring protocol is needed to monitor terrestrial invertebrate populations in the monument. The status and role of terrestrial invertebrates are considered a vital link in the overall assessment of the monument ecosystem. Without this information, a critical integrative component will be missing in the monument's monitoring program. As part of the monument's natural resources inventorying and monitoring effort, the Sensitive Ecosystems Program, a study was initiated in 1987 to evaluate the ecology of invertebrates and to develop a protocol to evaluate invertebrate populations over time. A final report and monitoring protocol were submitted. The study provided one of the most comprehensive invertebrate surveys to date. The monitoring

protocols, however, pose a problem in both their value and implementation. During the survey, the effects of weather were apparently so profound as to override any other factors and limit conclusions that could be drawn from the data. This precluded derivation of conclusions about the importance of other population-regulating factors and complicated the development of a meaningful long-term monitoring plan (Kingsley 1991).

Proposed Action: A thorough evaluation of all work to date will be completed. The existing final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of invertebrate populations. The results of this alternative will be to provide the apparatus and sequence to developing an effective and useful monitoring tool.

Update Monument Flora Inventory
Project Statement No.: ORPI-N-109

Issue: The monument flora inventory needs to be updated. More than a decade has passed since publication of Bower's (1980) Flora of Organ Pipe Cactus National Monument. Since then, extensive plant collections and a number of research projects have added substantially to the available botanical information of the area (Felger 1993). The current vascular plant database is inadequate to support the monument's geographic information system, natural resources monitoring program and general research projects.

Proposed Action: A project will be developed to bring the monument's plant inventory up to date. The project will provide a new information resource for managers and researchers in the form of a detailed bibliography of relevant botanical literature. The project will also produce a new tool for interpretation in the form of a user-friendly key for identification of plants within the monument.

Conduct Survey of Study Site Soils, Surficial Geology and Hydrology
Project Statement No.: ORPI-N-110

Issue: Site descriptions of soils, surficial geology and hydrology are needed at eighteen natural resources monitoring study sites. This data is required to provide necessary information for the development of the monument's integrated natural resources monitoring program. Such measurements are important for a more complete understanding of the ecosystem and its individual components.

Proposed Action: A survey will be conducted to develop site descriptions on soils, surficial geology and hydrology at all natural resources monitoring study sites. As a result of this action, data will be available to assist in the evaluation and assessment of biological measurements derived through the implementation of monitoring protocols.

Evaluate Status of and Develop Monitoring Program for Bighorn Sheep
Project Statement No.: ORPI-N-111

Issue: The status of desert bighorn sheep (*Ovis canadensis*) within Organ Pipe Cactus National Monument is unknown. Changes in riparian and upland ecosystems have resulted in mammalian species composition and population density shifts throughout the southwest. The desert bighorn sheep has been adversely affected by these changes and they have not adapted well. Baseline data applicable to the Organ Pipe Cactus herd has been collected over the years. Additional information, however, is needed to supplement the existing database and to develop a monitoring protocol to assess and evaluate the status of the species into the future, so that well-informed and effective management actions can be implemented if necessary.

Proposed Action: A study will be developed to provide data on the status and condition of the desert bighorn sheep in the monument. Information collected will include relative demography, abundance and natural history characteristics of the species. The assessment will be conducted using non-destructive sampling

techniques such as live trapping, radio tracking and field observation to gather georeferenced (GPS) research data. A long-term monitoring protocol will be developed for the sheep and their vegetation resources in Organ Pipe Cactus National Monument and adjacent lands. The monument resources management staff will be trained in the implementation of the protocol.

Evaluate Status of and Develop Monitoring Program for Javelina
Project Statement No.: ORPI-N-112

Issue: The status of javelina (*Dicotyles tajacu*) within Organ Pipe Cactus National Monument is unknown. Changes in riparian and upland ecosystems related to past overgrazing, and perhaps also to climatic shifts, have resulted in large mammal species composition and population density shifts throughout the southwest. The javelina reaches its northwestern distribution limit near the monument. Little baseline data applicable to javelina in the monument has been collected over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species into the future.

Proposed Action: A study will be developed to provide data on the status and condition of javelina in the monument. Information collected will include relative demography, abundance and natural history characteristics of the species. The assessment will be conducted using non-destructive sampling techniques such as live trapping, radio tracking and field observation to gather georeferenced (GPS) research data. A long-term monitoring protocol will be developed for javelina and their vegetation resources in Organ Pipe Cactus National Monument and adjacent lands. The monument resources management staff will be trained in the implementation of the protocol.

Evaluate Status of and Develop Monitoring Program for Mountain Lion
Project Statement No.: ORPI-N-113

Issue: Little is known of the population size, spatial distribution, and temporal variability of the mountain lion (*Felis concolor*) in the monument. Increasing urbanization and agricultural development on land adjacent to the monument in Mexico may be contributing to a loss of habitat in the region. With external pressures increasing, existing mountain lion populations may pushed into lands such as the monument where consumptive resource uses have been eliminated. Little baseline data applicable to mountain lions in the monument has been collected over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species into the future.

Proposed Action: An inventory will be conducted and a plan will be developed to monitor this mammal throughout the monument. Such an assessment will assist the Superintendent and staff to better understand the role mountain lions play in the monument ecosystem. Data will be beneficial in identifying threats and issues that affect the species. In addition, management actions affecting mountain lions will be based on the best available information.

Evaluate Status of and Develop Monitoring Program for Mule Deer
Project Statement No.: ORPI-N-114

Issue: Little is known of the size, spatial distribution, and temporal variability of desert dwelling mule deer (*Odocoileus hemionus*) populations. Management practices, such as agricultural development and urbanization, on adjacent lands, may impact mule deer populations as well as predator species. It is important to identify baseline ecological parameters associated with this species so that an information base is available from which management actions can be evaluated.

Proposed Action: An inventory will be conducted and a plan developed to monitor mule deer populations throughout the monument. Such a study will assist the Superintendent and staff to better understand the role mule deer populations

play in the monument ecosystem. Data will be beneficial in identifying threats and issues that affect the species. In addition, management actions affecting mule deer will be based on the best available information.

Evaluate Status of and Develop Monitoring Program for White-tailed Deer
Project Statement No.: ORPI-N-115

Issue: The current status of Coues white-tailed deer (*Odocoileus virginianus couesi*) within the monument is not known. Factual data to substantiate the health and current population status are inadequate to guide future management decisions and actions which would have a direct bearing upon the welfare of the species or its habitat. Additional information is needed to supplement the existing database and to identify a monitoring protocol to assess and evaluate the status of the species, so that well-informed and effective management actions can be implemented if necessary.

Proposed Action: A non-destructive inventory and demographic assessment will be conducted, and a monitoring protocol for white-tailed deer and their vegetation resources at Organ Pipe Cactus National Monument will be developed to document the occurrence of these native mammals, and their relative abundance within riparian and upland habitats. A primary product of this research effort will be a long-term monitoring protocol which the monument resources management staff can use to gauge the health of this ecosystem component over time.

Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise
Project Statement No.: ORPI-N-116

Issue: Long-term ecological data is needed on desert tortoise populations in the monument to effectively understand and manage this rare and sensitive species. Disease and unidentified causes have resulted in a rapid decline in some desert tortoise populations. The status of the Arizona (Sonoran) population is not well known, except that tortoise populations in northern Arizona and the Phoenix area are severely declining. The Sonoran population has been proposed for listing and recently very nearly was. Listing has been deferred (1991), providing that federal and state agencies in Arizona undertake aggressive management of their populations. The National Park Service is considering (1991) a Memorandum of Understanding (MOU) linking the Service with other land managing agencies for the purpose of tortoise management.

Proposed Action: An inventory will be conducted to provide information on desert tortoise populations in the monument. This knowledge will serve as an additional management tool for examining the ecological health of monument ecosystems. A monitoring protocol will be developed to provide a means of evaluating the health of desert tortoise populations in the future.

Conduct Inventory and Develop Monitoring Protocol for Ferruginous Pygmy-Owl
Project Statement No.: ORPI-N-117

Issues: Long-term ecological data is needed on ferruginous pygmy-owl populations in the monument to effectively understand and manage this rare and sensitive species. The ferruginous pygmy-owl is absent from the Arizona lowlands except possibly in the Organ Pipe Cactus National Monument region. Unidentified factors appear to be affecting the status of the ferruginous pygmy-owl within the boundaries of the monument. The last recorded observation of the ferruginous pygmy-owl was during censusing in 1990.

Proposed Action: An inventory and assessment of ferruginous pygmy owls will be conducted in the monument. The results of this assessment will assist management in making effective decisions regarding the ferruginous pygmy-owl. Through research and subsequent monitoring and data analysis of various factors affecting the ecology of this owl, monument staff can provide more effective means for its protection.

Conduct Inventory and Develop Monitoring Protocol for Microphytic Crusts
Project Statement No.: ORPI-N-118

Issue: The status and role of microphytic crusts in the overall functioning of the monument ecosystem are unknown. Baseline data is needed to determine the extent and role these crusts play and their relationships to other environmental components. A protocol is required to assess microphytic crusts over time, thus provide integrative data necessary to understand the monument ecosystem.

Proposed Action: A study will be conducted to provide information on microphytic crusts. Data will include species presence, species distribution and abundance. A long-term monitoring protocol will be developed to assess the condition of crusts over time. Research will be concentrated at current natural resources monitoring sites.

Conduct Inventory and Develop Monitoring Protocol for Aquatic Invertebrates
Project Statement No.: ORPI-N-119

Issue: The status and role of aquatic invertebrates in the overall functioning of the monument ecosystem is unknown. Baseline data is needed to determine species presence, abundance, habitat requirements and relationships to other environmental components. A protocol is required to assess population fluctuations and to provide integrative data necessary to understand the monument ecosystem.

Proposed Action: An inventory of monument aquatic invertebrates will be conducted. Based on the results of the study, monitoring protocols will be developed to allow for continued monitoring of aquatic invertebrate populations. Data from monitoring will be integrated with other assessment databases to evaluate relationships within the ecosystem.

Implement Climate Monitoring Protocol
Project Statement No.: ORPI-N-120

Issue: Climatic data is needed to assess the significance of, and evaluate cumulative results and relationships of, ecological components of the monument's natural resources monitoring program. Weather data, primarily precipitation, air and soil temperature and relative humidity, is critical in evaluating the monitoring data collected on flora and fauna. Climatic data is the primary integrative component of the ecological assessment program. In 1987 and 1988, nine automated climate stations were established at natural resources monitoring sites. The climate stations, in combination with an additional eight Forester rain gauges, are located throughout the monument as part of a natural resources inventorying and monitoring program.

Proposed Action: Climate stations and rain gauges will continue to be operated and maintained. Results will be summarized and made available to researchers and staff involved in assessing ecological monitoring data. The primary integrative variables of precipitation, air and soil temperature, and relative humidity will be accessible for natural resources evaluation and interpretation.

Implement Land Use Trends Monitoring Protocol
Project Statement No.: ORPI-N-121

Issue: Data on urbanization and agricultural development on lands in Mexico adjacent to the monument is needed. Increased development and associated issues such as infusion of non-native plants and animals, pesticide and herbicide drift and groundwater depletion are of concern to monument management. In 1987, a project conducted by Mr. Bruce Brown of Great Western Research assessed the impacts of land use trends on Mexican lands adjacent to the monument. A monitoring program was developed by the Principal Investigator to evaluate change in land use over time.

Proposed Action: The monitoring protocol as recommended by the Principal Investigator will be implemented. Dialogue will be continued and enhanced with resource officials in Mexico. Data

on development and agriculture will be evaluated, including that on groundwater use, pesticide and herbicide application and land use trends. Repeat photography will be accomplished at identified photopoints and duplicate photos will be delivered to resource officials in Mexico. The result of the action will be a proactive and cooperative step towards understanding and mitigating potential threats facing the natural resources of the monument.

Implement Nocturnal Rodent Monitoring Protocol
Project Statement No.: ORPI-N-122

Issue: Long-term ecological monitoring data is needed on nocturnal rodent populations to assist in the assessment of the overall health and condition of the monument ecosystem. Nocturnal rodent populations provide a primary integrative element in understanding the dependency and relationships of ecosystem components. In 1988, as part of the SEP Dr. Yar Petryszyn was contracted to gather baseline data on nocturnal rodents. A primary purpose of the study was to establish a broad-based data set for the major primary consumers in select areas of the monument. Diversity, densities, habitat selection and activity were monitored using live trapping grids (Petryszyn 1988). A monitoring protocol was developed to assess the status of nocturnal rodents over time. The protocol was tested in the field and monument resources management staff were trained in its application.

Proposed Action: The monitoring protocol for nocturnal rodents as developed and recommended by Dr. Yar Petryszyn will be implemented. A base program will be established that will be implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable dataset will be developed. Integration with other monitoring protocols will be facilitated more effectively.

Implement Lizard Monitoring Protocol
Project Statement No.: ORPI-N-123

Issue: Long-term ecological monitoring data is needed on lizards to assist in the assessment of the overall health and condition of the monument ecosystem. Lizards are valuable indicators of ecosystem health and long-term change. Data acquired on lizards is critical to developing a comprehensive integrative monitoring program that provides management with decision making tools based on sound ecological evaluations. In 1988, as part of the monument's natural resources inventorying and monitoring program, Dr. Charles H. Lowe was contracted to gather baseline data on amphibians and reptiles. Two key objectives for the study identified in the request for proposal (NPS 1988) were to design a monument-wide study to provide information about species occurrence, distribution, and relative abundance for all herp species and to develop monitoring protocols for long-term herpetofauna monitoring at sites identified as part of the study.

Proposed Action: The monitoring protocol for lizards developed and recommended by Dr. Charles H. Lowe will be fully implemented. A base program will be established which will be implemented twice annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed. Integration with other monitoring protocols will be facilitated more effectively.

Implement *Echinomastus erectrocentrus* var. *acunensis* Monitoring Protocol
Project Statement No.: ORPI-N-124

Issue: Long-term biological data is needed on acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*) to effectively understand and manage this rare and sensitive species. The acuna cacti population in the monument is considered one of the most viable for the species, but it is still subject to an array of threats, such as predation, poaching and visitor impacts. In 1988, Dr. George A. Ruffner was contracted to gather and compile data on special status plants. Acuna cactus was one of these. Growth, mortality, reproductive status, and

recruitment of the acuna cactus were researched on study plots scattered across the species' range in Organ Pipe Cactus. The protocol monitoring utilized was developed by Dr. George Ruffner and his assistants, and was designed to assess population dynamics of acuna cactus by monitoring growth, mortality, recruitment and reproductive status of several hundred marked individuals, occurring in six study plots scattered across Acuna Basin, thus encompassing the entire population of this variety within the monument (Ruffner et al. 1991b).

Proposed Action: The monitoring protocol for acuna cactus as recommended by Dr. George Ruffner as part of the Sensitive Ecosystems Program will be implemented. A base program will be established which will be implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable dataset will be developed.

Implement Monitoring Protocol for Vegetation Structure and Diversity in Natural Communities
Project Statement No.: ORPI-N-125

Issue: Long-term ecological monitoring data on vegetation structure and diversity in natural communities is essential to assess the overall health and condition of the monument ecosystem. Data concerning the presence, density, frequency, coverage and diversity of perennial plant species is an important integrative component necessary to evaluate other ecological monitoring data. In 1988, as part of the SEP, Dr. Charles H. Lowe was contracted to gather baseline data on vegetation structure and diversity in natural communities. The objective of the research was to provide the monitoring program with baseline vegetation data, soil texture data and slope, aspect and elevation information for one or more vegetation quadrats at 16 specified research study sites. In total, 26 0.1 hectare plots were established (Lowe et al. 1992). As part of the management recommendations, continued monitoring of vegetation plots is identified. This data is necessary for continued integration of the overall monitoring program.

Proposed Action: The resource management recommendation to continue monitoring vegetation communities at the natural resources monitoring study sites will be implemented. An interval of five years or more will be established for readings of perennial taxa on the 0.1 hectare quadrats. The next reading will be completed in 1994-1995. Subsequent monitoring intervals will be determined at the end of 1995. Procedures outlined by the Principal Investigator to acquire the initial baseline will be adhered to for all monitoring activities. Proper seasonal timing for ephemeral taxa will be employed. Data will be managed and analyzed according to standards identified in the final report. The information will be integrated with other data sets and will be incorporated into the monument's geographic information system databases.

Implement *Stenocereus thurberi* and *Lophocereus schottii* Monitoring Protocols
Project Statement No.: ORPI-N-126

Issue: Long-term ecological monitoring data is needed on organ pipe cacti (*Stenocereus thurberi*) and senita cacti (*Lophocereus schottii*) to develop a better understanding of these two sensitive species. Both species of columnar cacti are at or near their northern range limit in the monument, and as might be expected, both are sensitive to prolonged freezing temperatures. *S. thurberi* and *L. schottii* were two of seventeen plants investigated by Dr. George Ruffner as part of the monument's long-term natural resources inventorying and monitoring program. As part of the assessment, Dr. Ruffner and his assistants enhanced and expanded a protocol to monitor both species.

Proposed Action: The monitoring protocols, as refined and expanded by Dr. George Ruffner, will be implemented. The data set established over twenty years ago will be continued. Data will be periodically reviewed for validity and trend assessments. Monument resources management staff will implement the protocols.

Implement *Peniocereus striatus* Monitoring Protocol
Project Statement No.: ORPI-N-127

Issue: Long-term biological data is needed on dahlia rooted cereus (*Peniocereus striatus*) to effectively understand and manage this rare and sensitive species. Most likely, less than 200 individuals of this species exist in the monument. *P. striatus* was one of seventeen special status plants investigated by Dr. George Ruffner as part of the monument's natural resources inventorying and monitoring program. Dr. Ruffner and his assistants developed a protocol to monitor the *P. striatus* population.

Proposed Action: The monitoring protocol for *P. striatus*, as recommended by Dr. George Ruffner, will be fully implemented. A base program will be established that will be implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable dataset will be developed.

Implement *Atamisquea emarginata* Monitoring Protocol
Project Statement No.: ORPI-N-128

Issue: Long-term biological data is needed on the desert tree caper (*Atamisquea emarginata*) to effectively understand and manage this sensitive species. *A. emarginata* is probably the species that is most at risk for future declines or extinction within the monument due to a combination of low population size, localized distribution, large disjunction from other populations and possibly, groundwater drawdown (Ruffner et al. 1992c). *A. emarginata* was one of seventeen special status plants investigated by Dr. George Ruffner as part of the monument's natural resources inventorying and monitoring program. As part of their assessment, Dr. Ruffner and his assistants developed a protocol to monitor the *A. emarginata* population.

Proposed Action: The monitoring protocol for *A. emarginata*, as recommended by Dr. George Ruffner, will be implemented. A base program will be established that will be implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.

Develop Long Term Population Monitoring of Snakes
Project Statement No.: ORPI-N-129

Issue: Current monitoring programs do not address any of the major vertebrate predators in the monument. Snakes are one of the primary predators, if the not the key predators, of many small vertebrate species at Organ Pipe Cactus National Monument. Further, snakes are substantially impacted by highway mortality on Arizona State Route 85, which runs through the monument.

Proposed Action: An analysis will be conducted and a monitoring handbook prepared detailing transect methods for periodic, regular monitoring of the highway and other monument roads. A technical report will be prepared on transect methods and analysis techniques. In addition, baseline results on existing data will be presented and illustrated. This protocol will significantly expand the monitoring program, and enhance the ability to synthesize and integrate ecosystem results for other monitored taxa. This project will provide valuable scientific data useful for monitoring and general interest on community ecology.

Develop Mexican Leafcutting Ant Population Monitoring Program
Project Statement No.: ORPI-N-130

Issue: Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). This population was discovered during ground searches of more than 100 km of suitable riparian habitat at Organ Pipe, and consists of approximately 40 colonies in the park, plus one outlier 300 m outside the northeast boundary. The large size and unusual

habits of the ant colonies make them significant objects of park interpretation and research activities. Several distinct local subpopulations were identified during the mid and late 1980s, and the natural diet, foraging behavior, and reproductive biology of these ants were studied intensively. Crucial resources for the survival of the ants were determined. Agricultural development south of the monument, however, may isolate the U.S. population from the main population in Mexico.

Proposed Action: Scientists at the National Biological Survey/Cooperative Park Studies Unit will be contracted with to design monitoring protocols. A monitoring handbook will be developed and park staff will conduct monitoring activities.

III.F. Water Resources

III.F.1. Overview

Water resources are an integral component of this desert ecosystem. Most significant natural and cultural resource values, including high species diversity, extensive human history, and varied geographic features, are dependent on maintenance of relatively undisturbed surface and subsurface water resources. The most immediate and irreversible threats in terms of water resources are water withdrawals. Other critical threats are air and water pollution. Although not currently severe, these threats are of immediate concern due to the urbanization and agricultural development occurring south of the border. Comprehensive management involves water quality, quantity, planning, aquatic organisms, and aquatic habitat (including wetlands and floodplains). Water resources management should be integrated into all aspects of park operations and planning. A Water Resources Management Plan has been written for Organ Pipe Cactus National Monument to facilitate with managing these resources.

III.F.2. National Park Service Policy and Program Objectives

The authorities to manage water resources include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declared that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities be undertaken to degrade park values, except where legally authorized.

The primary relevant authority is the Clean Water Act of 1972 (and as amended by the 1987 Federal Water Quality Act), which was designed to restore and maintain the integrity of the nation's water by correcting and limiting effluent discharge; protecting existing quality where it exceeds levels necessary to support propagation of fish, shellfish, wildlife and recreation; and designating "Outstanding National Resource Waters" to maintain waters with the highest quality and ecological importance.

Other authorities include the National Environmental Policy Act of 1969 and amendments, Endangered Species Act of 1973 and amendments, Wilderness Act of 1964, Fish and Wildlife Coordination Act, Resource Conservation and Recovery Act, and Safe Drinking Water Act. Relevant executive orders include Floodplain Management (EO 11988), Protection of Wetlands (EO 11990), and Pollution Control Standards (EO 12088). The NPS obtains and uses water rights with the Reserved Water Rights and Prior Appropriation Doctrines and other federal laws as applicable. Otherwise, parks use water rights in accordance with applicable state laws and procedures. State, county, and local laws and regulations may also apply.

The water resources program in a park is relative to the diversity, magnitude, and complexity of its resources. The policy and objectives as stated in

NPS Management Policies and reiterated in the NPS-77 guideline are:

These policies require management of natural resources to maintain, rehabilitate, and perpetuate the inherent integrity of water resources and aquatic ecosystems. Specific management policies provide for protection of quality and quantity of surface water and groundwater (4:15-16), preservation of floodplains and wetlands (4:16-17), maintaining, protecting, and securing water rights (4:17), and protection of aquatic biological resources (4:5-14).

III.F.3. Organ Pipe Cactus National Monument Current Program

Approximately twelve years of water level data has been collected from all wells within the monument and at Lukeville. This data has been collected in conjunction with a complete water resources inventory conducted by the NPS Water Resources Division and monument personnel, which also has also included water quality data. US Geologic Survey (USGS) personnel, under NPS contract, installed a gauge height recorder at one well in Lukeville. Additionally, the USGS monitored wells in Organ Pipe along the border on a bimonthly basis, until 1992. The NPS/USGS contract allowed for the updating of the existing V-notch weir at Quitobaquito Springs by installing a continuous recording system, which is maintained by the USGS.

An initial report by USGS in 1978 estimated future drawdown near the international boundary at Lukeville and stressed the need for additional hydrologic data to improve the accuracy of this model. Three additional monitoring wells were drilled in 1988, and after collection of monitoring well data for several years to establish trends, the model will be rerun. Over the past three years, National Park Service efforts through the Sensitive Ecosystems Program have made significant progress in researching this problem and in working with Mexican resource personnel. Efforts have included researching past, present and future land usage in the Sonoyta Valley, developing an eight year database of depth-to-water measurements for 165 wells adjacent to the monument, gathering electrical data for wells, calculating extraction by point and attempting to define boundaries of the aquifer.

Since 1980, the monument has participated in the National Atmospheric Deposition Program (NADP) by establishing a monitoring site to evaluate precipitation. Rainfall is continuously monitored and weekly samples, when sufficient precipitation has occurred, are evaluated at the monument for Ph and conductivity. Chemical variables measured at the NADP laboratory (Central Analytical Laboratory) in Champaign, Illinois, include the following ions: calcium, magnesium, potassium, sodium, ammonium, nitrate, chloride, sulfate, and orthophosphate. A ten year database now exists on precipitation chemistry.

III.F.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N06 Disruption of Native Plant Communities and Accelerated Erosion From Past Land Practices

N10 Disruption of Park Resources Due to Mineral Extraction & Geothermal Activities

N11 Degradation of Park Water Quality Due to External Activities

N12 Alteration of Natural Flow Regimes

N13 Lack of Secure Water Rights

N20 Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

Identify and Inventory Water Related Resource Attributes
Project Statement No.: ORPI-N-200

Issue: The water-related resource attributes of the monument have not been fully assessed. The identification and inventory are needed to both document the possibility of impact and to measure its magnitude, in the event impact does occur. This information will be required in water rights litigation or in any other similar arena in which the NPS seeks relief from such impact to protect the monument and the purposes for which it was created. The possibility of future impact to water-related resource attributes exists because of agricultural expansion and development along the Mexican border. Water withdrawals from aquifers underlying the monument or alterations in surface water flow regimes are likely to affect water-related resource attributes. Without identification and inventory, actions to arrest and reverse effects will be delayed, resulting in additional or longer-lasting effects.

Proposed Action: A thorough inventory will be conducted of all water-related resource attributes. Such a study will give the superintendent an adequate database from which to make informed management decisions and to protect water rights. Such results will also be of use to all other resource related inventories conducted at the monument. The identification and inventory of water-related resource attributes will require a technical assessment of natural resources and scientific literature. This project will be best undertaken by an interdisciplinary team working as a unit. Field and office assessments will result in summary reports, maps and atlases. When completed, additional projects and/or studies may be required to evaluate the nature and magnitude of the relationship between water and water-related resource attributes. This project will be accomplished or contracted for by the National Park Service, Water Resources Division.

Monitor Land Subsidence

Project Statement No.: ORPI-N-201

Issue: Further lowering of the groundwater table along the southern boundary will probably result in land subsidence. Monitoring needs to be initiated now so that future subsidence can be identified and documented.

Proposed Action: A first order survey of existing bench marks and boundary monuments along the international boundary will be made from the Ajo Range (IBM # 163) west to the Sonoyta Mountains (IBM # 168). Photographs will be taken to document surface conditions and to aid in relocating the survey markers. The area will be resurveyed at five year intervals unless changes in the rate of water table decline indicate the need for more or less frequent observations.

Monitor Groundwater Resources in the Rio Sonoyta Watershed

Project Statement No.: ORPI-N-202a

Issue: The primary threat to the natural resources of Organ Pipe Cactus National Monument is the continued urbanization and agricultural development near its southern boundary in the neighboring state of Sonora, Mexico. Of concern to monument management is the effect on native plants and animals of herbicide and pesticide drift, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. The primary concern is that continued or increased pumping of groundwater in Mexico may lower the groundwater table and also reduce the hydrostatic pressure at certain locations within Organ Pipe, such as at Quitobaquito, where the endangered desert pupfish occurs. As of 1988, there were approximately 22,455 irrigated acres in production in the Sonoyta Valley, supported by 165 wells. Annual groundwater pumpage is approximately 83,160 acre feet, which is 2.5 times the aquifer recharge rate. Although there now exists a moratorium on the drilling of new wells, current wells are pumping at less than half their potential capacity of 191,000 acre feet.

Proposed Action: The collection of groundwater data both within the monument and on adjacent Mexican lands will continue. Additional monitoring sites will be developed to provide a more comprehensive database and more reliable predictive models.

Investigate Groundwater Use on Tohono O'odham Lands
Project Statement No.: ORPI-N-202b

Issue: Land and water use on Tohono O'odham Reservation lands east and adjacent to Organ Pipe Cactus National Monument may pose future threats to natural resources. Land within the immediate vicinity of the boundary is not intensively used and is predominantly grazed by livestock. Approximately 20 miles to the east of the boundary, however, near the Mexican border, is Papago Farms, an agricultural area. Papago Farms is significant because of its location in the headwaters of the Rio Sonoyta watershed. Although no data is presently available, it is believed that the major portion of the water supply for the farms comes from groundwater. Surface water runoff may also contribute to the supply. Water consumed on the Tohono O'odham Reservation contributes to the collective overdraft of water in the Rio Sonoyta watershed.

Proposed Action: An inventory will be conducted to gather baseline data and develop a monitoring protocol for groundwater use on Tohono O'odham lands. Information will also be collected concerning the area under irrigation and recent cropping patterns. Well data and other information will be organized into a database and a preliminary analysis will be made. Data collection procedures will be established to periodically update information received from Papago Farms. Contacts from whom staff can obtain periodic data related to water volume and depth, and cropping patterns, will be identified in cooperation with the farm manager and the Gu Vo District of the Reservation.

Conduct Surface Water Inventory of the Rio Sonoyta Watershed
Project Statement No.: ORPI-N-202c

Issue: Insufficient information exists on surface water use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. On-going monitoring along the southern boundary has shown that continued urbanization and agricultural development in Sonora, Mexico, annually deplete the groundwater aquifer at 2.5 times the recharge rate. Very little data on surface water use in the Rio Sonoyta watershed is currently available. While data collection has begun on groundwater usage outside of the monument, little research has been done on surface water availability, locations, uses and trends which may impact the resources.

Proposed Action: A thorough inventory of the Rio Sonoyta Watershed will be accomplished. The project will include an inventory of surface water use, an assessment of historic flows and an examination of watershed hydrology.

Conduct Land Use Inventory of the Rio Sonoyta Watershed
Project Statement No.: ORPI-N-202d

Issue: Insufficient information exists on land use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. The region is exposed to a multitude of threats and issues, impacting water and other natural resources. Land is managed by an array of governmental, private, and tribal organizations. The types and extent of land uses are not well known, particularly on the Tohono O'odham Reservation and in Mexico. Land management practices in one area could affect water availability throughout the watershed. A more thorough understanding of land uses within the watershed will provide for more effective management of the resources, as well as assist in the mitigation of current and potential problems resulting from such land use.

Proposed Action: A thorough inventory of land use in the Rio Sonoyta watershed will be completed. The project will include defining the watershed, identifying and delineating land uses, collecting land ownership data and conducting a land capability study.

Evaluate Trends in Water Use in the Rio Sonoyta Watershed
Project Statement No.: ORPI-N-202e

Issue: Insufficient information exists on trends in ground and surface water use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. On-going monitoring along the monument's southern boundary has shown that continued urbanization and agricultural development in Sonoyta, Sonora, Mexico, on lands adjacent to the monument, annually depletes the groundwater aquifer at 2.5 times the recharge rate. Information on past, present and projected water uses in the watershed is needed to provide an understanding of development in the region and its associated impacts on the natural resources of the monument.

Proposed Action: An evaluation of trends in water use in the Rio Sonoyta watershed will be conducted. This project will include an evaluation of historic water uses, present uses and potential uses.

Develop and Implement Water Conservation Program

Project Statement No.: ORPI-N-203

Issue: Although the amount of water used by monument operations has been described as "a grain of sand among sand dunes", the actual amount used is not closely monitored. Even though the use is relatively small in comparison to Mexican agricultural demands, NPS credibility will be greatly enhanced if management makes an effort to use most efficiently the water necessary for its own operations.

Proposed Action: A Water Conservation Plan will be developed. This will utilize existing expertise by working with consultants from the NPS Water Resources Division and outside specialists, such as the Phoenix and Tucson City Water Conservation Departments, to modify and implement the plan to suit Organ Pipe's specific needs.

Define Characteristics of Regional Aquifers

Project Statement No.: ORPI-N-204

Issue: The alluvial aquifer that supplies the Rio Sonoyta Valley extends well beyond the monument boundary. The nature and extent of this aquifer, and the uses that it is incurring, may have a direct bearing on the extent of impacts to monument resources from groundwater pumping in Mexico. Current and possible expanded pumping adjacent to the monument in Sonora, Mexico, threatens aquifers that provide the monument's water supply, supports desert riparian vegetation and sustains important springs. A study of regional aquifers is proposed to supplement detailed studies of groundwater systems inside the monument.

Proposed Action: The characteristics of the regional aquifers will be evaluated. Existing geologic, groundwater and water consumption information will be examined to characterize the regional aquifer system for the Rio Sonoyta. This will involve a review of literature available in the US and Mexico. Once assembled, the information will be analyzed in an effort to determine the lateral and vertical extent of the aquifer, recharge and groundwater yields, major directions and pathways of flow, groundwater consumption and trends in the condition of the aquifer. A report will be prepared presenting this information. If the results of this project indicate the presence of a regional aquifer system, follow-up studies of the nature and extent of the aquifer may be needed.

Update Water Resources Inventory and Monitoring Program

Project Statement No.: ORPI-N-205

Issue: The current inventory of water resources provides little information about water quality or trends. A long term monitoring program needs to be initiated, based on the existing inventory, that will include water quantity and quality. Little or nothing is known of the water quality of all but a few sources. Tinajas might be particularly vulnerable to airborne contaminants. These may be transported in regional air flow or from agricultural activities in adjacent Mexico.

Proposed Action: Long term and seasonal trends in water quality and quantity will be examined. The existing water resource inventory will be

expanded to include water quality. An annual monitoring program will be established.

Develop a Geographic Information System Component for Water Resources
Project Statement No.: ORPI-N-206

Issue: An efficient and effective method for managing water resources data is needed. Existing information on ground and surface water resources is extensive. This includes locations of water sources such as springs, tinajas, and wells; twelve years of depth-to-water data for wells; the locations of and data from 17 sites where precipitation is measured; and the locations and depth-to-water data for 165 wells in the Sonoyta Valley adjacent to the monument. Implementation of other projects within the Water Resources Management Plan will yield more data, including, but not limited to, regional aquifer sizes, surface and groundwater use, and land subsidence.

Proposed Action: Water resources data will be input into a geographic information system and compatible databases. This will include digitizing all available water resources data so that it is compatible with other GIS data. Applications will be developed to utilize and model the data and to assist with management of resources.

Monitor Riparian Ecosystems
Project Statement No.: ORPI-N-207

Issue: Valuable riparian vegetation and the ecosystems that they support may be threatened by continued depletion of groundwater in the southern portion of the monument due to agricultural development on adjacent lands in Sonora, Mexico. Among the species of concern are mesquite (*Prosopis velutina*) and desert tree caper (*Atamisquea emarginata*), which is a rare species with its northern range limit in Organ Pipe. These species utilize deep tap roots extending to the groundwater level to supply their nutrient and moisture needs. These species may now be facing a significant threat due to the excessive use of groundwater in areas adjacent to the monument. On-going monitoring indicates that the groundwater aquifer in the Sonoyta Valley is being depleted at 2.5 times the recharge rate. There are currently many well documented cases in Arizona where large stands of mesquite have died off following the excessive withdrawal of groundwater for agricultural purposes. If such a drop in the water table were to occur within areas of the monument, a significant impact on riparian ecosystems could result.

Proposed Action: Five riparian study plots and two non-riparian controls will be established to evaluate the effects of water drawdown from agricultural uses. Riparian control plots will also be established with permanent and visible corner markers for aiding remote sensing studies. Aerial photography will be conducted at elevations necessary to map vegetation composition. Techniques will be developed and employed to accurately measure species composition and densities and the general vigor of the flora and fauna of all study plots. Techniques developed will be standardized for use in other desert park areas. These plots will be located in proximity to existing well and climate monitoring stations to utilize data collected from these sources.

Identify Pollution Threats from Kuakatch and Cuerda de Leña Washes
Project Statement No.: ORPI-N-208

Issue: Two intermittent streams, Kuakatch and Cuerda de Leña Washes, enter the park at the northeast corner and along the northern boundary. The infiltration of flow from both these streams and alluvial groundwater into the park provides an unquantified amount of recharge to the alluvial groundwater regime. Presently the lands in this vicinity are used for a small amount of grazing, and the impacts from such activities, if any, are unknown. If future uses such as grazing, agriculture, or land development occur in these areas, both quantity and quality of these water inflows are likely to change.

Proposed Action: A program will be developed that will involve data collection on the quantity and quality of ground and surface water. It will allow

for data collection by an independent government agency at important hydrologic times during each year. Efforts will include obtaining water level and quality measurements at neighboring wells on the Tohono O'odham Reservation and on other lands along the northern boundary. The project will involve personnel from both the USGS and the monument.

Control Accelerated Erosion
Project Statement No.: ORPI-N-209

Issue: Anthropogenic erosion is evident in the vicinity of those historic ranch sites where soils are of fine texture and where cattle trampling and grazing pressure was the strongest. Erosion problems are most severe at Dos Lomitas and Armenta Ranches, where 170 acres are affected. Broad scale loss of soil from wind and water has occurred in these areas and has resulted in changes in the vegetation communities. As the soil level drops, the landscape changes and erosion channel headcutting continues to expand. The resultant deepening of arroyos has caused problems in maintaining park dirt roads in the Armenta area, near the central north boundary and at Dos Lomitas, near the eastern south boundary.

Proposed Action: In 1989, the NPS contracted with Great Western Research to study methods of controlling erosion on these two sites. The result of this contract was a report entitled, "Erosion Control Studies at Armenta Ranch and Dos Lomitas", which recommended measures required to mitigate the eroded soils at both sites. The proposed action is to implement the study recommendations.

Evaluate Flood Hazards at Bates Well
Project Statement No.: ORPI-N-210

Issue: Normally dry channels, which are common in the monument, are subject to occasional flooding and some flash floods, when flood waters arrive with little or no warning. Two areas contain developments or visitor activities which could be threatened by flooding. These are the Bates Well and headquarters areas, including the campground.

Proposed Action: The headquarters area has been mapped and the results incorporated in park operations and planning. A flood hazard analysis of the Bates Well area will be conducted. This action will be needed if further developments at Bates Well are to be considered.

Evaluate Abandoned Mine Tailings
Project Statement No.: ORPI-N-211

Issue: The extent of cyanide and metals contamination from some of the numerous abandoned mines within the monument has not been investigated. Residuals of cyanide may exist, and the leaching of high levels of metals may be occurring at some sites, particularly where the ore was milled or otherwise beneficiated.

Proposed Action: Threats posed by abandoned mine tailings will be evaluated. The past use of cyanide processing in the monument will be determined through an examination of historic records and an on-site examination of each abandoned mine site. Where cyanide process waste or other fine waste are found, soil samples will be collected and analyzed for cyanide and metals. The metals analysis will include iron, arsenic, selenium, manganese, copper, boron and zinc. The project will identify remedial actions which may include: establishing vegetation on the material to reduce erosion, removing and disposing of the offending material, excluding visitors and wildlife from the site, and continued monitoring.

Monitor Chemistry of Monument Precipitation
Project Statement No.: ORPI-N-212

Issue: Data on precipitation chemistry is needed to provide an indicator of potential contamination of the inputs into the region's ground and surface water sources. This data will provide information on the spatial distribution and temporal trends in concentration and deposition of the major cations and anions in precipitation to support monument research on terrestrial and aquatic effects.

Proposed Action: The monument's current precipitation monitoring program will continue. An Aerochem Metrics precipitation collector and Belfort rain gauge are setup near the headquarters. Precipitation is recorded on a rain gauge chart and will continue to be collected. The site will be serviced weekly according to National Atmospheric Deposition Program protocols. Products will include semiannual data reports and annual data summaries.

Manage Wastewater
Project Statement No.: ORPI-N-213

Issue: The wastewater management system consists of several small independent systems. Waste from the main park campground, with 208 campsites (no hook-ups), a dump station and six restrooms, is disposed of in four open evaporative lagoons. There are also five septic tank leach field systems serving the monument. All sewage systems are currently functioning adequately. Regular inspections are necessary, however, to ensure that problems do not develop and go undetected.

Proposed Action: The present systems will continue to be operated in compliance with state regulations. The systems will be examined periodically for leaks and deteriorated conditions. This project will be accomplished by maintenance and resources management staff.

III.G. Threatened, Endangered and Sensitive Species

III.G.1. Overview

The NPS has a responsibility to manage threatened and endangered species for their protection and perpetuation. These species pose unique management challenges because they require special management for single species priority within an ecosystem concept. Primary concern for threatened and endangered species must be integral to all aspects of park operations and planning.

III.G.2. National Park Service Policy and Program Objectives

The premiere authorities include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declared that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so no activities be undertaken to degrade park values, except where legally authorized. Other more specific acts are the Endangered Species Act of 1973; state-specific endangered species acts; other wildlife statues or agreements pursuant to Section 6 of the Endangered Species Act; Migratory Bird Conservation Act; Fish and Wildlife Coordination Act; Bald and Golden Eagles Protection Act (1940, and amendments); Wilderness Act (1964); and Convention of International Trade in Endangered Species. Other international agreements apply.

The policy and objectives as stated in NPS Management Policies and reiterated in NPS-77 guideline are:

The NPS will identify and promote the conservation of all federally listed threatened, endangered, or candidate species within park boundaries and their critical habitats...The NPS will also identify all state and locally listed threatened, endangered, rare, declining, sensitive, or candidate species that are native to and present in the parks, and their critical habitats...All management actions for protection and perpetuation of special status species will be determined through the park's Resources Management Plan. (4:11)

The threatened and endangered species program conducted is relative to the diversity, magnitude, and complexity of park resources. Management and monitoring programs should be coordinated with other state and federal agencies to be most

effective. Programs entail inventorying and monitoring species, managing selected species and their critical habitat, and conducting research for their preservation. Park operations should not adversely impact these species or their critical habitat, and efforts should be made to protect them from external activities.

III.G.3. Organ Pipe Cactus National Monument Current Program

Two endangered species of mammals, the Sonoran pronghorn (*Antilocapra americana sonoriensis*) and the lesser long-nosed bat (*Leptonycteris curasoae*), and one endangered species of desert pupfish (*Cyprinodon macularius eremus*) range within the monument. In total, there are approximately 50 plant and animal species of special concern found within the monument, including category 2 species, such as the Quitobaquito snail, desert tortoise and gila monster.

Research, monitoring and management of all federally listed species is coordinated with the US Fish and Wildlife Service and the Arizona Game and Fish Department. Annual permits are obtained to monitor populations, and biological assessments are prepared for any actions that may impact listed species. In regards to the Sonoran pronghorn, assistance is provided to the U.S. Fish and Wildlife Service in species management.

Monitoring of two endangered species, the lesser long-nosed bat and the desert pupfish, is conducted annually via population estimates and assessments. The monument's Chief of Resources Management serves on the working group for the recovery of the Sonoran pronghorn.

III.F.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

NO2 Impacts on Threatened, Endangered and Sensitive Animals

NO3 Impacts on Threatened, Endangered and Sensitive Plants

N20 Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

Develop a Threatened & Endangered Species Management Plan.
Project Statement No.: ORPI-N-250

Issue: Currently a plan does not exist to assist the monument in the management of threatened and endangered species. A comprehensive plan is needed to address all facets of the threatened and endangered species management program at the park level.

Proposed Action: Develop an extensive management plan to guide management, monitoring and research of threatened and endangered species. This document will provide reference material on federal and state programs. Critical information on the Endangered Species Act such as section 7 and related compliance information will be provided. Much of the information from the Western Region's "Threatened, Endangered and Sensitive Species Preservation," handbook, will be incorporated. This management plan will be park specific and will provide both general and precise information.

Expand and Implement the Quitobaquito Desert Pupfish Monitoring Program
Project Statement No.: ORPI-N-251

Issue: Anthropogenic impacts and natural processes pose a potential threat to the endangered species of desert pupfish (*Cyprinodon macularius eremus*) at Quitobaquito. The endemic pupfish inhabits the spring outflows and the pond at Quitobaquito. A monitoring protocol developed to assess the status of the desert pupfish population requires a review and modification both to ensure validity and to enhance the usefulness of the data.

Proposed Action: The current desert pupfish protocol will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide the modification of the long-term monitoring protocol and associated techniques. Methods for

database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.

Conduct Lesser Long-Nosed Bat Monitoring Program

Project Statement No.: ORPI-N-252

Issue: Information is needed for the wise management of the largest known United States maternity colony of the lesser long-nosed bat (*Leptonycteris curasoae*). A combination of monitoring activities developed to assess the status of the bat population requires a review, modification and consolidation both to ensure validity and to enhance the usefulness of the data.

Proposed Action: The current lesser long-nosed bat monitoring program will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide modification of the long-term monitoring protocol and associated techniques. Methods for database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.

Evaluate Effects of Poaching on Monument Resources

Project Statement No.: ORPI-N-253

Issue: Organ Pipe Cactus National Monument has several plant and animal species of interest to the illegal collecting trade, particularly cacti and reptiles. In a 1987 Park Service natural resources assessment, poaching was listed as the seventh most prevalent threat source, affecting 47 parks in eight regions (memo to park interpreters from WRO Chief of Interpretation 4/5/88). Additionally, numerous species, including raptors such as the peregrine falcon, and mammals such as the Sonoran pronghorn, mountain lion, desert bighorn sheep and various bat species, and invertebrates including certain tarantula and scorpion species, are locally rare. The effects of poaching of these species could adversely affect monument population levels and interrelationships with other species. The proximity to the border of Sonora, Mexico, makes the monument a prime target for the illegal trade in such species, especially since many of these plants and animals often have a high value on the black market.

Proposed Action: A study will be developed to determine the extent of the poaching problem at Organ Pipe Cactus National Monument. Research will include: a survey of selected reptilian and cacti species within the monument and interviews with knowledgeable professionals (e.g. local courts, Pima County sheriff, Tohono O'odham Tribal Police, AZ Department of Agriculture, etc.) on the cacti and reptile marketing business. Information will also be gathered from U.S. Customs officials at the Lukeville port of entry. A survey of evidence of poaching within park boundaries will be conducted and a review of law enforcement records for Arizona on cases involving poaching and illegal possession of poached specimens will be completed. Depending on the type and extent of the poaching found in the first phase of the project, an evaluation of methods for controlling and preventing poaching will be incorporated into the study, including involvement of the interpretive staff. Identification of problem areas and species will be incorporated into the monument geographic information system, allowing for analysis and control.

Identify Sonoran Mud Turtle Mortality Source at Quitobaquito

Project Statement No.: ORPI-N-254

Issue: There is an ongoing population decline of the Sonoran mud turtle (*Kinosternon sonoriense*) at Quitobaquito. Several inexplicably dead turtles have been recovered floating in the pond, something rarely, if ever, observed in other natural populations. The problem is to identify the cause of this apparently abnormal mortality.

Proposed Action: A two track program will be carried out to investigate the cause of mortality. Eight carcasses of mud turtles found dead at Quitobaquito are currently deep frozen at the University of Arizona. They will be subjected to

gross dissection and chemical analysis to search for mortality sources. The data will assist in long term management for survival of this isolated population.

Survey Rio Sonoyta Populations of the Sonoran Mud Turtle
Project Statement No.: ORPI-N-255

Issue: Nothing is known of the current distribution and abundance in Mexico of the desert-isolated taxon, the Rio Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*). This taxon is endemic to Quitobaquito and the Rio Sonoyta, and is separated from the rest of the species range by approximately 100 miles. The only protected population, at Quitobaquito, is declining, and the population status is unpredictable, especially given agricultural and urban development associated with the Rio Sonoyta in adjacent Mexico.

Proposed Action: Mud turtles will be sought by on-foot hand collecting, observation with binoculars, and live trapping at each major perennial reach of the Rio Sonoyta in Mexico. Additional survey will be made at closely adjacent stock tanks. The work will be done jointly with herpetologists from Mexico. The findings will indicate the population status of the taxon as a whole, and the degree of threat posed by the population decline at Quitobaquito in particular.

Conduct a Study on Biological-Hydrologic Relationships in the Rio Sonoyta
Project Statement No.: ORPI-N-256

Issue: Information on the biological-hydrological relationships of the Rio Sonoyta area is needed to guide management actions. In a desert ecosystem, the availability of water is critical in the determination of flora and fauna distributions. This is especially true for determining the habitat of aquatic species, such as the endangered pupfish, and riparian vegetation communities. These important resources are highly dependent on local hydrologic factors and management success is determined largely through an understanding of the biological-hydrologic relationships. This information is currently lacking for Sonoran Desert ecosystems.

Proposed Action: A study will be developed to monitor, with hydrologic instrumentation, the Rio Sonoyta and, if necessary, other riparian areas with similar hydrologic character. Work will also be conducted at Quitobaquito and the two systems will be compared. This comparison will assist the NPS in the management of the important Quitobaquito area. The potential linkage of the two systems will also be examined. Although most of this work will be conducted in Mexico, the work falls under the monument's role as a MAB biosphere preserve, as similar systems on both sides of the border will be compared and assessments concerning the potential impacts of man will be made.

Survey and Monitor Moisture-Sensitive Herpetofauna on the Monument
Project Statement No.: ORPI-N-257

Issue: The Ecological Monitoring Program currently lacks an explicit focus on animal assemblages characterized by special moisture sensitivity. Monitoring and research on such animals is critical to prediction and early observation of effects of climatic change in natural communities in this desert region.

Proposed Action: The distribution of moisture-sensitive reptiles associated with desert mountains will be surveyed in the monument. Extensive transects will be established to document intrageneric species transitions across the slope and moisture gradient. Long term monitoring will be established for tracking the positions of these species transitions, and comparative laboratory studies will supplement the understanding of the climatic sensitivity of the species. This study is an outstanding research opportunity at Organ Pipe that will assist in prediction and early observation of climate change impacts.

Determine Status of the Organ Pipe Shovelnosed Snake
Project Statement No.: ORPI-N-258

Issue: The Organ Pipe shovelnosed snake (*Chionactis palarostris organica*) may be threatened by highway mortality. It is known in the U.S. only from live, and primarily dead, specimens observed on the paved highway, Arizona State Route 85. The healthiest populations may all be severely impacted by highway mortality. An assessment is required for populations occurring along the highway, the impact of the highway on these populations, and the extent of populations away from the highway. At issue is the strong potential that highway traffic, and with it highway mortality, will increase in the near future.

Proposed Action: The highway will be monitored for these snakes throughout the appropriate times of day and year. Standard live trapping protocols will be carried out to non-destructively observe population status both near and at a distance from the highway. On-foot and side-road surveys will also be conducted. Management recommendations will be developed, especially concerning the highway, and a monitoring protocol will be formalized if the species is possibly in jeopardy. Morphological data will be collected to ensure a clear taxonomic picture of the species. Cooperation with Mexican students of herpetology will be sought through the Centro Ecologico and University of Sonora in Hermosillo, to undertake further studies that can evaluate species status and ecology in its limited range in Mexico.

Determine Status of the Mexican Rosy Boa

Project Statement No.: ORPI-N-259

Issue: The Mexican rosy boa at Organ Pipe Cactus National Monument is probably affected by illegal collecting and may be impacted by highway mortality. This is a slow-moving snake that is quite active during the season of maximum visitor traffic. None have been reported near Route 85 since September 1983 despite great survey effort. In contrast, eight have been seen on side roads with only a small fraction of the effort. This species is highly desired by snake collectors and keepers, and the rosy boa subspecies (*Lichanura t. trivirgata*) is known in the U.S. only at and near the monument. It is clear that attempts to collect this species illegally from dirt roads and back country areas at Organ Pipe are regular.

Proposed Action: Road-driving and on-foot transects initiated in 1993 will be continued and expanded to include additional monument areas thought to support populations of rosy boas. Continuing the mark-recapture study should yield a high probability of recaptures at specific areas of sampling focus. Reproductive data on gravid females will be obtained as possible. Data will assist in evaluating the importance of existing and potential impacts on the species. Intensive habitat descriptors will continue to be collected to ensure valid contrasts among years. Results will provide a clear picture of the ecology and management needs for the species at Organ Pipe.

Analyze Mexican Leafcutting Ant Population Size and Structure Analysis

Project Statement No.: ORPI-N-260

Issue: Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). This population was discovered during ground searches of more than 100 km of suitable riparian habitat at Organ Pipe, and consists of more than 40 colonies in the park, plus one outlier 300 m outside the northeast boundary. The large size, limited occurrence, and unusual habits of the ant colonies make them significant objects of park interpretion and research activities, and provide a unique opportunity for application of modern techniques in molecular genetics to analysis of natural population and colony-level structure, as well as evaluation of gene flow, genetic diversity, and effective population size. Several distinct local subpopulations (demes) were identified during the mid and late 1980s. Agricultural development south of the monument may isolate the U.S. population from the main population in Mexico, and detailed data on population structure, size, and genetic diversity may be important to evaluate long-term impacts of isolation, inbreeding, and chance events.

Proposed Action: A research project will be developed to assess the status of the Mexican leafcutting ant population in the monument.

Expand Long-term Ecology Studies of *Stenocereus thurberi*
Project Statement No.: ORPI-N-261

Issue: Although an initial study of the organ pipe cactus (*Stenocereus thurberi*) has been completed, additional data from varying locations is needed to provide information relevant to management of the species. Frost and freezing temperatures appear to be two of the greatest factors affecting the growth of the organ pipe cactus. It is unknown if temperature is the sole cause of the lack of organ pipe cactus populations in extensive plains and flats, or if water availability or other factors may be the cause (Ruffner, et al 1991).

Proposed Action: A series of studies will be developed to provide additional information and to show periodic trends in the growth, distribution and relationships of the organ pipe cactus. Specific actions will include expanding current monitoring to include organ pipe cacti in the Sonoyta Valley, La Abra Plain and Growler Canyon; examining photosynthesis of organ pipe cactus relevant to diurnal, seasonal, elevational and genetic differences; studying the root systems of organ pipes and their relationship to water uptake and storage; and evaluating the consumers and pollinators of the organ pipe cactus.

Expand Long-term Ecology Studies of *Echinomastus erectrocentrus var. acunensis*
Project Statement No.: ORPI-N-262

Issue: The demographic status of the acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*) needs to be fully researched to insure protection of this species from poaching and other factors which could eliminate its only known population in the monument. In Organ Pipe Cactus NM, the acuna cactus is found only in Acuna Basin. This situation makes the species vulnerable to complete degradation by outside forces and the population could be completely obliterated by a single disaster.

Proposed Action: A program will be developed to gather additional data on the ecology of the acuna cactus in the monument. This will entail collecting additional data on the demographic status and ecology of this rare cactus both within and outside monument boundaries. The causes affecting population decline and recruitment will be determined and the possibility of other populations occurring within the monument's boundaries will be examined. A broader understanding of outside factors affecting the growth and distribution of the acuna cactus will be obtained from the synthesis of information gained through natural resources monitoring programs and other research activities.

Expand Long-term Ecology Studies of *Lophocereus schottii*
Project Statement No.: ORPI-N-263

Issue: Additional information is needed to adequately protect the monument's population of senita cactus (*Lophocereus schottii*). Illegal collection of senita cactus has occurred. The senita's growing tips are suitable for rerooting and transplanting, and have been removed from several individuals at the Dos Lomitas natural resources monitoring site (Ruffner et al. 1991). Further research on other factors affecting distribution of the senita cactus, including border and poaching effects on the local population, would be beneficial.

Proposed Action: A program will be developed to gather additional data on the ecology of senita cacti in the monument. Activities will include: mapping individual senita cacti within monument boundaries; compiling a bibliography of information published to date on the ecological functioning of senita cactus; developing a geographic information system (GIS) theme to indicate location and distribution information on the senita cactus throughout its known range; cooperating with U.S. land management agencies and scientists/managers from Sonora and Sinaloa, Mexico to gather information and data on other senita cacti; examining effects of predation by moth larvae or other predators; determining viability of replanting to protect the biodiversity of this species; monitoring and mitigating illegal

collection activity and maintaining records of damage rates; and synthesizing all available research data and bibliographic information on factors affecting the local population.

Expand Long-term Ecology Studies of *Bursera microphylla*
Project Statement No.: ORPI-N-264

Issue: Additional information is needed to adequately understand and protect Organ Pipe Cactus National Monument's population of elephant trees (*Bursera microphylla*). Little is known of the elephant tree's natural history. Low temperatures, as with other desert plant species, appears to be a limiting factor in the growth of the elephant tree, which is included in a family of mostly tropical species (Rzedowski and Kruse 1979). According to the Special Status Plant study conducted as part of the monument's natural resources inventorying and monitoring program, researchers discovered that the elephant tree population in the monument was actually recruiting and appeared to be a viable and sustaining one (Ruffner et al. 1991). The causes for this increase in population need to be further explored in order to analyze factors affecting the demographic status.

Proposed Action: Studies will be conducted to determine the demographic status of elephant trees in the monument. Activities will include: mapping individual elephant tree populations within monument boundaries; compiling a bibliography of information published to date on the ecological functioning of the elephant tree; developing a geographic information system (GIS) theme to indicate location and distribution information of the elephant tree throughout its known range; determining the type and extent of damage of predation, investigating pollinating mechanisms; determining if illegal collection activity exists and maintaining records of damage rates; and synthesizing all available research data and bibliographic information on factors affecting local population.

Evaluate Status of and Develop Monitoring Program for Sonoran Pronghorn
Project Statement No.: ORPI-N-265

Issue: The current status of the Sonoran pronghorn (*Antilocapra americana sonoriensis*) in the monument is not fully understood. The Sonoran pronghorn is an endangered subspecies, with a limited distribution in southwestern Arizona and in northwestern Sonora, Mexico. There are less than 300 individuals in the United States and less than 500 in the State of Sonora, Mexico (Thompson-Olais 1993). The known distribution of the subspecies within the United States is in Organ Pipe Cactus National Monument and on the Barry M. Goldwater Range, primarily within the boundaries of the Cabeza Prieta National Wildlife Refuge. A multi-agency Core Working Group was established in 1991 to focus recovery efforts for the Sonoran pronghorn. Agencies invited include the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Arizona Game and Fish Department, Tohono O'odham Nation and Centro Ecologico de Sonora in Hermosillo, State of Sonora, Mexico. The group has coordinated surveys of pronghorn and is involved in other aspects of species recovery, including the revision of the Recovery Plan.

Proposed Action: The monument will continue as a member of the Core Working Group addressing Sonoran pronghorn recovery. Activities outlined in the revised recovery plan will be implemented in conjunction with Core Working Group agencies. The U.S. Fish and Wildlife Service will lead recovery efforts.

Evaluate Status of Mastiff Bats (*Eumops sp.*)
Project Statement No.: ORPI-N-266

Issue: The status of two sensitive bat species, Underwood's mastiff Bat (*Eumops underwoodi*) and the western mastiff bat (*Eumops perotis*) in the monument is unknown. *E. underwoodi* is known in only two locations in Arizona. Earlier records have *E. underwoodi* occurring at the south end of the Baboquiveri Mountains near Sasabe. In the early 1980's, a number of individuals of both sexes at Quitobaquito Pond in the southwest corner of Organ Pipe Cactus National Monument were

captured. This site remains the only other known United States location, and is also the western most record of occurrence.

Proposed Action: A research project will be developed to assess the status of both mastiff bat species in the monument. Questions to be addressed will include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture rate, and relative abundance of *E. underwoodi* and *E. perotis*.

III.H. Air Resources

III.H.1. Overview

The NPS has a responsibility to manage air resources based upon the following laws: the National Environmental Policy Act of 1969, the Wilderness Act of 1964, the Endangered Species Act of 1973, the Surface Mining Control and Reclamation Act, the Clean Air Act of 1977 and the park's specific enabling legislation.

The Clean Air Act established classes I, II, and III of clean air, and provided a means to measure and prevent any significant deterioration of air. Class I areas are given the highest standards for air, and class III, the lowest standards. No park unit is less than a class II, and most parks with wilderness and high visitation are class I areas. The Act also required the development of state air quality plans to implement standards.

III.H.2. National Park Service Policy and Program Objectives

The NPS Management Policy as outlined in NPS-77 states:

The National Park Service will seek to perpetuate the best possible air quality in parks because of its critical importance to visitor enjoyment, human health, scenic vistas, and the preservation of natural systems and cultural resources...The Park Service will assume an aggressive role in promoting and pursuing measures to safeguard [air quality related values] from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the Park Service will err on the side of protecting air quality and related values for future generations.

Air resources management should be integrated into all aspects of park operations and planning. All in-park air pollution sources will comply with federal, state, and local air quality laws.

Air resources management within parks should include the following:

1. Inventory of air quality related values.
2. Monitor and document the condition of air quality and related values.
3. Evaluate air pollution impacts and identify causes.
4. Ensure healthful indoor air quality in NPS facilities.
5. Review of permit applications for major new air pollution sources (transboundary and international).
6. Participate in local, regional, state and federal air pollution control planning processes.
7. Promote public understanding of air quality issues through educational and interpretive programs

The NPS air resources management program should preserve, protect, and enhance air quality and air quality related values in NPS units by ensuring compliance with the requirements of the Clean Air Act and the NPS Organic Act of 1916.

There are several roles that the NPS plays in implementing its national air resources program as mentioned above. More specific aspects of the program include: ambient air quality monitoring of criteria pollutants consisting of ozone and sulfur dioxide, visibility monitoring, biological effects monitoring, air quality modeling, and air quality compliance as related to park planning.

III.H.3. Organ Pipe Cactus National Monument Current Program

Organ Pipe Cactus NM is a Class II floor clean air site as identified in the Clean Air Act of 1977. The recent 1990 Clean Air Act amendment did not allow for reclassification of any Class II sites. Because the monument has over 300,000 acres of wilderness, there is cause for concern with the Class II classification. The Class II level criteria pollutant levels are quite high and may allow for significant deterioration to the monument's sensitive ecosystems and wilderness values before preventative actions are required.

The current air quality program consists of one National Atmospheric Deposition Program (NADP) site, one dichotomous particulate sampler and one continuous background radiation sampler. Until recently, the monument also serviced a PM-10 Hi-Volume particulate sampler, but it was replaced with the dichotomous unit. The NADP site and radiation sampler are serviced every Tuesday. The dichotomous sampler is serviced every six days.

III.H.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

A primary goal for the monument's air quality program is to have the site reclassified from a Class II to a Class I area. This redesignation process must be conducted by the state, but the monument must first prove the necessity of such action. This will require the State Department of Environmental Quality to conduct an analysis that addresses the health, environmental, economic, social, and energy effects of the proposed redesignation. Public hearings must be held in the area. Official recommendations related to redesignation actions require concurrence from the federal land managing agency, which in this case is the NPS.

Although the monument is designated as a Class II airshed, it is recommended that it be managed as a Class I area until the redesignation takes place. Justification for such an action involves several aspects. Organ Pipe is a Biosphere Reserve; it is over 90% wilderness; many plant species reach their northern range limit here; and other plants found in the park are rarely found elsewhere in the United States. The potential for increased visibility impairment and air quality impacts, especially along the southern boundary, are very likely. The growing town of Sonoyta, Sonora, Mexico, is adjacent to the monument's south boundary. The town supports a population of more than 25,000, as well as a growing agricultural and farming community that burns fields and uses U.S. banned pesticides. There is also an interchange of three Mexico highways near the border, supporting much semi-truck and other large diesel vehicle use. The smelter in Cananea, Sonora, Mexico, which is approximately 175 miles southeast of the monument, is expanding its operation. Prevailing winds in the spring, summer and sometimes winter, come from the south; thus the plant's operation could have an impact on air quality.

SERVICEWIDE ISSUES:

N14 Visibility Impairment and Biological Damage Caused by Air Pollution (Includes Wet and Dry Deposition).

Develop and Implement Ambient Air Quality Monitoring Program
Project Statement No.: ORPI-N-300

Issue: The effects of gaseous pollutants on monument resources, including the many varieties of cacti and special status plants, are unknown. Since 1985, when the Ajo mine smelter was closed, air quality at the monument has improved dramatically. Now would be an opportune time to initiate a gaseous pollutant monitoring program to establish a baseline. Growth adjacent to the monument is expected to increase as urbanization and agricultural development expands. In addition, possible future trade agreements may accelerate this process. Approximately 5000 hectares have been set aside 20 miles south of the monument by the state government of Sonora, Mexico, to develop twelve factories, including a pesticide disposal plant. All these activities threaten the future air quality of the monument.

Proposed Action: A program to monitor ambient air quality in the monument will be developed.

This will entail inventorying, monitoring and documenting both air quality related values and the condition of air quality. In addition, air pollution impacts will be evaluated. An ozone and sulfur dioxide monitoring program will be established, thus ensuring that baseline and trend data will be known. The monument will thus be able to monitor change more closely and accurately. The data will also give the monument a defense to use in reducing current or potential air pollutant impacts to its resources.

Develop and Implement Visibility Monitoring Program
Project Statement No.: ORPI-N-301

Issue: Although scenic opportunities are a prime visitor resource at Organ Pipe Cactus National Monument, there is no program in place to monitor visibility. The vistas seen from visitor use drives and mountain tops may extend 70 miles or more. The night sky is another unique and important resource. The 1989 National Park Service visitor use survey states that 81 percent of the visitors believe that the monument's natural scenery is extremely important, and 43 percent believe that a clear night sky is extremely important.

Proposed Action: A visibility monitoring assessment program will be established and implemented with the coordination of the National Park Service, Air Quality Division. The program will include installation and maintenance of at least one, and possibly two, automated camera stations: one on the south boundary as a first priority, and one in the northern portion of the monument. A transmissometer will also be installed and maintained to determine the extent of visibility impairment. Selected monitoring of airborne particulates using an IMPROVE particulate sampler, in conjunction with continuous monitoring of meteorological factors, will result in an assessment of the extent, severity and trends of ambient pollution as affect visibility in the monument.

III.I. Archeological Resources

III.I.1. Overview

Cultural remains identified in the monument date from perhaps 9000 B.C. to historic ranches and mines. Throughout this span of time, the area represents a unique history of desert adaptation and interaction between cultures. Prehistoric cultures represented are San Dieguito, Archaic (Cochise and Amargosa), Hohokam (the best-represented culture), Trincheras, and Patayan. The monument also contains sites representing the historic Tohono O'odham (Papago) and Hia C-ed O'odham (Sand Papago). Physical remains of prehistoric and ethnographic sites include: villages; graves; temporary camps with evidence of food gathering, food preparation or artifact manufacture; stone quarries; rock art, trails and rock basins (tinajas) with bedrock mortars . Surface evidence of these activities are scatters of stone, pottery, shell and occasional other materials; these occur in isolation or in association with rock patterns (lines, rings, fire-cracked rock or "sleeping circles") and traces of features such as houses, fire-hearths, canals, and reservoirs.

Slightly over 9000 acres of the monument, or approximately 2.5%, have been archaeologically surveyed. Most of this was accomplished in 1989-1991, when areas of known site density, high probability and low probability were surveyed to obtain a sample of the archeological resources. Prior to that, archeological sites had been recorded from early reconnaissance, scattered clearances, and survey of the east boundary on the crest of the Ajo Mountains. A total of 226 sites are adequately recorded for the monument; 162 more have been located but are not adequately recorded.

First priority objectives in archeological resources management and protection are completion of inventory, resource evaluation, data management, avoidance and mitigation of human impacts and natural erosion. With clear ties between archeology and surviving Native Americans, a both framework and procedures need to be established for dealing with traditional uses and traditional cultural properties.

III.I.2. National Park Service Policy and Program Objectives

The NPS policy for cultural resources is to "...preserve and foster appreciation of the cultural resources in its custody through appropriate programs of research, treatment, and interpretation." The basic principles of cultural resource management are to inventory, assess and protect resources; unavoidable impacts on significant resources are to be mitigated by treatment or data recovery." This policy is based on the following laws: the Historic Sites Act of 1935, the National Historic Preservation Act of 1966 -amended in 1980, the Archeological Resources Protection Act of 1974, and the Native American Graves Protection and Repatriation Act of 1990. Guidelines for implementing Service policy and these laws are given in NPS-28, Cultural Resources Management Guidelines (Rev. 3 - 1985, Rev. 4 - pending). The relationship between park planning and compliance with the Historic Preservation Act of 1966 is specified in a Programmatic Agreement between the NPS, the Advisory Council on Historic Preservation, and State Historic Preservation Officers (1991).

III.I.3. Organ Pipe Cactus National Monument Current Program

The first priority for archeological resources management is an adequate inventory and database. The first step is the completion of the report of survey for work conducted from 1989 to 1991, which will establish a database and foundation for future archeological work in the monument. This is being completed by archeological staff at the Western Archeological and Conservation Center (WACC) in Tucson, AZ.

III.I.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

To meet continuing on-site needs for cultural resources management and protection, a cultural resources specialist position is needed. This position will have the responsibility of interacting with other staff members to insure an effective and comprehensive program of cultural resource inventory, management, protection and interpretation. The incumbent will also assist the staff in insuring that necessary consultation with Native Americans occurs.

Issues of concern to Native Americans are of increasing importance to park management. Compliance with the Historic Preservation Act of 1966 requires consultation with appropriate Native Americans, especially concerning Traditional Cultural Properties. The Native American Graves Protection and Repatriation Act imposes specific requirements concerning the protection and disposition of human remains and associated artifacts. The monument lies within the traditional territories of the Tohono O'odham and Hia C-ed O'odham, and these groups have been consulted concerning treatment of human remains. O'odham individuals have also participated in the interpretive program. More frequent and consistent consultation and coordination with these groups will be a responsibility of the proposed cultural resources management specialist position.

SERVICEWIDE ISSUES:

C01 Inadequate Planning Documents (GMP, SFM, DCP)

C02 Inadequate Archeological Survey and Inventory

C04 Need for Ethnographic Overviews and Assessments, Oral Histories and Life Histories.

C12 Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance

C14 Need for Major Archeological Data Recovery

C20 Inadequate Security

C26 Other; Need to Re-analyze and Re-evaluate Previous Collections Based on Current Archeological Knowledge, Methods, and

Techniques.

Complete Archeological Survey Report: 1989-1991; Curation of Artifacts from Surveys
Project Statement No.: ORPI-C-001

Issue: The Archeological Survey Report: 1989-1991 has not been completed. Completion of the report requires data analysis, a final report, a National Register nomination, and cataloging of collected artifacts. From 1989 to 1991, an archeological survey of 8000 acres (approximately 2.3% of the monument) was completed that investigated 1) areas of predicted high site density; 2) areas of predicted low site density; 3) portions of areas of proposed development; and 4) areas of known site density. This survey established that archeological resources are more numerous and significant than previously known; that remains of 12,000 years of human history are in the monument, and that archeological resources represent significant prehistoric events signifying relationships between human populations and their adaptations to the Sonoran Desert.

Proposed Action: An analysis and report meeting USDI and NPS standards will be completed. Site records will be entered into the Classified Sites Inventory, and artifacts will be cataloged and stored according to NPS standards and directives. This is required to meet management and planning needs, to comply with National Historic Preservation Act (NHPA) mandates, and to meet NPS and USDI requirements for artifact curation and conservation.

Prepare Prehistoric Sites Preservation Guide
Project Statement No.: ORPI-C-002

Issue: The monument does not have guidelines for the preservation of important irreplaceable prehistoric sites. Guidelines are needed to establish baseline preservation procedures and treatments. Prehistoric sites are subject to damage from natural processes, pests, visitor impacts, vandalism, and theft. The NPS is responsible for the protection and preservation of these resources. The monument does not have sufficient staff necessary to implement guidelines at this time.

Proposed Action: A prehistoric sites preservation guideline for the monument will be prepared. This will establish specific actions and treatments consistent with monument planning and NPS policies and guidelines. Monument management and staff can then follow the guidelines to insure that adequate protection and preservation measures are applied to important nonrenewable sites. Implementation of this project will help ensure that the monument's prehistoric preservation program complies with the Organic Act of 1916, NPS-28 Cultural Resources Management Guidelines, Chapter 5 of the 1988 NPS Management Policies, Sections 106 and 110 of the National Historic Preservation Act, the Archeological Resources Protection Act, and the 1937 Presidential Proclamation establishing the monument under Section 2 of the 1906 Antiquities Act.

Develop Archeological Base Map/Database in GIS
Project Statement No.: ORPI-C-003

Issue: There is presently no integrated database and base map of natural and cultural resources and modern features such as roads. Organ Pipe Cactus National Monument proposes to develop a Geographic Information System that will contain all such data. Maps of cultural resources with overlays of natural resources and cultural features could then be generated. These maps will create a single visual impression of the natural and cultural landscape. The GIS will be capable of creating maps which show the locations of cultural resources and modern features such as highways and dirt roads, campgrounds, NPS facilities, and utilities.

Proposed Action: A cultural resources database to be used with GIS will be developed, to produce integrated maps of natural and cultural resources along with overlays of modern cultural features in Organ Pipe Cactus National Monument. Universal Transverse Mercator (UTM) grid co-ordinates and latitude/longitude have been determined for all sites

recorded between 1989-1991, thereby providing accurate locational information. Locational information needs to be determined for previously recorded sites. Site typologies which contain descriptive information, time period, cultural affiliation, and site function need to be determined. Cultural resources data, including site boundaries, will be entered into the GIS. Any number of integrated maps will be produced, containing cultural resources information along with information on vegetation, soils, topography, drainages, slope, aspect and degree, erosion and deposition, and recent cultural features such as roads (open & closed) and hiking trails. Depending on the type of information needed, these maps will be used by planners in preparing proposals for new construction activities; by law enforcement agents for protection and surveillance activities; and by resources management personnel for use in studying natural impacts to sites and to assist in developing monitoring protocols.

Data Bank Management: Correct Plotting of Site Locations on Monument and Western Archeological and Conservation Center Maps
Project Statement No.: ORPI-C-004

Issue: Planning documents prepared for the recent GMP used a cultural resources base map that contained out-of-date and often incorrect data regarding site locations. There is a conglomeration of old maps, reports, field notes, and locations descriptions for cultural resources which were identified prior to 1980. An up-to-date corrected USGS 15' topographic map is needed by Organ Pipe Cactus National Monument and by the databank at the Western Archeological and Conservation Center (WACC). A corrected base map would make a single visual impression of where cultural resources are located. WACC has up-to-date USGS 7.5' topographic maps showing the locations of sites identified since 1980. The monument, however, does not have copies of these maps. The large base map and smaller maps will be used in planning, by law enforcement for protection & surveillance at sites, and by resources management for studying natural disturbances in site areas. Map overlays will also be made for cultural resources by site category (eg. historic, prehistoric ceramic period, prehistoric Archaic period).

Proposed Action: A map index will be created, and all current base maps at WACC and ORPI will be revised and updated. Site locations will be accurately plotted on topographic maps and aerial photos. Legal descriptions and UTM's for all sites will be calculated as a prerequisite for developing the cultural resources GIS database. The project will be accomplished by NPS personnel working at WACC.

Develop and Fund Public Archeology Program
Project Statement No.: ORPI-C-005

Issue: Although Organ Pipe Cactus National Monument is a natural area, archeological survey of 2.3% of the monument area shows that it contains a large number of significant archeological resources, many of which are very vulnerable to impact by visitor traffic and vandalism. These resources have high research and interpretive potential for understanding the relationships between man and the desert. Information about them can contribute to the monument interpretive program, to more effective resource management, and to public awareness of their importance. Past interpretation and training have focused on natural resources; more effort is needed to inform park staff and the public concerning archeological resources.

Proposed Action: Interpretation, training, and awareness of archeological and ethnographic resources will be expanded for the public and park staff, as an integral part of monument operations. Knowledge of the monument's resources, and their regional context, is continuously growing; thus interpretative potential grows as well. Heightened awareness of an increasingly threatened resource is important for visitors, during their visit to the monument and after. Increased sensitivity to traditional Native American values and locations is important for resolution of current conflicts between Native Americans and Euro-Americans. Increased potential for deliberate and unintentional

human impact on archeological resources requires better trained park staff. All of these needs are best met by increased effort and involvement from the park staff, with assistance from archaeologists, ethnologists, and Native Americans knowledgeable about the monument's cultural resources.

Develop and Fund Archeological Site Protection Program
Project Statement No.: ORPI-C-006

Issue: Theft of cultural resources is a significant problem in many National Parks and Monuments. Law enforcement agencies estimate that looting and vandalism of cultural resources is a multi-million dollar business. The loss of information to scientists can not be estimated in dollar figures. Cultural resources, including prehistoric and historic archeological sites, on all federal lands, are protected by the Federal Antiquities Act of 1906, the Archeological Resource Protection Act of 1979 (amended 1987/1988), and the Native American Grave Protection and Repatriation Act of 1990.

Proposed Action: An archeological site protection program will be funded and developed. The program will increase formal and informal training for all ORPI staff, including interpreters, resources management, and law enforcement. The program will include the development of an ORPI site steward program, to be implemented by Volunteers in Parks (VIPs). These stewards will receive certification training through the Arizona State Historic Office. The program will also focus on public education about pothunting, including surface collection, and how this activity destroys archeological information and eventually, the sites, and also how it is against the law and that violators will be prosecuted.

Ethnographic Research: Ethnographic Overview & Assessment, Ethnographic Inventory, Ethnohistory and Oral History, Ethnobotany, and Ethnoarcheology
Project Statement No.: ORPI-C-007

Issue: The monument does not have an Ethnographic Overviews and Assessment, a basic cultural resources document needed for parks with known traditional use by Native American groups. An inventory is needed to establish if important ethnographic areas occur which are not presently known to park management. Additional information on these and on known areas needs to be gathered in order to ensure management of these areas in a sensitive manner. Documenting historic and current Native American use is essential to management, the Interpretative Division, and to enhance relationships with the native O'odham population. Ethnographic studies are essential to ensure that the monument manages its traditional cultural properties as required by federal laws, NPS policies and guidelines.

Proposed Action: The following documents will be prepared: an ethnographic overview and assessment, an ethnographic inventory to provide monument management with information on ethnographic resources, an ethnobotany of Organ Pipe Cactus National Monument to provide information on traditional uses of plants by Native American groups, and an ethnoarcheology to provide baseline information for interpretation of past human behavior. Preparation of the Ethnographic Research Documents will help provide adequate information for management to address impacts of park operations and activities on traditional resources. Traditional use areas will be protected through the site monitoring program and damage to important ethnographic areas will be avoided by reducing potential conflict over resources. Management will be able to comply with federal legislation and NPS policies and guidelines regarding ethnographic resources.

Conduct Oral History Project With People Who Have Historical Knowledge of the Monument
Project Statement No.: ORPI-C-008

Issue: Documented interviews with individuals knowledgeable about the history and prehistory of the monument are lacking. Several archaeologists have conducted previous related research that remains unpublished. Many residents of surrounding areas (Sonoyta, Mexico and Ajo, Arizona) and former NPS employees have

information about historical activities that occurred in and around the monument. The information regarding the history of cultural resources and of ORPI programs and operations is invaluable. This information needs to be acquired while these individuals are alive and willing to share their experiences.

Proposed Action: The following will be identified: individuals who have information about historical, developmental periods of the monument; individuals who have information on historic lifeways in the monument; and researchers who have conducted previous investigations that are unpublished. Oral interviews will be conducted, and the meetings will be documented through the use of appropriate media (tape, video, etc.).

Write Quitobaquito Management Area Human History

Project Statement No.: ORPI-C-009

Issue: The Quitobaquito Basin represents the oldest continuously occupied area within Organ Pipe Cactus National Monument. At the present time, the survey and recording data for sites within the immediate Quitobaquito Basin are incomplete. A survey conducted by the Arizona State Museum in the 1970's identified sites, but site boundaries were not delineated; sites were not mapped; and records are incomplete as to temporal and cultural affiliation and site type. Additional sites are known to exist within the Quitobaquito Basin, but have not been recorded. No large scale surveys have been conducted in the basin surrounding other springs along the western flanks of the Quitobaquito Hills. Information on cultural resources is totally lacking for these areas, which historically are associated with sites around the Quitobaquito Springs.

Proposed Action: A survey project to locate, identify, and record cultural resources in the Quitobaquito area will be conducted and a cultural history of the area prepared. This will provide documentation required for planning and managing the Quitobaquito Management Area. The cultural history will include prehistoric, protohistoric, and historic cultural resources. This task will be undertaken by a small group of National Park Service professional archaeologists and students from the United State and Mexico. This mixture of student personnel from the United States and Mexico will facilitate continued co-operation between the two governments in the management of cultural and natural resources. This project will also provide training for a number of students.

Data Recovery Projects

Project Statement No.: ORPI-C-010

Issue: During the recent intensive survey of approximately 8,000 acres, 260 prehistoric, protohistoric, and historic ethnographic field loci were identified, and 188 field loci were mapped and recorded. Erosion at many sites has removed the cultural deposits and exposed features. Sheetwash erosion has exposed fire-cracked rock features, leaving loose clusters and scatters of fire-cracked rock and charcoal stains. These features have had the upper portion of the cultural deposit removed, however, in many cases there is sufficient cultural deposit remaining to obtain samples for analysis. At some sites, features are exposed in the banks of headwater cutting rills and small washes. These features retain sufficient integrity to obtain flotation, pollen, radiocarbon, and archeomagnetic samples which can be used to address questions related to subsistence activities, seasonality, and dates of use.

Proposed Action: Data recovery targeted at eroded features and prehistoric occupation surfaces, rather than vast site areas, will be conducted. This will provide samples for use in addressing questions of period of use, subsistence activities, and seasonality of use. This limited data recovery program will provide a maximum amount of information which can be integrated with site survey reports. Samples can be collected and the analysis conducted at a later date, depending on funding. Collecting the samples insures that information will be recovered from the features prior to complete destruction. Excavation of one-half of a feature will also allow for the establishment of long term monitoring protocols to determine the rate of feature destruction from

alluvial and eolian processes. This ancillary study would assist in planning for future data recovery programs.

Archeological Survey of Use Zones
Project Statement No.: ORPI-C-011

Issue: Use and operation of the monument takes place within four developed areas, plus approximately 125 miles of open and closed roads (some of which are used as hiking trails), and an undetermined amount of official and unofficial trails. Within these use zones, there is continuous potential for impact on archeological resources from visitation, monument operation, construction and maintenance. An extremely small portion (less than 1%) of these use zones have been surveyed for archeological resources. Hence there is no database upon which to measure the attrition of these resources from human erosion, vandalism or impacts incidental to human activities. A resource inventory for use in planning new developments and construction within these zones is also lacking.

Proposed Action: Systematic and intensive walking surveys of all road and trail corridors, as well as areas of direct and indirect impact around all park facilities (headquarters area, campgrounds, rest areas etc.) will be conducted. All sites will be documented in sufficient detail to ensure that impacts by construction and other earth-disturbance can be objectively identified and minimized with a minimum of time and effort.

Write Overview/Synthesis of the Archeological & Historic Resources of the Monument

Project Statement No.: ORPI-C-012

Issue: Recent archeological survey in and around the monument has shown that there are archeological resources in this portion of the Sonoran Desert that are rich and varied. While there have been syntheses of the archeology of the region over the last 30 years, the most recent data, most importantly that resulting from three years survey in the monument (1989-1991), is not included. New survey data increases knowledge of the prehistory of the area significantly, but it needs to be synthesized with other data to provide a context for planning in management and research. An overview is also important for evaluating resources as they are encountered in future discoveries, as well as for planning mitigative measures ahead of future development.

Proposed Action: An archeological overview summarizing the status of archeological knowledge in the monument and surrounding area will be prepared. This document will include a clear matrix of site types represented, their environmental associations, their place in regional prehistory, the environmental zones represented and the extent to which they have been surveyed. Field and sampling strategies for future work will be identified.

Develop Archeological Site Location Predictive Model in Association With GIS
Project Statement No.: ORPI-C-013

Issue: The location of cultural resources and the potential for an effective model of site location is important for management objectives. This information is important in management decisions concerning 1) development of land-use plans; 2) environmental assessments; 3) possible surface disturbing activities. Modeling can contribute to an evaluation of a site's significance in terms of eligibility to the National Register, as well as with a determination of its most appropriate use. Modeling can help to define research issues. This information can guide data collection priorities for survey and data recovery efforts and help establish which areas and sites will be selected for these efforts. Modeling can contribute to protection by helping to establish priorities among sites for specialized protection.

Proposed Action: An archeological site location predictive model will be developed in GIS. This will consist of entering data currently suitable for the initial development of a model; continuing to collect data and refining the model. Development of the model will be accomplished by an interdisciplinary effort led by an NPS archeologist.

This will provide management with the information needed to both plan for and protect the resource, and fulfill research goals.

Record Rock Art Sites
Project Statement No.: ORPI-C-014

Issue: Three forms of rock art, petroglyphs, pictographs, and geoglyphs, have been identified in Organ Pipe Cactus National Monument. Many rock art sites have been assigned site numbers and have been plotted on USGS topographic maps, however, none of the known sites have been fully recorded. At least two of the petroglyph sites have been vandalized with modern graffiti; one pictograph site may have been destroyed by natural forces; and natural weathering is affecting pictographs in rockshelters. All rock art sites, including those that are known and plotted on maps, as well as those that have been reported but not assessed or plotted by archaeologists, need to be thoroughly documented.

Proposed Action: A long-term program to record rock art with NPS staff archaeologists and members of the American Rock Art Recording Association (ARARA) will be initiated. NPS archaeologists are familiar with NPS guidelines and policies. Members of ARARA have served as WACC VIP's and have been recording rock art sites at Petrified Forest National Monument over the past several years. The cost of establishing and implementing a Rock Art Recording Program using trained members of ARARA as VIP's will cut costs dramatically. This work will be conducted under the auspices of NPS staff archaeologists. Any new rock art sites that are discovered during the course of this project will be recorded. This work will also involve designing monitoring protocols and a schedule of visitation by law enforcement/site stewards to aid in protection efforts.

Complete Archeological Sample Survey and Assessment of the Monument
Project Statement No.: ORPI-C-015

Issue: The Sample Inventory Survey conducted between 1989-1991 examined approximately 8,000 acres (approximately 2.3%) of the monument and resulted in the identification of 260 prehistoric, protohistoric, and historic ethnographic sites, as well as the recording of 188 field loci. The National Historic Preservation Act as amended in 1980 legislates that all federal lands will be completely surveyed in order to determine the nature and extent of cultural resources and to determine eligibility of sites to the National Register of Historic Places. The monument needs to determine site locations and condition assessments in order to properly manage the resource. Complete survey of the monument is probably not feasible given fiscal constraints. However, continued sample survey of large blocks is necessary for the development of a predictive model of site location, which in turn addresses NHPA and management objectives.

Proposed Action: A sample survey of the monument will be conducted. This will provide management with in-depth information needed to properly manage cultural resources as mandated by law. The resources can not be managed unless information exists regarding location, cultural and temporal affiliations, types of disturbance, and potential for future disturbance. Continued survey will provide information to be used in planning surface disturbing activities and assisting with protection efforts.

Intensive Transect Recording/Mapping of Large Sites.
Project Statement No.: ORPI-C-016

Issue: Accurate site interpretation is based on an assessment and analysis of the density and diversity of surface artifacts and features present. Large prehistoric Archaic period and ceramic period Hohokam, Patayan, and Trincheras sites present a number of interpretive problems for the archeologist. These sites usually lack visible surface features (with the exception of adobe-walled structures and roasting pits) and consist of an artifact scatter or group of scatters that seem to go on forever, with decreasing density and localized variability. Interpretative and recording problems include 1) determination of site

boundaries based on surface artifact distributions, 2) identifiable patterning in the surface artifact distributions which are indicative of use areas and subsurface features, and 3) determination of site function based on the artifact assemblage.

Proposed Action: The intensive transect recording technique (ITR) will be used to record and map large dispersed sites. Computer maps of artifact diversity and density will be generated. ITR will be used to map and record large dispersed artifact scatters, resulting in quantitative data which can be used to determine site surface boundaries, intra-site activity or use areas, and site functions. It will also assist in predicting areas where sub-surface features are likely, as well as provide baseline data for monitoring protocols.

Test Excavation of "Reservoir" at AZ Z:13:1(ASM), a Large Hohokam Community.
Project Statement No.: ORPI-C-017

Issue: A probable reservoir has been identified at a large Hohokam village, AZ Z:13:1(ASM), which is approximately 200 acres in size and dates primarily to the Classic period, ca. A.D. 1150-1400. This site was first recorded as Gila Pueblo I:13:4 by Frank Midvale in 1929.

Proposed Action: An archeological testing program to determine the function of the "Sun Temple"-reservoir feature at AZ Z:13:1(ASM) will be conducted. Resolution of this feature's function is significant for interpretation of the site within the Hohokam Regional System. Reservoirs in Papagueria may have had a ceremonial or integrative function similar to Pre-Classic period ballcourts and classic period platform mounds and compounds. Information from this excavation will also assist with the preparation of the National Register Nomination for this District. Additionally, if a well is excavated, then the prehistoric ground water depth can be determined, with important implications for prehistoric and modern environmental studies.

Archival Research Related to Early Archeological Surveys and Ethnographic Research
Project Statement No.: ORPI-C-018

Issue: The earliest information (late 1600's, early 1700's) concerning the monument area and its peoples is contained in documents associated with the explorations of Father Kino and Manje. Subsequent entradas into southwestern Arizona by Jesuit and Franciscan missionaries, the Spanish, and the Mexican military contain references to ethnographic groups and natural resources. Several other sources, including the field notes of the 1800's boundary surveys, American military excursions, early ranching chronicles, and mining claims, contain references to the area. The field notes and other documents of researchers, such as McGee, Hornaday, and Lumholtz, also contain references to archeological sites and ethnographic groups occupying the area in the late 1800's and early 1900's. Thomas Childs, an Anglo who married an Hia C'ed O'odham woman, made copious notes concerning his life among the Sand Papago O'odham at Quitobaquito and Bates Well. The 1929 Gila Pueblo archeological survey field notes which contain information on five sites within the monument, and Emil Haury's 1937 field notes, are located at the Arizona State Museum. Ezell's 1951 field notes contain information critical to documenting archeological and ethnographic resources. A xerox copy of his field notes is in the archives at WACC. Ezell's personal papers (including some documents pertaining to Organ Pipe Cactus National Monument) have recently been given to Special Collections at the University of Arizona. Some field notes may also be in the private collections of Julian Hayden and Al Schroeder. The majority of the field notes from these expeditions have never been examined for information related to cultural resources. These primary documents are an invaluable source of information regarding archeological and ethnographic cultural resources.

Collections of artifacts from prehistoric and ethnographic sites at Organ Pipe Cactus National Monument were made by various institutions and

individuals, and are not curated at the Western Archeological and Conservation Center, NPS. The earliest known collections are those from the 1929 Gila Pueblo Survey and from Haury's survey of AZ Z:13:1(ASM). Both collections are housed at the Arizona State Museum. It is possible that McGee, Hornaday, and Lumholtz may have made collections of ethnographic from O'odham villages that they visited. The locations of these collections is undetermined. The locations of collections made by other researchers are also undetermined. Finally, the location of a tape recording of an interview between Paul Ezell and Lumholtz's guide to the Pinacate is undetermined.

The presence and occurrence of original maps associated with these expeditions also need to be determined, and copies made for the monument archives.

Proposed Action: Primary documents containing information on the archeological and ethnographic resources of the monument will be identified and located. This will result in a substantial body of information regarding ethnographic populations which have inhabited the area since first contact with the Kino/Manje expedition in the late 1600's. Field notes on archeological resources will aid in a more complete understanding and documentation of recorded sites. In addition, artifact holdings at other institutions will be determined.

Specialized Artifact Studies
Project Statement No.: ORPI-C-019

Issue: Recent surveys have identified overlapping cultural traditions throughout 12,000 years of human occupation in the monument. The occurrence of overlapping cultural traditions and the presence of large, apparently sedentary villages leads to a number of questions: were populations local (ie. manufacturing items for use from materials in the monument area) or transitory (bringing items in that were manufactured in other areas), and what was the nature and extent of prehistoric trade. Specialized studies of various artifact types will be conducted that can address these questions.

Proposed Action: Specialized studies of various artifact types will be pursued, including ceramics, chipped and ground stone, and shell, to determine if ceramics were locally manufactured, where the raw material for chipped stone artifacts was collected, and the types and seasonality of shell that was used.

Re-analyze All Previous Collections at the Monument, Western Archeological and Conservation Center and Other Institutions.
Project Statement No.: ORPI-C-020

Issue: All artifacts collected on previous surveys and curated at the monument, WACC, and other institutions need to be analyzed (because no analysis has ever been conducted) or re-analyzed in light of current data. The earliest known collections were made during the 1929 survey by Gila Pueblo, which identified five sites. Emil Haury made collections from at least one site, AZ Z:13:1(ASM), in 1937. The integrity of artifact identifications from the 1951 survey by Paul Ezell is in doubt. The ceramic identifications made by Ezell are of particular concern because: 1) they include ceramic types that have never been described in the literature; 2) prehistoric and historic ceramics were lumped into a single ceramic ware; and 3) prehistoric ceramics from different cultural traditions were also lumped into a single ceramic ware. Therefore, it is impossible to discern the nature of the archeological record of sites recorded by Ezell and later researchers who used his ceramic typology, because of the problems with ceramic identifications. Other whole vessels in the collections have been identified by various researchers as O'odham or Patayan based on their theoretical orientation. Finally, new techniques can be applied to the analysis of the ceramic and chipped stone assemblages.

Proposed Action: Collections that have not been studied will be analyzed and the artifact collection at WACC and other institutions will be reanalyzed. Unstudied collections will be analyzed and all previously analyzed prehistoric and historic collections will be reanalyzed; specialized studies of ceramic and chipped stone assemblages will be

conducted; and a synthesis report of the findings will be completed.

Prepare National Register Nominations for Archeological Sites and Districts
Project Statement No.: ORPI-C-021

Issue: A number of prehistoric and historic cultural resources, including Growler Mining District and Bull Pasture, have been listed on the National Register of Historic Places. Other cultural resources within the monument are eligible to the National Register, but National Register Nominations have not been prepared, or prepared Nominations are being denied because inappropriate criteria have been used. An assessment of cultural resources within the monument and preparation of National Register Nominations need to be completed.

Proposed Action: National Register Nominations for archeological and historic sites and districts will be prepared. This will complete the management objectives of survey, identification, recording, report preparation, and assessment of sites for eligibility for inclusion in the National Register. An assessment of current knowledge of cultural resources and of failed Nominations will be made. An archeologist will consult with the Arizona State Historic Preservation Officer (SHPO) to insure that the sites or districts meet the criteria for inclusion. The archeologist will prepare National Register Nomination forms for sites and districts.

Develop and Fund Archeological Job Training Program
Project Statement No.: ORPI-C-022

Issue: Archeological surveys to locate, identify, describe, and understand prehistoric and historic Native American cultures are being conducted primarily by non-Native Americans. Many believe that an understanding of prehistoric Native American cultures is hampered by a lack of the Native American perspective. Park surveys are frequently conducted by NPS archaeologists from WACC and other regional centers, and per diem payments increase the costs of survey and reduce the amount of actual field time. Organ Pipe Cactus is uniquely situated adjacent to the Tohono O'odham Reservation and the town of Ajo, which has a large Native American population. Development and funding of a job training program for Native Americans would enhance the archeological survey by having a Native American perspective on archeological remains and the behavior they represent. A greater amount of survey could be accomplished by employing Native Americans from the local area because per diem costs would not be incurred. Additionally, Native American students would gain practical experience and receive encouragement to pursue careers in anthropology.

Proposed Action: An archeological training program for Native Americans interested in careers in anthropology, archeology, and resources management will be developed and funded. This training program will be targeted toward Native Americans in the local community, because historically, this is their ancestral area. The task will be undertaken by resources management staff in conjunction with the job training program on the Tohono O'odham Reservation as well as with various local districts of the Tohono O'odham Reservation. It will encompass training in all phases of the survey and subsequent laboratory analysis. Trainees will work with crews of professional archaeologists to learn how to identify and record sites. Their input into the interpretation of archeological sites will be actively sought.

Assessment of Human Impacts and Natural Disturbance and Monitoring of Monument Cultural Resources
Project Statement No.: ORPI-C-023

Issue: The monument does not have established monitoring guidelines or a comprehensive program to monitor historic structures, archeological sites, or ethnographic resources. The monument has insufficient staff to adequately patrol and monitor its cultural resources. The monument has difficulty protecting and preserving cultural resources from natural processes, visitor impacts, vandalism, and

other impacts as required by NPS policies, guidelines, and federal legislation.

Proposed Action: Monitoring guidelines will be prepared, and adequate monitoring of ethnographic sites, historic structures and archeological sites will be performed to preserve and protect irreplaceable cultural resources. The program will help insure that the monument's historic preservation program complies with the laws, policies and guidelines applicable to cultural resources management and protection. Additional personnel will be required on the monument staff to fully implement this plan. Law enforcement patrols will be increased and a cultural resources management specialist will be needed to evaluate the sites and provide the expertise necessary for the program to be successful. The cultural resources management specialist will also be needed for implementation of related project statements in the RMP.

III.J. Historic Resources

III.J.1. Overview

Central to the mission of the National Park Service is the management of many of the nation's most important historic resources. Historic resources at Organ Pipe Cactus are varied and are of both regional and national significance. The historic period is represented in the monument beginning as early as 1540, and continues through the present, including recent mining and ranching activities.

III.J.2. National Park Service Policy and Program Objectives

A wide range of legislation governs the management of cultural and historic resources within the National Park Service. Primary among the guidelines of importance are the acts and proclamations which establish individual units of the Service. Following is a summary of the important laws and regulations which form the basis of and authority for National Park Service cultural resources management policies and guidelines.

The Antiquities Act of 1906 was the first legislation to specifically guide the management of cultural resources within the National Park Service, and it provides for the protection of historic, prehistoric and scientific remains on Federal lands. The Act of August 25, 1916, the "Organic Act", stated that parks are to conserve "... the historic objects ... therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The Historic Sites Act of 1935 authorized the numerous programs related to historic buildings, and otherwise authorized the preservation of properties of national historic significance. The National Trust Act of 1949 invited public participation in the preservation of historic resources. The Management of Museum Properties Act of 1955, or the Museum Act of 1955, authorized action related to objects in National Park Service museum collections.

The National Historic Preservation Act of 1966 (amended 1970, 1976) declared a national policy of historic preservation. It also provided authority for the expansion of the National Register of Historic Places, and provided certain procedures to be followed by Federal agencies in the event that a proposed action might have an effect on National Register properties. It also provided a definition of historic preservation. The National Environmental Policy Act of 1969 noted that it is the policy of the government to "preserve important historic, cultural and natural aspects of our national heritage." Executive Order 11593 "Protection and Enhancement of the Cultural Environment", May 13, 1971, provided for all Federal agencies to provide leadership in historic preservation, to ensures the preservation of cultural properties in Federal ownership, and to ensure that federal plans contributed to cultural resources protection. The American Indian Religious Freedom Act of 1978 allowed native Americans access to sites and use and possession of sacred objects for religious purposes.

The Archeological Resources Protection Act of 1979 provided for the protection of archeological resources located on public lands. The National

Historic Preservation Act (amended 1980) expanded the roles of Federal, state, local and private sectors, and provided new mandates for Federal land managers in the area of historic preservation.

Numerous regulations also relate to historic preservation. 36 CFR 60 is especially relevant, as it describes nominations by a Federal agency to areas for the National Register of Historic Places.

III.J.3. Organ Pipe Cactus National Monument Current Program

The current program at Organ Pipe Cactus National Monument focuses on the need to preserve and protect historic resources, including the stabilization of ruins and historic structures. It also emphasizes the monitoring and protection of a wide range of historic sites from natural and human impacts and disturbances.

Historic resources at the monument include nine sites on the National Register for Historic Places, as well as isolated objects, roads and trails, water wells, ranches and associated facilities, prospects and mines, cemeteries, ruins, structures, and cultural landscapes.

III.J.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES

C06 Need for Historic Preservation Guides

C10 Need for Specialized Studies for Unique or Complex Management Issues

C12 Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance

C17 Control of Environmental Impacts

Maintain Stabilized Ruins and Historic Structures
Project Statement No.: ORPI-C-050

Issue: Routine general housekeeping and maintenance, annual maintenance, cyclical maintenance, and monitoring schedules need to be established and followed to preserve and protect historic resources and the investments the government has placed in them. There are currently no established preservation and maintenance schedules, nor any clear priorities or plans to guide historic preservation activities at the monument. Funding and staffing limitations do not provide for a level of protection and preservation considered standard for the National Park Service. Historic structures on the List of Classified Structures, as well as those pending or entered in the National Register of Historic Places (NRHP) are nonrenewable resources. The structures must be maintained until planning actions for future preservation are approved according to NPS policies, guidelines and federal law, including Section 106 of the National Historic Preservation Act (NHPA). Some historic structures are routinely used by the public and interpreted for their enjoyment, thus safety and proper maintenance are critical concerns.

Proposed Action: Routine general housekeeping, annual maintenance, integrated pest management (IPM), and cyclical maintenance will be performed as needed to preserve historic structures and features. The goal will be to maintain historic resources in the condition that they were in when acquired by the NPS until a formal preservation plan is formulated and approved through the Section 106 review process. This action will help ensure that the monument's historic preservation program complies with the Organic Act of 1916, NPS-28 Cultural Resources Management Guidelines, Chapter 5 of the 1988 NPS Management Policies, Sections 106 and 110 of the National Historic Preservation Act, the Archeological Resources Protection Act, and the founding legislation of Section 2 of the Antiquities Act of 1906 that President Franklin D. Roosevelt used to establish the monument.

Prepare Historic Structures Preservation Plan
Project Statement No.: ORPI-C-051

Issue: A comprehensive plan to direct historic structure preservation activities unique to the monument does not exist. The term "historic" as used here includes both historic and prehistoric sites as found in the Secretary of the Interior's Guidelines for Archeology and Historic Preservation. Without a plan prepared and approved in coordination with the Western Regional Office (WRO) to address Section 106 and related compliance requirements, NPS actions that may adversely affect historic structures (this also includes historic roads, trails, and mine areas), archeological sites and features may be out of compliance with the National Historic Preservation Act (NHPA) of 1966 as amended. Historical sites are not renewable resources and must be managed properly so that irreplaceable information of historical, archeological, architectural and scientific interest is not lost forever. In this respect, management of important sites is analogous to management of endangered species.

Proposed Action: An Historic Structures Preservation Plan will be prepared. A review of known sites and resources will be completed, and a plan formulated to address the management of historic and archeological sites which contain structures and features that may be eligible for, or are pending National Register action, or are entered in the NRHP.

Prepare Historic Structures Preservation Guides
Project Statement No.: ORPI-C-052

Issue: The monument does not have Historic Structures Preservation Guidelines for its historic buildings listed on, or pending nomination to, the National Register of Historic Places or the List of Classified Structures. Preservation and treatment of historic structures requires established guidelines for general housekeeping, IPM, and annual and cyclic maintenance to set treatment standards and scheduling for efficient management of the resources. Without guidelines, the historic preservation program at the monument is not fully successful and does not totally comply with federal legislation, the 1988 NPS Chapter 5 Management Policies, NPS-28 Guidelines for Cultural Resources Management, or Franklin D. Roosevelt's 1937 Presidential Proclamation that established the monument based on Section 2 of the Antiquities Act of 1906.

Proposed Action: Historic Structures Preservation Guidelines will be developed to establish specific schedules and procedures consistent with monument planning, NPS policies and guidelines. Monument management and staff can follow the guidelines to insure adequate preservation treatments are applied that protect and preserve historic structures and features.

III.K. Natural and Cultural Resources Management and Research Administration, Management and Planning

III.K.1. Organ Pipe Cactus National Monument Current Program

The current Resources Management Program at Organ Pipe Cactus National Monument encompasses a broad array of activities designed to both address resource threats and issues and to develop an on-going system of monitoring and evaluating the status of monument natural and cultural resources. The majority of natural resources management activities are carried out by existing monument staff. Historic preservation activities such as historic site inspections are implemented by monument staff, while archeological activities are closely coordinated with the Western Archeological Conservation Center, Tucson, AZ. In 1994, there were 43 identified research projects on-going within the monument. These projects all have defined Principal Investigators and do not include activities, such as ecological monitoring, that are carried out by monument resources management staff. Research administration is coordinated by the Chief of Resources Management and Research with assistance from the National Biological Survey, Cooperative National Park Resources Studies Unit (CPSU/UA). In addition, support with on-going natural and cultural resources management activities is provided by natural and cultural

resources staff of the Southern Arizona Group Office and the Western Regional Office.

III.K.2. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N24 Other Issues

C26 Other Issues

Develop and Direct a Comprehensive Natural and Cultural Resources Management and Research Program
Project Statement No.: ORPI-I-001

Issue: A comprehensive program is required to address the full range of natural and cultural resources issues facing Organ Pipe Cactus National Monument. Components of the program are extensive and include, but are not limited to: vegetation and wildlife management, non-native species control, ecological monitoring, historic structures and archeological site evaluations, threatened, endangered and sensitive species management, erosion control, abandoned mine lands, geographic information systems, air quality and groundwater evaluations. To properly develop and direct a comprehensive natural and cultural resources management program, it is necessary to have a well organized and prioritized agenda that deals with permanent staffing, infrastructure support, full identification of issues and recommended actions and long-term goals.

Proposed Action: A comprehensive natural and cultural resources management program will be developed. The Division of Natural and Cultural Resources Management and Research will be broadened and expanded. An extensive Natural and Cultural Resources Management Plan will be developed and annually reviewed and updated. The plan will provide specific project and program statements to address issues and establish a permanent financial and programming infrastructure.

Manage Natural and Cultural Resources Management and Research Program
Project Statement No.: ORPI-I-002

Issue: A commitment of staff and funding is necessary to fully manage the monument's natural and cultural resources management and research program. The program is extensive and includes activities such as vegetation and wildlife management, non-native species control, ecological monitoring, historic structures and archeological site evaluations, threatened, endangered and sensitive species management, erosion control, abandoned mine lands, geographic information systems, air quality and groundwater evaluations. To properly manage a comprehensive natural and cultural resources management and research program, it is necessary for an effective management and programming infrastructure to be in place.

Proposed Action: The Division of Natural and Cultural Resources Management will be directly responsible to the Superintendent for the management, planning, direction and coordination of the monument's Natural and Cultural Resources Management and Research Program. The function of the division is to administer the monument's natural and cultural resources management and research programs. A division chief coordinates a multifaceted program, as outlined in planning documents.

Provide Natural and Cultural Resources Management and Research Administrative Support
Project Statement No.: ORPI-I-103

Issue: A commitment of staff and funding is needed to provide administrative support to the natural and cultural resources management program. The resources management and research programs have doubled in recent years. Current monument administrative staff is unable to meet the growing needs of this and other programs. Without administrative assistance within the division, the administrative workload of contracting, file management, data entry, personnel, budget

updates, status reports and routine clerical duties will not be effectively or efficiently handled.

Proposed Action: An administrative assistant will be hired for the Division of Natural and Cultural Resources Management and Research. The administrative assistant will work directly for the chief of the division. Responsibilities will include contracting, payroll, budget programming updates, purchasing, filing and other administrative and clerical duties. The position will coordinate activities with the monument's administrative officer.

Develop Research Opportunities and Needs Assessment

Project Statement No.: ORPI-I-004

Issue: It is the policy of the National Park Service to encourage and aid research by independent workers. Research procedures must not conflict with the primary purpose of the park or detract from the integrity of natural ecosystems or cultural resources within the area. Currently Organ Pipe does not have a staff researcher. However, plans call for the establishment of such a position. With this position, a prioritized list of research needs will be developed and staff can solicit proposals for research of high priority projects in conjunction with the Cooperative Park Studies Unit (CPSU) at the University of Arizona. By working with the CPSU, the monument staff can ensure that needed research is addressed and a quality study is completed.

Proposed Action: Such an assessment will provide a chance to develop new scientific techniques and present new opportunities for university students and researchers in studying Sonoran ecosystems. This alternative will provide new information not usually obtainable through a standard park-based inventory and monitoring program.

Establish Editorial Assistant Position at Organ Pipe Cactus National Monument

Project Statement No.: ORPI-I-005

Issue: Currently there is not an Editorial Assistant (EA) position at Organ Pipe Cactus National Monument to coordinate overall production of research related reports, proposals, and technical information for the resources management division program, including the Ecological Monitoring Program. Both the scope of responsibility and staff size have increased substantially over the past years. Future growth is also predicted. Current personnel complete virtually all editorial duties themselves, including typing and editing of reports. The present program is administered by the Chief of Resources Management and the EA position would assist with both the resource management program and funded NPS research at Organ Pipe. Reports, research results, data analyses, various resource management plans could be edited and prepared for reviewers and finalized for distribution through the Editorial Assistant.

Proposed Action: An editorial assistant position within the Resources Management Division will be established, thus achieving more efficient program operation using available skills and expertise. The incumbent would type highly complex, technical reports, mock up text material in report format including charts and graphs, and prepare bibliographies and footnotes, as well as independently prepare manuscripts for distribution or publication. The EA will verify information in the manuscripts by using various basic guidelines and technical scientific sources. To a lesser degree, this position can also include some assistance with administrative needs when necessary.

Develop and Implement a Comprehensive Natural and Cultural Resources Interpretation Program

Project Statement No.: ORPI-I-006

Issue: A commitment of staff and funding is needed to develop and implement a comprehensive resources interpretation program. The current interpretation program is inadequate to be of assistance in meeting the goals of natural and cultural resources management and protection.

Lack of increased funding has resulted in a loss of programs and reduced services.

Proposed Action: A comprehensive natural and cultural resources interpretive program will be developed. The existing interpretive staff will be supplemented with additional field personnel. Emphasis will be placed on personnel services. The overall effort will consist of two primary components: enhancement of internal traditional visitor programs and expansion into outreach services.

III.L. Information/Data Management

III.L.1. Overview

Information is produced through research, planning, projects, and reports. Managers should strive to obtain regular, accurate data about resources and utilize methods to handle information in a manner that makes it accessible and useable. Managing data should be integrated into all aspects of park operations and planning.

III.L.2. National Park Service Policy and Program Objectives

The premiere authorities include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declared that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized.

The existing and potential volume of information for a park helps determine the extent of an information management system. Computer word processing and data analysis programs are commonplace in most parks, but GIS is not. The policy and objectives as stated in NPS Management Policies and reiterated in NPS-77 guideline are:

Sufficient information will be available prior to initiating a plan. Each park will develop, gather, compile, store, analyze, and update information about natural and cultural resources and regional demographic, ethnographic, and socioeconomic data relevant to planning and management.

III.L.3. Organ Pipe Cactus National Monument Current Program

There is a large body of research completed or ongoing in the monument and an extensive ecosystem monitoring program in design for the long term. Similarly, numerous projects have been and are being conducted that produce data for future use. All of these activities require a system for analyzing and synthesizing information and keeping it useable, both now and in the future.

To date, the information management program primarily has been used for basic word processing, database input and analysis, and tracking finances. Computers and peripherals have assisted personnel in producing quality and timely reports, aided researchers with collecting and analyzing data, and proved to be an invaluable tool for decision making and planning. These routine uses are expanding to accommodate the implementation of the monument's GIS, management of the museum collection on ANCS, management of the long term natural resources monitoring activities, and development of software and hardware support.

A GIS management plan has been written and approved, and a GIS program is currently being developed. This is the most efficient and effective means for collecting, storing, analyzing, and disseminating information about any georeferenced data. The monument and the University of Arizona are working cooperatively to implement the initial hardware and software procurement and installation and to develop and analyze the database. The program will need periodic review, upgrades, and administrative infrastructure.

III.L.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N24 Other Issues

C26 Other Issues

Develop and Manage Resources Information Management Program
Project Statement No.: ORPI-I-050

Issue: A commitment of staff and funding is needed to develop and manage a comprehensive resources management information management program. Several years of inventorying, monitoring and research has yielded an abundance of data sets that must be maintained and effectively managed to be useful in resources management activities. To effectively develop and manage the program, it is necessary for a comprehensive management infrastructure to be in place.

Proposed Action: An information management specialist position will be established to implement the program. Computer technology will be fully integrated with other resources management and research programs. The information management specialist will be responsible for the management of the Resource Management and Research Division's computers and information management program. This will include managing the monument's research and monitoring database programs and files, systems analysis, performing park-specific programming as needed, ensuring appropriate back-up of all computers, supervision of the geographic information system (GIS) specialist and the GIS program, information management procurement, troubleshooting of equipment, information management planning, and providing assistance to all Resource Management/Research Division personnel in the area of information management.

Implement Geographic Information System Program
Project Statement No.: ORPI-I-051

Issue: A commitment of staff and funding is required to comprehensively implement the monument's geographic information system (GIS) program. An approved GIS plan and several years of work completed through a cooperative agreement with the University of Arizona have yielded a well outlined program and a comprehensive GIS database. To effectively implement the program, it is necessary to acquire sufficient technical expertise and establish a permanent financial base to support the program.

Proposed Action: The monument will implement actions outlined in the approved GIS plan. A GIS Specialist position will be established to implement the program. GIS will be fully integrated with other resources management and research programs, such as archeological site evaluation and ecological monitoring. The GIS will eventually be integrated with all monument functions, including maintenance and interpretation.

Update Information Management Plan
Project Statement No.: ORPI-I-052

Issue: The Organ Pipe Cactus Resources Management Information Management Plan (IMP) requires updating to incorporate the rapid changes occurring in the field of information management. In January 1991, a Resources Management Information Management Plan was developed. The development of the internal IMP was the first step in identifying and developing procedures for managing large resources databases. The plan needs to be updated, revised and expanded to incorporate changes in hardware and software (including updated versions), and to address database application needs. In addition, the monument's geographic information system program needs to integrated into the overall IMP.

Proposed Action: The existing IMP will be updated. The plan will be a tool for resources managers to use for software and hardware acquisition, computer maintenance and general use. National automated data processing standards will be identified to keep the division in harmony with NPS-wide systems. All resources management

staff will be involved to varying degrees with the maintenance and care of the computers. All staff members will work closely with research and resources management projects involving database management systems and geographic information systems.

Conduct Geographic Information System/Airborne Video Monitoring Research
Project Statement No.: ORPI-I-053

Issue: A cost effective means of providing monument-wide visual displays to assist with mapping and evaluating resource conditions is needed. This type of data is required to support and enhance existing resources monitoring and research projects.

Proposed Action: A project will be developed to assess the merit of using aerial video over conventional aerial photography for monitoring and mapping the status of resources at the monument. In particular, the cost effectiveness and logistics of acquiring and processing the two types of imagery will be compared, as will the diversity and usefulness of products obtained, relative to immediate and longer term management needs. Image data produced in this project will be used to (1) produce GIS vegetation data layers (with an emphasis on riparian corridor characteristics in the Sonoran Desert), and (2) analyze patterns of vegetation change over the next 3 years. Finally, project results will be outlined in a technical report detailing equipment requirements, standard methodologies, results of the feasibility study, suggested applications, and recommendations for future monument and NPS-wide use.

Develop Custom Geographic Information System Automated Quad Indexing System
Project Statement No.: ORPI-I-054

Issue: A customized geographic information system (GIS) quad indexing system is required to provide the most efficient means of allowing access to GIS capabilities by all monument divisions. In order to maximize staff productivity and efficiency, a custom GIS interface is needed to facilitate routine requests for plotting and indexing standard maps that are used throughout the monument.

Proposed Action: A customized GIS graphic user interface (GUI) computer program will be developed that will greatly facilitate the tracking and plotting of mapped data and provide a user friendly means to reduce the time and training required to regenerate and plot standard monument maps.

Implement Global Positioning System Data Acquisition
Project Statement No.: ORPI-I-055

Issue: An efficient and routine mechanism is needed to generate maps from point data, incidents, or natural and cultural resources monitoring data collected by the monument staff, researchers, contractors, graduate students and volunteer personnel. In order to generate division maps on a routine basis, all field data must be adequately georeferenced. Traditional land survey techniques are expensive and time intensive, making it difficult to adequately generate georeferenced critical field data for all divisions and research programs. The monument has purchased both global position system (GPS) receiver and a GPS community base station. A program directing the GPS data collecting activities is still needed, however, in order to systematically acquire accurate spatial information and to integrate it into the monument geographic information system.

Proposed Action: A program will be developed that will acquire geographic data through the use of GPS technology. This program will ensure georeferencing of all field data to guarantee accurate mapping for all divisions. Visual patterns, maps and spatial analyses of resource conditions will be generated. In addition, an automated portable global positioning GPS/GIS program will be developed for field use by all monument divisions.

Develop Computerized Bibliographic Information System
Project Statement No.: ORPI-I-056

Issue: The monument does not have the ability to efficiently track the wealth of historic, technical and ecological information that is available. Selective but intermittent studies have been continuously conducted since the monument was established in 1937. Without the development of an adequate tracking system and information base, park management cannot efficiently manage the resources or respond to developing resource problems systematically without duplication of effort. In addition, public interest and environmental groups frequently request bibliographic citations or information upon which management actions are based. Researchers and other professionals routinely depend upon and utilize the monument's information base as the first step in addressing management concerns.

Proposed Action: A computerized bibliographic information system will be developed and will increase management's ability to respond effectively to cultural and natural resource issues. An adequate information base will prevent duplication of effort and prevent costly mistakes. Adequate and effective access to informational resources are a mandatory prerequisite for efficient and cost effective management. Time frames in examining resource issues will be significantly reduced with the production of an annotated bibliography and the creation of a computer information tracking system. In addition, the bibliographic assessment will summarize the strengths and highlight the weaknesses in the existing information base.

Prepare Administrative History of Natural and Cultural Resources Management and Research

Project Statement No.: ORPI-I-057

Issue: An administrative history of natural and cultural resources management and research is needed for Organ Pipe Cactus National Monument. The history of efforts to protect and understand the resources of the monument has never been compiled. For a natural and cultural resources management and research program to be successful, there needs to be a knowledge of its past. Information on program evolution, strategies, successes and failures all contribute to building a stronger program today with a clearer vision for the future.

Proposed Action: An administrative history detailing the development of natural and cultural resources management and research efforts in the monument will be prepared. The administrative history will provide a chronology of issues, program activities and milestones, and infrastructure development. The history will be composed of two sections, one dealing with natural resources and biological research and the other with cultural resources and associated historical and archeological studies. The final product will serve as the definitive source on the development and status of resources management and research programs at Organ Pipe Cactus National Monument.

Incorporate and Integrate New Data into the Information Management and Geographic Information Systems

Project Statement No.: ORPI-I-058

Issue: Currently, there is no mechanism for integrating and incorporating new cultural and natural resources management and research information into a synthesis report. Such a mechanism would expedite and facilitate management's ability to make difficult resource decisions. Because researchers and contractors tend to be specialists, there are often conflicting recommendations made to management on the proper action required to mitigate a resource problem. Without an annual mechanism to review and evaluate new information, management is faced with the difficult task of resolving differing professional recommendations generated by different disciplines and measuring techniques. Software update recommendations and spatial data transfer between agencies and studies must be examined for usefulness, precision, and accuracy.

Proposed Action: A multidisciplinary team will be created to integrate and evaluate new information, and incorporate this data into the

information management and geographic information systems. Research models will be updated and reevaluated on a periodic basis if natural and cultural resources inventorying and monitoring and research data indicate the need. Monitoring protocols will be examined for deficiencies and recommendations will be made. The team will produce an annual summary report of the year's results.

Conduct Feasibility Study to Link the Geographic Information System with the Maintenance Management System
Project Statement No.: ORPI-I-059

Issue: A linkage needs to be made between the monument's geographic information system (GIS) and maintenance management systems (MMS) to improve the effectiveness and usefulness of both programs. The MMS is a comprehensive information program to help managers plan, control and carry out the National Park Service (NPS) maintenance mission. MMS provides an effective means for: developing annual work programs and budgets; distributing work on an annual basis; determining labor, equipment and materials needs; monitoring complaints and inspection reports; scheduling work, recording work accomplished, and evaluating performance. Unfortunately, there is no automated system for tracking, managing, analyzing, and displaying mapped information about the extent of maintenance activities or the location of NPS facilities, roads, and trails throughout Organ Pipe Cactus National Monument. Consequently, there is a lack of information and coordination of mapped inventory data and property.

Proposed Action: A feasibility study will be conducted to evaluate the feasibility of linking GIS with MMS. MMS and GIS protocols, hardware, and software systems will be evaluated, and the cost effectiveness of various computer linkages will be examined and delineated. With digital photographic and cartographic information available, maintenance staff can collect, prepare, retrieve, manipulate, and review thematic data composites relating to a wide range of maintenance activities. Computer based georeferenced inventories will significantly increase management's ability to document, demonstrate, illustrate, and track the effectiveness of the monument maintenance program.

III.M. Integrated Pest Management

III.M.1. Overview

Every park has the potential for pest species, however, the existence of a particular species in a park does not constitute a pest problem. Most problems are due to human interaction with a plant or animal or are due to the presence of non-native species. The NPS requires the use of the Integrated Pest Management (IPM) decision and action process for dealing with pests. This involves research and planning to protect natural and cultural resources in an effective and ecological manner, as well as to provide for public safety. Integrated pest management should be integrated into all aspects of park operations and planning, because many problems can be avoided with forethought.

III.M.2. National Park Service Policy and Program Objectives

The authorities to manage pests include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized.

Other authorities include a presidential memorandum and a variety of laws, regulations, and executive orders that directly or indirectly affect the decision to use pesticides. They can be

put into the four categories of 1) pesticide use, 2) protection of nontarget species, 3) worker/applicator safety, and 4) storage/disposal of pesticides or pesticide residues. For pesticide use, the primary authorities are the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), regulations established by the Environmental Protection Agency, and a presidential memorandum for federal procedures. Nontarget species are protected by the Migratory Bird Treaty Act of 1918 and by the Endangered Species Act of 1973. Worker safety and pesticide storage and disposal are covered by specific instructions on the label. Non-compliance with the label is a violation of FIFRA.

The degree of the IPM program in a park depends on the complexity and abundance of pests and the extent of habitat, such as museum collections, structures, cultivated landscapes, etc. Implementing the IPM policy requires designation of a coordinator and training for all employees who purchase, use or supervise the use of pesticides. The policy and objectives as stated in NPS Management Policies and reiterated in the NPS-77 guideline are:

Integrated pest management procedures will be used to determine when to control pests and whether to use mechanical, physical, chemical, cultural, or biological means... The choice to use a chemical pesticide will be based on a review by regional and Washington office coordinators of all other available options [e.g., mechanical, physical, biological, cultural, and regulatory] and a determination that these options are either not acceptable or not feasible...Chemical pesticides that are not specifically exempt from reporting (regardless of who the applicator is) will be used only with prior approval by the Director on an annual basis. (4:13,14)

In addition, Department Policy (DM 517) requires approval by the Department of the Interior's Office of Environmental Affairs when pesticide use projects meet certain criteria.

III.M.3. Organ Pipe Cactus National Monument Current Program

While pests are not a major problem at Organ Pipe Cactus, the staff is alert and trained for situations where integrated pest management techniques must be used, both for native and non-native pests. Some species are persistent and require constant attention for prevention or treatment. Examples are scorpions, cockroaches, conenose bugs, spiders, and mice in buildings, termites infestations in structures, and museum pests in exhibits or collections.

Certain insects, vertebrates, and plants occasionally cause problems and require periodic control measures. This is often a result of conflict with human values or resources protection. Regular encounters between bees and wasps with humans are a safety problem. Rattlesnakes around the visitor center may be relocated. Trespass cattle are removed.

Non-native species are considered pests and are evaluated for removal when feasible. One example is tamarisk, which park staff has been treating for several years through mechanical and chemical means. A thorough inventory of non-native plants was done in 1991, and non-native species were assessed to determine which could be controlled. Another non-native of concern is the Africanized honeybee. Researchers established monitoring stations in the park a few years ago. No Africanized honeybees have been caught, but their occurrence will initiate the action plan for this species. In the meantime, the stations collect data about populations and activities of the European honeybee, another non-native.

III.M.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N04 Degradation of Park Resources Due toNon Native Animals

C26 Other Issues

Monitor and Control Africanized Honey Bees
Project Statement No.: ORPI-I-100

Issue: There is serious concern for both visitors and the natural environment when the expected Africanized honey bee becomes established, most likely by the year 1994. Organ Pipe Cactus offers many nest sites, thus it is water and available nectar and pollen plants that will be crucial for this bee. Most colonies are expected to choose nest sites near water sources, and so will have potentially severe impacts on humans and animals.

Proposed Action: A program to address the safety and environmental issues posed by Africanized honey bees will be developed. Research to monitor for the eventual arrival of the Africanized honey bees will be continued. Once the bees arrive, then research will focus on their dispersion through the monument and assess their impacts on the natural environment. An integrated pest management action plan to control the species will be developed. Methods and techniques for control will be established and implemented. An aggressive public health and safety effort will be conducted. An Africanized honey bee coordinator will be designated to coordinate the monument's integrative pest management effort for this species.

Develop an Integrated Pest Management Plan
Project Statement No.: ORPI-I-101

Issue: The monument has several occasions where plant and animal species become pests. In order to comprehensively deal with problems, a monument-wide Integrated Pest Management (IPM) Plan is needed to deal with pests in households, museums, and campgrounds, as well as those creating public health problems. While individual IPM action plans have been written for some species, a broader scope is essential to handle pest problems and ensure the use of standardized IPM approaches to protect human health and safety, natural and cultural resources, and property.

Proposed Action: An Integrated Pest Management plan will be developed that will provide a comprehensive and unified approach to addressing IPM issues. This alternative will ensure that management is in compliance with NPS guidelines for integrated pest management. This action will entail writing an IPM plan for both general and specific pest problems that periodically develop and need repeated attention. The plan will: 1) identify overall pest management problems, 2) define a comprehensive approach, 3) cover IPM decision processes, 4) provide separate action plans, and 5) describe individual responsibilities as well as interdivisional relationships. Action plans (subsets of the IPM plan) may be prepared for individual species, such as cockroaches, or for general problems, such as museum pests.

Manage Pest Species
Project Statement No.: ORPI-I-102

Issue: Pests are generally a low level problem at Organ Pipe Cactus, but they are a persistent problem requiring constant attention. Certain insects, vertebrates, and plants occasionally cause problems that require periodic control measurements. Integrated Pest Management (IPM) techniques have been used for the past ten years and will continue to be used as treatment for household, structural, and museum pests and for non-native plants and animals.

Proposed Action: Monument resources management staff will continue to manage pest species using IPM techniques. Staff will continue to develop skills through training and experience to become aware of and treat problems. They will implement the IPM plan and update it as necessary. Monitoring and documentation will continue as standard practices. This action will ensure compliance with NPS guidelines and policies.

Develop and Implement a Comprehensive Boundary Fence Maintenance Program
Project Statement No.: ORPI-I-103

Issue: Without adequate fence maintenance along the monument's southern, northern and eastern boundaries, livestock (primarily cattle), will gain access to park lands. This encroachment, as evidenced in the past, will lead to resource

degradation and possible displacement of native species. In addition, fencing is needed to delineate park boundaries, which along the southern boundary, are being encroached on by agricultural lands, and on the east and north, by grazing lands.

Proposed Action: A program outlining a schedule of routine fence inspections, repairs and cyclic replacement of older and damaged sections will be developed. Initially, a full assessment of the fence line needs to be conducted. The total length, status, construction and age will be examined. An evaluation will be conducted to determine high, moderate and low risk areas. As a result of this evaluation, priorities will be established for fence replacement and routine monitoring. The various sections of fenceline will be prioritized according to urgency of need for treatment.

Monitor and Control Trespass Grazing
Project Statement No.: ORPI-I-104

Issues: A monitoring program is needed to analyze impacts of trespassed livestock. Guidelines need to be developed to control this intrusion. Trespass grazing occurs routinely in the eastern portion of the monument adjacent to Tohono O'odham lands. Fencing the boundary is frequently not successful due to the rough country, lack of fence maintenance and the impact of flooding. Neither have efforts for a land exchange with the Tohono O'odham been successful in the past. Occasional trespass grazing also occurs along the northern boundary with BLM lands and along the southern boundary with Mexico. The monument has limited records of these encroachments, since many of these areas are remote and rarely visited.

Proposed Action: Trespass locations and frequencies will be inventoried and monitoring plots will be established to record impacts and trends. The monument will continue to work with neighbors for solutions. A report will be prepared outlining the situations and recommendations for change. Plots will be read and a schedule for rereading proposed. A monitoring handbook will be developed to guide staff in protocol implementation. Training will be provided to staff on monitoring methodology.

III.N. Wildland Fire

III.N.1. Overview

Fire is an inherent component of many ecosystems and should be allowed to function in its natural role where feasible and practical. Where this is not possible, park staff needs to manage fire to the degree appropriate for its historical role and current affects on human safety and health. All wildland fires either contribute to (prescribed fires) or conflict with (wildfires) resources management objectives. Each park where fires can burn must have a program that incorporates the broad NPS policy and specific park characteristics, legislative obligations, and environmental and social considerations. Wildland fire should be integrated into all aspects of park operations and planning where fire has a historical role and affects human values.

III.N.2. National Park Service Policy and Program Objectives

The authorities to manage fire include 1) the Organic Act, which directs protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act, which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park, which amended the general authorities to specifically mandate that all park units be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized. Other authorities that apply are the Endangered Species Act, Clean Air Act, Clean Water Act, and Wilderness Act.

The type and degree of a park fire program is relative to the diversity, magnitude, and complexity of the situation. The policy and objectives as stated in NPS Management Policies and reiterated in NPS-77 guideline are:

Park fire management programs will be designated around resource management objectives and the various management zones of the park. Fire related management objectives will be clearly stated in a fire management plan, which is to be prepared for each park with vegetation capable of burning, to guide a fire management program that is responsive to park needs.

All fires in parks are classified as either prescribed fires or wildfires. Prescribed fires include fires deliberately ignited by managers (prescribed burns) or fires of natural origins permitted to burn under prescribed conditions (prescribed natural fires) to achieve predetermined resource management objectives. All fires that do not meet the criteria for prescribed fires are wildfires. (4:14)

As stated in NPS-18, fire is an integral component of natural resources management. It may be used to 1) restore or maintain natural ecosystems, 2) influence natural successional patterns, 3) restore or maintain an historic scene, 4) restore or maintain vistas, 5) reduce fuels which contribute to a wildfire hazard, 6) create fuelbreaks near developments or park boundaries, 7) enhance the habitat of sensitive species, and 8) control exotic species.

Fire may be excluded for the protection of natural or cultural resources, to meet various legal requirements, or because its presence may be incompatible with other park values or resources, or with those of park neighbors. The use or exclusion of fire must be in support of the objectives defined in the resources management plan. This plan must clearly articulate the park's resource objectives and the role, if any, which fire can play in achieving these objectives. Specific objectives for fire are written in the fire management plan.

III.N.3. Organ Pipe Cactus National Monument Current Program

Organ Pipe Cactus currently suppresses all fires since it does not have a fire management plan. Very little information exists on the natural periodicity of fire and its effects. By the account of records, lightning fire is a rare occurrence in the monument, but evidence does exist to show it has happened. The removal of authorized grazing several years ago has allowed herbaceous plants to grow, which are the desert fuels that easily ignite and carry fires. The NPS history shows that fire occurrence increases in deserts once grazing is removed, such as in Joshua Tree National Monument.

Human caused fires have increased dramatically in the past decade along the international border with Mexico. There is a combination of an increasingly agriculturally based population in Sonoyta, of a well travelled road in Mexico along the border, and of spreading non-native plants, which are readily flammable. Many fires start on the border and burn into the monument.
Observation of repeatedly burned areas shows that native plants, especially succulents, are often damaged, and that non-native species, such as the persistent red brome and russian thistle, are encouraged. These species regenerate quickly, sometimes within the same season, and are ready for the next fire. This promotes the reburn cycle that is harmful to native species not adapted to frequent fires.

III.N.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N07 Disruption of Natural Fire Regimes

C01 Inadequate Planning Documents

C17 Control of Environmental Impacts

Develop a Fire Management Plan
Project Statement No.: ORPI-I-150

Issue: The monument does not have a plan to comprehensively manage fires and, consequently, is not in concurrence with Western Region policies and Guideline NPS 18 - Wildland Fire Management. The staff, however, follows

appropriate procedures by taking immediate action to protect human life and property, as well as natural and cultural resources. There is field evidence of natural fires, such as charcoal, burned stumps, and vegetation patterns, but these are not managed by the monument.

Proposed Action: A Fire Management Plan will be developed for the monument in accordance with NPS guidelines and policies. Appropriate research will be undertaken to ensure a comprehensive and effective product. By writing a fire management plan to conduct a comprehensive program, the monument will be in concurrence with Western Region policies and NPS 18. Additionally, staff will be better trained and certified to operate a program that takes into account protection of humans and property as well as cultural and natural resources, and recognition of environmental factors.

Conduct a Fire Management Program
Project Statement No.: ORPI-I-151

Issue: Following the approval of a comprehensive plan to manage wildfires and prescribed natural fires, the staff must implement the program. Qualifications and certifications must be raised to a level to operate the full program. Training is needed in managing and monitoring both natural fires as well as wildfires. Training is also needed in implementing a prescribed fire program. Additional equipment and supplies are needed as well as upgrading of existing equipment. Staff and equipment will be capable and available to assist with interagency fires off the monument in accordance with NPS regulations. Resources advisors for natural and cultural resources must be designated.

Proposed Action: As a follow up to the approved Fire Management Plan, staff will implement the plan and work with other agencies to manage fires in and around the monument. Staff will be trained and certified to meet the requirements set forth in the plan. Joint suppression agreements and possibly prescribed natural fire agreements will be completed with adjacent agencies in the United States and Mexico, as appropriate. Complete fire records and an atlas will be maintained for documentation and future research. Safety, prevention, and hazard reduction programs will be conducted. Research will identified and supported to assess and monitor fire effects and history. The program will be reviewed annually and revised if necessary.

Conduct Fire History and Ecology Research
Project Statement No.: ORPI-I-152

Issue: Information about fire history and ecology is lacking, thus hampering a true comprehension of the role of fire in this desert ecosystem. Limited research has been done in Sonoran desert communities, so there is an inadequate data bank to draw upon. Site specific research is needed for Organ Pipe Cactus National Monument.

Proposed Action: A monument-wide fire history study using field evidence of fire occurrence and records or other documents will be completed. The occurrence, location and spread will be mapped in a fire atlas. Frequency will be determined per given site.

III.O. Wilderness Management

III.O.1. Overview

The NPS has a responsibility to manage backcountry, which includes wilderness, areas to provide recreation and to preserve resources values that created the attraction. These primitive, undeveloped portions of parks allow humans to encounter and appreciate wildness. They also offer the best opportunities for the NPS to manage natural resources as ecological systems. Cultural resources accent wilderness values and illustrate human histories. Wilderness management should be integrated into all aspects of park operations and planning.

III.O.2. National Park Service Policy and Program Objectives

The premiere authorities include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units will be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized.

Other relevant legislation includes the National Environmental Policy Act of 1969, Wilderness Act of 1964, Wild and Scenic Rivers Act of 1968, Federal Cave Resources Protection Act of 1988, Alaska National Interest Lands Conservation Act of 1980, National Historic Preservation Act of 1966, and Executive Order 11644 for "Use of Off Road Vehicles on the Public Land". Specific park legislation is important, especially if wilderness is designated.

Each park must plan a program relative to the magnitude and complexity of its backcountry. Special designations of wilderness or wild and scenic river status require exacting considerations for management. The policy and objectives as stated in NPS Management Policies and reiterated in the NPS-77 guideline are:

The National Park Service will encourage recreational activities that are consistent with applicable legislation [and] that promote visitor enjoyment of park resources through a direct association or relation to those resources.

In managing recreation, the NPS is guided by 1) protecting natural and cultural resources and natural processes (including prohibition of consumptive uses unless specified by law or regulation), 2) protecting unique or important backcountry recreational opportunities by avoiding inadvertent changes in the recreational experience, 3) providing a varied spectrum of backcountry recreational uses as appropriate in the diverse NPS parks, and 4) avoiding unacceptable levels of danger for the public. Limitations imposed on recreational uses should be based on research and the minimum necessary to achieve the four objectives stated above. Management involves planning, regulating, permitting, and restricting uses. Due to the variety of NPS areas, the superintendent should develop specific standards for resource impacts and use levels through a planning process. The standards should be related to other plans.

III.O.3. Organ Pipe Cactus National Monument Current Program

Public Law 94-429, signed in 1978, designated 312,000 acres as wilderness and 1240 acres as potential wilderness within Organ Pipe Cactus. With this action, approximately 95% of the monument was designated. A backcountry management plan was approved in 1985 that directs visitor use. It defines regulations, use zones, carrying capacities, and other special conditions. A wilderness management plan specifically for the monument does not exist. Consequently, there are no guidelines for research, search and rescue, and other projects and activities that occur within this designated area. The existing backcountry use plan is inadequate for use.

III.O.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N18 Visitor Use Impacts on Backcountry Park Resources

N21 Loss of Fragile and Irreplaceable Cave Resources

N22 Overuse or Impacts to Recreation and/or Landscaped Zones

C01 Inadequate Planning Documents

C26 Other Issues

Develop a Wilderness Management Plan
Project Statement No.: ORPI-I-200

Issue: A Wilderness Management Plan specifically designed for the monument does not exist. There are no guidelines for research, search and rescue, and other management projects and activities that occur within designated wilderness. A management plan will be developed and implemented to promote and protect the wilderness ethics, values and experiences the monument has to offer.

Proposed Action: A full Wilderness Management Plan will be developed to guide activities and provide for long-term program direction at Organ Pipe Cactus National Monument. Development of a wilderness plan will detail everything from wilderness history, laws, and special uses to specific park policies and uses. Issues that must be addressed include: limits of acceptable change (especially for areas of critical habitat and sensitive ecosystems), wilderness ethics, signing, wilderness values and experiences, impacts from aircraft overflights, trails and levels of maintenance, and impacts from research, management and visitor use activities. The issue of an additional 1240 acres as potential wilderness will be reviewed formally and, if acceptable, proposed to Congress for inclusion in the National Wilderness Preservation System as part of the existing Organ Pipe Cactus Wilderness.

Develop a Trail Use Management Plan
Project Statement No.: ORPI-I-201

Issue: There is currently no formal program for managing trails, or assessing their impacts on monument resources. There are several miles of trails in the monument varying from heavily designated primary routes to primitive paths along abandoned roadways. There is minimal maintenance of trails. Sheet and gully erosion occur in some areas as a result of no maintenance or poor layout of trails. It is unknown if any of these trails cut through critical threatened and endangered species or sensitive species required habitat. Some trails cut through cultural sites and are a source of erosion.

Proposed Action: A Trail Use Management Plan will be prepared. The plan will outline a comprehensive program for trail management in the monument. Issues to be addressed in the plan include trail sustainability, design and construction, and maintenance and monitoring.

Develop a Cave Management Plan
Project Statement No.: ORPI-I-202

Issue: A comprehensive plan for managing cave resources at Organ Pipe Cactus National Monument is needed. There are several caves in the monument, but inventory and mapping details are incomplete. There has not been an assessment of their condition, not preparation of maps, description of cultural and natural resources values, nor an analysis of vulnerability due to vandalism or degradation. Very little has been done to manage caves.

Proposed Action: A Cave Management Plan will be developed for the monument. An inventory of all cave resources will be conducted. Maps will be prepared, including descriptions which note special considerations for each cave. The vulnerability of each will be assessed, particularly regarding vandalism. The plan will define research and detail a monitoring system to protect resources and document trends. It will categorize caves according to natural and cultural assessments and identify those that can be safely opened to the public.

Determine Visitor Impacts and Use Limits
Project Statement No.: ORPI-I-203

Issue: No comprehensive study of visitor impacts, use, and limits has been conducted for Organ Pipe Cactus. Visitor use is concentrated in certain areas, such as the visitor center and campground, backcountry campsites, scenic drives, Quitobaquito, and cultural sites. More visitors are using the backcountry trails and roads. Increasing visitation and potential overcrowding greatly lessen

the quality of recreational experiences and cause numerous natural and cultural resources degradation problems, including those associated with visitor-oriented structures and facilities.

Proposed Action: A study of visitor impacts, uses, and limits will be conducted. Survey data will serve to determine the physical, biological, cultural, environmental, and social conditions that define the monument's recreational uses. Emphasis will be placed on use in designated wilderness areas. Once the ideal use conditions and limits are established, they can be continuously reviewed and updated with long term monitoring.

III.P. Abandoned Mineral Lands

III.P.1. Overview

Abandoned mineral lands include mines (hardrock, coal, industrial minerals, and sand and gravel), wells (oil, gas, and geothermal), access roads and associated processing facilities. Mineral lands are considered abandoned when no responsible party can be identified, and responsibility falls on the NPS for mitigating safety hazards and remediating environmental impacts. (Handbook for the Remediation of Abandoned Mine Lands - 1992).

III.P.2. National Park Service Policy and Program Objectives

Each National Park Service park or unit with abandoned mineral lands should develop and maintain an inventory of Abandoned Mineral Land (AML) sites, documenting safety hazards, impacts on natural and cultural resources, and visitor use. Such an inventory will provide the information to establish remediation priorities, and to monitor resource conditions and corrective actions. This information will also be used to write a comprehensive Abandoned Mineral Lands Plan, in compliance with Western Regional Directive WR-085, from which a long-term program will be established.

Safety hazards and resource impacts associated with abandoned mines should be mitigated or eliminated as funding and personnel become available. Alternatives for treating mine openings include permanent closure, temporary closure, maintenance as wildlife habitat, no action, or, once safety problems are addressed, retention and interpretation as an historic feature.

All remediation of abandoned mineral lands must be consistent with NPS policies, in compliance with the National Environmental Policy Act of 1969 (NEPA), protection of threatened and endangered species, and preservation of cultural resources. Where appropriate, AML issues should be addressed in park management documents, including the Statement for Management, Land Protection Plan, Resources Management Plan, Backcountry Management Plan, and related documents.

Program Objectives:

The objectives for managing an AML program are broad-based and incorporate many facets of the National Park Service's overall administrative responsibilities. There are four major objectives:

- Elimination or mitigation of safety and health hazards associated with AML sites;
- Mitigation of impacts to NPS resources;
- Preservation of historically or culturally significant AML sites;
- Management for specific wildlife habitats, especially threatened and endangered species. (Handbook for the Remediation of Abandoned Mine Lands - 1992).

III.P.3. Organ Pipe Cactus National Monument Current Program

There are over 400 mining holes, scrapes and shafts within the monument. None of these mining sites are currently operational. Mining was officially closed in the late 1970's. Of the 400+ holes, 92 are considered hazardous and are equipped with either grate covers and/or barbed

wire fences. Annually, each of these hazardous sites is inspected and repairs are made to the safety devices. Warning signs in both English and Spanish are replaced. Notations are made as to the feasibility of obliterating the feature entirely. In the past, most of this work has been conducted by a volunteer.

All of these abandoned mine workings were fenced and signed in 1983. This work followed an intensive reconnaissance in which information was collected primarily on visitor safety, and secondarily, on the use of these sites by wildlife. Before any further actions can be carried out for interpreting, obliterating, or rehabilitating these sites, a determination must be made as to their importance to wildlife. Since many of these abandoned operations date from the latter half of the nineteenth century, any dependence on them by wildlife has probably developed over a long period of time. With increasing impacts on the monument's fauna, it is imperative to determine how vital these abandoned mines are to the continued existence of specific wildlife species. Once it is determined which sites are vital for wildlife use, those remaining can be obliterated and revegetated.

III.P.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N10 Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities

C26 Other Issues

Conduct Comprehensive Monitoring and Maintenance of Abandoned Mine Safety Features
Project Statement No.: ORPI-I-250

Issue: Ninety-two hazardous mine and well openings within the monument pose a threat to visitors and wildlife. All of these hazardous mines and wells have safety features (e.g. fencing, gates) which need to be maintained on an annual basis.

Proposed Action: A yearly monitoring program of the fences, signs, and wildlife use for all hazardous abandoned mine and well sites will be conducted. Repair of fencing and replacement of signs will be done on a cyclic basis, thereby maintaining a high standard for public safety. Park staff can carry out a yearly monitoring program. Resources management staff will carry out a cyclic/replacement program using regional cyclic funds.

Conduct Study of Wildlife Use of Abandoned Mines
Project Statement No.: ORPI-I-251

Issue: Abandoned mine sites need to be evaluated to determine their impacts on or value to wildlife. There are over 400 abandoned hazardous and non-hazardous mines and wells within Organ Pipe Cactus National Monument. When information on the locations of these operations was being collected, the use of some sites by wildlife was noted. Of particular interest, is the fact that one horizontal mine tunnel provides habitat for the largest known maternity colony in the United States for the lesser long-nosed bat (*Leptonycteris curasoae*). Evidence also suggests that mine holes not hazardous to humans are fatal to species such as the desert tortoise (*Gopherus agassizii*), which once in, is unable to get out. Before any further actions can be carried out to interpret or rehabilitate these sites, a determination must be made as to their importance to wildlife. Because many of these operations date from the latter half of the nineteenth century, any dependence on them by wildlife has probably developed over a long period of time. With increasing impacts on the monument's fauna, it is imperative to determine how vital these abandoned mines are to the present and continued existence of specific wildlife species.

Proposed Action: An inventory of all abandoned mine lands will be conducted to evaluate use by wildlife. Those abandoned mine sites upon which wildlife may be dependent for survival, or at hazard from, will be studied. Wildlife censusing and observation techniques will be utilized and a report prepared from the findings. The results of

this report will be used to make management recommendations concerning appropriate actions defining the role of these sites as park resources for wildlife protection and preservation.

Develop Mine Hazards Safety Program
Project Statement No.: ORPI-I-252

Issue: Abandoned hazardous mines and wells within Organ Pipe Cactus National Monument pose safety threats to park visitors and employees. A mine and well safety survey conducted in 1983 identified over 400 abandoned mining features and wells. Of these, 92 were determined to be hazardous. These were signed in English and Spanish and were fenced and/or grated. Many park employees, visitors and illegal aliens encounter these abandoned mines and wells in the backcountry. It is important that safety information be provided to all affected groups who may encounter these features.

Proposed Action: An educational program will be developed to make the hazards of abandoned mines and wells known to park visitors and staff. The program will include developing a free brochure illustrating the hazards of the abandoned mines and wells and summarizing the mine and safety program. The brochure will be available in English, Spanish and German and will be distributed at the visitor desk and other appropriate areas. Those sites, such as Victoria Mine which are significant historically, as well as heavily visited, will serve as a focal point, not only for introducing the mining history of the monument, but also for providing an area to emphasize safety. Interpretive displays will be developed at the sites as well as at the Visitor Center, illustrating the hazards of abandoned mines and wells.

Rehabilitate Selected Mines
Project Statement No.: ORPI-I-253

Issue: With increasing visitor use and a better understanding of wildlife use at Organ Pipe Cactus National Monument, steps must be taken to protect both visitors and wildlife from hazardous and non-hazardous abandoned mine lands. Of the 400+ holes, 92 are considered hazardous and are equipped with either grate covers and/or barbed wire fences. Annually, each of these hazardous sites is inspected and repairs are made to the safety devices. In the past, most of this work has been conducted by a volunteer.

Proposed Action: Mine sites that have been determined not to have cultural or natural resource significant values will be closed using existing spoils and rehabilitating the site. This alternative presents a permanent solution to the problem of aesthetics and visitor safety. Fences can and will be climbed; signs can and will be stolen; explosives are not cost effective; and nets are not a resolution that allows for the sites to be recontoured and revegetated. In order to return the landscape to a more natural condition through filling, recontouring, and site revegetation, this type of closure becomes the preferred way to approach a final solution to abandoned mine sites in Organ Pipe Cactus National Monument.

III.Q. Aircraft Management

III.Q.1. Overview

Natural sounds, quiet and solitude, are innate features of many national park units, and are considered aesthetic values, as are tangible resources. They relate to the visitor's perception of a park and its environment through the senses.

Organ Pipe Cactus lies within the Sells Military Air Space, and two military training routes cross the northern half of the monument. The western boundary and portions of the northern boundary are adjacent to the Barry Goldwater Bombing Gunnery Range. The monument receives a great number of

overflights, and it is common to see military aircraft flying at less than 500 feet above the ground, both near the residential area and in high visitor use areas. Aircraft crashes have occurred, adversely affecting resources and threatening public safety.

III.Q.2. National Park Service Policy and Program Objectives

The premiere authorities include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized.

Individual park legislation might generally or specifically note scenic beauty or features and cultural sites or environs. The National Environmental Policy Act and Wilderness Act apply to aesthetic considerations.

The policy and objectives as stated in NPS Management Policies and reiterated in the NPS-77 guideline are:

The individual parks contain various tangible natural and cultural features such as animals, plants, waters, geologic features, historic buildings and monuments, and archeological sites. They also have intangible qualities such as natural quiet, solitude, space, scenery, a sense of history, sounds of nature, and clear night skies that have received congressional recognition and are important components of people's enjoyment of parks. These NPS Management Policies use the terms resources and values to mean the full spectrum of tangible and intangible attributes for which parks have been established and are being managed. (1:3)

Management Policies make numerous references to aspects of aesthetics as central issues in the considerations that go into resources management. It includes, under the natural resources and values that the NPS must protect, "aesthetic values, such as scenic vistas, natural quiet, and clear night skies."

The National Park Service will strive to preserve the natural quiet and the natural sounds associated with the physical and biological resources of the parks...Activities causing excessive or unnecessary sounds in and adjacent to parks...will be monitored, and action will be taken to prevent or minimize unnatural sounds that adversely affect park resources or values or visitors' enjoyment of them."

III.Q.3. Organ Pipe Cactus National Monument Current Program

An aircraft management plan is needed to help establish a procedure for working with the military and for monitoring impacts on natural and cultural resources and humans.

Public relations have been initiated with Luke Air Force Base to report overflights. Documentation of violations and overflights are kept by monument staff. Research was conducted to examine effects of low overflights and sonic booms on endangered species, including the Sonoran pronghorn antelope on the Cabeza Prieta National Wildlife Refuge, and recently, the lesser long-nosed bat in the monument.

III.Q.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N15 Noise, Visual, and Biological Impacts Related to Aircraft Overflights.

C26 Other Issues

Develop and Implement Aircraft Overflight Monitoring Program
Project Statement No.: ORPI-I-300

Issue: The monument needs to develop and implement an aircraft overflight monitoring program to assess the impact of aircraft use in the monument. The program will help to establish a solid monitoring program from which to study the impacts of overflights on natural and cultural features and on visitor experiences.

Proposed Action: An aircraft overflight monitoring program will be developed. Means will be identified to cooperate and communicate with the Air Force, Marines, and National Guard. The plan will also outline management's use of aircraft outside and inside wilderness. A draft aircraft monitoring program already exists and would require little modification to implement. The program will be implemented by all monument staff from maintenance and park rangers to volunteers. The monitoring form developed will be similar to ones developed and used in other parks and monuments, such as Grand Canyon National Park and Saguaro National Monument. This program will be an excellent tool for increasing communication and cooperation among divisions, as well as providing solid documentation of overflight incidents.

III.R. Man and the Biosphere Program

III.R.1. Overview

The concept of managing resources through a "Man and the Biosphere" (MAB) approach began in 1970 at the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO). MAB's structure is intergovernmental in nature and strives towards the "management of problems arising from the interactions between human activities and natural systems". There are approximately 100 nations participating in the MAB program. In 1972, the United States began to play an active role in this program.

III.R.2. National Park Service Policy and Program Objectives:

The National Park Service defines a biosphere reserve as "a site representative of a biogeographic province that is part of a worldwide network of natural reserves set aside for conserving genetic resources, facilitating long-term research and monitoring, and encouraging education, training, and demonstration of sustainable resource uses." The sustainable resource uses phrase is critical to NPS management from a MAB perspective, because of the primary Park Service goal to preserve in an unimpaired manner the natural and cultural resources for future generations.

As stated in NPS-77, "the designation of park lands as international biosphere reserves will not alter the purposes for which the parks were established or change the management requirements." MAB unit superintendents are highly encouraged to include biosphere reserve objectives into statements for management, general management plans, action plans, and park interpretive programs.

Biosphere reserves consist of a core area, buffer zone, and sometimes a transition area. The core zone is usually a wilderness area. If designated, buffer zones may be non-wilderness areas that still limit manipulative research or development, and transition areas may vary according to adjacent land use practices and cooperative efforts.

Research in MAB sites should be compatible with the core area and buffer area management goals. For example, in wilderness areas, research should be conducted in a manner that maintains the ecological integrity of the core area. Research should be designed to address issues of concern to the region as well as the park, and should strive to incorporate cooperative research with neighboring land managers, both in the U.S. and other countries. Communication with adjacent land managers regarding the policies concerning the MAB concept is a key to maintaining cooperative working relations and an understanding public. Efforts should be made to interpret the park's MAB status and management approach through brochures, exhibits, presentations, and other effective means.

III.R.3. Organ Pipe Cactus National Monument Current Program

Organ Pipe Cactus National Monument was designated as Biosphere Reserve in 1976, and includes 133,278 hectares. The core area is a wilderness zone of approximately 300,000 acres, established in 1978. In 1987, the Sensitive Ecosystem Program was initiated, which is a long-term inventory and monitoring program consisting of several projects. Many of the projects are MAB oriented, especially those dealing with adjacent land use trends in Mexico. An exhibit in the visitor center displays the Sensitive Ecosystem Program, but there are no specific interpretive programs designed for Biosphere Reserve education. There are audio-visual automated slide programs available in Spanish for the public, but they do not expound upon the Biosphere Reserve concept.

Planning at Organ Pipe from a MAB perspective is infiltrating all areas of operation. The General Management Plan to be completed soon will be the first in the NPS to incorporate MAB as an overall management approach. The Resources Management Plan is currently being revised with project statements specifically dedicated to MAB and its role in resources management.

The monument currently works cooperatively with Sonora, Mexico's federal water resource personnel and state conservation/educational agency personnel. There are no established cross-cultural environmental education programs or international interpretive activities.

III.R.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

A critical factor is that for many projects to be successful, MAB must be an integral part of the planning, development and implementation. This is especially important because the monument is surrounded by different nations and agencies. To the east is the Tohono O'odham Reservation, to the south is Sonora, Mexico, and to the west is the Barry Goldwater Gunnery Range, which includes the Cabeza Prieta National Wildlife Refuge. This total area encompasses more than four million acres.

There is a great potential for expanding working relations with Mexican-American conservation agencies, as well as with federal, state and local agencies in Sonora, including schools and municipalities. There also exists great potential for cooperative MAB resource projects on the Tohono O'odham Reservation, the Cabeza Prieta NWR and the Gunnery Range. The Pinacate Volcanic Resource Area in Sonora, Mexico, is a little larger than the monument and is almost adjacent to the south boundary. The Pinacate is a newly designated Biosphere Reserve, and may open another arena for cooperative MAB projects.

SERVICEWIDE ISSUES:

N24 Other Issues

C26 Other Issues

Develop a Man and the Biosphere Action Program for the Sonoran Desert
Project Statement No.: ORPI-I-350

Issue: The Sonoran Desert Biogeographic Region in southern Arizona and northern Sonora, Mexico, is an area exposed to a multitude of threats and issues, impacting both natural and cultural resources and the people living in the region. Land is managed by an array of governmental, private and tribal organizations. Adverse land management practices in one area affect other areas as well. While preservation of resources is a high priority in one region, economic needs drive management in another. Issues are not only cross-boundary, they are cross-cultural and international in scope as well.

Proposed Action: An integrated regional program of cooperation for the Sonoran Desert will be established and developed by monument staff and MAB program specialists. This program will deal with identified problems and communication needs among neighbors within the Sonoran Desert Biogeographic Region. Four specific activities are identified: fully define the geographic area of the Sonoran Desert Biosphere Reserve Region within the United States; identify resource issues of regional concern; prepare a position paper on resource issues of common concern for all involved land owners and managers; develop a consultative MAB framework to promote discussion and cooperation among groups and individuals in the region. Following the intensive interviews and presentation of the position paper to all participants, a workshop will be held to bring together representatives of the diverse interests of the region. The agenda will include a review of a proposed inter-agency/inter-organization agreement to institutionalize the consultative MAB framework, similar to the Appalachian Region model. The format and location of the workshop will be determined through the interviews.

Conduct Man and the Biosphere Multi-cultural Interpretive Programs
Project Statement No.: ORPI-I-351

Issue: The monument currently does not have a domestic or international environmental education program. On October 26, 1976, the United Nations Education, Scientific and Cultural Organization (UNESCO) recognized and designated Organ Pipe Cactus National Monument as a Man and the Biosphere (MAB) Reserve. "This network of protected samples of the world's major ecosystem types is devoted to conservation of nature and scientific research in the service of man. It provides a standard against which can be measured the effect of man's impact on his environment." The monument uses this MAB concept throughout its management efforts.

Proposed Action: Man and the Biosphere multi-cultural interpretive programs will be developed. This activity will address the issue of providing information to our local and international neighbors about the National Park Service concept and the monument's biological diversity and critical resource management issues. A plan will be developed which includes in-park education programs for students from the U.S. and Mexico, and an outreach program to the local schools in Ajo, Sonoyta, and on the Tohono O'odham reservation. This program will be conducted through the coordinated efforts of the monument's resources management and interpretation divisions.

III.S. Museum/Archives/Library

III.S.1. Overview

The concept of developing and maintaining museum collections within parks to conserve objects of cultural and natural significance has been central to

the National Park Service since the establishment of the first parks. Museums provide care for objects and specimens to ensure preservation, as well as to provide valuable information for researchers and the visiting public.

An extensive collection of archeological, ethnographic, historical, natural, and biological materials is associated with Organ Pipe Cactus National Monument. Additional resources include archives, historic and documentary photographs, maps, and library materials. While the majority of the archeological materials are housed at the Museum Collections Repository - Western Archeological and Conservation Center (MCR-WACC) in Tucson, AZ, the remainder of the collections are stored on-site in the monument's museum facility. Monument personnel remain responsible for the preservation of these collections in perpetuity.

III.S.2. National Park Service Policy and Program Objectives

The authorities to manage museum collections include five laws which provide the legal basis for the National Park Service to undertake collections management. These laws include: 1) the Act for the Preservation of American Antiquities (1906) which authorizes the President to declare national monuments for the protection of sites and objects; as well as authorizes Federal departments to protect archeological sites and objects within their jurisdiction; 2) the Organic Act (1916) which directs protection and preservation of natural and cultural resources while providing for public use which leaves the resources unimpaired; 3) the Historic Sites Act (1935) which authorizes the Secretary of the Interior through the National Park Service to preserve objects of significance and maintain associated museums; 4) the Museum Act (1955) which authorizes the Secretary of the interior to add to museum collections through donations, purchases, exchanges and loans, and further authorizes the loan of museum objects to other institutions; and 5) the Archaeological Resources Protection Act (1979) which provides for protection of archeological resources and requires that materials excavated from public lands be housed in a suitable repository.

Further legislation pertaining to collections management include laws, regulations and conventions specific to cultural collections, as follows: 43 CFR Part 3 "Preservation of American Antiquities", the American Indian Religious Freedom Act of 1978, 43 CFR Part 7 "Protection of Archeological Resources: Uniform Regulations", 36 CFR Part 79 "Curation of Federally-Owned and Administered Archeological Collections", and the 1970 UNESCO Convention of the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property. Laws, regulations and conventions specific to natural history collections include the following: the Lacey Act of 1900, the Migratory Bird Treaty Act of 1918, the Bald Eagle Protection Act of 1940, the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, as amended, 36 CFR Section 2.5 "Research Specimens", 50 CFR Section 17.11 and 17.12 "Endangered and Threatened Wildlife and Plants", and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. National Park Service policies and objectives are stated in NPS Management Policies and NPS-28, Cultural Resources Management Guideline, and provide specific objectives and standards for collections management, including inventories, preservation of data and collections, treatment of museum objects (including preservation, restoration, and reproduction), acquisition, management, and disposition of museum objects, archives and manuscripts, and environmental monitoring and control.

III.S.3. Organ Pipe Cactus National Monument Current Program

The management of archeological, ethnographic, historical, natural and biological materials is an ongoing concern. The museum collection for the monument currently includes over 11,000 objects. In addition to museum collections, the Resources Management Division operates and maintains archives, maps and photographic and library materials. The library includes over 1400 accessions and is continuing to grow. The map collection also includes over 1400 items, and is growing due to the Environmental Monitoring Program and the implementation of a GIS program.

III.S.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

C01 Inadequate Planning Documents

C03 Incomplete Cataloging of Museum Collections (ANCS)

C09 Need for Collection Management Plan, Collection Storage Plan, and Collection Condition Surveys

C10 Need for Specialized Studies for Unique or Complex Management Issues

C19 Inadequate Cultural Monitoring Program

N24 Other Issues

Develop a Collections Management Plan
Project Statement No.: ORPI-I-400

Issue: The monument currently does not have a Collections Management Plan. Management of the collection of archeological, ethnological, and historical materials is an on-going concern. The museum collection, currently located in the monument, contains over 10,000 items. Most of the monument's cultural and archeological items are stored at the Museum Collections Repository-Western Archeological and Conservation Center (MCR-WACC) in Tucson, AZ. The monument staff is responsible for the preservation of the collection in perpetuity. To assist in this work, a Collections Management Plan as required by NPS 28 - Cultural Resources Management, must be written.

Proposed Action: A Collections Management Plan, in conformance with NPS-28, will be developed to guide the preservation and protection of museum specimens. This document will include a brief history of the collection, with an overview of the present collection (e.g. types of materials stored at monument), the current Scope of Collections Statement with recommended changes to the statement, current status and recommendations regarding museum records, current status (environment and maintenance) of museum exhibits with recommendations for improvement and housekeeping instructions, current status and recommendations for museum security and fire detection/protection; current status of museum staffing with recommendations for improvement, and future planning needs and sources of funding. With this plan, the monument will be in compliance with NPS standards.

Manage Library and Museum
Project Statement No.: ORPI-I-401

Issue: A curatorial position is needed to manage the museum, archives, photos, maps, and library materials. Presently, a Geographer, with the assistance of a VIP, spend, approximately 15% of the time maintaining these resources. This amount of time is not sufficient, nor is it always available, as many other duties conflict with time constraints. Without the necessary permanent infrastructure, the

museum and library cannot be managed at an optimal level.

Proposed Action: A curatorial position will be established to manage the library and museum. This action will provide the Resources Management and Research Division with a basis to develop and standardize the infrastructure for management of the Sonoran Desert Biosphere Reserve Center, which includes the library and museum. It will relieve the Geographer from the work overload associated with the library and museum program.

Automate Library Catalog System

Project Statement No.: ORPI-I-402

Issue: The Sonoran Desert Biosphere Reserve Center has a scientific library collection of over 1400 accessions, and it continues to grow. The items are currently typed on index cards and stored in a file drawer according to author, title, subject and accession number. This is the only record of the library information. No computerized accessioning and retrieval system is used for the cataloging of library items.

Proposed Action: The monument's Resources Management and Research Library will be automated using the software program Librarian's Assistant. This computer application is a library management/on line software program which is capable of cataloging, searching databases, and indexing literature and collection information. As a result of this action, the library collection will be more accessible to users and easier for resources management staff to inventory and maintain.

Obtain and Maintain Historic Photograph Collection

Project Statement No.: ORPI-I-403

Issue: A complete and continuing photo collection is needed as a pictorial baseline for reference and to illustrate changes. The monument has a collection of historic photographs and continues an organized photographic file of current projects and natural scenes. There has been no systematic search, however, of libraries, historical societies, museums, university biology, anthropology, and archeology departments, or other repositories to obtain copies of early historic photographs. Old photographs would show the conditions of historic and prehistoric structures and natural scenes. For example, pictures would illustrate structures that are now collapsed, missing, or vandalized. Other photos would show effects of grazing, mining, and fire on the environment. Changes in vegetation and riparian areas would be evident, as would the development of Sonoyta, Gringo Pass, and Quitobaquito. The monument's resources are continually changing, which makes prediction of future conditions perplexing. It is difficult to quantify internal and external influences.

Proposed Action: To make the best use of photographs in managing and protecting natural and cultural resources, a systematic inventory of photos on file, plus a search for off-site pictures is necessary. Significant pictures will be added to the collection. The result will be a more complete and valuable collection that will serve as an historic reference as well as a monitoring baseline.

Update and Maintain Automated National Catalog System Program

Project Statement No.: ORPI-I-404

Issue: The Automated National Catalog System (ANCS) for the Organ Pipe Cactus National Monument museum needs cyclic update and maintenance.

Proposed Action: Monument staff will enter collection data into ANCS. While most of the data entry has been completed, additional actions are needed for system maintenance. These include: reviewing hard copies of all museum catalog cards

produced with ANCS to verify information; inventorying museum collections and verifying information on labels with ANCS records; integrating the WACC ANCS database with the monument's; and, preparing and cataloging into ANCS specimens acquired since 1992.

III.T. Other

III.T.1. Overview

This topic includes an array of integrated resource projects and programs that are not categorized into specific topics. They address filling positions to carry out programs, visitor use projects, non-native and extirpated species, and bibliographic assessment and retrieval.

III.T.2. National Park Service Policy and Program Objectives

The premiere authorities include 1) the Organic Act (1916), which directs the protection and preservation of natural and cultural resources while providing for public use that leaves the resources unimpaired, 2) the General Authorities Act (1970), which declares that all units will be managed in accordance with their respective individual statutory directives in addition to other related legislation, 3) the Redwood National Park Act (1978), which amended the General Authorities Act to specifically mandate that all park units will be managed and protected so that no activities will be undertaken to degrade park values, except where legally authorized.

III.T.3. Organ Pipe Cactus National Monument Current Program

There are approximately 50 plant and animal species of special concern found within the Monument, including category 2 species, such as the Quitobaquito snail.

Research, monitoring and management of all federally listed species is coordinated with the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. Annual permits are obtained to monitor populations, and biological assessments are prepared for any actions that may impact listed species. In regards to the Sonoran pronghorn, assistance is provided to the U.S. Fish and Wildlife Service in species management.

Monitoring of two endangered species, the lesser long-nosed bat and desert pupfish, is conducted annually via population estimates and assessments. The Monument's Chief of Resources Management serves on the working group for the recovery of the Sonoran pronghorn.

III.T.4. Organ Pipe Cactus National Monument Issues and Proposed Actions

SERVICEWIDE ISSUES:

N02 Impacts on Threatened, Endangered, and Other Sensitive Animals

N03 Impacts on Threatened, Endangered, and Other Sensitive Plants

N04 Degradation of Park Resources Due to Non Native Animals

N05 Degradation of Park Resources Due to Non Native Plants

N06 Disruption of Native Plant Communities and Accelerated Erosion due to Past Land Activities

N08 Loss of Cultural Landscapes

N18 Visitor Use Impacts on Backcountry Park Resources

N20 Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

N22 Overuse and Impacts to Recreation or Landscaped Zones

N23 Loss of Paleontological Resources

N24 Other Issues

Develop An Integrated Management Plan for Quitobaquito
Project Statement No.: ORPI-I-450

Issue: An integrated plan is needed to guide the management of the valuable natural and cultural resources of Quitobaquito. Three hundred years of grazing and ranching caused profound ecological change before the National Park Service assumed control of the QMA in 1956. Attempts to clean up, restore, and improve the situation exacerbated rather than mitigated the situation. Improper management measures undertaken contrary to professional advice destroyed the QMA historical fabric and damaged the natural resources simultaneously.

Proposed Action: An integrated management plan for Quitobaquito will be developed. This approach will provide the superintendent with in-depth information on the status of rare species and cultural resources in the Quitobaquito area, as well as some aspects of their life history. It will also integrate Quitobaquito into the rest of Organ Pipe's resources management program. This approach will also tend to institutionalize the management of Quitobaquito.

Prepare & Implement Plan to Comply with Special Directive 91-6 (Borrow Materials Plan)
Project Statement No.: ORPI-I-451

Issue: The monument does not have a plan or established guidelines to govern the use of borrowed material sources and spoil areas inside the monument as required by NPS Special Directive 91-6 (August 5,1991). This issue must be addressed in future park planning documents (RMP, GMP, Wilderness Management Plans, etc.). The directive also specifies that the only permitted use of borrowed sources inside proposed or designated wilderness areas is for trails, in accordance with an approved Wilderness Management Plan, which the monument does have.

Proposed Action: A Borrow Material and Spoil Area Plan will be developed to establish legitimate sources for borrow extraction and spoil disposal in compliance with NPS Special Directive 91-6, Chapter 9 of the 1988 NPS Management Policies, and related natural and cultural resources management policies, guidelines and legislation. The monument will consider its needs for potential emergency situations, water sources protection, road repair, trail maintenance, horticultural activities, archeological resources and historic preservation projects, and locate borrow source and spoil areas on and off the monument to insure natural and cultural resources are protected at all locations prior to implementing borrow extraction or spoil deposition.

Develop Road Maintenance Standards and Procedures
Project Statement No.: ORPI-I-452

Issue: After years of maintaining the Ajo Mountain and Puerto Blanco Loop Drives in a graded gravel condition, serious channeling and loss of road beds have occurred to the point where road beds are 12 or more inches below the desert floor. This channeling becomes an increasing problem with successive rain events, as additional soil material is lost.

Proposed Action: Road maintenance standards will be developed. This action will provide procedures for use by monument road and trails crews to use in the routine maintenance of these roads. The standards will help to mitigate and prevent to the extent possible, continued widening and deepening, and loss of material. Standards will also outline maintenance procedures to ensure that negative impacts to roadside resources do not occur.

Establish A Carrying Capacity for Loop Drives

Project Statement No.: ORPI-I-453

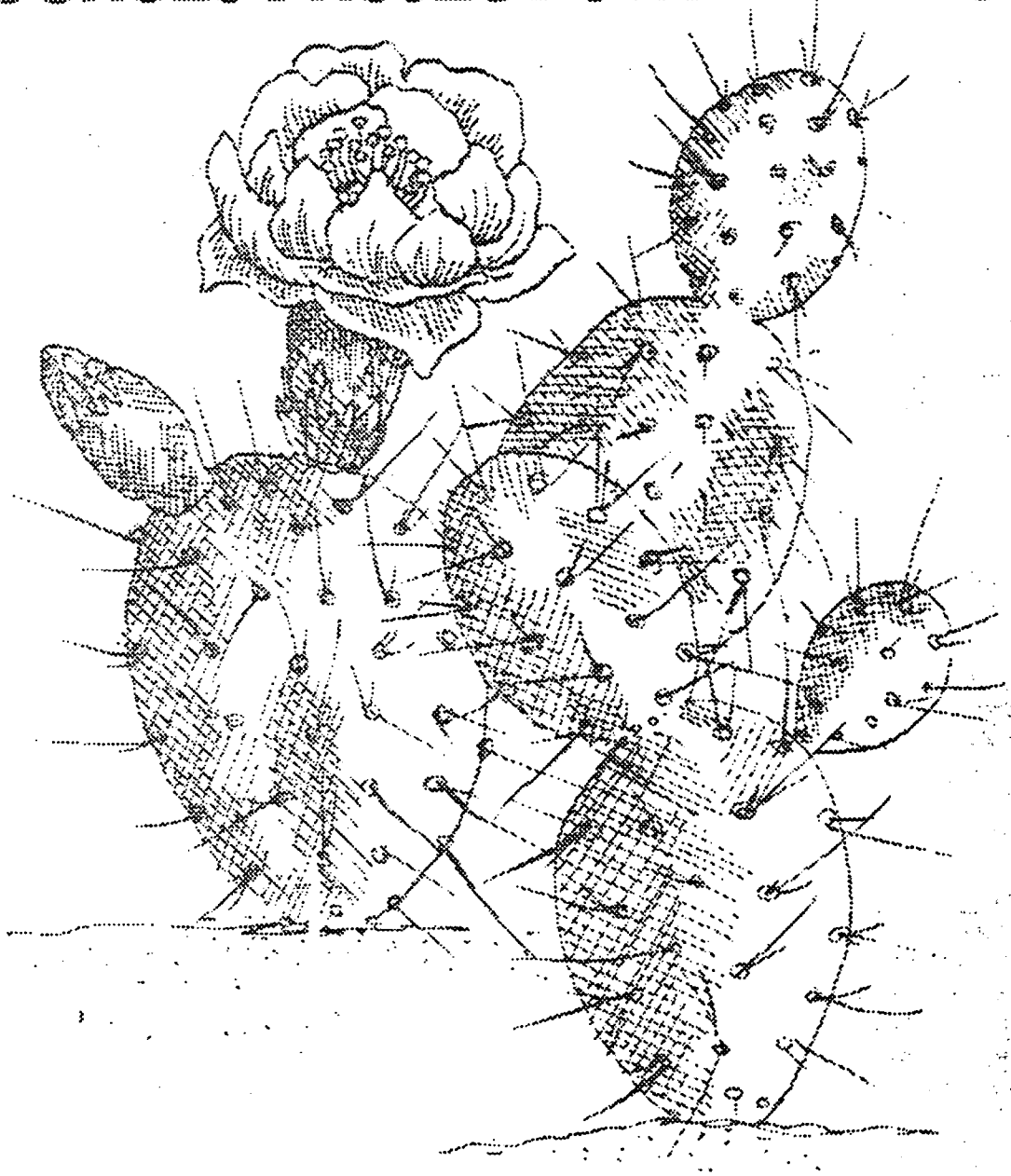
Issue: The carrying capacities of monument drives need to be established to protect resources and visitor experiences. Heavy use, combined with the variety of activities along the routes, can create undesirable and unsafe congestion, which also detracts from the visitor's experience. The popularity of the drives demands that the roads be kept open, which puts pressure on maintenance staff to grade roads after flooding. There is also the matter of road widening and deepening with progressive grading. Other concerns are that a roads pass populations of sensitive plants and offer backcountry access for poaching, vandalism and other illegal activities. As visitation increases, the problems will get worse. It must be determined if there is a maximum use level for the loop drives that should not be exceeded daily. Resources protection, visitor safety and quality recreational experiences seem to require that a carrying capacity be defined and carefully enforced.

Proposed Action: A carrying capacity for monument loop drives will be established. This alternative provides a definitive daily use level for the loop drives based on sociological, cultural and natural resource considerations. It will aim to protect resources and preserve quality visitor experiences.

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

NATURAL AND CULTURAL RESOURCES PROJECT STATEMENTS



PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-001

2. Project Title: **Implement and Manage Vegetation Management Program**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: A commitment of staff and funding is needed to implement and manage the monument's vegetation management program. Management is required for extensive monument programs, including revegetation of disturbed sites, non-native species control, sensitive species monitoring and general vegetation community research. Without the necessary permanent infrastructure, these programs cannot be implemented effectively or efficiently.

For the past fourteen years, Organ Pipe Cactus National Monument has had an active on-going revegetation program designed to restore impacted and disturbed areas to natural conditions. In 1978, 95% of the monument was designated as wilderness, resulting in the closure of approximately 85 miles of primitive roads. The Resources Management Division began growing native plants in a makeshift nursery near monument headquarters in an attempt to recover these areas. A trial and error method used in the nursery paid off fairly quickly, and resulted in successful methods for growing creosote bush and many other plants from seed. During the summer of 1988, a new nursery and greenhouse complex was completed at the Sonoran Desert Biosphere Reserve Center, located near monument headquarters. In 1988, the revegetation program also expanded beyond revegetating abandoned roads. Nursery grown plants have been used to stabilize soil in erosion areas within the park, and to reclaim other disturbed areas such as construction and development sites. The revegetation program continues to grow annually. Approximately ten years of work is still needed to fully restore abandoned roadways. In addition, revegetation efforts continue to become a necessity for many other projects requiring plant salvage and restoration.

Another program area addresses non-native plant species occurring in Organ Pipe Cactus National Monument. Recently, a compilation of introduced plants was completed that gives detailed information on 64 non-native plants and their abundance, distribution, threats and management recommendations. The presence of introduced species is of concern, since the monument was established to preserve a segment of the Sonoran Desert ecosystem. Some species can have serious adverse impacts on the ecosystem. A few of the introduced species include tamarisk, which can dominate drainages to the exclusion of native plants; and weedy annuals such as Russian thistle and red brome, which thrive following disturbances and can out compete natives species. These annuals are also readily ignitible, thus promoting wildfire.

In addition to revegetation of disturbed sites and non-native species controls, other vegetation programs include monitoring of sensitive species and coordinating general vegetation related research. Due to the extent of the program, a more permanent infrastructure is needed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in the management of vegetation programs on an as-needed basis. Efforts such as the revegetation of disturbed sites will be operated and staffed primarily by volunteers. As a result of this action, an optimal and effective level of vegetation management will not be attained.

B. **Implement and Manage Vegetation Management Program.** A permanent coordinator position to manage and implement the vegetation management program will be established. Responsibilities will include coordination and supervision of revegetation projects, operation of a native plants nursery, threatened and endangered plant species management, long-term plant monitoring to determine ecosystem health, non-native species management, and overseeing independent and contracted research programs. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the vegetation program.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A permanent coordinator will direct and manage all activities associated with vegetation management. The coordinator will:

- Operate a native plants nursery. Develop and maintain a seed storage base for revegetation projects. Determine and implement guidelines for long-term seed storage for threatened and endangered species. Be directly responsible for propagation, containerization, identification, and transplantation of plant stock. Maintain physical facility which includes a fully equipped greenhouse with climate control and a mist system, 1600 square feet of shaded growing beds with drip system capability, 5000 square feet of open growing beds, and a salvage yard for large cacti. Monitor construction and maintenance activities, and when necessary, salvage plants and relocate them to the nursery.

- Manage monument revegetation program. Identify and prioritize revegetation needs. Prepare work plans and schedule equipment for revegetation projects. Supervise up to two Biological Technicians as well as seasonal and volunteer workers in all aspects of revegetation work. Prepare and implement site plans, initiate site preparation, and implement plant stock installation on revegetation sites. Be directly responsible for plant identification, plant mapping using standard mapping principles as well as Global Positioning Systems, and long-term plant monitoring. Design and maintain data logs of plant inventories and revegetation data. Develop and implement maintenance schedule for insuring survival of plants on revegetation sites.

- Develop computer databases for vegetation management data including monitoring data, Sensitive Ecosystem Program data, seed collection and storage information, and revegetation data. Integrate vegetation data with the monument's Geographic Information System.

- Monitor and evaluate trends in natural vegetation and take action as necessary to maintain the natural habitat. Direct special attention to vegetation used by wildlife, especially bighorn sheep, Sonoran pronghorn, desert tortoise and other sensitive species. Develop and implement programs to protect rare, threatened, and endangered plant species, and to restore impacted vegetation communities.

- Develop and implement a non-native vegetation management program. Identify research needs and coordinate research projects. Evaluate effects of exotic vegetation encroachment on natural springs such as Quitobaquito, native plants, and faunal communities. Assist with research projects to identify

solutions to control or eradicate non-native vegetation. Prioritize and supervise management control programs. Provide professional and technical expertise to park management.

- Develop goals and objectives, defining management issues to be addressed for both native and non-native vegetation management. Develop and draft guidelines and standard operating procedures for resource management activities within area of responsibility.

- Prepare project statements and funding requests identifying and justifying proposed projects and programs. Manage budgets for all vegetation related projects. Research and requisition all equipment and supplies necessary for completion of projects and on-going programs. Track funds from park-based budget as well as from special project monies.

- Draft and prepare in final form environmental assessments, environmental impact statements, and categorical exclusions for proposed actions related to assigned responsibilities. Review and make recommendations to park management for or against projects based on environmental impacts, and makes recommendations for mitigation of impacts.

- Identify the need for research programs in areas of assigned responsibilities and define management issues to be addressed. Prepare proposals, develop and conduct studies and surveys, or coordinate with contractors and monitor research. Evaluate all research on the basis of validity, accuracy, and appropriateness. Act as liaison with researchers conducting studies relating to vegetation.

Personnel: The vegetation management coordinator will be a permanent National Park Service employee.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.6 and 516 DM6 App. 7.4 E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-001 Implement and Manage Vegetation Management Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	52,000	52,000	52,000	52,000
Other	10,000	10,000	10,000	10,000
TOTAL	62,000	62,000	62,000	62,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	62,000	62,000	62,000	62,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-002

2. Project Title: **Develop a Vegetation Management Plan**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: A plan must be developed that will guide vegetation management programs at Organ Pipe Cactus National Monument. No such plan is currently being developed or in effect. A Vegetation Management Plan (VMP) is needed to assist management in the implementation of programs including, but not limited to:

- Revegetation and plant community restoration in natural areas;
- Landscaping in development areas;
- Sensitive plant species management;
- Non-native plant species control;
- Hazardous tree management;
- Preserving cultivars of historical significance;
- Outlining the role of interpretation in vegetation management programs.

Vegetation is dynamic; it changes whether or not it is actively managed. Through vegetation management planning, managers can understand the vegetation dynamics within their park and coordinate short-term actions aimed at achieving long-term goals. Natural resources management, cultural resources management, visitor protection, planning, and maintenance all influence vegetation. Actions taken in one vegetative setting often impact other settings. Coordination is best achieved through a comprehensive management plan which addresses relationships among all vegetation related activities in all areas of the park and its adjacent landscape (NPS 1991f).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The results of no action will be to continue vegetation management with no formal plan to guide actions. This will not provide management with necessary information to make the most knowledgeable decisions regarding vegetation.

B. **Develop Vegetation Management Project Statements and Incorporate Them into the Natural and Cultural Resources Management Plan (RMP).** Vegetation management issues will be identified through the RMP scoping process. Project statements will be developed to address issues and will be incorporated into the RMP.

C. **Develop a Vegetation Management Plan.** A plan will be developed to address vegetation management issues and guide implementation of programs such as revegetation and plant community restoration in natural areas, landscaping in development areas, sensitive plant species management, non-native plant species control, hazardous tree management, preserving cultivars of historical significance and outlining the role of interpretation in vegetation management programs. The final Vegetation Management Plan will be an addendum to the RMP. Project statements from the VMP will be integrated wholly into the RMP for both informational and programming purposes.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Alternative B., however, will serve as the interim activity (as opposed to no action) until a Vegetation Management Plan is developed. In the interim Alternative B. will provide vegetation management project statements for issues that have been identified. This will ensure that vegetation management issues are addressed in resources management activities, research programming and funding priorities.

When funding becomes available, a full VMP will be developed to guide vegetation management activities and provide for long-term program direction. The plan will describe the monument's vegetation and communities, set specific management policies and objectives, identify management techniques and research needs, and provide for long-term monitoring to identify and mitigate impacts on park ecosystems (NPS 1991).

The plan will identify issues and problems, set goals and objectives, summarize information databases and develop, analyze and recommend alternatives. The following elements will be included:

- An introduction, including the monument's objectives for vegetation management and issue definitions;
- A vegetation assessment;
- Management alternatives for meeting the stated objectives and issues, including identification of specific management treatments, preferred alternatives, benefit, drawbacks and annual goals;
- A review of existing research findings and identification of research needs;
- A plan for long-term monitoring, including quantitative standards against which success in achieving the monument's objectives can be measured;
- A strategy for achieving compliance with the National Environmental Protection Act (NEPA), the Endangered Species Act and other compliance requirements;
- An outline of interpretive and public involvement policies; and
- Assignment of roles and responsibilities.

The plan will be an addendum to the Natural and Cultural Resources Management Plan. Upon completion, project statements in the VMP will be integrated into the RMP and allocated priorities in the overall resources management and research program.

Personnel: This project will be contracted. Monument resources management staff will assist with data gathering. Review of the document will involve staff from all monument divisions, National Park Service and/or National Biological Survey scientists and resources personnel, and other applicable individuals.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.6 and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. Project statements developed as part of the VMP will all be evaluated for needed compliance. If collection of vegetation is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-002 Development a Vegetation Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	-	-	-
Personnel Services	2,600	-	-	-
Other	0,000	-	-	-
TOTAL	17,600	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	17,600	-	-	-

References:

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-003

2. Project Title: **Evaluate Effectiveness of and Develop Standards for the Revegetation Program**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: The overall effectiveness of the monument's revegetation program is unknown. An assessment is needed to fully evaluate past revegetation projects, establish standard operating procedures for propagation and monitoring, and develop guidelines to direct future revegetation activities.

For the past fourteen years, Organ Pipe Cactus National Monument (ORPI) has had an active on-going revegetation program designed to restore impacted and disturbed areas to natural conditions. In 1978, 95% of the monument was designated as wilderness, resulting in the closure of approximately 85 miles of primitive roads. The Resources Management Division began growing native plants in a makeshift nursery near monument headquarters in an attempt to recover these areas. A trial and error method used in the nursery paid off fairly quickly, and resulted in successful methods for growing creosote bush and many other plants from seed. During the summer of 1988, a new nursery and greenhouse complex was completed at the Sonoran Desert Biosphere Reserve Center (SDBRC) located near monument headquarters. Also in 1988, the revegetation program expanded beyond revegetating abandoned roads. Nursery grown plants have been used to stabilize soil in erosion areas, and to reclaim other disturbed areas such as construction and development sites. The revegetation program continues to grow annually. Several years of work are still needed to fully restore abandoned roadways. In addition, revegetation efforts continue to become a necessity for many other projects requiring plant salvage and site restoration.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The results of no action will be to continue the revegetation program as has been done for the past fourteen years. New projects will be taken on without a full evaluation of the strengths and weaknesses of past efforts. Standard operating procedures and guidelines will not be available to assist staff. Program continuity and consistency will be jeopardized due to a lack of documentation on procedures and evaluations.

B. **Develop Standards for the Revegetation Program.** Guidelines will be compiled detailing greenhouse and nursery operations. Included will be guidelines covering facility equipment operation, upkeep, and maintenance. Sections will be developed covering various plant propagation methods and techniques pertinent to Sonoran Desert plant species, potting procedures and pre-transplanting care and upkeep. Standard reporting and data management procedures will be established. This project will be accomplished by monument resources management staff. Consultation will be sought from nursery and greenhouse managers associated with government, university, and private institutions. Literature searches will use logs and reports housed at Organ Pipe's SDBRC, and will be extended to university and other libraries.

C. **Evaluate the Effectiveness of the Revegetation Program.** Past revegetation sites will be evaluated based on existing documentation. Plant status, soil conditions, climate data, hydrology, species type, topography, slope and aspect will be factored into the evaluation of revegetation success. Comparable sites with variable techniques will be examined. Test plots will be set up to compare volunteer plant recruitment and establishment against plots using nursery grown transplants. Transplant variables tested will include: type of plant, watering regime, treatments such as fertilizing and mulching, container size, etc. For the plots testing natural recruitment, various site preparations will be used, such as soil scalping, or plowing in severely compacted areas, along with artificial placement of nurse objects, and soil surface erosion control structures. Statistical analyses will be performed comparing various revegetation methods, and will include cost through plant establishment.

6. Description of the Recommended Project or Activity: Both alternatives B. and C. are recommended. Alternative C. will provide the necessary information to develop the standard operating procedures and guidelines identified in alternative B.

The project will consist of the following elements:

- A full evaluation of all past revegetation sites will be completed. Initial work will include reviewing all past documentation on revegetation projects and summarizing to the best extent possible. In the field, revegetation sites will be evaluated. Documentation will assist in determining type and quantity of plants involved at each site. Plant status (mortality, condition, etc.) will be quantified and evaluated in relation to other impacting variables such as soil condition, past climatic conditions, planting technique and species type. An analytical report will be prepared summarizing the results of the evaluation. This analysis will include a critical assessment of techniques, a review of plants used and how they fared under various conditions, and a ranking of preferred alternatives for varying site circumstances.

- An experiment will be conducted to determine the effectiveness of the monument's current program of reliance on containerized nursery grown plants, as opposed to one of applying prepared soil seed mixes. Test plots will be selected. Variables tested will include various plant types, watering regimes, soil mixes and conditions, site disturbance, treatments such as fertilizing and mulching and container size. Each site area will be prepared with heavy machinery. Areas will include at least three test sites. One site will include containerized stock; a seed mix will be applied to the second; and the third will serve as a control. Each site will be monitored over time to determine the success and effectiveness of each method.

- In conjunction with, and based on the results of the above experiments, standard operating procedures will be developed for the overall revegetation program. These will cover facility equipment operation and maintenance, plant propagation methods and techniques pertinent to applicable species, potting procedures, propagule storage considerations, pre-transplanting care and upkeep, standard reporting and data management procedures. The guidelines will also examine natural, developed, cultural and special use zone revegetation. Outside nursery and greenhouse managers associated with government, university, and private institutions will be consulted.

Personnel: Part of the work on this project will be contracted, including the evaluation of past revegetation efforts and the development of standard operating procedures. Monument resources management staff will

work closely with the contractor, providing field assistance and documentation review. The resources management staff will coordinate and supervise the test site experiment.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. An archeological clearance may be necessary for work associated with experimental test sites. If collection of vegetation is necessary as part of this project, a scientific collecting permit from the monument Superintendent must be issued. Specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-003 Evaluate Effectiveness of and Develop Standards for the Revegetation Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	20,000	5,000	0,000	0,000
Personnel Services	22,000	11,000	5,500	5,500
Other	5,000	2,000	1,000	1,000
TOTAL	47,000	18,000	6,500	6,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	47,000	18,000	6,500	6,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe National Monument, Western Region

1. Project Number: ORPI-N-004

2. Project Title: **Revegetate Abandoned Road Portals**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: Several abandoned road portals are visible from primary visitor scenic drives and roadways, leading to vehicular traffic into areas of designated wilderness and, resultant disruption to the recovery of natural ecosystems.

Public Law 94-429, signed in 1978, designated 312,600 acres as wilderness and 1240 acres as potential wilderness within Organ Pipe Cactus National Monument. The National Park Service manages wilderness areas to preserve their wilderness character for the public purposes of recreation, scenic preservation, scientific study, education, conservation, and historical use (NPS 1988). At the time of designation, more than 85 miles of unpaved roads became off-limits to vehicles. These roads were left from mining, ranching and related historic activities. Road scars of this nature are extremely visible and are easily mistaken for active roads or parking areas. Unfortunately, the roads have proved to be quite a temptation for off-road recreation enthusiasts, and this use has further impacted the sensitive desert resource.

Abandoned roads were initially closed by means of 4" x 4" x 8' wooden barriers near ground level, engraved with the words, "Wilderness Area, Vehicles Prohibited" or "Road Closed, Natural Restoration Area". This was sufficient to keep most park visitors from driving on the roads, but a few people simply drove around the barriers and continued to use them. It was clear that the only way to insure that no one would drive in these areas was to make them impossible to find.

Primitive roads were removed from the official park map. It became the objective of resources managers to "camouflage" the entrances of the roads in order to deter their continued use. This was to be accomplished by revegetating the portions of the roadways which were visible from the developed and legitimately utilized areas of the monument. This activity became the genesis of the revegetation program at Organ Pipe Cactus National Monument.

Initially, cacti and other drought resistant species were utilized, due to the ease with which they could be propagated, as well as the minimal care they required upon transplanting into the field. The survival rate was relatively high, but the objective of "camouflaging" the roadways was not being met. It became clear that a linear strip of cacti in an environment consisting primarily of creosote bush (*Larrea tridentata*), brittlebush (*Encelia farinosa*), triangle-leaf bursage (*Ambrosia deltoidea*) and other shrubs did little to hide the roads. Thus the staff began efforts to propagate many of the native shrubs. Fortunately, the trial and error methods used in the nursery enjoyed early success towards this end. Successful methods for growing creosote bush and many other plants from seed were developed.

The revegetation of abandoned road portals has historically relied primarily on volunteer labor. It has enjoyed one volunteer's care and dedication since near its inception. This individual's extensive background in horticulture and arboriculture has helped to establish a viable program.

Overall, the program for revegetating the portals of abandoned roads has been successful. Reliance on seasonal volunteer labor, lack of adequate staff for maintenance and monitoring of numerous sites and competing revegetation priorities have prevented the completion the project. Most significantly, recent construction activities in the residential area and along one of the primary scenic drives have commanded all revegetation resources and capabilities. It has been several years since planting was done at any of the abandoned road portals.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A no action alternative would result in discontinuing the present minimal program of revegetating abandoned road portals. Abandoned roads will continue to be used by visitors and recovery may be indefinitely delayed.

B. **Continue Present Minimal Program of Revegetating Abandoned Road Portals.** This action would result in the continued revegetation of abandoned road portals in a haphazard and disjointed manner. Ability to do work will be based on available volunteer labor, existing materials and competing needs.

C. **Erect Barrier Gates and Signs at Abandoned Road Portals.** Gates and signs will be erected at all abandoned road portals which have not been revegetated. Signs will indicate that the roads are closed to vehicles and that the area beyond is designated wilderness. This alterative, while effective in preventing most vehicle traffic, has been proven not to stop everyone in the past. Even a few vehicles violating the no trespass area can create significant long-lasting damage to fragile desert soils and vegetation.

D. **Revegetate Abandoned Road Portals.** A program will be developed to complete the work initiated on the revegetation of abandoned road portals. Sites previously restored will be evaluated and necessary maintenance will be accomplished. This will include both soil conditioning and plant replacement. Remaining portals will be revegetated using both established and experimental techniques.

6. Description of the Recommended Project or Activity: Alternative D. is the recommended activity. A program will be developed to cost effectively complete the revegetation of abandoned road portals. Activities will include the following:

- At sites not yet restored, a series of experiments will be designed to test various methods for re-establishment of native vegetation. The basis of these studies will be the reduction or elimination of soil compaction and the method of seed introduction onto the sites. Other factors to be considered will be seasonality of activity, species selection, and required maintenance. Test sites will be monitored for a specified time period and results evaluated in terms of success versus cost. The most appropriate strategy will be implemented on all abandoned roads portals in ORPI still requiring revegetation.

- All sites will be extensively monitored for the first two years and periodically for an indefinite period. Documentation will be extensive and will include numbering and tagging of all plants, mapping utilizing global positioning systems and plotting using the monument's geographic information system.

Personnel: This project will be coordinated by the monument's resources management division. Funding will provide for necessary temporary staff to accomplish the work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App 7.4 E(6), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. An archeological clearance may be necessary for work associated with experimental test sites.

8. Funding:

FUNDING

ORPI-N-004 Revegetate Abandoned Road Portals	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	44,000	44,000	44,000	-
Other	5,000	5,000	5,000	-
TOTAL	49,000	49,000	49,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	49,000	49,000	49,000	-

References:

National Park Service, United States Department of the Interior. 1988c. National Park Service Management Policies. 160 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe National Monument, Western Region

1. Project Number: ORPI-N-005

2. Project Title: **Develop and Implement a Site Restoration Program for the Dowling Ranch and the Stack Property**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: Approximately 160 acres of newly acquired land within the monument has been significantly impacted by past use. Action is needed to evaluate the condition of the land and to set up a program of site rehabilitation and restoration.

The Land Protection Plan for Organ Pipe Cactus National Monument recommended that tract 01-105, the Dowling Ranch (157.67 acres), be given the highest priority for protection and acquisition, followed by land tract 01-126, the Stack property (2.0 acres) (NPS 1985d).

Dowling Ranch is located approximately one mile west of Lukeville. The Dowling complex represents the site of the earliest known Anglo-American residence in what is today Organ Pipe Cactus National Monument. In the 1850's Edward E. Dunbar and a partner operated a trading post at the site. Over the years, the area has seen many uses, including serving as a base camp for the US Bureau of Animal Industry, a US Customs station, a mineral processing site, and for most of the twentieth century, a cattle ranch (Greene 1977). The most recent private owner, Gringo Pass, Inc., donated 115 acres of the ranch site to the National Park Service (NPS 1990b). In 1993, the remaining 42.67 acres were acquired by the NPS in a land exchange with Gringo Pass, Inc.

The Stack Property lies about a half-mile north of Lukeville and a quarter mile west of State Highway 85. The site is visible from both Highway 85 and the Puerto Blanco Drive. It includes a well and a drip irrigation system that was most recently used to propagate non-native vegetation, including palm, grapefruit, orange and fig trees, as well as scotch pine. In 1993, the two acres comprising the Stack Property were also acquired by the NPS in a land exchange with Gringo Pass, Inc.

Both the Stack Property and the Dowling Ranch have been impacted by human activity, including livestock grazing, road construction, residential and well development, and non-native plant cultivation. Both properties are bounded by federally designated wilderness. The objective of park management is to return both sites, to the extent possible, to natural conditions.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A no action alternative entails leaving these impacted areas alone and allowing natural restoration to occur. Vehicle traffic will continue into these areas and excessive site erosion will continue.

B. **Close Vehicle Traffic Into the Dowling Ranch and Stack Properties.** Barriers will be placed at roadway entrances to both of these areas. Access will be limited to administrative use. This will allow natural restoration to occur uninterrupted, by limiting impacting vehicular traffic to only official vehicles.

For the Dowling Ranch, however, administrative traffic, primarily for law enforcement purposes, is heavy, and may negate any benefit of establishing traffic barriers.

C. **Develop and Implement a Site Restoration Program for the Dowling Ranch and Stack Property.** A full evaluation of these newly acquired lands will be conducted. This evaluation will include examining the extent of human induced impacts, as well as an investigation of the cultural resources of the sites. Based on this evaluation, a plan for the restoration of these sites will be developed and implemented.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. Due to the extent of impacts on these sites, a proactive program of restoration is the recommended alternative. This will assist the normal process of restoration and provide for a more rapid return to a natural state.

The restoration program will include the development of a vegetation and site restoration plan for both the Stack and Dowling properties. Aerial photographs of both areas will be taken to assist with planning. The plan will include an examination of the impacts and significant cultural resources and will recommend a preferred alternative for site restoration. Items to be included in the plan are a strategy for the removal of all non-native plant species, elimination of compacted soil conditions wherever possible to encourage natural regeneration, and reclamation of all road scars not required for law enforcement activities.

Personnel: This project will be coordinated by the monument's resources management division. Funding will provide for necessary temporary staff to accomplish the work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 E(6), (7), U.S. Department of the Interior. NHPA compliance under section 106 may be required for this project. An archeological clearance has been completed at both the Dowling Ranch and Stack Property.

8. Funding:

FUNDING

ORPI-N-005 Develop and Implement a Site Restoration Program for the Dowling Ranch and the Stack Property	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	33,000	11,000	-	-
Other	8,000	2,500	-	-
TOTAL	41,000	13,500	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	41,000	13,500	-	-

References:

Greene, Jerome A. 1977. Historic Resource Study - Organ Pipe Cactus National Monument, Arizona. USDI, National Park Service, Denver Service Center, Historic Preservation Division, Denver, CO. 204 pp.

National Park Service, United States Department of the Interior. 1985d. Organ Pipe Cactus National Monument - Land Protection Plan. 33 pp.

National Park Service, United States Department of the Interior. 1990b. Environmental Assessment A - Land Exchange with Gringo Pass, Inc - Organ Pipe Cactus National Monument. 14 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe National Monument, Western Region

1. Project Number: ORPI-N-006

2. Project Title: **Develop and Implement a Program to Manage Hazardous Trees**

3. Servicewide Issue: N24 - Other Issues

4. Problem Statement: Certain vegetation types, due to their size, type and/or condition, pose hazards to visitor safety. As defined by the Western Region Directive WR-093 and 1993 Guidelines for Managing Hazardous Trees a "hazardous tree" is any tree, cactus, palm, or other large vascular plant, either alive or dead, which due to outwardly visible defects could fall down (in part or in entirety) and strike a person or property within any portion of a designated development zone (NPS 1993b).

Areas falling within defined locations requiring management of hazardous trees are limited. These areas, however, are of strong concern because of the volume of people that use them. These sites include the residential complex, volunteer campground, visitor campgrounds, visitor center/administration building complex, maintenance facility and pullouts and parking lots along scenic drives. One other area, Quitobaquito, although in federally designated wilderness, is a site that receives a great deal of visitation. It is also an area that contains large non-native, potentially hazardous vegetation, such as cottonwood trees (*Populus fremontii*), and therefore is considered to require management to ensure visitor safety.

A program is needed to manage hazardous trees to minimize threats to staff and visitors. The program, however, must be sensitive to the natural environment for which the monument was established.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A no action alternative would be in violation of Western Region Directive #WR-093 concerning the management of hazardous trees.

B. **Develop and Implement a Program to Manage Hazardous Trees.** A program will be developed to manage hazardous trees in the monument. The program will be in compliance with Western Region Directive WR-093 and will balance safety risks with minimal intrusion into the natural setting of the area.

6. Description of the Recommended Project or Activity: Alternative B. is the preferred option. A program to manage hazardous trees will be developed and implemented. The program will include the following elements:

- Implementation of hazardous tree management activities within the framework of Western Region Directive WR-093 and the 1993 Western Region Guidelines for Managing Hazardous Trees;

- Evaluation of areas to be managed for hazardous trees. Both the boundaries and park acreage within the designated development zone that do and don't require to hazardous tree management activities will be explicitly delineated;

- Identification of plant species to be examined for hazards and a selection of specific individuals to be monitored, based on the level of threat they pose. Implementation of a seven-point rating/evaluation system as described in the 1993 Western Region Guidelines for Managing Hazardous Trees, with a park-specific modification of only the defect rating component (to account for the particular vegetation communities and disease or defect processes existing in the monument ecosystem);

- Development of a reasonable public education program (via interpretive media, safety messages, and other suitable communications) about the known potential for risk of exposure in the monument to hazardous tree conditions;

- Subject monument hazardous tree management activities to the full scope of ongoing environmental compliance review and documentation procedures;

- Designation of particular specimens, complete stands of vegetation, or even entire "showcase" species as exempt from direct, physical mitigation of hazards.

- Establishment of regularly scheduled inspections in order to identify hazardous conditions and observe any worsening of known defective conditions;

- Incorporation into the operations plan for resources management a list of areas to be inspected, and actions scheduled to abate and/or mitigate known hazardous conditions (if any);

- Documentation and review of annual accomplishments.

Personnel: Development of the hazardous tree program will be contracted. This plan will be coordinated and implemented by the monument's resources management and research division. Funding will provide for necessary seasonal staff to accomplish the work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 E(7), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-006 Develop and Implement a Program to Manage Hazardous Trees	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	10,000	0,000	0,000	0,000
Personnel Services	2,600	2,600	2,600	2,000
Other	2,000	2,000	2,000	2,000
TOTAL	14,600	4,600	4,600	4,600
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	14,600	4,600	4,600	4,600

References:

National Park Service, United States Department of the Interior. 1993b. Western Region Directive #WR-093-The Management of Hazardous Trees. 4 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-007

2. Project Title: **Monitor and Mitigate Woodcutting**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities

4. Problem Statement: Woodcutting of tree species such as ironwood (*Olneya tesota*) and mesquite (*Prosopsis sp.*) along the southern boundary of Organ Pipe Cactus National Monument and in adjacent Sonora, Mexico, threatens both these resources and the myriad of plant and animal species dependent on them. Ironwood is a keystone species in the Sonoran Desert, playing a major role in nitrogen, water dynamics and habitat structure within the desert and desert wash communities (Suzán Azpiri 1992). Preliminary surveys indicate that more than 160 plant species, including six threatened succulents, depend upon legumes such as ironwood and mesquite for their germination in the Sonoran Desert. Endangered wildlife species such as the Sonoran pronghorn antelope, desert bighorn and masked bobwhite quail also depend upon these two legumes for shelter and forage (Nabhan and Plotkin 1994). According to National Park Service researchers and other biologists, 36 of the 82 breeding bird species associated with desert mesquite and ironwood forests have declined due to habitat loss (Conservation International 1993).

The accelerated rate of legume tree depletion in the Mexican state of Sonora for charcoal and carvings (Mellink et al. 1991, Nabhan 1992) has reached the Sonoyta region, which borders the monument. The deforestation in the Sonoyta region is the result of woodcutting for charcoal production, brick foundries, tourist crafts and vegetation conversion to exotic pasture grasses (Nabhan and Suzán 1994). Research at the monument focusing on the effects of legume wood cutting, pesticides and herbivory on two night-blooming cereus cacti has found substantial woodcutting within the monument along the southern boundary. The effects of harvesting activities were observed for a distance of at least 500 m beyond the US border into the biosphere reserve, suggesting that the "generated edge" may be 0.5 to 1 km wide (Nabhan and Suzán 1994).

The Mexico-US border in the Organ Pipe-Sonoyta region represents a clear case of habitat fragmentation as a result of contrasting land uses, and the imposition of artificial boundaries onto natural communities (Nabhan and Suzán 1992). Fragmentation of habitats has been recognized as one of the major threats to biological diversity (Harris 1984), dramatically affecting the survival of rare and endangered species (Soulé and Kohn 1989).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** All activities to monitor and mitigate the impacts of woodcutting will cease. Law enforcement patrols, resources management monitoring and interpretation efforts addressing woodcutting will no longer be supported.

B. **Continue Present Program.** The present program of routine resource protection patrols by law enforcement staff and weekly monitoring of sensitive areas such as Quitobaquito by resources management personnel for evidence of woodcutting will continue. Educational efforts through the existing environmental

education outreach program will reinforce conservation ideals and resources protection. Research and monitoring by qualified scientists addressing woodcutting and associated impacts will continue to be encouraged and supported.

C. **Expand and Implement Woodcutting Monitoring and Mitigation Program.** An expanded program to monitor and mitigate the impacts of woodcutting will be developed and implemented. Components of the program will include the establishment of permanent monitoring sites, expanded interpretative efforts within and outside the monument and a concerted effort to work on the issue with Mexican neighbors.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. An expanded woodcutting monitoring program will include the following components:

- A monument liaison will be established to contact and positively interact with Mexican neighbors. This liaison will be a member of the division of resources management, and will possess the ability to work effectively with neighbors and will also understand the biological and sociological aspects of managing a biosphere reserve. Objectives will be to develop a network of monument neighbors to build support and understanding for resources protection and the biosphere concept. The responsibilities of this individual will also including serving as a general liaison within and outside the monument for dealing with woodcutting issues.

- Monitoring efforts will be expanded. A protocol for monitoring woodcutting and impacts throughout the monument will be developed, tested and implemented. Current study sites will be adapted for this monitoring effort and new sites will be identified and established. Protocol implementation, scheduling, data management and linkages with the monument's geographic information system (GIS) will be outlined and established.

- A full evaluation of species at risk due to woodcutting will be completed. Priorities for protection and mitigation alternatives will be identified. Geographic areas in the monument will be ranked according to levels of sensitivity. These areas will be mapped utilizing global positioning system (GPS) technology and will be linked with the GIS to provide for subsequent analysis.

- A format for future land use trends studies on lands surrounding the monument will be developed, incorporating woodcutting as a component of analysis, along with traditional data on groundwater use and agricultural production.

- Research priorities will be established for further studies addressing woodcutting, habitat protection and impacted species.

- Interpretative efforts will be expanded and will incorporate programs both within and outside the monument. Internal programs, primarily to monument visitors, will focus on the impacts of woodcutting and mitigation strategies available, including creating an awareness of the consequences of using mesquite charcoal, purchasing ironwood carvings, etc. Outreach programs will focus on providing information to the local communities in the United States, Mexico and Tohono O'odham Nation, dealing with the impacts of woodcutting and the value of conservation and resources protection. Outreach programs will be developed through the existing environmental education program, "Juntos."

Personnel: Staff will include permanent resources management, interpretative and protection staff currently employed at the monument. Funding will be needed for assistance with establishing monitoring and research priorities and in expanding the interpretive effort.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4) and E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-007 Monitor and Mitigate Woodcutting	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	20,000	10,000	10,000	10,000
Other	50,000	10,000	10,000	10,000
TOTAL	70,000	20,000	20,000	20,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	68,000	18,000	18,000	18,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-050

2. Project Title: **Develop a Wildlife Management Plan**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non Native Animals
N17 - Loss of Biological Diversity

4. Problem Statement: A plan needs to be developed that will guide wildlife management programs at Organ Pipe Cactus National Monument. No such plan is currently being developed or in effect. A Wildlife Management Plan (WMP) is needed to assist in the implementation of programs including, but not limited to:

- Biological diversity.
- Genetic diversity.
- Mitigating management practices adjacent to parks that have negative impacts on wildlife.
- Non-native animal species control.
- Analyzing effects of historic animal management practices.
- Population management.
- Outlining the role of interpretation in wildlife management programs.
- Scientific specimen collecting.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The results of no action will be to continue wildlife management with no formal plan to guide actions. This will not provide management with necessary information to make the most knowledgeable decisions regarding wildlife.

B. **Develop Wildlife Management Project Statements and Incorporate Them Into the Natural and Cultural Resources Management Plan (RMP).** Wildlife management issues will be identified through the RMP scoping process. Project statements will be developed to address issues and will be incorporated into the RMP.

C. **Develop a Wildlife Management Plan.** A plan will be developed to address wildlife management issues and guide implementation of programs such as biological diversity, genetic diversity, mitigate management practices adjacent to parks that have negative impacts on wildlife, non-native animal species control, analyze effects of historic animal management practices, population management, outlining the role

of interpretation in wildlife management programs and procedures for scientific specimen collecting. The final Wildlife Management Plan will be an addendum to the RMP. Project statements from the WMP will be integrated wholly into the RMP for both informational and programming purposes.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Alternative B., however, will serve as the interim activity (as opposed to no action) until a Wildlife Management Plan is developed. Alternative B. will serve the interim benefit of providing wildlife management project statements for issues that have been identified. This will ensure that wildlife management issues are addressed in resources management activities, research programming and funding priorities. Wildlife project statements in the RMP will be located in a variety of program areas including natural resources inventorying and monitoring and threatened, endangered and sensitive species management.

When funding becomes available, a full WMP will be developed to guide wildlife management activities and provide for long-term program direction. The plan will describe the monument's wildlife and communities, set specific management policies and objectives, identify management techniques and research needs, and provide for long-term monitoring to identify and mitigate impacts on park ecosystems.

The plan will identify issues and problems, set goals and objectives, summarize information databases and develop, analyze and recommend alternatives. The plan will include the following elements:

- An introduction, including the monument's objectives for wildlife management and issue definitions;
- A wildlife assessment in terms of biological and genetic diversity.
- Management alternatives for meeting the stated objectives and issues, including identification of specific management treatments, preferred alternatives, benefits, drawbacks and annual goals;
- A review of existing research findings and the identification of research needs;
- A plan for long-term monitoring, including quantitative standards against which success in achieving the monument's objectives can be measured;
- A strategy for achieving compliance with the National Environmental Protection Act (NEPA), the Endangered Species Act and other compliance requirements;

- An outline of interpretive and public involvement policies; and

- Assignment of roles and responsibilities.

The plan will be an addendum to the Natural and Cultural Resources Management Plan. Upon completion, project statements in the WMP will be integrated into the RMP and allocated priorities in the overall resources management and research program.

Personnel: This project will be contracted. Monument resources management staff will assist with data gathering. Review of the document will involve staff from all monument divisions, National Park Service and/or National Biological Survey scientists and resources personnel, and other applicable individuals.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. Project statements developed as part of the WMP will all be evaluated for needed compliance. If collection of wildlife specimens is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-050 Development a Wildlife Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	-	-	-
Personnel Services	2,600	-	-	-
Other	0,000	-	-	-
TOTAL	17,600	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	17,600	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-051

2. Project Title: **Implement and Manage Wildlife Management Program**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non Native Animals
N17 - Loss of Biological Diversity

4. Problem Statement: A commitment of staff and funding is needed to implement and manage the monument's wildlife management program. Management is required for extensive monument programs, including scientific research projects, non-native animal control, threatened, endangered and sensitive species management, long-term wildlife monitoring to determine ecosystem health, and overall wildlife assessments and management. Without the necessary permanent infrastructure, these programs cannot be implemented effectively or efficiently.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in the management of wildlife programs on an as-needed basis. Efforts such as habitat modification will be operated and staffed primarily by volunteers. As a result of this action, an optimal and effective level of wildlife management will not be attained.

B. **Implement and Manage Wildlife Management Program.** A permanent coordinator position to manage and implement the wildlife management program will be established. Responsibilities will include coordinating scientific research projects, non-native animal control, threatened, endangered and sensitive species management, long-term wildlife monitoring to determine ecosystem health, and overall wildlife assessments and management. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the wildlife management program.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A permanent coordinator will direct and manage all activities associated with wildlife management. The coordinator will:

- Develop protocols including those for assessing the status of mammals, birds, reptiles, amphibians and invertebrates. Ensure compliance with protocol design and provides input on field techniques and procedures.

- Coordinate wildlife surveys, including those for bighorn sheep, requiring the use of aircraft. Ensure compliance with aircraft and survey safety requirements. Work with other agencies, including the Arizona Game & Fish Department and US Fish & Wildlife Service, to obtain assistance with surveys.

- Diagnose various resources problems and formulate and write management plans to solve these problems by applying scientifically accepted management and research techniques to effectively evaluate threats to resources and to develop proper mitigation strategies.

- Conduct a program of non-native fauna monitoring and control. Supervise activities, including cattle and other livestock removal. Work with local ranchers and land owners to reduce the occurrence of trespass by livestock. Assist the monument's Integrated Pest Management Coordinator with on-going monitoring and mitigation of species such as Africanized honey bees.

- Coordinate area programs for threatened and endangered wildlife species, as well as candidate species. Keep abreast of frequently changing laws, regulations and individual species status changes. Organize and direct surveys to locate listed or candidate species, determine their distribution, identify their critical habitat and threats to, or impacts upon, such critical habitat. Formulate plans for the protection of these species in consultation with the U.S. Fish and Wildlife Service and Arizona Game and Fish Department.

- Provide technical review, advice and assistance to other members of the monument staff in wildlife management, monitoring and mitigation matters. Develop goals and objectives, defining issues to be addressed for both native wildlife and non-native animal species management. Develop and draft guidelines and standard operating procedures for resources management activities within area of responsibility.

- Document and record wildlife management, monitoring and research activities with audio/visual equipment and still camera formats. Assist in the development and maintenance of resources management slides, video tape, and photo files. Provide photographic documentation of wildlife management, monitoring and research activities to other divisions, agencies, and organizations as appropriate.

- Manage the monument's overall research program - a varied program pursued by NBS scientists, contracted researchers, cooperating researchers and independent investigators. An average of forty separate and distinct studies are being conducted within the monument at any one time. Serve as a liaison with cooperating scientists, provide coordination, draft related correspondence and reports, prepare research/collections permits, review and evaluate research reports and products, maintain research files and implement other activities related to the program. Insure that all research is consistent with NPS standards and that results from research undergo peer and regional review. Facilitate application, review and approval process for independent investigators. Provide oversight on contracted and independent wildlife research.

- Prepare publications on specific wildlife research studies and projects. Publications include those for scientific literature addressing research findings and results, as well as publications for general public distribution.

- Prepare environmental compliance documents for selected wildlife programs and reviews NEPA documents for any work that could affect wildlife. Works with Denver Service Center and other NPS, contractor and outside agency planning staffs on issues relating to monument developments. Review and evaluate NEPA documents prepared by other agencies as well as land use and development plans prepared by local jurisdictions and developers for proposed actions outside of the monument. As appropriate, drafts responses which clearly document any technical errors and omissions and the probable/potential impacts of such proposals.

Personnel: The wildlife management coordinator will be a permanent National Park Service employee.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4, B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-051 Implement and Manage Wildlife Management Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	52,000	52,000	52,000	52,000
Other	10,000	10,000	10,000	10,000
TOTAL	62,000	62,000	62,000	62,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	62,000	62,000	62,000	62,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-100

2. Project Title: **Direct Natural Resources Inventorying and Monitoring Program**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Direction and guidance is needed to effectively steer the Organ Pipe Cactus National Monument's natural resources inventorying and monitoring program into the next phase of program integration and synthesis. After seven years of baseline research and initial monitoring protocol implementation, a review and evaluation of significant components is necessary to validate and properly direct the future course of the overall program.

In September 1986, an international panel of scientists and managers met to plan the development of a program to both assess ecosystem conditions at Organ Pipe Cactus National Monument and to monitor ecosystem components through the future. The step down planning technique was used to efficiently organize the management goals and objectives of this program, entitled the Sensitive Ecosystems Program (SEP). During this meeting, 22 research projects were identified and prioritized. Funding, however, fell short of what was needed to fully implement the program.

Even with reduced funding, the results of the Sensitive Ecosystems Program have given the monument the framework for one of the most extensive ecological research and inventorying and monitoring programs in the NPS. Through this program, baseline data and monitoring protocols have been provided by scientists on monument reptiles, amphibians, small mammal populations, avifauna, terrestrial invertebrates, special status plants, non-native vegetation, endangered species, climate, air quality, groundwater usage, land-use trends on property adjacent to the monument and vegetation structure and diversity in natural communities.

The initial research phase of SEP has been completed. This research phase of the program was designed to establish accounts of monument natural resources, including but not limited to: presence, abundance, distribution, and condition of these resources. Part of this research phase also analyzed past, present, and future land use trends surrounding Organ Pipe Cactus National Monument and indicated associated impacts to the monument's natural resources. By scientific experimentation, researchers were responsible for developing methodologies, tools, and step-by-step instructions for long-term monitoring of identified components that are seen as being the "vital signs" of the monument ecosystem.

An effort is now needed to bring together the results of the baseline research so that an integrated monitoring program can be developed which will accurately assess the status and health of monument ecosystems over time.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in monument staff implementing monitoring protocols as recommended by the principal investigators. No effort will be made to integrate the protocols so that the various components (such as climate and vegetation) can be compared and analyzed. The ability of the monitoring program to gauge the health of the monument ecosystem will not be determined.

B. **Direct Natural Resources Inventorying and Monitoring Program.** A science advisory committee will be established to serve as a steering group to guide the direction of the program. Specific tasks to be initiated will include an examination of final research reports and monitoring protocols, an evaluation of monitoring sites and ecosystem components, an assessment of data and information management needs and an evaluation of program elements for transferability to other arid areas.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A science advisory committee will be established and consist of five members. The committee will include researchers who are familiar with the monument ecosystem, resource managers who are familiar with the daily routine of conducting resource monitoring, and National Park Service and/or National Biological Survey scientists who have experience managing cooperative research and monitoring programs (NPS 1993a).

The science advisory committee will meet at least four times a year. The group will solicit participation from other individuals on an as needed basis. Activities the committee will work on include:

- Evaluation of monitoring sites. Determine the appropriate number of sites and where they are to be placed in order to provide a comprehensive ecological characterization of the monument. Examine current monitoring sites and present ranking in core areas. Determine if there are additional places in the monument where monitoring should be done. Issues to consider are the purpose of the plots, ecological significance of the plots, number of sites needed, gradients captured and potential changes and threats to ecosystem health.

- Determination of ecosystem components. Determine the full complement of ecosystem components that need to be monitored in order to understand the function of the whole and its most critical parts. Issues include the physical environment, primary production, primary consumers, secondary consumers and the relationships between ecosystem components.

- Identification of monitoring which needs to be conducted to understand changes associated with specific human-induced impacts or perceived threats.

- Management of data and information. Evaluate if data is being properly collected, stored, analyzed and converted into usable information for: researchers involved in integration and synthesis; interpreters in presentations to the public; resources managers in evaluating the condition of the resources; and, management in making decisions which may impact resources.

- Examination of the overall program. Many aspects of the program need to be addressed including: 1) a process for the critique of final research reports and monitoring protocols; 2) development of a standardized database management system, incorporating the geographic information system; 3) preparation of a unified reporting system; 4) development and testing of a training curriculum for

monitoring staff; 5) assessment of collected monitoring data; 6) establishment of evaluation protocols for the program; and 7) evaluation of program elements for transferability to other arid areas.

- Development of project statements for the Natural and Cultural Resources Management Plan (RMP) for activities to support and develop the natural resources monitoring program.

Personnel: The science advisory committee will be composed of National Park Service and/or National Biological Survey resources management and research staff as well as scientists familiar with the monument's ecosystem.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.6, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-100 Direct Natural Resources Inventorying and Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	5,000	5,000	5,000	5,000
Personnel Services	0,000	0,000	0,000	0,000
Other	2,000	2,000	2,000	2,000
TOTAL	7,000	7,000	7,000	7,000
Funds Available in Park Base	7,000	7,000	7,000	7,000
Additional Funds Needed	0,000	0,000	0,000	0,000

References:

National Park Service, United States Department of the Interior. 1993a. Organ Pipe Cactus National Monument, Natural Resources Management, Sensitive Ecosystems Program - Monitoring Activities Annual Report - FY 1992. Division of Natural Resources and Research. 78 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-101

2. Project Title: **Manage Natural Resources Monitoring Program**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: A commitment of staff and funding is required to fully manage the monument's natural resources monitoring program. Several years of baseline research has yielded an array of monitoring protocols for use in evaluating the health of the monument ecosystem. To properly implement the program, it is necessary for an effective management and administrative infrastructure to be in place.

In September 1986, an international panel of scientists and managers met to plan the development of a program to both assess ecosystem conditions at Organ Pipe Cactus National Monument and to monitor ecosystem components through the future. The step down planning technique was used to efficiently organize the management goals and objectives of this program, entitled the Sensitive Ecosystems Program (SEP). During this meeting, 22 research projects were identified and prioritized. Funding, however, fell short of what was needed to fully implement the program.

Even with reduced funding, the results of the Sensitive Ecosystems Program have given the monument the framework for one of the most extensive ecological research and inventorying and monitoring programs in the NPS. Through this program, baseline data and monitoring protocols have been provided by scientists on park reptiles, amphibians, small mammal populations, avifauna, terrestrial invertebrates, special status plants, non-native vegetation, endangered species, climate, air quality, groundwater usage, land-use trends on property adjacent to the monument and vegetation structure and diversity in natural communities.

Proper management of the program is necessary to continue baselines established during the initial research through implementation of monitoring protocols. This initial data will assist in future efforts to integrate the monitoring protocols, allowing for the development of a more comprehensive program of ecosystem assessment.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in monument staff not implementing monitoring protocols as recommended by the principal investigators. Databases established by principal investigators will not be continued.

B. **Manage the Natural Resources Monitoring Program.** A permanent coordinator position to manage the natural resources monitoring program will be established. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the natural resources monitoring program.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A permanent coordinator will direct and manage all activities associated with natural resources monitoring. Support will be provided via an administrative assistant. The coordinator will:

- Be responsible for the overall coordination of research activities associated with the natural resources monitoring program;

- Maintain contact as appropriate with the research community involved with natural resources monitoring and will act as liaison for integrating the various disciplines involved in the program;

- Develop, implement and coordinate the natural resources monitoring program emanating from proposed protocols. Prepare the annual operating program and schedule all activities. Identify personnel needs and maintain equipment to be used as part of the natural resources monitoring effort;

- Select, supervise and provide training to seasonal and permanent biological technicians in implementing the monitoring program;

- Maintain and manage all monitoring data, correspondence, reports and records.

- Maintain written and verbal communication with the international community (Mexico) to facilitate natural resource research taking place in Mexico.

Personnel: The natural resource monitoring coordinator will be a permanent National Park Service employee.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.6 and 516 DM6, App. 7.4 E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-101 Manage the Natural Resources Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	43,000	43,000	43,000	43,000
Other	5,000	5,000	5,000	5,000
TOTAL	48,000	48,000	48,000	48,000
Funds Available in Park Base	48,000	48,000	48,000	48,000
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-102

2. Project Title: **Develop Database Management System for Natural Resources Monitoring and Research Program**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: A database management system is needed to manage, analyze, interpret and archive large natural resources monitoring data sets. Baseline research and natural resources monitoring have generated extensive data sets which require a sophisticated data management system to properly utilize and integrate information. Linkages among databases are essential for promoting an understanding of the relationships among resources and identifying long-term trends and thresholds.

The monument's natural resources monitoring program, called the Sensitive Ecosystems Program, was initiated in 1987. Since that time, baseline data has been acquired on nocturnal rodents, birds, amphibians, reptiles, climate, groundwater, terrestrial invertebrates, land use trends, special status plants, non-native vegetation, ecosystem recovery from past cattle grazing, boundary vegetation patterns and vegetation structure and diversity in natural communities.

Much of the baseline research has been completed. Large databases have been generated as part of both this research and other general biological studies. As part of the inventory process, monitoring protocols were developed and implemented to allow for the continued gathering of basic biological data on components of the monument's ecosystem.

Commercial application programs have been used to manage data thus far. Different protocols utilize a variety of these applications. Currently there are no linkages between data sets, thus integrative modeling and assessments cannot be completed. In addition, there has not been an effort to unite natural resources monitoring data with the monument's geographic information system.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Natural resources and research data will continue to be stored and evaluated using present methods. No effort will be made to integrate databases or to link them to the monument's geographic information system. As a result, large data sets will continue to be stored and used under less than optimal conditions. No long-term system will be available to manage these databases. The ultimate objectives of providing management with tools to make informed decisions regarding natural resources will be compromised.

B. **Develop Database Management System for Natural Resources Monitoring and Research Program.** An evaluation will be made of the current natural resources monitoring and research program and the type of data collected. Current methods of data storage and retrieval will be evaluated. An action program will

be developed and implemented, outlining the desired requirements, including database integration and geographic information system linkage.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Components of this alternative will include:

- An evaluation and assessment of the natural resources monitoring and research program. The type of data collected will be examined and reviewed in terms of purposes for collection and use. A literature search will be conducted to identify similar programs and possible customized database management systems.

- Current methods of data management will be appraised. The strengths and weaknesses of current applications will be identified. Each natural resources monitoring protocol and associated data management requirements will be critically evaluated.

- An action plan will be developed based on the above assessment. Goals of the natural resources monitoring and research program will direct the structuring of the plan. Commercial applications versus customized software will be evaluated. A key component of the plan will include the identification of a database management system which will allow for the integration of data sets for analysis and modeling with linkages to the monument's geographic information system.

- The action plan will be implemented and a database management system constructed based on the overall program objectives identified in the plan. The system will be fully supported with a user friendly interface and user manuals.

Personnel: This project will be completed through either a contract or a cooperative agreement with the Advanced Resources Technology at the University of Arizona, Tucson, AZ. The Natural Resources Monitoring Science Advisory Committee, monument resources management staff and National Park Service and/or National Biological Survey scientists will be involved in the action plan development, review and implementation.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4) and E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-102 Develop Database Management System for Natural Resources Monitoring and Research Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	70,000	-	-	-
Personnel Services	80,000	-	-	-
Other	0,000	-	-	-
TOTAL	80,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	80,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-103

2. Project Title: **Prepare and Publish Natural Resources Monitoring Handbook and Video**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Several completed natural resources monitoring protocols need to be compiled and edited. These protocols illustrate the mechanics of the overall program and provide step-by-step instructions for implementation, data analysis and management. Monitoring protocols, however, are currently scattered within separate documents and are not available as one unified handbook. In addition, an illustrative means of instructing new resources management personnel in protocol implementation is needed. The written protocols themselves have proven incapable of providing the graphic detail necessary to understand the ecological components of some of the protocols.

The monument's natural resources monitoring program, called the Sensitive Ecosystems Program, was initiated in 1987. Since that time, baseline data has been acquired on nocturnal rodents, birds, amphibians, reptiles, climate, groundwater, terrestrial invertebrates, land use trends, special status plants, non-native vegetation, ecosystem recovery from past cattle grazing, boundary vegetation patterns and vegetation structure and diversity in natural communities.

A requirement for most of the baseline studies was the development of a tested monitoring protocol that could be used to monitor various groups of flora and fauna over time. As a result of these monitoring protocols, the monument has established the framework for one of the most extensive NPS ecological research and inventorying and monitoring programs.

Monitoring protocols are currently located within final reports, as addendums to other deliverables or as separate stand alone documents. Several of the protocols have been tested and implemented by resources management staff. While detailed instructions for protocols are provided, it will be necessary to standardize the format, consolidate all the protocols into one source and provide better illustrations and training materials on procedures and techniques.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Natural resources monitoring protocols will not be edited, standardized and consolidated into one format. A training video will not be developed to instruct new resources management monitoring staff. Protocols will be implemented in their present format. As a result of no action, the monument's monitoring program will continue, but no unified source with a standardized narrative will be available to minimize chances for misinterpretation of protocol procedure, nor will training materials be available to guide new staff members.

B. **Standardize Format of Monitoring Protocols.** Monitoring protocols will be reviewed and the format standardized. Protocols will continue to exist as separate documents. As a result of this action, the ease

and understanding of the protocols will be enhanced. One source containing all monitoring protocol information will still not be available.

C. **Prepare and Publish Natural Resources Monitoring Handbook and Video.** As in alternative B., monitoring protocols will be reviewed and the format standardized. In addition, all protocols will be consolidated into one handbook. The handbook will be enhanced with graphics illustrating procedures and techniques. Using the handbook as a source, a descriptive training video will be prepared, providing detailed information on protocol implementation and data management. As a result of this action, a much more user friendly system of organizing and describing protocols will be available to assist monitoring staff. In addition, the learning of protocol applications will be simplified through the use of a training video.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. Associated activities will include:

- Assessing the existing monitoring protocols to evaluate format and ease of interpretation.

- Developing a standard monitoring protocol format and modifying existing protocols to fit this system. Factors involved in establishing the format will be ease of use, interpretation and completeness. Included in the format will be instructions for all phases of protocol implementation, including field preparation, field procedures, report requirements and data management.

- Generating narrative descriptions and graphics to illustrate monitoring methods and techniques.

- Designing and developing a handbook which will consolidate all of the monitoring protocols. A primary version will be created for monument use and will include all protocols and materials. A general distribution version will also be available, in which reference to sensitive species, including maps and descriptions, will be absent. The handbook will be in loose-leaf format to incorporate updates and changes to protocols.

- Based on the handbook, a training video will be developed. The video will describe monitoring procedures and techniques and will illustrate their proper implementation. A professional product will be created, and will include an effective narrative and editing.

Personnel: The National Park Service Cooperative Park Studies Unit, University of Arizona, Tucson, AZ, and/or the National Biological Survey, in conjunction with monument resources management staff, will coordinate the development of the handbook and video. A contract will be awarded to compile and edit the document, and to develop the handbook graphics and training video.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-103 Prepare and Publish Natural Resources Monitoring Handbook and Video	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	-	-	-
Personnel Services - CPSU/UA	10,000	-	-	-
Personnel Services - ORPI	2,000	-	-	-
Other	2,000	-	-	-
TOTAL	44,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	44,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-104

2. Project Title: **Replace and Supplement Climate Monitoring Equipment**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Since 1988, as part of the monument's natural resources monitoring program, extensive climate data has been collected at nine different locations in the monument. This has been accomplished via automated weather stations equipped with datapod digital recorders from Omnidata, Inc. Automated weather station equipment installed at natural resources monitoring sites in 1987 and 1988 has begun to breakdown and exhibits frequent recording malfunctions. Exposure to extreme high temperatures, coupled with constant use, has contributed to the equipment's deterioration. In addition, there are two monitoring sites which require the initial installation of climate stations. The climate data gathered at these stations is a critical component of both the monument's natural resources monitoring and research programs. Present equipment must be replaced and a program of cyclic replacement must be established for the future.

Not all climate stations are equipped with a full array of monitoring equipment. At a minimum, air temperature, relative humidity and precipitation are recorded. At fully equipped stations, air temperature and relative humidity are measured at 48 inches above the ground (U.S.N.W.S. standard). Also recorded are air temperature at 15 cm, soil temperature at 10 cm depth, precipitation, wind speed and direction and solar radiation. Information is recorded hourly for most variables and stored in a computer database. Weather stations are serviced and the computer chips are retrieved and downloaded once a month. Calibration of air temperature sensors and relative humidity sensors is done semiannually and calibration of tipping bucket rain gauges is done yearly. Although this planned maintenance system has prevented the development of some problems, many equipment failures have occurred. As equipment breakdowns become more frequent, repair costs have the potential of escalating. In addition, repair parts and services may become scarce as the equipment ages.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Existing climate stations and equipment will continue to be used. Equipment that breaks down will be repaired at the monument or sent to the manufacturer. Eventually some equipment may no longer be repairable, resulting in a loss of data and eventual elimination of the climate monitoring effort.

B. **Discontinue Climate Monitoring.** All climate stations and equipment will be removed from the field. Data collection will no longer continue. Staff time and funds will be reallocated. Climate data will no longer be available to evaluate monitoring data or assist researchers with their studies.

C. **Replace Climate Monitoring Equipment.** Monitoring equipment at all climate stations will be replaced with new updated equipment. Equipment will be selected based on compatibility with existing data

sets, durability in the field and a cost/benefit analysis. Potentials such as greater memory capabilities, user friendly software and transmission down-loading will be evaluated.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. Several advances have been made in the field of outdoor electronic recording technology since the automated weather stations were installed. Sophisticated but simple to use application generator software packages for data recorders are available to ease field data logger set-up, data retrieval and data presentation. In addition, there are many data loggers on the market which surpass the datapod recorders in durability and quality. The following activities will be accomplished:

- A literature search will be done to determine the proper equipment to meet the monument needs. This equipment will be purchased after a careful analysis of all variables;

- Equipment will be installed at all existing climate stations. All stations will be fully equipped to monitor the full array of variables;

- Two additional climate stations will be established at the new monitoring study sites of Pozo Nuevo and Lower Colorado Larrea;

- A program of cyclic replacement for climate monitoring equipment will be established.

Personnel: Monument resources management staff will purchase and install the equipment. Assistance will be requested from the manufacturer.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.7 and 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-104 Replace and Supplement Climate Monitoring Equipment	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	4,500	-	-	-
Other	75,000	-	-	-
TOTAL	79,500	-	-	-
Funds Available in Park Base	4,500	-	-	-
Additional Funds Needed	75,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-105

2. Project Title: **Map Natural Resources Monitoring Study Sites**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Accurate high resolution base maps are needed for all natural resource monitoring study sites. Maps must include the locations of all permanent plots which contain mammal grids, lizard and bird transects, perennial vegetation quadrats and the locations of monitored individuals of sensitive plant species. In addition, topography and man-made features such as General Land Office (G.L.O.) survey markers and other geographic features will be included.

The monument's natural resources monitoring program, called the Sensitive Ecosystems Program was initiated in 1987. Since that time, baseline data has been acquired on nocturnal rodents, birds, amphibians, reptiles, climate, groundwater, land use trends, special status plants, non-native vegetation, ecosystem recovery from past cattle grazing, boundary vegetation patterns and vegetation structure and diversity in natural communities.

Most of the baseline research was collected at select study sites, which vary in size from 2.5 hectares to 126 hectares. Initially, 14 study sites were identified, with another four added later. The sites were designed to represent both sensitive and typical habitat types. Included are areas such as a typical creosote/bursage community, canyon habitat, sensitive species sites, riparian areas and regions potentially impacted by adjacent land use.

The only graphic descriptions prepared for these study sites are sketches on topographic maps. The purpose of the maps was to allow principal investigators to locate the general boundaries of each study area. Only six sites were given defined boundaries, denoted by rebar at corner points. Other sites are identified by topographic features.

As the monitoring program becomes integrated and institutionalized, it is of paramount importance that study sites and associated research transects and plots be accurately mapped. This is necessary for ecological modeling, evaluating abiotic and biotic data sets, extrapolating monitoring results and ease of relocating sites in the field.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Natural resource monitoring sites will not be mapped. Existing site descriptions will be used and monitoring transects and plots will be illustrated on existing sketch maps. As a result of this action, it will continue to be difficult to locate transects. Ecological modeling and spatial analyses using sophisticated and accurate maps will not be possible.

B. **Map Natural Resources Monitoring Study Sites.** All natural resources monitoring study sites will be mapped using global positioning system technology. Research transects, plots and grids will also be mapped. This alternative will allow natural resources monitoring field work to progress more efficiently. In addition, the ability to conduct ecological modeling using natural resources monitoring data sets will be facilitated by the availability of high resolution digital maps.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. High resolution ortho-photographs will be taken of all study sites. From these orthos, accurate large-scale topographical base maps of the study sites (1:500 scale, 10 foot contour interval) will be produced, using optical projection methods. A survey utilizing global positioning system (GPS) equipment will be used to georeference the permanent plots. Points will be established in the field, and geographic coordinates using GPS will be established. A control point base station located at monument headquarters will provide data so that field measurements can be differentially corrected to provide more accurate readings. Research transects, plots, grids and individual sensitive plant species will also be mapped and differentially corrected using GPS.

Field data will be down-loaded into the monument's geographic information system. High resolution digital study site maps will be incorporated into the main monument database. The end product will consist of high resolution digital maps of all natural resources monitoring study sites, and updated primary geographic information systems database that includes mapped ecological monitoring research areas.

Personnel: An amendment to the existing cooperative agreement with the Advanced Resources Technology Lab, University of Arizona, Tucson, AZ, will be prepared for this work. Monument resources management staff will assist with fieldwork and data integration.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-105 Map Natural Resources Monitoring Study Sites	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	50,000	-	-	-
Personnel Services	10,500	-	-	-
Other	5,000	-	-	-
TOTAL	65,500	-	-	-
Funds Available in Park Base	10,500	-	-	-
Additional Funds Needed	55,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-106

2. Project Title: **Publish and Distribute Natural Resources Inventory and Assessment Final Reports**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Several completed natural resources inventory and assessment reports need to be edited, published and distributed. These reports provide the baseline from which existing ecological monitoring protocols have been developed. Final reports need to be available for scientific review and information, public awareness and program evaluation.

The monument's natural resources monitoring program, called the Sensitive Ecosystems Program, was initiated in 1987. Since that time, baseline data has been acquired on nocturnal rodents, birds, amphibians, reptiles, climate, groundwater, terrestrial invertebrates, land use trends, special status plants, non-native vegetation, ecosystem recovery from past cattle grazing, boundary vegetation patterns and vegetation structure and diversity in natural communities.

Much of the baseline research has been completed. Final reports for most studies have been submitted, reviewed and approved. Lack of funding, however, has prevented the editing, publishing and distribution of this important information.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Natural resources inventory and assessment final reports will not be published or distributed. Information will remain in monument files for use primarily by monument staff. As a result, baseline data will not be readily available to the scientific community or the public. Studies may be duplicated elsewhere without the benefit of knowledge already acquired.

B. **Provide Minimal Distribution of Final Reports.** Information as to what natural resources inventory and assessment reports are available will be distributed, primarily to the local scientific community The reports will be photocopied and supplied upon request. Thus information from the final reports will be available on at least a minimal basis. The scientific community, most likely users of the information, will have better access to the reports.

C. **Publish and Distribute Natural Resources Inventory and Assessment Final Reports.** The backlog of approved final reports will be edited, published and distributed to identified universities, researchers and other sources. The result will be to enhance the overall monitoring program by providing access to results and conclusions.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. An assessment will be made of the backlog of final reports awaiting publication. Priorities will be set as to

which reports should be made available first. Data, including maps and descriptions of sensitive resource information, will be removed from reports intended for distribution.

The Cooperative Park Studies Unit, University of Arizona and/or the National Biological Survey will coordinate editing, publication and eventual distribution of the reports. The reports will be issued in either the existing technical report series or a similar format, but will be identified as part of the monument's natural resources monitoring program series.

Personnel: The National Park Service Cooperative Park Studies Unit, University of Arizona, Tucson, AZ, and/or the National Biological Survey will coordinate the editing, publication and distribution of the final reports. Monument resources management staff will assist with editing, including ensuring the removal of sensitive data, establishing priorities for publication and identifying sources for distribution.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-106 Publish and Distribute Natural Resources Inventory and Assessment Final Reports	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services - CPSU/UA	32,000	-	-	-
Personnel Services - ORPI	20,000	-	-	-
Other	0,000	-	-	-
TOTAL	52,000	-	-	-
Funds Available in Park Base	52,000	-	-	-
Additional Funds Needed	0,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-107

2. Project Title: **Develop an Avian Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: A monitoring protocol is needed for avian species in the monument. The status and role of avian populations are considered a vital link in the overall assessment of the monument ecosystem. Without this information, a critical integrative component will be missing in the monument's monitoring program.

As part of the monument's natural resources inventorying and monitoring effort, the Sensitive Ecosystems Program, a study was initiated in 1988 to evaluate the status of avian species and to develop a protocol to evaluate bird populations over time. The request for proposals identified as primary objectives:

- The design of a study that will provide information about the distribution and relative abundance of species named in the monument's birds inventory and checklist and/or such other species as may be deemed to be of importance;

- Review and evaluate the bird section of the monument's "red list."

- Establish criteria for selecting species and study sites to be included in a long-term monitoring effort (NPS 1988).

A draft final report and monitoring protocol were submitted, but never approved or finalized. The monitoring protocol was designed to obtain information on the relative abundance of all breeding birds at the 17 study sites during breeding and non-breeding periods. This was to be done by censusing birds within belt transects, with the belt width varying, dependent on the particular study site.

Concerns have been expressed about the methodology and the usefulness of data collected from this draft protocol. The principal investigator did not complete the project and is no longer associated with the study.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A protocol for monitoring avian populations will not be developed. No attempt will be made to incorporate birds into the monument's integrated monitoring program. The result will be that a vital component needed to develop an assessment of ecosystem health will not be available.

B. **Implement the Draft Avian Monitoring Protocol.** The draft avian monitoring protocol will be implemented. Belt transects will be run at all study sites. Direct counts will be made of all birds heard or seen within the transect while walking down the transect line. Observations of sex, behavior, and age will be recorded. Plot mapping will be used to record the location of bird sightings within the transect belts.

All bird species occurring off the transects will also be recorded. This alternative will be to implement a protocol with questionable results. The time and effort spent may yield little value.

C. **Develop Avian Monitoring Protocol.** A thorough evaluation of all work to date will be completed. The existing draft final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of avian populations. The results of this alternative will be to provide the apparatus and sequence for developing an effective and useful monitoring tool.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Activities to be accomplished include:

- The goals and objectives of avian monitoring will be evaluated and refined in light of the developing integrative nature of the natural resources monitoring protocol. Emphasis will be on the utilization of avian populations as an interrelated component in assessing ecosystem health.

- A thorough examination of the existing avian draft final report and monitoring protocol will be completed. Leading ecologists with experience in bird censusing will be sought to peer review the report. A literature search will be conducted to reference and compare similar work.

- Data collected as part of the baseline study and protocol testing will be reviewed. The methodology will be investigated and validated in the field. A variety of field personnel will be used to compare the implementation of techniques and the accuracy of data.

- Alternative methods for sampling avian populations will be identified and tested in the field. The emphasis will be on isolating techniques which will provide meaningful data in light of the overall program goals and objectives.

- A preferred option will be selected for monitoring avian populations. A monitoring protocol will be developed in a format consistent with program requirements. Monument resources management staff will be trained in protocol implementation.

Personnel: The work for this project will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ. Monument resources management staff will assist in protocol review and field testing.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. dead birds, etc.) is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-107 Develop an Avian Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	25,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	25,000	25,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	25,000	25,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-108

2. Project Title: **Develop a Terrestrial Invertebrate Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: A monitoring protocol is needed to monitor terrestrial invertebrate populations in the monument. The status and role of terrestrial invertebrates are considered a vital link in the overall assessment of the monument ecosystem. Without this information, a critical integrative component will be missing in the monument's monitoring program.

As part of the monument's natural resources inventorying and monitoring effort, the Sensitive Ecosystems Program, a study was initiated in 1987 to evaluate the ecology of invertebrates and to develop a protocol to evaluate invertebrate populations over time. The request for proposals identified the following as primary objectives:

- Determine which invertebrate species are important to monument ecosystems generally, and particularly in the designated research sites;
- Identify any indicator species and explain how they relate to naturally functioning ecosystems in the monument or any deviations from natural processes;
- Identify whether non-native species pose a threat to the integrity of native plants and animals in the monument;
- Supplement the monument's museum collection of invertebrates;
- Provide monument staff with a methodology for monitoring the "health" of the monument's invertebrate populations (NPS 1987).

In 1987, a contract for the implementation of the study was awarded to Dr. Kenneth J. Kingsley. The study examined the distribution and ecology of invertebrates in the monument. The period of the invertebrate survey was marked by low rainfall and high temperatures, creating difficult conditions for many invertebrate species. The survey was limited to easily visible (macroinvertebrate) taxa, primarily arthropods. Over 5,000 records and 4,200 specimens were made. More than 1,000 taxa were recorded. Most taxa were rare, with 439 being recorded only once. Only 50 taxa were recorded more than 10 times.

A final report and monitoring protocol were submitted. The study provided one of the most comprehensive invertebrate surveys to date. The invertebrate museum collection is probably one of the most complete in the National Park Service. The monitoring protocols, however, pose a problem in both their value and implementation. During the survey, the effects of weather were apparently so profound as to override any other factors, and thus limited conclusions which could be drawn from the data. This precluded derivation

of conclusions about the importance of other population-regulating factors and complicated development of a meaningful long-term monitoring plan (Kingsley 1991).

To develop a valid monitoring protocol for terrestrial invertebrates, it will be necessary to revisit the conclusions and recommendations from this study. Invertebrates represent an important component of the monument's overall integrated monitoring program. It is necessary that an effective but practical protocol be developed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A protocol for monitoring terrestrial invertebrate populations will not be developed. No attempt will be made to incorporate invertebrates into the monument's integrated monitoring program. Thus, information on a that a vital component necessary to develop an assessment of ecosystem health will not be available.

B. **Implement the Existing Terrestrial Invertebrate Monitoring Protocol.** The existing terrestrial invertebrate monitoring protocol will be implemented. Techniques identified by the principal investigator will be fully executed at all study areas. The results of this alternative will be to implement an expensive and time-consuming set of protocols which may provide questionable results. The time and effort spent may yield little value.

C. **Develop Terrestrial Invertebrate Monitoring Protocol.** A thorough evaluation of all work to date will be completed. The existing final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of invertebrate populations. The results of this alternative will be to provide the apparatus and sequence to developing an effective and useful monitoring tool.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Activities to be accomplished include:

- The goals and objectives of invertebrate monitoring will be evaluated and refined in light of the developing integrative nature of the natural resources monitoring protocol. Emphasis will be on the utilization of invertebrate populations as an interrelated component in assessing ecosystem health.

- A thorough examination of the existing terrestrial invertebrate final report and monitoring protocol will be completed. Leading ecologists with experience in censusing invertebrate populations will be sought to peer review the report. A literature search will be conducted to reference and compare similar work.

- Criteria will be established for selecting species and study sites to be included in a long-term monitoring effort, considering, but not limited to, species that are: special status (i.e. endangered, threatened or sensitive); occupy different trophic levels, feeding guilds, etc. so that all levels are represented; and common, dominant, endemic, non-native and species of special interest; which occupy sites that are subject to dramatic change, such as alteration of habitat.

- Data collected as part of the baseline study and protocol testing will be reviewed. The methodology will be investigated and validated in the field. A variety of field personnel will be used to compare the implementation of techniques and the accuracy of data.

- Alternative methods for sampling invertebrate populations will be identified and tested in the field. The emphasis will be on isolating techniques which will provide meaningful data in light of the overall program goals and objectives.

- A preferred option will be selected for monitoring invertebrate populations. A monitoring protocol will be developed in a format consistent with program requirements. Monument resources management staff will be trained in protocol implementation.

Personnel: The work for this project will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ. Monument resources management staff will assist in protocol review and field testing.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-108 Develop a Terrestrial Invertebrate Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	40,000	40,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	40,000	40,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	40,000	40,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-109

2. Project Title: **Update Monument Flora Inventory**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: The monument flora inventory needs to be updated. More than a decade has passed since publication of Bower's (1980) Flora of Organ Pipe Cactus National Monument. Since then, extensive plant collections and a number of research projects have added substantially to the available botanical information of the area (Felger 1993). The current vascular plant database is inadequate to support the monument's geographic information system, natural resources monitoring program and general research projects.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument flora inventory will not be updated. This will result in inadequate and outdated information being used to support natural resources management and research efforts.

B. **Update Monument Flora Inventory.** A project will be developed to bring the monument's plant inventory up to date. The project will provide a new information resource for managers and researchers in the form of a detailed bibliography of relevant botanical literature. The project will also produce a new tool for interpretation in the form of a user-friendly key for identification of plants within the monument.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A project will be designed to update the monument's flora inventory. Objectives of the project will be to:

- Complete an in-depth survey of monument flora and prepare an updated and comprehensive checklist of higher plants found in the monument. This listing will include significant synonyms. Taxonomic decisions will be based on ongoing floristic studies in the region, and will incorporate current systematic research. The listing will be prepared in a readily useable format, and will be alphabetical by family, genus and species for ease of use. This listing, as well as other information generated from the project, will be made available to the monument in a standardized electronic format.

- Prepare an in-depth, current bibliography of botanical publications relating to the plant taxa occurring in the monument. This bibliography will be indexed and cross-referenced for each taxon.

- Prepare an original identification key to families, genera, species and infraspecific taxa of plants of the monument, striving for ease of use by the non-botanist.

Personnel: This project will be contracted. Monument staff will assist in product review and approval of the final project.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-109 Update Monument Flora Inventory	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	20,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	20,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	20,000	-	-	-

References:

Bowers, Janice. 1980. Checklist of Vascular Plants of Organ Pipe Cactus National Monument, Arizona. Southwest Parks & Monuments Association, Tucson, AZ. 32 pp.

Felger, Richard, S. 1993. Plants of Organ Pipe Cactus National Monument. A Proposal to the Southwest Parks & Monuments Association. 7 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-110

2. Project Title: **Conduct Survey of Study Site Soils, Surficial Geology and Hydrology**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: Site descriptions of soils, surficial geology and hydrology are needed at eighteen natural resources monitoring study sites. This data is required to provide necessary information for the development of the monument's integrated natural resources monitoring program. Such measurements are important for a more complete understanding of the ecosystem and its individual components.

The monument's natural resources monitoring program, called the Sensitive Ecosystems Program, was initiated in 1987. Since that time, baseline data has been acquired on nocturnal rodents, birds, amphibians, reptiles, climate, groundwater, land use trends, special status plants, non-native vegetation, ecosystem recovery from past cattle grazing, boundary vegetation patterns and vegetation structure and diversity in natural communities.

Most of the baseline research was collected at select study sites varying in size from 2.5 hectares to 261 hectares. Initially, fourteen study sites were identified, with another four added later. The sites were designed to represent both sensitive and typical habitat types. Included are areas such as a typical creosote/bursage community, canyon habitat, sensitive species sites, riparian areas and regions potentially impacted by adjacent land use.

At this time, there is little information on the soils, surficial geology and hydrology of these study sites. This data is needed to better understand the biotic resource measurements currently being collected.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Information on study sites soils, surficial geology and hydrology will not be collected. As a result, baseline data necessary to interpret results from other protocols will not be available.

B. **Conduct Survey of Study Site Soils, Surficial Geology and Hydrology.** A survey will be conducted to develop site descriptions for soils, surficial geology and hydrology at all natural resources monitoring study sites. As a result of this alternative, data will be available to assist in the evaluation and assessment of biological measurements derived through the implementation of monitoring protocols.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. A USGS, university, or private researcher will be contracted to conduct the survey of soils, surficial geology and hydrology at all natural resources monitoring study sites. The project will include:

- A review of all previous research on the soils, surficial geology and hydrology of Organ Pipe Cactus National Monument, and the development of a professional assessment of its completeness in relation to the particular study sites.

- A first order soils survey will be completed for each of the selected study areas. Field procedures will include: visual observations of topography, vegetation, and soil differences; excavation and examination of soils at different depths; collection of soil samples for laboratory analysis; and preparing logs of information gathered at the sampling sites. When results are received from the laboratory, final identification will be made and soil maps prepared, digitized and georeferenced. Sampling locations will be the same as those used for biological transects. Criteria will be established for selecting sites and soils for long-term monitoring. A protocol will be developed to evaluate soil changes.

- A geological map will be prepared for each appropriate study area. The lithology, structural geology and land form will described. An evaluation will be made of the relevancy of site geology to the biotic inhabitants present.

- A preliminary surficial hydrology investigation will be conducted and a map for each study site will be completed. A hypothetical monitoring system model (including instruments and protocols) predicting groundwater change will be developed.

- Data will be incorporated into the monument's geographic information system, and made available for map production and analysis.

Personnel: The work for this project will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ. Monument resources management staff will assist in protocol review and field testing.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-110 Conduct Survey of Study Site Soils, Surficial Geology and Hydrology	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	60,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	60,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	60,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-111

2. Project Title: **Evaluate Status of and Develop Monitoring Program for Bighorn Sheep**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The status of desert bighorn sheep (*Ovis canadensis*) within Organ Pipe Cactus National Monument is unknown. Changes in riparian and upland ecosystems have resulted in mammalian species composition and population density shifts throughout the southwest. The desert bighorn sheep has been adversely affected by these changes and has not adapted well. Some heroic rare mammals capture the interest of the public at large and are also of economic interest because scarcity has increased their hunting trophy value. The desert bighorn sheep is one such animal whose trophy price of thousands of dollars attracts poachers and unscrupulous sportsmen.

The ecology of rare mammals is often not well understood, especially by resource managers. At Organ Pipe Cactus National Monument, for instance, establishment of a 2-table picnic ground at Dripping Springs in the Bates Mountains eliminated the herd from that area. At that time, no one understood the crucial relationship between bighorn sheep, water, and humans. The sheep simply moved away rather than come close to humans and they were reluctant to travel to water at night when no one was present. The campground was abandoned sometime in the early 1970s, but the sheep did not return for more than ten years.

Baseline data applicable to the Organ Pipe herd has been collected over the years. Additional information, however, is needed to supplement the existing database and to develop a monitoring protocol to assess and evaluate the status of the species in the future, so that well-informed and effective management actions can be implemented if necessary.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will rely on the existing scant database to make management decisions affecting native mammals. No research on native sheep will be conducted.

B. **Evaluate Status and Develop Monitoring Program for Bighorn Sheep.** A non-destructive inventory, demographic assessment and development of a monitoring protocol for desert bighorn sheep and their vegetation resources at Organ Pipe Cactus National Monument will document the occurrence of these native mammals, and their relative abundance within riparian and upland habitats. A primary product of this research effort will be a long-term monitoring protocol which the monument resources management staff can use to gauge the health of this ecosystem component over time.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. A study will be developed to provide data on the status and condition of the desert bighorn sheep

in the monument. Information collected will include relative demography, abundance and natural history characteristics of the species. The assessment will be conducted using non-destructive sampling techniques such as live trapping, radio tracking and field observation to gather georeferenced (GPS) research data. A long-term monitoring protocol will be developed for the sheep and their vegetation resources both in Organ Pipe Cactus National Monument and on adjacent lands. The monument resources management staff will be trained in the implementation of the protocol.

Personnel: This project will be contracted. Monument resources management staff will assist with field work and monitoring protocol review, testing and implementation.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. skulls), vegetation, etc. is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards, and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-111 Evaluate Status of and Develop Monitoring Program for Bighorn Sheep	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	55,000	36,000	37,000	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	55,000	36,000	37,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	55,000	36,000	37,000	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-112

2. Project Title: **Evaluate Status and Develop Monitoring Program for Javelina**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The status of javelina (*Dicotyles tajacu*) within Organ Pipe Cactus National Monument is unknown. Changes in riparian and upland ecosystems related to past overgrazing, and perhaps also to climatic shifts, have resulted in large mammal species composition and population density shifts throughout the southwest. The javelina reaches its northwestern distribution limit near the monument. The omnivorous javelina frequents xeroriparian habitats, is an ecosystem condition indicator and perhaps will be useful for global warming studies.

Little baseline data applicable to javelina in the monument has been collected over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species in the future,so that well-informed and effective management actions can be implemented if necessary.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will rely on the existing scant database to make management decisions affecting native mammals. No research on javelina will be conducted.

B. **Evaluate Status and Develop Monitoring Program for Javelina.** A non-destructive inventory, demographic assessment and development of a monitoring protocol for javelina and their vegetation resources at Organ Pipe Cactus National Monument will document the occurrence of these native mammals and their relative abundance within riparian and upland habitats. A primary product of this research effort will be a long-term monitoring protocol which the monument resources management staff can use to gauge the health of this ecosystem component over time.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. A study will be developed to provide data on the status and condition of javelina in the monument. Information collected will include relative demography, abundance and natural history characteristics of the species. The assessment will be conducted using non-destructive sampling techniques such as live trapping, radio tracking and field observation to gather georeferenced (GPS) research data. A long-term monitoring protocol will be developed for javelina and their vegetation resources both in Organ Pipe Cactus National Monument and an adjacent lands. The monument resources management staff will be trained in the implementation of the protocol.

Personnel: This project will be contracted. Monument resources management staff will assist with research field work and monitoring protocol review, testing and implementation.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4) and E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. skulls), vegetation, etc. is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-112 Evaluate Status of and Develop Monitoring Program for Javelina	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	55,000	36,000	37,000	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	55,000	36,000	37,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	55,000	36,000	37,000	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-113

2. Project Title: **Evaluate Status of and Develop Monitoring Program for Mountain Lion**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: Little is known about the population size, spatial distribution, and temporal variability of the mountain lion (*Felis concolor*) in the monument. Observations of mountain lions in the monument are sparse. At least six verified sightings have been recorded in the last ten years. The role that these play in the overall monument ecosystem is not understood. Increasing urbanization and agricultural development on land adjacent to the monument in Mexico may be contributing to a loss of habitat in the region. With external pressures increasing, existing mountain lion populations may be pushed into lands such as the monument, where consumptive resource uses have been eliminated.
Little baseline data applicable to mountain lions has been collected in the monument over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species in the future, so that well-informed and effective management actions can be implemented if necessary.

5. Alternative Actions/Solutions and Their Impacts:

A. **No Action.** Mountain lion populations will continue to be accounted for without accuracy or precision. No information will be available to justify intervention in disruptive management practices, either within or outside of the monument.

B. **Evaluate Status and Develop Monitoring Program for Mountain Lion.** An inventory will be conducted and a plan developed to monitor this mammal throughout the monument. Such an assessment will assist the Superintendent and staff in better understanding the role mountain lions play in the monument ecosystem. Data will be beneficial in identifying threats and issues that affect the species. In addition, management actions affecting mountain lions will be based on the best available information.

6. Description of the Recommended Project or Activity: Option B. is the recommended action. This study will involve several steps, as outlined below:

- Museum collections, and published and gray literature concerning this species will be searched, reviewed and annotated. This will include ecologic, life history, taxonomic and distribution information.

- A systematic search of monument habitats will be conducted to locate and describe the distribution of populations and prey species.

- An assessment of current individual population sizes and home ranges in the monument will be made. These population figures will include an estimate of their reliability.

- A monitoring protocol will be developed in sufficient detail so that it can be administered by Park Service personnel.

- A final report will be prepared which will include the findings from the tasks above.

Personnel: This project will be contracted. Monument resources management staff will assist with field work and monitoring protocol review, testing and implementation.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App 7.4 B(4) and E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. scat, etc.) is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-113 Evaluate Status of and Develop Monitoring Program for Mountain	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	41,200	33,700	34,700	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	41,200	33,700	34,700	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	41,200	33,700	34,700	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-114

2. Project Title: **Evaluate Status of and Develop Monitoring Program for Mule Deer**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: Little is known of the size, spatial distribution, and temporal variability of desert dwelling mule deer (*Odocoileus hemionus*) populations. Management practices on adjacent lands, such as agricultural development and urbanization, may impact mule deer populations as well as predator species. It is important to identify baseline ecological parameters associated with this species so that an information base is available from which management actions can be evaluated. In addition, according to the Arizona Game and Fish Department, mule deer are among the most important game species in the state. The likelihood of poaching, especially along the monument's margins, is high.

Little baseline data applicable to mule deer populations has been collected in the monument over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species in the future, so that well-informed and effective management actions can be implemented if necessary.

5. Alternative Actions/Solutions and Their Impacts:

A. **No Action.** Deer populations will continue to be accounted for without accuracy or precision. No information will be available to justify intervention in disruptive management practices, either within or outside the monument.

B. **Evaluate Status and Develop Monitoring Program for Mule Deer.** An inventory will be conducted and a plan developed to monitor mule deer populations throughout the monument. Such a study will assist the Superintendent and staff in better understanding the role mule deer populations play in the monument ecosystem. Data will be beneficial in identifying threats and issues that affect the species. In addition, management actions affecting mule deer will be based on the best available information.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This study will involve several steps, as outlined below:

- Museum collections, and published and gray literature will be searched, reviewed and annotated. This will include ecologic, life history, taxonomic and distribution information.

- A systematic search of monument habitats will be conducted to locate and describe the distribution of populations and/or predator species.

- An assessment of current population sizes and home range in the monument will be made. These population estimates will include an estimate of their reliability.

- A monitoring protocol will be developed in sufficient detail so that it can be administered by Park Service personnel.

- A final report will be prepared, and will include the findings from the tasks above.

Personnel: This project will be contracted. Monument resources management staff will assist with field work and monitoring protocol review, testing and implementation.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4) and E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens (i.e. scat, etc) is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding:

FUNDING

ORPI-N-114 Evaluate Status of and Develop Monitoring Program for Mule Deer	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,200	21,700	23,700	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	30,200	21,700	23,700	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	30,200	21,700	23,700	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-115

2. Project Title: **Evaluate Status of and Develop Monitoring Program for White-tailed Deer**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The current status of Coues white-tailed deer (*Odocoileus virginianus couesi*) within Organ Pipe Cactus National Monument is not known. Factual data to substantiate the health and current population status are inadequate to guide future management decisions and actions which would have a direct bearing upon the welfare of the species or its habitat. Additional information is needed to supplement the existing database and to identify a monitoring protocol to assess and evaluate the status of the species in the future, so that well-informed and effective management actions can be implemented if necessary.

The population of white-tailed deer in the monument has historically been low. Schultz (1966) reported an estimate of eighteen white-tailed in the monument, based on visitor observation records. Research by Henry and Sowls (1979) estimated six to twelve individuals in the Ajo Mountains, separated from the nearest neighboring populations by more than twenty miles. Most white-tailed deer observations in the monument have been from the Ajo Mountains, while in recent years some observations have been made in the Diablo Mountains (Petryszyn and Barnett 1992) and the Puerto Blanco Mountains (Petryszyn 1992). In 1979 Henry and Sowls noted that due to the small size of the population, the possibility of extinction occurring is a very real threat.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will rely on the existing scant database to make management decisions affecting native mammals. No further research on white-tailed deer will be conducted.

B. **Evaluate Status and Develop Monitoring Program for White-tailed Deer.** A non-destructive inventory and demographic assessment will be conducted, and a monitoring protocol for white-tailed deer and their vegetation resources at Organ Pipe Cactus National Monument will be developed to document the occurrence of these native mammals, and their relative abundance within riparian and upland habitats. A primary product of this research effort will be a long-term monitoring protocol which the monument resources management staff can use to gauge the health of this ecosystem component over time.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. Components of the activity will include:

- The National Park Service will contract a research project to continue the work initiated by Henry and Sowls in 1979. A condition assessment update of the habitat will be provided and amended to the original research report. In addition, an evaluation of the status of the species since the original work

will be developed, including an evaluation of population size, structure and distribution. Original recommendations will be evaluated and updated.

- A monitoring protocol for white-tailed deer will be developed in conjunction with the new assessment. The protocol will be tested in the field by contracted researchers and monument resources management staff. A monitoring protocol handbook will be provided, illustrating the methods and techniques used to implement the protocol.

- All white-tailed deer observation and research data will be incorporated into the monument's ecological monitoring program database. This database will provide a linkage with the monument's geographic information system, and will allow for evaluations and modeling.

Personnel: Research and protocol development will be contracted. Monument resources management personnel staff will assist with all project elements.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-115 Evaluate Status of and Develop Monitoring Program for White-tailed Deer	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	-	-	-
Personnel Services	5,000	-	-	-
Other	2,000	-	-	-
TOTAL	57,000	-	-	-
Funds Available in Park Base	5,000	-	-	-
Additional Funds Needed	52,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-116

2. Project Title: **Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise**

3. Servicewide Issue: NO2 - Impacts on Threatened, Endangered and Other Sensitive Animals

4. Problem Statement: Long-term ecological data is needed on desert tortoise populations in the monument to effectively understand and manage this rare and sensitive species. Disease and unidentified causes have resulted in a rapid decline in some desert tortoise populations. The Mojave (California) and Beaver Dam Slope (Arizona/Utah) populations have been in decline for some time and are now listed as endangered. The status of the Arizona (Sonoran) population is less well known, except that tortoise populations in northern Arizona and the Phoenix area are severely declining. The Sonoran population has been proposed for listing and recently very nearly was. Listing has been deferred (1991), providing that federal and state agencies in Arizona undertake aggressive management of their populations. The National Park Service is considering (1991) a Memorandum of Understanding (MOU) linking the Service with other land managing agencies for the purpose of tortoise management.

Organ Pipe Cactus National Monument has been maintained in relatively pristine condition since its establishment in 1937. However, comparison of modern photos with old photos indicates that this area has been heavily impacted by past cattle grazing and other land uses. Activities which have reduced and modified the vegetative communities and habitats, and presumably the tortoises, include grazing, conversion of plant communities, surface water withdrawal, road construction and increased use of backcountry areas by visitors.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will rely on the existing scant database to make management decisions affecting the tortoise. No further research will be conducted. Such action may result (wholly or in part) in listing of the species as endangered.

B. **Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise.** An inventory will be conducted to provide information on desert tortoise populations in the monument. This knowledge will serve as an additional management tool for examining the ecological health of monument ecosystems. A monitoring protocol will be developed to provide a means of evaluating the health of desert tortoise populations in the future.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. An inventory of tortoises at Organ Pipe Cactus National Monument will be conducted to document their occurrence, abundance, disease status, population trends, habitat adequacy and demographics. Special attention will be given to tortoise habitat preservation, public education and safeguarding against tortoise loss due to human activity. One of the products of this research effort will be a set of long-term monitoring protocols that the monument staff can use to gauge the health of this ecosystem component over time. The goal is to develop a complete long-term monitoring program for the monument.

The inventory will be conducted using non-destructive sampling techniques such as live trapping, radio tagging, den examination and observation. Long-term monitoring protocols will be developed for tortoise forage vegetation in Organ Pipe Cactus National Monument. The park staff will be trained in the implementation of these protocols following their development.

The project is designed to supplement and develop baseline information on tortoises within Organ Pipe Cactus National Monument, providing more information about the interaction with tourists, roadways and the rest of the monument environment. Funding for the implementation of long-term monitoring and other management actions recommended as a result of this research must be sought well in advance of need. This specific project is limited to a baseline survey and assessment, and to the development of monitoring protocols.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and protocol review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-116 Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	51,500	51,500	51,500	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	51,500	51,500	51,500	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	51,500	51,500	51,500	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-117

2. Project Title: **Conduct Inventory and Develop Monitoring Protocol for Ferruginous Pygmy-Owl**

3. Servicewide Issue: NO2 - Impacts on Threatened, Endangered and Other Sensitive Animals

4. Problem Statement: Long-term ecological data is needed on ferruginous pygmy-owl populations in the monument to effectively understand and manage this rare and sensitive species. According to Monson and Phillips (1981) and Johnson-Duncan, et al. (1986) the ferruginous pygmy-owl today is absent from the Arizona lowlands except possibly in the Organ Pipe Cactus National Monument region. Unidentified factors appear to be affecting the status of the ferruginous pygmy-owl within the boundaries of Organ Pipe Cactus National Monument. This species of owl has been located only in or around natural resources monitoring study sites at East of Armenta, near the Alamo Campground, and at Growler Wash. The last recorded observation of the ferruginous pygmy-owl was during censusing in 1990. This diurnal owl is relatively easy to locate in the appropriate habitat. Individuals within the monument, however, have been difficult to relocate in recent years. The ferruginous pygmy-owl ranges from SE Arizona to South America, and the cause for its decline from the northern part of its range is unknown. In general, little is known about the ecology and life history of this species. The ferruginous pygmy-owl is classified as threatened by the Texas Parks and Wildlife Department (B. Thompson [pers comm.] cited in B. Millsap and R. Johnson [1986]) and also occurs in Arizona where it is not listed (LeFranc and Millsap 1984).

Raptors are biologically important as ends of the food chain, and are environmentally sensitive to change (Olendorff et al. 1989). Riparian habitats contain the greatest raptor diversity; 82% of 45 western raptor species use riparian habitats (Olendorff et al. 1989). The ferruginous pygmy-owl nests in riparian areas which, in the southwestern U.S., have been significantly destroyed as a result of complex land-use practices. An extended study of the habitat needs and life history information for the ferruginous pygmy-owl is needed in order to fully understand and determine its needs and status at the monument.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No effort will be made to evaluate the status of ferruginous pygmy owls in the monument. This alternative will not provide management with needed information to properly protect and manage monument resources. Management will have to rely on existing scant knowledge to make decisions affecting the ferruginous pygmy-owl. This lack of action may be to the detriment of this species.

B. **Conduct Inventory and Develop Monitoring Protocol for Ferruginous Pygmy-Owl.** An inventory and assessment of ferruginous pygmy owls will be conducted in the monument. The results of this assessment will assist management in making effective decisions regarding the ferruginous pygmy-owl. Through research and subsequent monitoring and data analysis of various factors affecting the ecology of this owl, monument staff can provide more effective means for its protection.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. An assessment will provide information on occurrence, population, habitat needs, demographics, abundance, life history, and food habits. This alternative will include the following elements:

- Conducting literature survey for this species and compiling bibliography using Procite.
- Examining riparian and other habitat needs in Organ Pipe.
- Determining occurrence, population density and distribution of ferruginous pygmy-owl in the monument.
- Studying breeding biology of ferruginous pygmy-owl.
- Studying food requirements of ferruginous pygmy-owl.
- Cooperating with other land management agencies in the U.S. and Sonora, Mexico, to gather information on the ferruginous pygmy-owl to determine the best methods for protection.
- Using a geographic information system to model suitable habitat and known occurrence within monument boundaries, as well as population and demographic information.
- Developing and testing protocols for long-term monitoring of the owl. Developing a protocol handbook to guide implementation of the monitoring effort. In addition, preparing a training video to assist biological technicians in the application of required techniques.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and protocol review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-117 Conduct Inventory and Develop Monitoring Protocol for Ferruginous Pygmy-Owl	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	60,000	20,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	60,000	20,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	60,000	20,000	-	-

Reference:

Johnson-Duncan et al. 1986. F. Pygmy-owl.

LeFranc and Millsap. 1984. F. Pygmy-owl.

Milsap and Johnson, R. 1986. F. Pygmy-owl.

Monson and Phillips. 1981. Ferr. Pygmy-owl.

Olendorff et al. 1989. F. Pygmy-owl.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-118

2. Project Title: **Conduct Inventory and Develop Monitoring Protocol for Microphytic Crusts**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: The status and role of microphytic crusts in the overall functioning of the monument ecosystem is unknown. Baseline data is needed to determine the extent and role these crusts play and their relationships to other environmental components. A protocol is required to assess microphytic crusts over time and to provide integrative data necessary to understand the monument ecosystem.

Cryptogamic crusts (now called microphytic) are a very important component of the desert ecosystem (Harper and Marble, 1988). They are composed of lichens, mosses, green algae and cyanobacteria. The crusts are ubiquitous throughout desert regions and contribute a great deal to the systems in which they occur (Belnap and Pearson 1989). Research indicates that these crusts are the major source of fixed nitrogen for desert ecosystems (Skujins, 1972; West and Skujins, 1977; Terry and Burns, 1987). Stable isotopes of nitrogen have been used to demonstrate that nitrogen fixed by these crusts are, in fact, utilized by surrounding vascular plants (Mayland et al., 1966).

Cryptogamic crusts are very susceptible to mechanical disturbances (Harper and Marble, 1988). Grazing has significantly reduced their presence throughout the west, as have other human activities (Anderson et al. 1982). Fire is another factor that impacts these crusts negatively, as most cryptogams are killed (St. Clair and Nebeker, 1980). These crusts have also been shown to be sensitive to sulfur dioxide (Sheridan, 1979). Lab exposure to fairly low levels of SO2 resulted in a significant decrease (50%) in nitrogen-fixing ability and a reduced photosynthetic capacity, as indicated by reduced chlorophyll content.

A comprehensive survey of microphytic crusts will result in an increased understanding of the significant relationships among these crusts, such as their habitat and importance in ecosystem stability and dynamics.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A study of monument microphytic crusts will not be conducted. Monitoring protocols will not be developed. Knowledge of this important indicator component of the ecosystem will not be developed.

B. **Conduct Inventory and Develop Monitoring Protocol for Microphytic Crusts.** A study will be conducted to provide information on microphytic crusts. Data will include species presence, species distribution and abundance. A long-term monitoring protocol will be developed to assess the condition of crusts over time. Research will be emphasized at current natural resources monitoring sites.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A study will be designed to identify microphytic crusts occurring within the monument. Components of the study will include:

- Research into species distribution, abundance, phenology and habit will be conducted.
- Indicator species will be identified and studied to determine how they relate to naturally functioning ecosystems.
- A determination will be made as to what microphytic crust species are important to monument ecosystems both generally, and specifically, at the eighteen designated natural resources monitoring sites.
- Identify, if any, non-native species pose a threat to the integrity of any native plants and animals in the monument.
- Supplement the monument's museum collection of microphytic crusts based on an inventory of the entire monument.
- Provide information and color slides that will assist monument staff in interpreting mycrophytic crusts to the visiting public.
- Develop a methodology for monitoring the "health" of the monument's microphytic crusts. Monument resources management staff will be trained in protocol implementation and database analysis.

Personnel: The work for this project will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ. Monument resources management staff will assist in protocol review and field testing.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding

FUNDING

ORPI-N-118 Conduct Inventory and Develop Monitoring Protocol for Microphytic Crusts	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	80,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	80,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	80,000	-	-	-

References:

Anderson, D. C., K. T. Harper and S.R. Rushforth. 1982. Recovery of Crytogamic Soil Crusts from Grazing on Utah Winter Ranges. Journal of Range Management. 35:355-359.

Belnap, J. and L. C. Pearson. 1989. Effects of Wet and Dry Pollutants on Physiology of Cryptogamic Crusts and Rock Lichens - Organ Pipe Cactus National Monument. A proposal to the National Park Service. 5 pp.

Harper, K. T. and J. R. Marble. 1988. A Role for Nonvascular Plants in Management of Arid and Semiarid Rangelands. In press.

Sheridan. 1979. Microphytic Crusts.

St. Clair, L. L. and G. T. Nebeker. 1980. The Impact of Fire on Cryptogamic Soil Crusts. Botanical Society American Misc. Series Publication 158.

Terry, R. E. and S. J. Burns. 1987. Nitrogen Fixation in Cryptogamic Soil Crusts as Affected by Disturbance. USDA General Technical Report INT-215 pp. 369-372.

West, N. E. and J. Skujins. 1977. The Nitrogen Cycle in North American Cold-winter Semi-desert Ecosystems. Oecol. Plant. 12:45-53.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-119

2. Project Title: **Conduct Inventory and Develop Monitoring Protocol for Aquatic Invertebrates**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: The status and role of aquatic invertebrates in the overall functioning of the monument ecosystem is unknown. Baseline data is needed to determine species presence, abundance, habitat requirements and relationships to other environmental components. A protocol is needed to assess population fluctuations and to provide integrative data necessary to understand the monument ecosystem.

Aquatic invertebrates are a sensitive indicator of the aquatic health of an ecosystem. Earlier superficial surveys suggest that there is a high probability of undescribed and perhaps endemic species occurring in Quitobaquito and other aquatic habitats in the monument. Other aquatic habitats include tinajas, as well as perennial, intermittent, and ephemeral water sources. Invertebrate representatives of interest include the sponges (Porifera), rotifers (Trochel-minthes), snails (Gastropodia) and ostrocod and cladoceran crustaceans. In addition, capecod crustaceans, mites (Acarina) and oligochaete worms (Annelida) have not been reported within the monument borders, but they may be present (NPS 1987).

A multidisciplinary study will be required to survey both the monument and adjacent agricultural land use areas for the presence of aquatic invertebrates. A monitoring program needs to be developed that will provide information on species occurrence, distribution, abundance, mortality rates and causes, reproduction, recruitment and food habits.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A study of monument aquatic invertebrates will not be conducted. Monitoring protocols will not be developed. Knowledge of this important indicator component of the ecosystem would not be gained.

B. **Conduct Inventory and Develop Monitoring Protocol for Aquatic Invertebrates.** An inventory of monument aquatic invertebrates will be conducted. Based on the results of the study, monitoring protocols will be developed to allow for the continued monitoring of aquatic invertebrate populations. Data from monitoring will be integrated with other assessment databases to evaluate relationships within the ecosystem.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A study will be designed which will provide information on species distribution, abundance, age and size structure, growth rates, mortality rates and causes, reproduction and recruitment, and food habits of species deemed of importance. Methods employed will be compatible with those generally acceptable to science, and will be applicable to long-term monitoring.

Components of the assessment and protocol development will include:

- The development of a summary of existing literature and data.

- Four or five sampling trips during the first year will be completed to provide a good list of invertebrates occurring in the monument's aquatic habitats. Sampling techniques and tools will include common coarse-meshed nets, plankton nets, an Ekmann dredge and a simple coring device for microbenthic species.

- Components for monitoring will be selected. Criteria for selecting species and study sites will be identified. Criteria may include: special status species, species that occupy different tropic levels and feeding guilds, species that are either common, dominant, endemic or non-native, species of special interest to the public or management, and species which occupy sites subject to dramatic, change such as loss of habitat.

- A protocol will be developed to direct implementation of the monitoring effort. Detailed instructions on the implementation of the protocol will be provided, including baseline information, distribution maps, sample site maps, report formats and database management techniques.

- Monitoring protocols will be tested in the field and refined to reflect evaluation. Monument resources management staff will be trained in protocol implementation and database analysis.

Personnel: The work for this project will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ. Monument resources management staff will assist in protocol review and field testing.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this project, the principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Collected specimens must include National Park Service catalogue cards and identification, and be deposited in the monument's museum. Approval of the Superintendent is needed to deposit specimens in collections outside of the monument. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained by the principal investigator.

8. Funding

FUNDING

ORPI-N-119 Conduct Inventory and Develop Monitoring Protocol for Aquatic Invertebrates	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	40,000	40,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	40,000	40,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	40,000	40,000	-	-

References:

Parker, Kathleen. 1977. Site Preferences, Reproductive Characteristics and Population Dynamics of Organ Pipe Cactus (*Lemaireocereus thurberi*) in Southern Arizona. University of Wisconsin, Madison. M. S. Thesis.

Parker, Kathleen. 1987b. Plants.

Parker, Kathleen. 1988a. Plants.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991a. Special Status Plants of Organ Pipe Cactus National Monument, Arizona: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 223 pp.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991b. Monitoring Protocol Handbook for Plants of Organ Pipe Cactus National Monument, Arizona. Final Report. Ruffner Associates. 42 pp.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991c. Database Information for Special Status Plants of Organ Pipe Cactus National Monument: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 82 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-120

2. Project Title: **Implement Climate Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Climatic data is needed to assess the significance of, and evaluate cumulative results and relationships of, ecological components of the monument's natural resources monitoring program. Weather data, primarily precipitation, air and soil temperature and relative humidity, are critical in evaluating the monitoring data collected on flora and fauna. Climatic data is the primary integrative component of the ecological assessment program.

In 1987 and 1988, nine automated weather stations were established at natural resources monitoring sites. The weather stations were located throughout the monument as part of a natural resources inventorying and monitoring program called the Sensitive Ecosystems Program. Not all climate stations are equipped with a full array of monitoring equipment. At a minimum, air temperature, relative humidity and precipitation are recorded. At fully equipped stations, air temperature and relative humidity are measured at 48 inches (U.S.N.W.S. standard) above the ground. In addition, air temperature at 12 inches above the ground, soil temperature at an 8 inch depth, precipitation, wind speed and direction, and solar radiation are recorded. Information is recorded hourly for most variables and stored in a computer database, along with the information from the other eight weather stations.

In addition to the automated weather stations, eight forester rain gauges are located throughout the monument. These gauges provide additional data on precipitation, as do two National Atmospheric Deposition Program collectors. Thus precipitation is recorded at a total of 19 locations in the monument.

The climate data gathered at the weather stations and rain gauges is a critical component of the monument's natural resources monitoring and research program. This data has been used by most principal investigators associated with the ecological monitoring program, as well as by, numerous other biological researchers.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue Climate Monitoring.** Climate stations and rain gauges will no longer be operated. Data will not be available to researchers to assist in the evaluation of data. The result of this action will be the elimination of one of the most critical integrative components of the ecological monitoring program.

B. **Implement Climate Monitoring Protocol.** Climate stations and rain gauges will be operated and maintained. Results will be summarized and made available to researchers and staff involved in assessing ecological monitoring data. The primary integrative variables of precipitation, air and soil temperature, and relative humidity will be accessible for natural resources evaluation and interpretation.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Climate stations will be serviced and the computer chips retrieved and downloaded once a month. Calibration of air temperature sensors and relative humidity sensors will be done semiannually, and calibration of tipping bucket rain gauges will be accomplished yearly. Forester rain gauges will be serviced monthly and data downloaded into a spreadsheet format.

Summaries, comparisons and the raw hourly data will be available for all nine weather stations, and will be stored on floppy disks in the vault of the Sonoran Desert Biosphere Reserve Center, as well as in the office of the Chief of Resources Management and Research. Requests by researchers for data will be made available upon request. A summary of monitoring activities and a review of data will be provided in the annual Natural Resources Monitoring Program Report.

Personnel: Monument resources staff will carry out field work and data management/assessment associated with the implementation of this protocol.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-120 Implement Climate Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	7,300	7,300	7,300	7,300
Other	5,000	5,000	5,000	5,000
TOTAL	12,300	12,300	12,300	12,300
Funds Available in Park Base	12,300	12,300	12,300	12,300
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-121

2. Project Title: **Implement Land Use Trends Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Data on urbanization and agricultural development on lands in Mexico adjacent to the monument is needed. Increased development and associated issues such as infusion of non-native plants and animals, pesticide and herbicide drift and groundwater depletion are of concern to monument management.

In 1987, a project conducted by Mr. Bruce Brown of Great Western Research assessed the impacts of land use trends on Mexican lands adjacent to the monument. The Sonoyta Valley is a common water source shared by the U.S. and Mexico. The southern portion of the monument forms part of the Rio Sonoyta watershed as well as the northern portion of the groundwater aquifer.

The Mexican portion of the Sonoyta Valley is a prime site for agricultural development. At the conclusion of the research phase in 1988, 32,000 acres had been set aside for irrigated agriculture. Total water withdrawals from the 165 agricultural wells in 1987-88 was estimated to be 83,152 acre/feet, more than 2.5 times the annual groundwater recharge rate of 28,135 acre/feet.

Although moratoriums are currently in effect to 1) prohibit development of new wells for irrigation, and 2) limit the land developed for irrigated agriculture to the present 32,000 acres, this is of little reassurance when one realizes that the total annual pumping capacity in the Sonoyta Valley is estimated to be 191,000 acre/feet, or more than six times the estimated annual groundwater recharge rate.

A monitoring program was developed by the principal investigator to evaluate change in land use over time. The emphasis of the program was on continued dialogue with resource counterparts in Mexico; biannual photopoint photography of the agricultural area to detect changes through time; reliance on the data collected by Mexican agricultural officials reporting crops, acreages, and water volumes withdrawn for agriculture; and computation of the amount of water withdrawn for agricultural purposes based upon electrical consumption, pumping lifts, and pump system efficiencies.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue Monitoring of Land Use Trends.** Monitoring protocols to assess land use trends on adjacent lands in Mexico will no longer be implemented. Dialogue with resource officials in Mexico will not be continued and an evaluation of development threats will not be fully conducted. The results of this alternative will be a gross neglect of some of the most threatening issues facing the monument.

B. **Implement Land Use Trends Monitoring Protocol.** The monitoring protocol as recommended by the principal investigator will be implemented. Dialogue with resource officials in Mexico will be continued

and enhanced. Data on development and agriculture will be evaluated, including that on groundwater use, pesticide and herbicide application and land use trends. Repeat photography will be accomplished at identified photopoints and duplicate photos will be delivered to resource officials in Mexico. The results of the action will be a proactive and cooperative step toward understanding and mitigating potential threats facing the natural resources of the monument.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The land use trends monitoring protocol will be implemented in its entirety. Elements of the protocol include:

- Dialogue will be continued and enhanced with resource officials in Mexico. Data will be shared and efforts will be made to accompany Mexican staff with field work such as groundwater monitoring.

- Implementation of photopoint photography of agricultural areas in Mexico will be continued to detect changes through time. Photography will be accomplished in April and November. Four photopoints are located on the southern boundary of the monument and two are in Sonoyta, Sonora, Mexico. All photos will be taken in black & white print, color print and slide. All photographs and slides will be labeled, reviewed and archived. One set of black & white photographs will be delivered to resource officials in Mexico.

- Periodic aerial photography of the agricultural area will be conducted to detect changes through time. Photos will be reviewed and archived. Copies will be provided to resource officials in Mexico.

- Review and analysis of data collected by Mexican agricultural officials on crops, acreages, and water volumes withdrawn for agriculture will be completed.

- The amount of water withdrawn for agricultural purposes will be based completed, upon electrical consumption, pumping lifts, and pump system efficiencies.

- A summary of monitoring activities and a review of data will be included in the annual Natural Resources Monitoring Program Report.

Personnel: Monument resources staff will carry out field work and data management/assessment associated with the implementation of this protocol.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-121 Implement Land Use Trends Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	4,500	4,500	4,500	4,500
Other	2,000	2,000	2,000	2,000
TOTAL	6,500	6,500	6,500	6,500
Funds Available in Park Base	6,500	6,500	6,500	6,500
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-122

2. Project Title: **Implement Nocturnal Rodent Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term ecological monitoring data is needed on nocturnal rodent populations to assist in the assessment of the overall health and condition of the monument ecosystem. Nocturnal rodent populations provide a primary integrative element in understanding the dependency and relationships of ecosystem components.

Monitoring of small mammals utilizing capture, mark, release and recapture techniques provides a long term assessment of environmental effects such as rainfall, grazing, habitat changes and people usage impacts. The status of rodent populations has a broad application in that it is indicative of the general health of the environment. Being primary consumers as well as the prey base for many predators (snakes, raptors, and a number of larger mammals), rodent populations rapidly react to changes in available food resources and, in turn, influence population numbers and the health of the animals which depend on them as a food source (Petryszyn 1991).

In 1988, as part of the monument's natural resources inventorying and monitoring program, the Sensitive Ecosystems Program, Dr. Yar Petryszyn was contracted to gather baseline data on nocturnal rodents. A primary purpose of the study was to establish a broad-based data set for the major primary consumers in select areas of the monument. Diversity, densities, habitat selection and activity were monitored using live trapping grids (Petryszyn 1988). A monitoring protocol was developed to assess the status of nocturnal rodents over time. The protocol was tested in the field and monument resources management staff were trained in its application.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for nocturnal rodents will not be implemented. Trend and species data acquired as part of the baseline research on nocturnal rodents will not be continued. The results of no action will be the loss of valuable data necessary to provide an understanding of the monument ecosystem on which better informed management decisions can be based.

B. **Modify and Implement Nocturnal Monitoring Protocol.** The recommended monitoring protocol will be modified based on staffing and financial considerations. In some years, the protocol will not be implemented, and in others, it will be fully executed at the full array of study areas. The results of this action will be to collect an inconsistent and disjointed database. The standard for evaluation and integration with other monitoring data will be compromised.

C. **Implement Nocturnal Rodent Monitoring Protocol.** The monitoring protocol for nocturnal rodents developed and recommended by Dr. Yar Petryszyn as part of the Sensitive Ecosystems Program will be

implemented. A base program will be established and be implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed. Integration with other monitoring protocols will be facilitated more effectively.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Implementing the rodent monitoring protocol as identified by the principal investigator provides the best alternative for evaluating the status of nocturnal rodent populations in the monument. The protocol will serve as a standard, providing consistency in implementation, evaluation and integration with other data sets.

The protocol will be implemented at primary study sites annually. Nocturnal rodents will be monitored using capture, mark, release, and recapture methods. Forty-nine traps will be baited and set on each of the two mammal grids located at each study site. Trap stations will be given alphanumeric designations A1 through G7, with A1 always being the southwest grid corner, and G7 the northeast grid corner. This designation is important in tracking species' microhabitat selection and species distribution. Trapping will be conducted during two consecutive nights at each site with rodent processing, i.e. weighing, sexing, and marking, beginning near dawn.

Data analysis will be conducted at the end of the field season. The most important factor in estimating rodent population size is consistency. Regardless of what system of estimating population size is utilized, as long as that system is used consistently for the duration of the study, a valid comparison of different sites during different periods of time, as well as with other studies, can be made (Petryszyn 1991).

Trapping for two consecutive nights captures only a portion of the animals that are present in the area, but this portion seems to remain relatively constant. By utilizing the known rate of capture of previously uncaptured individuals, an estimate of total numbers can be calculated. Total biomass is also estimated, by multiplying the estimated densities by the mean weight of the species for a specific monitoring session. Biomass can reflect conditions such as abundance of juveniles (less weight per individual) or abundant food supply (heavier individuals), and can be readily used to compare populations of different-sized species (Petryszyn 1991).

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-122 Implement Nocturnal Rodent Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	500	500	500
Personnel Services	7,300	7,300	7,300	7,300
Other	2,000	2,000	2,000	2,000
TOTAL	9,800	9,800	9,800	9,800
Funds Available in Park Base	9,800	9,800	9,800	9,800
Additional Funds Needed	0,000	0,000	0,000	0,000

References:

Petryszyn, Yar. 1991. Monitoring Protocol for Small Nocturnal Mammals at Organ Pipe Cactus National Monument, Arizona - Sensitive Ecosystems Program. 41 pp.

Petryszyn, Yar. 1988. Proposal - Special Status Mammals of Organ Pipe Cactus National Monument.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-123

2. Project Title: **Implement Lizard Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term ecological monitoring data on lizards is needed to assist in the assessment of the overall health and condition of the monument ecosystem. Lizards are valuable indicators of ecosystem health and long-term change. Data acquired on lizards is critical to developing a comprehensive integrative monitoring program that provides management with decision-making tools based on sound ecological evaluations.

In 1988, as part of the monument's natural resources inventorying and monitoring program, the Sensitive Ecosystems Program, Dr. Charles H. Lowe was contracted to gather baseline data on amphibians and reptiles. The scope of the fieldwork included an extensive monument-wide phase of research and a site-intensive phase at 16 special study sites (Lowe 1988). Two key objectives of the study, as identified in the request for proposals (NPS 1988d), were to design a monument-wide study to provide information about species occurrence, distribution, and relative abundance for all herp species, and to develop monitoring protocols for long-term herpetofauna monitoring at sites identified as part of the study.

The principal investigator and his assistants accomplished the most comprehensive survey and assessment of herpetofauna undertaken to date in the monument. The quality of the products produced is exceptional. A monitoring protocol was developed to measure population changes in lizards that can be correlated with natural and human-caused environmental changes at the monument. Lizards and the data collected on these ectothermic vertebrates have intrinsic biological importance. They form one component within the broader integrated monitoring program which will be capable of detecting biotic effects of global climate change, of local human-caused disturbances and of natural environmental fluctuations (Lowe 1991). The protocol was tested in the field and monument resources management staff were trained in its implementation.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for lizards will not be implemented. Trend and species data acquired as part of the baseline research on lizards will not be continued. Documentation on the parameters of long-term change in lizard communities will not be accomplished. The results of no action will be the loss of valuable data necessary to provide an understanding of the monument ecosystem on which better informed management decisions can be based.

B. **Modify and Implement Lizard Monitoring Protocol.** The recommended monitoring protocol will be modified based on staffing and financial considerations. In some years the protocol will not be implemented and in others it will be fully executed at the full array of study areas. The results of this action will be to collect an inconsistent and disjointed database. The standard for evaluation and integration with other monitoring data will be compromised.

C. **Implement Lizard Monitoring Protocol.** The monitoring protocol for lizards developed and recommended by Dr. Charles H. Lowe as part of the Sensitive Ecosystems Program will be fully implemented. A base program will be established and implemented twice annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed. Integration with other monitoring protocols will be facilitated more effectively.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Implementing the lizard monitoring protocol as identified by the principal investigator provides the best alternative for evaluating the status of lizard communities in the monument. The protocol will serve as a standard, providing consistency in implementation, evaluation and integration with other data sets.

The protocol will be implemented at primary study sites twice annually. Lizards will be monitored using a line transect method whereby a transect, varying in length from 100 to 300 meters, will be walked repeatedly. All lizards seen within 7.5 meters on either side of the center line will be recorded. Data will be recorded regarding distance from the origin, distance from the center line, species, size/age class and time. Gender will also be recorded if possible.

Each line will be walked beginning at the east end for better observation, and all lines will be walked beginning with first warmth, shortly after sunrise. A clear, warm and fairly calm morning is required for good lizard activity. The walks will be timed to coincide with the peaks of activity of each of the various species of lizards present, with particular attention being given to the "indicator species", usually *Cnemidophorus spp*. Once the number of indicator species individuals has peaked and is diminishing for one or two walks, the session will end. Each line will be run once in the late spring and once again in mid-summer, after the onset of the monsoon rains. The design of the protocol is such that one person can walk two lines alternately.

Data analysis will be conducted at the end of the field season. The principal data point resulting from a one-day run of a lizard line is the maximum number of individuals of the indicator species observed during a single morning. The secondary result is the maximum number of individuals per walk for every other species observed during the daily run. The greatest number observed (for any species) on any walk is termed "peak value" (for each species) for that daily run (Lowe 1990).

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM, Chapter 2, Appendices 1 and 7, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-123 Implement Lizard Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	500	500	500
Personnel Services	8,900	8,900	8,900	8,900
Other	2,000	2,000	2,000	2,000
TOTAL	11,400	11,400	11,400	11,400
Funds Available in Park Base	11,400	11,400	11,400	11,400
Additional Funds Needed	0,000	0,000	0,000	0,000

References:

Lowe, Charles H. 1988. Proposal - Ecology of Amphibians and Reptiles of Organ Pipe Cactus National Monument.

Lowe, Charles H. 1990. A 50 Year Summary for the Herpetofauna of Organ Pipe Cactus National Monument, Arizona (1932 - 1982). Special Report No. 10 - Assessment of Scientific Information and Activities at Organ Pipe Cactus National Monument Biosphere Reserve. USDI, NPS, Cooperative National Park Resources Studies Unit, University of Arizona, Tucson, AZ. pp. 63 - 73.

National Park Service, United States Department of the Interior. 1988d. Requests for Proposals - Ecology of Amphibians and Reptiles of Organ Pipe Cactus National Monument.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-124

2. Project Title: **Implement *Echinomastus erectrocentrus* var. *acunensis* Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term biological data is needed on acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*) to effectively understand and manage this rare and sensitive species. The acuna cacti population in the monument is considered one of the most viable for the species, but is still subject to an array of threats, such as predation, poaching and visitor impacts.

Acuna cactus is a candidate category 1 species being considered for federal status as a threatened plant species. This variety is known from three small, isolated populations in Arizona, and from scattered individuals in northern Sonora, Mexico. Numbers in the two Arizona populations outside of the monument have declined sharply in recent years for unknown reasons (Ruffner et al. 1991a). The monument population of acuna cacti is the healthiest of all known populations of this variety (Ruffner et al. 1991b).

In the late 1970s, Dr. William Buskirk and students from Earlham College developed a protocol to monitor acuna cacti at the monument, primarily to detect theft of the highly valued cactus. Although these monitoring efforts brought a greater knowledge and understanding of the cactus, much remained unknown concerning its basic biology and population dynamics. Meanwhile, the unexplained serious decline in the state's other two acuna populations prompted the U.S. Fish and Wildlife Service (USF&WS) to declare the cactus a candidate species, for listing consideration as a threatened plant.

In 1988, as part of the monument's ecological inventorying and monitoring program, the Sensitive Ecosystems Program, Dr. George A. Ruffner was contracted to gather and compile data on special status plants. The objectives of the project included revising and updating the existing red list file, conducting an analysis and assessment of 17 special status plants, investigating the "status unknown" plants from the monument flora and developing, testing and implementing a long range monitoring protocol for special status plants (Ruffner 1988).

Acuna cactus was one of the special status plants investigated as part of Dr. Ruffner's study. Growth, mortality, reproductive status, and recruitment of the acuna cactus were researched on study plots scattered across the species range in Organ Pipe Cactus. The protocol utilized was developed by Dr. George Ruffner and his assistants, and was designed to assess population dynamics of acuna cactus by monitoring growth, mortality, recruitment and reproductive status of several hundred marked individuals, occurring in six study plots scattered across Acuna Basin, thus encompassing the entire population of this variety within the monument (Ruffner et al. 1991b).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for acuna cactus will not be implemented. Valuable data on growth, mortality, reproductive status and recruitment will not be collected. The data acquired since 1988 will serve as the sole database, resulting in an incomplete database. It has been determined by the principal investigator that an additional five years of data is necessary to adequately evaluate the population parameters for this species.

B. **Implement the *Echinomastus erectrocentrus* var. *acunensis* Monitoring Protocol.** The monitoring protocol for acuna cactus as recommended by Dr. George Ruffner as part of the Sensitive Ecosystems Program will be implemented. A base program will be established and implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended option. Implementing the monitoring protocol as identified by the principal investigator provides the best alternative for evaluating the status of the acuna cacti population in the monument. At present (1988-1991), the population appears to be stable or increasing with annual recruitment being equal to or greater than annual mortality. Continued monitoring of this species is vital for assessing possible population declines as have occurred elsewhere (Ruffner et al. 1991c).

The protocol will be implemented at the acuna study site annually during the month of March. Field activities will consist of locating, measuring, and assessing the reproductive condition (counting flowers and buds) of all previously tagged and mapped individuals on six 0.1 ha permanent plots. At the same time, intensive and systematic searches will be made within these plots to locate additional plants, plants which, in estimation, have germinated since the last monitoring activity ("new"), or plants which, in estimation, had in fact been alive but had escaped detection during the provides monitoring session ("old"). This very intensive search will be facilitated by cordoning off the 0.1 ha plots (20 m x 50 m) into 2 m x 20 m subplots, using non-stretchable tape measurers. All newly found plants will be measured, tagged, and given an X and Y coordinate value relative to the 0 m x 0 m corner point of the plot.

Approximately two weeks after the initial flower/bud count, a second count will be made. This day will roughly correspond with the conclusion of flowering phenology for the species. The reproductive condition of the individual plants for the year will be assessed using the higher of the two counts.

Data analysis will be conducted at the end of the field season. Population variables to be analyzed will include growth, mortality, reproductive status and recruitment.

Personnel: The work for this project will be conducted by monument resources management staff. Field assistance, data review and recommendations will be accomplished through a contract.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM, Chapter 2, Appendices 1 and 7, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be

deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-124 Implement *Echinomastus erectrocentrus* var. *acunensis* Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	3,500	3,500	3,500	3,500
Personnel Services	3,600	3,600	3,600	3,600
Other	500	500	500	500
TOTAL	7,600	7,600	7,600	7,600
Funds Available in Park Base	4,100	4,100	4,100	4,100
Additional Funds Needed	3,500	3,500	3,500	3,500

References:

Ruffner, George. 1988. Proposal - Special Status Plants of Organ Pipe Cactus National Monument.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991a. Special Status Plants of Organ Pipe Cactus National Monument, Arizona: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 223 pp.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991b. Monitoring Protocol Handbook for Plants of Organ Pipe Cactus National Monument, Arizona. Final Report. Ruffner Associates. 42 pp.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991c. Database Information for Special Status Plants of Organ Pipe Cactus National Monument: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 82 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-125

2. Project Title: **Implement Monitoring Protocol for Vegetation Structure and Diversity in Natural Communities**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term ecological monitoring data on vegetation structure and diversity in natural communities is essential to assess the overall health and condition of the monument ecosystem. Data concerning the presence, density, frequency, coverage and diversity of perennial plant species is an important integrative component necessary to evaluate other ecological monitoring data.

In 1988, as part of the monument's natural resources inventorying and monitoring program, the Sensitive Ecosystems Program, Dr. Charles H. Lowe was contracted to gather baseline data on vegetation structure and diversity in natural communities. The objective of the research was to provide the monitoring program with baseline vegetation data, soil texture data and slope, and aspect and elevation information for one or more vegetation quadrats at 16 specified research study sites. In total 26 0.1 hectare plots were established (Lowe 1992).

Field work on this project was completed between 1989 and 1991. The vegetation parameters designated and measured for perennial plant taxa were presence (providing species richness), density, frequency, coverage and diversity. For ephemeral plant taxa, presence and density were measured within 1.0 square meter quadrats within the 0.1 hectare quadrats for perennials. Samples for mechanical analysis of soil texture were obtained from small trenches dug at each of the 26 0.1 hectare quadrats. At the time of soil sampling, permanent photo points were established for re-photography at each of the 0.1 hectare quadrats, and the slope and aspect of each site were measured.

As part of the management recommendations, continued monitoring of vegetation plots is identified. This data is necessary for continued integration of the overall monitoring program.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for evaluating vegetation structure and diversity in natural communities will not be implemented. The current data set will serve as the sole source of information on vegetation communities for integration with other monitoring data. As a result of no action, the long-term viability of the monitoring effort will be jeopardized by inadequate and out of date data.

B. **Implement Monitoring Protocol for Vegetation Structure and Diversity in Natural Communities.** The monitoring protocol as recommended by the principal investigator will be implemented. A program of systematically assessing the status of vegetation structure and diversity in natural communities will be established.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The resource management recommendation to continue monitoring vegetation communities at the natural resources monitoring study sites will be implemented. An interval of five years or more will be established for readings of perennial taxa on the 0.1 hectare quadrats. The next reading will be completed in 1994-1995. Subsequent monitoring intervals will be determined at the end of 1995.

Procedures outlined by the principal investigator for acquiring the initial baseline will be adhered to for all monitoring activities. Proper seasonal timing for ephemeral taxa will be employed.

Data will be managed and analyzed according to standards identified in the final report. The information will be integrated with other data sets and will be incorporated into the monument's geographic information system databases.

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-125 Implement Monitoring Protocol for Vegetation Structure and Diversity in Natural Communities	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	-	-	-
Personnel Services	35,000	-	-	-
Other	4,000	-	-	-
TOTAL	39,500	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	39,500	-	-	-

References:

Lowe, Charles H. 1992. Vegetation Structure and Diversity in Natural Communities in Organ Pipe Cactus National Monument.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-126

2. Project Title: **Implement *Stenocereus thurberi* and *Lophocereus schottii* Monitoring Protocols**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term ecological monitoring data is needed on organ pipe cacti (*Stenocereus thurberi*) and senita cacti (*Lophocereus schottii*) to develop a better understanding of these two sensitive species. Both species of columnar cacti are at or near their northern range limit in the monument, and as might be expected, both species are sensitive to prolonged freezing temperatures. Growth patterns of both species reflect climatic events, with growth being correlated with rainfall and prolonged freezing temperatures. Both species are excellent indicators for monitoring growth because of extensive baseline data (20 years of growth measurements on marked individuals of both species [Parker 1988]). In addition, these species may be impacted by human or natural events (Ruffner et al. 1991a).

L. thurberi is a large arborescent cactus that reaches 3-7 meters in height and 2-6 meters in width. Numerous columnar branches arise from ground level. The species occurs throughout the monument, including Senita Basin, Puerto Blanco Mountains, Quitobaquito Hills, Sierra de Santa Rosa, Bates Mountains and in Alamo, Grass, Estes and Arch Canyons of the Ajo Mountains. The highest densities occur on upper slopes with a southerly exposure (Ruffner et al. 1991b). High soil moisture is needed for germination; 85% of seedlings were found under nurse plants or rocks (Parker 1977, 1987b).

L. schottii is also a large arborescent cactus with many ascending elongated branches arising from ground level. Branches reach 3-7 meters in height, are 11-13 cm in diameter and usually have 6-7 prominent ribs. The entire plant is 2-5 meters in diameter (Ruffner et al. 1991b). The species occurs in the monument only at the southernmost boundary, and is easily distinguished from *S. thurberi* by fewer ribs and small stout spines that do not obscure the view of the stem, as do *S. thurberi* spines. Mature individuals also have hair-like spines on terminal parts of the stems (Ruffner et al. 1991a). *L. schottii* occurs in the monument primarily near the Arizona/Sonora border on La Abra Plain and south to Pozo Salado and along the border, and in Senita and Lost Cabin Mine Basins. In the monument, this species appears to be restricted to very coarse, granitically derived alluvial soils on flat sites (Parker 1988a). Within Organ Pipe Cactus, the populations of this species are relatively small and its distribution is limited. The species is frost sensitive (Ruffner et al. 1991).

S. thurberi and *L. schottii* were two of seventeen plants investigated by Dr. George Ruffner as part of the monument's long-term natural resources inventorying and monitoring program entitled the Sensitive Ecosystems Program. As part of the assessment, Dr. Ruffner and his assistants enhanced and expanded a protocol to monitor both species.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monitoring protocols to examine growth of *S. thurberi* and *L. schottii* will not be continued. The existing twenty year database will serve as the sole source of evaluation and assessment. Additional monitoring sites identified by the principal investigator will not be examined. The results of this alternative will be that data on two of the monument's high-profile sensitive species will not be gathered. Future analysis of monitoring data beneficial to management of the species will not be possible.

B. **Implement *Stenocereus thurberi* and *Lophocereus schottii* Monitoring Protocols.** The monitoring protocols, as refined and expanded by Dr. George Ruffner, will be implemented. The data set established over twenty years ago will be continued. Data will be periodically reviewed for validity and trend assessments. Monument resources management staff will implement the protocols.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The monitoring protocols for both *S. thurberi* and *L. schottii*, as recommended by Dr. George Ruffner, will be implemented. Aspects of the monitoring include:

- Monitoring sites for *S. thurberi* and *L. schottii* are located at Lost Cabin Mine Basin (both species), Senita Basin (both species), Baker Mine (*S. thurberi*) and Bates Well (*S. thurberi*).

- Monitoring will be conducted in mid-January, as this is the time that growth measurements have been taken for over 20 years.

- All but the smallest stems of each marked plant are tagged, labelled and pegged with a wooden dowel inserted 1-2 cm into the tissue near the base of the stem. New stems will be measured their first year, and pegged once they are large enough for peg installation. New arms will be labelled with an aluminum tag which is sequentially numbered relative to that individual plant.

- The length of each arm is measured along the lateral margin of the arm, from the bottom of the peg to the tip of the stem, excluding spines. Data, including plant and arm number, will be recorded on data sheets under appropriate headings.

- Data will be entered into a electronic spreadsheet. Growth of each arm over the previous year will be calculated. In addition, growth of the entire plant over the previous year will determined.

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM, Chapter 2, Appendices 1 and 7, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-126 Implement *Stenocereus thurberi* and *Lophocereus schottii* Monitoring Protocols	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	500	500	500
Personnel Services	3,600	3,600	3,600	3,600
Other	500	500	500	500
TOTAL	4,600	4,600	4,600	4,600
Funds Available in Park Base	4,600	4,600	4,600	4,600
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-127

2. Project Title: **Implement *Peniocereus striatus* Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term biological data is needed on dahlia rooted cereus (*Peniocereus striatus*) to effectively understand and manage this rare and sensitive species. Most likely, less than 200 individuals of this species exist in the monument. The population occurs on the south boundary, east of Lukeville. A significant threat may be spraying for boll weevil larvae, subsidized by the US Department of Agriculture, in cotton fields along the border. This spraying has probably reduced sphingid moth numbers (Nabhan, 1992). Sphingid moths are a primary pollinator of *P. striatus*.

P. striatus was one of seventeen special status plants investigated by Dr. George Ruffner as part of the monument's long-term inventorying and monitoring program entitled the Sensitive Ecosystems Program. Ruffner and his assistants located 59 individuals near Dos Lomitas and Blankenship Ranch, for an estimated density of 11.0 plants/hectare. There appears to be about 10-17 hectares of suitable habitat for the species in the monument (Ruffner et al., 1991b).

Dr. Gary Nabhan noted threats to the species in his final status report on *P. striatus* to the US Fish and Wildlife Service, National Park Service and resources agencies in Mexico. Concerns include illegal collecting, trampling, browsing and land clearing, impacts to nurse plants, threats to pollinators and threats to seed dispersers (Nabhan, 1992).

Dr. Ruffner and his assistants developed a protocol to monitor the *P. striatus* population. Two locations along the south boundary of the monument containing a total of 22 plants were tagged and inspected. Plants were photographed and condition data recorded. This information than be compared to observations from the previous years. Monument resources management staff were trained in protocol implementation and data management.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for *P. striatus* will not be implemented. Valuable data on the population's condition will not be collected. The data acquired since 1989 will serve as the sole database. The results will be that the database will be incomplete.

B. **Implement the *P. striatus* Monitoring Protocol.** The monitoring protocol for *P. striatus*, as recommended by Dr. George Ruffner as part of the Sensitive Ecosystems Program, will be fully implemented. A base program will be established and implemented annually, as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended option. Implementing the monitoring protocol as identified by the principal investigator provides the best alternative for evaluating the status of the *P. striatus* population in the monument.

The protocol will be implemented annually at the identified sites along the monument's southern boundary. The plants will be inspected to determine general health and condition. The number of new stems, if any, will be recorded, along with the number of immature flower buds, mature flowers and fruits. Also noted will be any evidence of herbivory or hedging.

Data analysis will be conducted at the end of the field season. Variables to be analyzed will include general plant condition, reproductive structures and evidence of predation.

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-127 Implement *Peniocereus striatus* Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	500	500	500
Personnel Services	1,000	1,000	1,000	1,000
Other	500	500	500	500
TOTAL	2,000	2,000	2,000	2,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	0,000	0,000	0,000	0,000

References:

Nabhan, Gary. 1992. Peniocereus striatus.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991b. Monitoring Protocol Handbook for Plants of Organ Pipe Cactus National Monument, Arizona. Final Report. Ruffner Associates. 42 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-128

2. Project Title: **Implement *Atamisquea emarginata* Monitoring Protocol**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Long-term biological data is needed on the desert tree caper (*Atamisquea emarginata*) to effectively understand and manage this sensitive species. *A. emarginata* is probably the species that is most at risk for future declines or extinction within the monument due to a combination of low population size, localized distribution, large disjunction from other populations, and possibly, groundwater drawdown (Ruffner et al. 1992).

A. emarginata was one of seventeen special status plants investigated by Dr. George Ruffner as part of the monument's long-term inventorying and monitoring program entitled the Sensitive Ecosystems Program. The species occurs in and near Aguajita Wash, from the international border to about 1 km north near Quitobaquito Springs, and at Hocker Well. Density is about 1.0 individuals/hectare in and adjacent to Aguajita Wash, and about .11 individuals/hectare in the adjacent *Atriplex* spp. flats. About 100 individuals occur in the monument (Ruffner et al. 1991).

As part of their assessment, Dr. Ruffner and his assistants developed a protocol to monitor the *A. emarginata* population. A study plot was established which covers approximately a five hectare area from the international border to about 200 m north of Puerto Blanco Drive, and from Aguajita Wash east to the next closest wash about 200 m away. Thirty individual plants were selected for use in monitoring growth rate, size-frequency distribution and average plant canopy cover. Monument resources management staff were trained in protocol implementation and data management.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monitoring protocol for *A. emarginata* will not be implemented. Valuable data on condition will not be collected. The data acquired since 1990 will serve as the sole database. The results will be that the database will be incomplete.

B. **Implement the *A. emarginata* Monitoring Protocol.** The monitoring protocol for *A. emarginata*, as recommended by Dr. George Ruffner as part of the Sensitive Ecosystems Program, will be implemented. A base program will be established and implemented annually as prescribed by the protocol. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended option. Implementing the monitoring protocol as identified by the principal investigator provides the best alternative for evaluating the status of the *A. emarginata* population in the monument.

The protocol will be implemented annually, at the identified site. All 30 tagged individuals will be located and monitored in the approximately five hectare permanent study site. A 1:100 scale aerial photograph and a mylar overlay showing locations of the monitored plants will be used. Monitoring efforts will consist of measuring plant heights and canopy coverage. In addition, assessments will be made of the reproductive condition of each plant. Data analysis will be conducted at the end of the field season.

Personnel: The work for this project will be conducted by monument resources management staff. Assistance will be acquired through contract for data review and recommendations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this monitoring effort a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and all be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-128 Implement *Atamisquea emarginata* Monitoring Protocol	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	500	500	500	500
Personnel Services	1,000	1,000	1,000	1,000
Other	500	500	500	500
TOTAL	2,000	2,000	2,000	2,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	0,000	0,000	0,000	0,000

References:

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991c. Database Information for Special Status Plants of Organ Pipe Cactus National Monument: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 82 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-129

2. Project Title: **Develop Long Term Population Monitoring of Snakes**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: Current monitoring programs do not address any of the major vertebrate predators in the monument. Snakes are one of the primary predators, if the not the key predators, of many small vertebrate species at Organ Pipe Cactus National Monument. Further, snakes are substantially impacted by highway mortality on Arizona State Route 85, which runs through the monument.

The Sensitive Ecosystems Program (SEP) produced extensive monitoring protocols for lizards, rodents and birds. Interpreting population monitoring results will be difficult without simultaneous monitoring of major predators such as snakes. During SEP research a large dataset was assembled on snake populations and a major snake population monitoring program was initiated along with other ecosystem monitoring at the East Armenta Environmental Monitoring Program (EMP) site. This is the only major program of snake population study that has been conducted in the Sonoran Desert. As of 1993, well over 1000 snakes had been marked, and recaptures of older ($\geq$ 10 yr of age) individual snakes were being obtained. For the first time, species populations of nearly 100% marked snakes have been attained in a non-temperate region. This is a state-of-the-art population study and monitoring program that is a basis for more taxonomically inclusive monitoring of vertebrate predators in the desert.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The result of no action will be to continue the snake population monitoring on a part- time, volunteer basis for the short term, at best. Scientific information available will be greatly reduced and the potential for long term monitoring will be lost. Information on predation as an important ecosystem process will be neglected.

B. **Develop, Test, and Implement a Monitoring Protocol for Snakes.** The existing SEP dataset will be enlarged by inclusion of new data on snakes obtained between 1991 and 1993. An analysis will be conducted and a monitoring handbook prepared detailing transect methods for periodic, regular monitoring of the highway and of other monument roads. A technical report will be prepared on transect methods and analysis techniques. In addition, baseline results on existing data will be presented and illustrated. This protocol will significantly expand the monitoring program, and enhance the ability to synthesize and integrate ecosystem results for other monitored taxa. The mark recapture program of live trapping and hand capture will be continued for all species. Ongoing population monitoring of snakes within four miles of the East Armenta site will be continued, using hand collecting and road driving. A set of cover trap arrays will be installed for long term, low impact, labor saving monitoring of the marked populations of snakes. This project will provide valuable scientific data useful for monitoring and general interest on community ecology.

6. Description of the Recommended Project or Activity. Alternative B. is the preferred alternative.

The program will consist of the following elements:

- The existing snake datasets for (1) Route 85, (2) Armenta (North Boundary) Road, and (3) live traps at the East Armenta Ecological Monitoring Program (EMP) site will be assembled for analysis. The ORPI climatic dataset from automated weather pods will also be assembled in files containing the raw data on temperature, rainfall, humidity, etc. A third dataset containing moon phases for the baseline study period (1987-1994) will also be computerized.

- Simple and multiple regression analysis, both linear and nonlinear, and path analysis, will be applied to this data, with each snake dataset independently studied for correlation with all meteorological variables. The analysis will identify the relevant variables based on their ability to predict snake activity. The result will be a regression formula giving an "expected" value for snakes observed within a given transect or methodological procedure. This analysis will (1) identify the optimal times and weather conditions for snake monitoring by slow-speed road driving, (2) assist with the interpretation of the data so obtained, (3) determine the research baseline for monitoring from several monument areas based on data collected 1987-1994, and (4) make it possible to interpret snake observations made during other routine activities involving driving on the monument.

- The regression formula--a model of snake activity--will be evaluated on existing data to determine the finesse of predictability that can be attained. During the second project year, this regression will also be tested on newly accumulated data. Results of this exercise will be used to define the timing and frequency of periodic transect activities for long term monitoring of snakes.

- Existing data (1987-1994) for other roads in the monument will be analyzed using the regression model. A baseline will be constructed from the existing data for each major road section of the monument.

- The analysis will be used to prepare a monitoring handbook, as well as a companion Cooperative Park Studies Unit Technical Report giving the analytical methodology and baseline results.

- During the second project year resources management staff will be trained to continue the monitoring. This ongoing monitoring will be in place by year three of the project.

- A scientific report will be prepared for publication in a peer-reviewed journal.

- Continue the current mark-release-recapture program for the trophically important species (rattlesnakes, whipsnakes, constricting colubrids). Live traps are in place on an established study area. Marking is by subcaudal (tail) scale clipping. Traps are checked twice per day while operating, and are closed down during non-sampling periods. During periods of high snake activity, on-foot hand capture is used intensively. All snakes encountered on the Armenta Ranch and East Armenta sites, as well as the Armenta (North Boundary) Road and Route 85 within 2.5 miles of Armenta Road will be marked.

- Armenta Road will be monitored regularly by slow-speed (9-14 mph) driving, with all rodents, lagomorphs, and predatory mammals and birds on this transect being recorded. This will provide baseline data on non-monitored ecosystem components, as well as extensive data on nocturnal rodents.

- Live traps will be refurbished by replacing the plastic trap buckets as needed. This replacement, approximately once every five years, is the only maintenance required for the live traps.

- A system of cover traps will be established on the primary population study site, the East Armenta site. This area is very rarely utilized by monument visitors and is hence ideal for cover trapping. The cover traps are boards and pieces of tin left on the ground. Snakes utilize these as hiding spots and thermoregulation shelters, and are captured at convenience by looking under the "trap". They require no maintenance, and are not known or expected to have any negative impact on the native fauna. This cover trapping system may potentially be extended for long term monitoring of snakes and other animals (rodents, geckos, invertebrates) at various other EMP sites.

- Annual reports will detail the mark-recapture program, snake population trends, and transect results for all species.

- The results of this monitoring protocol, will be integrated with other monitoring results.

Personnel: The project will be carried out via collaboration between the resources management computer specialist and an outside herpetologist contracted to provide specific expertise in snake ecology at Organ Pipe Cactus National Monument.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-129 Develop Long Term Population Monitoring of Snakes	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	12,000	12,000	12,000
Personnel Services	3,000	2,000	1,500	1,500
Other	1,000	1,000	500	500
TOTAL	19,000	15,000	14,000	14,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	19,000	15,000	14,000	14,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-130

2. Project Title: **Develop Mexican Leafcutting Ant Population Monitoring Program**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). This population was discovered during ground searches of more than 100 km of suitable riparian habitat at Organ Pipe, and consists of approximately 40 colonies in the park, plus one outlier 300 m outside the northeast boundary. The large size and unusual habits of the ant colonies make them significant objects of park interpretation and research activities. Several distinct local subpopulations were identified during the mid and late 1980s, and the natural diet, foraging behavior, and reproductive biology of these ants were studied intensively. Crucial resources for the survival of the ants were determined. Agricultural development south of the monument, however, may isolate the U.S. population from the main population in Mexico.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No action.** Up-to-date information on the number, distribution, and health of colonies will not be available, and management will not have population trend data on which to base decisions.

B. **Develop a Mexican Leafcutting Ant Population Monitoring Program.** Scientists at the National Biological Survey/Cooperative Park Studies Unit will be contracted with to design monitoring protocols. A monitoring handbook will be developed and park staff will conduct monitoring activities.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended alternative. This will include establishing a program for systematic ground search and regular census of known subpopulations as follows:

- Training of staff to identify new potential habitat, as well as conduct ground searches using the existing aerial photo library.
- Training of staff to recognize and assess the general health and age of colonies in the field.
- Completing periodic census of known subpopulations.
- Conducting a ground search of potential riparian habitat in the northern and western areas of the monument to detect additional subpopulations.

Personnel: Staff will include permanent resources management, interpretative and protection staff currently employed at the monument. Funding will be needed for assistance with establishing monitoring and research priorities and in expanding the interpretive effort.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-130 Develop Mexican Leafcutting Ant Population Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	2,000	1,000	1,000	1,000
Other	300	300	300	300
TOTAL	2,300	1,300	1,300	1,300
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	2,300	1,300	1,300	1,300

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-200

2. Project Title: **Identify and Inventory Water Related Resource Attributes**

3. Servicewide Issue: N13 - Lack of Secure Water Rights

4. Problem Statement: The water-related resource attributes of the monument have not been fully assessed. The identification and inventory are needed to both document the possibility of impact and to measure its magnitude, in the event impact does occur. This information will be required in water rights litigation or in any other similar arena in which the NPS seeks relief from such impact to protect the monument and the purposes for which it was created.

At present there exists an incomplete, and perhaps inadequate, understanding of the relationship of water to the natural resources. The first step in developing this understanding is to identify and inventory the nature and magnitude of resource attributes that are affected by, or are dependent on, both surface and subsurface water.

The possibility of future impact to water-related resource attributes exists because of agricultural expansion and development along the Mexican border. Water withdrawals from aquifers underlying the monument or alterations in surface water flow regimes are likely to affect water-related resource attributes. Without identification and inventory, actions to arrest and reverse effects will be delayed, resulting in additional or longer-lasting effects.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This action would leave the monument without an adequate database to protect its water rights or to understand the relationships between water and water-related resource attributes of the monument. Water resource attributes might be lost under such stewardship.

B. **Identify and Inventory Water Related Resource Attributes.** Such a study will give the Superintendent an adequate database from which to make informed management decisions and to protect water rights. Such results will also be of use to all other resource related inventories conducted at the monument.

6. Description of the Recommended Project or Activity: Option B. is the recommended action. The identification and inventory of water-related resource attributes will require a technical assessment of natural resources and scientific literature. This project will be best undertaken by an interdisciplinary team working as a unit. Field and office assessments will result in summary reports, maps and atlases. When completed, additional projects and/or studies may be required to evaluate the nature and magnitude of the relationship between water and water-related resource attributes.

Personnel: This project will be accomplished or contracted for by the National Park Service, Water Resources Division.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-200 Identification and Inventory of Water Related Resource Attributes	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	20,000	20,000	-	-
Other	0,000	0,000	-	-
TOTAL	20,000	20,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	20,000	20,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-201

2. Project Title: **Monitor Land Subsidence**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Further lowering of the groundwater table along the southern boundary will probably result in land subsidence. Monitoring must be initiated now so that future subsidence can be identified and documented.

Agricultural pumping and irrigation in Mexico was initiated in proximity to the monument about 20 years ago. Increased withdrawals of groundwater from the alluvial aquifer have caused a lowering in the groundwater table within the park by about ten feet. Subsidence can generally be expected when the lowering of the groundwater exceeds about 50 feet. The amount of land subsidence increases as the water table continues to decline. Once subsidence has occurred, it cannot be corrected.

Subsidence resulting from groundwater withdrawal is an increasing problem in alluvial basins in the southwestern US. The two major types of impacts from subsidence are changes in the land surface and drainage patterns, and permanent changes in the aquifer. Surface impacts occur when the centers of alluvial basins subside, and the surrounding mountains do not. Earth cracks, some hundreds of feet long and tens of feet deep, form at the point of flexure around the margins of the basin. The cracks can capture and divert small drainages, disrupting drainage patterns across the bajadas and causing significant erosion and sedimentation. Vegetative changes occur when water supporting vegetation along one channel is diverted away to another channel. Earth cracks can also damage roads, pipelines and other structures.

Damage to the aquifer occurs when alluvium, which is no longer supported by the full depth of groundwater, compacts. This permanently reduces the hydraulic conductivity of the substrate, as well as the water holding capacity of the aquifer.

At this time it is not believed that land subsidence along the international border has taken place. The purpose of this project is to provide a quantitative baseline against which future data can be compared. A baseline can be established with an accurate survey of existing benchmarks and boundary monuments along the border. The ability to identify when and if subsidence occurs, and its magnitude, will strengthen the monument's ability to negotiate for pumping rates that do not exceed groundwater recharge.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The no action alternative would result in a weakened NPS position for demonstrating impacts from groundwater pumping. The first evidence of land subsidence will be the observation of earth cracks.

B. **Monitor Land Subsidence.** Expanding the number of surveyed points to include the entire Sonoyta Valley is an alternative that would provide a greater understanding of the extent and depth of alluvium that

fills the valley. The additional warning of subsidence provided by these additional sites is minimal, however, as subsidence is expected to appear first at the southern boundary.

6. Description of the Recommended Project or Activity: Option B. is the recommended action. A first order survey of existing bench marks and boundary monuments along the international boundary will be made from the Ajo Range (IBM # 163) west to the Sonoyta Mountains (IBM # 168). It is expected that almost all of these markers are within the 60 foot wide strip of land adjacent to the international boundary reserved by Presidential Proclamation. Survey work in this area will be coordinated with the US Customs and Immigration Service.

Photographs will be taken to document surface conditions and to aid in relocating the survey markers. The area should be resurveyed at five year intervals unless changes in the rate of water table decline indicate the need for more or less frequent observations. The Mexican government should be notified of the NPS concern over subsidence, as well as its intention to monitor the condition.

Personnel: This project will be accomplished or contracted for by the National Park Service, Water Resources Division.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. An archeological clearance, under NHPA, Section 106, will be required.

8. Funding:

FUNDING

ORPI-N-201 Monitor Land Subsidence	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	7,000	-	-	-
Other	1,000	-	-	-
TOTAL	8,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	8,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-202a

2. Project Title: **Monitor Groundwater Resources in the Rio Sonoyta Watershed**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: The primary threat to the natural resources of Organ Pipe Cactus National Monument is the continued urbanization and agricultural development near its southern boundary in the neighboring state of Sonora, Mexico. Of concern to monument management is the effect on native plants and animals of herbicide and pesticide drift, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. The primary concern is that continued or increased pumping of groundwater in Mexico may lower the groundwater table and also reduce the hydrostatic pressure at certain locations within Organ Pipe, such as at Quitobaquito, where the endangered desert pupfish (*Cyprinodon macularius eremus*) occurs. As of 1988, there were approximately 22,455 irrigated acres in production in the Sonoyta Valley, supported by 165 wells. Annual groundwater pumpage is approximately 83,160 acre feet, which is 2.5 times the aquifer recharge rate. Although there now exists a moratorium on the drilling of new wells, current wells are pumping at less than half their potential capacity of 191,000 acre feet.

Approximately twelve years of water level data have been collected from all wells within the monument and at Lukeville. This data has been collected in conjunction with a complete water resources inventory conducted by the NPS Water Resources Division and monument personnel. This inventory has also included water quality data. USGS personnel, under NPS contract, have installed a gauge height recorder at one well in Lukeville. Additionally, USGS monitors wells in Organ Pipe along the border on a bimonthly basis. The NPS/USGS contract has also allowed for the updating of the existing V-notch weir at Quitobaquito Springs by installing a continuous recording system, which is maintained by the USGS.

An initial report by USGS in 1978 estimated future drawdown near the international boundary at Lukeville and stressed the need for additional hydrologic data to improve the accuracy of this model. Three additional monitoring wells were drilled in 1988, and after collection of monitoring well data for several years to establish trends, the model will be rerun. Over the past three years, National Park Service efforts through the Sensitive Ecosystems Program, a baseline research program, have made significant progress in researching this problem and in working with Mexican resource personnel. Efforts have included researching past, present and future land usage in the Sonoyta Valley, developing an eight year database of depth-to-water measurements for 165 wells adjacent to the monument, gathering electrical data for wells, calculating extraction by point and attempting to define boundaries of the aquifer.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will leave the monument with no means of knowing the status of groundwater resources.

B. **Monitor Groundwater Resources in the Rio Sonoyta Watershed.** This program will continue the collection of groundwater data, both within the monument and on adjacent Mexican lands, and will include both existing monitoring activities and the development of new ones.

6. Description of Recommended Project or Activity: Option B. is the recommended action. The program will encompass the following:

Organ Pipe Cactus National Monument

- Monitor groundwater continuously at 3 locations on the southern boundary of the monument. Monitoring wells dug in 1988 along the monument's southern boundary will continue to be monitored on a continuous basis. USGS will be contracted to maintain and provide data summaries for these wells. Continuous recording of these wells will allow any trends in groundwater levels to be determined.

- Monitor groundwater quarterly in 6 locations on the southern boundary of the monument. Depth-to-water data will be collected quarterly at the following designated wells: Kalil Well, Stack Well, Dowling Well, Pozo Salado Well, Hocker Well, and Corner Well. Data will be incorporated into an analytical spreadsheet to monitor trends and to assist in modeling and evaluating impacts.

- Monitor groundwater quarterly at 4 locations within the monument not located on the southern boundary. Depth-to-water data will be collected quarterly at the following designated wells: Pozo Nuevo Well, Bonita Well, Alamo Well, and Bates Well. These sites, removed from the impacts of agricultural development, will serve as control sites.

- Monitor spring flow at Quitobaquito. The recorder at Quitobaquito which monitors water flow from the northeast and southwest springs will continue to be operated. USGS will be contracted to maintain and provide data summaries on spring flow. Data will reveal trends and will provide information indicating possible impacts from groundwater depletion in the area.

Sonoyta, Sonora, Mexico

- Collect annual depth-to-water and electrical data for 165 agricultural wells located in the Sonoyta Valley in Mexico. Annual depth-to-water and electrical data will continue to be collected from Secretaria de Agricultura y Recursos Hidraulicos (SARH) Mexican agricultural officials in Sonoyta, Sonora, Mexico. All data collected will be input into databases maintained at the monument.

- Increase the number of data checks on selected wells. Currently all agricultural wells in the Sonoyta Valley are shut down for approximately one week each November, while SARH staff measure and record data related to the static water levels. These annual measurements have been conducted by SARH since the early 1980's. In order to develop a more complete understanding of the aquifer, it

is desirable to obtain well data for different periods throughout the annual cycle. This task would include selection of the wells and conducting the related measurements for the first year.

Personnel: U.S. Geological Survey personnel and monument resources management staff would complete the work identified in this project.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-202a Monitor Groundwater Resources in the Rio Sonoyta Watershed	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	2,000	3,000	3,000	3,000
Other	23,000	13,000	13,000	13,000
TOTAL	25,000	16,000	16,000	16,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	23,000	14,000	14,000	14,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-202b

2. Project Title: **Investigate Groundwater Use on Tohono O'odham Lands**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Land and water use on Tohono O'odham Reservation lands east and adjacent to Organ Pipe Cactus National Monument may pose future threats to natural resources. Land within the immediate vicinity of the boundary is not intensively used and is predominantly grazed by livestock. Approximately 20 miles to the east of the boundary, however, near the Mexican border, is Papago Farms, an agricultural area. Papago Farms is significant because of its location in the headwaters of the Rio Sonoyta watershed. Although no data is presently available, it is believed that the major portion of the water supply for the farms comes from groundwater. Surface water runoff may also contribute to the supply. Water consumed on the Tohono O'odham Reservation contributes to the collective overdraft of water in the Rio Sonoyta watershed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will leave unanswered questions on groundwater usage on the Tohono O'odham Reservation lands, which may impact the natural resources of Organ Pipe.

B. **Investigate Groundwater Use on Tohono O'odham Lands.** An inventory will be conducted to gather baseline data and develop a monitoring protocol for groundwater use on Tohono O'odham lands.

6. Description of the Recommended Project or Activity: Alternative B. is the recommend alternative. An inventory will be conducted of wells in the vicinity of Papago Farms for location, water depth and pumped volumes. Information will also be collected concerning the area under irrigation and recent cropping patterns. Well data and other information will be organized into a database and preliminary analysis will be made.

Data collection procedures will be established to periodically update information received from Papago Farms. Contacts from whom staff can obtain periodic data related to water volume and depth, and cropping patterns, will be identified in cooperation with the farm manager and the Gu Vo District of the Reservation.

Personnel: The work for this project will be contracted. Resource management staff will assist with the data gathering and will implement long-term monitoring protocols, including obtaining annual data and updating the database.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-202b Investigate Groundwater Use on Tohono O'odham Lands	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	6,000	0,000	0,000	0,000
Personnel Services	500	250	250	250
Other	0,000	0,000	0,000	0,000
TOTAL	6,500	250	250	250
Funds Available in Park Base	0,000	250	250	250
Additional Funds Needed	6,500	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-202c

2. Project Title: **Conduct Surface Water Inventory of the Rio Sonoyta Watershed**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Insufficient information exists on surface water use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. On-going monitoring along the southern boundary has shown that continued urbanization and agricultural development in Sonora, Mexico, annually deplete the groundwater aquifer at 2.5 times the recharge rate. Very little data on surface water use in the Rio Sonoyta watershed is currently available. While data collection has begun on groundwater usage outside of the monument, little research has been done on surface water availability, locations, uses and trends that may impact the resources.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will leave unanswered questions on surface water use within the Rio Sonoyta watershed which may impact the natural resources or Organ Pipe.

B. **Conduct Surface Water Inventory of the Rio Sonoyta Watershed.** A thorough inventory of the Rio Sonoyta Watershed will be implemented. The project will include an inventory of surface water use, an assessment of historic flows and an examination of watershed hydrology.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended alternative. This work encompasses three primary components, including:

- Inventory of Surface Water Use. An inventory of surface water use in the Rio Sonoyta watershed will be made. This will include surface water use by the Tohono O'odham Reservation and Mexico. The primary user of surface water is the Tohono O'odham Tribal farm. At the present time, little is known concerning surface water use from the Rio Sonoyta in Mexico.

- Collect Historic Flow Information. Available historic flow information will be collected for the Rio Sonoyta and its major tributaries within the watershed.

- Watershed Hydrology. A preliminary hydrological analysis of the Rio Sonoyta Basin will be conducted, based upon available historic information related to climate, watershed size, soils, flows, and uses. Estimates will be made for runoff, flows, and groundwater recharge.

Personnel: The work for this project will be contracted. Resources management staff will assist with the data gathering.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-202c Conduct Surface Water Inventory of the Rio Sonoyta Watershed	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	-	-	-
Personnel Services	1,000	-	-	-
Other	0,000	-	-	-
TOTAL	26,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	26,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument

1. Project Number: ORPI-N-202d

2. Project Title: **Conduct Land Use Inventory of the Rio Sonoyta Watershed**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Insufficient information exists on land use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. The region is exposed to a multitude of threats and issues, impacting water and other natural resources. Land is managed by an array of governmental, private, and tribal organizations. The types and extent of land uses are not well known, particularly on the Tohono O'odham Reservation and in Mexico. Land management practices in one area could affect water availability throughout the watershed. A more thorough understanding of land uses within the watershed will provide for more effective management of the resources, and will assist in mitigation of current and potential problems resulting from such land use.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will leave unanswered questions on land use within the Rio Sonoyta watershed, which may impact the natural resources of Organ Pipe Cactus National Monument.

B. **Conduct Land Use Inventory of the Rio Sonoyta Watershed.** A thorough inventory of land use in the Rio Sonoyta watershed will be completed. The project will include defining the watershed, identifying and delineating land uses, collecting land ownership data and conducting a land capability study.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This action encompasses four primary components, including:

- Define Watershed. The objective of this component is to define the boundaries of the watershed on available maps. At present, no single map of the complete watershed area exists, and therefore, two sets of maps will be used: one for the US lands; and one for the Mexican lands. The area of the watershed will be computed along with appropriate subareas. The resulting map will serve as a "base map" for the other components described below.

- Identify and Delineate Land Uses. Land use data will be collected for the watershed area. Appropriate land use categories will be developed to encompass current activities present in the watershed area. Examples of these categories are: agriculture, grazing/range, riparian, streambeds, reserves, urban, etc. Visits will be made to various parts of the watershed to ascertain existing uses. The results will be delineated upon a copy of the base map of the watershed to be named: "Land Use Map".

- Collect Land Ownership Data. Land ownership data of the watershed will be collected in concert with land use data. Ownership in the US pertains to Organ Pipe, the Tohono O'odham Reservation, and the Cabeza Prieta National Wildlife Refuge. In Mexico, however, ownership

is divided between public and private entities. As far as possible, both private and public lands will be identified. The results will be delineated on a copy of the base map to be named: "Land Ownership Map."

- Conduct Land Capability Survey. A land capability survey will be made of the watershed. Land capability will be based primarily upon soils, elevation and climate. The general soil associations found in the watershed will be identified. This information will be used in conjunction with elevation and climatic data to determine land capability. The results will be useful to identify different land characteristics such as productivity, erosion risk and drainage. Land will be classified according to its highest capability, taking into consideration applicable limitations. Land capability classes will be mapped along with appropriate symbols and legends.

Personnel: The work for this project will be contracted. Monument resources management staff will assist with the data gathering.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-202d Conduct Land Use Inventory of Rio Sonoyta Watershed	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	55,000	-	-	-
Personnel Services	1,000	-	-	-
Other	0,000	-	-	-
TOTAL	56,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	56,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-202e

2. Project Title: **Evaluate Trends in Water Use in the Rio Sonoyta Watershed**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Insufficient information exists on trends in ground and surface water use in the Rio Sonoyta watershed, of which Organ Pipe Cactus National Monument is a part. On-going monitoring along the monument's southern boundary has shown that continued urbanization and agricultural development in Sonoyta, Sonora, Mexico, on lands adjacent to the monument, annually depletes the groundwater aquifer at 2.5 times the recharge rate. Information on past, present and projected water uses in the watershed is needed to provide an understanding of development in the region and its associated impacts on the natural resources of the monument.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will leave unanswered questions on trends in ground and surface water use in the Rio Sonoyta watershed, which may impact the natural resources of Organ Pipe.

B. **Evaluate Trends in Water Use in the Rio Sonoyta Watershed.** An evaluation of trends in water use in the Rio Sonoyta watershed will be conducted. This project will include an evaluation of historic water uses, present uses and potential uses.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This recommended action encompasses three primary components, including:

- Historic Uses. Historic water use data in the watershed will be compiled. Users and quantities will be identified, along with a descriptive history of water use. Documentation of formal claims will be included where possible.

- Present Uses. Present water use data for the watershed will be compiled. This will include the use of both surface and groundwater. Types of uses and respective quantities will be determined where adequate information is available and estimated where it is not. Historic data collected in previous studies of the watershed will form the database for the analysis of present water use in the basin.

- Future Potential Uses. Projections will be made of future water use in the Rio Sonoyta Basin. Separate projections will be made for the Tohono O'odham Nation, Organ Pipe and Mexico. An appropriate time horizon will be selected for the analysis (20 to 25 years). Future uses will be compared to projected available resources. Conclusions concerning water and land policies will be developed from comparisons.

Personnel: The work for this project will be contracted. Monument resource management staff will assist with the data gathering.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-202e Evaluate Trends in Water Use in the Rio Sonoyta Watershed	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	25,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	25,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-203

2. Project Title: **Develop and Implement Water Conservation Program**

3. Servicewide Issue: N24 - Other Issues

4. Problem Statement: Although the amount of water used by monument operations has been described as "a grain of sand among sand dunes", the actual amount used is not closely monitored. Even though the use is relatively small in comparison to Mexican agricultural demands, NPS credibility will be greatly enhanced if management makes an effort to most efficiently use the water necessary for our own operations.

Inholdings include the GSA owned Port of Entry facilities and the privately owned Gringo Pass enterprise, both at Lukeville, Arizona. Both have active wells and sewage systems. Wells are not monitored for pumpage rates. Owners and operators of these inholdings should also be invited to participate in monument water conservation efforts.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Continue monument operations without a well developed plan of water conservation.

B. **Develop and Implement Water Conservation Plan.** This action will utilize existing expertise by working with consultants from the NPS Water Resources Division and outside specialists, such as the Phoenix and Tucson City Water Conservation Departments, to modify and implement existing NPS plans to suit Organ Pipe's specific needs.

6. Description of the Recommended Project or Activity: Option B. is the recommended action. During August, 1990, a drought contingency plan was developed for Big Bend National Park by Mark Flora of the NPS Water Resources Division. That plan defined alternative management actions that could be undertaken to reduce water consumption. The Big Bend plan provides a good starting point for water conservation efforts at Organ Pipe, which would encompass the following:

- Encourage a parkwide voluntary water conservation program and provide park residents with an information fact-sheet on residential water conservation.

- Install/calibrate water meters at key locations that would allow for the routine tracking of water use and identification of possible waterline leakage. A minimum program would include metering water at the visitor center, visitor and volunteer campgrounds, at the dump station and at individual residences or groups of residences.

- Install/retrofit devices so that consumption is reduced to 1.5 gallons/flush for toilets, 2 gallons/minute (gpm) for showers and 1.5 gpm for personal use spigots. Install automatic shut-off faucets in all public restroom facilities.

- Evaluate the need for contracting a leak detection survey. This activity is especially recommended for sections of distribution systems that are old, suspected of leaking, or are located in areas of potential water supply shortages.

- Phase-out lawn areas, promote the use of native vegetation for landscaping activities, and require the use of drip irrigation systems where watering is essential.

Personnel: This work will be accomplished by park staff with supplemental funding for equipment and supplies.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-203 Develop and Implement Water Conservation Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	10,000	5,000	-	-
Other	10,000	10,000	-	-
TOTAL	20,000	15,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	20,000	15,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-204

2. Project Title: **Define Characteristics of Regional Aquifers**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: The alluvial aquifer that supplies the Rio Sonoyta Valley extends well beyond the monument boundary. The nature and extent of this aquifer, and the uses that it is incurring, may have a direct bearing on the extent of impacts to monument resources from groundwater pumping in Mexico. Current and possible expanded pumping adjacent to the monument in Sonora, Mexico, threatens aquifers that provide the monument's water supply, supports desert riparian vegetation and may supply important springs. A study of regional aquifers is proposed to supplement detailed studies of groundwater systems inside the monument.

The surface watershed for the Rio Sonoyta extends several miles south and east of the monument into Mexico. It also includes portions of the Tohono O'odham Reservation. Whether the groundwater drainage basin conforms to the surface watershed is not known, nor are recharge rates, water withdrawals and major avenues of flow. Understanding these basic principles would enhance the knowledge gained through detailed studies in the monument.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Knowledge concerning the regional aquifers would remain very limited. Possible threats and impacts occurring to the aquifer would remain unknown, possibly impacting monument water supplies and resources.

B. **Define Characteristics of Regional Aquifers.** Examine existing geologic, groundwater and water consumption information to characterize the regional aquifer system for the Rio Sonoyta.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This will involve a review of literature available in the US and Mexico. Once assembled, the information will be analyzed in an effort to determine the lateral and vertical extent of the aquifer, recharge and groundwater yields, major directions and pathways of flow, groundwater consumption and trends in the condition of the aquifer. A report would be prepared presenting this information.

Personnel: This project will be accomplished through an agreement with the USGS or through a private contractor.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-204 Define Characteristics of Regional Aquifers	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	18,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	18,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	18,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-205

2. Project Title: **Update Water Resources Inventory and Monitoring Program**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: The current inventory of water resources provides little information about water quality or trends. A long term monitoring program for water quantity and quality must be initiated, based on the existing inventory.

The existing inventory (Brown et al. 1983) identified 84 water sources including 11 springs, 60 tinajas, 3 stock tanks, 7 watering troughs, and 3 sewage disposal ponds. The report maps all water sources and provides the following information on each source: location; elevation; classification (following Brown, et. al, 1983); naturalness; permanence; maximum capacity; brief history; remarks; and references. One of the reasons for this study was to assess the effects upon fauna and flora as pumpage from wells used for grazing leases terminated in about 1978. This study determined that the availability of park surface water resources has changed during this century. Some water supplies have been lost, but the overall change is an increase in water sources available to wildlife, due to human development of artificial water sources.

The existence of many of the sources is tenuous and may be affected by relatively small climate changes. The availability of water varies substantially with season, and probably from year to year as well. These sources are critical to the existence of monument wildlife. Water is a fundamental component in understanding the natural processes occurring in the monument.

Little or nothing is known of the water quality of all but a few sources. Tinajas might be particularly vulnerable to airborne contaminants. These may be transported in regional air flow or from agricultural activities in adjacent Mexico.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument will have no knowledge of water quality for most sources and no way to identify or document trends in the availability or quality of monument waters. Opportunities to correct or avoid impacts to monument resources may be lost.

B. **Update Water Resources Inventory and Monitoring.** Long term and seasonal trends in water quality and quantity will be examined. The existing water resources inventory will be expanded to include water quality. An annual monitoring program will be established.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Three components are proposed.

- The first year of the project will focus on study design. The design will identify sample sites, sampling protocols and schedules, and parameters for analysis. Some sampling will be conducted in order to identify existing conditions and to evaluate logistical constraints to facilitate the study design and produce accurate cost estimates. It is envisioned that the long term project will include two components. Funding requests may have to be revised once the design is completed.

- A limited monitoring program will be conducted every year. This will include several volume measurements of selected sources and a few water quality analyses of key water sources. This program will provide current information on water availability and quality, and is much more likely to produce data for particularly wet or dry years than are the more intensive sampling cycles described below.

- Intensive flow measurements and sampling will be conducted every five years. This will include several flow measurement samples collected throughout the year from most, if not all, water sources in the monument. Water quality analysis will be consistent with the design developed during the first year of the project and will probably include basic constituents, metals, radionuclides and pesticides. Species and density of macroinvertebrates might also be included.

If the results of this project indicate the presence of a regional aquifer system, follow-up studies of the nature and extent of the aquifer may be needed.

Personnel: This work will be contracted through the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ, in cooperation with the NPS Water Resources Division. Assistance will be provided by monument resources management staff.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project. An collection permit assessment may be necessary for the collection of aquatic invertebrates.

8. Funding:

FUNDING

ORPI-N-205 Update Water Resources Inventory and Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	40,000	12,000	12,000
Personnel Services	2,000	10,000	2,000	2,000
Other	0,000	0,000	0,000	0,000
TOTAL	32,000	50,000	14,000	14,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	32,000	50,000	14,000	14,000

References:

Brown, B. T., L. P. Hendrickson, R. R. Johnson and W. Werrel. 1983. An Inventory of Surface Water Resources at Organ Pipe Cactus National Monument. Technical Report No. 10. USDI, NPS, Cooperative National Park Resources Studies Unit, University of Arizona, Tucson, AZ. 97 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-206

2. Project Title: **Develop a Geographic Information System Component for Water Resources**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: An efficient and effective method for managing water resources data is needed. Existing information on ground and surface water resources is extensive. This includes locations of water sources such as springs, tinajas, and wells; twelve years of depth-to-water data for wells; the locations of and data from sites where precipitation is measured; and the locations and depth-to-water data for 165 wells in the Sonoyta Valley adjacent to the monument. Implementation of other projects within the Resources Management Plan will yield more data, including, but not limited to, regional aquifer sizes, surface and groundwater use, and land subsidence.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will result in inefficient database management for water resources. The lack of a GIS component will also prevent production of high quality usable digital maps. The overall effectiveness of the WRMP would be diminished by a "No Action" alternative.

B. **Develop a Geographic Information System Component for Water Resources.** This will include digitizing all available water resources data so that it is compatible with other GIS data. Applications will be developed to utilize and model the data and to assist with data management.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Specific water resources GIS activities include:

- Digitize and analyze all ground and surface water resource data - springs, tinajas, wells and Quitobaquito pond.
- Digitize and analyze ground and surface water data in Sonoyta, Sonora, Mexico, adjacent to the south boundary.
- Digitize and analyze ground and surface water data on the Tohono O'odham Reservation lands adjacent to the boundary.
- Evaluate impacts of groundwater depletion on monument resources due to agricultural development on adjacent lands in Mexico.
- Evaluate impacts to natural resources due to surface water use in the Rio Sonoyta watershed.

- Digitize, evaluate and analyze the Quitobaquito area. Water quality and quantity monitoring is essential to the preservation and management of the endangered Quitobaquito pupfish and its habitat.

- Incorporate information from other water resource projects as they are implemented.

Personnel: This project will be completed through either a contract or a cooperative agreement with the Advanced Resources Technology Lab at the University of Arizona, Tucson, AZ. The Natural Resources Monitoring Science Advisory Committee, monument resources management staff and National Park Service and/or National Biological Survey scientists will provide review and assistance.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-206 Develop a Geographic Information System Component for Water Resources	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	15,000	10,000	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	25,000	15,000	10,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	25,000	15,000	10,000	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-207

2. Project Title: **Monitor Riparian Ecosystems**

3. Servicewide Issue: N12 - Alteration of Natural Flow Regimes

4. Problem Statement: Valuable riparian vegetation and the ecosystems that they support may be threatened by continued depletion of groundwater in the southern portion of the monument, due to agricultural development on adjacent lands in Sonora, Mexico. Among the species of concern are mesquite (*Prosopis velutina*) and desert tree caper (*Atamisquea emarginata*), which is a rare species with its northern range limit in Organ Pipe. These species utilize deep tap roots extending to the groundwater level to supply their nutrient and moisture needs. These species may now be facing a significant threat due to the excessive use of groundwater in areas adjacent to the monument. On-going monitoring indicates that the groundwater aquifer in the Sonoyta Valley is being depleted at 2.5 times the recharge rate. There are currently many well documented cases in Arizona where large stands of mesquite have died off following the excessive withdrawal of groundwater for agricultural purposes. If such a drop in the water table were to occur within areas of the monument, a significant impact on riparian ecosystems could result.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative could result in the loss of riparian vegetation going undetected and undocumented.

B. **Monitor Riparian Ecosystems.** This alternative will give the monument the ability to detect and document the loss of riparian vegetation, and will provide information that could be used to initiate steps to prevent further decline.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Five riparian study plots and two non-riparian controls will be established to evaluate the effects of water drawdown from agricultural uses. Riparian control plots will also be established with permanent and visible corner markers for aiding remote sensing studies. Aerial photography will be conducted at elevations necessary to map vegetation composition. Techniques will be developed and employed to accurately measure species composition and densities and the general vigor of the flora and fauna of all study plots. Techniques developed will be standardized for use in other desert park areas. These plots will be located in proximity to existing well and climate monitoring stations to utilize data collected from these sources.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resource management staff will assist with the data gathering.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-207 Monitor Riparian Ecosystems	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	5,000	5,000	5,000
Personnel Services	2,000	1,000	1,000	1,000
Other	0,000	0,000	0,000	0,000
TOTAL	27,000	6,000	6,000	6,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	27,000	6,000	6,000	6,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-208

2. Project Title: **Identify Pollution Threats from Kuakatch and Cuerda de Leña Washes**

3. Servicewide Issue: N11 - Degradation of Park Water Quality Due to External Activities

4. Problem Statement: Two intermittent streams, Kuakatch and Cuerda de Leña Washes, enter the park at the northeast corner and along the northern boundary. The infiltration of flow from both these streams and alluvial groundwater into the park provides an unquantified amount of recharge to the alluvial groundwater regime. Presently the lands in this vicinity are used for a small amount of grazing, and the impacts from such activities, if any, are unknown. If future uses such as grazing, agriculture, or land development occur in these areas, both quantity and quality of these water inflows are likely to change. In the northeast corner, shallow groundwater conditions probably exist near the boundary, since an abandoned, shallow, dug well is located in this area. Kuakatch Wash and associated washes within the Tohono O'odham Reservation drain approximately 30 square miles to the east.

The surface water drainage of Cuerda de Leña Wash outside the northern boundary is approximately 110 square miles. The town of Why, AZ, is located in this area, and the lack of water supplies here have historically restricted both town and area development. In addition, a plume of groundwater contamination may reach into the northern portion of the monument from the extremely large tailings pile located at the inactive copper mine near the town of Ajo. Any future activities in this area, particularly water or mineral development, could have effects upon the park. Fortunately, few natural water sources exist here, and the only potable water supplies which could be affected by external inputs from the northeast and north are at Bates Well.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The effect of current and any future external activities occurring within these drainages on the quantity and quality of monument water supplies will remain unknown.

B. **Identify Pollution Threats from Kuakatch and Cuerda de Leña Washes.** This alternative would provide the information needed to accurately assess and predict future trends of surface and groundwater contamination from these two major washes.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This program will involve data collection on the quantity and quality of ground and surface water. It will allow for data collection by an independent government agency at important hydrologic times during each year. Efforts will include obtaining water level and quality measurements at neighboring wells on the Tohono O'odham Reservation and on other lands along the northern boundary.

Personnel: The project will be contracted to the USGS. Monument resources management staff will provide assistance in the field.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4, B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-208 Identify Pollution Threats from Kuakatch and Cuerda de Leña Washes	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	5,000	5,000	5,000	5,000
Personnel Services	1,000	1,000	1,000	1,000
Other	0,000	0,000	0,000	0,000
TOTAL	6,000	6,000	6,000	6,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	6,000	6,000	6,000	6,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-209

2. Project Title: **Control Accelerated Erosion**

3. Servicewide Issue: N06 - Disruption of Native Plant Communities and Accelerated Erosion Due to Past Land Practices

4. Problem Statement: Anthropogenic erosion is evident in the vicinity of those historic ranch sites where soils are of fine texture and where cattle trampling and grazing pressure was the strongest. Erosion problems are most severe at Dos Lomitas and Armenta Ranches, where 170 acres are affected. Broad scale loss of soil from wind and water has occurred in these areas and has resulted in changes in the vegetation communities. As the soil level drops, the landscape changes and erosion channel headcutting continues "upstream." The resultant deepening of arroyos has caused problems in maintaining park dirt roads in both the Armenta area, near the central north boundary and Dos Lomitas, near the eastern south boundary.

Perennial grasses and forbs, except for unpalatable species not used by cattle, horses, and burros, are almost completely absent from problem areas. The lack of vegetative ground cover, either from grazing, or in some cases, from roads, has permitted large areas of critical gully erosion to develop unchecked.

Small scale attempts at reducing active headcutting, by placing brush and rock in the cuts, have been tried on an experimental basis. Seven hundred acres of contoured water spreading dikes have been constructed in the vicinity of Blankenship Ranch and the Growler Valley. In 1968, badly eroded areas were inspected by representatives of the Soil Conservation Service and recommendations were made for a recovery plan. In the 1970's, 80's and 90's, monitoring studies have been conducted under the direction of Terrance Marsh (North Central College, Naperville, Illinois) to assess further headcutting and width increases in existing gullies at the north and south boundary areas. The indication is that some stability has been attained and revegetation is occurring in certain gully sections. While this is encouraging, a definite need has been identified to monitor gully status in the future to assure no further soil losses.

In 1989, the NPS contracted with Great Western Research to study methods of controlling erosion on two sites. The result of this contract was a study entitled, "Erosion Control Studies at Armenta Ranch and Dos Lomitas", which recommended measures required to mitigate the eroded soils at both sites. At Armenta Ranch, the watershed was estimated to be 49 square miles in size and 20 miles in length. The affected area encompasses about 66 acres, and soil losses were estimated to range from 25 to 50 tons per year. The Dos Lomitas watershed was estimated to be 13 square miles in size and 11.5 miles in length. This affected area is larger, totalling about 110 acres in size, and soil losses were estimated to range between 17 and 34 tons per year. Field observations identified two distinct and different erosion conditions: main channel erosion and side channel erosion. Mitigation measures were recommended for both erosion conditions, and consisted of using small earthen dikes, larger brush and rock structures and limited channelization work. The purpose of this project is to implement the recommendations of the contract study.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Erosion of fine soils and the incision of small channels will continue and possibly accelerate.

B. **Control Accelerated Erosion.** Implement the 1989 study "Erosion Control Studies at Armenta Ranch and Dos Lomitas" recommendations.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This will include the following:

- Armenta Ranch- Highest priority will be given to erosion problems in the side channels rather than in the main channel, and the following actions will be accomplished:

  – Side Channels. Initiate pilot program of installing small earthen dikes at the mouth of selected side channels from a total potential of 34 locations. Monitor effectiveness and compare with data from Marsh's project.

  -- Main Channels. 1) Stabilize gabion structure at road and place additional rock downstream. 2) Install rock and brush structures just west of road. 3) Investigate the feasibility and practicality of diverting the north channel into the next adjacent channel. 4) Recreate the channel crossing the boundary road.

- Dos Lomitas- Highest priority will be given to erosion problems in the side channels rather than in the main channel, and the following actions will be accomplished:

  – Side Channels. Initiate pilot program of installing small earthen dams at the mouth of selected side channels from a total potential of 49 locations. Monitor effectiveness and compare with data from Marsh's project.

  – Main Channel. This work will be the lowest priority and will include construction of additional rock and brush structures spaced in the main channels to slow water during smaller flows. The structure will be designed so that larger flows will overtop, leaving the materials in place.

Several additional areas exhibiting severely eroded conditions have been mapped and photographed as part of Mr. Marsh's study. Park staff will be involved in the monitoring efforts to assess potential problems before (or as) they arise. Mitigation may be necessary in some areas, and may involve revegetation or other appropriate stabilization measures. Areas with fine soil texture prone to compaction and erosion (at both the north and south boundaries) need to be more intensively surveyed for problems. The full extent of the damage has not been quantified in recent years.

Personnel: This project will be contracted. Resources management and maintenance staff will provide assistance.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4, B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-209 Control Accelerated Erosion	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	80,000	0,000	0,000	0,000
Personnel Services	1,000	500	500	500
Other	0,000	0,000	0,000	0,000
TOTAL	81,000	500	500	500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	81,000	500	500	500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-210

2. Project Title: **Evaluate Flood Hazards at Bates Well**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Normally dry channels, which are common in the monument, are subject to occasional flooding and some flash floods, when flood waters arrive with little or no warning. Two areas contain developments or visitor activities that may be threatened by flooding. These are:

- Bates Well area
- Headquarters area including the campground

The evaluation of two drainages at Bates Well-Growler Wash and the wash north of the site will be required if facilities there are to be occupied on a seasonal or full time basis by park personnel. Flooding to the floor of Henry Gray's house at Bates Well has been reported in the past. Establishing a ranger station at Bates Well has been proposed in the past but is not planned for the near future.

In April, 1991, two drainages in the headquarters area were evaluated. They were the wash immediately west of the headquarters and the wash to the north of the campground. Results of these evaluations are pending. No further action is currently needed at this location.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative is not acceptable, as it will result in the NPS not meeting the mandated requirements of E.O. 11988, thus placing the safety of staff and property in jeopardy.

B. **Evaluate Flood Hazards at Bates Well.** This action will be needed if further developments at Bates Well are considered.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. At the time that further developments at Bates Well are considered, a flood hazard analysis of the Bates Well area should be conducted as part of the initial site selection and planning. The headquarters area has been mapped and the results incorporated in park operations and planning.

Personnel: This project will be conducted by the NPS Water Resources Division.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-210 Evaluate Flood Hazards at Bates Well	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	4,500	-	-	-
Other	1,500	-	-	-
TOTAL	6,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	6,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-211

2. Project Title: **Evaluate Abandoned Mine Tailings**

3. Servicewide Issue: N10 - Disruption of Park Resources Due to Mineral Extraction & Geothermal Activities

4. Problem Statement: The extent of cyanide and metals contamination from some of the numerous abandoned mines has not been investigated. Residuals of cyanide may exist, and the leaching of high levels of metals may be occurring at some sites, particularly where the ore was milled or otherwise beneficiated.

Cyanide has been used for the extraction of gold since the turn of the century. For many years cyanide extraction was used after the ore was finely crushed. More recently, heap leaching has been used to extract gold from large volumes of piled ore. The waste from both of these processes has been shown to retain cyanide for many years in arid climates. Additionally, the crushing and processing of ore and waste rock releases metals that can reach toxic levels in soils and water.

The adverse effects of cyanide residuals and metals contamination include direct and indirect symptoms of chronic and acute toxicity. These are manifested as loss of vigor and reproductive potential among plants and animals, and neurologic and physiologic disorders in animals. Differential tolerance to these compounds can result in changes in species composition.

The monument has an inventory of 12 abandoned mine sites. Many of the more than 160 dangerous openings have been closed with fencing or steel grates. No assessment has been conducted of the use of cyanide in the monument, including residuals that might be present or metals contamination.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will result in the continued lack of knowledge concerning this problem and continued possible impacts.

B. **Evaluate Abandoned Mine Tailings.** The past use of cyanide processing in the monument should be determined through an examination of historic records and an on-site examination of each abandoned mine site.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Where cyanide process waste or other fine wastes are found, soil samples should be collected and analyzed for cyanide and metals. The metals analysis should include iron, arsenic, selenium, manganese, copper, boron and zinc.

The project will identify remedial actions which may include: establishing vegetation on the material to reduce erosion, removing and disposing of the offending material, excluding visitors and wildlife from the site, and continued monitoring.

Personnel: Monument resources management staff will perform records research, field inventory and sampling, and development of remedial action plans. The NPS has a Memorandum of Understanding (MOU) with the United States Bureau of Mines (BOM) through the Mining and Minerals Branch. The MOU provides free BOM services in characterizing tailings at some NPS parks. Organ Pipe may jointly draft a project proposal to characterize its 36 tailings sites.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project. Further actions to reclaim or stabilize polluting mine waste may require environmental assessments and historic compliance at the time the specific plan is developed.

8. Funding:

FUNDING

ORPI-N-211 Evaluate Abandoned Mine Tailings	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	2,500	-	-	-
Other	4,000	-	-	-
TOTAL	6,500	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	6,500	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-212

2. Project Title: **Monitor Chemistry of Monument Precipitation**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Data on precipitation chemistry is needed to provide an indicator of potential contamination of the inputs into the region's ground and surface water sources. This data will provide information on the spatial distribution and temporal trends in concentration and deposition of the major cations and anions in precipitation to support monument research on terrestrial and aquatic effects.

Since 1980 the monument has participated in the National Atmospheric Deposition Program (NADP) by establishing a monitoring site to evaluate precipitation. Rainfall is continuously monitored and weekly samples are evaluated at the monument for Ph and conductivity when sufficient precipitation has occurred. Chemical variables measured at the NADP laboratory (Central Analytical Laboratory) in Champaign, Illinois include the following ions: calcium, magnesium, potassium, sodium, ammonium, nitrate, chloride, sulfate, and orthophosphate. A ten year database now exists on precipitation chemistry. A second NADP collector was installed in 1993, and is serviced every other week. The purpose of the collector is to provide an evaluation of the chemical analysis protocol. The collector will be removed in 1995.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue Monitoring of Monument Precipitation.** The current monument precipitation monitoring program will be discontinued. As a result, valuable information will not be available to assist in evaluating potential impacts to monument resources.

B. **Monitor Chemistry of Monument Precipitation.** An Aerochem Metrics precipitation collector and Belfort rain gauge are set-up near the headquarters. Precipitation is recorded on a rain gauge chart and will continue to be collected.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The site will be serviced weekly according to NADP protocols. Products will include semiannual data reports and annual data summaries.

Personnel: This project will involve personnel from both the Central Analytical Lab and the monument.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4, B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-212 Monitor Chemistry of Monument Precipitation	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,100	1,100	1,100	1,100
Other	0,000	0,000	0,000	0,000
TOTAL	1,100	1,100	1,100	1,100
Funds Available in Park Base	1,100	1,100	1,100	1,100
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-213

2. Project Title: **Manage Wastewater**

3. Servicewide Issue: N24 - Other Issues

4. Problem Statement: The wastewater management system consists of several small independent systems. Waste from the main park campground, with 208 campsites (no hook-ups), a dump station and six restrooms, is disposed of in four open evaporative lagoons. There are five septic tank leach field systems serving the following:

- Campground duplex residence
- Group campground restroom
- NPS residential area with 10 single family residences, a duplex, the community house, the resource center, and a 12 site Volunteer in Parks campground
- Visitor center and administrative offices
- Maintenance shop

All sewage systems are currently functioning adequately. Regular inspections are necessary, however, to ensure that problems do not develop and go undetected.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue Managing Wastewater.** Current wastewater management will be discontinued. As a result of this action the monument risks being out of compliance with state regulations and permitting a sewage leak to go unchecked.

B. **Manage Wastewater.** The systems will continue to be operated in compliance with state regulations.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The systems will be examined periodically for leaks and deteriorated conditions.

Personnel: This project will be accomplished by maintenance and resources management staff.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-213 Manage Wastewater	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	2,000	2,000	2,000	2,000
Other	0,000	0,000	0,000	0,000
TOTAL	2,000	2,000	2,000	2,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-250

2. Project Title: **Develop a Threatened & Endangered Species Management Plan**

3. Servicewide Issue: NO2 - Impacts on Threatened, Endangered, and Other Sensitive Species

4. Problem Statement: Currently a plan does not exist to assist the monument in the management of threatened and endangered species. Two species of endangered mammals, the Sonoran pronghorn (*Antilocapra americana sonoriensis*) and the lesser long-nosed bat (*Leptonycteris curasoae*), and one species of endangered desert pupfish (*Cyprinodon macularius eremus*) range within the monument. In total, there are approximately 50 plant and animal species of special concern found within the monument, including category 2 species, such as the Quitobaquito snail, desert tortoise and gila monster.

Endangered and threatened plant and animal species present unique challenges for the National Park Service. They require special management with single species priority within an ecosystem management concept (NPS 1991f). The NPS Management Policies prescribes management of endangered, threatened and candidate species in conformance with the Endangered Species Act, recovery plans and other related documents (NPS 1988c).

At Organ Pipe Cactus National Monument, research, monitoring and management of all federally listed species is done in conjunction with the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. Annual permits are obtained to monitor populations, and biological assessments are prepared for any actions that may impact listed species. No plan exists, however, to bring together all of the facets of threatened and endangered species management at the park level.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The present program will be continued in accordance with all applicable laws, primarily the Endangered Species Act of 1973, as amended through the 100th Congress. Management and research will continue to pursue optimal species populations and habitat protection. Emphasis will be on a species by species basis. No unifying reference or program document will bring all elements together.

B. **Prepare Individual Species Plans.** This alternative will include the preparation of individual listed species management plans. Management efforts will incorporate species recovery plans where they exist. As in the above alternative, all species will be examined individually and no comprehensive plan will provide guidance for the entire program.

C. **Develop a Threatened & Endangered Species Management Plan.** An extensive threatened and endangered species plan will be developed to guide management, monitoring and research of threatened and endangered species. This document will provide reference material on federal and state programs. Critical information on the Endangered Species Act such as Section 7 and related compliance information will be provided. Much of the information from Western Region's "Threatened, Endangered and Sensitive Species

Preservation," handbook, will be incorporated. This management plan will be park specific and will provide both general and detailed information.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. A threatened and endangered species management plan will be developed. The plan will include the following:

- General information on the Endangered Species Act and its implications to the park's overall management program. Responsibilities at all levels will be identified.

- Procedures will be outlined illustrating compliance procedures, including Section 7 informal and formal consultation.

- Arizona state laws applicable to federal and state listed species will be identified and interpreted.

- An overview of current federal and state listed species, including category species, occurring in Organ Pipe will be provided. Information will include status, range, abundance and current state of management, monitoring and research.

- A comprehensive program will be developed for all species. Unifying elements, such as permitting, compliance and reporting, will be set up on a consistent schedule.

- Specific project statements will be outlined for all management, monitoring and research activities. These statements will identify a means for optimal species protection and recovery, as identified in approved Recovery Plans. The purpose, methods and procedures, data management and alternatives for actions will be specifically addressed. Emphasis will be on developing a Threatened and Endangered Species Management Program, as opposed to projects. On-going activities will be distinct from one-time research activities.

- Budget and personnel for long-term threatened and endangered species management will be developed.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide document review and field assistance.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 2.8, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The plan will need to be reviewed by the U.S. Fish and Wildlife Service and Arizona Game and Fish Department. Possible Section 7 consultation may be required.

8. Funding:

FUNDING

ORPI-N-250 Develop a Threatened and Endangered Species Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	15,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	15,000	-	-	-

References:

National Park Service, United States Department of the Interior. 1988c. National Park Service Management Policies. 160 pp.

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-251

2. Project Title: **Expand and Implement the Quitobaquito Desert Pupfish Monitoring Program**

3. Servicewide Issue: NO2 - Impacts on Threatened, Endangered and Other Sensitive Animals

4. Problem Statement: Anthropogenic impacts and natural processes pose a potential threat to the endangered species of desert pupfish (*Cyprinodon macularius eremus*) at the Quitobaquito Management Area. A monitoring protocol developed to assess the status of the desert pupfish population requires a review and modification to both ensure validity and enhance the usefulness of data. Quitobaquito Springs/Pond is located in the southwestern portion of Organ Pipe Cactus National Monument, adjacent to the US/Mexico International Border. The endemic pupfish inhabits the spring outflows and the pond at Quitobaquito. The water for the pond is provided by two springs located to the north. The man-made channel and pond support the bulk of the desert pupfish population.

The goal of the National Park Service is to ensure the continued survival and well being of the desert pupfish, to provide shallow water habitat for the Sonoran mud turtle (*Kinosternon sonoriense longifemorale*) young and to provide a varied habitat for aquatic crustaceans and microorganisms. On-going monitoring over the past several years has emphasized obtaining data on the status of the desert pupfish and examining the pond and channel for the presence of non-native species.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue the Existing Monitoring Program.** The present system of monitoring the desert pupfish population will be discontinued. As a result of this action, park management will have no knowledge of the status of the pupfish and will not be able to mitigate potential threats.

B. **Continue With Existing Monitoring Program.** Weekly visual inspections of the pond, channel, springs and overflow will be conducted. An annual census of desert pupfish will continue to provide population estimates as well as to indicate the presence of non-native fish. As a result of this action, data will be available on the desert pupfish population. Weaknesses in the technique, however, will comprise the long-term integrity and usefulness of the data.

C. **Expand and Implement the Quitobaquito Desert Pupfish Monitoring Program.** The current desert pupfish protocol will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide long-term monitoring protocol modification and techniques. Methods for database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Activities associated with this alternative include the following:

- Management objectives for the Quitobaquito desert pupfish will be identified. These objectives will be based on existing legislation, including the recent recovery plan for the species, and will be strongly integrated into the overall natural resources management and research program.

- A thorough evaluation of the existing Quitobaquito desert pupfish monitoring protocol will be conducted. Methodology, information management, interpretation and existing data sets will be examined. Strengths and weaknesses of the current program will be identified.

- The existing monitoring protocol will be modified to enhance the usefulness of the data collected. Identified management objectives will guide the type of data needed. Information acquired will guide protection and management actions affecting the species. The modified technique will be field tested to ensure validity of methods and data collected.

- A protocol handbook will be developed to guide implementation of the monitoring effort. In addition, a training video will be prepared to assist biological technicians in the application of required techniques.

- The final protocol will be integrated into the monument's overall natural resources monitoring program.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and protocol review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. Proper endangered species permits from the US Fish and Wildlife Service and the Arizona Game and Fish Department will be required.

8. Funding

FUNDING

ORPI-N-251 Expand and Implement the Quitobaquito Desert Pupfish Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	12,000	0,000	0,000	0,000
Personnel Services	1,100	1,100	1,100	1,100
Other	500	500	500	500
TOTAL	13,600	1,600	1,600	1,600
Funds Available in Park Base	1,600	1,600	1,600	1,600
Additional Funds Needed	12,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-252

2. Project Title: **Expand and Implement the Lesser Long-nosed Bat Monitoring Program**

3. Servicewide Issue: N02 - Impacts on Threatened, Endangered, and Other Sensitive Animals

4. Problem Statement: Information is needed for the wise management of the largest known United States maternity colony of the federally listed endangered species, the lesser long-nosed bat (*Leptonycteris curasoae*). A combination of monitoring activities developed to assess the status of the lesser long-nosed bat population requires a review, modification and consolidation to ensure validity and enhance usefulness of the data. In 1989, an inspection of an abandoned horizontal mine shaft (adit) revealed that a maternity colony of approximately 20,000 bats was utilizing the tunnel between the months of April and September. Through coordination with the U.S. Fish and Wildlife Service, a monitoring program was established to obtain baseline data on the colony. This included establishing a remote monitoring computer within the tunnel to record temperature and humidity, setting up a sound meter, making estimates of young and conducting periodic flight counts throughout the habitation season. Thus far, valuable data has been obtained and a better understanding of the population, as well as of the species in general, is being developed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Discontinue the Existing Monitoring Program.** The present system of monitoring the lesser long-nosed bat population will be discontinued. As a result of this action, park management will have no knowledge of the status of the species and will not be able to mitigate potential threats.

B. **Continue With Existing Monitoring Program.** This alternative will allow for the continuation of the present program, resulting in a continuous record of environmental conditions in the largest known U.S. maternity colony of this endangered species. As a result of this action, data will be available on the lesser long-nosed bat maternity colony in the monument. Weaknesses in the program, however, may comprise the long-term integrity and usefulness of the data.

C. **Expand and Implement the Lesser Long-nosed Bat Monitoring Program.** The current lesser long-nosed bat monitoring program will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide long-term monitoring protocol modification and techniques. Methods for database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended action. Activities associated with this alternative include the following:

- Management objectives for the lesser long-nosed bat will be identified. These objectives will be based on existing legislation and will be strongly integrated into the overall natural resources management and research program.

- A thorough evaluation of the existing lesser long-nosed bat monitoring protocol will be conducted. Methodology, information management, interpretation and existing data sets will be examined. Strengths and weaknesses of the current program will be identified.

- The existing monitoring protocol will be modified to enhance the usefulness of the data collected. Identified management objectives will guide the type of data needed. Information acquired will guide protection and management actions affecting the species. The modified technique will be field tested to ensure validity of methods and data collected.

- A protocol handbook will be developed to guide implementation of the monitoring effort. In addition, a training video will be prepared to assist biological technicians in the application of required techniques.

- The final protocol will be integrated into the monument's overall natural resources monitoring program.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and protocol review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. Proper endangered species permits from the US Fish and Wildlife Service and the Arizona Game and Fish Department will be required.

8. Funding

FUNDING

ORPI-N-252 Expand and Implement the Lesser Long-nosed Bat Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	0,000	0,000	0,000
Personnel Services	1,100	1,100	1,100	1,100
Other	500	500	500	500
TOTAL	16,600	1,600	1,600	1,600
Funds Available in Park Base	1,600	1,600	1,600	1,600
Additional Funds Needed	15,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-253

2. Project Title: **Evaluate Effects of Poaching on Monument Resources**

3. Servicewide Issue: N18 - Visitor Use Impacts on Backcountry Park Resources

4. Problem Statement: Organ Pipe Cactus National Monument has several plant and animal species of interest to the illegal collecting trade, particularly cacti and reptiles. In a 1987 Park Service natural resource assessment, poaching was listed as the seventh most prevalent threat source, affecting 47 parks in eight regions (memo to park interpreters from WRO Chief of Interpretation 4/5/88). Additionally, raptors, such as the peregrine falcon, and mammals, such as the Sonoran pronghorn, various types of bats, mountain lion, desert bighorn sheep, and invertebrates including certain tarantula and scorpion species, are locally rare. The effects of poaching these species could adversely affect monument population levels and interrelationships with other species. The proximity to the border of Sonora, Mexico, makes the monument a prime target for the illegal trade in such species, especially since many of these plants and animals often have a high value on the black market.

Cacti species of greatest concern, many of which are discussed elsewhere in the Natural & Cultural Resources Management Plan, include saguaro cactus (*Carnegiea gigantea*), organ pipe cactus (*Stenocereus thurberi*), senita cactus (*Lophocereus schottii*), acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*), dalia rooted cereus (*Peniocereus striatus*), barrel cactus (*Ferocactus* spp.) and other typical Sonoran desert vegetation, including succulents and shrub and tree species. These either have high intrinsic value, are rare or are attractive for landscaping use.

Reptiles of special concern are all snake species, the Gila monster and desert tortoise. Collectors and hobbyists find poisonous and exotic reptiles of great interest, and these species are offered at high prices on the black market in the pet trade as well as for medicinal use, clothing and leather goods.

In 1983 at Organ Pipe Cactus National Monument, a case incident involved the illegal collection of reptiles, including four species of rattlesnake, eight other species of snake, three species of lizard and a whipscorpion. Included in the catch were two organ pipe shovel-nosed snakes and five species of snake collected outside of the monument. The latter included two protected and highly-prized species: the Arizona ridge-nosed rattlesnake and the banded rock rattlesnake. In 1984, in a routine border search, a vehicle was found to contain 210 reptiles and amphibians. The animals had been collected in Mexico and were being smuggled into the United States. Presently, however, little documented poaching has been recorded within monument boundaries. Information gathered from resource managers and from case incidents through the law enforcement division is needed to determine the type and extent of illegal collection and poaching, and the impact that these activities have on monument resources.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument staff has inadequate empirical data on the level and type of poaching within Organ Pipe boundaries. This alternative will not solve the problem of lack of information on the subject and managers would not be able to make accurate decisions on protecting park resources. Populations of especially rare cacti and reptiles may be severely impacted, and collection may cause loss of biological diversity without the monument staff being aware of a problem until it is too late.

B. **Evaluate Effects of Poaching on Monument Resources.** This alternative will provide monument staff with the necessary data to determine if there is a poaching problem, as well as provide necessary information to make effective decisions on the best monitoring techniques and methods of protecting the affected species. This strategy will comply with the NPS responsibility of preserving and protecting all monument resources.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A study will be developed to determine the extent of the poaching problem at Organ Pipe Cactus National Monument. Research addressing this problem will include: a survey of selected reptilian and cacti species within the monument and interviews with knowledgeable professionals (e.g. local courts, Pima County sheriff, Tohono O'odham Tribal Police, AZ Department of Agriculture, etc.) on the cacti and reptile marketing business. Information will be gathered from U.S. Customs officials at the Lukeville port of entry. A survey of evidence of poaching within park boundaries will be conducted and a review of law enforcement records for Arizona on cases involving poaching and illegal possession of poached specimens will be completed.

Depending on the type and extent of the poaching found in the first phase of the project, an evaluation of methods for controlling and preventing poaching will be incorporated into the study, including involvement of the interpretive and law enforcement staff. Identification of problem areas and species will be incorporated into the monument geographic information system, allowing for analysis and control.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management and protection staff will provide field assistance and documentation review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-253 Evaluate Effects of Poaching on Monument Resources	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	40,000	40,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	40,000	40,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	40,000	40,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-254

2. Project Title: **Identify Sonoran Mud Turtle Mortality Source at Quitobaquito**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: There is an ongoing population decline of the Sonoran mud turtle (*Kinosternon sonoriense*) at Quitobaquito. Several inexplicably dead turtles have been recovered floating in the pond, something rarely, if ever, observed in other natural populations. The problem is to identify the cause of this apparently abnormal mortality.

The single native aquatic turtle at Organ Pipe is the Sonoran mud turtle. It is represented by the subspecies *K. s. longifemorale* (Rio Sonoyta mud turtle) that is endemic to Quitobaquito and the Rio Sonoyta. The status of this taxon is not known for Rio Sonoyta, and it cannot be considered secure there due to various agricultural and industrial schemes proposed for the Sonoyta Valley in Mexico. Hence there is special interest in the preservation of the Quitobaquito population.

The Sonoran mud turtle was formerly abundant at Quitobaquito, but has been declining since at least the 1970's. Intensive population monitoring was conducted from 1982 to 1985, as well as in 1989, and from 1992 through 1993. The decline has continued into the 1990's, although spurts of reproduction have been observed in association with years of good rainfall. The inexplicably dead mud turtles observed at Quitobaquito suggest that adult survivorship is adversely affected in some way not normally seen in this species. Pesticides, poor water quality, disease, and starvation are possible causes.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The result of inaction may be the extirpation of the only protected population of this taxon.

B. **Identify the Source of Mortality for Quitobaquito Turtles.** A two track program will be carried out to investigate the cause of mortality. Eight carcasses of mud turtles found dead at Quitobaquito are currently deep frozen at the University of Arizona. They will be subjected to gross dissection and chemical analysis to search for mortality sources. The data will assist in long term management for survival of this isolated population.

6. Description of the Recommended Project or Activity. Alterative B. is the recommended action. The study will proceed in several steps as outlined below:

- The first procedure will be to dissect frozen specimens to calculate gross fatbody size to determine if starvation or energy deficiency is directly or indirectly implicated in mortality. This is not anticipated, as such mortality has not been observed in other natural populations where similar or lower growth rates indicate equal or lower food and energy availability.

- The second track will be to search for water quality or agricultural contaminants that may be affecting the turtles. Interviews will be conducted by resources management personnel with officials in Mexico in an attempt to narrow down the field of possible agricultural contaminants (herbicides and pesticides) affecting the turtles. Cooperative Park Studies Unit (CPSU) data on water quality will be consulted as a baseline for inorganic analysis. This information will be used to direct chemical analyses of the available carcasses.

- A final report will be prepared presenting the results of the above analyses, and will provide management recommendations.

Personnel: The work will be carried out with collaboration among resources management staff, CPSU scientists, and University of Arizona researchers involved in the turtle monitoring study.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-254 Identify Turtle Mortality Source at Quitobaquito.	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	3,000	-	-	-
Personnel Services	1,000	-	-	-
Other	0,000	-	-	-
TOTAL	4,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	4,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-255

2. Project Title: **Survey Rio Sonoyta Populations of the Sonoran Mud Turtle**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: Nothing is known of the current distribution and abundance in Mexico of the desert-isolated taxon, the Rio Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*). This taxon is endemic to Quitobaquito and the Rio Sonoyta, and is separated from the rest of the species range by approximately 100 miles. The only protected population, at Quitobaquito, is declining, and the population status is unpredictable, especially given agricultural and urban development associated with the Rio Sonoyta in adjacent Mexico.

The Sonoran mud turtle was formerly abundant at Quitobaquito but has been declining since at least the 1970's. Intensive population monitoring has been conducted from 1982 to 1985, as well as in 1989, and from 1992 through 1993. The decline has continued into the 1990's, although spurts of reproduction have been observed in association with years of good rainfall. Inexplicably dead mud turtles have been observed at Quitobaquito, raising the possibility that population decline is related to pesticides, poor water quality, disease or starvation.

The only other populations of this subspecies are in the Rio Sonoyta where they currently receive no protection. They are at least occasionally sold in a pet store in Sonoyta. A large population near the highway bridge in the town of Sonoyta was reduced and possibly eliminated between 1987 and 1989. In 1983, mud turtles were found in modest abundance in the perennial reach south of Quitobaquito, and in 1986, they were seen in abundance on the eastern edge of Sonoyta. The population status in Rio Sonoyta must be considered insecure, at least until a thorough survey is made.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The result of no action will be to continue treating the limited population at Quitobaquito as an isolated entity, outside the context of a possibly much larger subspecies metapopulation in the Sonoyta Valley.

B. **Survey the Sonoran Mud Turtle in the Rio Sonoyta.** Mud turtles will be sought by on-foot hand collecting, observation with binoculars, and live trapping at each major perennial reach of the Rio Sonoyta in Mexico. Additional survey will be made at closely adjacent stock tanks. The work will be done jointly with herpetologists from Mexico. The findings will indicate the population status of the taxon as a whole, and the degree of threat posed by the population decline at Quitobaquito in particular.

6. Description of the Recommended Project or Activity. Alternative B. is preferred. The degree of threat posed by limited population size and decline at Quitobaquito will be assessed.

The project will consist of the following elements:

- Collaboration will be sought with Mexican scientists through the Centro Ecologico and Universidad de Sonora in Hermosillo and the Parque Nacional de Pinacate office in Sonoyta.

- Perennial surface waters in the Rio Sonoyta Valley in Mexico will be identified and surveyed for potential aquatic turtle habitat.

- Potential habitat will be censused for mud turtles by visual observation, hand collecting and live trapping.

- A final report will be made in English and Spanish to both the NPS and appropriate Mexican agencies. This will include an evaluation of the taxon status, a discussion of Quitobaquito, and overall conservation recommendations.

Personnel: This extensive survey will involve collaboration of Organ Pipe resources management staff, Cooperative Park Studies Unit and/or other University of Arizona biologists, and Mexican scientists from the State of Sonora.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-255 Survey Rio Sonoyta Populations of the Sonoran Mud Turtle	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	4,000	-	-	-
Personnel Services	1,000	-	-	-
Other	0,000	-	-	-
TOTAL	5,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	5,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-256

2. Project Title: **Conduct a Study on Biological-Hydrologic Relationships in the Rio Sonoyta**

3. Servicewide Issue: NO2 - Impacts on Threatened, Endangered and Other Sensitive Animals

4. Problem Statement: Information on the biological-hydrological relationships of the Rio Sonoyta area is needed to guide management actions. In a desert ecosystem, the availability of water is critical in the determination of flora and fauna distributions. This is especially true for determining the habitat of aquatic species, such as the endangered pupfish, and riparian vegetation communities. These important resources are highly dependent on local hydrologic factors, likewise, success in managing these areas is determined by an understanding the biological-hydrologic relationships.

The current lack of information on this issue makes it difficult to forecast the consequences of different management actions or environmental changes on these resources. The Rio Sonoyta is a special ecosystem in the Sonoran Desert. The river has reaches with perennial flow and is an important source of water for terrestrial fauna in the region. There is also the potential for negative impacts to the system due to farming upstream in the Sonoyta, Mexico region. The area is also close to Quitobaquito, natural habitat for pupfish, Sonoran mud turtles, obligate riparian species and riparian vegetation. These water resource areas also serve as wildlife magnets and corridors.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This option will result in information not being collected on the relationship between fish, riparian habitat and hydrology in the Rio Sonoyta. Baseline data on the hydrology, fauna, and flora characteristics of the Rio Sonoyta Wash will not be collected. Documentation of any changes in the Rio Sonoyta system will not be available.

B. **Conduct a Study on Biological-Hydrologic Relationships in the Rio Sonoyta.** A study will be developed to investigate the biological-hydrologic relationships in the Rio Sonoyta. Included in the study will be the identification of habitat characteristics of the endangered pupfish (*Cyprinodon macularius*), Sonoran mud turtle (*Kinosternon sonoriense*), obligate riparian species and the riparian vegetation communities. The knowledge gained will enhance NPS abilities to protect and manage these resources.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. A study will be developed to monitor, with hydrologic instrumentation, the Rio Sonoyta and, if necessary, other riparian areas with similar hydrologic character. Streamflow gauges will be installed at several points along the wash. Soil moisture measurements will be taken perpendicular to the stream at the gauge locations to determine moisture gradients. Transects will be taken across selected stream reaches to determine streambed geometry, pupfish habitat, and vegetation characteristics. Pupfish populations will be monitored on a seasonal basis to determine pupfish movement. One of the streamflow gauges will have a telemetry system which will notify the NPS when the Rio Sonoyta has high flows.

This will allow researchers to determine pupfish habitat requirements during high flow events, a problem that has confounded researchers. Vegetation characteristics will be related to moisture gradients. Work will also be conducted at Quitobaquito, and the two systems will be compared. This comparison will assist the NPS in the management of the important Quitobaquito area. The potential linkage of the two systems will also be examined. Although most of this work will be conducted in Mexico, the work falls under the monument's role as a Man and Biosphere Program (MAB) preserve, by comparing similar systems on both sides of the boundary and assessing the potential impacts of man.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and protocol review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state, federal and international threatened, endangered or sensitive species permits must be obtained.

8. Funding:

FUNDING

ORPI-N-256 Conduct a Study on Biological-Hydrologic Relationships in the Rio Sonoyta	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	105,000	64,000	54,000	39,000
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	105,000	64,000	54,000	39,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	105,000	64,000	54,000	39,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-257

2. Project Title: **Survey and Monitor Moisture-Sensitive Herpetofauna on the Monument**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The Ecological Monitoring Program (EMP) currently lacks an explicit focus on animal assemblages characterized by special moisture sensitivity. Monitoring and research on such animals is critical to prediction and early observation of effects of climatic change in natural communities in this desert region.

Organ Pipe Cactus National Monument lies on the transition from the Arizona Upland to the east, receiving under eleven to twelve inches annual rainfall with its thornscrub vegetation, and the Lower Colorado Valley Sonoran Desert to the west, receiving under three to seven inches annual rainfall. Mesic canyons and rock face microsites support a moisture-associated fauna with population centers known in the Ajo Mountains and suspected in the most mesic areas of all other major rockpiles at Organ Pipe.

Some of the moisture-associated reptile species considered sensitive by the Arizona Heritage Program are Ajo Mountain whipsnake (*Masticophis bilineatus lineolatus*) and Redbacked whiptail (*Cnemidophorus burti xanthonotus*). The canyon spotted whiptail (*Cnemidophorus burti*) is considered a candidate for Endangered Species Act (ESA) listing. All are on the Organ Pipe Red List including Clark's spiny lizard (*Sceloporus clarki*), blacknecked gartersnake (*Thamnophis cyrtopsis*), and southwestern blackheaded snake (*Tantilla hobartsmithi*).

Of these reptiles, the two lizard species are highly suitable for long term distributional monitoring by extensive transect survey, and the three snakes are expected to be strong presence/absence indicators of past and present hydric conditions. All of these species can be surveyed at the same places at Organ Pipe. They are all predicted to 1) expand their ecological distributions across arid rock slopes and downward onto begets and valley floors under increased rainfall, or 2) disappear from outlying desert rockpiles and become increasingly restricted to mesic sites in the Ajo Mountains under decreasing rainfall.

The two lizard species present exceptional research opportunities relevant to the Global Climate Change Program. They are currently abundant and easily observable at Organ Pipe, and both have more xeric-adapted congeners, the western whiptail (*Cnemidophorus tigris*) and the desert spiny lizard (*Sceloporus magister*), that are clearly displayed ecological replacements on the monument. The survey and monitoring of these species can conveniently be supplemented by comparative laboratory studies of water loss rates of living animals.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will leave the EMP without an explicit focus on moisture relations in this transitional desert region.

B. **Survey and Monitor Moisture-Sensitive Herpetofauna on the Monument.** The distribution of moisture-sensitive reptiles associated with desert mountains will be surveyed in the monument. Extensive transects will be established to document intrageneric species transitions across the slope and moisture gradient. Long term monitoring will be established for tracking the positions of these species transitions, and comparative laboratory studies will supplement the understanding of the climatic sensitivity of the species. This study is an outstanding research opportunity at Organ Pipe that will assist in prediction and early observation of climate change impacts.

6. Description of the Recommended Project or Activity. Alternative B. is the recommended alternative.

The project will include the following elements:

- Review the available data on distributions of the species at and near Organ Pipe Cactus National Monument.
- Based on additional field surveys, prepare fine scale maps of the geographic and ecological distribution of the species at several selected areas on the monument.
- Establish map and GPS-based permanent survey areas for long term study and remapping of species occurrence. Integrate the survey results into the monument GIS database.
- Conduct laboratory trials of water loss on live specimens of the moisture-sensitive species.
- Prepare a Cooperative Park Studies Unit Technical Report on moisture-sensitive reptile species at Organ Pipe Cactus National Monument.
- Publish results of the laboratory physiology and ecological distribution findings in a peer-reviewed journal.
- Continue yearly monitoring of the extensive transects for lizards. Step-down to Organ Pipe resources management personnel will occur during project years two and three.

Personnel: Initial study will be contracted. Monitoring responsibilities will be transferred to the monument resources management division.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7,4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-257 Survey and Monitor Moisture-Sensitive Herpetofauna on the Monument	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	10,000	10,000	500	0,000
Personnel Services	0,000	500	1,000	2,000
Other	0,000	0,000	0,000	0,000
TOTAL	10,000	10,500	1,500	2,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	10,000	10,500	1,500	2,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-258

2. Project Title: **Determine Status of the Organ Pipe Shovelnosed Snake**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The Organ Pipe shovelnosed snake (*Chionactis palarostris organica*) may be threatened by highway mortality. It is known in the U.S. only from live, and primarily dead, specimens observed on the paved highway, Arizona State Route 85. Sampling away from the highway has yielded only two specimens, indicating that the species is both uncommon and highly localized. The healthiest populations may all be severely impacted by highway mortality. An assessment is required for 1) populations occurring along the highway, 2) the impact (total or percentage mortality) of the highway on these populations, and 3) the extent of populations at Organ Pipe Cactus National Monument away from the highway. At issue is a strong potential that highway traffic, and with it highway mortality, will increase in the near future.

The Organ Pipe shovelnosed snake is a subspecies of the Sonoran shovelnosed snake. Both the species and its Organ Pipe subspecies have very limited geographic distributions and are poorly known. Prior to the paving of Route 85 in 1949, at least some authorities considered this the rarest snake in the United States. Since 1949, a large number have been observed on Route 85, and in recent years, approximately 75% of these have been automobile casualties. Intensive snake population study with live-trapping has been carried out at a site approximately 1.8 mile from Route 85 since 1988, yielding only one capture for this species among over 1,000 snakes observed. General observations elsewhere on the monument by contracted herpetologists have failed to produce a single additional verified observation. In 1993, herpetologists contracted with the Arizona Heritage Program made specific attempts to locate this species on and off the road, but found that populations were reduced compared to 1988, and confirmed the great difficulty of locating this species except on the roadway. It is possible that hydrological impacts of the highway have created "highway riparian" areas that attract these snakes, with a serious possibility that this increases the strength of highway mortality as a population sink.

Whereas these findings need additional confirmation, on present evidence it seems possible that the Organ Pipe shovelnosed snake may become a candidate for federal listing under provisions of the Endangered Species Act.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The result of inaction will be to maintain our present state of relative ignorance on the status and ecology of this species. The species may possibly disappear from the fauna of the United States. Because this species is an unusual and attractively colored coral snake mimic, there is substantial interest in and awareness of it in both the scientific and amateur herpetological communities.

B. **Monitor the Species Using Existing Park Funding and Personnel.** Resources management personnel at Organ Pipe Cactus National Monument will monitor the paved highway for snakes of this species. All individuals observed alive or dead will be recorded, and the total observed highway mortality will be reported annually. This alternative will provide minimal data relevant to the appearance of the species on the paved highway.

C. **Conduct an Assessment of Population Status and Highway Impact for the Organ Pipe Shovelnosed Snake on the Monument.** The highway will be monitored for these snakes throughout the appropriate times of day and year. Standard live trapping protocols will be carried out to non-destructively observe population status both near and at a distance from the highway. On-foot and side-road surveys will also be conducted. The ecologically similar, but better known, Western shovelnosed snake will also be studied to help evaluate the findings for the Organ Pipe species. Mark-release-recapture operations will be conducted to determine population size and other ecological parameters. Management recommendations will be developed, especially concerning the highway, and a monitoring protocol will be formalized if the species is possibly in jeopardy. Morphological data will be collected to ensure a clear taxonomic picture of the species. Cooperation with Mexican students of herpetology will be sought through the Centro Ecologico and University of Sonora in Hermosillo, to undertake further studies that can evaluate species status and ecology in its limited range in Mexico. This alternative will provide the data required to evaluate the status of this species.

6. Description of the Recommended Project or Activity. Alternative C. is recommended, with alternative B. remaining as a potential if long term monitoring activities are required. Alternative C. will provide the information required to assess the status of the species in the U.S. and the impact of current, and potentially increased, highway traffic on the species.

The project will consist of the following elements:

- The highway will be monitored each day of the primary activity season (early April-late June) during the crepuscular activity period for this snake. A set of cover trap (boards placed on the ground) arrays will be established to determine the distribution of the species away from the highway. Small live traps modified from an earlier herpetology project design will be placed near the highway, but out of sight, in early May, and operated until at least mid-June. These traps will be removed before monument visitors increase in numbers. The live traps will compare the relative abundance of these snakes near and at short distances (less than 1/2 mile) from the highway. On-foot and back-road surveys will also be conducted in an organized program, and incidental observations will be encouraged through training of monument field personnel.

- All snakes encountered alive on the project will be marked and released for potential recapture to determine abundance, movements, home range, and growth. These procedures will define 1) the natural mortality for the species, 2) the percentage of near-highway individuals killed in traffic, and 3) the number and percentage impact of highway mortality over natural mortality.

- Morphological data will be collected for all observed individuals, primarily for characteristics of ecological interest (body size, reproductive status) and species and subspecies taxonomy (color and pattern). The data will be contrasted to similar observations underway on the similar, parapatrically (adjacent but non-overlapping) distributed Western shovelnosed snake (*Chionactis occipitalis*), which appears to be a fully distinct species.

- Ecological studies of the similar, but more readily observed, Western shovelnosed snake will be intensified using methodology similar to that applied to the Organ Pipe species.

- A small number of individuals of both species will be maintained in semi-natural cages to observe behavior and habitat selection as an adjunct to field studies for these shy animals.

- A final report will be completed, documenting 1) the status of the Organ Pipe shovelnosed snake in the U.S., both near and away from the pavement of State Route 85, 2) the natural history and ecology of the species in the United States, 3) the impact of highway mortality on the species at Organ Pipe. The report will also produce 4) management recommendations for the species at Organ Pipe, and if called for, 5) a monitoring program for the species at Organ Pipe.

- This project presents a good opportunity to pursue joint research and monitoring between herpetological personnel from Mexico and the United States. Although this species is known from a narrow geographic band in Sonora, little is known of its geographic variation or abundance there, even on roadways, and there is no available scientific data on its ecology. International cooperation should be pursued through contacts at the Centro Ecologico and University of Sonora in Hermosillo, Sonora.

Personnel: The work on the first two years of this project will be contracted. Trained herpetologists with both experience at Organ Pipe Cactus National Monument and with the study species will provide a high level of expertise for the project. Monument personnel will cooperate with and participate in the project, and will be prepared to undertake population monitoring if such is required, based on the first two project years.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM 6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-258 Determine Status of the Organ Pipe Shovelnosed Snake	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	16,000*	13,000*	0,000	0,000
Personnel Services	500	500	2,000**	2,000**
Other	0,000	0,000	0,000	0,000
TOTAL	16,500	13,500	2,000	2,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	16,500	13,500	2,000	2,000

*Assumes no other herpetology projects with which to share personnel.
**If monitoring step down is required.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-259

2. Project Title: **Determine Status of the Mexican Rosy Boa**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The Mexican rosy boa at Organ Pipe Cactus National Monument is probably affected by illegal collecting and may be impacted by highway mortality. This is a slow-moving snake that is quite active during the season of maximum visitor traffic. As of 1993, none have been reported near Route 85 since September 1983 despite great survey effort. In contrast, eight have been seen on side roads with only a small fraction of the effort. This species is highly desired by snake collectors and keepers, and the rosy boa subspecies (*Lichanura t. trivirgata*) is known in the U.S. only at and near the monument. It is clear that attempts to collect this species illegally from dirt roads and back country areas at Organ Pipe are regular.

Limited knowledge indicates the rosy boa is fairly widespread at Organ Pipe. Even more limited data indicates that it is strongly confined to lower rock slopes and upper bajadas. The extent of suitable habitat at Organ Pipe is not known. The abundance of the species, though at least moderate in some areas, is also not known. Thus, it is not yet possible to evaluate the regional importance of the depletion at Route 85, or to evaluate the potential importance of illegal collecting.

Finally, there is little general ecological information for the rosy boa. Work begun in 1993 has initiated a study of movements, reproduction, habitat selection, and body temperature, and has established a base of marked snakes at accessible sites for further study. This body of marked snakes represents a unique opportunity to make recaptures. This species occurs near its range margin at Organ Pipe, making its ecology particularly interesting from the standpoint of biogeography and global climate change.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The result of inaction will be to allow highway mortality impacts and illegal collecting to continue unchallenged and poorly evaluated. A preliminary report to the Arizona Heritage Program will not be made available documenting the 1993 findings. The extensive efforts to mark snakes in 1993 will be wasted.

B. **Continue Census and Mark-Recapture Efforts.** Road-driving and on-foot transects initiated in 1993 will be continued and expanded to include additional monument areas thought to support populations of rosy boas. Continuing the mark-recapture study should yield a high probability of recaptures at specific areas of sampling focus. Reproductive data on gravid females will be obtained as possible. Data will assist in evaluating the importance of existing and potential impacts on the species.

C. **Continue Radiotelemetry Study Along With Mark-Recapture Census.** 1993 results are for a very wet winter year, expected to be most auspicious and least stressful for the rosy boa. Thus, the results are

certainly not representative, and may not represent key environmental stresses faced by the species throughout its desert environment. The study will be continued largely as currently designed, with between four and six individuals monitored per year using surgically implanted transmitters. Intensive habitat descriptors will continue to be collected to ensure valid contrasts among years. Results will provide a clear picture of the ecology and management needs for the species at Organ Pipe.

6. Description of the Recommended Project or Activity. Alternatives B. and C. are favored. At a minimum, the efforts invested during 1993, to establish the groundwork for ecological study, would be capitalized on under Alternative B. Alternative C. will establish a firm basis for understanding the relationships between ecological and climatic variation for this species, and will be a state-of-the-art study of desert reptiles.

Implementation of Alternative B. will include the following:

- Conducting a regular driving transect study on Ajo Mountain and Puerto Blanco Drives, as well as on the roads near monument headquarters, and in the Growler Pass area. Establishing an on-foot survey of transects starting at and extending away from Route 85 in the rhyolitic hills just north of headquarters. Continuing on-foot census operations near Twin Peaks, at Estes Canyon, and near Interpretive Stop 22 on Ajo Mountain Drive. Results for 1993 show that walking is an excellent method for locating the snakes, thus indicating that establishing transects Route 85 will assist in verifying that snakes are actually rare or absent there, rather than simply avoiding the highway (although the latter is not expected).

- Collecting standard data on body dimensions, sex, injuries, body temperature, ambient climate, activity and habitat.

- Maintaining gravid females, captured during mid-late summer, in captivity with appropriate feeding until they give birth. Mother and offspring will be marked and released at the capture site, after they have received at least a single feeding.

- Snakes will be marked with a Passive Inductive Transponder (PIT) system, rather than by scale clipping. Marking experience in 1993 indicates that scale clipping is a poor method for this species.

In addition to the elements of Alternative B. the following will be completed for Alternative C:

- Regular radiotelemetry monitoring of both male and female rosy boas at selected study areas will be undertaken. The program of habitat description (vegetation, substratum, slope, aspect, elevation, shelter site) will be continued. Location plots using GPS-established reference points will also be continued.

- A program of radio tracking without temperature sensitive transmitters will partially supplant the established transmitters, thus allowing smaller transmitters and smaller snakes for study.

- In 1993, it appeared that snakes moved down from rock slopes to low-lying wash banks at the driest times, even during this year of relatively high subsurface moisture. The larger,

temperature-sensitive transmitters will continue to be deployed to examine the distinct possibility that drought survival entails reducing metabolic rate as well as water loss rate.

- The habitat description program will be expanded to include a study of relative humidity in the subsurface refuge so extensively used by this species. A fiber-optic scope or other viewing device will be used with available miniaturized humidity sensors to achieve a novel approach to studying the water relationships of free-ranging desert reptiles. A standard set of microclimatic measurements in unused burrows will be maintained.

- Contract with the scientists to design monitoring protocols if the need is indicated. A monitoring handbook will be developed and park staff will conduct monitoring activities.

Personnel: The work for this project will be contracted.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4, B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-259 Determine Status of the Mexican Rosy Boa	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract Alternative B.*	10,000	6,000	6,000**	6,000**
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	10,000	6,000	6,000	6,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	10,000	6,000	6,000	6,000

*Assumes no other herpetology projects with which to share personnel.
**Optional funding years.

FUNDING

ORPI-N-259 Determine Status of the Mexican Rosy Boa	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract Alternative C.*	23,000	16,000	10,000**	8,000**
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	23,000	16,000	10,000	8,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	23,000	16,000	10,000	8,000

*Assumes no other herpetology projects with which to share personnel.
**Optional funding years.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-260

2. Project Title: **Analyze Mexican Leafcutting Ant Population Size and Structure Analysis**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them

4. Problem Statement: Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). This population was discovered during ground searches of more than 100 km of suitable riparian habitat at Organ Pipe, and consists of more than 40 colonies in the park, plus one outlier 300 m outside the northeast boundary. The large size, limited occurrence, and unusual habits of the ant colonies make them significant objects of park interpretion and research activities, and provide a unique opportunity for application of modern techniques in molecular genetics to analysis of natural population and colony-level structure, as well as evaluation of gene flow, genetic diversity, and effective population size. Several distinct local subpopulations (demes) were identified during the mid and late 1980s. Agricultural development south of the monument may isolate the U.S. population from the main population in Mexico, and detailed data on population structure, size, and genetic diversity may be important to evaluate long-term impacts of isolation, inbreeding, and chance events.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No action.** No information on the population structure, size, and genetic diversity will be available, and management will not have data for long-term decisions.

B. **Analyze Mexican Leafcutting Ant Population Size and Structure Analysis.** A research project will be developed to assess the status of the Mexican leafcutting ant population in the monument.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended alternative. This will include establishing a program to apply techniques of molecular genetics (protein and nucleic acid analysis) to obtain data on the population structure, as follows:

- Training staff to recognize colonies in the field, conducting periodic census of known subpopulations, and conducting ground searches of potential riparian habitat in the park to detect additional subpopulations and recruitment.

Personnel: Staff will include permanent resources management, interpretative and protection staff currently employed at the monument. Funding will be needed for assistance with establishing monitoring and research priorities and in expanding the interpretive effort.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-260 Analyze Mexican Leafcutting Ant Population Size and Structure Analysis	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	4,000	3,000	3,000	4,000
Other	2,000	1,000	1,000	2,000
TOTAL	6,000	4,000	4,000	6,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	6,000	4,000	4,000	6,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-261

2. Project Title: **Expand Long-term Ecology Studies of *Stenocereus thurberi***

3. Servicewide Issue: NO3 - Impacts on Threatened, Endangered, and Other Sensitive Plants

4. Problem Statement: Although an initial study of the organ pipe cactus (*Stenocereus thurberi*) has been completed, additional data from varying locations is needed to provide information relevant to management of the species. Organ Pipe Cactus National Monument was designated in 1937 to preserve one of the few stands of organ pipe cactus in the United States, as well as to preserve a representative sample of flora and fauna typical of the Sonoran Desert. Other columnar cacti also represented within the monument's boundary include the saguaro (*Carnegiea gigantea*) and senita (*Lophocereus schottii*). Research is currently being conducted on these cacti species as well.

Frost and freezing temperatures appear to be two of the greatest factors affecting growth of the organ pipe cactus. Annual variation in mean growth rate is correlated with winter precipitation and freeze frequency such that rates are greater in growing seasons following unusually wet and mild winters and vice versa (Parker 1988a). When young growing tips become frozen, they cease elongating and die, even though the stem itself may continue to grow, even increasing in width. A freezing period will sometimes decrease establishment by new individuals and adversely affect some mature individuals (Ruffner et al 1991a). Low temperatures and differences in various local habitats within the monument may affect growth and recruitment in the organ pipe cactus population and may restrict these plants to slopes with southern exposures and those where cold air drainage away from the locale is important to its successful growth (Ruffner et al 1991a). It is unknown if temperature is the sole cause for the lack of organ pipe cactus populations in extensive plains and flats, or if water availability or other factors may also be contributing factors (Ruffner et al 1991a).

A recent study by Ruffner Associates found that a low percentage of flowers set fruit, which indicates that pollinators and/or resources are limiting (Ruffner et al 1991a). The lesser long-nosed bat (*Leptonycteris curasoae*) and hawkmoths are two of the known organ pipe pollinators. The life histories of additional pollinators, if there are any, are unknown at this time. Birds, mammals, and humans consume the mature fruit, although little is known about these consumers and their effects on this cactus species.

Modified microhabitats beneath nurse plants of the organ pipe may have effects on growth and distribution, yet long term effects of changes to these nurse plants or to the organ pipe have not been examined. Growth measurements have only been taken in Senita Basin, at Baker and Lost Cabin Mines, Bates Well and Dos Lomitas, yet there is a need for additional data from other locations in the monument where the organ pipe cactus is found. Comparisons of various populations and varying microhabitats will help determine how best to manage the monument's organ pipe cactus population.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No further studies involving organ pipe cacti will be conducted. Sufficient knowledge to ensure protection of the monument's population will not be available.

B. **Expand Long-term Ecology Studies of *Stenocereus thurberi*.** This alternative will provide additional information and show periodic trends in the growth, distribution and relationships of the organ pipe cactus which can then be compared with other park resources, all of which are needed for effective management of the organ pipe cactus. It will ensure that all earlier studies of organ pipe cactus ecology can be synthesized, and from the results, a modern study designed to better answer remaining questions about the species.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This alternative will entail several separate actions, as follows:

- Studies and current monitoring will be expanded to include the Sonoyta Valley, La Abra Plain and Growler Canyon. Comparisons among site differences will be analyzed.

- Detailed field studies on the photosynthesis of organ pipe cactus relevant to diurnal, seasonal, elevational and genetic differences will continue.

- Field studies will be done on the root systems of organ pipes and their relationship to water uptake and storage.

- Field studies will be done on the consumers and pollinators of the organ pipe cactus.

- Aerial mapping and development of a geographic information system component to determine distribution and locations of all populations of the organ pipe in the monument will be accomplished. Distribution data on the organ pipe elsewhere within its geographical range will be obtained for comparison.

- Information published to date on the ecological functioning of the organ pipe cactus will be synthesized.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and documentation review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-261 Expand Long-term Ecology Studies of *Stenocereus thurberi*	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	50,000	50,000	50,000
Personnel Serviees	35,000	35,000	35,000	35,000
Other	5,000	5,000	5,000	5,000
TOTAL	90,000	90,000	90,000	90,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	90,000	90,000	90,000	90,000

References:

Parker, Kathleen. 1988a. Plants.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991a. Special Status Plants of Organ Pipe Cactus National Monument, Arizona: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 223 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-262

2. Project Title: **Expand Long-term Ecology Studies of *Echinomastus erectrocentrus var. acunensis***

3. Servicewide Issue: NO3 - Impacts on Threatened, Endangered, and Other Sensitive Plants

4. Problem Statement: The demographic status of the acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*) needs to be fully researched to insure protection of this species from poaching and other factors which could eliminate its only known population in the monument. In Organ Pipe Cactus National Monument the acuna cactus is found only in Acuna Basin. This situation makes the species vulnerable to complete degradation by outside forces, and the population could be completely obliterated by a single disaster. Recent studies in the monument's natural resources monitoring program indicate, however, that there has been some recruitment of younger age classes of the acuna cactus, while the historic population has declined. Numbers in the only other two known populations of this species in Arizona, outside of the monument, have declined sharply in recent years for unknown reasons (Ruffner 1991a).

Recent field studies conducted by Dr. Robert A. Johnson, of Ruffner and Associates (SPMA Grant), quantified flowering phenology and seed set, and identified pollinators and edaphic conditions that may limit the geographic distribution of the acuna cactus. Distribution of the species is limited by sufficient soil moisture during germination and seedling establishment, and is influenced by local soil type, with a preference for fine-textured soils on rocky, gravelly hillsides. The acuna cactus is susceptible to predation by the opuntia borer, *Moneilema gigas* (Cerambycidae). Growth rate and flower-bearing differences seem to be affected by annual precipitation.

Because of its restricted distribution, locally high densities, and accessibility of acuna cactus due to the location of a park road nearby, the cactus is also a target for human collection, despite reports that is difficult to cultivate (Ruffner et al. 1991a; Riha and Subik 1981, Oldfield 1985). The acuna cactus is especially vulnerable to illegal collection in March when it is in flower (Bennett et al. 1987). Emphasis should be made on continuing long-term monitoring and research of the acuna cactus to determine population dynamics, age structure and sources of mortality (Ruffner et al. 1991a).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No further studies involving acuna cacti will be made. Sufficient knowledge to enhance protection of the monument's population will not be available. No action implies that current knowledge on the status and demographics of the acuna cactus is enough for monument staff to determine proper management techniques in order to protect this species. Such a lack of action may result in the complete obliteration of the only population in the monument.

B. **Expand Long-term Ecology Studies of *Echinomastus erectrocentrus var. acunensis*.** This alternative will entail gathering additional data on the demographic status and ecology of this rare cactus, both within and outside monument boundaries. The causes affecting population decline and recruitment will be

determined and the possibility of other populations occurring within the monument's boundaries will be examined. A broader understanding of outside factors affecting the growth and distribution of the acuna cactus will be obtained from synthesis of information gained through natural resources monitoring programs and other research activities.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action for this issue. This study will include several separate actions, as follows:

- Mapping of the individuals and population of acuna cactus within monument boundaries.
- Compilation of a bibliography of information published to date on the ecological functioning of acuna cactus.
- Development of a geographic information system (GIS) theme to indicate location and distribution information on the acuna cactus throughout its known range. GIS modeling of factors affecting distribution will aid in finding other populations within the monument.
- Cooperative liaisons with U.S. land management agencies and scientists/managers from Sonora, Mexico will be developed, for the purpose of gathering information and data on other acuna cactus populations, thus ensuring a full understanding of its life history and demographic status.
- Affects of predation by *M. gigas* and pyralid moth larvae on acuna cactus will be examined.
- The viability of preserving seeds to protect the biodiversity of the species for possible reintroduction to historic range will be determined.
- Illegal collection activity will be monitored and mitigated by instituting a daily patrol during the flowering season, and removal of scenic pullouts near Acuna Basin.
- Synthesis of all available research data and bibliographic information on factors affecting the acuna cactus population at the monument will be accomplished.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona. Resources management staff will provide field assistance and documentation review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-262 Expand Long-term Ecology Studies of *Echinomastus erectrocentrus var. acunensis*	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	20,000	20,000	20,000
Personnel Services	35,000	8,900	8,900	8,900
Other	2,000	0,000	0,000	0,000
TOTAL	87,000	28,900	28,900	28,900
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	87,000	28,900	28,900	28,900

References:

Bennett, P. S., R. R. Johnson and M. R. Kunzmann. 1987. Cactus Collection Factors of Interest to Resource Managers. Proceedings of California Conference on the Conservation and Management of Rare and Endangered Plants, Sacramento, California. pp. 215-223.

Oldfield, S. 1985. The Cactaceae, a Family Threatened by Trade. Oryx 18:148-151.

Riha and Subik. 1981. Acuna cactus.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991a. Special Status Plants of Organ Pipe Cactus National Monument, Arizona: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 223 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-263

2. Project Title: **Expand Long-term Ecology Studies of *Lophocereus schottii***

3. Servicewide Issue: NO3 - Impacts on Threatened, Endangered, and Other Sensitive Plants

4. Problem Statement: Additional information is needed to adequately protect the monument's population of senita cactus (*Lophocereus schottii*). The senita cactus is one of three columnar cacti found in Organ Pipe Cactus National Monument. It is locally abundant only in Senita Basin and the Lost Cabin Mine area. Senita cacti are also found in other parts of the monument, with just a few individuals located in the Dos Lomitas area, Pozo Salado, in the Diablo Mountains, the Sierra de Santa Rosa, along the Ajo Mountain Drive and along the Puerto Blanco Drive in the Sonoyta Mountains. Sightings from the Diablo Mountains, Sierra de Santa Rosa and along the Ajo Mountain Drive, however, were not verified during the Special Status Plants project in the monument's natural resources inventorying and monitoring program (Ruffner et al. 1991b). The only other known location of senita cactus in the United States is in the Cabeza Prieta National Wildlife Refuge adjacent to ORPI. Ongoing and recent research and monitoring include studies of necrotic bacteria on columnar cacti, diseases, growth measurements and types of pollinators.

As with the saguaro and organ pipe cactus, the senita is affected by freezing temperatures, causing slow growth or deterioration of tissue, primarily to immature stems and seedlings. Of the three columnar cactus species in the monument, studies show that the senita is morphologically the least tolerant to low temperatures. Freeze frequency during winter subsequently affects the growth of senita cacti for several years (Parker 1988a). Effects of periodic and prolonged freezing temperatures will minimize establishment of new individuals and adversely affect some mature individuals, yet since this has occurred over millennia, it is unlikely to greatly disrupt the demographic status of the ORPI population over the long term (Ruffner et al. 1991a) Studies on local and global climatic fluctuations, as well as continuation of long-term monitoring, will reveal causes and trends of distribution and demographic status of the senita cactus.

It has been observed that hawkmoths and some bees may pollinate the senita, but there is a lack of knowledge on this subject. Investigations should be commenced to study the pollinators of the senita cactus.

Illegal collection of senita cacti has occurred. The senita's growing tips are suitable for rerooting and transplanting, and have been removed from several individuals at the Dos Lomitas natural resources monitoring site (Ruffner et al. 1991a). Future research on other factors affecting distribution of the senita cactus, including border and poaching effects on the local population, would be beneficial. A cooperative effort with the Cabeza Prieta National Wildlife Refuge should continue in order to gain additional knowledge of its population as compared with the monument's.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No further research on this species will be conducted. This option implies that further information is not needed to make effective decisions for the protection of this resource. Such an assumption does not address issues such as global climate change, and border and poaching effects, all of which may determine or effect distribution or decline.

B. **Expand Long-term Ecology Studies of *Lophocereus schottii*.** This alternative will synthesize information gathered from multiple research and monitoring projects to provide for improved management of the senita population at the monument. A broader understanding of outside forces affecting the local population, as well as synthesis of all information, will aid in protecting this species.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action for this issue. The study will include several separate actions, as follows:

- Mapping individual senita cacti within monument boundaries.
- Compiling a bibliography of information published to date on the ecological functioning of the senita cactus.
- Developing a geographic information system (GIS) theme to indicate location and distribution information on the senita cactus throughout its known range. Conducting GIS modeling on factors affecting distribution to help find other populations within the monument and within this plant's geographic range.
- Cooperating with U.S. land management agencies and scientists/managers from Sonora and Sinaloa, Mexico, to gather information and data on other senita cactus populations, thus gaining full understanding of its life history and demographic status.
- Examining effects of predation by moth larvae or other predators.
- Determining viability of replanting to protect the biodiversity of this species.
- Monitoring/mitigating illegal collection activity and maintaining records of damage rates.
- Synthesizing all available research data and bibliographic information on factors affecting local population.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and documentation review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort, a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in

the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-263 Expand Long-term Ecology Studies of *Lophocereus schottii*	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	20,000	20,000	20,000
Personnel Services	8,900	8,900	8,900	8,900
Other	1,000	0,000	0,000	0,000
TOTAL	59,900	28,900	28,900	28,900
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	59,900	28,900	28,900	28,900

References:

Parker, Kathleen. 1988a. Plants.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991a. Special Status Plants of Organ Pipe Cactus National Monument, Arizona: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 223 pp.

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 1991b. Monitoring Protocol Handbook for Plants of Organ Pipe Cactus National Monument, Arizona. Final Report. Ruffner Associates. 42 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-264

2. Project Title: **Expand Long-term Ecology Studies of *Bursera microphylla***

3. Servicewide Issue: NO3 - Impacts on Threatened, Endangered, and Other Sensitive Plants

4. Problem Statement: Additional information is needed to adequately understand and protect Organ Pipe Cactus National Monument's population of elephant trees (*Bursera microphylla*). The elephant tree is fairly abundant, and found locally in the monument in Senita Basin, Sierra de Santa Rosa, and the Ajo, Bates, Sonoyta and Diablo Mountains, on basaltic SW to SE facing slopes. The species is most common in the Growler Mountains near Kino Peak. The elephant tree populations in the monument are approximately 160 km south of the northernmost portion of the species range.

Low temperatures, as with other desert plant species, appears to be a limiting factor in the growth of the elephant tree, which is included in a family of mostly tropical species (Rzedowski and Kruse 1979). Studies have shown that the elephant tree has a stunted growth form in populations in the northern part of its range. This is caused by water availability, but does not take into consideration effects of temperature variability within local microhabitats, or regional climatic differences (Ruffner et al. 1991c).

Little is known of the elephant tree's natural history. For example, there have been no conclusive studies on the types of pollinators and threats of predation on this species. Birds may be the seed dispersal mechanism for this tree, however, no current research has revealed this information.

No known human threats exist to the elephant tree within the monument, however the potential for collection is possible.

According to the Special Status Plant study conducted as part of the monument's natural resources inventory and monitoring program, researchers discovered that the elephant tree population in the monument was actually recruiting, and appeared to be a viable and sustaining one (Ruffner et al. 1991c). The causes for this increase in population needs to be further explored in order to analyze factors affecting its demographic status.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No studies on elephant tree demographics will be conducted. This option implies that the monument staff does not need any other information to make effective decisions on protecting this resource. Such an assumption would not address such issues as global climate change, and border and poaching effects, which may be significant factors in the demographic status of the elephant tree.

B. **Expand Long-term Ecology Studies of *Bursera microphylla*.** This alternative will combine information gathered from multiple research and monitoring projects to provide for improved management of the elephant tree population at the monument. A broader understanding of outside forces affecting the local population, as well as synthesis of all information, will aid in properly preserving this species.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action for this issue. This study will include several separate actions, as follows:

- Mapping individual elephant tree populations within the monument boundaries.
- Compiling bibliography of information published to date on the ecological functioning of the elephant tree.
- Developing a geographic information system (GIS) theme to indicate location and distribution information of the elephant tree throughout its known range. Conducting GIS modeling on factors affecting distribution to help find other populations within the monument.
- Determining type and extent of damage from predation and investigating pollinating mechanisms.
- Determining if illegal collection activity exists and maintaining records of damage rates.
- Synthesizing all available research data and bibliographic information on factors affecting local populations.

Personnel: The work for this project will be contracted through the Cooperative National Park Studies Unit, University of Arizona, Tucson, AZ. Resources management staff will provide field assistance and documentation review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. If collection of specimens is necessary as part of this research effort a scientific collecting permit will be issued from the monument Superintendent. Collected specimens will include National Park Service catalogue cards and identification, and will be deposited in the monument's museum. If needed, the appropriate state and federal threatened, endangered or sensitive species permits must be obtained.

8. Funding

FUNDING

ORPI-N-264 Expand Long-term Ecology Studies of *Bursera microphylla*	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	20,000	20,000	20,000
Personnel Services	8,900	8,900	8,900	8,900
Other	1,000	0,000	0,000	0,000
TOTAL	59,900	28,900	28,900	28,900
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	59,900	28,900	28,900	28,900

References:

Ruffner, G. A., R. A. Johnson, M. A. Baker, D. J. Pinkava and N. Trushell. 199¹c. Database Information for Special Status Plants of Organ Pipe Cactus National Monument: Sensitive Ecosystems Project. Final Report. Ruffner Associates. 82 pp.

Rzedowski, J. and H. Kruse. 1979. Algunas tendencias evolutivas en *Bursera* (Burseraceae). Taxon 28:103-116.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-265

2. Project Title: **Evaluate Status of and Develop Monitoring Program for Sonoran Pronghorn**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The current status of the Sonoran pronghorn (*Antilocapra americana sonoriensis*) in the monument is not fully understood. The Sonoran pronghorn is an endangered subspecies, with a limited distribution in southwestern Arizona and in northwestern Sonora, Mexico. There are less than 300 individuals in the United States and less than 500 in the State of Sonora, Mexico (Thompson-Olais 1993). The known distribution of the subspecies within the United States is in Organ Pipe Cactus National Monument and on the Barry M. Goldwater Range, primarily within the boundaries of the Cabeza Prieta National Wildlife Refuge. On-going research associated with this subspecies has been sponsored by the United States Fish and Wildlife Service and the Arizona Game and Fish Department, and has focused on natural history and habitat use.

A recovery plan for the subspecies was developed in 1982. A recovery goal of 300 animals in Arizona was estimated before the Sonoran pronghorn could be downlisted. Since that time, a number of research studies, coordinated primarily by the Arizona Game and Fish Department and the United States Fish and Wildlife Service, have been conducted. These studies examined the natural history and habitat use of the Sonoran pronghorn, providing valuable information on the subspecies.

Key components of the recovery plan include monitoring the present U.S. population, assisting with monitoring in Mexico, protecting and managing known habitat, and continuing research efforts to provide a better understanding of the subspecies. A critical area of concern is the impact of military operations on Sonoran pronghorn, primarily that of sub- and supersonic noise caused by aircraft over areas of critical habitat. The proper management of data associated with the above components is of utmost importance to ensure research validity, to aid with the implementation of monitoring protocols, enhance the quality of future research, and to aid in the decision making processes. Data management comprises the entry, storage, manipulation, analysis and retrieval of data. A comprehensive and efficiently operating database is conducive to meaningful analysis, comparative study, and modeling. Production of high quality graphics, including thematic maps, is essential to improve intra-agency, interagency and international communications.

A multi-agency Core Working Group was established in 1991 to focus recovery efforts for the Sonoran pronghorn. Agencies invited include the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Arizona Game and Fish Department, Tohono O'odham Nation and Centro Ecologico de Sonora in Hermosillo, State of Sonora, Mexico. The group has coordinated surveys of pronghorn and is involved in other aspects of species recovery, including the revision of the Recovery Plan.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. No further research or monitoring addressing the status of Sonoran pronghorn will be accomplished.

B. **Evaluate Status of and Develop Monitoring Program for Sonoran Pronghorn.** The monument will continue as a member of the Core Working Group addressing Sonoran pronghorn recovery. Activities outlined in the revised recovery plan will be implemented in conjunction with Core Working Group agencies. The U.S. Fish and Wildlife Service will lead recovery efforts.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. Components of the activity will include:

- Continued participation with the Core Working Group involved with the recovery of the Sonoran pronghorn.

- Implementing activities outlined in the revised Sonoran pronghorn recovery plan under the lead of the U.S. Fish and Wildlife Service, including establishing a protocol for survey techniques and frequency and completing comprehensive aerial surveys in the U.S. and Mexico; investigating satellite telemetry to look at some of the unknown factors of life history and monitoring the population; investigating, evaluating and prioritizing the present and future status of re-introduction sites within the historic range; re-establishing and monitoring new separate herd(s) to guard against disease and to decrease the chances of catastrophes decimating core populations; establishing a protocol for collection and examination of specimens and/or parts to assist with verification of taxonomic status and examining additional specimen evidence available now.

Personnel: Monument resources management staff will assist with all project elements.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-265 Evaluate Status of and Develop Monitoring Program for Sonoran Pronghorn	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	6,000	6,000	6,000	6,000
Other	500	500	500	500
TOTAL	6,500	6,500	6,500	6,500
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	4,500	4,500	4,500	4,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-266

2. Project Title: **Evaluate Status of Mastiff Bats (*Eumops sp.*)**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them

4. Problem Statement: The status of two sensitive bat species, Underwood's mastiff Bat (*Eumops underwoodi*) and the western mastiff bat (*Eumops perotis*) in the monument is unknown. *E. underwoodi* is known in only two locations in Arizona. Earlier records have *E. underwoodi* occurring at the south end of the Baboquiveri Mountains near Sasabe. In the early 1980's, Yar Petryszyn, National Biological Survey/Cooperative Park Studies Unit UA, captured a number of individuals of both sexes at Quitobaquito Pond in the southwest corner of Organ Pipe Cactus National Monument. This site remains the only other known United States location, and is also the western most record of occurrence.

Only rudimentary knowledge is available on the mastiff bat's seasonal use of water sources, population numbers, sex ratios, breeding periods, food resources, foraging behavior, etc. No roosts of *E. underwoodi* and only a few for *E. perotis* have been found in the United States.

Due to their large size, narrow wings, and restricted maneuverability, these bats require a fairly large body of water to utilize for drinking. Water sources of this size are limited in the arid southwest. *E. underwoodi* has been mist netted only over artificially created stock tanks and at Quitobaquito pond. *E. perotis* utilizes similar sources, but has also been netted over extended natural pools in areas such as lower Sabino Canyon in the Santa Catalina Mountains. Large ponds are difficult to mist net because of their size and the need for a boat to set and check mist nets. The dearth of knowledge on these bats is probably, in part, due to this difficulty.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will rely on the existing scant database to make management decisions affecting native mammals. No further research on mastiff bats will be conducted.

B. **Evaluate Status of Mastiff Bats.** A research project will be developed to assess the status of both mastiff bat species in the monument. Questions to be addressed will include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture rate, and relative abundance of *E. underwoodi* and *E. perotis*.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. Components of the research will include addressing the status of two sensitive species, *Eumops underwoodi* and *Eumops perotis* at a unique "oasis", Quitobaquito pond, in a lower Sonoran mesquite, willow and cottonwood habitat. Questions that will be addressed include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture

rate, and relative abundance of both species. This information will assist the preservation of these species by providing biological knowledge important for management decisions.
This study will monitor Quitobaquito Pond for two consecutive nights on a bimonthly basis for one year. This will entail setting a 120 ft. mist net across the pond. This setup has proven to be successful in the past. The net will be checked periodically from sunset to the next morning's first light. All bats captured will be identified, sex determined, relative age estimated, weighed, and reproductive activity and time of capture noted. Each bat will be marked with a plastic, color and number coded band placed on the forearm. These bands are universally used for bats. Any recapture of banded bats will be recorded. Once bats are processed in this matter, which will take less than thirty minutes, they will be released.

The data accumulated should shed light on the relative number of bats utilizing Quitobaquito seasonally and annually. Sex ratios, breeding strategies, size, and nightly activity periods will be determined for the bats visiting Quitobaquito. Recapture rates will be analyzed. Some questions that will be addressed are: Do bats that are captured once return to be captured later that same night or the next night? Once captured, do they learn to avoid the net or the area? Are those same bats captured two months or more later? Do bats utilize this water source faithfully throughout the year? What ratio of females have young in any given year? What is the relative abundance of *E. underwoodi* and *E. perotis* at this water source?

Since little is known of the diets of these bats, any fecal pellets deposited in the holding bags (a common occurrence) will be analyzed for prey content. Short of sacrificing the animal and analyzing stomach content, this is the only way to get information on food items.

A monitoring protocol will be developed and monument staff will be trained to implement it.

Personnel: Research will be contracted. Monument resources management personnel staff will assist with all project elements and will conduct monitoring using the protocol developed.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6, App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-N-266 Evaluate Status of Mastiff Bats (*Eumops sp.*)	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	5,000	-	-	-
Personnel Services	4,000	-	-	-
Other	500	-	-	-
TOTAL	9,500	-	-	-
Funds Available in Park Base	4,500	-	-	-
Additional Funds Needed	5,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-300

2. Project Title: **Develop and Implement Ambient Air Quality Monitoring Program**

3. Servicewide Issue: N14 - Visibility Impairment and Biological Damage Caused by Air Pollution (Includes Wet and Dry Deposition).

4. Problem Statement: The effects of gaseous pollutants on monument resources, including the many varieties of cacti and special status plants, are unknown. Since 1985 and the closing of the Ajo Mine Smelter, air quality at the monument has improved dramatically. Now would be an opportune time to initiate a gaseous pollutant monitoring program to establish a baseline. Growth adjacent to the monument is expected to increase as urbanization and agricultural development expands. In addition, possible future trade agreements may accelerate this process. Approximately 5000 hectares have been set aside 20 miles south of the monument by the state government of Sonora, Mexico, to develop twelve factories, including a pesticide disposal plant. All these activities threaten the future air quality of the monument.

Organ Pipe Cactus National Monument is an International Biosphere Reserve containing over 300,000 acres of designated wilderness. This area includes some of the most pristine and biologically diverse Sonoran Desert in the United States. The monument is a Class II designated area under the Clean Air Act. Although it has the resource values of a Class I site, the monument is not allocated specific air quality funds to implement programs needed to maintain its high resource values. The Clean Air Act amendments of 1990 state a "requirement that Federal Land Managers identify as well as protect air quality related values."

The nearest large city is Sonoyta, Sonora, Mexico. Sonoyta has a population of approximately 25,000. Extensive agricultural development and maintenance of fields occurs in the area, including frequent burning, pesticide and herbicide use, and transport of goods on dirt roads. Thirty miles of the monument boundary bordering these fields. Major vehicle traffic occurs in Sonoyta and through the monument on Highway 85, including diesel buses and trucks, tourists and local commuters. There are also smelters in northeastern Sonora, Mexico, and their impact on the monument resources is unknown.

National Park Service Management Policies state that the NPS will seek to perpetuate the best possible air quality in parks because of its critical importance to visitor enjoyment, human health, scenic vistas and the preservation of natural systems and cultural resources (NPS 1988). Two gaseous criteria pollutants, ozone and sulfur dioxide, are particularly toxic to native plant species found in NPS units. These pollutants are known to be harmful to vegetation even below the National Ambient Air Quality Standard (NAAQS) established by the Environmental Protection Agency (NPS 1991f).

Ozone (which forms when volatile organic compounds and nitrogen oxides interact in the presence of sunlight) can be transported long distances in the atmosphere and thus is often an areawide problem. Sulfur dioxide is more likely to be a localized problem (within 100 km of the pollution sources), affecting individual parks (NPS 1991f).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Data to assess gaseous pollutant impacts on sensitive resources will not be collected. As a result, information will not be available to assist management actions, and mitigate and protect resources.

B. **Develop and Implement Ambient Air Quality Monitoring Program.** A program to monitor ambient air quality in the monument will be developed. This alternative will entail inventorying air quality related values, monitoring and documenting the condition of air quality and related values and evaluating air pollution impacts. An ozone and sulfur dioxide monitoring program will be established, thus ensuring that baseline and trend data will be known. The monument will be able to monitor change more closely and accurately. The data will also give the monument a defense for reducing current or potential air pollutant impacts to its resources.

6. Description of the Recommended Project or Activity: Option B. is the recommended action for this issue. Activities associated with this alternative include:

- Conducting a literature search and identifying resources that may be affected by gaseous pollutants. Identifying potential sources of pollution.

- Inventorying air quality related values, monitoring and documenting the condition of these values and evaluating potential air pollution impacts.

- Establishing a program to monitor ambient air quality. Developing a baseline of air quality in the monument. This will involve working with the NPS Air Quality Division to install monitoring devices for ozone and sulfur dioxide.

- Training resources management staff in the operation of monitoring equipment.

- Integrating efforts into the monument's natural resources monitoring program.

Personnel: NPS Air Quality Division and the monument resources management staff will establish and maintain the monitoring program.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.6, and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-300 Develop and Implement Ambient Air Quality Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	15,000	15,000	15,000	30,000
Other	40,000	2,000	2,000	4,000
TOTAL	55,000	17,000	17,000	34,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	55,000	17,000	17,000	34,000

References:

National Park Service, United States Department of the Interior. 1988c. National Park Service Management Policies. 160 pp.

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-N-301

2. Project Title: **Develop and Implement Visibility Monitoring Program**

3. Servicewide Issue: N14 - Visibility Impairment and Biological Damage Caused by Air Pollution (Includes Wet and Dry Deposition).

4. Problem Statement: Although scenic opportunities are a prime visitor resource at Organ Pipe Cactus National Monument, there is no program in place to monitor visibility. The monument is an International Biosphere Reserve containing over 300,000 acres of designated wilderness. This area covers some of the most pristine and biologically diverse Sonoran Desert in the United States. The vistas seen from visitor use drives and mountain tops may extend 70 miles or more. The night sky is another unique and important resource which the monument offers. The 1989 National Park Service visitor use survey states that 81 percent of the visitors believe that the monument's natural scenery is extremely important, and 43 percent believe that a clear night sky is extremely important.

The monument is a Class II designated area under the Clean Air Act. Although it has the resource values of a Class I site, the monument is not allocated specific air quality funds to implement programs needed to maintain its high resource values. The Clean Air Act amendments of 1990 state a "requirement that Federal Land Managers identify as well as protect air quality related values."

Since 1985 and the closure of the Ajo Mine Smelter, air quality at the monument has improved dramatically. Now would be an opportune time to expand the air quality program from a dichotomous particulate monitoring station to include a visibility monitoring program, including monitoring of sulphur dioxide. The nearest large city is Sonoyta, Sonora, Mexico. Sonoyta has a population of approximately 25,000. Extensive agricultural development and maintenance of fields occurs in the area, including frequent burning, pesticide and herbicide use, and transport of goods on dirt roads. Thirty miles of monument borders these fields. In addition, major vehicle traffic occurs both in Sonoyta and through the monument on Highway 85, from diesel buses and trucks, tourists and local commuters.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The current and potential impacts of agricultural use and urban development on the monument's air quality resources will not be analyzed. Accepting the status quo will not provide any information on visibility impairments. Baseline and trend data on visibility impairment will not be known. Degradation of resources from air pollutants may occur undetected.

B. **Develop and Implement Visibility Monitoring Program.** This alternative will ensure that visibility data is collected and analyzed through reliable technology. Data will be available to management to assist in mitigating potential problems. Visibility monitoring provides information about current visibility conditions at the parks, and over time, can be used to assess trends (NPS 1991f).

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A visibility monitoring assessment program will be established and implemented with the coordination of the National Park Service, Air Quality Division. The program will include installation and maintenance of at least one and possibly two, automated camera stations: one on the south boundary as first priority and one in the northern portion of the monument. A transmissometer will also be installed and maintained to determine the extent of visibility impairment. Selected monitoring of airborne particulates using an IMPROVE particulate sampler, in conjunction with continuous monitoring of meteorological factors, will result in the assessment of the extent, severity and trends of ambient pollution as these affect visibility in the monument. This project will include the following:

- Installing and providing quality assurance services for the camera photography, transmissometer, IMPROVE airborne particulate sampler, and meteorological station, including calibration and precision checks, accuracy audits, and instrumentation operation support in the monument.

- Data assessment services including data collection, automated and manual reduction, computer processing and analysis.

- Appropriate air quality (including visibility) records, documents and charts.

- The development of a regional southern Arizona computer model which will permit prediction of visibility trends from information collected in the region.

- A seasonal summary of visibility levels for the life of the project. After at least one year of data collection, the following analyses can be performed:

  Particulate Mass Budget - Determination of the composition of the air pollutants, i.e., what percent is sulfate, nitrate, organics, etc.

  Extinction Budget - Statistical analyses of the particulate and optical data to determine which pollutants cause the light extinction. Data is needed from slides or transmissometers. Relative humidity and temperature data help in these analyses.

  Source/Receptor Modeling - Use of pollutant concentration data combined with back trajectory modeling to determine the important source areas and transport pathways.

Personnel: NPS Air Quality Division and monument resources management staff will establish and maintain the monitoring program.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-N-301 Develop and Implement Visibility Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	11,500	11,500	11,500	23,000
Other	120,000	3,000	3,000	6,000
TOTAL	131,500	14,500	14,500	29,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	131,500	14,500	14,500	29,000

References:

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-001

2. Project Title: **Complete Archeological Survey Report: 1989-1991; Curation of Artifacts from Surveys**

3. Servicewide Issue: C02 - Inadequate Archeological Survey and Inventory

4. Problem Statement: From 1989 to 1991, an archeological survey of 8000 acres (approximately 2.3% of the monument) was completed that investigated 1) areas of predicted high site density; 2) areas of predicted low site density; and 3) portions of areas of proposed development. This survey established that archeological resources are more numerous and significant than previously known; remains of 12,000 years of human history are present in the monument, and the archeological resources represent significant prehistoric events signifying relationships between human populations and their adaptation to the Sonoran Desert. Completion of the report requires data analysis, a final report, a National Register nomination, and cataloging of collected artifacts.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Unassessed and unreported field records and collections will be relied on for management and research. A National Register nomination will not be submitted. The result will be a large quantity of unorganized and unevaluated data and objects which will be of no value for planning and management for compliance with National Park Service Guidelines and the National Historic Preservation Act.

B. **Complete Archeological Survey Report: 1989-1991; Curation of Artifacts from Surveys.** This alternative will allow the monument to meet management and planning needs, to comply with NHPA mandates, and meet NPS and USDI requirements for artifact curation and conservation.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A complete analysis and report meeting USDI and NPS standards will be completed; site records will be entered into the Classified Sites Inventory, and artifacts will be cataloged and stored according to NPS standards and directives. In the first year, the survey report summarizing three field seasons of work will be completed, and in the second year, all artifacts will be cataloged for curation.

Personnel: All work will be completed be National Park Service staff stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior.

8. Funding:

FUNDING

ORPI-C-001 Complete Archeological Survey Report: 1989-1991; Curation of Artifacts from Surveys	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	2,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	2,000	0,000	0,000	0,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	2,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-002

2. Project Title: **Prepare Prehistoric Sites Preservation Guide**

3. Servicewide Issue: C12 - Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance

4. Problem Statement: The monument does not have guidelines for preservation of important irreplaceable prehistoric sites. Guidelines are needed to establish baseline preservation procedures and treatments. Prehistoric sites are subject to damage from natural processes, pests, visitor impacts, vandalism, and theft. The NPS is responsible for the protection and preservation of these resources. The monument does not have sufficient staff necessary to implement guidelines at this time.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Protection and preservation of archeological sites will not occur in any systematic way, resulting in the possible loss of irreplaceable interpretative and scientific resources. Archeological sites that may be important to American Indian Tribes with traditional ties to the resources may be damaged. When archeological sites cannot be preserved in place, the NPS must evaluate the situation and may have to excavate sites to retrieve data necessary to mitigate further losses and to comply with Section 106 and 110 of the National Historic Preservation Act. Preservation treatment and protection of prehistoric archeological resources will not comply with sections of Chapter 5 of the 1988 NPS Management Policies, NPS-28 Guidelines for Cultural Resources Management, the Organic Act of 1916, and the 1937 Presidential Proclamation that established the monument under Section 2 of the 1906 Antiquities Act.

B. **Prepare a Prehistoric Sites Preservation Guide.** This alternative will establish specific actions and treatments consistent with monument planning and NPS policies and guidelines. Monument management and staff can then follow the guidelines to insure adequate protection and preservation measures are applied to important nonrenewable sites. Implementation of this alternative will help ensure that the monument's historic preservation program complies with the Organic Act of 1916, NPS-28 Cultural Resources Management Guidelines, Chapter 5 of the 1988 NPS Management Policies, Sections 106 and 110 of the National Historic Preservation Act, the Archeological Resources Protection Act, and the 1937 Presidential Proclamation establishing the monument under Section 2 of the 1906 Antiquities Act.

6. Description of the Recommended Project or Activity: Alternative B is the recommended solution for this issue. Preparation of a Prehistoric Sites Preservation Guideline will permit the monument to efficiently manage the protection and preservation of important nonrenewable archeological sites.

It is estimated that seven weeks will be required to complete background archeological research, visit a representative sample of sites to assess conditions and problems, and to complete a draft of the guidelines. This will not include formulation of scopes of work for preservation treatments specific to preservation problems identified during site orientation visits. It is estimated that the background research and site visits will take three weeks, the completion of the draft plan, four weeks. A final draft will be completed after

reviews and comments are received, and changes will be incorporated after an additional two weeks. The author will have to work closely with monument staff, the Western Archeological and Conservation Center (WACC) survey archeologist and the Southern Arizona Group archeologist.

Personnel: The monument does not have cultural resources management specialty personnel on staff to prepare the guidelines. There is a heavy backlog of projects in the Western Region and the Southern Arizona Group Office. Thus, this project will be completed through either the Denver Service Center or a contract.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), C(4), US Department of the Interior. NHPA compliance under section 106 is not required to prepare the guide; however, each project which may be implemented under the guideline must comply with Section 106 of the NHPA. The Arizona State Historic Preservation Office should be consulted during preparation of the guidelines to insure that they approve of proposed procedures for use in future preservation treatment projects.

8. Funding:

FUNDING

ORPI-C-002 Prepare Prehistoric Sites Preservation Guide	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	12,000	-	-	-
Personnel Services	0,000	-	-	-
Other	8,000	-	-	-
TOTAL	0,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	20,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-003

2. Project Title: **Develop Archeological Base Map/Database in GIS**

3. Servicewide Issue: CO1 - Inadequate Planning Documents

4. Problem Statement: There is presently no integrated database and base map of natural and cultural resources and modern features such as roads. Organ Pipe Cactus National Monument has developed a Geographic Information System (GIS) that will contain all such data. Currently, however, archeological information is not entered into the GIS system. This information is necessary to allow for the generation of maps showing cultural resources with overlays of natural resources and cultural features. These maps will create a single visual impression of the natural and cultural landscape. The GIS will be capable of creating maps showing the locations of cultural resources and modern features such as highways and dirt roads, campgrounds, NPS facilities, and utilities.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in researchers and managers needing to search through various existing maps and documents at the Western Archeological and Conservation Center (WACC) to identify locations of known cultural resources. The possibility of incorrect plotting of data from previous surveys could lead to spurious conclusions.

B. **Develop Archeological Base Map/Database in GIS.** A cultural resources database to be used in GIS will be developed. This will produce integrated maps of natural and cultural resources along with overlays of modern cultural features in Organ Pipe Cactus National Monument.

6. Description of the Recommended Project or Activity: Alternative B is the recommended action. Universal Transverse Mercator (UTM) grid co-ordinates and latitude/longitude have been determined for all sites recorded between 1989-1991, thereby providing accurate locational information. Locational information needs to be determined for previously recorded sites. Site typologies need to be determined, and should contain descriptive information, time period, cultural affiliation, and site function. Cultural resource data, including site boundaries, will be entered into the monument GIS. Any number of integrated maps can be produced which contain cultural resource information along with information on vegetation, soils, topography, drainages, slope, aspect and degree, erosion and deposition, and recent cultural features such as roads (open & closed) and hiking trails. Depending on the type of information needed, these maps can be used by planners in preparing proposals for new construction activities; by law enforcement for protection and surveillance activities; and by resources management to study natural impacts to sites and to assist in developing monitoring protocols.

Personnel: Work will be completed by NPS personnel stationed at WACC.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-003 Develop Archeological Base Map/Database in GIS	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	13,500	2,500	2,500	2,500
Other	0,000	0,000	0,000	0,000
TOTAL	13,500	2,500	2,500	2,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	13,500	2,500	2,500	2,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-004

2. Project Title: **Data Bank Management: Correct Plotting of Site Locations on Monument and Western Archeological and Conservation Center Maps**

3. Servicewide Issue: CO1 - Inadequate Planning Documents (GMP, SFM, DCP)

4. Problem Statement: Planning documents prepared for the draft General Management Plan (GMP) used a cultural resource base map that contained out-of-date and often incorrect data regarding site locations. There is a conglomeration of old maps, reports, field notes, and location descriptions for cultural resources which were identified prior to 1980. An up-to-date corrected USGS 15' topographic map is needed by Organ Pipe Cactus National Monument and by the data bank at the Western Archeological and Conservation Center (WACC). A corrected base map will make a single visual impression of where cultural resources are located. WACC has up-to-date USGS 7.5' topographic maps showing the locations of sites identified since 1980, however the monument does not have copies of these maps. The large base map and smaller maps will be used in planning, by law enforcement for protection & surveillance at sites, and by resources management to study natural disturbance in site areas. Map overlays could be made for cultural resources by site category (eg. historic, prehistoric ceramic period, prehistoric Archaic period).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Failure to revise the maps will provide incorrect data to planners and researchers, resulting in erroneous conclusions. Failure to provide accurate site locational information to law enforcement impedes site protection efforts.

B. **Data Bank Management: Correct Plotting of Site Locations on Monument & WACC Maps.** A map index will be created, and all current base maps at WACC and the monument will be revised and updated. Site locations will be accurately plotted on topographic maps and aerial photos. Legal descriptions and UTM's for all sites will be calculated as a prerequisite for developing the cultural resource GIS database.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. The project will involve several steps:

- All maps in the collections will be examined and a map index created. The map index will include the date that the map was originally prepared, data it was based on, and will be cross-indexed to the most recent/corrected data and map. Preparation of the map index will include a literature search of field notes related to research conducted prior to 1980.

- New USGS 15' topographic maps showing the location of sites will be prepared with mylar overlays. These overlays will include the survey project number and sites accurately plotted. An overlay of site locations by site type will also be prepared.

- A set of USGS 7.5' topographic maps showing the locations of all known sites will be prepared for the monument.

- The USGS 7.5' topographic maps at WACC will be updated and revised to contain site locational information on sites identified prior to 1980.

- A set of aerial photos of the monument will be obtained for WACC and site locations will be accurately plotted on both the WACC and monument aerial photos.

- Updating of maps, aerial photos, and data bank information will continue.

This study and map plotting project will provide researchers, archeologists, planners, and law enforcement with accurate up-to-date information regarding site locations. This information is not covered under the freedom of information act; therefore access to the maps will be restricted.

Personnel: This project will be accomplished by NPS personnel working at WACC.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-004 Data Bank Management: Correct Plotting of Site Locations on Monument and Western Archeological and Conservation Center Maps	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,000	1,500	1,500	1,500
Other	0,000	0,000	0,000	0,000
TOTAL	5,000	1,500	1,500	1,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	5,000	1,500	1,500	1,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-005

2. Project Title: **Develop and Fund Public Archeology Program**

3. Servicewide Issue: C20 - Inadequate Security

4. Problem Statement: Although Organ Pipe Cactus National Monument is a natural area, archeological survey of 2.3% of the monument has shown that it contains a large number of significant archeological resources, many of which are vulnerable to impact by visitor traffic and vandalism. These resources have high research and interpretive potential for understanding the relationships between people and the desert. Information about them can contribute to the monument interpretive program, more effective resources management, and public awareness of their importance. Past interpretation and training have focused on natural resources; more effort is needed to inform park staff and the public about archeological resources.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The current level of effort will be maintained. This consists of limited displays, incidental reference to cultural resources in park publications and interpretation, ethnographic living history programs, and occasional training of selected staff. This approach fails to inform the public of the full story of human occupation of the monument; it also fails to introduce visitors to the ethics and procedures of cultural resources preservation. Visitors finding archeological resources may not understand their significance or the importance of leaving them undisturbed. The same applies to park staff, who have a more direct responsibility for the preservation and management of cultural resources.

B. **Develop and Fund Public Archeology Program.** Interpretation, training, and awareness of archeological and ethnographic resources for the public and for park staff will be expanded, as an integral part of monument operations. Knowledge of the monument's resources, and their regional context, is continuously growing; its interpretative potential grows as well. Heightened awareness of an increasingly threatened resource is important for visitors, during their visit to the monument and after. Increased sensitivity to traditional Native American values and locations is important for resolution of current conflicts between Native Americans and Euro-Americans. Increased potential for deliberate and unintentional human impact on archeological resources requires better trained park staff. All of these needs are best met by increased effort and involvement from the park staff, with assistance from archeologists, ethnologists, and Native Americans knowledgeable about the monument's cultural resources.

6. Description of the Recommended Project or Activity: Alternative B. is recommended if the monument is to meet its obligations for cultural resource interpretation, management and protection. The park's participation in Arizona Archeology Week will be expanded. Demonstrations and living history programs will also be expanded, and will include topics such as artifact manufacture, traditional plant use, and native agricultural practices. New and expanded exhibits will be developed, using new archeological and ethnographic data and current approaches to cultural resources protection. Interpretation will be incorporated in all archeological field projects. A pamphlet on the cultural history of the monument and on the laws and procedures for cultural resources management will be developed. Annual cultural resources orientation will be provided for monument employees, particularly those in interpretation and law

enforcement. Interpreters will attend training such as Interpretation of Cultural Resources and Interpretation of Native American Cultures.

Personnel: This project will be completed by National Park Service employees stationed at Organ Pipe Cactus National Monument, with assistance from Western Archeological and Conservation Center personnel.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(3), C(5), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-005 Develop and Fund Public Archeology Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,000	5,000	5,000	5,000
Other	3,000	3,000	3,000	3,000
TOTAL	8,000	8,000	8,000	8,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	8,000	8,000	8,000	8,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-006

2. Project Title: **Develop and Fund Archeological Site Protection Program**

3. Servicewide Issue: C20 - Inadequate Security

4. Problem Statement: Theft of cultural resources is a significant problem in many national parks and monuments. Law enforcement agencies estimate that looting and vandalism of cultural resources is a multi-million dollar business. The loss of information to scientists cannot be estimated in dollar figures. Cultural resources on all federal lands, including prehistoric and historic archeological sites, are protected by the Federal Antiquities Act of 1906, the Archeological Resource Protection Act (ARPA) of 1979 (amended 1987/1988), and the Native American Grave Protection and Repatriation Act of 1990.

Paul Ezell's field notes of the early 1950's fieldwork in Organ Pipe Cactus National Monument documents that a number of individuals in Ajo had extensive artifact collections that came from the monument. During the past three years, archeologists have documented a number of additional cases of recent theft and vandalism of cultural resources at the monument. A visit to AZ Z:13:8(ASM), a rock shelter, indicated recent human disturbance (excavation) to the archeological deposits. A whole pot that once rested in the arms of a saguaro outside the rock shelter has been removed by unknown persons. Several petroglyph sites in Growler Canyon have been defaced with graffiti that was scratched into the rocks during the 1960's. A pestle that rested in a mortar cup for perhaps a thousand years at a site in Alamo Canyon was stolen during the fall of 1990. Potholes have been identified in the embankments of the ballcourt at AZ Z:13:1(ASM), one of the most significant sites in the monument. A cross that was restored to a grave at the Quitobaquito cemetery has also been stolen. During the fall-spring of 1990-1991, rangers made contact on several occasions with an individual who is suspected of looting in and around the remote Bates Mountains. During December 1991, a Western Archeological and Conservation Center (WACC) archeologist documented the theft of artifacts from a cave site, AZ Z:13:120(ASM), in the Bates Mountains.

Several factors make protection of cultural resources difficult, including the vast size of the monument, coupled with the lack of a complete cultural resources survey and inventory of archeological sites, lack of funding for ARPA training and related activities, and lack of awareness by the public that artifact collection is illegal. Until 1991, none of the monument rangers had received ARPA training in citing individuals, conducting field investigations in association with archeologists, and gathering information (including surveillance) which would lead to the arrest and conviction of looters. Two monument rangers and an archeologist from WACC received ARPA training in 1991, and have formed a cultural resources investigative team. However, given the high density and diversity of cultural resources in the monument, additional cultural resources protection efforts need to be developed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Looters and vandals will continue to destroy and steal cultural resources from the monument.

B. **Develop and Fund an Archeological Site Protection Program.** This program will consist of three components.

- The program will increase formal and informal training for all monument staff, including interpreters, resources management, and law enforcement personnel. Rangers will attend ARPA training. Sensors will be purchased for those sites that are particularly vulnerable to vandalism. The ARPA program will target amateur and professional pothunters with vigorous surveillance and investigations which should lead to arrests and successful prosecutions.

- A site steward program composed of Volunteers in Parks (VIP's) will be developed. These stewards will receive certification training through the Arizona State Historic Preservation Office. They will adopt sites and patrol them, checking for evidence of pothunting and natural disturbance.

- The program will also focus on public education about pothunting, including surface collection and how this activity destroys archeological information, and eventually the sites. It will also emphasize that pothunting is against the law and will result in prosecution.

  These activities will be accomplished by: 1) funding and developing a brochure for park visitors on the nature and extent of cultural resources and their protection; 2) participation in special programs such as Archeology Week; and 3) special talks on cultural resources.

6. Description of the Recommended Project or Activity: Alternative B. is the only option that will deter illegal theft and destruction of cultural resources. This task will be undertaken by a number of individuals with different orientations. It will consist of the following components:

- ARPA base funding will be increased by development of the described programs. This increase in funding will also be used for purchase of capital equipment used in surveillance (sensing devices, 35 mm SLR cameras with telephoto lenses, an ARPA response kit containing all equipment needed to conduct an ARPA investigation, and damage assessment).

- The monument will continue to participate in the Archeological Resources Inventory (ARI) program. Levels of site protection will be identified, based on ARI and site significance. Monitoring protocols for site visitation will be developed, scheduled and implemented in order to update ARI forms and monitor for human disturbance.

- A Site Stewards Program will be developed and implemented. This program provides training for park staff and VIP's who adopt a site, visit it on a regular schedule, complete updated site records, and document human disturbance. This program will assist law enforcement personnel in the identification of recent human disturbance which could result in surveillance and arrest of pothunters.

- ARPA investigative training will be provided for all law enforcement staff.
- ARPA legislative training will be provided for resources management staff.
- In-field training with WACC on cultural resources (what they are) and how to identify different types of disturbances will be provided.

Personnel: This project will be completed by National Park Service employees.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-006 Develop and Fund Archeological Site Protection Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,000	5,000	5,000	5,000
Other	5,000	5,000	5,000	5,000
TOTAL	10,000	10,000	10,000	10,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	10,000	10,000	10,000	10,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-007

2. Project Title: **Ethnographic Research: Ethnographic Overview & Assessment, Ethnographic Inventory, Ethnohistory and Oral History, Ethnobotany, and Ethnoarcheology**

3. Servicewide Issue: CO4 - Need for Ethnographic Overviews and Assessments, Oral Histories and Life Histories

4. Problem Statement: The monument does not have an Ethnographic Overview and Assessment, a basic cultural resources document needed for parks with known traditional use by Native American groups. An inventory is needed to establish if important, yet currently undocumented, ethnographic areas are located within the monument's boundaries. Additional information on these and known areas needs to be gathered in order to assure appropriate management. Documenting historic and current Native American use of the monument is essential for management, interpretation and fostering relationships with the local O'odham population. Ethnographic studies are essential to ensure that the monument manages its traditional cultural properties as required under federal laws, and NPS policies and guidelines.

The monument was home to Tohono and Hia C'ed O'odham in both historic and recent times. Quitobaquito and Bates Well are locations of 19th and 20th century settlements of the Hia C'ed O'odham. The journals of early explorers also document the presence of a Tohono O'odham village in the Alamo Canyon area. The monument contains a network of trails that the O'odham and their ancestors used to travel between settlements and to travel to the Sea of Cortez on annual salt migrations.

Elderly O'odham have knowledge of settlements, plant harvesting and use, animal hunting, and other native activities which occurred in the monument which will be lost if ethnohistory/oral history projects are not initiated. An ethnobotany research project focusing on native uses of plant resources and the effects on the plants should be undertaken. An ethnoarcheology project examining the artifact record at traditional villages and camps is imperative for understanding human use of and adaptation in the desert.

The O'odham residents have also observed biogeographic changes in the location and abundance of plant and animal resources that may relate to land use changes and/or climatic changes in these ecosystems. Some beginnings have been made, by collecting, though not very systematically, information on settlements, the Quitobaquito cemetery, and plant use. Much information, however, is still missing. It is imperative that oral history, ethnohistorical, ethnobotanical, and ethnoarcheological data is gathered while knowledgeable people are still living.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Management of ethnographic resources will not be based on adequate information, due to an almost exclusive reliance on existing documents, such as records, books, and photographs, which are an important but incomplete source of data. The possibility of conflict with Native Americans will continue. If no additional data is gathered, there are a number of issues regarding native settlement, trails and resource use that will never be resolved. Such information is important for resources management and interpretation, and for the O'odham themselves, who are much interested in recovering any available information about their recent culture. The monument will not be able to properly manage and protect areas of traditional cultural use without knowledge of locations, ethnographic function, and possible sacred values. The monument cannot completely comply with Chapter 5 of the 1988 NPS Management Policies, NPS-28 Guidelines for Cultural Resources Management, and Section 106 of NHPA.

B. **Complete Ethnographic Research: Ethnographic Overview and Assessment, Ethnographic Inventory, Ethnohistory and Oral History, Ethnobotany and Ethnoarcheology.** Preparation of the Ethnographic Research Documents will help provide adequate ethnographic information for monument management to address impacts of park operations and activities on traditional resources. Traditional use areas will be protected through the site monitoring program, and damage to important ethnographic areas can be avoided. Park management will be able to comply with federal legislation and NPS policies and guidelines regarding ethnographic resources.

6. Description of the Recommended Project or Activity: Alternative B. is the only option that will provide the required data. This research will provide management with information on ethnographic resources, an Ethnobotany of Organ Pipe Cactus National Monument to provide information on traditional use of plants by Native American groups, and ethnoarcheology data to provide baseline information for interpretation of past human behavior. Comprehensive collection of data will be completed on: 1) plants and their uses by the O'odham: 2) settlements, trails, gathering locations and natural features within the monument which were important to the O'odham; 3) the ethnoarcheology of historic settlements and camps, such as Quitobaquito, Bates Well, Alamo Canyon, and other locations; 4) current gathering and uses of native plants and the effects on the plant communities; and 5) the nature and extent of subtle changes in the environment, including the availability of plants, animals, and water. This will provide a sound database for resources management, interpretation, and continued traditional use of the monument by the O'odham.

Personnel: This project is uniquely suited for study by an advanced graduate student in cultural anthropology. Preferably the student will be O'odham, however an O'odham student assistant will also be appropriate if an O'odham graduate student is not available. It is important to gather and record information from an O'odham perspective. The project will be completed through a contract.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(1), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-007 Ethnographic Research: Ethnographic Overview & Assessment, Ethnographic Inventory, Ethnohistory and Oral History, Ethnobotany and Ethnoarcheology	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	30,000	30,000	30,000
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	30,000	30,000	30,000	30,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	30,000	30,000	30,000	30,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-008

2. Project Title: **Conduct Oral History Project With People Who Have Historical Knowledge of the Monument**

3. Servicewide Issue: CO4 - Need for Ethnographic Overviews and Assessments, Oral Histories and Life Histories.

4. Problem Statement: Documented interviews with individuals knowledgeable about the history and prehistory of the monument are lacking. Several archeologists have conducted previous research that remains unpublished. Many residents of surrounding areas (Sonoyta, Mexico and Ajo, Arizona), as well as former NPS employees, have information about historical activities that occurred in and around the monument. Such information regarding the history of cultural resources and of programs and operations is invaluable. This information needs to be acquired while knowledgeable individuals are alive and willing to share their experiences.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Information which could fill in gaps in the monument's history, and information concerning historic and prehistoric cultural resources, could be lost forever.

B. **Conduct Oral History Project with People Who Have Historical Knowledge of the Monument.** Individuals having information on the following will be identified: historical and developmental periods of the monument; and historic lifeways in the monument. Researchers who have conducted previously unpublished investigations will also be contacted. Oral interviews will be conducted with identified persons, and the meetings will be documented via the appropriate media, tape, video, etc.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended activity. Interviews will be conducted, and historical events, activities, and historic and prehistoric cultural resources and landmarks will be documented, thus filling in gaps and highlighting the history of Organ Pipe Cactus National Monument.

A list will be compiled of individuals who have historic knowledge of the monument. Oral history interviews will be conducted with these individuals, including Emil Haury, Julian Hayden, and a number of individuals in Ajo, AZ, and Sonoyta, Sonora, Mexico. Results will be compiled into a report and published.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-008 Conduct Oral History Project With People Who Have Historical Knowledge of the Monument	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	6,000	6,000	6,000	6,000
Other	2,000	2,000	2,000	2,000
TOTAL	8,000	8,000	8,000	8,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	8,000	8,000	8,000	8,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-009

2. Project Title: **Write Quitobaquito Management Area Human History**

3. Servicewide Issue: C02 - Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews & Assessments.

4. Problem Statement: The Quitobaquito Basin represents the oldest continuously occupied area within Organ Pipe Cactus National Monument. The first archeological reconnaissance of the area was conducted by Julian Hayden in the 1930's. Hayden (personal communication 1989) noted the presence of San Dieguito I artifacts, ca. 9,000 B.C.–7,500 B.C., in the vicinity of an extinct spring located above the active springs. Occupation of the Quitobaquito basin and surrounding area during the subsequent Archaic period, 7.000 B.C.–A.D. 150, has been documented by Teague (1977) and Rankin (NPS 1989a). Distinctive projectile point styles and the occurrence of manos, metates, and mortars are associated with the Archaic period. Two hunting and gathering complexes, the Amargosa of the lower Colorado River and the Cochise of southeastern Arizona, have been identified in Organ Pipe Cactus National Monument. Projectile points associated with both Archaic complexes have been recovered within the Quitobaquito basin and immediate vicinity (NPS 1989a). Teague (1977) also noted sites with Archaic period and later ceramic period components.

Continued use of the Quitobaquito region during the prehistoric ceramic period, 300 B.C.- A.D. 1400, is indicated by the presence of artifacts affiliated with three distinct cultural groups. Use of the area by local populations of Hohokam is indicated by the presence of locally produced plain ware ceramics. Exchange with other Hohokam populations is indicated by the presence of buff wares and red-on-buff ceramics from the Salt-River basin and red-on-brown ceramics produced in the Tucson basin. The Trincheras culture, with a core area in the Altar Valley of Sonora, also used the Quitobaquito area as evidenced by the presence of Trincheras purple-on-red ceramics. Use of the area by the Patayan of the Lower Colorado area is indicated by the presence of Lower Colorado buff wares. Prehistoric ceramic period sites in the Quitobaquito basin are spatially extensive and indicate a great deal of cultural mixing and superposition. The sites contain a high frequency of fire-cracked rock clusters indicating roasting activities. These sites also contain the greatest diversity in chipped stone raw material types. Finally, the presence of a high frequency of obsidian and marine shell indicates that Quitobaquito was a major stop on the trade network of prehistoric people.

Use of the area during the historic period by the Hia C'ed O'odham (Sand Papago) has been noted by the earliest explorers who passed through the area. Their main village of 'A'al Waippia was located near the Quitobaquito Springs, with other smaller satellite villages located in the vicinity of other springs along the western slope of the Quitobaquito Hills. At present, two cemeteries, one that predates A.D. 1900, have been identified. Extensive stabilization and recording of oral history of people associated with the large Quitobaquito cemetery have been undertaken (Bell, Anderson, and Stewart 1980). Limited recording has been conducted at the smaller cemetery. Finally, use of the area by Anglo and Mexican ranchers, miners, and store owners is also documented in various source materials.

In 1993, a small-scale survey and recording project was conducted within the Quitobaquito Basin. Sixteen sites were identified and recorded. The sites ranged from Early Archaic (ca 8500 B.C.) to historic (ca. 1940s) Hia C'ed O'odham. The survey resulted in the delineation of a use zone on the lower bajada in an area that surrounds the entire basin. This use zone is an area where artifacts are consistently present in low densities, however, the densities do not warrant designation of separate sites. In affect, the use zone constitutes a site, with other sites identified within it. The distribution of artifacts suggests that water was available in the northern part of the site, that surrounds the entire basin. Artifacts were also observed eroding out of the banks overlooking the basin and along the upper edge of the basin. The distribution of artifacts suggests that springs and or a cienega (marsh) were present prehistorically in the northern portion of the basin. The basin deposits were also examined during the survey. The deposits have a high organic content, which supports the contention that another cienega was present in the basin.

The 1993 survey also resulted in the identification of prehistoric trails, a historic wagon trail, the Jim Orozco original homestead, a ritual cremation of bighorn sheep, and a previously unknown Hia C'ed O'odham village with eight structures. This villages was alluded to in the oral history project conducted by Zepeda, but was not identified by the previous 1977 survey of the basin. Artifacts on the site indicate occupation in the late 1800s. The historic Hia C'ed O'odham material reflects use of traditional O'odham goods as well as use of European derived artifacts. Trade with the Tohono O'odham and Quechan (Yuman) groups is also indicated.

In order to understand the Quitobaquito settlement-subsistence system, a holistic approach must be taken. Present information indicates that not all sites associated with Quitobaquito are in the immediate vicinity of the pond. The cemeteries (SON B:4:6 and 24 [ASM]) are an example. The oral histories (Anderson, Bell, and Stewart 1980, Zepeda 1985) document other villages associated with Quitobaquito that are not located in the immediate vicinity of the pond. Secondly, the springs (Quitobaquito, Burro, Williams, and other unnamed springs) constitute an environmental use zone. Studies of springs indicate that they can change locations and their associated cienegas migrate in relation to the spring location (Henderson and Mickley 1985). Therefore, any reference to Quitobaquito could properly be considered a reference to this environmental zone. To understand human use of Quitobaquito is to examine the entire spring/cienega system.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The prehistory and history of the Quitobaquito Management Area (QMA) will be incomplete. It will be difficult to plan and manage this area without both sufficient data on the cultural resources and a history of the area.

B. **Write Quitobaquito Management Area History.** A survey project will be funded and conducted to locate, identify, and record cultural resources in the Quitobaquito Management Area, as well as to prepare a cultural history of the area. This option will provide the superintendent and planners with documentation that is required in planning and managing the QMA. The culture history will include prehistoric, protohistoric, and historic cultural resources.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended option for this issue. A cultural resources inventory survey of the Quitobaquito Management Area, which is defined as the western flanks of the Quitobaquito Hill extending south into Mexico, will be funded and conducted. Data gathering will include survey, site recording and archival research into historic documents and

photographs. Upon completion, the Quitobaquito Culture History for the Quitobaquito Development Concept Plan will be prepared. This task will be undertaken by a small group of National Park Service professional archeologists and students from the United State and Mexico. This mixture of student personnel from the United States and Mexico will facilitate continued cooperation between the two governments in the management of cultural and natural resources. This project will also provide training for a number of students. The project will consist of the following components:

- Surveying the western flanks of the Quitobaquito Hills, targeting a 1 km radius around the springs for the most intensive inspection. An area south of the border will also be surveyed for remains of historic structures and agricultural features and fields associated with historic Hia C'ed O'odham use of the springs for field irrigation.

- Thoroughly recording, mapping, and photographing all cultural resources.

- Conducting interviews with Julian Hayden, other researchers, and O'odham who have information concerning other sites in the area. In particular, ritual use areas need to be identified that may not be recognizable to non-natives.

- Conducting archival research into old photographic collections for evidence of early historic structures.

- Conducting archival research of primary source material dating from the Kino/Manje expedition in the late 1600's for references to the area.

- Writing the Quitobaquito Culture History for the Quitobaquito Development Concept Plan.

Personnel: This project will be completed by National Park Service employees stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.6, and 516 DM6 App. 7.4 E(1), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museums and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-009 Write Quitobaquito Management Area History	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	50,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	50,000	0,000	0,000	0,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	50,000	0,000	0,000	0,000

References:

Anderson, Bell and Stewart. 1980. Arch.

National Park Service, United States Department of Interior. 1989a. Arch. Survey 1989E.

Teague. 1977. Arch.

Zepeda, Ofelia. 1985. The Sand Papago Oral History Project. Ms. on file, Western Archeological and Conservation Center, National Park Service. Tucson, AZ.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-010

2. Project Title: **Data Recovery Projects**

3. Servicewide Issue: C14 - Need for Major Archeological Data Recovery

4. Problem Statement: During the recent intensive survey of approximately 8,000 acres, 260 prehistoric, protohistoric, and historic ethnographic field loci were identified and 188 field loci were mapped and recorded. Erosion at many sites has removed the cultural deposits and exposed features. Sheetwash erosion has exposed fire-cracked rock features, leaving loose clusters and scatters of fire-cracked rock and charcoal stains. These features have had the upper portion of the cultural deposit removed, however in many cases, there is sufficient cultural deposit remaining to obtain samples for analysis. Features at some sites are exposed in the banks of headwater cutting rills and small washes. These features retain sufficient integrity to obtain flotation, pollen, radiocarbon, and archeomagnetic samples that can be used to address questions related to subsistence activities, seasonality, and dates of use.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The data potential of these features will be reduced to zero in the near future if no samples are collected and analyzed.

B. **Stabilization.** The feasibility of stabilizing vast areas from sheetwash erosion and headwater cutting of rills and washes is quite low. The cost of such an endeavor is beyond the scope of realistic funding.

C. **Data Recovery Projects.** Data recovery targeted at eroded features and prehistoric occupation surfaces, rather than at vast site areas, will be funded and conducted. This option will provide samples to be used to address questions of periods of use, subsistence activities, and seasonality of use. This limited data recovery program will provide a maximum amount of information which can be integrated with site survey reports. This approach has the advantage in that the samples can be collected and the analysis conducted at a later date, depending on funding. Collecting the samples insures that information will be recovered from the features prior to complete destruction. Excavation of one-half of the feature will also allow for the establishment of long term monitoring protocols to determine the rate of feature destruction from alluvial and eolian processes. This ancillary study will assist in planning for future data recovery programs.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended solution. Limited data recovery programs targeted at endangered features will be conducted. This project will be undertaken by an NPS archeologist in cooperation with professional and para-professional archeologists. It will consist of the following:

- Accurately plotting the location of all features to be excavated on the site map.

- Drawing plan view and/or profile sketches and photographing all features prior to excavations.

- Bisecting the features; excavating only 1/2 of the feature. Collecting flotation, pollen, radiocarbon, and where possible, archeomagnetic samples from all features.

- Drawing profiles and photographing excavated portions of the features.

- Filling the excavated portion of the features with clean fill and marking the features with a piece of rebar indicating the feature number.

- Hand excavating limited areas around features to determine if other features are present and identifying activity areas. Excavating exposed features.

- Having samples from the features analyzed by outside consultants in palynology, macrofossil analysis, and radiocarbon analysis. Preparing a report using the data from the analysis to address questions concerning the period of site use, subsistence activities indicated, and seasonality of use.

- Developing and implementing monitoring protocols to examine the features on a regular schedule and after unusual precipitation events to determine rates of degradation of the features.

Personnel: This project will be completed by National Park Service employees stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(1), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-010 Data Recovery Projects	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	3,000	3,000	3,000	3,000
Other	5,000	5,000	5,000	5,000
TOTAL	8,000	8,000	8,000	8,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	8,000	8,000	8,000	8,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-011

2. Project Title: **Archeological Survey of Use Zones**

3. Servicewide Issue: CO2 - Inadequate Archeological Survey & Inventory

4. Problem Statement: Use and operation of the monument takes place within four developed areas, plus approximately 125 miles of open and closed roads (some of which are used as hiking trails), and an undetermined mileage of official and unofficial trails. Within these use zones, there is continuous potential for impact on archeological resources from visitation, monument operation, construction and maintenance. An extremely small portion (less than 1%) of these use zones have been surveyed for archeological resources. Hence there is no database upon which to measure the attrition of these resources from human erosion, vandalism or impacts incidental to human activities. A resource inventory for use in planning new developments and construction within these zones is also lacking.

During the 1990 B parkwide survey, reconnaissance along an unofficial hiking trail from Bates Well through the Bates Mountains resulted in the recording of four sites and identification of an additional 36 sites. Visitation to the recorded sites in December 1992 revealed the theft of artifacts. Pictograph Canyon, located along another segment of this unofficial hiking trail, was surveyed by Paul Ezell in 1951, and five sites were identified. During 1991, reconnaissance of the Pictograph Canyon area resulted in the identification of 16 sites. Four of Ezell's sites were relocated, however, the pictographs were not relocated. Their locations and condition remains unknown.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument will continue to be operated with the current level of inventory, which requires that new ground-disturbing construction or modifications of existing facilities need spot clearance surveys on a case-by-case basis, unless they happen to occur in the few areas already surveyed. Evaluation of impacts from visitor traffic will remain a matter of chance discovery which cannot be evaluated against systematically recorded baseline data.

B. **Archeological Survey of Use Zones.** A systematic and intensive walking survey of all road and trail corridors will be conducted. Surveys will also be conducted at areas of direct and indirect impact around all park facilities (headquarters area, campgrounds, rest areas, etc.). All sites will be documented in sufficient detail so that impacts by construction and other earth-disturbances within these zones can be objectively identified and minimized with a minimum of time and effort.

6. Description of the Recommended Project or Activity: Alternative B. is recommended as the only satisfactory way to meet management requirements for preservation of archeological resources in place. Piece-by-piece clearance surveys are costly, often repetitive, and often difficult to program and coordinate with planning, construction and park operations. This is the only way to obtain a complete and adequate database against which it is possible to measure destructive effects of vandalism and visitor traffic on archeological sites. Monitoring protocols will be established.

Areas to be surveyed include the Bates Valley from Bates Well to the Puerto Blanco Drive, Pictograph Canyon area, Alamo Canyon Campground area and associated trails leading to Copper Mountain and Grass Canyon, the area along old SR-85, and any other areas determined by park staff.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-011 Archeological Survey of Use Zones	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	50,000	50,000	50,000	50,000
Other	10,000	10,000	10,000	10,000
TOTAL	60,000	60,000	60,000	60,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	60,000	60,000	60,000	60,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-012

2. Project Title: **Write Overview/Synthesis of the Archeological & Historic Resources of the Monument**

3. Servicewide Issue: C02 - Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments.

4. Problem Statement: A recent archeological survey in and around the monument has shown that there are archeological resources in this portion of the Sonoran Desert that are rich and varied. While there have been syntheses of the archeology of the region over the last 30 years, the most recent data, most importantly that resulting from three years of survey in the monument (1989-1991), is not included. New survey data increases the knowledge of the prehistory of the area significantly, but it needs to be synthesized with other data in order to provide a context for planning for management and research. Only 2.3% of the monument has been surveyed; a valid framework of culture and environment is needed to effectively plan for a survey. An overview is also important for evaluating resources as they are encountered in future discoveries, as well as for planning mitigative measures ahead of future development.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Existing out-of-date syntheses and scattered reports and data will be used for planning resources management activities, as well as for identifying research needs. This will result in repetitive and inefficient resources management, planning and research.

B. **Write Overview/Synthesis of the Archeological & Historic Resources of the Monument.** This option provides the most effective and efficient way of planning future cultural resources management.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. An archeological overview summarizing the status of archeological knowledge in the monument and surrounding area will be prepared. This document will include a clear matrix of site types represented, their environmental associations, their place in regional prehistory, the environmental zones represented, and the extent to which they have been surveyed. Field and sampling strategies for future work will be identified. Both an overview/synthesis of the archeological and historic cultural resources of the monument, published as a professional report, and a popular version of the overview/synthesis, published for the public, will be written.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior.

8. Funding:

FUNDING

ORPI-C-012 Write Overview/Synthesis of the Archeological & Historic Resources of the Monument	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	33,500	5,000	0,000	0,000
Other	5,000	5,000	0,000	0,000
TOTAL	38,500	10,000	0,000	0,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	38,500	10,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-013

2. Project Title: **Develop Archeological Site Location Predictive Model in Association With GIS**

3. Servicewide Issue: C02 - Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews & Assessments.

4. Problem Statement: Predictive models of archeological site location can improve the definition and recognition of sites and their distribution in the environment. Settlement pattern models can clarify the process of cultural change and interaction, and provide a regional framework for understanding the development of human systems. These models serve as a framework for understanding cultural adaptation to differing environments, and also provide insights into the nature of social, political, and economic processes.

This type of information addresses several critical management objectives. Models can identify patterns in spatial relationships between sites and their physical locations, and thus indicate potential relationships between the natural or social environment and the locations of past human activities. Models can be used to generate statements concerning the probability of site occurrence in particular locations.

The development of a research oriented site location predictive model can be incorporated into the Organ Pipe GIS. The location of cultural resources and the potential for an effective model of site location are important for management objectives, and for planning for development of land-use plans, environmental assessments, and possible surface disturbing activities. Modeling can contribute to an evaluation of a site's significance in terms of eligibility to the National Register, as well as with a determination of its most appropriate use. Modeling can help also to define research issues. This information can guide data collection priorities for survey and data recovery efforts, and help to establish which areas and sites will be selected for such efforts. Modeling can also contribute to protection by helping to establish priorities among sites for specialized protection.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The lack of a predictive model of archeological site location in GIS is an inefficient management of the resource.

B. **Develop Archeological Site Location Predictive Model in Association with GIS.** This is the only option that will provide management with the information needed to plan for and protect the resource, and simultaneously fulfill research goals. This alternative consists of entering data currently suitable for the initial development of a model, continuing to collect data, and refining the model.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Development of an accurate predictive model of archeological site location will progress and be refined over a long period of time. It will consist of the following components:

- Entry of data from the 1980 Ajo Crest Survey and 1989-1991 Sample Survey into GIS.
- Statistical analysis of this database to determine patterning of the data.
- Survey of selected blocks to test the hypothesis of site location predicted by the model.
- Refinement of the model based on additional survey data from research and cultural resources management surveys.
- Continued survey of blocks and the refinement of the model.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-013 Develop Archeological Site Location Predictive Model in Association With ORPI GIS	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	6,000	3,500	3,500	3,500
Other	3,000	1,500	1,500	1,500
TOTAL	9,000	5,000	5,000	5,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	9,000	5,000	5,000	5,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-014

2. Project Title: **Record Rock Art Sites**

3. Servicewide Issue: C02 - Inadequate Archeological Survey and Inventory

4. Problem Statement: Three forms of rock art - petroglyphs, pictographs, and geoglyphs - have been identified in Organ Pipe Cactus National Monument. Many rock art sites have been assigned site numbers and plotted on USGS topographic maps, however, none of the known sites have been fully recorded. At least two of the petroglyph sites have been vandalized with modern graffiti; one pictograph site may have been destroyed by natural forces; and natural weathering is affecting pictographs in rockshelters. All rock art sites, including both those that are known and plotted on maps, and those that have been reported but not assessed nor plotted, need to be thoroughly documented.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The sites will not be recorded or documented, thus leaving a gap in the knowledge of this unique of cultural resource.

B. **Initiate a Long-Term Program to Record the Various Forms of Rock Art through a Contract.** The contractors may not be familiar with NPS guidelines and policies, but will be familiar with the study of rock art sites. The study will have the same affect as Alternative C, although the cost is likely to be greater.

C. **Record Rock Art Sites.** A long-term program of recording rock art will be initiated. National Park Service (NPS) staff archeologists and members of the American Rock Art Recording Association (ARARA) will be responsible for carrying out the project. NPS archeologists are familiar with NPS guidelines and policies, and members of ARARA have served as Western Archeological and Conservation Center (WACC) Volunteers in Parks (VIP's), recording rock art sites at Petrified Forest National Monument over the past several years. Any new rock art sites that are discovered during the course of this project will also be recorded. This work will also involve designing monitoring protocols and a schedule of visitation by law enforcement/site stewards to aid in protection efforts.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended course of action. Thorough recording of rock art sites will be completed. The recording team will consist of a combination of NPS archeologists, members of ARARA, and trained park staff (including VIP's). All known rock art sites will be plotted on USGS topographic maps, entered into the GIS and WACC databases, and thoroughly recorded and documented, including site maps, photographs, sketches, and/or rubbings of all elements, and plan maps showing the relationships between the elements. A yearly report will be completed and will include all information from field notes, site forms, photographs, sketches, site maps, and recommendations for monitoring, preservation, and protection efforts. The park staff, including site stewards, will be responsible for monitoring and protection efforts.

Personnel: This project will be coordinated by personnel from WACC, and will utilize NPS personnel, and ARARA members.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.6, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-014 Record Rock Art Sites	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,000	5,000	5,000	5,000
Other	7,500	7,500	7,500	7,500
TOTAL	12,500	12,500	12,500	12,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	12,500	12,500	12,500	12,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-015

2. Project Title: **Complete Archeological Sample Survey and Assessment of the Monument**
3. Servicewide Issue: C02 - Inadequate Archeological Survey and Inventory

4. Problem Statement: The Organ Pipe Cactus National Monument Sample Inventory Survey conducted between 1989-1991 examined approximately 8,000 acres (slightly greater than 2%) of the monument, and resulted in the identification of 260 prehistoric, protohistoric, and historic ethnographic sites, and the recording of 188 field loci. The survey was a stratified judgmental survey in which the environment of the monument was subdivided into zones based on the types and availability of water. Survey blocks were then selected from each zone for intensive survey. Areas with high and low predicted site density were examined. Sites were identified in all locations examined. Survey of the Ajo Crest in 1980, an area where few sites were predicted, resulted in the identification and recording of 40 sites. Unofficial survey in remote portions of Pictograph Canyon in the Bates Mountains resulted in the identification of 20 sites. Many areas in the monument have had no survey, therefore the potential for the presence of sites and types of sites is unknown.

The National Historic Preservation Act (NHPA), as amended in 1980, legislates that all federal lands will be completely surveyed in order to determine the nature and extent of cultural resources and to determine the eligibility of sites to the National Register of Historic Places. The monument needs to determine site locations and condition assessments in order to properly manage the resource. Complete survey of the monument is probably not feasible given fiscal constraints. However, continued sample survey of large blocks is necessary for the development of a predictive model of site location, which in turn addresses NHPA and management objectives.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Vast areas of the monument will remain unsurveyed, and there will be major gaps in the knowledge of the archeological record. Failure to continue the sample survey will fail to meet management needs to determine site location and appropriate activities for these areas. Resources will continue to be looted and vandalized, adversely affected by the unintentional impacts of camping and hiking, and destroyed by natural disturbances.

B. **Complete Archeological Sample Survey and Assessment of the Monument.** This option will provide management with in-depth information needed to properly manage cultural resources as mandated by law. The resources cannot be managed unless information is known on location, cultural and temporal affiliations, types of disturbance, and the potential for future disturbance. Continued survey will provide information which can be used in planning surface disturbing activities and in assisting in protection efforts.

6. Description of the Recommended Project or Activity: Alternative B. is the only option that satisfies the requirements of NHPA, and the dual management objectives of research and protecting the resources. A large scale sample survey of the monument will be funded and conducted. This task will be undertaken by NPS archeologists who are familiar with the resources of the monument and with NPS policies and

guidelines. A mixture of in-house NPS archeologists, students, and Volunteers in Parks (VIP's) will conduct the survey, analysis, and report preparation. The sampling design will be integrated with the monument geographic information system (GIS) in order to refine and test models of site location which will guide selection of areas to be examined. Areas of high priority are: 1) areas where no survey has been conducted; 2) areas where sites are known to exist but no systematic survey or recording has taken place; and 3) large blocks in areas originally surveyed by Paul Ezell and Alice Hunt in order to locate and rerecord these sites.

The project will include the following elements:

- Identification of areas to be surveyed:
  - -- Areas of high predicted site density
  - -- Areas of low predicted site density
    - -- Areas where no survey has been conducted
    - -- Areas where sites are known but no survey or recording has taken place
    - -- Large blocks around areas originally surveyed by Ezell and Hunt
  - -- Refinement of the model of site locations based on yearly survey results
- Survey of selected areas over each four year period. Sites in these areas will be located, identified, and recorded.
- A yearly analysis of survey results will be completed, leading to:
  - -- Preparation of annual progress reports
  - -- Refinement in the model of predicted site location
- Completion of a major report and evaluation at the end of each four year period
- Incorporation of data into the monument GIS
- Development of monitoring protocols
- Re-evaluation of sample areas and survey strategy based on information from the GIS archeological predictive model
- Mapping and recording of prehistoric trails as a separate project within the larger sample survey. Integrating trail information with locations of camps and large year-round occupied villages.

Personnel: This project will be coordinated and carried out by National Park Service employees stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(1), U.S. Department of the Interior. NHPA compliance under

section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-015 Complete Archeological Sample Survey & Assessment of the Monument	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	55,000	55,000	55,000	55,000
Other	10,000	10,000	15,000	15,000
TOTAL	65,000	65,000	70,000	70,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	65,000	65,000	70,000	70,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-016

2. Project Title: **Intensive Transect Recording/Mapping of Large Sites**

3. Servicewide Issue: C02 - Inadequate Archeological Survey & Inventory, Including Archeological Identification & Evaluation Studies, Overviews & Assessments.

4. Problem Statement: Accurate site interpretation is based on an assessment and analysis of the density and diversity of surface artifacts and features present. Large prehistoric Archaic period and ceramic period Hohokam, Patayan, and Trincheras sites present a number of interpretive problems for the archeologist. These sites usually lack visible surface features (with the exception of adobe-walled structures and roasting pits) and consist of an artifact scatter or group of scatters that seem to go on forever with decreasing density and localized variability. Interpretative and recording problems include 1) determination of site boundaries based on surface artifact distributions, 2) identifiable patterning in the surface artifact distributions which are indicative of use areas and subsurface features, and 3) determination of site function based on the artifact assemblage.

Intensive Transect Recording (ITR) is a technique specifically designed to gather quantitative data which can be used to address these problems, as well as analyze the potential for the presence of subsurface features. ITR data on large sites also provides quantitative baseline data for long-term monitoring protocols concerning natural and cultural disturbances.

ITR is accomplished by establishing a Cartesian coordinate grid of 50 meters (m) square across an entire area where artifacts are observed. Two 50 m tapes are stretched out east-west and parallel to each other 50 m apart to establish two sides of a 50 m grid. Along each "baseline" tape, pinflags are established at 10 m intervals to mark each transect. A five person transect recording crew then stretches 50 m tapes between the parallel baselines, thus establishing 50 m long transects at 10 m intervals. Each crew member walks along the 50 m transect tape, recording artifact types and absolute frequencies for each 1 m square unit along the transect. Exposed subsurface features and artifact frequencies are recorded on forms specially prepared for transect recording. During transect recording, all diagnostic artifacts (decorated ceramics and projectile points) are collected with reference to provenience.

The information from the transect recording forms, along with transit data on topography and erosion, are combined and transferred to a computer coding form. Only those units containing information are coded; empty units are recorded as blanks. Two types of computer generated maps are then prepared. The first map, SURFACE, indicates the distribution of artifact types in each unit. A unit containing artifacts is indicated by a symbol for the appropriate type of artifact; units containing more than one artifact type are indicated by superimposed symbols. Maps can be generated indicating the distribution of specific artifact classes, e.g. a particular type of pottery. The second map, SYMAP, presents density data graphically by using variable darkness and texture. These maps indicate the density of artifacts per square meter.

Plotting the occurrences of actual numbers of artifacts across the site creates an objective visual representation of surface distributions which can then be interpreted. Site boundaries can be delineated

based on a quantitative measure of artifact distribution, rather than a subjective interpretation by the investigator. Computer generated maps provide data on intrasite artifact clustering, which reflects use areas within a site. Analysis of absolute densities and types of artifacts provides quantitative data for testing of hypotheses concerning site function. ITR has been an effective tool for predicting the locations and types of subsurface features associated with surface artifact distributions.

Although the process is labor intensive, it has been shown to be cost effective. Each crew person can transect and record an average of 500 linear meters/day. Non-professional crew members can be trained to recognize artifact categories and to record the field data.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Traditional recording and mapping techniques will be used at large sites. These techniques do not provide quantitative data for accurate site interpretation and baseline data for monitoring protocols. Traditional recording techniques are susceptible to the subjective ability of the crew, resulting in non-representative or inaccurate data.

B. **Intensive Transect Recording/Mapping of Large Sites.** Computer maps of artifact diversity and density will be generated for large sites, utilizing the procedures described above.

6. Description of the Recommended Project or Activity: Alternative B. is the preferred course of action. ITR will be used to map and record large dispersed artifact scatters to gather quantitative data for use in determining site surface boundaries, intra-site activity or use areas, and site function; predicting areas where sub-surface features are likely; and providing baseline data for monitoring protocols. The following sites will be mapped and recorded: AZ Z:13:127(ASM), a Hohokam village that covers an area of 100,000 m^2, AZ Z:13:1(ASM), a Hohokam village that covers an area of 200 acres, 8(ASM), a large Hohokam village, and other large sites in the Quitobaquito region. All related necessary equipment will also be purchased.

Personnel: This project will be completed by National Park Service employees stationed at the Western Archeological and Conservation Center. The team will consist of an NPS archeologist crew chief and five crew members.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-016 Intensive Transect Recording/Mapping of Large Sites	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	15,000	30,000	15,000	15,000
Other	5,500	5,500	1,500	1,500
TOTAL	20,500	35,500	16,500	16,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	20,500	35,500	16,500	16,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-017

2. Project Title: **Test Excavation of "Reservoir" at AZ Z:13:1(ASM), a Large Hohokam Community**

3. Servicewide Issue: C26 - Other; Testing to Determine Feature Function as Part of a Determination of Eligibility to the National Register of Historic Places.

4. Problem Statement: A probable reservoir has been identified at a large Hohokam village, AZ Z:13:1(ASM), which is approximately 200 acres in size and dates primarily to the Classic period, ca. A.D. 1150-1400. This site was first recorded as Gila Pueblo I:13:4 by Frank Midvale in 1929. He noted that the village contained trash mounds and a "sun temple", a term that has become synonymous with ballcourts and reservoirs. The site was subsequently designated AZ Z:13:1(ASM) by Emil Haury in 1937. Haury recorded a village with large trash mounds and a mounded feature (reservoir) that he considered to be a possible pueblo-like building, based on the presence of Salado polychrome pottery. The predominant pottery at the site is Hohokam red-on-buff of the Tucson variety (ie. red-on-brown). The site was subsequently recorded and given a new site designation, AZ Z:13:3(ASM), by Paul Ezell in 1951. He recorded the site as a camp and believed that the mounded feature was natural.

Prehistoric reservoirs and ballcourts have been identified at Hohokam sites since the time of the Gadsen purchase. Hohokam reservoirs and ballcourts have a similar morphology, they are large, oval, basin shaped hollows surrounded by large embankments of the excavated dirt. In some cases, reservoirs and ballcourts are indistinguishable without testing. The feature at AZ Z:13:1(ASM) is approximately 40 m x 35 m, with embankments 1 m above the surrounding ground surface. The feature is open to the northeast and has a smaller breach in the embankment on the south side. The shape, size, presence of an opening on one end, and time period of the site, closely match the description for prehistoric reservoirs. Ground surface reconnaissance and recording of the site, however, have failed to reveal the presence of a canal leading into the feature. Likewise, an aerial flight over the area did not reveal the presence of canals at this site. Capturing of runoff from the slope to the northeast is unlikely due to the presence of roasting pits, pithouses, and trash mounds. Therefore, it appears that a well was dug to the groundwater level, and a reservoir constructed around the well to hold the domestic water source. Identification of the feature as a reservoir with a well is not certain until it has been tested.

Sites with reservoirs are known primarily throughout the Hohokam culture area from the late Pioneer period (A.D. 500) to the early Classic period (A.D. 1150). In the Hohokam periphery of Papagueria, reservoirs have been identified that date to the late Pioneer period, but all of these reservoirs are in the eastern and northern portion of the Tohono O'odham Reservation. Survey of Organ Pipe and adjacent areas has documented an expansion of Hohokam populations during the Classic period (A.D. 1150-1400) into western Papagueria, which includes the Cabeza Prieta, Organ Pipe, and the western portion of the Tohono O'odham Reservation. Large Hohokam villages, in excess of 100 acres, contain at least one reservoir and some, such as Lost City AZ Y:16:1(ASM) in the Cabeza Prieta, contain two reservoirs. It appears that reservoirs in Western Papagueria may have served an integrative function similar to the integrative-ceremonial function

of ballcourts during the Pre-Classic period, and compounds and platform mounds of the Classic period, as found in the Salt-Gila and Tucson Basins.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Identification of the feature as a reservoir is suggested but cannot be confirmed. Interpretation of the site within the Hohokam Regional System remains open to question.

B. **Test Excavation of "Reservoir" at AZ Z:13:1 (ASM), a Large Hohokam Community.** An archeological testing program will be conducted to determine the function of the "sun temple" reservoir feature at AZ Z:13:1(ASM). Resolution of this question is significant for interpretation of the site within the Hohokam Regional System. Reservoirs in Papagueria may have had a ceremonial or integrative function similar to Pre-Classic period ballcourts and classic period platform mounds and compounds. Resolution of this question is important for preparation of the National Register Nomination for this District. Additionally, if a well was excavated, then the prehistoric groundwater depth can be determined, providing valuable information for prehistoric and modern environmental studies.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action for this issue. A test excavation of the feature will be completed to determine its function. This task can be undertaken by a small group of archeologists from the National Park Service and unskilled laborers. The testing will consist of the following components:

- Completing detailed contour mapping of the feature at 10 cm intervals using an alidade, plane table, and stadia. This will be accomplished prior to any test excavations. The contour map will serve as a guideline for the most efficient placement of trenches through the feature.

- Hand excavating two or three one meter wide trenches through the embankments into the center of the feature. Examining trench profiles for stratigraphy, in particular for the presence of a plastered floor in the center of the feature. Drawing and photographing profiles. Hand excavating a single trench across the opening to determine if a canal or other water control device leads into the feature. Recovering radiocarbon, floatation, pollen and archeomagnetic samples, if possible, and having the samples analyzed. Backfilling the trenches.

- Preparing a report on the test excavations.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(3), E(1), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-017 Test Excavation of "Reservoir" at AZ Z:13:1 (ASM), a Large Hohokam Community	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	18,500	-	-	-
Other	15,000	-	-	-
TOTAL	33,500	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	33,500	-	-	-

References:

Ezell, Paul. 1954. An Archeological Survey of Northwestern Papagueria. Kiva 19:1-26.

Haury, Emil W. 1950. The Stratigraphy and Archaeology of Ventana Cave. University of Arizona Press, Tucson.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-018

2. Project Title: **Archival Research Related to Early Archeological Surveys and Ethnographic Research**

3. Servicewide Issue: C26 - Other; Need for Complete Archival Documentation of Previous Research.

4. Problem Statement: The earliest information (late 1600's, early 1700's) concerning the monument area and its peoples is contained in documents associated with the explorations of Father Kino and Manje. Subsequent entradas into southwestern Arizona by Jesuit and Franciscan missionaries, the Spanish, and the Mexican military contain references to ethnographic groups and natural resources. The field notes of the 1800's boundary surveys, American military excursions, early ranching chronicles, and mining claims contain references to the area. The field notes and other documents of researchers, such as McGee, Hornaday, and Lumholtz, also contain references to archeological sites and ethnographic groups occupying the area in the late 1800's and early 1900's. Thomas Childs, an Anglo who married an Hia C'ed O'odham woman, made copious notes concerning his life among the Sand Papago O'odham at Quitobaquito and Bates Well. The 1929 Gila Pueblo archeological survey field notes, which contain information on five sites within the monument, and Emil Haury's 1937 field notes are located at the Arizona State Museum. Ezell's 1951 field notes contain information critical to documenting archeological and ethnographic resources. A xerox copy of his field notes is in the archives at the Western Archeological and Conservation Center (WACC). Ezell's personal papers (including some documents pertaining to Organ Pipe Cactus National Monument) have recently been given to Special Collections at the University of Arizona. Some field notes may also be in the private collections of Julian Hayden and Al Schroeder. The majority of the field notes from these expeditions have never been examined for information related to cultural resources. These primary documents are an invaluable source of information regarding archeological and ethnographic cultural resources.

Collections of artifacts from prehistoric and ethnographic sites at Organ Pipe Cactus National Monument (ORPI) were made by various institutions and individuals, and are not curated at WACC. The earliest known collections are those from the 1929 Gila Pueblo Survey and from Haury's survey of AZ Z:13:1(ASM). Both collections are housed at the Arizona State Museum. It is possible that McGee (1901), Hornaday (1908), and Lumholtz (1912) may have made collections of ethnographic materials from O'odham villages which they visited. The locations of these collections are undetermined. Locations of collections made by other researchers are also undetermined. Finally, the location of a tape recording of an interview between Paul Ezell and Lumholtz's guide to the Pinacate is undetermined.

The presence and occurrence of original maps associated with these expeditions also need to be determined, and copies made for the monument archives.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No attempt will be made to identify the locations of these primary documents, nor to obtain copies for the monument archives. This will result in a large gap in the knowledge of the extent and location of archeological and ethnographic collections from the monument, as well as the retention of monument collections by other institutions.

B. **Archival Research Related to Early Archeological Surveys and Ethnographic Research.** Primary documents containing information on the archeological and ethnographic resources of the monument will be identified and located. This will result in a substantial body of information regarding ethnographic populations which have inhabited the area since first contact with the Kino/Manje expedition in the late 1600's. Field notes on archeological resources will aid in a more complete understanding and documentation of recorded sites. Artifact holdings at other institutions will also be determined.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action, and will involve the following actions:

- Identifying and locating documents which are most likely to contain relevant information. Identifying researchers in other disciplines which may have recorded information pertinent to this study. Studying the documents for information related to the present topic. Preparing an index to the documents indicating the type and location of pertinent information within the document and the location of the document.

- Obtaining copies of pertinent information for WACC/ORPI archives.

- Preparing a synthesis of archival documentary information.

- Determining artifact holdings at other institutions and in private collections. The objective is to identify where artifact collections may be located and to request written notification of collections. Institutions which should be queried,in addition to the Arizona State Museum, Heye Foundation, San Diego Museum of Man, and Smithsonian, include those that have natural specimens collected by Hornaday and others who worked in the area during the late 1800's and early 1900's. Individuals such as Julian Hayden and Al Schroeder, who work in the area, should also be queried.

- Inventorying of collections at other institutions and in private collections. A positive response to the letter inquiry should lead to a visit to determine the extent of the holdings. An on-site inventory will be generated.

- Consolidating of archeological and ethnographic collections at WACC.

Personnel: This project will be completed by National Park Service personnel stationed at WACC.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-018 Archival Research Related to Early Archeological Surveys and Ethnographic Research	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	6,000	6,000	6,000	-
Other	3,000	3,000	3,000	-
TOTAL	9,000	9,000	9,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	9,000	9,000	9,000	-

References:

Ezell, Paul. 1954. An Archeological Survey of Northwestern Papagueria. Kiva 19:1-26.

Haury et al. 1950. Arch.

Hornaday, W. T. 1908. Campfires on Desert and Lava. Charles Scriber's Sons, New York. 366 pp.

Lumholtz, C. 1912. New Trails in Mexico. Rio Grande Press, Glorieta, New Mexico. 411 pp.

McGee, W. J. 1901. The Old Yuma Trail. National Geographic Magazine. 3.103-107, 129-143.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-019

2. Project Title: **Specialized Artifact Studies**

3. Servicewide Issue: CO2 - Inadequate Archeological Survey and Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments

4. Problem Statement: Recent surveys have identified overlapping cultural traditions throughout 12,000 years of human occupation in the monument. The occurrence of overlapping cultural traditions, and the presence of large, apparently sedentary villages, leads to a number of questions: were populations local (ie. manufacturing items for use from materials in the monument area) or transitory (bringing items in which were manufactured in other areas), and what was the nature and extent of prehistoric trade. Specialized studies of various artifact types can be conducted to address these questions.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** With this alternative, archeologists and monument staff will not have sufficient information to address these questions, which are important for an understanding of human use of the area, as well as trade and exchange networks.

B. **Specialized Artifact Studies.** Specialized studies of various artifact types, including ceramics, chipped and ground stone, and shell, will be undertaken to determine if ceramics were locally manufactured; where the raw material for chipped stone artifacts was being collected; and the types and seasonality of shell which was utilized.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Studies to be conducted by outside analysis will include:

- Obsidian Source Study to determine the locations where obsidian was procured prior to manufacture into tools.
- Obsidian Hydration Dating of chipped stone artifacts to determine artifact date.
- Artifact Microwear Study of chipped stone tools and flakes and shell. This study will determine if and how artifacts were used.
- Opal Phytolith Study of chipped and ground stone artifacts. The study will determine what kinds of plants were being processed and what plant parts were being used.
- Ceramic Temper Source Study to determine the raw material sources for temper used in the manufacture of ceramics. This project has been initiated through the analysis of plain ware ceramics from the Organ Pipe Cactus National Monument 1989-1991 surveys. Completion of

the project involves a number of specialists, including the USGS. The following elements of the study still need to be completed:

-- Development of a detailed geologic map of the monument.

-- Collecting sand samples from various washes to compare against the geologic map.

-- Collecting raw material samples of various rock types that are used as temper.

-- Petrographic analysis of temper - raw material and temper in sherds.

-- Comparative study of raw material temper types and temper in sherds.

- Ceramic Clay Source Study, which will include collecting clay samples from throughout the monument and analyzing them to determine trace mineral content; and Scanning Electron Microprobe test of ceramics for trace mineral analysis to determine clay sources.

- Turquoise Source Study, which will include continuing to collect a sample of turquoise artifacts from archeological sites, and if present, from raw material sources in the monument; and analyzing turquoise artifacts to determine the source of the raw material.

Personnel: This project will be completed by contract.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(1), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Cultural specimens for museum and reference use in the monument may be collected only when required.

8. Funding:

FUNDING

ORPI-C-019 Specialized Artifact Studies	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	6,000	7,000	7,000
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	15,000	6,000	7,000	7,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	15,000	6,000	7,000	7,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-020

2. Project Title: **Re-analyze all Previous Collections at the Monument, Western Archeological and Conservation Center, and Other Institutions**

3. Servicewide Issue: C26 - Other; Need to Re-analyze and Re-evaluate Previous Collections Based on Current Archeological Knowledge, Methods, and Techniques.

4. Problem Statement: All artifacts collected on previous surveys and curated at Organ Pipe Cactus National Monument, the Western Archeological and Conservation Center (WACC), and other institutions need to be analyzed (because no analysis has ever been conducted), or re-analyzed in light of current data. The earliest known collections were made during the 1929 survey by Gila Pueblo, which identified five sites. Emil Haury made collections from at least one site, AZ Z:13:1(ASM), in 1937. The integrity of artifact identifications from the 1951 survey by Paul Ezell is in doubt. The ceramic identifications made by Ezell are of particular concern because: 1) they include ceramic types that have never been described in the literature; 2) prehistoric and historic ceramics were lumped into a single ceramic ware; and 3) prehistoric ceramics from different cultural traditions were also lumped into a single ceramic ware. Therefore, it is impossible to discern the nature of the archeological record of sites recorded by Ezell and later researchers who used his ceramic typology, because of the problems with ceramic identifications. Other whole vessels in the collections have been identified by various researchers as O'odham or Patayan, based on their theoretical orientation. Finally, new techniques can be applied to the analysis of the ceramic and chipped stone assemblages.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The results of this alternative are a lack of correct scientific information concerning existing collections, and questionable integrity of the collections as baseline data for discerning the archeological record of the monument.

B. **Re-analyze all Previous Collections at WACC, ORPI, and Other Institutions.** This alternative includes analyzing collections that have not been studied and re-analyzing the artifact collections at WACC and other institutions, thus providing more accurate and dependable data.

6. Description of the Recommended Project or Activity: Alternative B. is the only option which will provide accurate information. Actions to be undertaken include analyzing all unstudied collections and re-analyzing all previously analyzed prehistoric and historic collections; conducting specialized studies of ceramic and chipped stone assemblages; and completing a synthesis report of the findings. The study will focus primarily on collections made by Ezell in 1951. Ezell lumped the prehistoric and historic ceramics into a single ceramic tradition which is not useful for determining temporal or cultural affiliation. Ezell also identified new ceramic types which were not published anywhere in the literature. His new types may represent legitimate new types or may be local variants of previously identified types. Ezell's identification of all Lower Colorado Buff Wares was based on the ceramic typology of Schroeder, which is no longer considered valid. The Ezell collection should thus be reanalyzed in light of recent data. Obsidian projectile

points in the collection should be analyzed to determine their source location (which relates to questions of procurement and exchange) and samples should be submitted for obsidian hydration dating to determine temporal affiliation of the sites.

Further actions will include an analysis of previous collections according to the 1990 standards of analysis. The first year of work will include a trip to the San Diego Museum of Man to examine the ceramic type collections for Lower Colorado Buff Wares, and also the reanalysis of all Lower Colorado Buff Wares in the monument collection. Work during the first year will also include preparation of a corrected Lower Colorado ceramic type collection for WACC. Analysis during the remaining years will include monument collections at WACC and other institutions.

Personnel: This project will be completed by National Park Service personnel stationed at WACC.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-020 Re-analyze All Previous Collections at WACC, ORPI and Other Institutions	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	6,500	6,500	6,500	6,500
Other	3,000	3,000	3,000	1,000
TOTAL	9,500	9,500	9,500	7,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	9,500	9,500	9,500	7,500

References:

Ezell, Paul. 1954. An Archeological Survey of Northwestern Papagueria. Kiva 19:1-26.

Haury et al. 1950. Arch.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-021

2. Project Title: **Prepare National Register Nominations for Archeological Sites and Districts**

3. Servicewide Issue: C26 - Other; Need to Assess Archeological Data and Prepare National Register Nominations Where Appropriate

4. Problem Statement: A number of prehistoric and historic cultural resources, including Growler Mining District and Bull Pasture, have been listed on the National Register of Historic Places. Other cultural resources within the monument are eligible to the National Register, however, National Register nominations have not been prepared, or prepared nominations are being denied because inappropriate criteria are being used. An assessment of cultural resources within the monument and preparation of National Register Nominations must be completed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Sites that are eligible for the National Register will not be listed and afforded additional protection, due to lack of preparation of appropriate nominations.

B. **Prepare National Register Nominations for Archeological Sites and Districts.** This alternative will complete management objectives of survey, identification, recording, report preparation, and assessment of sites for eligibility for inclusion in the National Register.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The activity will consist of an assessment of current knowledge of cultural resources and of failed nominations. An archeologist will consult with the Arizona State Historic Preservation Officer (SHPO) to insure that the site or district meets the criteria for inclusion. The archeologist will prepare National Register nomination forms for sites and districts. The following sites will be included: Cuerda de Lena, Hohokam Villages, and various other districts and sites within the monument.

Personnel: This project will be completed by National Park Service personnel stationed at the Western Archeological and Conservation Center.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-021 Prepare National Register Nominations for Archeological Sites and Districts	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	17,500	8,500	8,500	8,500
Other	1,500	500	500	500
TOTAL	19,000	9,000	9,000	9,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	19,000	9,000	9,000	9,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-022

2. Project Title: **Develop and Fund Archeological Job Training Program**

3. Servicewide Issue: C26 - Other, Need for Cultural Resources Management Related Training

4. Problem Statement: Archeological surveys to locate, identify, describe, and understand prehistoric and historic Native American cultures are being conducted primarily by non-Native Americans. Many believe that our understanding of prehistoric Native American cultures is hampered by the lack of the Native American perspective. Park surveys are frequently conducted by National Park Service (NPS) archeologists from the Western Archeological and Conservation Center (WACC) and other regional centers, and per diem payments increase the costs of survey, thus reducing the amount of actual field time accomplished within budget constraints. Organ Pipe Cactus is uniquely situated adjacent to the Tohono O'odham Reservation and the town of Ajo, which has a large Native American population. Development and funding of a job training program for Native Americans would enhance the archeological survey by having a Native American perspective on archeological remains and the behavior they represent. A greater amount of survey could be accomplished by employing Native Americans from the local area because per diem costs would not be incurred. Additionally, Native American students would gain practical experience and receive encouragement to pursue careers in anthropology.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The Native American perspective will not be incorporated into archeological surveys and Native Americans will not receive job training which could lead to anthropology careers. The cost of conducting the survey will remain high and less acreage will be examined.

B. **Develop and Fund Archeological Job Training Program.** This program will be geared towards Native Americans interested in careers in anthropology, archeology, and resources management. This training program will be targeted toward Native Americans in the local community, as historically, this is their ancestral area.

6. Description of the Recommended Project or Activity: Alternative B. is the preferred option. The task will be undertaken by the Western Archeological and Conservation Center and the resources management staff, in conjunction with the job training program on the Tohono O'odham Reservation, and with various local districts of the Tohono O'odham Reservation. It will consist of trainee positions in all phases of survey and subsequent laboratory analysis. Trainees will work with crews of professional archeologists to learn how to identify and record sites. Their input into the interpretation of archeological sites will be actively sought.

Personnel: This project will be completed by National Park Service staff.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.11, and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding:

FUNDING

ORPI-C-022 Develop and Fund Archeological Job Training Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	7,500	7,500	7,500	7,500
Other	0,000	0,000	0,000	0,000
TOTAL	7,500	7,500	7,500	7,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	7,500	7,500	7,500	7,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-023

2. Project Title: **Assessment of Human Impacts and Natural Disturbances and Monitoring of Cultural Resources**

3. Servicewide Issue: C06 - Need for Historic Preservation Guides

4. Problem Statement: The monument does not have established monitoring guidelines nor a comprehensive program for monitoring historic structures, archeological sites, and ethnographic resources. In addition, the monument has insufficient staff to adequately patrol and monitor its cultural resources. The monument thus has difficulty protecting and preserving cultural resources from natural processes, visitor impacts, vandalism, and other impacts, as required by National Park Service (NPS) policies, guidelines, and federal legislation.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. No Action. Management of the cultural resources fails to fully comply with the Organic Act of 1916, NPS-28 Cultural Resources Management Guideline, Chapter 5 of the 1988 NPS Management Policies, Sections 106 and 110 of the National Historic Preservation Act, the Archeological Resources Protection Act and Franklin D. Roosevelt's 1933 Presidential Proclamation that established the monument. Cultural resources at the monument will continue to be subject to natural deterioration, visitor impacts, and vandalism. Valuable irreplaceable cultural resources may be damaged or lost.

B. **Assessment of Human Impacts and Natural Disturbances and Monitoring of Cultural Resources.** Prepare monitoring guidelines and perform adequate monitoring of ethnographic sites, historic structures and archeological sites to preserve and protect irreplaceable cultural resources. The program will help insure that the monument's historic preservation program complies with the laws, policies and guidelines which apply to cultural resources management and protection.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. Monitoring guidelines will be prepared and adequate monitoring of ethnographic sites, historic structures and archeological sites will be performed to preserve and protect irreplaceable cultural resources. Routine site monitoring will aid in planning, as well as in establishing data needed to develop plans and guidelines for general housekeeping, IPM for sites, and annual and cyclical cultural maintenance programs. Damage and deterioration from natural processes, visitor impacts and vandalism will be better controlled. The NPS will then be more capable of fully complying with Franklin D. Roosevelt's 1937 Presidential Proclamation which established the monument, using Section 2 of the 1906 Antiquities Act for justification, as well as with all applicable cultural resources laws, policies and guidelines.

Personnel: Additional personnel will be required on the monument staff to fully implement this plan. Law enforcement patrols need to be increased and a cultural resources management specialist will be needed to evaluate the sites and provide the expertise necessary for program to be successful. The cultural resources

management specialist will also be needed for implementation of related project statements in the Resources Management Plan.

Because the monument does not have a cultural resources management specialist on staff at this time, the Western Regional Historic Architect, archeologists at the Western Archeological and Conservation Center and the Southern Arizona Group Archeologist may be able to provide technical assistance to the park to help in drafting the monitoring guidelines.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA Section 106 compliance is not required.

8. Funding:

FUNDING

ORPI-C-023 Assessment of Human Impacts and Natural Disturbance and Monitoring of Monument Cultural Resources	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	48,000	48,000	48,000	48,000
Other	4,100	4,100	4,100	0,000
TOTAL	52,100	52,100	52,100	52,100
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	52,100	52,100	52,100	52,100

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-050

2. Project Title: **Maintain Stabilized Ruins and Historic Structures**

3. Servicewide Issue: C12 - Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance

4. Problem Statement: Routine general housekeeping and maintenance, annual maintenance, cyclical maintenance, and monitoring schedules need to be established and followed to preserve and protect historic resources and the investments the government has placed in them. There are no established preservation and maintenance schedules, nor clear priorities or plans to guide historic preservation activities at the monument. Funding and staffing limitations do not provide for a level of protection and preservation considered standard for the National Park Service (NPS). Historic structures in the List of Classified Structures and those pending or entered in the National Register of Historic Places (NRHP) are nonrenewable resources. The structures must be maintained until planning actions for future preservation are approved according to NPS policies, guidelines and federal law, including Section 106 of the National Historic Preservation Act (NHPA). Some historic structures are routinely used by the public and interpreted for their enjoyment, thus safety and proper maintenance are critical concerns.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Management of the cultural resources fails to meet the Organic Act of 1916, 1988 NPS Management Policies (Chapter 5), and NPS-28 Cultural Resources Management Guidelines. The level of impact and loss of historic fabric, features and structures will increase with time and lack of preservation activities. Safety for the public and monument employees will become more of a problem and structures now interpreted for the public may have to be closed or dismantled to avoid potential accidents.

B. **Maintain Stabilized Ruins and Historic Structures.** Routine general housekeeping, annual maintenance, integrated pest management (IPM), and cyclical maintenance will be performed as needed to preserve historic structures and features. Historic resources will be maintained, as much as is possible, in the condition that they were in when acquired by the NPS, until a formal preservation plan is formulated and approved through the Section 106 review process. This action will help ensure that the monument's historic preservation program complies with the Organic Act of 1916, NPS-28 Cultural Resources Management Guidelines, Chapter 5 of the 1988 NPS Management Policies, Sections 106 and 110 of the National Historic Preservation Act, the Archeological Resources Protection Act, and the founding legislation of Section 2 of the Antiquities Act of 1906 which President Franklin D. Roosevelt used to establish the monument.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. Routine general housekeeping, IPM, annual maintenance, and cyclical maintenance will be performed to preserve and protect historic structures and features. This project will help preserve and protect irreplaceable historical resources and will ensure compliance with federal laws and NPS management policies and resources management guidelines.

The following procedures need to be established and implemented:

- A general housekeeping schedule which ensures regular visits to historic structures and features. This schedule will be incorporated with the site monitoring plan, guarding against natural deterioration, visitor impacts, IPM needs, vandalism and theft.

- Routine annual maintenance will be performed as needed, by park staff when possible, or contracted to sources outside the monument.

- Cyclical maintenance requirements will be established with the technical assistance of the Western Regional Office (WRO) historical architect and the Southern Arizona Group Office (SOAR) archeologist. Work may be performed by monument staff or contracted out.

Personnel: Personnel required for this activity will include park staff, with technical assistance provided by the WRO historical architect and the SOAR archeologist. Presently, even minor projects are beyond monument staff workload limits, and may have to be contracted out.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), C(4), U.S. Department of Interior. NHPA Section 106 compliance is required for all undertakings or actions that may have a "no adverse" or "adverse effect" on historic resources. The Section 106 review is initiated in the NPS with the preparation of a XXX form (Assessment of Actions Having an Effect on Cultural Resources).

8. Funding:

FUNDING

ORPI-C-050 Maintain Stabilized Ruins and Historic Structures	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	7,300	3,300	1,500	1,500
Other	0.000	0.000	0.000	0.000
TOTAL	7,300	3,300	1,500	1,500
Funds Available in Park Base	0.000	0.000	0.000	0.000
Additional Funds Needed	7,300	3,300	1,500	1,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-051

2. Project Title: **Prepare Historic Structures Preservation Plan**

3. Servicewide Issue: C06 - Need for Historic Structures Preservation Guides

4. Problem Statement: There is not a comprehensive plan to direct historic structures preservation activities unique to the monument. The term "historic" as used here includes both historic and prehistoric sites as found in the Secretary of the Interior's Guidelines for Archeology and Historic Preservation. Without a plan prepared and approved in coordination with the Western Regional Office (WRO) to address Section 106 and related compliance requirements, NPS actions that may adversely affect historic structures (this also includes historic roads, trails, and mine areas), archeological sites and features may be out of compliance with the National Historic Preservation Act (NHPA) of 1966 as amended. Historical sites are not renewable resources, and must be managed properly so that irreplaceable information of historical, archeological, architectural and scientific interest is not lost forever. In this respect, management of important sites is analogous to management of endangered species.

A definitive plan is needed to evaluate historic structures at the monument, set management goals of site preservation, guide data recovery to mitigate potential losses where required, and determine which sites do not warrant further preservation and protection.

Theft, vandalism, visitor wear and tear, and deterioration through natural processes have negatively impacted sites at the monument to various degrees in the past and will continue to do so unless proper steps are taken to preserve, protect, and evaluate sites, and mitigate impacts through data recovery projects, as required by the Section 106 process. Elements that make the resources eligible or potentially eligible for the National Register of Historic Places (NRHP) and information of historical, archeological, and scientific interest are at risk, and will continue to be lost unless action is taken.

Any action, including allowing natural processes to take their course on historic structures, that may have an "adverse effect" on cultural resources must be reviewed by the State Historic Preservation Officer (SHPO) and the ACHP through formal consultation and written documentation as part of the Section 106 process.

Similarly, actions that apparently will have "no effect" or "no adverse effect" on historic and prehistoric archeological sites need to be reviewed by archeologists at the Western Archeological and Conservation Center (WACC). Actions that may affect structural sites on the List of Classified Structures require review through the NPS XXX process (Assessment of Actions Having an Effect on Cultural Resources) by WRO cultural resources specialists for applicability to Section 106 and the 1990 NPS Programmatic Agreement for Section 106 with the SHPO and ACHP.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Historic structures and features may lose important elements and historic fabric that make the resources eligible for inclusion in the NRHP and may result in the loss of information of historical, archeological, architectural and scientific interest. The SHPO and the ACHP will not have the opportunity to comment on actions that may adversely affect historic structures as required by law. Without WACC or WRO cultural resources specialists reviewing proposed actions that may affect cultural resources, failure to comply with the NHPA Section 106 and 110 responsibilities can occur. Examples of such actions include not being able to protect remote sites from theft and vandalism and not taking steps to mitigate losses, as well as the inability to preserve structures due to lack of funds or staff, and allowing natural deterioration of sites or structures to take its course.

B. **Prepare a Historic Structures Preservation Plan.** A review of known sites and resources will be completed and a plan formulated addressing the management of historic and archeological sites containing structures and features that may be eligible, are pending National Register action, or are entered in the NRHP. The plan should identify those sites for which no future protection and preservation is required, delineate those sites where scientific data recovery is required to mitigate future loss of part or the entire site(s), and unequivocally set the level of preservation or non-preservation for all List of Classified Structures (LCS) structures. The LCS needs to be updated and reviewed by the SHPO. The plan should be prepared jointly by monument personnel and WRO cultural resources specialists, in consultation with the SHPO and ACHP, through the Section 106 process. The plan should result in a formal management agreement that will conform to NPS Management Policies, the NPS 28 Cultural Resources Management Guideline, the 1990 NPS Programmatic Agreement with the National Conference of State Historic Preservation Officers and the ACHP, and other applicable laws, NPS policies and guidelines, as well as Franklin D. Roosevelt's 1937 Presidential Proclamation that established the monument with lands that "contain historic landmarks, and have situated thereon various objects of historic and scientific interest, and whereas it appears to be in the public interest to preserve such lands as a national monument." The authority to reserve the land for a national monument used by President Roosevelt was Section 2 of the Antiquities Act of 1906.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. An Historic Preservation Plan will be prepared to delineate the treatment of known historical and archeological sites, structures, and features in the monument. The purpose of the plan is to provide management direction for resources determined to be significant under NRHP criterion, as well as sites listed on, or potentially eligible to be entered in, the NRHP. The plan will include all structures in the monument's LCS. The resources will be evaluated and prioritized in regard to level of protection and preservation measures to be rendered in order to facilitate treatment of the most important sites, structures, and features. It will also list those resources that will not be protected and preserved and will be allowed to deteriorate naturally or be dismantled as safety concerns are addressed. The plan will also address plans for mitigating losses of sites, structures and features that cannot be preserved and protected, due to remoteness, vandalism, theft, and visitor impacts or natural deterioration processes, in compliance with federal laws, NPS policies and guidelines.

Personnel: Technical assistance to the monument will be provided by specialists from WRO and WACC, and by the SOAR archeologist.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), B(5), US Department of the Interior. NHPA compliance under Section 106 is required for implementation of the proposed plan. The SHPO and ACHP will be consulted early in the planning process to facilitate writing and approval of the proposed plan.

8. Funding:

FUNDING

ORPI-C-051 Prepare Historic Structures Preservation Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	10,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	10,000	0,000	0,000	0,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	10,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-C-052

2. Project Title: **Prepare Historic Structures Preservation Guides**

3. Servicewide Issue: C06 - Need for Historic Structure Preservation Guides

4. Problem Statement: The monument does not have Historic Structures Preservation Guidelines (HSPG) for its historic buildings listed on, or pending, nomination to the National Register of Historic Places (NRHP) or the List of Classified Structures (LCS). Preservation and treatment of historic structures requires established guidelines for general housekeeping, integrated pest management (IPM), and annual and cyclic maintenance to set treatment standards and scheduling for efficient management of the resources. Without guidelines, the historic preservation program at the monument does not fully comply with federal legislation, the 1988 NPS Chapter 5 Management Policies, NPS-28 Guidelines for Cultural Resources Management, or Franklin D. Roosevelt's 1937 Presidential Proclamation that established the monument, based on Section 2 of the Antiquities Act of 1906.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Preservation management and treatment of historic structures cannot follow established guidelines and policies that specifically address unique monument historic structures, features and ruins that are nonrenewable resources. Past preservation treatment of important historic buildings has been sporadic and falls short of the requirements discussed in Chapter 5 of the 1988 NPS Management Policies, NPS-28 Guidelines for Cultural Resources Management, and the Organic Act of 1916. Without HSPGs, the monument's historic preservation program will continue to have compliance difficulties and irreplaceable resources may be lost.

B. **Prepare Historic Structures Preservation Guidelines.** These will establish specific schedules and procedures consistent with monument planning and NPS policies and guidelines. Monument management and staff can follow the guidelines to insure that adequate preservation treatments are applied to protect and preserve historic structures and features, as well as government investments in them.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. Historic Structures Preservation Guidelines will be prepared for the monument. The guidelines will be prepared following the completion of the Historic Structures Preservation Plan (ORPI-C-051) which will evaluate historic structures and determine which historic structures will be preserved, as well as the level of treatment. The guidelines will set standards and schedules for general housekeeping, site monitoring, annual maintenance, and cultural cyclic maintenance. Historical background data related to each structure will be researched, documented, and included in the HSPGs, to establish baseline information required to efficiently manage and treat historic fabric. The following sites will have guidelines prepared: listed National Register sites - Victoria Mine and Milton Mine (combined as one site), and Gachado Line Camp; and nominated sites - Dos Lomitas Ranch and Blankenship Well, Bates Ranch and Well, and Quitobaquito (for remaining historic features).

Personnel: Because the monument does not have a cultural resources specialist on staff, and due to existing program backlogs and heavy workloads at the Southern Arizona Group Office and the Western Regional Office, it will be most efficient to contract this project to the Denver Service Center. The computer program being developed by the NPS in conjunction with the Maintenance Management System will aid in preparation of HSPGs, and should reduce project costs.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), B(5), US Department of the Interior. NHPA compliance under section 106 is not required to prepare the guides; however, the Arizona State Historic Preservation Office must be consulted in the development of the guidelines to insure their acceptability. Any action that will have an "adverse effect" on cultural resources, such as allowing structures entered on the National Register of Historic Places to deteriorate naturally, must be reviewed by the Advisory Council on Historic Preservation through the Section 106 process. Implementation of this project will help ensure that the monument's historic preservation program complies with the Organic Act of 1916, NPS-28 Cultural Resources Management Guidelines, Chapter 5 of the 1988 NPS Management Policies, and Sections 106 and 110 of the National Historic Preservation Act.

8. Funding:

FUNDING

ORPI-C-052 Prepare Historic Structures Preservation Guides	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	10,000	15,000	0,000	0,000
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	10,000	15,000	0,000	0,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	10,000	15,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-001

2. Project Title: **Develop and Direct a Comprehensive Natural and Cultural Resources Management and Research Program**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A comprehensive program is required to address the full range of natural and cultural resources issues facing Organ Pipe Cactus National Monument. Components of the program are extensive and include, but are not limited to: vegetation and wildlife management, non-native species control, ecological monitoring, historic structures and archeological site evaluations, threatened, endangered and sensitive species management, erosion control, abandoned mine lands, geographic information systems, air quality and groundwater evaluations. To properly develop and direct a comprehensive natural and cultural resources management program, it is necessary to have a well organized and prioritized agenda which deals with permanent staffing, infrastructure support, full identification of issues and recommended actions and long-term goals.

There are numerous threats facing the natural and cultural resources of Organ Pipe Cactus National Monument. A primary resources management concern is the continued urbanization and agricultural development near the southern boundary of the monument, in the neighboring state of Sonora, Mexico. Of concern to management is the effect of herbicide and pesticide drift on native plants and animals, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. In light of an expanding population along the international border, and the prospect of the North American Free Trade Agreement, threats are likely to increase.

Issues relating to water resources include alteration of natural flow regimes and groundwater levels, degradation of park water quality, floodplain management and wetlands protection, water rights, and related resource issues such as accelerated erosion. Although a research database exists for the monument, there is still a lack of basic data necessary to fully understand park resources and related threats. Significant cultural resources, both historic and prehistoric, are exposed to vandalism, natural deterioration and theft of materials. In addition, other pressing concerns include the protection of threatened, endangered and sensitive plant and animal species and communities, air quality management, visitor use impacts on resources, protection and management of wilderness, abandoned mine lands mitigation, control of trespassed livestock and revegetation of impacted sites.

A comprehensive, well directed, base funded and expertly managed natural and cultural resources management program is necessary to meet the challenges of the many issues facing the monument. Without this program, the ability to anticipate, understand and mitigate impacts to the irreplaceable resources of the monument will not exist.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The current natural and cultural resources management program will be maintained. Existing activities such as ecological monitoring and revegetation of disturbed sites will continue based on availability of funds. The Division of Natural and Cultural Resources Management and Research will remain at existing staffing and funding. As a result of this alternative, the monument will continue to have an effective resources program capable of addressing many issues. Weaknesses of the program, however, in areas such as cultural resources management, and maintaining the long-term viability of programs such as natural resources monitoring, will not be addressed.

B. **Develop and Direct a Comprehensive Natural and Cultural Resources Management Program.** A comprehensive natural and cultural resources management program will be developed. The Division of Natural and Cultural Resources Management and Research will be broadened and expanded. The division will continue to coordinate all natural and cultural resources management programs with direct responsibility to the Superintendent. An extensive Natural and Cultural Resources Management Plan will be developed and annually reviewed and updated. The plan will provide specific project and program statements to address issues and establish permanent financial and programming infrastructure.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A comprehensive natural and cultural resources management program will be developed. Components of the program will include:

- The development of an extensive Natural and Cultural Resources Management Plan (RMP) prepared by a multidisciplinary team of natural and cultural resources managers, biologists, park managers, archeologists, park rangers and interpreters. The RMP will provide a comprehensive evaluation of issues and recommended alternatives for mitigation. The emphasis of the RMP will be on programs (as opposed to projects only) and the establishment of the necessary infrastructure and support systems to maintain a viable and effective natural and cultural resources management and research program. The RMP will be submitted for final approval in 1994.

- A resources management and research review committee will be established to annually review priorities in the RMP and to recommend changes or modifications. The committee will be chaired by the Chief of the Division of Natural and Cultural Resources and Research and will be composed of the Superintendent, other park division chiefs or their designees, representing interpretation, maintenance, protection and administration. In addition, Cooperative Park Study Unit or National Biological Survey (NBS) biologists, National Park Service archaeologists, historic preservation specialists and information managers will also serve on the committee.

- An annual update to the RMP will be submitted to reflect changes established by the committee. Priorities will be reflected in programming sheets and updated project/program statements.

- Based on programs and priorities identified in the RMP, an annual operations plan will be prepared for each fiscal year, identifying primary and secondary goals for all areas of responsibility. The operations plan will include descriptive narratives of tasks to be accomplished and programming sheets identifying activities, responsible staff and target dates. The plan will be reviewed quarterly to monitor progress.

- A Resources Management and Research Report will be developed at the end of each fiscal year. The report will identify the attainment of goals set forth in the operations plan, as well as any other additional accomplishments.

Personnel: All program activities will be coordinated by the Chief of Natural and Cultural Resources Management and Research. Involvement of other monument staff, as well as other NPS staff and outside agencies, such as the National Biological Survey, will be required.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.1, 1.2, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-001 Develop and Direct a Comprehensive Natural and Cultural Resources Management and Research Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,000	5,000	5,000	5,000
Other	500	500	500	500
TOTAL	5,500	5,500	5,500	5,500
Funds Available in Park Base	5,000	5,000	5,000	5,000
Additional Funds Needed	500	500	500	500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-002

2. Project Title: **Manage Natural and Cultural Resources Management and Research Program**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A commitment of staff and funding is necessary to fully manage the monument's natural and cultural resources management and research programs. The program is extensive and includes activities such as vegetation and wildlife management, non-native species control, ecological monitoring, historic structures and archeological site evaluations, threatened, endangered and sensitive species management, erosion control, abandoned mine lands, geographic information systems, air quality and groundwater evaluations. To properly manage a comprehensive natural and cultural resources management and research program, it is necessary for an effective management and programming infrastructure to be in place.

There are numerous threats facing the natural and cultural resources of Organ Pipe Cactus National Monument. A primary resources management concern is the continued urbanization and agricultural development near the southern boundary of the monument, in the neighboring state of Sonora, Mexico. Of concern to monument management is the effect of herbicide and pesticide drift on native plants and animals, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. In light of an expanding population along the international border, and the prospect of the North American Free Trade Agreement, threats are likely to increase.

Issues relating to water resources include alteration of natural flow regimes and groundwater levels, degradation of park water quality, floodplain management and wetlands protection, water rights, and related resource issues such as accelerated erosion. Although a research database exists for the monument, there is still a lack of basic data necessary to fully understand park resources and related threats. Significant cultural resources, both historic and prehistoric, are exposed to vandalism, natural deterioration and theft of materials. In addition, other pressing concerns include the protection of threatened, endangered and sensitive plant and animal species and communities, air quality management, visitor use impacts on resources, protection and management of wilderness, abandoned mine lands mitigation, control of trespassed livestock and revegetation of impacted sites.

An effective management program is necessary to meet the challenges of the many issues facing the natural and cultural resources of the monument.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Delegate Natural and Cultural Resources Management Responsibilities to the Division of Visitor Protection and Interpretation.** Responsibilities for natural and cultural resources management will be assigned to the Division of Visitor Protection and Interpretation. Resource monitoring and threat mitigation will be conducted by park rangers. Additional staff will be requested to address the increased work load.

Resources management activities will be identified as a branch within the division, with a branch chief reporting directly to the Chief Ranger. A weakness will be that resources management confined to a traditional role in ranger activities, dilutes its capabilities as a professional and high priority program with direct access to upper management. Without a strong division level program supported by a comprehensive planning strategy, with programming and monument priority setting responsibilities, the ability of management to truly deal with the gamut of resource issues encountered is compromised.

B. **Manage Natural and Cultural Resources Management and Research Program.** The Division of Natural and Cultural Resources Management is responsible to the Superintendent for the management, planning, direction and coordination of the monument's Natural and Cultural Resources Management and Research Program. The function of the division is to administer the monument's natural and cultural resources management and research programs including, but not limited to, long-term ecological monitoring, backcountry/wilderness management, wildland fire planning, geographic information systems, integrated pest management, nursery/revegetation efforts, internal and external research studies, historic properties management, air and water quality monitoring, archeological resources, threatened and endangered species programs, museum management, non-native species control, abandoned mine lands, boundary fence inspections, Man and the Biosphere program and erosion mitigation and control.

The result of this action is that natural and cultural resources issues are managed by professional resources staff with direct access to top management. A division chief coordinates a multifaceted program, as outlined in planning documents.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The Division of Natural and Cultural Resources Management and Research is responsible to the Superintendent for all resources management activities. Responsibilities of the division chief include, but are not limited:

- Preparing an annual operations plan for each fiscal year, identifying primary and secondary goals for all areas of responsibility. The operations plan will include descriptive narratives of tasks to be accomplished and programming sheets identifying activities, responsible staff and target dates. The plan will be reviewed quarterly to monitor progress.

- Developing monthly reports and activities logs to assist staff in meeting goals set in the operations plan. Staff provides updates to record changes in the schedule, as well as new activities not previously identified. Logs are prepared one week prior to the beginning of each new month and are distributed to resources management staff, the Superintendent, division chiefs, administrative officer, secretary and applicable volunteers. The log identifies reports and activities to complete, staff responsible and due dates. Also included is the travel and training schedule for the month, as well as an overall division activities schedule.

- Developing, implementing and updating: long-range management planning documents such as the Natural and Cultural Resources Management Plan and attendant funding justifications and requests; action plans such as the Collection Management Plan and Research Needs Assessment; and routine progress reports such as the Investigator's Annual Report. In addition, heading planning team for long-range planning documents.

- Developing standard operating procedures for resources management and research activities. These include use of the museum, operation of computer equipment, seed storage procedures and research request processing.

- Creating financial plans as a programming device to show anticipated expenses by object class. Programs are tracked on a fixed time basis by comparing actual vs. planned expenditures to ensure obligation of authorized funds.

- Developing performance standards and employee development plans for all resources management staff. Performance evaluation is ongoing throughout the appraisal year. At the end of the appraisal period, a written performance evaluation will be made. All identified natural and cultural resource training needs are prioritized, based on resources program management needs.

- Serving as a member of the Superintendent's planning team. Collecting, assembling and providing input regarding natural and cultural resource values and considerations in the development and revision of the monument's planning documents, such as the General Management Plan, Statement for Management, Development Concept Plans, and Wilderness and Fire Management Plans.

- Interpreting broad Service resources management policies, laws and regulations; applying them to monument operations; and representing them to state and other federal agencies, international groups and agencies, educational institutions, the scientific community and local jurisdictions. Consulting with and exchanging technical information with these outside sources, as well as with colleagues in other parks, Regional Offices and Service Centers.

- Establishing and maintaining a communication network with local land users, including cattle ranchers, mining organizations, neighboring communities, state, federal, and Mexican agencies, agricultural officials and farmers in Mexico. Working with these groups to communicate monument positions on common issues, especially conflicting resource use issues.

- Setting both long and short-term goals for the division; providing overall direction and emphasis for work.

- Assuming responsibility for the overall research program, a varied program pursued by NPS scientists, contracted researchers, cooperating researchers and independent investigators. An average of 40 separate and distinct studies are being conducted within the monument at any one time. Serving as a liaison with cooperating scientists, providing coordination, completing related correspondence and reports, reviewing and evaluating research reports and products and implementing other activities related to the program. Identifying, describing and prioritizing research needs.

Personnel: A permanent National Park Service employee will serve as the Chief of Natural and Cultural Resources Management and Research.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.2 and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-002 Manage Natural and Cultural Resources Management and Research Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	62,000	62,000	62,000	62,000
Other	5,000	5,000	5,000	5,000
TOTAL	67,000	67,000	67,000	67,000
Funds Available in Park Base	67,000	67,000	67,000	67,000
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-003

2. Project Title: **Provide Natural and Cultural Resources Management and Research Administrative Support**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A commitment of staff and funding is needed to provide administrative support to the natural and cultural resources management program. The resources management and research programs have doubled in recent years. Current monument administrative staff is unable to meet the growing needs of this and other programs. Without administrative assistance within the division, the administrative work load of contracting, file management, data entry, personnel, budget updates, status reports and routine clerical duties will not be effectively or efficiently handled.

The function of the Division of Natural and Cultural Resources Management is to administer the monument's natural and cultural resources management and research programs, including but not limited to, long-term ecological monitoring, backcountry/wilderness management, wildland fire planning, geographic information systems, integrated pest management, nursery/revegetation efforts, internal and external research studies, historic properties management, air and water quality monitoring, archeological resources, threatened and endangered species programs, museum management, non-native species control, abandoned mine lands, boundary fence inspections, Man and the Biosphere program, and erosion mitigation and control.

The administrative worklog associated with managing the above programs is substantial. Administrative assistance is required to effectively coordinate and manage these efforts.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Administrative functions such as personnel, budget and purchasing will be handled by monument staff and coordinated by the monument's administrative officer. Resources management staff will continue to oversee filing and other clerical duties. As a result of no action, the efficiency of the division will be hampered. Time-consuming routine duties will be performed by resources staff and may not get done at all when priorities warrant.

B. **Provide Natural and Cultural Resources Management and Research Administrative Support.** An administrative assistant will be hired for the Division of Natural and Cultural Resources Management and Research. The position will perform all administrative and clerical functions for the division and interact directly with the Administrative Officer.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. An administrative assistant will be placed in the Division of Natural and Cultural Resources Management and Research and will work directly for the chief of the division. Responsibilities will include payroll, budget

programming updates, purchasing, filing and other administrative and clerical duties. The position will coordinate activities with the monument's administrative officer.

Personnel: The administrative assistant will be a full time National Park Service employee.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.1, 1.2, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-1-003 Provide Natural and Cultural Resources Management and Research Administrative Support	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	35,000	35,000	35,000	35,000
Other	5,000	5,000	5,000	5,000
TOTAL	40,000	40,000	40,000	40,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	40,000	40,000	40,000	40,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-004

2. Project Title: **Develop Research Opportunities and Needs Assessment**

3. Servicewide Issue: N-20 Lack of Basic Understanding of Park Resources

4. Problem Statement: It is the policy of the National Park Service to encourage and aid research by independent workers. Research is considered to be organized study that produces new knowledge. Study procedures must not, of course, conflict with the primary purpose of the park or detract from the integrity of natural ecosystems or cultural resources within the area. Research may be very basic or oriented toward problem situations. The park staff should be involved in the process so that they may convey their concerns to the prospective researcher before work is begun, and afterwards when management recommendations are made as a result of research findings. Currently Organ Pipe does not have a staff researcher. Plans, however, call for the establishment of such a position. With this position, a prioritized list of research needs will be developed and staff can solicit proposals for research of high priority projects in conjunction with the Cooperative Park Studies Unit (CPSU) at the University of Arizona. By working with the CPSU, the monument staff can ensure that needed research is addressed and a quality study is completed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will not provide monument staff with information needed to fully understand the types and processes of resources at Organ Pipe. Lack of definitive action may lead to the destruction or irreparable deterioration of resources and the inability to carry out the NPS mission.

B. **Develop a Research Opportunities and Needs Assessment.** This alternative will provide new information not usually obtainable through a standard park-based inventory and monitoring program. Such an assessment will provide a chance to develop new scientific techniques and present new opportunities for university students and researchers in studying Sonoran ecosystems.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. A prioritized list of research projects will be identified from the Resources Management Plan and will be compiled by monument staff and CPSU/UA staff. Working with the CPSU/UA, the Division of Resources Management can accomplish its goals and will be able to implement recommendations on preserving or protecting resources based on research. These studies will contribute to a better understanding of park resources and environments and of their use by people. Vouchers from research projects may enhance the monument collection and will provide baseline information for future investigations.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.2, and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. Biological specimens for museums and reference use in the monument may be collected only when required.

8. Funding

FUNDING

ORPI-I-004 Develop Research Opportunities and Needs Assessment	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	10,000	-	-	-
Other	5,000	-	-	-
TOTAL	15,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	15,000	-	-	-

References:

National Park Service, United States Department of the Interior. 1986. Interpretation Guideline (NPS-6). 116 pp.

National Park Service, United States Department of the Interior. 1989b. Resources Management Plan Guidelines. 11 pp.

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-005

2. Project Title: **Establish Editorial Assistant Position at Organ Pipe Cactus National Monument**

3. Servicewide Issue: N24 - Other Issues

4. Problem Statement: Currently there is not an Editorial Assistant (EA) position at Organ Pipe Cactus National Monument to coordinate overall production of research related reports, proposals, and technical information for the resources management division program, including the Ecological Monitoring Program (EMP). Both the scope of responsibility and staff size have increased substantially over the past years. Future growth is also predicted. Current personnel complete virtually all editorial duties themselves, including typing and editing of reports. The present program is administered by the Chief of Resources Management and the EA position would assist with both the resource management program and funded NPS research at Organ Pipe. Reports, research results, data analyses, various resource management plans (e.g. Water Resources, Fire Management, etc.) could be edited and prepared for reviewers and finalized for distribution through the Editorial Assistant. The incumbent would type highly complex, technical reports, mock up text material in report format including charts and graphs, and prepare bibliographies and footnotes, as well as independently prepare manuscripts for distribution or publication. The EA will verify information in the manuscripts by using various basic guidelines and technical scientific sources. To a lesser degree, this position can also include some assistance with administrative needs when necessary.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative would result in a continued burden on the present resources management staff and could continue to cause delays in accomplishing work objectives.

B. **Establish an Editorial Assistant Position.** The EA will assist with natural and cultural resources editorial information, as well as, administrative needs for review by the Division Chief.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended course of action. The recommended action is to establish and fill an editorial assistant position within the Resources Management Division, thus achieving more efficient program operation using available skills and expertise.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2, App. 2, 1.2 and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-005 Establish Editorial Assistant Position	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	17,686	17,686	17,686	17,686
Other	3,000	3,000	3,000	3,000
TOTAL	20,686	20,686	20,686	20,686
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	20,686	20,686	20,686	20,686

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-006

2. Project Title: **Develop and Implement a Comprehensive Natural and Cultural Resources Interpretation Program**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A commitment of staff and funding is needed to develop and implement a comprehensive resources interpretation program. The current interpretation program is inadequate to be of assistance in meeting the goals of natural and cultural resources management and protection. Lack of increased funding has resulted in a loss of programs and reduced services.

Interpretation is an effective tool for providing information on natural and cultural resources threats, issues and programs to the visiting public and monument neighbors. Current threats to resources include impacts from urbanization and agricultural development on adjacent Mexican lands, including pesticide drift, water table drawdown, and introduction of non-native plants and animals. Other threats and issues include alteration of natural flow regimes and groundwater levels, degradation of park water quality, floodplain management and wetlands protection, protection of threatened, endangered, and rare plant and animal species and communities, implementation of monitoring protocols, air quality management, evaluation of visitor use impacts and limits, protection and management of wilderness, abandoned mine lands mitigation, control of trespassed livestock and revegetation of impacted sites.

Interpretation communicates the significance and value of the resources and natural processes to the public. In this way, it enlists the public's understanding, appreciation and protection of the resource, making it a key resources management partner (NPS 1991). Interpretation fulfills the important role of instilling an understanding of and appreciation for the value of parks and their resources, and through this process, developing public support for preserving them (NPS 1986). Interpreters can emphasize the importance of the National Park Service philosophy of protecting habitats, populations, and ecosystems (NPS/ORPI 1989).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A no action alternative will result in continuing at the present level of interpretative funding and staffing. No effort will be made to increase either financial or personnel support. As a consequence of no action, the critical information and education component of resources management will not be fulfilled, and will therefore weaken overall efforts to address natural and cultural issues and threats.

B. **Develop and Implement a Comprehensive Natural and Cultural Resources Interpretation Program.** A comprehensive natural and cultural resources interpretive program will be developed. The existing interpretive staff will be supplemented with additional field personnel. Emphasis will be placed on personnel services. The overall effort will consist of two primary components: enhancement of internal traditional visitor programs and expansion into outreach services.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A comprehensive natural and cultural resources interpretation program will be developed. As part of this program, interpretive efforts will deal primarily with natural and cultural resources issues, research and monitoring programs, and mitigation strategies. Components of the proposed program include:

- Establishing a liaison position to be involved with the overall resources management, research and interpretation program. The position will facilitate the dissemination of resources information to interpretative staff and will review all presentations prepared as part of the resources interpretation effort. Non-personal interpretive materials dealing with resources management and research will be developed by this individual.

- Establishing a permanent coordinator position to develop an outreach program with local communities in the U.S., Mexico and Tohono O'odham Reservation. One assistant will be assigned to this coordinator. An aggressive, articulate outreach program that anticipates the public's need for park information is one of the most important aspects of a complete interpretive program (NPS 1986).

- Four additional permanent field interpreter positions will be established to develop and present natural and cultural resources programs in the monument.

- Twenty percent of the duties of all interpretive staff hired as part of this program will consist assisting with resources management and research programs. Staff will assist with the monitoring of resources, mitigation efforts and sensitive species evaluation.

Personnel: Seven permanent National Park Service positions will be created as part of this effort. Position descriptions will be structured in the 401 series as opposed to 025.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions. 516 DM, Chapter 2, Appendices 1 and 7, U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-006 Develop and Implement a Comprehensive Natural and Cultural Resources Interpretation Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	288,000	288,000	288,000	288,000
Other	30,000	30,000	30,000	30,000
TOTAL	318,000	318,000	318,000	318,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	318,000	318,000	318,000	318,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-050

2. Project Title: **Develop and Manage Resources Information Management Program**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A commitment of staff and funding is needed to develop and manage a comprehensive resources information management program. Several years of inventorying, monitoring and research have yielded an abundance of data sets that must be maintained and effectively managed to be useful in resources management activities. To effectively develop and manage the program, it is necessary for a comprehensive management infrastructure to be in place.

The natural and cultural resources management and research program at Organ Pipe Cactus National Monument is extensive and involved, and inherently creates large sets of data. This information is critical in understanding the complexity of the resources and the threats to them, and in assisting with the formulation of mitigation and management efforts. Generally, there are between thirty and forty separate research studies being conducted at the monument at any one time. The majority of these studies are related to natural science. In 1986, a large scale inventorying and monitoring program was initiated. As a result of this program, several natural resources monitoring protocols were developed, which have contributed to the creation of extensive biological databases. These monitoring databases grow substantially annually. Proper management of this data is of utmost importance to assist in the interpretation of research and monitoring results, and in the creation of an environment for database analysis, comparison, evaluation, modeling and graphical outputs.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in the monument not developing and managing a resources information management program. Data sets will remain as they are with no attempt to organize and integrate them. As a result of no action, the growing dependency of resources management activities on computer technology to accomplish basic program objectives will be extremely compromised.

B. **Develop and Manage Resources Information Management Program.** An information management specialist position will be established to implement the program. Computer technology will be fully integrated with other resources management and research programs. The information management specialist will be responsible for the management of the Resource Management/Research Division's computers and information management program. Duties will include managing the monument's research and monitoring database programs and files, systems analysis, performing park-specific programming as needed, ensuring appropriate back-up of all computers, supervision of the geographic information system (GIS) specialist and the GIS program, information management planning and procurement, troubleshooting of equipment, and providing assistance to all Resource Management/Research Division personnel in the area of information management.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A permanent Information Management Specialist position will be established to develop and manage the monument's natural and cultural resources and research information management program. Responsibilities of the coordinator include, but are not limited to:

- Configuration management of all research and resources management computer systems, including personal computers, global positioning base stations and geographic information system work stations. Insuring that all hardware, operating systems software, and networking capabilities are provided in support of programmatic activities within the Division of Research and Resources Management.

- Overseeing identification, selection, installation, and maintenance of appropriate ADP hardware and associated operating system software. Providing analysis and support to define these needs, as well as the technical skills to properly configure hardware, software, and networking environments to provide the required solutions.

- Selecting and recommending for procurement the appropriate hardware and software. Provides configuration drawings and specifications for contractors to install cabling and appropriate power for required installations. Overseeing hardware installations and providing technical analysis and acceptance of equipment after installation. Configuring and installing all software and updates, insuring compatibility among all systems within the division.

- Ensuring that backup/restore operations are performed on resources management computers. Ensuring that these operations are performed according to Park, Regional and Washington policies. Training assigned resources management personnel in the use of commercial backup/restore software. Maintaining the backup log and the libraries of backup diskettes according to policy. Maintaining library of original and backup diskettes for commercial software.

- Ensuring that hardware diagnostics are performed on all resources management computers to ensure proper functioning. Analyzing hardware problems when they occur and taking corrective action, which may include replacing computer chips, replacing/reconfiguring expansion boards, sending machines to repair centers, or similar activities. Attaching new/additional hardware to existing systems and reconfiguring systems to accept such hardware changes.

- Continuously surveying the market for new products (hardware and software) to provide the latest technology solutions, replacements, and updates to existing environments. Recommends hardware and software to the Superintendent/ADP Committee in accordance with the Western Region ADP plan. Serving as the park's liaison with the Regional Office, other NPS users, other federal agencies, and commercial manufacturers to acquire and modify, if necessary, applications and system software.

- Supervision and coordination a Geographic Information System (GIS) for the park. Supervises the monument's GIS specialist. Supervising basic data entry functions and developing GIS applications for identified management needs, including the analyses and output of mapped and tabular information, for all park divisions. Coordinating activities with other NPS offices, cooperating federal agencies, regional, state and local land management agencies.

- Working with resources management personnel and research contractors to analyze tasks for possible computerization. Recommending whether a task should be computerized, or whether a modified manual system should be involved. Designing the new system. Developing testing criteria and test data for the new system. Performing implementation/analysis/debugging of the new system.

- Managing and analyzing all biological data gathered as part of on-going research and resources management activities. Ensuring that data is managed consistently and is easily retrievable. Taking raw data and summarizing to interpret results and conclusions. Writing reports providing descriptive analysis and results of data.

- Developing new computer programs based upon the results of systems analysis. Analyzing the needs of the system, and deciding which language (i.e. dBase, Basic, C, Assembly Language) will be most advantageous. Constantly works with the user through demonstrations, meetings, etc. to ensure that the program performs all of the intended operations.

- Writing reports and briefing supervisor, management, and the research community on resources information management issues in the monument. Working with government agencies and private organizations in developing management techniques and in locating and acquiring existing databases pertinent to the park.

Personnel: The information management specialist will be full time National Park Service employees.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.2, and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-050 Develop and Manage Resources Information Management Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	60,000	60,000	60,000	60,000
Other	10,000	10,000	10,000	10,000
TOTAL	70,000	70,000	70,000	70,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	70,000	70,000	70,000	70,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-051

2. Project Title: **Implement Geographic Information System Program**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A commitment of staff and funding is required to comprehensively implement the monument's geographic information system (GIS) program. An approved GIS plan and several years of work completed through a cooperative agreement with the University of Arizona have yielded a well outlined program and a comprehensive GIS database. To effectively implement the program it is necessary to acquire sufficient technical expertise and establish a permanent financial base of support the program.

Numerous resource management projects, research activities, and programs, such as ecological inventorying and monitoring, air quality monitoring, water resources evaluation and the Man and the Biosphere Program require effective management of large quantities of data, so that data is organized, protected and meaningfully interpreted. This is of utmost importance in order to ensure research validity, aid with the implementation of monitoring protocols, enhance the quality of future research, and aid in decision making processes. Production of high quality graphics, including thematic maps, is essential to improve intra-agency, interagency, and international communications. A geographic information system is the most efficient and effective means for collecting, storing, analyzing and disseminating information about any georeferenced data.

External threats from urbanization, conflicting land use practices, demographic changes, and environmental pollution are increasing at an alarming rate. A GIS is instrumental in detecting changes, analyzing trends, and projecting possible future conditions resulting from these external resource pressures. Digitizing photographic and cartographic information increases the speed at which monument staff can collect, prepare, retrieve, and manipulate data from different thematic data composites. Cartographic and subsequent data analysis significantly increases management's ability to document, demonstrate, illustrate, and predict long term changes in the health of the monument's resources. In addition, the GIS produces support materials such as maps, tables, charts and graphs to illustrate resource concerns and to describe park resources to interested parties. It provides the medium to better interpret data, identify issues and threats, articulate concerns, and provide information for management decisions.

At the monument, a GIS plan was developed and approved in FY 1991. The plan outlines the overall scope of GIS at the monument, including application development, GIS hardware and software recommendations and administration of the program. A high priority throughout the program development and implementation has been to build a system compatible with the University of Arizona GIS. Therefore, a GIS cooperative agreement between the University of Arizona and the monument was implemented. IDRISI GIS software was purchased to provide resources management staff with experience in using a PC based GIS. The long-term goal of the program is to work cooperatively with adjacent land managers and owners, and the University of Arizona, to develop a regional database which will assist in planning, management and resources protection.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No action will result in the monument not implementing a GIS program. Databases established through cooperative agreements will not be continued. As a result of this action, the monument will not have access to one of the most effective tools for evaluating threats and developing alternatives to protect natural and cultural resources.

B. **Implement Geographic Information System Program.** The monument will implement the actions outlined in the approved GIS plan. A GIS Specialist position will be established to implement the program. GIS will be fully integrated with other resources management and research programs, such as archeological site evaluation and ecological monitoring. The GIS will eventually be integrated with all monument functions, including maintenance and interpretation.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A permanent GIS specialist will implement activities associated with the GIS program. The coordinator will:

- Supervise basic data entry functions and develops GIS applications for identified management needs, including the analyses and output of mapped and tabular information, for all park divisions. Coordinate activities with other NPS offices, cooperate with federal agencies, international, regional, state and local land management agencies.

- Operate and maintain GIS hardware including the work station, printers, screen copiers, plotters, digitizing tablets, graphics terminals, and associated peripheral devices. Ensure that all devices are properly and effectively communicating with one another; perform maintenance operations as necessary including cleaning and resupplying; order and maintain, supplies needed for the GIS operation; and install and integrate new computer hardware products acquired.

- Maintain GIS software, principally by making sure it is available to all GIS users and also by performing periodic backups; obtain and load updates to the GIS software; and install and integrate new computer software programs acquired.

- Supervise and construct digital databases using geographically registered data and analyze and derive new themes or information using GRASS or other computerized GIS software. Translate research studies and findings into GIS models and databases (e.g. determining wildlife habitat or sensitive management zones from combinations of resource or research-derived factors).

- Prepare maps for in-house or contract digitizing or scanning.

- Determine or develop and implement methodologies for computerized data extraction from disparate data sources. Take GIS-generated results, such as acreages and locations, and translate, convert and export them into external statistical and mathematical models or other GIS packages for further analysis or aggregation at a larger scale.

- Augment the GIS database by digitizing or scanning mapped information, importing existing digital data, or converting data from other systems such as Dbase or other GIS and RIM databases to correct errors or modify, delete and add information.

Personnel: The GIS Specialist will be a full time National Park Service employee.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-051 Implement Geographic Information System Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	48,000	48,000	48,000	48,000
Other	10,000	10,000	10,000	10,000
TOTAL	58,000	58,000	58,000	58,000
Funds Available in Park Base	58,000	58,000	58,000	58,000
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-052

2. Project Title: **Update Information Management Plan**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: The Organ Pipe Cactus National Monument Resources Management Information Management Plan (IMP) requires updating to incorporate the rapid changes occurring in the field of information management. Organ Pipe Cactus has a long history of involvement and support with the Sonoran Desert research community. Numerous studies and research projects have been conducted throughout the region since the early 1900's.

The natural and cultural resources management and research program at the monument is extensive and involved, and inherently creates large sets of data. This information is critical in understanding the complexity of resources and threats to them, and in assisting with the formulation of mitigation and management efforts. Generally, there are between thirty and forty separate research studies being conducted at Organ Pipe Cactus at any one time. The majority of these studies are related to natural science. In 1986, a large scale inventorying and monitoring program was initiated. As a result of this program, several natural resources monitoring protocols were developed, which have contributed to the creation of extensive biological databases.

In January 1991, a Resources Management Information Management Plan (IMP) was developed. The development of the internal IMP was the first step in identifying and developing procedures for managing large resources databases. The plan needs to be updated, revised and expanded to incorporate changes in hardware and software (including updated versions), and to address database application needs. In addition, the monument's geographic information system program needs to be integrated in the overall IMP.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A no action alternative will not address the need to update and expand the IMP. This would result in a lack of guidance for managing the large amounts of resource and research information currently available.

B. **Update Information Management Plan.** A comprehensive update of the IMP will be prepared which will incorporate information such as database management and GIS. This alternative will address the need to have a means for the efficient and effective management of all natural and cultural resources information.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. The existing IMP will be updated. The plan will serve as a tool for resources managers to use for software and hardware acquisition, computer maintenance and general use. National automated data processing standards will be identified to keep the division in harmony with NPS-wide systems. All resources management staff will be involved to varying degrees with the maintenance and care of the computers. All staff members will

work closely with research and resource management projects involving database management systems and geographic information systems.

The goals of the plan will be to:

- Identify short and long-term goals of the resources management and research information management program.
- Develop an action plan and programming sheets to meet goals.
- Provide the means for organizing and managing information within the resources management and research program.
- Identify the information management hardware, software and training needs of the resources management and research program.
- Develop a strategy for managing large biological databases, as well as cultural resources databases.
- Integrate the monument's geographic information system into the overall information management program.
- Provide an index of resources management and research program hardware, software, databases and other information management programs.
- Provide management with an understanding of the role and purpose of technically advanced computer operations in effectively managing resources management information.

Personnel: The Information Management Plan will be prepared by the monument's resources management staff. Review will be provided by Regional and Southern Arizona Group information management specialists.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-052 Update Information Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	4,800	-	-	-
Other	500	-	-	-
TOTAL	5,300	-	-	-
Funds Available in Park Base	5,300	-	-	-
Additional Funds Needed	0,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-053

2. Project Title: **Conduct Geographic Information System/Airborne Video Monitoring Research**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them
C26 - Other Issues

4. Problem Statement: A cost effective means of providing monument-wide visual displays to assist with mapping and evaluating resource conditions is needed. This type of data is required to support and enhance existing resources monitoring and research projects.

No prior research has been conducted at Organ Pipe Cactus National Monument using airborne video monitoring. The feasibility of using airborne video/global positioning technology in lieu of conventional aerial photography as a means of providing imagery for assessing and monitoring the status of monument resources is unknown. If feasible, geographic information system (GIS)/airborne video will offer substantial savings over traditional techniques, and will provide a host of derivative products that are not directly available from conventional film.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will be forced to rely on traditional techniques and methods that do not illustrate long term resource changes as effectively as GIS/Airborne Video Technology. Visual patterns and conditions of resources will not be generated as efficiently or as cost effectively as possible.

B. **Conduct Geographic Information System/Airborne Video Monitoring Research.** This option will provide the monument with GIS/Airborne Video imagery specifically adapted to its needs. This effort will provide management with an effective means for analyzing existing trends and predicting future changes. Digitizing photographic and cartographic information will increase the speed with which the monument's staff can collect, prepare, retrieve, and manipulate data from different thematic data composites. Cartographic and subsequent data analysis will significantly increase management's ability to document, demonstrate, illustrate, and predict long term changes in the health of the monument's resources. In addition, the automated GIS system produces support materials such as maps, tables, charts, and graphs to illustrate the resource concerns and describe park resources to interested parties. It will also provide selected monument staff with the additional expertise and experience needed to operate the GIS at a level useful for the many political and ecological challenges faced by the monument on a continued basis.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. The project will assess the merit of using aerial video over conventional aerial photography for monitoring and mapping resource status at the monument. In particular, the cost effectiveness and logistics of acquiring and processing the two types of imagery will be compared, as will the diversity and usefulness of products

obtained, relative to immediate and longer term management needs. Image data produced in this project will be used to (1) produce GIS vegetation data layers (with an emphasis on riparian corridor characteristics in the Sonoran Desert), and (2) analyze patterns of vegetation changes over the next 3 years. Finally, project results will be outlined in a technical report detailing equipment requirements, standard methodologies, results of the feasibility study, suggested applications, and recommendations for future monument and NPS-wide use.

A multidisciplinary GIS team will be created to develop and standardize the GIS/Airborne Video protocols to be used in this project. The team will develop a strategy to address the following GIS themes: boundaries, land use changes, land ownership, Sonoran Desert vegetation community classification and identification system, riparian community stability, roads, trails, demographic influences on cultural and natural resources, and other external impacts from the surrounding area. At least two scales of resolution will be initially required to represent and generate the thematic data composites. Consideration will be given to the 1:1,200 and 1:24,000 scales for small and large scale resolution as appropriate. Physiographic and political boundaries will be adjusted to include selected natural or culture features that influence the monument's resources. Project emphasis will be on cost effectiveness of this new video technology. The nature of video imagery coupled with the linkage of GIS can support a wide array of multidisciplinary studies and products across administrative land units.

Products expected during project include:

- Methodology handbook explaining video data acquisition, data processing techniques, and equipment.
- Feasibility study and cost effectiveness analysis of airborne video versus conventional aerial photography for documenting and illustrating park resources management concerns.
- Complete development of image databases for the monument.
- Creation of GIS data layers to support a multitude of monument resources management and research programs.
- A report documenting differential analysis of riparian and community vegetation patterns of change over the next three years.
- Recommendations for implementation and future use of this technology in other NPS areas. Preliminary indications suggest that this technology is a superior, cost effective means of obtaining georeferenced imagery in a timely manner.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to incorporate this work. ART will be responsible for digitizing the necessary data and getting the system up and running for subsequent imagery use by monument personnel. Working with personnel in the monument's resources management division, video and photographic imagery will be interpreted and processed to produce GIS-compatible vegetation data layers. Staff will also assist in ground-truthing the resulting maps. Scientists from the National Park Service and/or National Biological Survey will serve on the multidisciplinary team identified in this project.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-053 Conduct Geographic Information System/Airborne Video Monitoring Research	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	27,000	38,500	20,500	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	27,000	38,500	20,500	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	27,000	38,500	20,500	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-054

2. Project Title: **Develop Custom Geographic Information System Automated Quad Indexing System**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A customized geographic information system (GIS) quad indexing system is required to provide the most efficient means of allowing access to GIS capabilities by all monument divisions. In order to maximize staff productivity and efficiency, a custom GIS interface is needed to facilitate routine requests for plotting and indexing standard maps which are used throughout the monument.

A GIS plan was developed and approved for the monument in FY 1991. The plan outlines the overall scope of GIS at the monument, including application development, GIS hardware and software recommendations and administration of the program. A high priority throughout the program development and implementation has been to build a system compatible with the University of Arizona GIS. Therefore, a GIS cooperative agreement between the University of Arizona and the monument was implemented. The long-term goal of the program is to work cooperatively with adjacent land managers and owners, and the University of Arizona, to develop a regional database that will assist in planning, management, and resource protection.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monument staff will rely on traditional techniques and methods to define, locate and facilitate plotting of computerized mapped data. As a result of no action, the organization of the overall GIS database will be less user-friendly, thus inhibiting utilization of the technology by monument staff.

B. **Develop Custom Geographic Information System Automated Quad Indexing System.** A customized GIS graphic user interface (GUI) computer program will be developed which will greatly facilitate the tracking and plotting of mapped data, as well as provide a user friendly means to reduce the time and training required to regenerate and plot standard monument maps.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A user-friendly customized GIS automated quad indexing system will be developed. The automated system will contain a data dictionary specifying standards and protocols, as well as documentation for each map. Maps and derivative products will be indexed by USGS quadrangles using a GUI.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to incorporate this work. ART will develop the GIS interface. Monument resources management staff and scientists from the National Park Service and/or National Biological Survey will assist with development and review.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-054 Develop Custom Geographic Information-System Automated Quad Indexing System	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	8,900	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	8,900	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	8,900	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-055

2. Project Title: **Implement Global Positioning System Data Acquisition**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: An efficient and routine mechanism is needed to generate maps from point data, incidents, or natural and cultural resources monitoring data collected by the monument staff, researchers, contractors, graduate students and volunteer personnel. In order to generate division maps on a routine basis, all field data must be adequately georeferenced. Traditional land survey techniques are expensive and time intensive, making it difficult to adequately generate georeferenced critical field data from all divisions and research programs.

A geographic information system (GIS) plan was developed and approved for the monument in FY 1991. The plan outlines the overall scope of GIS at the monument, including application development, GIS hardware and software recommendations and administration of the program. A high priority throughout the program development and implementation has been to build a system compatible with the University of Arizona GIS. Therefore, a GIS cooperative agreement between the University of Arizona and the monument was implemented. The long-term goal of the program is to work cooperatively with adjacent land managers and owners, and the University of Arizona, to develop a regional database which will assist in planning, management, and resource protection.

In 1992, a Global Positioning System (GPS) training course was conducted at the monument. GPS is based on a constellation of NAVSTAR (Navigation Satellite Timing and Ranging) satellites orbiting earth. The GPS satellites continuously transmit highly accurate timing and orbital information from which the range (distance) between the user and the satellite can be calculated. With this range of information, a receiver can calculate its location very quickly and accurately (GeoResearch 1991). GPS has been identified in the GIS plan as necessary for data acquisition.

GPS offers several advantages for GIS applications. Data is collected quickly and accurately and maintains a common reference system (Cadalyst 1990). With a GPS survey receiver, one surveyor can do the work of a whole team in a fraction of the time required by conventional techniques (Hurn 1989). Perhaps the biggest advantage GPS holds for GIS users is its high accuracy rating (Land & Speed 1990).

The monument has purchased one GPS receiver and has currently purchased a GPS community base station. A program directing the GPS data collecting activities is needed to systematically acquire accurate spatial information and to integrate it into the GIS.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monument staff will rely on traditional techniques and methods which do not illustrate long term resource changes as effectively as a geographic information system (GIS) with adequate georeferenced data. The monument staff will continue to depend on inaccurate maps and non-georeferenced field notes to obtain spatial information concerning such things as utility corridors, theft locations, research sites, roadway property, signage, portable gauges, and other inventory or site information. Visual patterns, maps, and spatial analysis of resource conditions will not be generated or conducted to meet management and research objectives.

B. **Implement Global Positioning System Data Acquisition.** This alternative will ensure georeferencing of all field data to guarantee accurate mapping for all divisions. Visual patterns, maps and spatial analysis of resource conditions will be generated. An automated portable global positioning GPS/GIS program will be developed for field use by all monument divisions.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. Activities associated with this alternative include:

- Developing a GPS addendum to the GIS Plan. This addendum will establish priorities for data acquisition using GPS technology. In addition, the addendum will identify an action program detailing data collection standards, a schedule of activities and budget programming sheets.

- Preparing a GPS field protocol handbook. Included in the handbook will be instructions on basic and advanced GPS concepts, equipment operating procedures, detailed step-by-step instructions for pre/during/post data collection missions, checklists for mission planning and directions on differentially correcting data.

- Implementing the GPS data collection schedule outlined in the GPS addendum.

- Integrating GPS data into the monument's GIS system.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to assist with this work. Monument resources management staff will assist in the preparation of all documents and implement field data collection. Two temporary employees will be hired to conduct field work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-055 Implement Global Positioning System Data Acquisition	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	5,000	5,000	5,000	-
Personnel Services	4,500	48,500	48,500	-
Other	0,000	7,000	7,000	-
TOTAL	9,500	60,500	60,500	-
Funds Available in Park Base	4,500	4,500	4,500	-
Additional Funds Needed	5,000	56,000	56,000	-

References:

Cadalyst. 1990. GPS.

GeoResearch. 1991. GPS.

Hurn. 1989. GPS.

Land and Speed. 1990. GPS.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-056

2. Project Title: **Develop Computerized Bibliographic Information System**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: The monument does not have the ability to efficiently track the wealth of historic, technical and ecological information that is available. Sociological, physical and natural changes within and around Organ Pipe Cactus National Monument may be adversely impacting the monument. Numerous resource pressures, generated by divergent interest groups, need to be investigated. Historically, selective but intermittent studies have been continuously conducted since the monument was established in 1937. Without the development of an adequate tracking system and information base, park management cannot efficiently manage the resources or respond to developing resource problems systematically, without duplication of effort. In addition, public interest and environmental groups frequently request bibliographic citations or information upon which management actions were based. Researchers and other professionals routinely depend upon and utilize the monument's information base as the first step in addressing management concerns. The development of a computerized bibliographic system including an annotated bibliography will place the monument in a better position to assess past actions and evaluate current programs.

Presently, the monument utilizes the bibliographic software PRO-CITE. The National Park Service's Cooperative Park Studies Unit, University of Arizona, Tucson, AZ, developed the initial monument database. The database, however, has not been updated in several years and knowledge and use of it is minimal.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No effort will be made to develop a comprehensive computerized bibliographic information system. The current program will be maintained but not updated. With this alternative, the monument will not have adequate access to current or past natural and cultural informational resources. This increases the time and reduces the cost effectiveness of management's ability to evaluate resource issues.

B. **Develop Computerized Bibliographic Information System.** A computerized bibliographic information system will be developed and will increase management's ability to respond effectively to cultural and natural resource issues. An adequate information base will prevent duplication of effort and costly mistakes. Adequate and effective access to informational resources are a mandatory prerequisite for efficient and cost effective management. Time frames in examining resource issues will be significantly reduced with the production of an annotated bibliography and the creation of a computer information tracking system. In addition, the bibliographic assessment will summarize the strengths and highlight the weaknesses in the existing information base. Information management is a critical first step in developing cost effective solutions.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action for this issue. A computerized bibliographic information system will be developed, including the production of an annotated bibliographic assessment. As stated above, the bibliographic assessment will summarize the strengths and highlight the weaknesses in the existing information base. This action will increase the effectiveness of all management programs.

Activities associated with this alternative include:

- Reviewing and evaluating the current bibliographic software and database. Identifying strengths and weaknesses of the program. Examining interface and ease of accessibility. Making recommendations on modifications and changes.

- Examining the extent of the backlog needing entry into the database. Evaluating the commitment required to bring the database to date and evaluating cyclic costs and personnel needs to keep it current.

- Based on the assessment of the current program, preparing an action plan to develop and implement a comprehensive computerized bibliographic information system. The action plan will identify objectives, a schedule of activities and budget programming sheets.

- Implementing the action plan to achieve the goal of creating a user-friendly and up-to-date computerized bibliographic information system.

- Creating linkages with other databases, including the monument's geographic information system, automated national catalog, resources management plan and research databases and library/archival data.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to assist with this work. Monument resources management will guide activities and provide data entry personnel. Scientists from the NPS Cooperative Park Studies Unit, University of Arizona will review all work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-056 Develop Computerized Bibliographic Information System	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	5,000	0,000	0,000	0,000
Personnel Services	24,250	2,200	2,200	2,200
Other	2,000	0,000	0,000	0,000
TOTAL	31,250	2,200	2,200	2,200
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	31,250	2,200	2,200	2,200

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-057

2. Project Title: **Prepare Administrative History of Natural and Cultural Resources Management and Research**

3. Servicewide Issue: N24 - Other Issues
C08 - Need for Historical Resources Studies and Administrative Histories

4. Problem Statement: An administrative history of natural and cultural resources management and research is needed for Organ Pipe Cactus National Monument. History of efforts to protect and understand the resources of the monument has never been compiled. Information on programs and activities exists in hundreds of archival files. In the 56-year history of the monument, the emphasis of resource threats and issues and the actions taken to understand and mitigate them have changed. Programs in the early years attempted to address overwhelming internal challenges such as unrestricted cattle ranching and mining. Since the late 1970's, with the elimination of internal consumptive uses, the greatest threats have come from adjacent land uses, and thus research and resources management programs have shifted their focus to address these new developments.

For a natural and cultural resources management and research program to be successful, there must be a knowledge of its past. Information on program evolution, strategies, successes and failures all contribute to building a stronger program today with a clear vision for the future.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No effort will be made to prepare an administrative history of natural and cultural resources management and research at Organ Pipe Cactus National Monument. Staff will rely on archival files and general information sources for program history and evolution. The result of this action will be that a clear definitive source for resources management and research administrative information will not exist.

B. **Prepare Administrative History of Natural and Cultural Resources Management and Research.** An administrative history detailing the development of natural and cultural resources management and research efforts in the monument will be prepared. The administrative history will provide a chronology of issues, program activities and milestones, and infrastructure development. The history will be composed of two sections, one dealing with natural resources and biological research, and the other with cultural resources and associated historical and archeological studies. The final product will serve as the definitive source on the development and status of resources management and research programs at Organ Pipe Cactus National Monument.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. An administrative history of natural and cultural resources management and research will be prepared. The administrative history will include the following components:

- A chronology of resources management and research activities focusing primarily since the establishment of the monument in 1937. In addition, projects, such as biological research prior to 1937, will be included. The chronology will provide a short time-sequence summary of issues, threats, management and mitigation strategies, important research efforts and findings, and general milestones in the overall program.

- Detailed sections for both natural resources management/biological research and cultural resources management/historic and archeological research. An exhaustive review of existing archival files and records will be required to assemble these sections. The emphasis will be on developing historical narratives detailing items identified in the chronology.

- An electronic database highlighting key components of the overall program. The database will be interactive and allow for quick search and retrieval on a variety of fields. It will list monitoring and management programs, dates, and personnel involved.

- A protocol for providing periodic updates to the administrative history.

Personnel: This project will be contracted. Monument staff will provide review and final approval of all work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-057 Prepare Administrative History of Natural and Cultural Resources Management and Research	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	30,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	30,000	-	-	-

PROJECT STATEMENT

1. Project Number: ORPI-I-058

2. Project Title: **Incorporate and Integrate New Data into the Information Management and Geographic Information Systems**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: Currently, there are no mechanisms for integrating and incorporating new cultural and natural resources management and research information into a synthesis report, which would expedite and facilitate management's ability to make difficult resource decisions. Because researchers and contractors tend to be specialists, there are often conflicting recommendations made to management on the proper action for mitigating resource problem. Without an annual mechanism to review and evaluate new information, management is faced with the difficult task of resolving differing professional recommendations generated by different disciplines and measuring techniques. Software update recommendations and spatial data transfer problems between agencies and studies must be examined for usefulness, precision, and accuracy.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails maintenance of the status quo. Monument staff will be forced to rely on traditional techniques and methods to determine the best decision. Conflicting recommendations will not be resolved efficiently.

B. **Incorporate and Integrate New Data into the Information Management and Geographic Information Systems (GIS).** Information from many sources will be integrated and presented in a report format, thus representing the state of information as a whole, rather than in disjointed pieces. This will assist in more effective and accurate interpretations of data by management, and will allow for decisions affecting resources to be made more efficiently.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. A multidisciplinary team will be created to integrate and evaluate new information, and incorporate this data into the information management and GIS systems. Research models will be updated and reevaluated on a periodic basis if natural and cultural resources inventorying and monitoring and research data indicate the need. Monitoring protocols will be examined for deficiencies and recommendations will be made. The team will produce an annual summary report of the year's new results.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to assist with this work. The data integration will be coordinated by scientists from the NPS Cooperative Park Studies Unit, University of Arizona. Monument resources management staff will assist with all activities.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-058 Incorporate and Integrate New Data into the Information Management and Geographic Information Systems.	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	5,000	5,000	5,000	5,000
Personnel Services	5,000	5,000	5,000	5,000
Other	1,000	1,000	1,000	1,000
TOTAL	11,000	11,000	11,000	11,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	11,000	11,000	11,000	11,000

PROJECT STATEMENT

Park and Region: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-059

2. Project Title: **Conduct Feasibility Study to Link the Geographic Information System with the Maintenance Management System**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A linkage needs to be made between the monument's geographic information system (GIS) and maintenance management system (MMS) to improve the effectiveness and usefulness of both programs. The MMS is a comprehensive information program which helps managers plan, control and carry out the National Park Service (NPS) maintenance mission. MMS provides an effective means for: developing annual work programs and budgets; distributing work on an annual basis; determining labor, equipment and materials needs; monitoring complaints and inspection reports; scheduling work, and recording work accomplished; and evaluating performance. Unfortunately, there is no automated system for tracking, managing, analyzing, and displaying mapped information about the extent of maintenance activities or the location of NPS facilities, roads, and trails. Consequently, there is a lack of information and coordination of mapped inventory data and property.

Recent advances in GIS, global positioning systems (GPS), and integrated software packages, such as Geolink, permit the field generation of computer based georeferenced location inventories of facilities and features. Because the inventory data is georeferenced and in a GIS digital database form, scale independent maps can be generated to track and delineate spatial data and increase the effectiveness of managing facilities and planning MMS projects and programs. Because MMS and GIS can exchange database management system information, it is possible to create dynamic linkages between the two software systems so that MMS maintenance data can integrate with mapped data from other divisions. Consequently, mapped information from cultural and natural resources could be overlaid and integrated with maintenance activities, developing utility corridors, and facilities planning and development programs. The purpose of this project is to conduct a study to examine the feasibility of linking MMS to GIS and GPS technologies.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monument staff will continue to rely on traditional techniques and methods that do not illustrate or track maintenance activities as effectively as a GIS. Visual patterns, inventory and land use maps, and integrative mapping applications of resources with other monument divisions will not be generated.

B. **Conduct Feasibility Study to Link Geographic Information System with the Maintenance Management System.** This option will provide the monument with solid information for examining the feasibility of linking MMS to GIS and GPS, to specifically address the lack of integrated mapping of facilities. This effort will provide management with an opportunity to explore a cost effective means of

addressing these spatial problems across divisions. This information and expertise will also be valuable for other park units utilizing MMS and GIS programs.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A feasibility study will be conducted to evaluate the feasibility of linking GIS with MMS. MMS and GIS protocols, hardware, and software systems will be evaluated and the cost effectiveness of various computer linkages will be examined and delineated. With digital photographic and cartographic information available, maintenance staff can collect, prepare, retrieve, manipulate, and review thematic data composites relating to a wide range of maintenance activities. Computer based georeferenced inventories will significantly increase management's ability to document, demonstrate, illustrate, and track the effectiveness of the monument maintenance program.

Personnel: The existing cooperative agreement with the Advanced Resources Technology Lab (ART) at the University of Arizona will be modified to assist with this work. Monument maintenance and resources management staff will assist with all activities.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-059 Conduct Feasibility Study to Link the Geographic Information System with the Maintenance Management System	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Cooperative Agreement	20,000	-	-	-
Personnel Services	0.000	-	-	-
Other	0.000	-	-	-
TOTAL	20.000	-	-	-
Funds Available in Park Base	0.000	-	-	-
Additional Funds Needed	20.000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-100

2. Project Title: **Monitor and Control Africanized Honey Bees**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non Native Animals
C26 - Other Issues

4. Problem Statement: The Africanized honey bee poses a substantial threat to monument staff and visitor safety. Africanized bees are expected to enter the monument by mid-1994. Complete Africanization of the majority of feral honey bee populations in the monument is expected to take two years. Feral European honey bee colonies are both a potential ecological resource and an ecological problem. While they are general pollinators, they are also non-native species which could outcompete and displace native pollinators.

The potential problem is exacerbated by the approaching populations of Africanized honey bees, which are descendants of bees that escaped from colonies in Brazil in 1956. The Africanized bee has been migrating northward since then, and arrived in Brownsville, Texas, in 1991. Their movements have received national attention and efforts have been made to immediately eliminate them when possible. Literature and experience portray this strain as being unpredictable and fiercely defensive.

In 1988, research was initiated in the monument by scientists of the Carl Hayden Bee Research Center, thus establishing a baseline of data. Techniques involved field observations and using a series of swarm traps to trap bees for analysis. The objectives were 1) determining the present population of feral honey bees, 2) determining their habitat preferences, 3) monitoring native nectar and pollen-producing plants by observing honey bee use and by pollen dietary analysis, 4) monitoring changes in density and habitat preferences of feral bees as Africanized bees enter the monument, 5) determining impacts of Africanized bees on visitors, plants, and animals, 6) developing non-destructive, non-toxic means to manage feral bee populations in specific areas of the monument if necessary, and 7) developing educational materials.

There is serious concern for visitors and the natural environment when the expected Africanized honey bee becomes established. Organ Pipe Cactus offers many nest sites, thus it is water and available nectar and pollen plants that will be crucial for this bee. Most colonies are expected to choose nest sites near water sources, and so will have potentially severe impacts on humans and animals.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monitoring and controlling of Africanized honey bees will not be conducted. The on-going research used to develop the baseline will not be continued. Techniques to protect humans and natural resources will not be developed and education will not be provided.

B. **Monitor and Control Africanized Honey Bees.** Research and building of the database will continue. When the Africanized honey bees enter the monument and become established, then there will be baseline data to monitor trends and document effects on the natural system. An action plan will be developed

outlining techniques for control and/or management actions to increase the safety of humans and protect natural resources.

6. Description of the Recommended Project or Activity: Option B. is recommended alternative. An action program will be developed to monitor and control Africanized honey bees. Components of the program will include:

- Monitoring for the eventual arrival of the Africanized honey bees. Once the bees arrive, then research will focus on their dispersion through the monument and on assessing their impacts to the natural environment.

- Developing an integrated pest management action plan to control the species. The 1990 approved IPM plan for Africanized honey bees prepared by the Southern Arizona Group Office will be used as a model for the monument specific program. Areas of high risk to visitors and staff will be identified. Methods and techniques for control will be established and implemented. Equipment necessary for safety will be purchased.

- Conducting an aggressive public health and safety effort. Safety information will be developed and distributed. Resources management, interpretive staff and the park safety officer will direct the development of personal and non-personal safety messages.

- Establishing an Africanized honey bee coordinator to oversee the monument's integrative pest management effort for this species.

Personnel: Research will be conducted by the USDA, Carl Hayden Bee Research Center, in cooperation with monument resources management staff and scientists from the National Park Service's Cooperative Park Studies Unit, University of Arizona, Tucson, AZ and/or National Biological Survey. IPM efforts within the monument will be directed by resources management staff. A member of the resources management staff will be designated as the Africanized honey bee coordinator.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(7), US Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the monument Superintendent. If a pesticide is needed, appropriate IPM request forms will be completed and submitted to the Western Regional Office. Pesticide use that may affect endangered species will require consultation with US Fish and Wildlife Service.

8. Funding

FUNDING

ORPI-I-100 Monitor and Control Africanized Honey Bees	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,800	1,800	1,800	1,800
Other	3,000	3,000	3,000	3,000
TOTAL	4,800	4,800	4,800	4,800
Funds Available in Park Base	1,800	1,800	1,800	1,800
Additional Funds Needed	3,000	3,000	3,000	3,000

PROJECT STATEMENT

Park and Region: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-101

2. Project Title: **Develop an Integrated Pest Management Plan**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non-Native Animals
N05 - Degradation of Park Resources Due to Non-Native Plants
C01 - Inadequate Planning Documents

4. Problem Statement: The monument has several occasions where plant and animal species become pests. In order to comprehensively deal with problems, a monument-wide Integrated Pest Management (IPM) Plan is needed to deal with pests occurring in households, museums, and campgrounds, as well as those creating public health problems. While individual IPM action plans have been written for some species, a broader scope is essential for handling pest problems and ensuring the use of standardized IPM approaches to protect human health and safety, natural and cultural resources, and property.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The existing process of dealing with pest problems as they occur will continue. Detailed information will be available on some species, but not on all. There will not be a comprehensive monument-wide approach to pests, nor will there be standardized practices or designated responsibilities. The monument will not comply with NPS-wide policy for integrated pest management.

B. **Develop Integrated Pest Management Project Statements and Incorporate Them into the Natural and Cultural Resources Management Plan (RMP).** Integrated pest management issues will be identified through the RMP scoping process. Project statements will be developed to address issues and will be incorporated into the RMP.

C. **Develop an Integrated Pest Management Plan.** An Integrated Pest Management Plan (IPM) will be developed which will provide a comprehensive and unified approach to addressing IPM issues. This alternative will ensure that management will be in compliance with NPS guidelines for integrated pest management. This action will entail writing an IPM plan for general and specific pest problems that periodically develop and need repeated attention. The plan will: 1) identify overall pest management problems, 2) define a comprehensive approach, 3) cover IPM decision processes, 4) provide separate action plans, and 5) describe individual responsibilities as well as interdivisional relationships. Action plans (subsets of the IPM plan) may be prepared for individual species, such as cockroaches, or for general problems, such as museum pests.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Alternative B., however, will serve as the interim activity (as opposed to no action) until an Integrated Pest Management Plan is developed. Alternative B. will serve the interim benefit of providing integrated pest management project statements for issues that have been identified. This will ensure that IPM management issues are addressed in resources management activities and research programming and funding priorities.

When funding becomes available, a full IPM plan will then be developed to guide integrated pest management activities and provide for long-term program direction at Organ Pipe Cactus National Monument. The first step will be to survey the monument and determine what plant and animal pests (native and non-native) exist, and where they occur. Second, staff will describe the IPM approach and decision process, operational procedures with personnel responsibilities, pest species and problem areas, pesticide use and storage, certification and training, and general actions to be taken for prevention and treatment. Third, information will be gathered about species, and action plans written for either individual species, i.e., cockroaches, or groups, i.e., household pests. Monument staff and other NPS specialists will prepare the plan and update it when necessary.

Personnel: This plan will be developed by monument resources management staff in consultation with Southern Arizona Group and Western Region IPM coordinators.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), US Department of the Interior. However, pesticide use that may affect endangered species will require consultation with US Fish and Wildlife Service. NHPA compliance under section 106 is required for treatment of cultural resources.

8. Funding

FUNDING

ORPI-I-101 Develop an Integrated Pest Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5.000	-	-	-
Other	1.000	-	-	-
TOTAL	6.000	-	-	-
Funds Available in Park Base	0.000	-	-	-
Additional Funds Needed	6.000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-102

2. Project Title: **Manage Pest Species**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non Native Animals
N05 - Degradation of Park Resources Due to Non Native Plants
C17 - Control of Environmental Impacts

4. Problem Statement: Pests are generally a low level problem at Organ Pipe Cactus, but they are a persistent problem requiring constant attention. Certain insects, vertebrates, and plants occasionally cause problems that require periodic control measurements. Integrated Pest Management (IPM) techniques have been used for the past ten years and will continue to be used as treatment for household, structural, and museum pests and for non-native plants and animals.

Scorpions, conenose bugs, cockroaches, spiders, and mice are considered pests when they enter buildings. Monitoring with sticky traps has been done for a few years, and the presence of pests, especially cockroaches, in the visitor center has been a particular nuisance. Currently, work is being done to make physical barriers, by improving door thresholds and seals. Other treatments for cockroaches include applying boric acid to sewage lines and sealing accesses to employee houses.

Termite infestations have occurred in structures, including historic buildings. Consequently, infestations have been treated directly, as well as preventative pesticide applications made to new structures.

Museum pests in the interpretative exhibits were a problem in the past. Staff treated the problem and have continued to monitor since. Collection specimens need to be examined for damage, and treated as necessary.

Honeybees are widespread in the monument, and are generally encountered around water sources, such as springs, seeps, and ponds. There have been no problems with humans interacting with the bees. Monument staff in cooperation with researchers of the Carl Hayden Bee Research Center, Agricultural Research Service, are collecting pollen for study. The researchers have also placed over 50 swarm traps, to monitor for Africanized honeybees. Staff attended a workshop for bees, wasps, and hornets in January 1989, and learned to deal with these species when they become pests. A separate project statement covers managing potential Africanized bee problems.

A major inventory of non-native plants was compiled for the monument in 1990, and new discoveries will be added when found. These species will be assessed to determine which constitute pest problems and which can be removed.

In the case of tamarisk, the staff has monitored known habitat for several years and has successfully eradicated small plants by pulling. Chemicals have not been used to date, and regular monitoring will continue.

The staff uses IPM techniques and receives training to maintain their expertise. This must continue in the future to ensure that monitoring and treating of pest problems is done within NPS guidelines and policies.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **Do Not Manage Pests Species.** Monument resources management staff will not manage pest species. As a result, problem plants and animals will remain troublesome. For example, termites will damage structures; cockroaches will invade food and paper supplies; dermistid beetles will damage collection items; and tamarisk will become established. The monument will not comply with NPS guidelines and policies.

B. **Manage Pest Species.** Monument resources management staff will continue to manage pest species using IPM techniques. Staff will continue to develop skills through training and experience. An awareness of problems will be maintained and treatments applied as necessary. Staff will implement the IPM plan and update it as necessary. Monitoring and documentation will continue to be standard practices. This action will ensure compliance with NPS guidelines and policies.

6. Description of the Recommended Project or Activity: Option B. is the recommended action. Integrated pest management is the decision making and action process used by the NPS to deal with pest species. Appropriate techniques will be taken when treating collections, archeological, and historical materials. Personnel will be certified for pesticide application.

This action covers routine activities in the monument for the treatment of pest species. If a species needs special attention, a separate project statement will be written to cover those activities, such as for Africanized bees. Currently, funding for routine activities comes from the park base. If more money is needed, it will be requested.

Personnel: Monument resources management staff will implement all IPM activities in consultation with Southern Arizona Group and Western Region IPM coordinators.

7. Compliance: The NPS IPM Coordinator in the Washington Office is preparing a Servicewide environmental assessment. Many IPM activities are categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(7), US Department of the Interior. If a pesticide is needed, appropriate IPM request forms will be completed and submitted to the Western Regional Office. Most actions done will need no further compliance under NEPA, unless it directly affects endangered species or is a special situation as determined by the park. NHPA compliance under section 106 is required for this project when historical structures and features are treated. Researchers must apply for and receive a scientific collecting permit from the Superintendent.

8. Funding

FUNDING

ORPI-I-102 Manage Pest Species	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,800	1,800	1,800	1,800
Other	200	200	200	200
TOTAL	2,000	2,000	2,000	2,000
Funds Available in Park Base	2,000	2,000	2,000	2,000
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-103

2. Project Title: **Develop and Implement a Comprehensive Boundary Fence Maintenance Program**

3. Servicewide Issue: NO4 - Degradation of Park Resources Due to Non-Native Animals
C17 - Control of Environmental Impacts

4. Problem Statement: Without adequate fence maintenance along the monument's southern, northern and eastern boundaries, livestock (primarily cattle), will gain access to park lands. This encroachment, as evidenced in the past, will lead to resource degradation and possible displacement of native species. In addition, fencing is needed to delineate park boundaries, which along the southern border, are being encroached on by agricultural lands, and on the east and north by grazing lands.

Currently there are approximately 70 miles of four stranded barbed wire fence along monument boundaries. The majority is located along the 30 mile southern boundary that borders the state of Sonora, Mexico. Fence locations vary from the heavily visited area around Lukeville, AZ, to the remote ridges of the Ajo Mountains. Along the southern boundary, fence cuts are a weekly occurrence, requiring a great deal of monitoring and maintenance. On the monument's west boundary, the fence is being removed to facilitate movement of the Sonoran pronghorn antelope between the Cabeza Prieta National Wildlife Refuge and the monument.

Most of the fence has been repaired numerous times. In many locations along the southern boundary, the fence posts have rotted at the base and have toppled over. Most of the fence along the south and northeastern boundaries should be replaced. In the many areas where the fences cross washes, they are often repaired more than once a year and should now be completely reassembled. Repair efforts in the past have been mostly carried out by volunteers. Although volunteers provide a source of good assistance, they are not a long-term, reliable solution.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Fences will not be inspected and all fence breaks will go unrepaired. No additional fencing will be installed. Trespassed livestock and non-native animals will freely cross into monument land.

B. **Continue With Present Program of Repairing Fence Breaks Only When They are Noticed and Annually Inspect all Fence Lines Using VIP Help.** This effort will not provide the needed replacement of older and damaged sections, nor will it provide a guarantee of controlling trespassed livestock.

C. **Repair Only the Most Damaged Sections.** While this will meet the need of providing emergency care to the sites that most desperately need it, it will not provide for long-term maintenance of the entire fenceline.

D. **Develop and Implement a Comprehensive Boundary Fence Maintenance Program.** A program outlining a schedule of routine fence inspections, repair and cyclic replacement of older damaged sections will be implemented. This alternative will provide for a systematic approach to an ongoing problem. Integration with the monument geographic information system (GIS) will also be accomplished. As a result, monument resources will be protected from non-native species.

6. Description of the Recommended Project or Activity: Option D. is the recommended alternative. Initially, a full assessment of the fenceline will be conducted. The total length, status, construction and age will be examined. An evaluation will be conducted to determine high, moderate and low risk areas. As a result of this evaluation, priorities will be established for fence replacement and routine monitoring. The various sections of fenceline will be prioritized according to urgency of need for treatment. Three types of action will be called for to address the various conditions of the fenceline, including rebuilding along the proper alignment, replacing due to the ravages of age, and/or repairing.

Personnel: Monument resources management staff will conduct the assessment. Permanent staff will be required to annually inspect and repair the fenceline.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 C(3), C(20), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-103 Develop and Implement a Comprehensive Boundary Fence Maintenance Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	32,000	22,000	22,000	22,000
Other	5,000	5,000	5,000	5,000
TOTAL	37,000	27,000	27,000	27,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	37,000	27,000	27,000	27,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-104

2. Project Title: **Monitor and Control Trespass Grazing**

3. Servicewide Issue: N04 - Degradation of Park Resources Due to Non Native Animals
C17 - Control of Environmental Impacts

4. Problem Statement: A monitoring program is needed to analyze impacts of trespassed livestock. Guidelines need to be developed to control this intrusion. Trespass grazing occurs routinely in the eastern portion of the monument adjacent to Tohono O'odham lands. Fencing the boundary is frequently not successful due to the rough country, lack of fence maintenance and the impact of flooding. Neither have efforts for a land exchange with the Tohono O'odham been successful in the past. Occasional trespass grazing also occurs along the northern boundary with BLM lands and along the southern boundary with Mexico. The monument has limited records of these encroachments, since many of these areas are remote and rarely visited.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Grazing will continue to be tolerated and no action will be taken to correct the situation. This is contrary to NPS policies.

B. **Monitor and Control Trespass Grazing.** An in-depth analysis of trespass grazing will be undertaken and the impacts monitored. The frequency of trespass will be recorded and reported to cattle owners. Plots will be established to document changes in vegetation and wildlife occurring as a result of grazing and its eventual removal. Work towards administrative solutions will continue.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. Trespass locations and frequencies will be inventoried and monitoring plots will be established to record impacts and trends. The monument will continue to work with neighbors for solutions. A report will be prepared outlining the situations and recommendations for change. Plots will be read and a schedule for rereading proposed. A monitoring handbook will be developed to guide staff in protocol implementation. Training will be provided to staff on monitoring methodology.

Personnel: This work will be contracted. Monument resources management staff will implement recommended protocols.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-104 Monitor and Control Trespass Grazing	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	0,000	0,000	0,000
Personnel Services	1,800	1,800	1,800	1,800
Other	1,000	1,000	1,000	1,000
TOTAL	32,800	2,800	2,800	2,800
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	32,800	2,800	2,800	2,800

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-150

2. Project Title: **Develop a Fire Management Plan**

3. Servicewide Issue: N07 - Disruption of Natural Fire Regimes
C01 - Inadequate Planning Documents

4. Problem Statement: The monument does not have a plan for comprehensively managing fires and, consequently, is not in compliance with Western Region policies and Guideline NPS 18: Wildland Fire Management. The staff, however, follows appropriate procedures by taking immediate action to protect human life and property, as well as natural and cultural resources. There is field evidence of natural fires, such as charcoal, burned stumps, and vegetation patterns, but these have not been managed by the monument.

Lightning caused fires occur, seemingly infrequently, in Organ Pipe Cactus National Monument, and are a factor of the environment. Human caused fires have increased in certain areas of the monument, such as along the border and along Highway 85. Their frequent occurrence during the past decade has had negative effects on the natural systems. Native vegetation communities are being converted to non-native plants, such as red brome grass and Russian thistle, which are well adapted to frequent fires and readily spread afterwards. Additionally, prehistoric archeological sites and historic structures could be damaged by wildfires, particularly along the border.

Staff needs to be fully trained and certified to operate a program of suppression and prescribed natural fires. There is the potential for the monument to work with neighbors to allow prescribed natural fires to cross boundaries, especially with the adjacent Cabeza Prieta National Wildlife Refuge, Bureau of Land Management, Tohono O'Odham Indian Reservation, and Mexican agencies.

There is not a clear understanding of fire's role in this ecosystem. It is also not known what influence both former grazing practices and current trespass grazing may have on reducing ignitions nor the effects of frequent fires. General observations do give insight to these questions, but a monument-wide study of fire occurrence and effects is needed to truly implement a comprehensive program. This need must be recognized in the plan.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument will not develop a Fire Management Plan, nor have an organized program. Fire effects on natural and cultural resources will not be studied. Staff will continue at the current level of training and expertise. The monument will not be in compliance with either NPS-Western Region policies of having a fire management plan or NPS Guideline 18: Wildland Fire Management.

B. **Develop a Fire Management Plan.** A Fire Management Plan will be developed for the monument in accordance with NPS guidelines and policies. Appropriate research will be undertaken to ensure a comprehensive and effective product. By writing a fire management plan for a comprehensive program,

the monument will be in compliance with Western Region policies and NPS 18. Additionally, staff will be better trained and certified to operate a program which takes into account protection of humans and property, and of cultural and natural resources, and recognition of environmental factors.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. An interdisciplinary team will convene to develop and write the plan, which will address augmenting staff capability through training, certification, and experience to manage the programs and conducting research into the role and effects of fire, particularly examining the influence of frequent burns and past grazing. An assessment will be made of potential danger to human life and property, as well as to cultural and natural resources. Ecological and cultural resources objectives will be determined regarding fire effects. Neighbors will be offered the option of developing a joint plan, or at the least, interagency agreements for fire response. After the plan is approved by the Regional Director, it will be updated every three years or less, as required by the Regional Office.

Personnel: The monument's Chief Ranger will coordinate efforts to develop this plan, with assistance from the Chief of Resources Management and Research.

7. Compliance: This project requires writing an environmental assessment which must be reviewed by appropriate agencies and individuals, such as US Fish and Wildlife, Arizona Game and Fish, State Historic Preservation Office, Bureau of Land Management, Tohono O'Odham, and private neighbors. Compliance with NHPA under section 106 is required. When fires are burning, whether lightning or human caused, protection of archeological and natural resources will be conducted in compliance with relevant legislation (NHPA, NEPA, etc.) and National Park Service regulations.

8. Funding

FUNDING

ORPI-I-150 Develop a Fire Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,000	500	500	500
Other	200	0,000	0,000	0,000
TOTAL	1,200	500	500	500
Funds Available in Park Base	1,200	500	500	500
Additional Funds Needed	0,000	0,000	0,000	0,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-151

2. Project Title: **Conduct a Fire Management Program**

3. Servicewide Issue: N07 - Disruption of Natural Fire Regimes
C17 - Control of Environmental Impacts

4. Problem Statement: Following the approval of a comprehensive plan for managing wildfires and prescribed natural fires, staff must implement the program. Qualifications and certifications must be raised to a level adequate for the operation of the full program. Training is needed in managing and monitoring natural fires as well as in expanding wildfire suppression capabilities. Additional equipment and supplies are needed as well as an upgrading of existing equipment. Resources advisors for natural and cultural resources must be designated.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** By not following through on the plan, the monument will not be in compliance with Western Region policies and NPS Guideline 18: Wildland Fire Management. Staff will not be trained to the level necessary to handle wildfires and prescribed fires. Interagency agreements will not be developed. Records will not be kept. Safety, prevention, and hazard reduction will not be carried out.

B. **Conduct a Fire Management Program.** A fire management program will be implemented based on the completed Fire Management Plan. This action complies with Western Region policies and NPS 18 and best serves the needs of the monument to protect human life and property, as well as the natural and cultural resources.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. As a follow up to the approved Fire Management Plan, staff will implement the plan and work with other agencies to manage fires in and around the monument. Staff will be trained and certified to meet the requirements set forth in the plan. Joint suppression agreements, and possibly prescribed natural fire agreements, will be completed with adjacent agencies in the United States and Mexico, as appropriate. Complete fire records and an atlas will be maintained for documentation and future research. Safety, prevention, and hazard reduction programs will be conducted. Research will identified and supported to assess and monitor fire effects and history. The program will be reviewed annually and revised if necessary.

7. Compliance: The Fire Management Plan will have met compliance requirements according to NEPA and NHPA. Actions taken to conduct the program will undergo further compliance procedures if needed, for example, fire lines will have an archeological clearance and effects on endangered species will be considered.

8. Funding

FUNDING

ORPI-I-151 Conduct a Fire Management Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	20,000	20,000	20,000	20,000
Other	5,000	5,000	5,000	5,000
TOTAL	25,000	25,000	25,000	25,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	25,000	25,000	25,000	25,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-152

2. Project Title: **Conduct Fire History and Ecology Research**

3. Servicewide Issue: N07 - Disruption of Natural Fire Regimes
C17 - Control of Environmental Impacts

4. Problem Statement: Information about fire history and ecology is insufficient to provide a complete understanding of the role of fire in this desert ecosystem. Only limited research has been done in Sonoran desert communities, thus there is an inadequate databank to draw upon. Site specific research is needed for Organ Pipe Cactus National Monument.

Both lightning and human caused fires occur in Organ Pipe Cactus National Monument. Although few lightning fires have been recorded, they are known to occur. Field evidence consists of charcoal, burned stumps, and vegetation patterns, mostly in the higher elevations. Good records of human caused wildfires during the past decade, however, have shown abnormally high frequencies in places along the international border. Vegetation changes have occurred, with the loss of native plants and replacement with non-native weeds.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The responses of plant species and communities to fire will not be studied or monitored. As a result, information regarding the ecological effects on plants and animals will not be available.

B. **Conduct Fire History and Ecology Research.** A monument-wide fire history study using field evidence of fire occurrence and records or other documents will be completed. The occurrence, location and spread will be mapped in a fire atlas. Frequency will be determined per given site.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended alternative, as it complies with Western Region policies and NPS Guideline 18: Wildland Fire Management. By examining fire history and effects, an improved understanding of fire's ecological role will result, thus aiding management. For example, the high frequency of human caused fires in certain areas along the border appear to have an adverse effect on the plant community. If this is verified by research, then staff can enhance the fire program by stressing prevention and augmenting suppression efforts. Another example includes determining the natural frequency and occurrence of fire in this ecosystem. Additionally, studying the role of fire in the Sonoran desert will contribute significantly to the literature on this topic and will have wide applications throughout this desert biome.
Field evidence of fire will be gathered from throughout the monument, and records on past fires will be collected. The occurrence, location and spread of fires will be mapped in a fire atlas, for possible inclusion in the monument's geographic information system. The frequency per each site will be determined.

Based on the historical information, determination will be made of specific communities and species to study for ecological effects. Long term monitoring plots will be established to track trends of plant and

community responses. Along the border, where abnormal frequencies are occurring, certain species, such as columnar cacti, may need to be studied. The effects of past uses of the land on fire frequency and effects will be examined. For example, past grazing altered vegetation communities, and may have caused fire occurrence to be less or more than was natural.

Ecological information will be incorporated into the updated Fire Management Plan and program to ensure that fire is managed in a manner to preserve ecological processes and reduce adverse impacts. While the focus is on vegetation communities, effects on wildlife and their habitats may also be included.

Personnel: Initial work on for this project will be contracted. Monitoring will be conducted by monument resources management staff.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 7.4 B(4), E(2), U.S. Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project. The principal investigator must apply for and receive a scientific collecting permit from the Superintendent.

8. Funding

FUNDING

ORPI-I-152 Conduct Fire History and Ecology Research	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	20,000	0,000	0,000	0,000
Personnel Services	5,000	5,000	5,000	5,000
Other	0,000	800	800	800
TOTAL	25,000	5,800	5,800	5,800
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	25,000	5,800	5,800	5,800

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-200

2. Project Title: **Develop a Wilderness Management Plan**

3. Servicewide Issue: N18 - Visitor Use Impacts on Backcountry Park Resources
C01 - Inadequate Planning Documents

4. Problem Statement: A Wilderness Management Plan specifically designed for the monument does not exist. There are no guidelines for research, search and rescue, and other management projects and activities which occur within designated wilderness. A management plan needs to be developed and implemented to promote and protect the wilderness ethics, values and experiences the monument has to offer.

Public Law 94-429, signed November 10, 1978, designated 312,000 acres as wilderness and 1240 acres as potential wilderness within Organ Pipe Cactus National Monument, resulting in 95% of the monument designated as wilderness. A Backcountry Management Plan for the monument was approved in 1985. The plan directs, regulates and provides for backcountry visitor use, as well as defines regulations, backcountry use zones, carrying capacities and other special orders. It does not, however, specifically address wilderness management or concerns.

Management is guided by the 1964 Wilderness Act and the National Park Service Wilderness Management Policy. National Park Service Management Policies state that each park with designated wilderness is required to develop a Wilderness Management Plan (NPS 1988). The central objective of every wilderness plan should be ensuring perpetuation or restoration of the wilderness character of the area. Designated wilderness requires higher standards for protection of visitor experiences than would normally be found in backcountry plans for park areas managed as natural zones (NPS 1991f).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** A Wilderness Management Plan will not be developed for the monument. The current Backcountry Management Plan will continue to serve as the primary source for management of the wilderness. This action will accept the current status quo of managing a wilderness area of over 300,000 acres without a Wilderness Management Plan. This is ineffective and substandard management for wilderness areas as large and remote as those occurring in Organ Pipe Cactus National Monument. In addition, no action is in violation of NPS policy.

B. **Develop Wilderness Management Project Statements and Incorporate Them into the Natural and Cultural Resources Management Plan (RMP).** Wilderness management issues will be identified through the RMP scoping process. Project statements will be developed to address issues and will be incorporated into the RMP. This alternative continues to be in violation of NPS policy.

C. **Develop a Wilderness Management Plan.** A Wilderness Management Plan will be developed that provides a comprehensive and unified approach to addressing wilderness issues. This alternative will ensure

that management is in compliance with NPS policies and guidelines, and will address the current problems and guidance for managers of the Organ Pipe Cactus Wilderness.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended option. Alternative B., however, will serve as the interim activity (as opposed to no action) until a Wilderness Management Plan is developed. Alternative B. will serve the immediate benefit of providing wilderness management project statements for issues that have been identified. This will ensure that wilderness management issues are addressed in resources management activities and research programming and funding priorities.

When funding becomes available, a full Wilderness Management Plan will be developed to guide activities and provide for long-term program direction at Organ Pipe Cactus National Monument. Development of a wilderness plan will detail everything from wilderness history, laws, and special uses to specific park policies and uses. Issues which must be addressed include: limits of acceptable change (especially for areas of critical habitat and sensitive ecosystems), wilderness ethics, signing, wilderness values and experiences, impacts from aircraft overflights, trails and levels of maintenance, and impacts from research, management, and visitor use activities. The issue of an additional 1240 acres as potential wilderness will be reviewed formally, and if acceptable, will be proposed to Congress for inclusion in the National Wilderness Preservation System as part of the existing Organ Pipe Cactus Wilderness.

Personnel: The Wilderness Management Plan will be developed by the monument in conjunction with Southern Arizona Group and Western Regional Office resources management staff.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. This project should include a public review period.

8. Funding

FUNDING

ORPI-I-200 Develop a Wilderness Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	3.000	3.000	3.000	3.000
Other	500	500	500	500
TOTAL	3.500	3.500	3.500	3.500
Funds Available in Park Base	0.000	0.000	0.000	0.000
Additional Funds Needed	3.500	3.500	3.500	3.500

References:

National Park Service, United States Department of the Interior. 1988c. National Park Service Management Policies. 160 pp.

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-201

2. Project Title: **Develop a Trail Use Management Plan**

3. Servicewide Issue: N18 - Visitor Use Impacts on Backcountry Park Resources
C01 - Inadequate Planning Documents

4. Problem Statement: There is currently no formal program for managing trails, or assessing their impacts on monument resources. There are several miles of trails in the monument varying from heavily designated primary routes to primitive paths along abandoned roadways. There is minimal maintenance of trails. Sheet and gully erosion occur in some areas as a result of no maintenance or poor layout of trails. It is unknown if any of these trails cut through critical threatened and endangered species or sensitive species required habitat. Some trails cut through cultural sites and are a source of erosion. Cultural resources surveys are needed for all trails identified on currently available maps. A monitoring program for cultural resources must be established before a regular maintenance program is initiated.

The majority of environmental impacts from recreational trails result from inappropriate trail construction and maintenance. Thorough site analysis, careful planning and design, and thoughtful maintenance and monitoring, guided by the concept of sustainability, will benefit backcountry resources, while affording a reasonable standard of safety and comfort for the traveler (NPS 1991f).

An assessment of impacts of trails and their use on cultural sites and natural resources is needed. Affects vary from trails crossing archeological sites, erosion as a result of trail location, and visitor access that facilitates vandalism. Some trails may need to be relocated for the protection of natural and cultural resources.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Minimal trail maintenance will continue unless extreme mishap occurs to a trail. There will be inadequate information about the amount and type of visitor use regarding the trail system. With this action, no effort will be made to collect additional or use existing data. Erosion impacting cultural and natural resources will be mitigated only in critical situations. Without a comprehensive plan, there will be no routine patrols and maintenance to repair damage, monitoring of changes, and protection of resources.

B. **Develop a Trail Use Management Plan.** A Trail Use Management Plan will be prepared. The plan will outline a comprehensive program for trail management in the monument. Issues to be addressed in the plan will include trail sustainability, impacts resulting from trail locations and use, design and construction, maintenance and monitoring.

6. Description of the Recommended Project or Activity: Option B. is recommended alternative. Basic data will be collected about the numbers and locations of trails, their conditions, associated cultural and natural resources, visitor numbers and type of use, conflicting uses, erosion, patrol and maintenance needs

and related concerns. Existing trails will be assessed regarding their impacts on cultural and natural resources. Some may be closed or relocated, and new ones may be created. A program for rehabilitation and routine maintenance and monitoring will be outlined. Integration with a geographic information system will provide managers with an easy method for analyzing and foreseeing potential problems with both present and future trails. The NPS Trails Management Handbook will be followed. The plan will be reviewed and updated on an annual basis.

Personnel: Development of the Trail Use Management will be contracted and monument staff will review and provide final approval.

7. Compliance: It is probable that an environmental assessment will be necessary since the existing trail system affects natural and cultural resources and changes will probably occur as a result of the plan. The NHPA compliance under section 106 will also be required.

8. Funding

FUNDING

ORPI-I-201 Develop a Trail Use Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	30,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	30,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	30,000	-	-	-

References:

National Park Service, United States Department of the Interior. 1991f. Natural Resources Management Guideline (NPS-77). 693 pp.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-202

2. Project Title: **Develop a Cave Management Plan**

3. Servicewide Issue: N21 - Loss of Fragile and Irreplaceable Cave Resources
C01 - Inadequate Planning Documents

4. Problem Statement: A comprehensive plan for managing cave resources at Organ Pipe Cactus National Monument is needed. There are several caves in the monument, but inventory and mapping details are incomplete. There has not been an assessment of cave conditions, preparation of maps, description of cultural and natural resources values, nor an analysis of vulnerability due to vandalism or degradation. Very little has been done to manage caves.

Caves provide habitat for several species of wildlife, most notably bats. Their dark, cool conditions also create specialized environments for highly adapted species, such as spiders and albino crickets. Certain plants also become associated with caves due to the specialized environments. Within the monument, most known caves are shallow and might be classified as rock shelters. These areas are used by bighorn sheep, javelina, bats, and rodents. Two sites in the monument are possible night roosts for the lesser long-nosed bat, an endangered species. Caves also provide habitat for potential pest species, such as Africanized bees. Prehistoric and historic people used caves for shelter, storage, and ceremony. Caves are also of geologic importance and formation information is valuable in understanding relationships of monument resources.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** With this alternative, the status quo will be continued. There will be no complete inventory of caves or their contents. No plan will be developed to effectively manage caves for the protection of resources. Changes will not be monitored, and research, if any, will not be coordinated. Without a cave management plan, the monument will not be following Western Region guidelines for cave management.

B. **Develop a Cave Management Plan.** An inventory of caves will be conducted, and associated natural and cultural significance analyzed. Based on this inventory, a cave management plan will be developed. As a result of this action, the monument will be in compliance with Western Region guidelines and also possess a baseline for managing and protecting cave resources.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A cave management plan will be developed for the monument. An inventory of all cave resources will be conducted. Maps will be prepared, including descriptions which note special considerations for each cave. The vulnerability of each will be assessed, particularly regarding vandalism. The plan will define research and detail a monitoring system for protecting resources and documenting trends. It will categorize caves according to natural and cultural assessments and identify those that can be safely opened to the public.

Personnel: Development of the cave management plan will be contracted, with monument staff providing review and final approval. Monument resources management staff will implement monitoring protocols.

7. Compliance: This project will likely require an environmental assessment according to NEPA, particularly if action is proposed that will affect sensitive species. Compliance with NHPA section 106 will be required if cultural resources are involved. Researchers must apply for and receive a scientific research permit from the U.S. Fish & Wildlife Service, Arizona Game & Fish, and the Superintendent of the monument.

8. Funding

FUNDING

ORPI-I-202 Develop a Cave Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	20,000	20,000	0,000	0,000
Personnel Services	0,000	0,000	5,000	5,000
Other	0,000	0,000	500	500
TOTAL	20,000	20,000	5,500	5,500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	20,000	20,000	5,500	5,500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-203

2. Project Title: **Determine Visitor Impacts and Use Limits**

3. Servicewide Issue: N18 - Visitor Use Impacts on Backcountry Park Resources
C18 - Control of Visitor Impacts

4. Problem Statement: No comprehensive study of visitor impacts, use, and limits has been conducted for Organ Pipe Cactus. Visitor use is concentrated in certain areas, such as the visitor center and campground, backcountry campsites, scenic drives, Quitobaquito, and cultural sites. More visitors are using the backcountry trails and roads. Increasing visitation and potential overcrowding greatly lessen the quality of recreational experiences and cause numerous natural and cultural resources degradation problems, including those associated with visitor-oriented structures and facilities.

Based on these facts and other related circumstances, particularly staff shortages, it is important that visitor impacts on monument resources be clearly identified and analyzed. There must be a determination of the maximum number of visitors that can be accommodated per day under the current limits of facilities and management. Since vandalism, robbery incidents, poaching, and killing of wildlife along Highway 85 are increasing, the threats to resources and visitor safety need to be assessed.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No study of visitor impacts and use limits will be conducted. Management actions for public safety and resources protection concerns will suffer from the lack of data. Negative visitor impacts may be exacerbated or go undetected. Visitors will not support monument issues due to lack of understanding and involvement.

B. **Determine Visitor Impacts and Use Limits.** A study of visitor impacts, both current and anticipated, on resources and facilities, will be conducted, and a determination made on uses and their limits. This will provide staff with definitive tools for understanding visitor types and trends and more effectively managing conflicts with resources and facilities. The staff and visitors will both benefit.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A study of visitor impacts, uses, and limits will be conducted. Survey data will serve to determine the physical, biological, cultural, environmental, and social conditions which define the monument's recreational uses. Emphasis will be placed on use in designated wilderness areas. Once the ideal use conditions and limits are established, they can be continuously reviewed and updated with long term monitoring.

The study will include information about impacted areas and their deterioration rates, susceptibility of specific soils and vegetation types to impacts; preferred visitor areas and types of uses, and threats to resources. Visitor use statistics will be gathered, recorded, and analyzed on a continuing basis. A correlation will be made between use and impact. Once impacts are identified, management will endeavor

to mitigate them. Use limits will be based on the studies, and maximum allowable levels may be established for selected areas. As additional information becomes available, the use limit figures will be readjusted as necessary.

Personnel: This work will be contracted, with monument staff providing review and final approval.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 D(1), E(2), U.S. Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project. Researchers will receive a scientific collecting permit from the Superintendent.

8. Funding

FUNDING

ORPI-I-203 Determine Visitor Use Impacts and Use Limits	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	40,000	20,000	-	-
Personnel Services	0,000	0,000	-	-
Other	0,000	0,000	-	-
TOTAL	40,000	20,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	40,000	20,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-250

2. Project Title: **Conduct Comprehensive Monitoring and Maintenance of Abandoned Mine Safety Features**

3. Servicewide Issue: N10 - Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities
C26 - Other Issues

4. Problem Statement: Ninety-two hazardous mine and well openings within the monument pose a threat to visitors and wildlife. All of these hazardous mines and wells have safety features (e.g. fencing, gates) which need to be maintained on an annual basis.

In 1983, a mine and well safety survey was conducted by the monument. Over 400 mine and well features were recorded. Of these features, 92 were determined to be hazardous. Mitigation included the construction of fencing around abandoned mines and wells, and the placing of metal grates where needed. Most of these sites are located in federally designated wilderness areas and safety materials needed to be flown in by helicopter.

All known abandoned mine workings are also signed in English and Spanish. Annually, all 92 hazardous sites are inspected and safety features are repaired. In the past, this task was completed by a volunteer. To comply with Arizona Law (ARS-318), and to insure the safety of the public, all of these fenced workings must be regularly inspected and necessary repairs made. Access to the majority of these sites, while requiring some moderate to strenuous hiking, is not too difficult for many visitors. This requires that the Service keep the signs and fencing in good repair to provide for visitor safety.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Potential abandoned mine lands hazards will not be inspected and corrected on a timely basis and monitoring for potential wildlife use will go unrecorded. This alternative leaves the state of needed repair of fencing and signing at abandoned mine workings unknown and unmaintained, thus possibly jeopardizing public safety.

B. **Conduct Minimum Monitoring and Maintenance.** Inspection, replacement of signs, and repair of fences at a few easily accessible abandoned mine workings will be done. This will postpone the harder to reach sites for future inspection and maintenance. This alternative does not solve the problem of unmonitored and unmaintained hazardous sites.

C. **Conduct Comprehensive Monitoring and Maintenance of Abandoned Mine Safety Features.** A comprehensive program of monitoring and maintenance of safety features at hazardous abandoned mine lands sites will be conducted. As a result of this action, an optimal level of visitor safety at these areas will be achieved.

6. Description of the Recommended Project or Activity: Alternative C. is the recommended course of action. A yearly monitoring program for the fences, signs, and wildlife use at all hazardous abandoned mine and well sites will be conducted. Repair of fencing and replacement of signs will be done on a cyclic basis, thereby maintaining a high standard of public safety. The program will include the following:

- Monitoring of all sites yearly by monument staff. All sites will be visited and inspected for a minimum of once a year to ascertain the condition of fencing and signing. Sites will be georeferenced, acquiring data with a global positioning system (GPS) and downloading the data into the park's geographic information system (GIS). The georeferencing will help in locating reclaimed or restored sites for monitoring.

- Data collected will include date, site number, condition of safeguards, and signs of wildlife use.

- Any other pertinent information, such as vandalism, amount of repair needed, and any repairs done at the time of the inspection will also be recorded.

- All missing signs will be replaced and all damaged fencing repaired on a minimum cycle of every three years.

Personnel: An increase in permanent resources management will be required to implement the above program.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), C(5), US Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project.

8. Funding

FUNDING

ORPI-I-250 Conduct Comprehensive Monitoring and Maintenance of Abandoned Mine Safety Features	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	7,200	7,200	7,200	7,200
Other	2,000	2,000	2,000	2,000
TOTAL	9,200	9,200	9,200	9,200
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	9,200	9,200	9,200	9,200

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-251

2. Project Title: **Conduct Study of Wildlife Use of Abandoned Mines**

3. Servicewide Issue: N10 - Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities
C26 - Other Issues

4. Problem Statement: Abandoned mine sites need to be evaluated to determine their impacts on or value to wildlife. There are over 400 abandoned hazardous and non-hazardous mines and wells within Organ Pipe Cactus National Monument. When information on the locations of these operations was being collected, the use of some sites by wildlife was noted. Of particular interest is the fact that one horizontal mine tunnel provides habitat for the largest known maternity colony of the lesser long-nosed bat (*Leptonycteris curasoae*). Evidence also suggests that mine holes not hazardous to humans are fatal to species such as the desert tortoise (*Gopherus agassizii*), which once in, are unable to get out. Before any further actions can be carried out to interpret or rehabilitate these sites, a determination must be made as to their importance to wildlife. Because many of these operations date from the latter half of the nineteenth century, any dependence on them by wildlife has probably developed over a long period of time. With increasing impacts on the monument's fauna, it is imperative to determine how vital these abandoned mines are to the present and continued existence of specific wildlife species.

To date, 92 hazardous mine shafts have been signed in English and Spanish, and have been fenced and/or grated for visitor safety. Photographs of each site have been taken and these sites have been marked on 15 minute topographic maps.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will allow for continued operation under the status quo, but will leave the monument without any understanding of interactions between wildlife and mine shafts. Any future decisions on the obliteration or rehabilitation of these sites will be based on insufficient data. The Service's mandate of protection and preservation of natural resources will not be met and the existence of some wildlife species within the monument could be endangered.

B. **Conduct Study of Wildlife Use of Abandoned Mines.** A study will be conducted to evaluate the use of abandoned mines by wildlife. Fence and grate closures installed in 1983 will be studied to see if they are restricting or in any other way compromising habitat of species of concern. Where restriction is occurring, management will consider changing the type or style of closure. The results of this study will

be used by management to ensure that actions taken with respect to abandoned mines consider not only human safety, but also the needs of wildlife.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. An inventory of all abandoned mine lands will be conducted to evaluate use by wildlife. Those abandoned mine sites upon which wildlife may be dependent for survival, or at hazard from, will be studied. Wildlife censusing and observation techniques will be utilized and a report prepared from the findings. The results of this report will be used to make management recommendations concerning appropriate actions defining the role of these sites as park resources for wildlife protection and preservation.

Personnel: Work on this project will be contracted. Monument resources management staff will review and approve all documents.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-251 Conduct Study of Wildlife Use of Abandoned Mines	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	25,000	25,000	10,000	10,000
Personnel Services	0,000	0,000	0,000	0,000
Other	0,000	0,000	0,000	0,000
TOTAL	25,000	25,000	10,000	10,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	25,000	25,000	10,000	10,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-252

2. Project Title: **Develop Mine Hazards Safety Program**

3. Servicewide Issue: N10 - Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities
C26 - Other Issues

4. Problem Statement: Abandoned hazardous mines and wells within Organ Pipe Cactus National Monument pose safety threats to park visitors and employees. A mine and well safety survey conducted in 1983 identified over 400 abandoned mining features and wells. Of these, 92 were determined to be hazardous. These were signed in English and Spanish and were fenced and/or grated. Many park employees, visitors and illegal aliens encounter these abandoned mines and wells in the backcountry. It is important that safety information be provided to all affected groups who may encounter these features.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The present program of annually inspecting mines to ensure that safety features are intact, and well signed in both English and Spanish, will continue, dependent on volunteer assistance.

B. **Develop Mine Hazards Safety Program.** An education program will be developed to make the hazards of abandoned mines and wells known to park visitors and staff. This alternative will result in visitors and staff having knowledge regarding safety in and around abandoned mines and will reduce the risks of incidents at these areas.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. The program will include utilizing the free brochure illustrating the hazards of the abandoned mines and wells produced by the Mining and Minerals Branch of the NPS. The brochure, which is available in English, will be translated into Spanish and German flyers, will be distributed at the visitor desk and other appropriate areas.

Those sites which are significant historically, such as Victoria Mine, as well as heavily visited, will serve as a focal point, not only for introducing the mining history of the monument, but also for providing an area for the emphasis of safety. Interpretive displays will be developed illustrating the hazards of abandoned mines and wells on-site as well as at the Visitor Center.

Incorporated into all interpretive messages for visitors using the backcountry will be information on the dangers of abandoned mine lands. Signing of hazardous mines and wells will continue and may serve as the only means of reaching illegal aliens crossing through the backcountry.

Personnel: This project will be coordinated by resources management and interpretive staff. Funding will be necessary to supplement interpretive efforts.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), D(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-252 Develop Mine Hazards Safety Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,500	1,500	1,500	1,500
Other	400	400	400	400
TOTAL	1,900	1,900	1,900	1,900
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	1,900	1,900	1,900	1,900

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-253

2. Project Title: **Rehabilitate Selected Mines**

3. Servicewide Issue: N10 - Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities
C26 - Other Issues

4. Problem Statement: With increasing visitor use and a better understanding of wildlife use at Organ Pipe Cactus National Monument, steps must be taken to protect both visitors and wildlife from hazardous and non-hazardous abandoned mine lands. There are over 400 mining holes, scrapes and shafts within the monument. None of these mining sites are currently operational. Mining was officially closed within the monument in the late 1970's. Of the 400+ holes, 92 are considered hazardous and are equipped with either grate covers and/or barbed wire fences. Annually, each of these hazardous sites is inspected and repairs are made to the safety devices. In the past, most of this work has been conducted by a volunteer.

All of these abandoned mine workings were fenced and signed in 1983. This work followed an intensive reconnaissance in which information was collected primarily on visitor safety, and secondarily, on the use of these sites by wildlife. Before any further actions can be carried out for interpreting, obliterating, or rehabilitating these sites, a determination must be made as to their importance to wildlife. Since many of these abandoned operations date from the latter half of the nineteenth century, any dependence on them by wildlife has probably developed over a long period of time. With increasing impacts on the monument's fauna, it is imperative to determine how vital these abandoned mines are to the continued existence of specific wildlife species. Once it is determined which sites are vital for wildlife use, those remaining can be obliterated and revegetated.

With increasing visitation use, greater pressure is being placed on the monument in the form of recreational use. This pressure requires that additional steps be taken to protect the visitor. A project statement calling for the evaluation of those sites on which it appears wildlife may be dependent for survival is included in this plan. It is intended that findings from such a study will be used to define the future role of these sites as park resources for wildlife protection and preservation. A more permanent solution is needed to resolve the hazards presented by sites with neither natural nor cultural resource values, and to rectify the impact on aesthetic values caused by these excavations. Such solutions must be economically sound and aesthetically acceptable, be within the capabilities of monument staff or contract, and must also satisfy any constraints imposed by NPS management policies.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Discontinue present fencing and signing policy. The monument will jeopardize visitor and employee safety.

B. **Continue the Present Fencing and Signing Policy.** This action alternative will maintain the status quo of routine inspection and repair of fencing, as well as result in continuing erosion of the soil around collars and on spoils. It will also mean that no efforts will be undertaken to find a permanent solution, e.g. closure, that will eliminate completely the hazard imposed by those sites that have neither cultural nor natural resource values.

C. **Cover Open Shafts With Nets.** This alternative is a viable one for both historically significant sites and for sites that have natural resource values. It could prove useful for all abandoned mine workings where public access must be curtailed because of cultural values and where access to wildlife, but not to humans, must be maintained. This alternative does not provide for site obliteration and rehabilitation and therefore does not correct the eyesore of permanent scars on the natural landscape.

D. **Closure by Blasting.** This method was tested at Saguaro National Monument and once at Organ Pipe Cactus National Monument. The objective was to determine if blasting was an effective and cost-efficient means to close vertical mine shafts. This test was also designed to evaluate the feasibility of recontouring adjacent ground to a near natural profile by utilizing explosives to move shaft-associated spoil banks. This alternative did not prove feasible. Due to the shock-absorbing makeup of spoil material, explosives failed to move them as hoped. To do the job, the amount of explosives necessary would be economically unreasonable and environmentally unsatisfactory.

E. **Closure by Filling With Spoils and Rehabilitating Site.** Mine sites determined not to have cultural or natural values of significance will be closed using existing spoils and rehabilitating the site. This alternative presents a permanent solution to the problem of aesthetics and visitor safety.

6. Description of the Recommended Project or Activity: Option E. is the preferred action. Fences can and will be climbed; signs can and will be stolen; explosives are not cost effective; and nets are not a resolution that allows for the sites to be recontoured and revegetated. Returning the landscape to a more natural condition through filling, recontouring, and site revegetation is the preferred final solution to abandoned mine sites in Organ Pipe Cactus National Monument.

There are two approaches to this type of closure of abandoned mines. The first method is to use mechanical equipment to place the spoils back in the opening. Where wilderness is not involved, and where it is feasible to get equipment to the sites with minimal effects on the natural resource, this is the preferred method. Where remote sites are involved, hand labor will have to be used to fill shafts. This method is more labor intensive, but is also more resource compatible.

Such a project will be accomplished by contract. One monument staff person per site will be necessary in order to monitor for both natural and cultural resource protection. This project will be long-term and any estimates of how many sites will be rehabilitated or netted each year will be entirely dependent on the available funding. When the study on mine shaft/wildlife relationships is completed it will be easier to estimate costs for the shafts to be filled.

Personnel: Monument staff in conjunction with Southern Arizona Group and Western Regional Office personnel will coordinate the evaluation of sites to determine natural and cultural resource significance. Mine closures will be accomplished through a contract.

7. Compliance: NEPA compliance will be obtained for all phases of this work. Prior to undertaking the project, the park staff, in consultation with the Regional NEPA Compliance Officer, will determine whether an EA will suffice or whether a full scale EIS is needed. The required document will then be prepared before any work is undertaken. NHPA compliance requires that prior to any work being attempted, an archeological clearance be obtained. In addition, each site will be monitored during rehabilitation operations to insure that archeological resources are protected. If archeological resources are found, the Park or Regional Archeologist will be notified immediately, so that clearance can be obtained before operations proceed.

8. Funding

FUNDING

ORPI-I-253 Rehabilitate Selected Mines	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	50,000	50,000	50,000
Personnel Services	5,000	5,000	5,000	5,000
Other	2,000	2,000	2,000	2,000
TOTAL	57,000	57,000	57,000	57,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	57,000	57,000	57,000	57,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-300

2. Project Title: **Develop and Implement Aircraft Overflight Monitoring Program**

3. Servicewide Issue: N02 - Impacts on Threatened and Endangered Animals
C26 - Other Issues

4. Problem Statement: The monument needs to develop and implement an aircraft overflight monitoring program to assess the impact of aircraft use in the monument. A solid monitoring program will allow for study of the impacts of overflights on natural and cultural features and on visitor experiences.

Organ Pipe Cactus National Monument lies within the Sells Military Air Space. Two military training routes cross the northern half of the monument. The western boundary and portions of the north boundary are adjacent to the 2.6 million acre Barry M. Goldwater Bombing Gunnery Range which is used by the Air Force, Marines, and National Guard.

The number of sorties flown every year is unknown, but the monument receives a great number of aircraft overflights both within and outside their flight span. It is common to see military aircraft flying less than 500 feet above the ground, both near the residential area and in high visitor use zones. Sonic booms occur frequently as do "dog-fighting" incidents. Unknown material being deliberately expelled from planes has been observed. There have been military aircraft crashes in the monument, the most recent being in 1987. These crashes have a major impact on monument resources, and may threaten employee and visitor safety. The impacts on wildlife, particularly endangered species such as the Sonoran pronghorn, are unknown. Impacts on visitor enjoyment and cultural resources are also undocumented.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Monument staff will not gather valuable low level overflight data. This will prevent the monument from adequately addressing the current problem. As a result of this alternative, it will be difficult to request funding for overflight impact projects, as no documentation will exist on the level, number and types of overflights.

B. **Continue with the Current Aircraft Reporting System.** The current system is contingent on one person phoning in incidents to the U.S. Air Force when that person or his/her designee is in the park and when the incidents are reported. There are no standardized and approved monitoring protocols nor documentation forms for employees to follow. Adoption of this alternative assumes that the status quo is acceptable. This is clearly not the case due to all of the violations seen and the disturbance incidents occurring.

C. **Develop and Implement an Aircraft Monitoring Program.** This alternative will give the monument necessary documentation of the problem and will help support the need for overflight impact studies.

6. Description of the Recommended Project or Activity: Option C. is the recommended alternative. This project will include developing an aircraft monitoring program and identifying means of cooperating and communicating with the Air Force, Marines, and National Guard. It will also outline management's use of aircraft outside and inside wilderness.

A draft aircraft monitoring program already exists and will require little modification to implement. The program will be implemented by all monument staff from maintenance and park rangers to volunteers. A monitoring form will be developed and implemented and will be similar to ones in use in other parks and monuments, such as Grand Canyon National Park and Saguaro National Monument. The program will provide solid documentation of overflight incidents.

Personnel: The monument resources management staff will coordinate the development of the monitoring program in conjunction with other division staff. Recording of incidents will be conducted by all employees.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM2 App. 2, 1.6, and 516 DM6 App. 7.4 B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-300 Develop and Implement Aircraft Overflight Monitoring Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	2,000	2,000	2,000	2,000
Personnel Services	1,000	1,000	1,000	1,000
Other	3,000	3,000	3,000	3,000
TOTAL	6,000	6,000	6,000	6,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	6,000	6,000	6,000	6,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-350

2. Project Title: **Develop a Man and the Biosphere Action Program for the Sonoran Desert**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: The Sonoran Desert Biogeographic Region in southern Arizona and northern Sonora, Mexico, is an area exposed to a multitude of threats and issues, impacting both natural and cultural resources and the people living in the region. Land is managed by an array of governmental, private and tribal organizations. Adverse land management practices in one area affect other areas as well. While preservation of resources is a high priority in one region, economic needs drive management in another. Issues are not only cross-boundary; they are cross-cultural and international in scope as well.

Organ Pipe Cactus National Monument, which is a part of this biogeographic region, is like many other National Park areas, in that the greatest threats to its resources are a result of the effects of development on adjacent lands. The primary resources management concern is the continued urbanization and agricultural development near its southern boundary, in the neighboring state of Sonora, Mexico. Of concern to management is the effect on native plants and animals of herbicide and pesticide drift, trespass grazing, invasion of non-native flora and fauna, and most significantly, groundwater depletion in the Sonoyta Valley. A primary concern is that continued or increased pumping in Mexico may lower the groundwater table and also reduce the hydrostatic pressure at certain locations within Organ Pipe, such as at Quitobaquito, where an endangered species, the Quitobaquito desert pupfish (*Cyprinodon macularius eremus*) occurs. As of 1988, there were approximately 22,455 irrigated acres in production in the Sonoyta Valley, supported by 165 wells. Annual groundwater pumpage is approximately 83,160 acre feet, which is 2.5 times the aquifer recharge rate. Although there is now a moratorium on the drilling of new wells, current wells are pumping at 50% below their potential capacity of 191,000 acre feet.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Continue status quo where conflicts between land owners are often unresolved or lead to resource degradation.

B. **Develop a Man and the Biosphere Action Program (MAB) for the Sonoran Desert.** A program will be developed to coordinate and discuss land management issues on a regional cooperative level. The Biosphere Reserve Concept of the Man and the Biosphere Program (MAB) will encourage an integrated regional program for the Sonoran Desert.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. This program will deal with identified problems and communication needs that must be developed among neighbors within the Sonoran Desert Biogeographic Region. Four specific activities are identified with this alternative:

- Fully define the geographic area of the Sonoran Desert Biosphere Reserve Region within the United States. This will involve identifying the lands adjacent to the present biosphere reserve at Organ Pipe Cactus National Monument, as well as other areas of influence, including the Pinacate Protected Area in Sonora, Mexico. Management philosophies of involved agencies will be examined, recorded and analyzed in regards to their impact on neighboring lands. Elements reviewed will include natural resources management, traditional uses, and management practices, consumptive uses, socioeconomic conditions and trends, existing agreements and cooperative relationships. An assessment and evaluation proposing additional core biosphere reserve areas will be conducted. A base map will be developed outlining various characteristics of the region and the interests of the residents. These will be compared with the UNESCO model of protected core areas, traditional use areas, and buffer zones, to see which lands provisionally fit into these three designations.

- Identifying resource issues of regional concern. Both natural and cultural resources management issues of concern will be identified through written surveys and interviews. Each land area will be examined. Issues will be reviewed in context to management philosophy and objectives, as well as relevance to other areas in the region. Land management practices and uses in one area that detrimentally affect resources in another area will be identified. Alternatives to providing cooperating relationships will be evaluated to deal with present and potential future issues. Research and management practices bringing benefits to all participants will be prioritized.

- Preparing a position paper on resource issues of common concern for all involved land owners and managers. This position paper will summarize results from the survey, assess the magnitude of the economic, social and ecological costs associated with problems, present advantages or benefits of solving problems and identify how a MAB orientation may be helpful in solving them. Among resource issues of potential common concern are: groundwater depletion and contamination, fuelwood depletion and desertification, soil erosion and duststorms, pesticide drift, non-native weed dispersal and competition with crops or rare plants, illegal poaching of bighorn, pronghorn and other fauna, off-road vehicles and illegal quarrying.

- Developing a consultative MAB framework to promote discussion and cooperation among groups and individuals in the region. Based on interviews with various managing agencies and groups, the MAB concept of a consultative framework will be developed for the region. The strategy will be to develop deeper dialogues between groups and individuals playing key roles in the Sonoran Desert Biogeographic Region. Representatives of the various agencies and organizations will meet with park officials, both to discuss the objectives of the consultative MAB framework and develop responses, ensuring that all relevant interests are integrated in the process.

Following the intensive interviews and presentation of the position paper to all participants, a workshop will be held to bring together representatives of the diverse interests of the region. The agenda will include a review of the proposed inter-agency/inter-organization agreement to institutionalize the consultative MAB framework, similar to the Appalachian Region model. The format and location of the workshop will be determined through the interviews.

Personnel: The project will be contracted.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-350 Develop a Man and the Biosphere Action Program for the Sonoran Desert	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	15,000	15,000	-	-
Personnel Services	5,000	5,000	-	-
Other	20,000	20,000	-	-
TOTAL	40,000	40,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	40,000	40,000	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-351

2. Project Title: **Conduct Man and the Biosphere Multi-cultural Interpretive Programs**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: The monument currently does not have a domestic or international environmental education program. On October 26, 1976, the United Nations Education, Scientific and Cultural Organization (UNESCO) recognized and designated Organ Pipe Cactus National Monument as a Man and the Biosphere (MAB) Reserve, i.e., International Biosphere Reserve. "This network of protected samples of the world's major ecosystem types is devoted to conservation of nature and scientific research in the service of man. It provides a standard against which can be measured the effect of man's impact on his environment." The monument uses this MAB concept throughout its management efforts.

The greatest resource threats facing the monument are a result of the effects of development on adjacent lands. Some of the monument's natural resources monitoring projects involve data collection along the international border, and specifically within the Sonoyta, Sonora, Mexico area. The population of this town is approximately 25,000. The closest educational centers in Mexico to Organ Pipe Cactus National Monument are in Sonoyta, Sonora, and in surrounding farming/agricultural communities.

The opportunity for international educational programs is excellent. There are some environmental education organizations that exist in Mexico already, but they are usually found in larger metropolitan cities. It would be invaluable to encourage an environmental ethic of natural and cultural resource preservation within the children and teenagers in the neighboring communities. In the long term, this will help protect the monument's resources, as well as the rich cultural and biological diversity found in Northern Sonora, specifically in the Pinacate Biosphere Reserve.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will not address the issue of educating our local and international community about the monument's critical resources management issues. There will be no education of conservation land use practices and ethics which affect the preservation of the monument and its surrounding ecosystem.

B. **Establish Educational Programs Only in the United States.** This alternative will not provide environmental education in neighboring communities in Mexico, an area where many of the monument's

primary resource threats originate. Valuable opportunities for education concerning land use practices will be lost.

C. **Establish Educational Programs Only in Mexico.** Although this alternative provides information to international neighbors where many threats originate, it does not address local populations.

D. **Conduct Man and the Biosphere Multi-cultural Interpretive Programs.** This alternative addresses the issue of providing information to both our local and international neighbors about the National Park Service concept and the monument's biological diversity and critical resources management issues.

6. Description of the Recommended Project or Activity: Option D. is the recommended alternative. This project will require a long-term commitment to establish and institutionalize the education program. A bilingual individual from the monument staff will be most suitable for the leadership of the program. A plan will be developed which includes in-park education programs for students from the U.S. and Mexico, as well as an outreach program to the local schools in Ajo, Sonoyta, and on the Tohono O'odham reservation. This program will be conducted through the coordinated efforts of the monument's resources management and interpretation divisions. Programs will include:

- Bilingual slide shows in the Visitor Center.
- School programs for teachers to use in math and biology classes.
- Environmental education programs (nature walks) for school groups who visit the monument.
- Bilingual exhibits in the Visitor Center.
- Interpretive programs dealing with cultural adaptations to arid regions,
- Spanish books and tapes in the Cooperative Association book display in the Visitor Center related to the natural and cultural history of the area.

Personnel: This project will be conducted by monument staff. An additional permanent staff member will be required to develop and implement the program.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 D(3), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-351 Conduct Man and the Biosphere Multi-cultural Interpretive Programs	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	45,000	45,000	45,000	45,000
Other	5,000	5,000	5,000	5,000
TOTAL	50,000	50,000	50,000	50,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	50,000	50,000	50,000	50,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-400

2. Project Title: **Develop a Collections Management Plan**

3. Servicewide Issue: N24 - Other Issues
C09 - Need for Collection Management Plan, Collection Storage Plan, and Collection Condition Surveys

4. Problem Statement: The monument currently does not have a Collections Management Plan. Management of the collection of archeological, ethnological, and historical materials is an on-going concern. The museum collection, currently located at the monument, contains over 10,000 items. Most of the monument's cultural and archeological items are stored at the Museum Collections Repository-Western Archeological and Conservation Center (MCR-WACC) in Tucson, AZ. The monument staff is responsible for the preservation of the collection in perpetuity. To assist in this work, a Collection Management Plan as required by NPS 28: Cultural Resources Management, must be written.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** The monument will not develop a Collections Management Plan and will not be in compliance with NPS 28. The staff will continue to manage the collection in accordance with NPS 28 to the best of their ability. This has thus far been accomplished by sending much of the collection to MCR - WACC and by properly cataloging and curating the items on display in the museum and in the collection repository at the monument's Sonoran Desert Biosphere Reserve Center.

B. **Develop a Collections Management Plan.** A Collections Management Plan will be developed in conformance with NPS 28 to guide the preservation and protection of museum specimens.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative for this issue. This document will include a brief history of the collection with an overview of the present collection (e.g. types of materials stored at the monument), a current Scope of Collections Statement with recommended changes to the statement, current status and recommendations regarding museum records, current status (environment and maintenance) of museum exhibits with recommendations for improvement and housekeeping instructions, current status and recommendations for museum security and fire detection/protection; current status of museum staffing with recommendations for improvement, and future planning needs and sources of funding. With the completion of this plan, the monument will be in compliance with NPS standards.

Personnel: The Collections Management Plan will be written by staff from the monument in conjunction with curators from MCR - WACC and the Western Regional Office.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), E(2), US Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project.

8. Funding

FUNDING

ORPI-I-400 Develop a Collections Management Plan	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	9,000	-	-	-
Other	1,000	-	-	-
TOTAL	10,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	10,000	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-401

2. Project Title: **Manage Library and Museum**

3. Servicewide Issue: N24 - Other Issues
C24 - Insufficient Professional Staff

4. Problem Statement: A curatorial position is needed to manage the museum, archives, photos, maps, and library materials. The Resources Management and Research Division currently operates and maintains the monument's research library, map, archival and museum collection. The museum contains over 10,000 objects, mostly biological specimens. In addition, the library has over 1400 accessions and continues to grow. The map collection is also extensive with over 1200 items. It also continues to grow due to the Sensitive Ecosystems Program and the implementation of the Geographic Information Systems Plan. Presently, a geographer, with the assistance of a volunteer, spend approximately 15% of their time maintaining these resources. This amount of time is not sufficient, and is not always available because of many other resources management duties. Without the necessary permanent infrastructure, the museum and library cannot be managed at an optimal level.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will continue to put a burden on the geographer who is currently responsible for the majority of the administration, accession, and overall museum and library operations. As the responsibilities of the geographer change, it will become impossible to eliminate all accession backlogs and operate a professional scientific library for the Sonoran Desert Biosphere Reserve Center.

B. **Manage Library and Museum.** This action will provide the Resources Management and Research Division with the basis to develop and standardize the infrastructure for the management of the Sonoran Desert Biosphere Reserve Center, which includes the library and museum.. It will relieve the geographer from the work overload associated with the library and museum program.

6. Description of the Recommended Project or Activity: Action B. is the preferred alternative. This alternative addresses the need to ensure adequate management of collections to promote a professionally run and well protected museum and library collection.

Personnel: The curator will be a permanent National Park Service position.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), B(3), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-401 Manage Library and Museum	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	40,000	40,000	40,000	40,000
Other	5,000	5,000	5,000	5,000
TOTAL	45,000	45,000	45,000	45,000
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	45,000	45,000	45,000	45,000

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-402

2. Project Title: **Automate Library Catalog System**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: No computerized accessioning and retrieval system is used for the cataloging of resources management and research library items. The Sonoran Desert Biosphere Reserve Center has a scientific library collection of over 1400 accessions which continues to grow. The items are currently typed on index cards and are stored in a file drawer according to author, title, subject and accession number. This is the only record of library information.

The monument recently obtained Librarian's Assistant, a library management/on-line software program which is capable of cataloging, searching databases, and indexing literature and collection information. The software is used by many public library systems. Most larger parks already have their libraries on line for automated data use and information exchange. The monument needs to computerize its library cataloging system to provide a more efficient, effective, and user friendly operation. Such action will also enable the monument to share databases with other National Park Service areas.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No attempt will be made to automate the monument's resources management and research library. This alternative will leave the monument lagging behind in technological advancements and applications for library systems. The cataloging system will not be improved nor made easier to access.

B. **Automate Library Catalog System.** The monument's resources management and research library will be automated using the software program Librarian's Assistant. As a result of this action, the library collection will be more accessible to users and easier for resources management staff to inventory and maintain.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended alternative. The project will include the transfer of all cataloged library and map items into the Librarian's Assistant software program. A set of keywords will be developed and all existing catalog cards will be marked to indicate appropriate keys. These keywords will be entered with each accession so that searches can be built around them (i.e. keyword - saguaro cactus). Cards will then be entered into the database. All cards will then be printed, verified and corrected. The final database will be placed on-line once all entries are corrected. New items will be immediately accessioned into the system. For the short-term, catalog cards

will still be maintained. The software is capable of producing catalog cards. Over the long-run, however, hard copies of catalog cards will be phased out in favor of a totally automated system.

Personnel: Data entry will be carried out by seasonal staff. The Chief of Resources Management and Research will be responsible for final verification of the database.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), B(4), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project.

8. Funding

FUNDING

ORPI-I-402 Automate Library Catalog System	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	5,500	-	-	-
Other	0,000	-	-	-
TOTAL	5,500	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	5,500	-	-	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western

1. Project Number: ORPI-I-403

2. Project Title: **Obtain and Maintain Historic Photograph Collection**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: A complete and continuing photo collection is needed as a pictorial baseline for reference, as well as to illustrate changes. The monument has a collection of historic photographs and continues an organized photographic file of current projects and natural scenes. There has been no systematic search of libraries, historical societies, museums, university biology, anthropology, and archeology departments, or other repositories to obtain copies of early historic photographs. Old photographs would show the conditions of historic and prehistoric structures and natural scenes. For example, pictures would illustrate structures that are now collapsed, missing, or that have been vandalized. Other photos would show effects of grazing, mining, and fire on the environment. Changes in vegetation and riparian areas would be evident, as would development of Sonoyta, Gringo Pass, and Quitobaquito. The monument's resources are continually changing, which makes prediction of future conditions perplexing. It is difficult to quantify internal and external influences.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative entails not purposely adding old photographs to the collections and not taking pictures for historical and comparative values. There will be no search of off-site repositories for photos.

B. **Obtain and Maintain Historic Photograph Collection.** To make the best use of photographs for the management and protection natural and cultural resources, a systematic inventory of photos on file, plus a search for off-site pictures is necessary. Significant pictures will be added to the collection. The result will be a more complete and valuable collection that will serve as historic reference as well as a monitoring baseline.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. A complete inventory of photographs in the monument will be made. Off-site repositories, such as Museum Collection Repository-Western Archeological and Conservation Center (MCR-WACC) and the Arizona Historical Society, will be searched for pictures that have significant value, particularly as baseline data. A protocol for the types of photos needed and desired will be established. Prints and negatives will be made for all photographs and will be stored properly either at the monument or WACC. Locations to determine the photographic coverage of the monument will be identified. Photo documentation will be initiated in

localities where it is needed, and for monitoring purposes. A computerized photography catalog will be developed and will contain information on photography objects and scenes, with a summary of the extent of the work. A final record will be prepared of repositories and collections searched, as well as others known but not searched.

Personnel: The work on this project will be contracted. Monument resources management staff will provide assistance and review.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), US Department of the Interior. The NHPA compliance under section 106 likewise is not required.

8. Funding

FUNDING

ORPI-I-403 Obtain and Maintain Historic Photograph Collection	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	10,000	10,000	10,000	-
Personnel Services	0,000	0,000	0,000	-
Other	0,000	0,000	0,000	-
TOTAL	10,000	10,000	10,000	-
Funds Available in Park Base	0,000	0,000	0,000	-
Additional Funds Needed	10,000	10,000	10,000	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western

1. Project Number: ORPI-I-404

2. Project Title: **Update and Maintain Automated National Catalog System Program**

3. Servicewide Issue: N24 - Other Issues
C03 - Incomplete Cataloging of Museum Collections (ANCS)

4. Problem Statement: The Automated National Catalog System for the Organ Pipe Cactus National Monument museum needs cyclic update and maintenance. In the fall of 1987, the Automated National Catalog System was issued to the field from the Curatorial Service Division, Washington Office. At the Museum Collection Repository-Western Archeological and Conservation Center (MCR-WACC), all previously catalogued items were entered into ANCS test version. The MCR-WACC database eventually will be transferred to the monument for installation into their computer. The items located at the monument, over 10,000 in number, and are being entered into this program. When the total database is compiled, it will be available for staff and selected users. The database will be located at the monument and will be updated as new items are added to the collection, whether housed at the monument or at MCR-WACC.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** No work will be done to finish entering information into the database. Since there will be an incomplete listing of items, the ANCS program will not be fully used for documents and reports.

B. **Update and Maintain Automated National Catalog System Program.** Monument staff will finish entering information into the database and will maintain the listing for future items. A complete cataloging will be kept at the monument, and the ANCS program will be fully utilized for reports and documents.

6. Description of the Recommended Project or Activity: Option B. is the recommended alternative. Monument staff will be responsible for entering information. While most of the data entry has been completed, additional actions are needed for system maintenance. These activities include:

- Reviewing hard copies of all museum catalog cards produced with ANCS to verify information.
- Inventorying the museum collection and verifying information on labels with ANCS records.
- Integrating the WACC ANCS database with the monument.
- Preparing and cataloging into ANCS specimens acquired since 1992.

Personnel: Data entry will be carried out by seasonal staff. The Chief of Resources Management and Research will be responsible for final verification of the data.

7. Compliance: This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(2), E(2), US Department of the Interior. The NHPA compliance under section 106 likewise is not required.

8. Funding

FUNDING

ORPI-I-404 Update and Maintain Automated National Catalog System Program	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	11,000	500	500	500
Other	0,000	0,000	0,000	0,000
TOTAL	11,000	500	500	500
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	11,000	500	500	500

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western

1. Project Number: ORPI-I-450

2. Project Title: **Develop An Integrated Management Plan for the Quitobaquito Management Area**

3. Servicewide Issue: N20 - Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them
C01 - Inadequate Planning Documents

4. Problem Statement: An integrated plan is needed to guide the management of the valuable natural and cultural resources of the Quitobaquito Management Area (QMA). The QMA includes a number of seeps and flowing springs which form an oasis in the Sonoran Desert. The largest spring, Quitobaquito, historically was utilized for farming and livestock ranching. Today, its waters are impounded by an earthen dam originally constructed in the 1860's and refurbished a hundred years later. Williams (Rincon) Spring is the second largest spring. Its impoundment was dismantled by the National Park Service and returned to a natural condition. Quitobaquito Springs have been declared critical habitat for a listed, endangered species of desert pupfish (*Cyprinodon macularius eremus*). Rare species found within the QMA are the Giant White Checkerspot butterfly (*Ascia howarthii*) and its forage plant *Atamisquia emarginata*. QMA is the only known United States occurrence for this butterfly, while *A. emarginata* occurs only in the QMA and one other place nearby.

Three hundred years of grazing and ranching caused profound ecological change before the National Park Service assumed control of the QMA in 1956. Attempts to clean up, restore, and improve the situation exacerbated rather than mitigated situation. Improper management measures undertaken contrary to professional advice destroyed the QMA historical fabric and damaged the natural resources simultaneously.

An interdisciplinary study undertaken between 1982 and 1985 inventoried QMA resources. Six informal recommendations were made to management based on these studies. All of the following recommendations have been implemented: to restrict management in order to ensure maximum diversity while maintaining the appearance of naturalness; to conduct spring water to the pond through an open concrete canal; to create shoal areas suitable for shorebirds and rearing of Sonoran mud turtle fry; to relocate the pupfish held in the Williams Spring and Bates Well refugia to Arizona State University; to monitor pupfish populations by an ecologically gentle technique; and to relocate the parking lot to a more distant site.

The final management plan must be configured to include suitable monitoring protocols consistent with those of the Sensitive Ecosystem Program (SEP).

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This option will result in continued management of the QMA without tracking the welfare of the unique species, communities and archeological sites that exist there. It is likely that degradation of the QMA may occur without NPS knowledge or management action to prevent it. Species, or entire ecological communities, could be lost before any action was taken to recognize and mitigate the problem.

B. **Continue Present Program.** The National Park Service has a funded pupfish census and periodic inspections, but little other biological or cultural monitoring occurs at the QMA.

C. **Develop an Integrated Management Plan for the Quitobaquito Management Area.** This option will provide the Superintendent with in-depth information on the status of rare species and cultural resources in the Quitobaquito spring and pond area as well as some aspects of their life history. It will also integrate the QMA into the rest of Organ Pipe resources management program. This approach will also assist in institutionalizing the management of QMA.

6. Description of the Recommended Project or Activity: Option C. is the recommended solution for this issue. The development of this plan will consist of the following components:

- Identification of the most significant QMA ecosystem and cultural resources components.
- Examining protocols used in the SEP. Designing QMA protocols, instruments, and analytical procedures congruent with SEP to the extent feasible.
- Testing monitoring protocols, instruments, and analytical procedures under field conditions.
- Preparing a monitoring handbook as a final product and training monument staff.
- Turning future modification of protocols, instruments, and analytical procedures over to the SEP Advisory Committee.

Personnel: This task will be accomplished by contracted scientists and monument resource managers in conjunction with the Cooperative Park Studies Unit, University of Arizona, Tucson, AZ.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), E(2), U.S. Department of Interior. NHPA compliance under Section 106 is likewise not required for this project. The principal investigator must apply for and receive a scientific collection permit from the monument Superintendent.

8. Funding

FUNDING

ORPI-I-450 Develop an Integrated Management Plan for the Quitobaquito Management Area	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	50,000	-	10,000	-
Personnel Services	0,000	-	0,000	-
Other	0,000	-	0,000	-
TOTAL	50,000	-	10,000	-
Funds Available in Park Base	0,000	-	0,000	-
Additional Funds Needed	50,000	-	10,000	-

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-451

2. Project Title: **Prepare & Implement Plan to Comply with Special Directive 91-6 (Borrow Materials Plan)**

3. Servicewide Issue: N24 - Other Issues
C26 - Other Issues

4. Problem Statement: The monument does not have a plan or established guidelines to govern the use of borrowed material sources and spoil areas inside the monument as required by NPS Special Directive 91-6 (August 5, 1991g). This issue must be addressed in future park planning documents (General Management Plan, Natural and Cultural Resources Management Plan, Wilderness Management Plans, etc.). The directive also specifies that the only permitted use of borrowed sources inside proposed or designated wilderness areas is for trails, in accordance with an approved Wilderness Management Plan, which the monument does not have.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** Without a plan, management of in-park borrow material sources and spoil disposal areas will continue to be out of compliance with NPS Special Directive 91-6 and Chapter 9:4 of the 1988 NPS Management Policies. There will be no legitimate specified source areas inside the monument for economical extraction of borrow material such as soil, sand, and gravel for emergencies situations, road repair, trail maintenance, horticultural activities, and historic preservation projects. Sediments cannot be derived from inside wilderness areas for continued trail maintenance. No spoil areas will be legitimately set aside to temporarily deposit contaminated waste materials or hazardous materials that may be introduced into the monument through road accident spills or other similar incidents. Importation of borrow material from outside the monument may introduce exotic vegetation, animal pest species, archeological remains, or paleontological specimens if the borrow source has not been properly cleared through NEPA, NHPA, or similar resources protection procedures. Furthermore, the action of importing materials from unqualified/unstudied sources may be aiding in the destruction of off-monument endangered species or habitat, wetlands, paleontological and archeological sites.

B. **Prepare & Implement Plan to Comply with Special Directive 91-6 (Borrow Materials Plan).** A Borrow Material and Spoil Area Plan will be developed to establish legitimate sources for borrow extraction and spoil disposal in compliance with NPS Special Directive 91-6, Chapter 9 of the 1988 NPS Management Policies, and related natural and cultural resources management policies, guidelines and legislation. The monument will consider its needs for potential emergency situations, water source protection, road repair, trail maintenance, horticultural activities, archeological resources and historic preservation projects, and

will locate borrow source and spoil areas on and off the monument to insure that natural and cultural resources are protected at all locations prior to implementing borrow extraction or spoil deposition.

6. Description of the Recommended Project or Activity: Option B. is the recommended solution for this issue. A borrow pit and spoil area plan will be prepared, which will comply with NPS Special Directive 91-6, Chapter 9 of the 1988 NPS Management Policies, as well as related natural and cultural resources management policies, guidelines and legislation. The overall needs for possible emergency situations. road repairs, water source protection, trail maintenance, horticultural activities, archeology, and historic preservation projects will be managed as required. Borrow and spoil areas will be evaluated (and/or reevaluated) before opening a new area or before each reuse of an existing area, according to the directive. The directive includes those sources and locations outside the monument which may be considered for use.

Personnel: Work on this project will be conducted by the monument's maintenance and resources management staff in conjunction with the archeologist from the Southern Arizona Group Office.

7. Compliance: NEPA and Section 106 of the NHPA compliance must be considered and implemented as necessary in relation to each new or existing borrow pit and spoil disposal area utilized or planned for potential use.

8. Funding

FUNDING

ORPI-I-451 Prepare & Implement Plan to Comply with Special Directive 91-6 (Borrow Materials Plan)	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personnel Services	1,500	200	200	200
Other	0,000	0,000	0,000	0,000
TOTAL	1,500	200	200	200
Funds Available in Park Base	0,000	0,000	0,000	0,000
Additional Funds Needed	1,500	200	200	200

References:

National Park Service, United States Department of Interior. 1991g. Special Directive 91-6 - Borrow Pits.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-452

2. Project Title: **Develop Road Maintenance Standards and Procedures**

3. Servicewide Issue: N22 - Overuse/Impacts to Recreation and/or Landscaped Zones
C18 - Control of Visitor Impacts

4. Problem Statement: After years of maintaining the Ajo Mountain and Puerto Blanco Loop Drives in a graded gravel condition, serious channeling and loss of road beds have occurred to the point where road beds are 12 or more inches below the desert floor. This channeling becomes an increasing problem with successive rain events, as additional soil material is lost.

In the past, dust palliatives have been tried as a means of stabilizing roadway surfaces. This treatment, however, has proved to be very expensive and is effective only for a short period of time, prior to its breakdown and loss. Road surveys have been conducted by State Highway Department officials who have recommended a combination of paving and natural road systems as the only acceptable method of solving the problem, short of major road construction. Recent conversations with a former road construction engineer would indicate that road grading procedures are available that would do much to improve the quality of these gravel roads without resorting to the use of asphalt.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative will allow roads to continue to widen and deepen, unless they are properly crowned and packed, and the proper drainage provided. Management will be continually faced with the problem of frequent maintenance to keep the roads safe and in good repair. Long periods of road shutdowns will continue to occur, greatly affecting visitor use.

B. **Develop Road Maintenance Standards.** This option will provide procedures for use by monument road and trails crews in the routine maintenance of these roads. The standards will help to mitigate and prevent to the extent possible, continued widening and deepening and loss of material. Standards will also outline maintenance procedures to ensure that negative impacts to road-side resources do not occur.

6. Description of the Recommended Project or Activity: Alternative B. is preferred alternative. A good deal of research will be needed to ascertain correct operating procedures and remedial actions needed to mitigate existing road surface problems. States vary in their degree of expertise on grading dirt or gravel roads. More than one highway department may need to be contacted. The end product (a manual) will need to be simple to follow, and must detail procedures to be used under the varied conditions encountered on park roadways.

Personnel: Work on this project will be contracted. Monument maintenance and resources management staff will review and approve all work.

7. Compliance: This project is categorically excluded from NEPA compliance, Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), C(9), U.S. Department of the Interior. NHPA compliance under section 106 is likewise not required for this project. Depending on the recommendations, an Environmental Assessment may be needed to implement the procedures identified in the handbook.

8. Funding

FUNDING

ORPI-I-452 Develop Road Maintenance Standards and Procedures	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	10,000	-	-	-
Personnel Services	0,000	-	-	-
Other	0,000	-	-	-
TOTAL	10,000	-	-	-
Funds Available in Park Base	0,000	-	-	-
Additional Funds Needed	10,000	-	-	-

References:

National Park Service, United States Department of Interior. 1991g. Special Directive 91-6 - Borrow Pits.

PROJECT STATEMENT

PARK AND REGION: Organ Pipe Cactus National Monument, Western Region

1. Project Number: ORPI-I-453

2. Project Title: **Establish a Carrying Capacity for Loop Drives**

3. Servicewide Issue: N22 - Overuse/Impacts to Recreation and/or Landscaped Zones
C18 - Control of Visitor Impacts

4. Problem Statement: The carrying capacities of monument drives need to be established to protect resources and visitor experiences. There are two primary loop drives in the monument. These are the Ajo Mountain Drive (21 miles) and Puerto Blanco Drive (53 miles). The roads are popular and heavily used during the visitor season because they offer scenery, picnic sites, and access to trailheads and unique features.

Heavy use, combined with the variety of activities along the routes, can create undesirable and unsafe congestion, which also detracts from the visitor's experience. The popularity of the drives demands that the roads be kept open, which puts pressure on maintenance staff to grade roads after flooding. There is also the matter of road widening and deepening with progressive grading. Other concerns are that the roads pass populations of sensitive plants and offer backcountry access for poaching, vandalism and other illegal activities. The staff size is not adequate to ensure monitoring of use to protect resources, even to give sound evidence of impacts.

As visitation increases, the problems will get worse. It must be determined as to whether there is a maximum use level for the loop drives that should not be exceeded daily. Resources protection, visitor safety and quality recreational experiences seem to require that a carrying capacity be defined and carefully enforced.

5. Alternative Actions/Solutions and Their Probable Impacts:

A. **No Action.** This alternative means that visitors can have unrestricted access to the loop drives. The problems identified will worsen.

B. **Establish a Carrying Capacity for Loop Drives.** This alternative provides a definitive daily use level for the loop drives based on sociological, cultural and natural resource considerations. It will protect resources and preserve a quality visitor experience.

6. Description of the Recommended Project or Activity: Alternative B. is the recommended action. Resources protection and the quality of visitor experiences will be estimated through a combined analysis of visitor observations and recreation surveys, incident reports and the condition of accessible cultural and

natural resources. The study will examine sensitive environmental and sociological indicators of overuse, crowding and resources deterioration. Once a use limit is defined, staff will design monitoring procedures to regulate traffic and track changes in resources. Roads will be closed once the carrying capacity is reached.

Personnel: Work on this project will be contracted. Monument maintenance and resources management staff will review and approve all work.

7. Compliance: An Environmental Assessment may be required since significant visitor effect may occur. This project is categorically excluded from NEPA compliance as described in Departmental Categorical Exclusions, 516 DM6 App. 7.4 B(4), D(1), US Department of the Interior. The NHPA compliance under section 106 likewise is not required for this project. The researcher must apply for and receive a scientific collecting permit from the Superintendent.

8. Funding

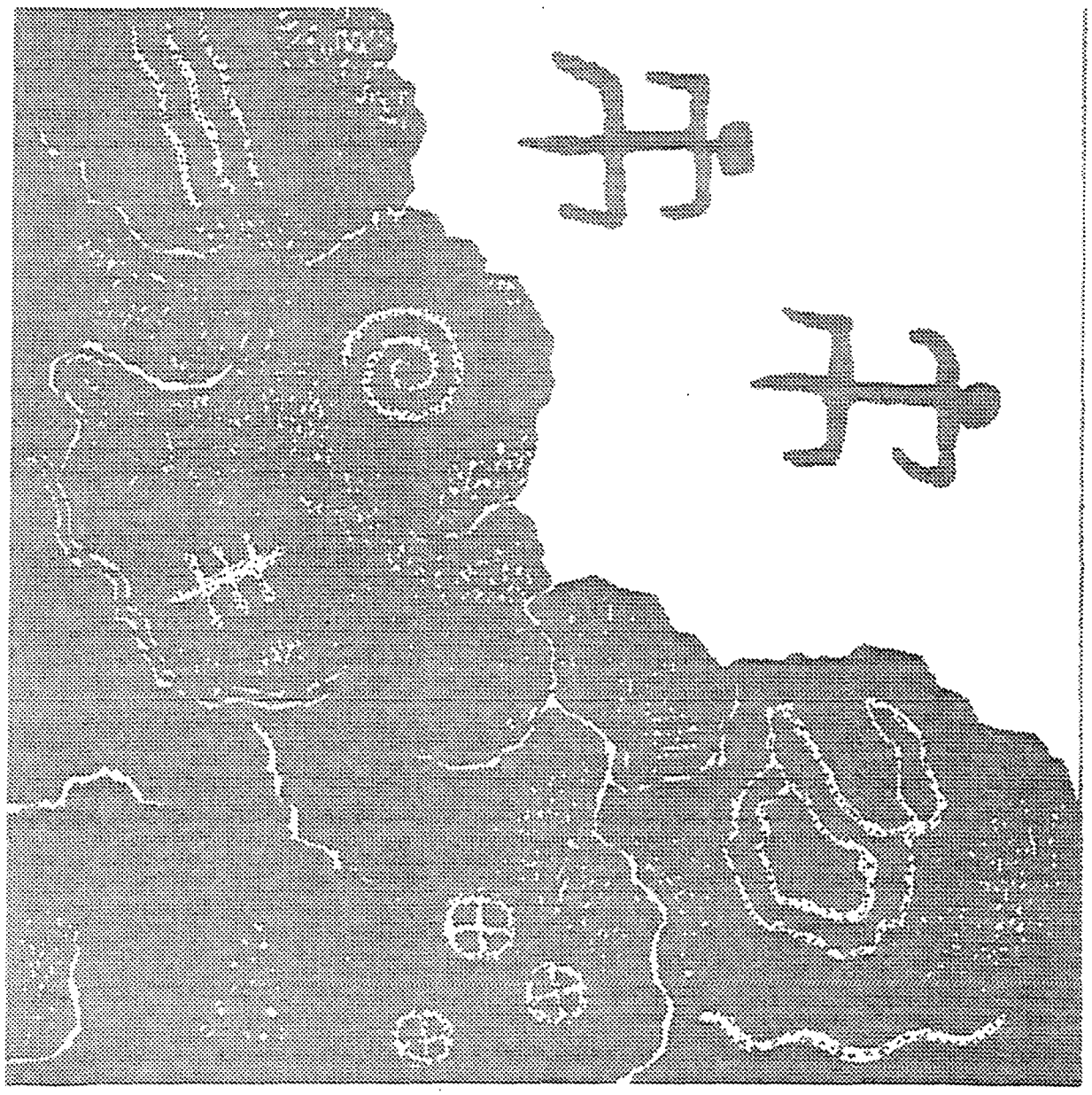
FUNDING

ORPI-I-453 Establish a Carrying Capacity for Loop Drives	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Contract	7,000	7,000	-	-
Personnel Services	0,000	0,000	-	-
Other	3,000	3,000	-	-
TOTAL	10,000	0,000	-	-
Funds Available in Park Base	0,000	0,000	-	-
Additional Funds Needed	10,000	10,000	-	-

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDICES



ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX A: LIST OF PREPARERS



APPENDIX A

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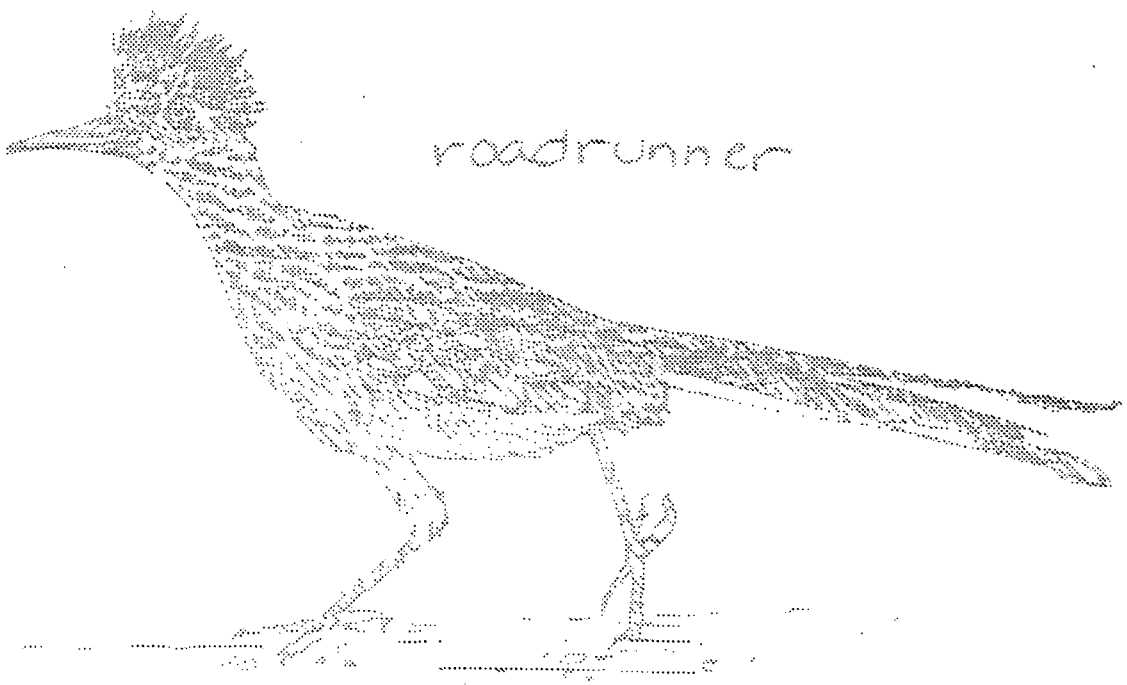
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ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX B: CONSULTATION LIST



APPENDIX B

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ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX C: SUMMARY TABLES



VEGETATION MANAGEMENT

PROJECT #	NAME	ISSUE	PROBLEM	ACTIONS
ORPI-N-001	**Implement and Manage Vegetation Management Program**	Disruption of Native Plant Communities	A commitment of staff and funding is needed to implement and manage the monument's vegetation management program.	A permanent coordinator position to manage and implement the vegetation management program will be established. Responsibilities will include coordinating and supervising revegetation projects, threatened and endangered species plant management and long-term plant monitoring.
ORPI-N-002	**Develop a Vegetation Management Plan**	Disruption of Native Plant Communities	No comprehensive vegetation management plan exists. Guidance is needed for programs such as revegetation, non-native plant species control and sensitive plant species management.	A plan will be developed to address vegetation management issues and activities and provide for long-term program direction at the monument.
ORPI-N-003	**Evaluate Effectiveness of and Develop Standards for the Revegetation Program**	Disruption of Native Plant Communities	The overall effectiveness of the monument's revegetation program is unknown. An assessment is needed to fully evaluate past revegetation projects.	A full evaluation of past revegetation sites will be conducted. An experiment will be conducted to determine the effectiveness of the monument's current program. Standard operating procedures and guidelines will be developed to assist with the implementation of future projects.
ORPI-N-004	**Revegetate Abandoned Road Portals**	Disruption of Native Plant Communities	Several abandoned road portals are visible from primary visitor scenic drives and roadways, leading to vehicular traffic into areas of designated wilderness and disrupting the recovery of natural ecosystems.	A program will be developed to cost-effectively revegetate remaining abandoned roadway portals.
ORPI-N-005	**Develop and Implement a Site Restoration Program for the Dowling Ranch and the Stack Property**	Disruption of Native Plant Communities	Approximately 160 acres of newly acquired land within the monument has been significantly impacted by past use. Action is needed to evaluate the condition of the land and to set-up a program of site rehabilitation and restoration.	A vegetation restoration program will be developed and implemented for the Dowling Ranch and Stack Property. This will include a full evaluation of the lands an examination of the extent of human induced impacts, an investigation of cultural resources, and the development and implementation of a plan for site restoration.
ORPI-N-006	**Develop and Implement a Program to Manage Hazardous Trees**	Other Issues	Certain vegetation types at Organ Pipe Cactus National Monument, due to their size, type and/ or condition pose hazards to visitor and staff safety.	A program will be developed manage hazardous trees in compliance with Western Region Directive #WR-093.

VEGETATION MANAGEMENT

PROJECT #	NAME	ISSUE	PROBLEM	ACTIONS
ORPI-N-007	**Monitor and Mitigate Woodcutting**	Disruption of Native Plant Communities	Woodcutting of tree species, such as ironwood and mesquite along the southern boundary of Organ Pipe Cactus National Monument and in adjacent Sonora, Mexico, threatens both these resources and the myriad of plant and animal species dependent on them. Ironwood is a keystone species in the Sonoran Desert, playing a major role in nitrogen, water dynamics and habitat structure within the desert and desert wash communities (Suzán Azpiri 1992).	An expanded program to monitor and mitigate the impacts of woodcutting will be developed and implemented. Components of the program will include the establishment of permanent monitoring sites, expanded interpretative efforts within and outside the monument and a concerted effort to work on the issue with Mexican neighbors.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-050	**Develop a Wildlife Management Plan**	Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them	A plan must be developed that will guide wildlife management programs at Organ Pipe Cactus National Monument. No such plan is currently being developed or in effect. A Wildlife Management Plan (WMP) is needed to assist in the implementation of programs.	A plan will be developed to address wildlife management issues and guide implementation of programs such as biological diversity, genetic diversity, mitigate management practices adjacent to parks that have negative impacts on wildlife, non-native animal species control, analyze effects of historic animal management practices, population management, outlining the role of interpretation in wildlife management programs and procedures for scientific specimen collecting.
ORPI-N-051	**Implement and Manage Wildlife Management Program**	Lack of Basic Data: Insufficient Understanding of Park Resources and Threats to Them	A commitment of staff and funding is needed to implement and manage the monument's wildlife management program. Management is required for extensive monument programs. Without the necessary permanent infrastructure, these programs cannot be implemented effectively or efficiently.	A permanent coordinator position to manage and implement the wildlife management program will be established. Responsibilities will include coordinating scientific research projects, non-native animal control, threatened, endangered and sensitive species management, long-term wildlife monitoring to determine ecosystem health, and overall wildlife assessments and management. The coordinator will establish the management infrastructure necessary to successfully implement and carry out the wildlife management program.

NATURAL RESOURCES INVENTORYING AND MONITORING

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-100	**Direct Natural Resources Inventorying and Monitoring Program**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Direction and guidance is needed to effectively steer the Organ Pipe Cactus National Monument's natural resources inventorying and monitoring program into the next phase of program integration and synthesis.	A science advisory committee will be established to serve as a steering group to guide the direction of the program. Specific tasks to be initiated will include an examination of final research reports and monitoring protocols and an evaluation of monitoring sites and ecosystem components.
ORPI-N-101	**Manage Natural Resources Monitoring Program**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	A commitment of staff and funding is required to fully manage the monument's natural resources monitoring program.	A permanent coordinator position will be established to manage the natural resources monitoring program. The coordinator will provide the management infrastructure necessary to successfully implement and carry out the natural resources monitoring program.
ORPI-N-102	**Develop Database Management System for Natural Resources Monitoring and Research Program**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	A database management system is needed to manage, analyze, interpret and archive large natural resources monitoring data sets.	An evaluation will be made of the current natural resources monitoring and research program and the type of data collected. Current methods of data storage and retrieval will be evaluated. An action program will be developed and implemented, outlining the desired requirements, including database integration and geographic information system linkage.
ORPI-N-103	**Prepare and Publish Natural Resources Monitoring Handbook and Video**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Several completed natural resources monitoring protocols need to be compiled and edited. In addition, an illustrative means of instructing new resources management personnel in protocol implementation is needed.	Monitoring protocols will be reviewed and the format standardized. In addition, all protocols will be consolidated into one handbook. The handbook will be enhanced with graphics illustrating procedures and techniques. Using the handbook as a source, a descriptive training video will be prepared, providing detailed information on protocol implementation and data management.
ORPI-N-104	**Replace and Supplement Climate Monitoring Equipment**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Automated weather station equipment has begun to break down and exhibits frequent recording malfunctions.	Monitoring equipment at all climate stations will be replaced with new updated equipment. Equipment will be selected based on compatibility with existing data sets, durability in the field and a cost/benefit analysis.
ORPI-N-105	**Map Natural Resources Monitoring Study Sites**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Accurate high resolution base maps are needed for all natural resources monitoring study sites. Maps must include the locations of all permanent plots, which contain mammal grids, lizard and bird transects and perennial vegetation quadrats.	All natural resources monitoring study sites will be mapped using global positioning system technology. Research transects, plots and grids will also be mapped.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-106	**Publish and Distribute Natural Resources Inventory and Assessment Final Reports**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Several completed natural resources inventory and assessment reports need to be edited, published and distributed. These reports provide the baseline from which existing ecological monitoring protocols have been developed.	The backlog of approved final reports will be edited, published and distributed to identified universities, researchers and other sources.
ORPI-N-107	**Develop an Avian Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	A monitoring protocol is needed for avian species in the monument. The status and role of avian populations are considered a vital link in the overall assessment of the monument ecosystem. A draft final report and monitoring protocol for avian species is available, but their validity is questionable.	A thorough evaluation of all work to date will be completed. The existing draft final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of avian populations.
ORPI-N-108	**Develop an Terrestrial Invertebrate Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	A monitoring protocol is needed to monitor terrestrial invertebrate populations in the monument. The status and role of terrestrial invertebrates are considered a vital link in the overall assessment of the monument ecosystem. A monitoring protocol and assessment report for invertebrates is available. The protocol may not be practical or provide useful information.	A thorough evaluation of all work to date will be completed. The existing final report and monitoring protocol will be peer reviewed and methodology validated in the field. Based on the evaluation, the protocol will either be implemented, refined or voided in place of a new effort to develop a useable method for assessing the status of invertebrate populations.
ORPI-N-109	**Update Monument Flora Inventory**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The monument flora inventory needs to be updated. More than a decade has passed since publication of Bower's (1980) flora of Organ Pipe Cactus National Monument. Since then, extensive plant collections and a number of research projects have added substantially to the available botanical information of the area (Felger 1993).	A project will be developed to bring the monument's plant inventory up to date. The project will provide a new information resource for managers and researchers in the form of a detailed bibliography of relevant botanical literature. The project will also produce a new tool for interpretation in the form of a user-friendly key for identification of plants within the monument.
ORPI-N-110	**Conduct Survey of Study Site Soils, Surficial Geology and Hydrology**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Site descriptions of soils, surficial geology and hydrology are needed at eighteen natural resources monitoring study sites. This data is required to provide necessary information for the development of the monument's integrated natural resources monitoring program.	A survey will be conducted to develop site descriptions on soils, surficial geology and hydrology at all natural resources monitoring study sites.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-111	**Develop Monitoring Program for Bighorn Sheep**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The status of desert bighorn sheep (*Ovis canadensis*) within Organ Pipe Cactus National Monument is unknown. Desert bighorn sheep have been adversely affected by changes in riparian and upland ecosystems throughout the Southwest. Information is needed to supplement the monument's existing database and to develop a monitoring protocol to assess and evaluate the status of the species in the future.	A study will be developed to provide data on the status and condition of the desert bighorn sheep in the monument. Information collected will include relative demography, abundance and natural history characteristics of the species. A long-term monitoring protocol will be developed for the sheep and their vegetation resources in Organ Pipe Cactus National Monument and on adjacent lands.
ORPI-N-112	**Evaluate Status of and Develop Monitoring Program for Javelina**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The status of javelina (*Dicotyles tajacu*) within Organ Pipe Cactus National Monument is unknown. Little baseline data applicable to javelina in the monument has been collected over the years. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species in the future.	A study will be developed to provide data on the status and condition of javelina in the monument. Information collected will include relative demography, abundance,,and natural history characteristics of the species. A long-term monitoring protocol will be developed for javelina and their vegetation resources in Organ Pipe Cactus National Monument and on adjacent lands.
ORPI-N-113	**Evaluate Status of and Develop Monitoring Program for Mountain Lion**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Little is known of the population size, spatial distribution, and temporal variability of the mountain lion (*Felis concolor*) in the monument. Increasing urbanization and agricultural development on land adjacent to the monument in Mexico may be contributing to a loss of habitat in the region. Information is needed to establish a species database and to develop a monitoring protocol to assess and evaluate the status of the species in the future.	An inventory will be conducted and a plan developed to monitor this mammal throughout the monument. Data will be beneficial in identifying threats and issues affect the species. Consequently, management actions affecting mountain lions will be based on the best available information.
ORPI-N-114	**Evaluate Status of and Develop Monitoring Program for Mule Deer**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Little is known of the size, spatial distribution, and temporal variability of desert dwelling mule deer (*Odocoileus hemionus*) populations. Management practices on adjacent lands. such as agricultural development and urbanization, may impact mule deer populations as well as predator species.	An inventory will be conducted and a plan developed to monitor mule deer populations throughout the monument. Data will be beneficial in identifying threats and issues affecting the species. Consequently, management actions affecting mule deer will be based on the best available information.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-115	**Evaluate Status of and Develop Monitoring Program for White-tailed Deer**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The current status of Coues white-tailed deer (*Odocoileus virginianus couesi*) within the monument is not known. Factual data to substantiate the health and current population status are inadequate to guide future management decisions and actions which would have a direct bearing upon the welfare of the species or its habitat. A monitoring protocol is needed to assess and evaluate the status of the species.	A non-destructive inventory and demographic assessment will be conducted, and a monitoring protocol for white-tailed deer and their vegetation resources at Organ Pipe Cactus National Monument will be developed to document the occurrence of these native mammals, and their relative abundance within riparian and upland habitats.
ORPI-N-116	**Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term ecological data is needed on desert tortoise populations in the monument to effectively understand and manage this rare and sensitive species. The status of the Arizona (Sonoran) population is not well known, except that tortoise populations in northern Arizona and the Phoenix area are severely declining. The Sonoran population has been proposed for listing. However, listing has been deferred (1991), providing that federal and state agencies in Arizona undertake aggressive management of their populations.	An inventory will be conducted to provide information on desert tortoise populations in the monument. This knowledge will serve as an additional management tool for examining the ecological health of monument ecosystems. A monitoring protocol will be developed to provide a means of evaluating the health of desert tortoise populations in the future.
ORPI-N-117	**Conduct Inventory and Develop Monitoring Protocol for Desert Tortoise**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Long-term ecological data is needed on desert tortoise populations in the monument to effectively understand and manage this rare and sensitive species.	An inventory of tortoises at Organ Pipe Cactus National Monument will be conducted to document their occurrence, abundance, disease status, population trends, habitat adequacy and demographics. Special attention will be given to tortoise habitat preservation, public education and safeguarding against tortoise loss due to human activity.
ORPI-N-118	**Conduct Inventory and Develop Monitoring Protocol for Microphytic Crusts**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The status and role of microphytic crusts in the overall functioning of the monument ecosystem is unknown. A protocol is required to assess microphytic crusts over time and to provide integrative data necessary to understand the monument ecosystem.	A study will be conducted to provide information on microphytic crusts. Data will include species presence, species distribution and abundance. A long-term monitoring protocol will be developed to assess the condition of crusts over time. Research will be emphasized at current natural resources monitoring sites.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-119	**Conduct Inventory and Develop Monitoring Protocol for Aquatic Invertebrates**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The status of and role which aquatic invertebrates play in the overall functioning of the monument ecosystem is unknown. A protocol is required to assess population fluctuations and to provide integrative data necessary to understand the monument ecosystem.	An inventory of monument aquatic invertebrates will be conducted. Based on the results of the study, monitoring protocols will be developed to allow for continued monitoring of aquatic invertebrate populations. Data from monitoring will be integrated with other assessment databases, to allow for the evaluation of relationships within the ecosystem.
ORPI-N-120	**Implement Climate Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Climatic data is needed to assess the significance of, and evaluate cumulative results and relationships of, ecological components of the monument's natural resources monitoring program. In 1987 and 1988, nine automated climate stations were established at natural resources monitoring sites. The climate stations, in combination with an additional eight Forester rain gauges, are located throughout the monument.	Climate stations and rain gauges will be operated and maintained. Results will be summarized and made available to researchers and staff involved in assessing ecological monitoring data. The primary integrative variables of precipitation, air and soil temperature, and relative humidity will be accessible for natural resources evaluation and interpretation.
ORPI-N-121	**Implement Land Use Trends Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Data on urbanization and agricultural development on lands in Mexico adjacent to the monument is needed. In 1987, a project conducted by Mr. Bruce Brown of Great Western Research assessed the impacts of land use trends on Mexican lands adjacent to the monument. A monitoring program was developed by the principal investigator to evaluate change in land use over time.	The monitoring protocol as recommended by the principal investigator will be implemented. Data on development and agriculture will be evaluated, including that on groundwater use, pesticide and herbicide application and land use trends. Repeat photography will be accomplished at identified photopoints and duplicate photos will be delivered to resource officials in Mexico.
ORPI-N-122	**Implement Nocturnal Rodent Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	The monitoring protocol for nocturnal rodents will be implemented as developed and recommended. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed. Integration with other monitoring protocols will be facilitated more effectively.	Long-term ecological monitoring data is needed on nocturnal rodent populations to assist in the assessment of the overall health and condition of the monument ecosystem. In 1988, a research project was conducted to acquire baseline data on nocturnal rodents. A monitoring protocol was developed to assess the status of nocturnal rodents over time.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-123	**Implement Lizard Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term ecological monitoring data is needed on lizards to assist in the assessment of the overall health and condition of the monument ecosystem. Lizards are valuable indicators of ecosystem health and long-term change. In 1988, a research project was conducted to acquire baseline data on lizards. One of the key objectives for the study was to develop monitoring protocols for herpetofauna.	The monitoring protocol for lizards will be fully implemented as developed and recommended. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed. Integration with other monitoring protocols will be facilitated more effectively.
ORPI-N-124	**Implement *Echinomastus erectrocentrus* var. *acunensis* Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term biological data is needed on acuna cactus (*Echinomastus erectrocentrus* var. *acunensis*) to effectively understand and manage this rare and sensitive species.	A base monitoring program will be established and implemented annually as prescribed by a protocol developed as part of the monument's natural resources monitoring program. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.
ORPI-N-125	**Implement Monitoring Protocol for Vegetation Structure and Diversity in Natural Communities**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term ecological monitoring data on vegetation structure and diversity in natural communities is essential to assess the overall health and condition of the monument ecosystem. In 1988, a research project was conducted to acquire baseline data on vegetation. One of the key objectives for the study was to develop monitoring protocols to assess vegetation status in the future.	The research project's recommendation to continue monitoring vegetation communities at the natural resources monitoring study sites will be implemented. Data will be managed and analyzed according to standards identified in the monitoring protocol. The data will be integrated with other data sets and will be incorporated into the monument's geographic information system databases.
ORPI-N-126	**Implement *Stenocereus thurberi* and *Lophocereus schottii* Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term ecological monitoring data is needed on organ pipe cacti (*Stenocereus thurberi*) and senita cacti (*Lophocereus schottii*) to develop a better understanding of these two sensitive species.	A base monitoring program will be established and implemented annually as prescribed by a protocol developed as part of the monument's natural resources monitoring program. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.
ORPI-N-127	**Implement *Atamisquea emarginata* Monitoring Protocol**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term biological data is needed on the desert tree caper (*Atamisquea emarginata*) to effectively understand and manage this sensitive species. *A. emarginata* is probably the species most at risk for future declines or extinction within the monument, due to a combination of low population size, localized distribution, large disjunction from other population and possibly, groundwater drawdown (Ruffner et al. 1992).	A base monitoring program will be established and implemented annually as prescribed by a protocol developed as part of the monument's natural resources monitoring program. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-128	Implement *Peniocereus striatus* Monitoring Protocol	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Long-term biological data is needed on dahlia rooted cereus (*Peniocereus striatus*) to effectively understand and manage this rare and sensitive species. Most likely, less than 200 individuals of this species exist in the monument.	A base monitoring program will be established and implemented annually as prescribed by a protocol developed as part of the monument's natural resources monitoring program. Sampling and data analysis methods outlined in the protocol will be adhered to. As a result of this action, a consistent and comparable data set will be developed.
ORPI-N-129	Develop Long Term Population Monitoring of Snakes	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Current monitoring programs do not address any of the major vertebrate predators in the monument. Snakes are one of the primary predators, if the not the key predators, of many small vertebrate species at Organ Pipe Cactus National Monument. Further, snakes are substantially impacted by highway mortality on Arizona State Route 85, which runs through the monument.	An analysis will be conducted and a monitoring handbook prepared detailing transect methods for periodic, regular monitoring of the highway and other monument roads. A technical report will be prepared on transect methods and analysis techniques. In addition, baseline results on existing data will be presented and illustrated. This protocol will significantly expand the monitoring program, and enhance the ability to synthesize and integrate ecosystem results for other monitored taxa.
ORPI-N-130	Develop Mexican Leafcutting Ant Population Monitoring Program	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). The large size and unusual habits of the ant colonies make them significant objects of park interpretation and research activities. Agricultural development south of the monument, however, may isolate the U.S. population from the main population in Mexico.	Scientists at the National Biological Survey/Cooperative Park Studies Unit will be contracted with to design monitoring protocols. A monitoring handbook will be developed and park staff will conduct monitoring activities.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-200	**Identify and Inventory of Water Related Resource Attributes**	Lack of Secure Water Rights	Water resource attributes have not been identified. This information will be needed when Arizona adjudicates water rights in the area.	Identify water related resource attributes through literature and field research conducted by an interdisciplinary team.
ORPI-N-201	**Monitor Land Subsidence**	Alteration of Natural Flow Regimes	Further lowering of the groundwater table along the southern boundary will probably result in land subsidence. Current surveys are not sufficiently accurate to document subsidence.	A first order survey of existing bench marks and boundary monuments along the international boundary will be made from the Ajo Range (IBM # 163) west to the Sonoyta Mountains (IBM # 168). Photographs will be taken to document surface conditions and to aid in relocating the survey markers. The area will be resurveyed at five year intervals unless changes in the rate of water table decline indicate the need for more or less frequent observations.
ORPI-N-202a	**Monitor Groundwater Resources in the Rio Sonoyta Watershed**	Alteration of Natural Flow Regimes	Annual groundwater pumpage on Mexican land adjacent to the monument is approximately 83,160 acre feet, which is 2.5 times the aquifer recharge rate. Continued lowering of the groundwater table will most likely negatively impact the natural resources in the monument.	The collection of groundwater data both within the monument and on adjacent Mexican lands will continue. Additional monitoring sites will be developed to provide a more comprehensive database as well as more reliable predictive models.
ORPI-N-202b	**Investigate Groundwater Use on Tohono O'odham Lands**	Alteration of Natural Flow Regimes	Land and water use on Tohono O'odham Reservation lands east and adjacent to Organ Pipe Cactus National Monument may pose future threats to natural resources.	An inventory will be conducted to gather baseline data and develop a monitoring protocol for groundwater use on Tohono O'odham lands. Contacts from whom staff can obtain periodic data related to water volume and depth, and cropping patterns, will be identified in cooperation with the farm manager and the Gu Vo District of the Reservation.
ORPI-N-202c	**Conduct Surface Water Inventory of the Rio Sonoyta Watershed**	Alteration of Natural Flow Regimes	Very little data on surface water use in the Rio Sonoyta watershed, of which the monument is a part, is currently available. Little research has been done on surface water availability, locations, uses and trends which may impact the resources.	A thorough inventory of the Rio Sonoyta watershed will be implemented. The project will include an inventory of surface water use, an assessment of historic flows and an examination of watershed hydrology.
ORPI-N-202d	**Conduct Land Use Inventory of the Rio Sonoyta Watershed**	Alteration of Natural Flow Regimes	The Rio Sonoyta watershed region is exposed to a multitude of threats impacting water and other natural resources. The types and extent of land uses in this area are not well known.	A thorough inventory of land use in the Rio Sonoyta watershed will be completed. The project will include defining the watershed, identifying, and delineating land uses, collecting land ownership data and conducting a land capability study.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-202e	**Evaluate Trends in Water Use in the Rio Sonoyta Watershed**	Alteration of Natural Flow Regimes	Continued urbanization and agricultural development is taking place in the Rio Sonoyta watershed area. Information on past, present and projected water uses in the watershed is needed to provide an understanding of development in the region and its associated impacts on the monument's natural resources.	An evaluation of trends in water use in the Rio Sonoyta watershed will be conducted. This project will include an evaluation of historic water uses, present uses and potential uses.
ORPI-N-203	**Develop and Implement Water Conservation Program**	Other Issues	Although considered a small amount, the actual volume of water used by monument operations is not closely monitored. NPS credibility will be enhanced if management makes an effort to efficiently use the water necessary for its operations.	A Water Conservation Program will be developed. This will utilize existing expertise through work with consultants from the NPS Water Resources Division and outside specialists, such as the Phoenix and Tucson City Water Conservation Departments, thus developing a program to suit Organ Pipe's specific needs.
ORPI-N-204	**Define Characteristics of Regional Aquifers**	Alteration of Natural Flow Regimes	Current and possible expanded pumping adjacent to the monument in Sonora, Mexico, threatens aquifers that provide the monument's water supply, support desert riparian vegetation and may sustains important springs. The nature and extent of these aquifers, and the uses that they are incurring, may have a direct bearing on the extent of impacts to monument resources from groundwater pumping in Mexico.	The characteristics of the regional aquifers will be evaluated. Existing geologic, groundwater and water consumption information will be examined to characterize the regional aquifer system for the Rio Sonoyta. Once assembled, the information will be analyzed in an effort to determine the lateral and vertical extent of the aquifers, recharge and groundwater yields, major directions and pathways of flow, groundwater consumption and trends in the condition of the aquifers.
ORPI-N-205	**Update Water Resources Inventory and Monitoring Program**	Alteration of Natural Flow Regimes	The current inventory of water resources provides little information about water quality or trends. Tinajas might be particularly vulnerable to airborne contaminants.	A cyclic program of water resource inventorying and monitoring will be initiated. the existing water resource inventory will be expanded to include water quality.
ORPI-N-206	**Develop a Geographic Information System (GIS) Component for Water Resources**	Alteration of Natural Flow Regimes	An efficient and effective method for managing water resources data is needed. Existing data on ground and surface water resources is extensive. Implementation of other projects within the Water Resources Management Plan will yield more data, including but not limited to, regional aquifer sizes, surface and groundwater use, and land subsidence.	Water resources data will be input into a geographic information system and compatible databases. This will include digitizing all available water resources data so that it is compatible with other GIS data. Applications will be developed to utilize and model the data and to assist with management of resources.

WATER RESOURCES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-207	**Monitor Riparian Ecosystems**	Alteration of Natural Flow Regimes	Valuable riparian vegetation and the ecosystems that they support may be threatened by continued depletion of groundwater on adjacent Mexican lands. Some species may now be facing a significant threat due to excessive use of groundwater.	Riparian study plots and non-riparian controls will be established to evaluate the effects of water drawdown from agricultural uses. Aerial photography will be conducted at elevations necessary to map vegetation composition. Techniques will be developed and employed to accurately measure species composition and densities, as well as the general vigor of the flora and fauna of all study plots.
ORPI-N-208	**Identify Pollution Threats from Kuakatch and Cuerda de Leña Washes**	Degradation of Park Water Quality Due to External Activities	Two intermittent streams enter the park at the northeast corner and along the northern boundary. Presently the lands in this vicinity are used for a small amount of grazing, and the impacts from such activities, if any, are unknown.	A program will be developed that will involve data collection on the quantity and quality of ground and surface water. It will allow for data collection by an independent government agency at important hydrologic times during each year.
ORPI-N-209	**Control Accelerated Erosion**	Disruption of Native Plant Communities and Accelerated Erosion Due to Past Land Practices	Severe erosion problems are evident in the vicinity of historic ranch sites where grazing pressure was the strongest. Broad scale loss of soil from wind and water has occurred in these areas and has resulted in changes in vegetation communities.	Recommendations from the Great Western Research 1989 Report, "Erosion Control Studies and Armenta Ranch and Dos Lomitas," will be implemented. Soil erosion will be mitigated through installation of earthen dikes, diverting channels and constructing rock and brush structures.
ORPI-N-210	**Evaluate Flood Hazards at Bates Well**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Most of the normally dry channels are subject to flooding and occasional flash floods, when flood waters can arrive with little or no warning. Bates Well may eventually contain developments or visitor activities that may be threatened by flooding.	A flood hazard analysis of the Bates Well area will be conducted. This action will be needed if further developments at Bates Well are considered.
ORPI-N-211	**Evaluate Abandoned Mine Tailings**	Disruption of Park Resources Due to Mineral Extraction & Geothermal Activities	The extent of cyanide and metals contamination from some of the numerous abandoned mines has not been investigated.	The threat posed by abandoned mine tailings will be determined. Remedial actions will be identified and may include revegetation, removing and disposing of material and continued monitoring.
ORPI-N-212	**Monitor Chemistry of Monument Precipitation**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	Data on precipitation chemistry is needed to provide an indicator of potential contamination of the inputs into the region's ground and surface water sources.	The monument's current precipitation monitoring program will continue. A National Atmospheric Deposition Program collection site will be serviced weekly according to established protocols.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-213	**Manage Wastewater**	Other Issues	There are five septic tank leach systems and four open evaporative lagoons serving the monument. All sewage systems are currently functioning adequately. Regular inspections are necessary, however, to ensure that problems do not develop and go undetected.	Wastewater systems will continue to be operated in compliance with state regulations and examined periodically for leaks and deteriorated conditions.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-250	**Develop a Threatened & Endangered Species Management Plan**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Currently no plan exists to assist the monument in the management of threatened and endangered species.	Develop an extensive Threatened and Endangered Species Management Plan to guide management, monitoring and research of threatened and endangered species.
ORPI-N-251	**Expand and Implement the Quitobaquito Desert Pupfish Monitoring Program**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Anthropogenic impacts and natural processes pose a potential threat to the endangered species of desert pupfish (*Cyprinodon macularius eremus*) at the Quitobaquito Management Area. A monitoring protocol developed to assess the status of the desert pupfish population requires a review and modification to ensure validity and enhance usefulness of data.	The current desert pupfish protocol will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide long-term monitoring protocol modification and techniques. Methods for database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.
ORPI-N-252	**Conduct Lesser Long-Nosed Bat Monitoring Program**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Information is needed for the wise management of the largest known United States maternity colony of the lesser long-nosed bat (*Leptonycteris curasoae*). A combination of monitoring activities developed to assess the status of the lesser long-nosed bat population requires a review, modification and consolidation both to ensure validity and to enhance usefulness of data.	The current lesser long-nosed bat monitoring program will be thoroughly evaluated. Objectives for species evaluation will be determined and will guide long-term monitoring protocol modification and techniques. Methods for database management and analysis will be determined. A handbook and training video will be produced to guide successful implementation of the protocol.
ORPI-N-253	**Evaluate Effects of Poaching on Monument Resources**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Organ Pipe Cactus National Monument has several plant and animal species of interest to the illegal collecting trade, particularly cacti and reptiles. The proximity to the border of Sonora, Mexico, makes the monument a prime target for the illegal trade in such species, especially since many of these plants and animals often have a high value on the black market.	A study will be developed to determine the extent of the poaching problem at Organ Pipe Cactus National Monument. Depending on the type and extent of poaching found, an evaluation of methods for controlling and preventing poaching will be incorporated into the study.
ORPI-N-254	**Identify Sonoran Mud Turtle Mortality Source at Quitobaquito**	Impacts on Threatened, Endangered, and Other Sensitive Animals	There is an ongoing population decline of the Sonoran mud turtle (*Kinosternon sonoriense*) at Quitobaquito. Several inexplicably dead turtles have been recovered floating in the pond, something rarely, if ever, observed in other natural populations. The problem is to identify the cause of this apparently abnormal mortality.	A two track program will be carried out to investigate the cause of mortality. Eight carcasses of mud turtles found dead at Quitobaquito are currently deep frozen at the University of Arizona. They will be subjected to gross dissection and chemical analysis to search for mortality sources. The data will assist in long term management for survival of this isolated population.
ORPI-N-255	**Conduct Inventory and Develop Monitoring Protocol for Ferruginous Pygmy-Owl**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Long-term ecological data is needed on ferruginous pygmy-owl populations in the monument to effectively understand and manage this rare and sensitive species. This diurnal owl is relatively easy to locate in the appropriate habitat in most cases, however, individuals within the monument have been difficult to relocate in recent years.	Conduct an assessment and develop a monitoring protocol to provide information on occurrence, population, habitat needs, demographics, abundance, life history, and food habits of the ferruginous pygmy-owl.

THREATENED, ENDANGERED & SENSITIVE SPECIES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-256	**Conduct a Study on Biological-Hydrologic Relationships in the Rio Sonoyta**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Information on the biological-hydrológical relationships of the Rio Sonoyta area is needed to guide management actions.	A study will be developed to monitor, with hydrologic instrumentation, the Rio Sonoyta and, if necessary, other riparian areas with similar hydrologic character. Work will also be conducted at Quitobaquito and the two systems will be compared. This comparison will assist the NPS in the management of the important Quitobaquito resource area. The potential linkage of the two systems will also be examined.
ORPI-N-257	**Survey and Monitor Moisture-Sensitive Herpetofauna on the Monument**	Impacts on Threatened, Endangered, and Other Sensitive Animals	The Ecological Monitoring Program currently lacks an explicit focus on animal assemblages characterized by special moisture sensitivity. Monitoring and research on such animals is critical to prediction and early observation of effects of climatic change in natural communities in this desert region.	The distribution of moisture-sensitive reptiles associated with desert mountains will be surveyed in the monument. Extensive transects will be established to document intrageneric species transitions across the slope and moisture gradient. Long term monitoring will be established for tracking the positions of these species transitions, and comparative laboratory studies will supplement the understanding of the climatic sensitivity of the species.
ORPI-N-258	**Determine Status of the Organ Pipe Shovelnosed Snake**	Impacts on Threatened, Endangered, and Other Sensitive Animals	The Organ Pipe shovelnosed snake (*Chionactis palarostris organica*) may be threatened by highway mortality. It is known in the U.S. only from live, and primarily dead, specimens observed on the paved highway, Arizona State Route 85. An assessment is required for populations occurring along the highway, the impact of the highway on these populations, and the extent of populations away from the highway. At issue is the strong potential that highway traffic, and with it highway mortality, will increase in the near future.	The highway will be monitored for these snakes throughout the appropriate times of day and year. Standard live trapping protocols will be carried out to non-destructively observe population status both near and at a distance from the highway. On-foot and side-road surveys will also be conducted. Management recommendations will be developed, especially concerning the highway, and a monitoring protocol will be formalized if the species is possibly in jeopardy. Morphological data will be collected to ensure a clear taxonomic picture of the species.
ORPI-N-259	**Determine Status of the Mexican Rosy Boa**	Impacts on Threatened, Endangered, and Other Sensitive Animals	The Mexican rosy boa at the monument is probably affected by illegal collecting and may be impacted by highway mortality. This is a slow-moving snake that is quite active during the season of maximum visitor traffic. This species is highly desired by snake collectors and keepers, and the rosy boa subspecies (*Lichanura t. trivirgata*) is known in the U.S. only at and near the monument. Attempts to collect this species illegally from dirt roads and back country areas at Organ Pipe are regular.	Studies initiated in 1993 will be continued and expanded to include additional monument areas thought to support populations of rosy boas. Reproductive data on gravid females will be obtained as possible. Data will assist in evaluating the importance of existing and potential impacts on the species. Intensive habitat descriptors will continue to be collected to ensure valid contrasts among years.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-260	**Analyze Mexican Leafcutting Ant Population Size and Structure Analysis**	Impacts on Threatened, Endangered, and Other Sensitive Animals	Data is required for long-term informed management of the only known U.S. population of the Mexican leafcutting ant (*Atta mexicana*). The populations in the monument provide a unique opportunity for application of modern techniques in molecular genetics to analysis of natural population and colony-level structure, as well as evaluation of gene flow, genetic diversity, and effective population size.	A research project will be developed to assess the status of the Mexican leafcutting ant population in the monument.
ORPI-N-261	**Expand Long-term Ecology Studies of *Stenocereus thurberi***	Impacts on Threatened, Endangered, and Other Sensitive Plants	Although an initial study of the organ pipe cactus (*Stenocereus thurberi*) has been completed, additional data from varying locations is needed to provide information relevant to management of the species.	A series of studies will be developed to provide additional information and to show periodic trends in the growth, distribution and relationships of the organ pipe cactus.
ORPI-N-262	**Expand Long-term Ecology Studies of *Echinomastus erectrocentrus var. acunensis***	Impacts on Threatened, Endangered, and Other Sensitive Plants	The demographic status of the acuña cactus (*Echinomastus erectrocentrus* var. *acunensis*) needs to be fully researched to insure protection of this species from poaching and other factors which could eliminate its only known population in the monument.	A program will be developed to gather additional data on the ecology of the acuna cactus in the monument. This will entail collecting additional data on the demographic status and ecology of this rare cactus, both within and outside monument boundaries.
ORPI-N-263	**Expand Long-term Ecology Studies of *Lophocereus schottii***	Impacts on Threatened, Endangered, and Other Sensitive Plants	Additional information is needed to adequately protect the monument's population of senita cactus (*Lophocereus schottii*). Of the three columnar cacti occurring in the monument, the senita cactus is the least tolerant of low temperatures. Better understanding of climatic factors and poaching effects on distribution will help protect the species.	A program will be developed to gather additional data on the ecology of senita cacti in the monument. Activities will include, but are not limited to: mapping individual senita cacti within monument boundaries; cooperating with both U.S. land management agencies and scientists/managers from Sonora and Sinaloa, Mexico, to gather information and data on other senita cacti; examining effects of predation by moth larvae or other predators; and determining viability of replanting to protect the biodiversity of this species.
ORPI-N-264	**Expand Long-term Ecology Studies of *Bursera microphylla***	Impacts on Threatened, Endangered, and Other Sensitive Plants	Additional information is needed to adequately understand and protect Organ Pipe Cactus National Monument's population of elephant trees (*Bursera microphylla*). Little is known of the elephant tree's natural history. Knowledge of factors influencing its distribution is necessary to properly preserve this species.	A program will be developed to gather additional data on the demographic status of elephant trees in the monument. Activities will include, but are not limited to: compiling a bibliography of information published to date on the ecological functioning of the elephant tree; developing a geographic information system (GIS) theme to indicate location and distribution information of the elephant tree throughout its known range; determining the type and extent of damage by of predation, investigating pollinating mechanisms; and determining if illegal collection activity exists and maintaining records of damage rates.

THREATENED, ENDANGERED & SENSITIVE SPECIES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-265	**Evaluate Status of and Develop Monitoring Program for Sonoran Pronghorn**	Impacts on Threatened, Endangered, and Other Sensitive Plants	The Sonoran pronghorn is an endangered subspecies, with a limited distribution in southwestern Arizona and in northwestern Sonora, Mexico. There are less than 300 individuals in the United States and less than 500 in the State of Sonora, Mexico (Thompson-Olais 1993). A multi-agency Core Working Group was established in 1991 to focus recovery efforts for the Sonoran pronghorn. The group has coordinated surveys of pronghorn and is involved in other aspects of species recovery, including the revision of the Recovery Plan.	The monument will continue as a member of the Core Working Group addressing Sonoran pronghorn recovery. Activities outlined in the revised recovery plan will be implemented in conjunction with Core Working Group agencies. The U.S. Fish and Wildlife Service will lead recovery efforts.
ORPI-N-266	**Evaluate Status of Mastiff Bats (*Eumops sp.*)**	Impacts on Threatened, Endangered, and Other Sensitive Plants	The status of two sensitive bat species, Underwood's mastiff Bat (*Eumops underwoodi*) and the western mastiff bat (*Eumops perotis*) in the monument is unknown. *E. underwoodi* is known in only two locations in Arizona. Earlier records have *E. underwoodi* occurring at the south end of the Baboquiveri Mountains near Sasabe. In the early 1980's, a number of individuals of both sexes at Quitobaquito Pond in the southwest corner of Organ Pipe Cactus National Monument were captured. This site remains the only other known United States location, and is also the western most record of occurrence.	A research project will be developed to assess the status of both mastiff bat species in the monument. Questions to be addressed will include: seasonal and nightly use of Quitobaquito, sex ratio, breeding strategies, "population" size (as it applies to this resource use), recapture rate, and relative abundance of *E. underwoodi* and *E. perotis*.

AIR RESOURCES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-N-300	**Develop and Implement Ambient Air Quality Monitoring Program**	Visibility Impairment and Biological Damage Caused by Air Pollution	The effects of gaseous pollutants on monument resources, including the many varieties of cacti and special status plants, are unknown. Growth adjacent to the monument is expected to increase as urbanization and agricultural development expands. In addition, possible future trade agreements may accelerate this process. Approximately 5000 hectares have been set aside 20 miles south of the monument by the state government of Sonora, Mexico, to develop twelve factories, including a pesticide disposal plant. All these activities threaten the future air quality of the monument.	A program to monitor ambient air quality in the monument will be developed. This alternative will entail inventorying air quality related values, monitoring and documenting the condition of air quality and related values and evaluating air pollution impacts. An ozone and sulfur dioxide monitoring program will be established, thus ensuring that baseline and trend data will be known. The monument will be able to monitor change more closely and accurately. The data will also give the monument a defense for reducing current or potential air pollutant impacts to its resources.
ORPI-N-301	**Develop and Implement Visibility Monitoring Program**	Visibility Impairment and Biological Damage Caused by Air Pollution	Although scenic opportunities are a prime visitor resource at Organ Pipe Cactus National Monument, there is no program in place to monitor visibility.	A visibility monitoring assessment program will be established and implemented with the coordination of the National Park Service, Air Quality Division. Components of the program will include, but are not limited to: installation and maintenance of at least one, and possibly two, automated camera stations - one on the south boundary as a first priority and one in the northern portion of the monument. A transmissometer will also be installed and maintained to determine the extent of visibility impairment.

ARCHEOLOGY

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-001	**Complete Archeological Survey Report: 1989-1991; Curation of Artifacts from Surveys**	Inadequate Archeological Survey and Inventory	The Archeological Survey Report: 1989-1991 has not been completed. Completion of the report requires data analysis, a final report, a National Register nomination and cataloguing of collected artifacts.	Analysis and report meeting USDI and NPS standards will be completed. Site records will be entered into the Classified Sites Inventory and artifacts catalogued and stored according to NPS standards and directives.
ORPI-C-002	**Prepare Prehistoric Sites Preservation Guide**	Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance	The monument does not have guidelines for preserving important prehistoric sites. Guidelines are needed to establish baseline preservation procedures and treatments. Prehistoric sites are subject to damage from natural processes, pests, visitor impacts, vandalism and theft.	A prehistoric sites preservation guideline will be prepared for the monument.
ORPI-C-003	**Develop Archeological Base Map/DataBase in GIS**	Inadequate Planning Documents	There is presently no integrated database and base map of natural and cultural resources and modern features such as roads for the monument.	A cultural resources database will be developed in GIS. It which will produce integrated maps of natural and cultural resources, along with overlays of modern cultural features.
ORPI-C-004	**Data Bank Management: Correct Plotting of Site Locations on Monument and Western Archeological & Conservation Center Maps**	Inadequate Planning Documents	Planning documents prepared for the recent draft General Management Plan used a cultural resource base map that contained out-of-date and often incorrect data regarding site locations. An up-to-date corrected USGS 15' topographic map is needed both by ORPI and for the data bank at the Western Archeological and Conservation Center.	A map index will be created. All current base maps at WACC and ORPI will be revised and updated. Accurate site locations on topographic maps and aerial photos.
ORPI-C-005	**Develop and Fund Public Archeology Program**	Inadequate Security	Archeological survey of 2.3% of the monument area shows that ORPI contains a large number of significant archeological resources, many of which are very vulnerable to impact by visitor traffic and vandalism. Past park interpretation has focused primarily on natural resources; more effort is needed to inform park staff and the public about archeological resources.	Interpretation, training and awareness of archeological and ethnographic resources for the public and for park staff will be expanded, as an integral part of monument operations.

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PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-006	**Develop and Fund Archeological Site Protection Program**	Inadequate Security	Many instances of theft and vandalism of cultural resources have been documented within the monument. The vast size of the monument makes protection of these resources difficult. Other problems include the lack of a complete inventory of archeological sites and a lack of funding and training for ARPA activities.	Formal and informal training in archeological site protection will be provided to all staff members. A site steward program composed of Volunteers-In-Parks will be developed.
ORPI-C-007	**Ethnographic Research: Ethnographic Overview & Assessment, Ethnographic Inventory, Ethnohistory and Oral History, Ethnobotany and Ethnoarcheology**	Need for Ethnographic Overviews and Assessments, Oral Histories and Life Histories	The monument does not have an Ethnographic Overview and Assessment, a basic cultural resources document needed for parks with known traditional use by Native American groups. Additional information needs to be gathered on important ethnographic sites in order to manage these areas in a sensitive manner.	Data will be collected on: plants and their uses by the O'odham; settlements, trails, gathering locations; ethnoarcheology of historic settlements; current gathering and use of native plants; the nature and extent of subtle changes in the environment, including availability of plants, animals and water.
ORPI-C-008	**Conduct Oral History Project With People Who Have Historical Knowledge of the Monument**	Need for Ethnographic Overviews and Assessments, Oral Histories and Life Histories	Documented interviews with individuals knowledgeable about the history and prehistory of ORPI are lacking. Several archeologists have conducted previous research that remains unpublished. Many local residents and former NPS employees have information about historical activities that occurred in the monument.	Individuals having information about historic lifeways in the monument, as well as researchers who have conducted previous but unpublished investigations will be identified. Oral interviews will be conducted and the meetings documented through the use of appropriate media, tape, video, etc.
ORPI-C-009	**Write Quitobaquito Management Area History**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	The Quitobaquito Basin represents the oldest continuously occupied area within ORPI. At the present time, survey and recording data for sites within this area is incomplete.	A survey project will be funded and conducted to locate, identify and record cultural resources in the Quitobaquito area and to prepare a cultural history of the area.
ORPI-C-010	**Data Recovery Projects**	Need for Major Archeological Data Recovery	Erosion at many cultural sites has removed the cultural deposits and exposed features. These features retain sufficient integrity to obtain flotation, pollen, radiocarbon and archeomagnetic samples that can be used to address questions related to subsistence activities, seasonality and date of use.	Data recovery targeted at eroded features and prehistoric occupation surfaces will be funded and conducted, rather than for vast site areas. Samples will be collected and the analysis conducted at a later date, depending on funding.

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PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-011	**Archeological Survey of Use Zones**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	Use and operation of the monument takes place within 4 sections of developed areas, approximately 125 miles of open and closed roads and an undetermined amount of official and unofficial trails. Within these use zones, there is continuous potential for impact on archeological resources.	A systematic and intensive walking surveys will be conducted for all road and trail corridors and areas of direct and indirect impact at park facilities.
ORPI-C-012	**Write Overview/Synthesis of the Archeological & Historic Resources of the Monument**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	While there have been syntheses of the archeology of the ORPI area of the Sonoran desert over the last 30 years, the most recent data is not included. New survey data needs to be synthesized with other data to provide a context for planning for management and research.	An archeological overview summarizing the status of archeological knowledge in the monument and surrounding area will be prepared.
ORPI-C-013	**Develop Archeological Site Location Predictive Model in Association with GIS**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	The location of cultural resources and the potential for an effective model of site location is important for management objectives. Modeling can guide data collection priorities for survey and data recovery efforts.	Data currently suitable for the initial development of a predictive model will be entered; data will continue to be collected and the model refined.
ORPI-C-014	**Record Rock Art Sites**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	Petroglyphs, pictographs and geoglyphs have been identified in ORPI, but none of the known sites have been fully recorded. Vandalism and weathering are threats.	A long-term program will be initiated to record rock art, utilizing NPS staff archeologists and volunteers. Monitoring and protection protocols will be designed.
ORPI-C-015	**Complete Archeological Sample Survey & Assessment of the Monument**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	The National Historic Preservation Act legislates that all federal lands be completely surveyed in order to determine the nature and extent of cultural resources. Complete survey of the monument is probably not feasible given fiscal constraints. However, continued sample survey of large blocks is necessary for the development of a predictive model of site location.	A sample survey of the monument will be funded and conducted.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-016	**Intensive Transect Recording/Mapping of Large Sites**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	Large prehistoric Archaic period and ceramic period Hohokam, Patayan and Trincheras sites present a number of interpretive problems for the archeologist. These problems include determination of site boundaries and site functions. Intensive transect recording is a technique specifically designed to gather quantitative data to address these problems.	The intensive transect recording technique will be used to record and map large dispersed sites. Computer maps of artifact diversity and density will be generated. Site surface boundaries, intra-site activity areas and site functions will be determined. Areas where sub-surface features are likely will be predicted. A baseline data for monitoring protocols will be provided.
ORPI-C-017	**Text Excavation of "Reservoir" at AZ Z:13:1 (ASM), a Large Hohokam Community**	Testing to Determine Feature Function as Part of a Determination of Eligibility to the National Register of Historic Places (Other)	A probable reservoir has been identified at a large Hohokam village in ORPI. Prehistoric reservoirs and ballcourts have been identified at Hohokam sites since the time of the Gadsen purchase. The features have a similar morphology and are sometimes indistinguishable without testing. Resolution of this question is significant for interpretation of the site within the Hohokam Regional System.	An archeological testing program will be conducted to determine the function of the reservoir feature at AZ Z:13:1(ASM).
ORPI-C-018	**Archival Research Related to Early Archeological Surveys and Ethnographic Research**	Need for Complete Archival Documentation of Previous Research (Other)	Some collections and ethnographic notes from early expeditions and surveys are in unknown locations. Early primary documents are an invaluable source of information regarding archeological and ethnographic cultural resources.	Primary documents containing information on the archeological and ethnographic resources of the monument will be identified and located. Artifact holdings at other institutions will be determined.
ORPI-C-019	**Specialized Artifact Studies**	Inadequate Archeological Survey & Inventory, Including Archeological Identification and Evaluation Studies, Overviews and Assessments	The occurrence of overlapping cultural traditions and the presence of large, apparently sedentary villages leads to a number of questions. Specialized studies of various artifact types can solve these problems.	Specialized studies of various artifact types will be pursued, including ceramics, chipped and ground stone and shell. It will be determined if ceramics were locally manufactured, the types and seasonality of shell that was collected and where the raw material for chipped stone was collected.
ORPI-C-020	**Re-analyze All Previous Collections at the Monument, Western Archeological & Conservation Center and Other Institutions**	Need to Re-analyze and Re-evaluate Previous Collections Based on Current Archeological Knowledge, Methods, and Techniques (Other)	Ceramic identifications from previous surveys are in doubt. This makes it impossible to discern the nature of the archeological record of sites recorded with this ceramic typology. New techniques can be applied to the analysis of whole vessels and ceramic and chipped stone assemblages.	Collections that have not been studied will be analyzed and the artifact collection at WACC and other institutions will be reanalyzed.

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PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-021	**Prepare National Register Nominations for Archeological Sites and Districts**	Need to Assess Archeological Data and Prepare National Register Nominations Where Appropriate (Other)	Many prehistoric and historic cultural resources in ORPI have been listed on the National Register of Historic Places. Other resources that are eligible, however, have not been submitted, or prepared nominations are being denied because inappropriate criteria are being used. An assessment of cultural resources within the monument and preparation of nominations needs to be completed.	The current knowledge of cultural resources and failed nominations will be assessed, and National Register Nomination forms for sites and districts will be prepared.
ORPI-C-022	**Develop and Fund Archeological Job Training Program**	Need for CRM-Related Training (Other)	Archeological surveys are being conducted primarily by non-Native Americans. Many believe that our understanding of prehistoric Native American cultures is hampered by lack of the Native American perspective. The monument is uniquely situated adjacent to the Tohono O'odham Reservation and the town of Ajo, which has a large Native American population.	An archeological training program for Native Americans interested in careers in anthropology, archeology and resources management will be developed and implemented. This training program will be targeted to the local O'odham, the ancestral residents of the ORPI area.
ORPI-C-023	**Assessment of Human Impacts and Natural Disturbances and Monitoring of Cultural Resources**	Need for Historic Preservation Guides	The monument does not have established monitoring guidelines or a comprehensive program to monitor historic structures, archeological sites or ethnographic resources. Staff has difficulty protecting cultural resources from natural processes, visitor impacts, vandalism and other threats.	Monitoring guidelines will be prepared and monitoring of ethnographic sites, historic structures and archeological sites will be conducted to preserve and protect irreplaceable cultural resources. Law enforcement patrols will be increased and a cultural resources management specialist position will be established.

HISTORIC RESOURCES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-C-050	**Maintain Stabilized Ruins and Historic Structures**	Inadequate Preservation Maintenance Programs Including Stabilization and Cyclic Maintenance	There are no established preservation and maintenance schedules and no clear priorities to guide historic preservation activities at ORPI. Funding and staffing limitations do not provide for a level of protection and preservation activities considered standard for the National Park Service.	Routine general housekeeping, annual maintenance, integrated pest management and cyclical maintenance will be performed as needed to preserve historic structures and features.
ORPI-C-051	**Prepare Historic Structures Preservation Plan**	Need for Historic Structures Preservation Guides	The monument does not have a comprehensive plan to direct historic structures preservation activities unique to the monument.	An historic structures preservation plan will be prepared. A review of known sites and resources will be completed and a plan formulated addressing the management of sites that may be eligible for National Register action.
ORPI-C-052	**Prepare Historic Structures Preservation Guides**	Need for Historic Preservation Guides	The monument does not have historic structures preservation guidelines for its historic buildings listed on, or pending nomination to, the National Register of Historic Places. Without guidelines, the historic preservation program at the monument is not fully successful and does not comply with federal legislation.	Historic structures preservation guidelines will be prepared to establish specific schedules and procedures consistent with monument planning.

PROGRAM ADMINISTRATION, MANAGEMENT AND PLANNING

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-001	**Develop and Direct a Comprehensive Natural and Cultural Resources Management and Research Program**	Program Administration, Management and Planning	A comprehensive program is required to address the full range of natural and cultural resources issues facing Organ Pipe Cactus National Monument. An organized and prioritized agenda is needed to deal with permanent staffing, infrastructure support, full identification of issues, recommended actions, and long-term goals.	A comprehensive natural and cultural resources management program will be developed. The Division of Natural and Cultural Resources Management and Research will be broadened and expanded. The division will continue to coordinate all natural and cultural resources management programs with direct responsibility to the Superintendent. An extensive Natural and Cultural Resources Management Plan will be developed and annually reviewed and updated.
ORPI-I-002	**Manage Natural and Cultural Resources Management and Research Program**	Program Administration, Management and Planning	A commitment of staff and funding is necessary to fully manage the monument's natural and cultural resources management and research programs. The programs are extensive and include activities such as vegetation and wildlife management, non-native species control, ecological monitoring, historic structures and archeological site evaluations and threatened, endangered and sensitive species management.	The Division of Natural and Cultural Resources Management will be directly responsible to the Superintendent for the management, planning, direction and coordination of the monument's Natural and Cultural Resources Management and Research Program. The function of the division is to administer the monument's natural and cultural resources management and research programs. A division chief coordinates a multifaceted program, as outlined in planning documents.
ORPI-I-003	**Provide Natural and Cultural Resources Management and Research Administrative Support**	Program Administration, Management and Planning	A commitment of staff and funding is needed to provide administrative support to the natural and cultural resources management and research program. Without administrative assistance within the division, the administrative work load of contracting, file management, data entry, personnel, budget updates, status reports and routine clerical duties will not be effectively or efficiently handled.	An administrative assistant will be hired for the Division of Natural and Cultural Resources Management and Research. The administrative assistant will work directly for the chief of the division. Responsibilities will include contracting, payroll, budget programming updates, purchasing, filing and other administrative and clerical duties. The position will coordinate activities with the monument's administrative officer.
ORPI-I-004	**Develop Research Opportunities and Needs Assessment**	Program Administration, Management and Planning	It is the policy of the National Park Service to encourage and aid research by independent workers. Plans call for the establishment of a staff researcher. With this position, a prioritized list of research needs must be developed to help the staff solicit proposals for research of high priority projects in conjunction with the Cooperative Park Studies Unit (CPSU) at the University of Arizona.	An assessment will be conducted which will provide a chance to develop new scientific techniques and present new opportunities for university students and researchers in studying Sonoran ecosystems.

PROGRAM ADMINISTRATION, MANAGEMENT AND PLANNING

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-005	**Establish Editorial Assistant Position at Organ Pipe Cactus National Monument**	Program Administration, Management and Planning	An editorial assistant (EA) position is needed to relieve current personnel who complete virtually all editorial duties themselves, including typing and editing of reports. The present program is administered by the Chief of Resources Management and the EA position would assist with both the resource management program and funded NPS research at Organ Pipe.	An editorial assistant position within the Resources Management Division will be established, thus achieving more efficient program operation using available skills and expertise. The incumbent would type highly complex, technical reports, mock up text material in report format including charts and graphs, and prepare bibliographies and footnotes, independently prepare manuscripts for distribution or publication, and verify information in the manuscripts by using various basic guidelines and technical scientific sources.
ORPI-I-006	**Develop and Implement a Comprehensive Natural and Cultural Resources Interpretation Program**	Interpretation of Resources Management Issues and Programs	A commitment of staff and funding is needed to develop and implement a comprehensive resources interpretation program. The current interpretation program is inadequate to be of assistance in meeting the goals of natural and cultural resources management and protection. Lack of increased funding has resulted in a loss of programs and reduced services.	A comprehensive natural and cultural resources interpretive program will be developed. The existing interpretive staff will be supplemented with additional field personnel. Emphasis will be placed on personnel services. The overall effort will consist of two primary components: enhancement of internal traditional visitor programs and expansion into outreach services.

INFORMATION MANAGEMENT

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-050	**Develop and Manage Resources Information Management Program**	Resources Management and Research Information Management	A commitment of staff and funding is needed to develop and manage a comprehensive resources information management program. Several years of inventorying, monitoring and research has yielded an abundance of data sets that must be maintained and effectively managed to be useful in resources management activities.	An information management specialist position will be established to implement the program. The information management specialist will be responsible for the management of the Resources Management and Research Division's computers and information management program.
ORPI-I-051	**Implement Geographic Information System Program**	Resources Management and Research Information Management	A commitment of staff and funding is required to effectively implement the monument's geographic information system (GIS) program. An approved GIS plan and several years of work completed through a cooperative agreement with the University of Arizona has yielded a well outlined program and a comprehensive GIS database.	The monument will implement actions outlined in the approved GIS plan. A GIS Specialist position will be established to implement the program. GIS will be fully integrated with other resources management and research programs, such as archeological site evaluation and ecological monitoring. The GIS will eventually be integrated with all monument functions, including maintenance and interpretation.
ORPI-I-052	**Update Information Management Plan**	Resources Management and Research Information Management	The Organ Pipe Cactus Resources Management Information Management Plan (IMP) requires updating to incorporate the rapid changes occurring in the field of information management. The plan needs to be updated, revised and expanded to incorporate the changes in hardware and software (including updated versions), and to address database application needs. In addition, the monument's geographic information system program needs to be integrated in the overall IMP.	The existing IMP will be updated. The plan will be a tool for resource managers to use for software and hardware acquisition, computer maintenance and general use. National automated data processing standards will be identified to keep the division in harmony with NPS-wide systems.
ORPI-I-053	**Conduct Geographic Information System/Airborne Video Monitoring Research**	Lack of Basic Data: Insufficient Understanding of Park Ecosystems and Threats to Them	A cost effective means of providing monument-wide visual displays to assist with mapping and evaluating resource conditions is needed. This type of data is required to support and enhance existing resources monitoring and research projects.	A project will be developed to assess the merit of using aerial video over conventional aerial photography for monitoring and mapping resource, status at the monument. In particular, the cost effectiveness and logistics of acquiring and processing the two types of imagery will be compared, as will the diversity and usefulness of products obtained.
ORPI-I-054	**Develop Custom Geographic Information System Automated Quad Indexing System**	Resources Management and Research Information Management	A customized geographic information system (GIS) quad indexing system is required to provide the most efficient means of assessing GIS capabilities by all monument divisions.	A customized GIS graphic user interface (GUI) computer program will be developed to greatly facilitate the tracking and plotting of mapped data and provide a user friendly means to reduce the time and training required to regenerate and plot standard monument maps.

INFORMATION MANAGEMENT

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-055	**Implement Global Positioning System Data Acquisition**	Resources Management and Research Information Management	An efficient and routine mechanism is needed to generate maps from incidents and point or natural and cultural resources monitoring data collected by the monument staff, researchers, contractors, graduate students and volunteer personnel.	A program will be developed to acquire geographic data through the use of GPS technology. This program will ensure georeferencing of all field data to guarantee accurate mapping for all divisions. Visual patterns, maps and spatial analysis of resource conditions will be generated. An automated portable global positioning GPS/GIS program will be developed for field use by all monument divisions.
ORPI-I-056	**Develop Computerized Bibliographic Information System**	Resources Management and Research Information Management	The monument does not have the ability to efficiently track the wealth of historic, technical and ecological information that is available. Without the development of an adequate tracking system and information base, park management cannot efficiently manage the resources or respond to developing resource problems systematically, without duplication of effort.	A computerized bibliographic information system will be developed, thus increasing management's ability to respond effectively to cultural and natural resource issues.
ORPI-I-057	**Prepare Administrative History of Natural and Cultural Resources Management and Research**	Resources Management and Research Information Management	An administrative history of natural and cultural resources management and research is needed for Organ Pipe Cactus National Monument. The history of efforts to protect and understand the resources of the monument has never been compiled.	An administrative history detailing the development of natural and cultural resources management and research efforts in the monument will be prepared. The administrative history will provide a chronology of issues, program activities and milestones, and infrastructure development.
ORPI-I-058	**Incorporate and Integrate New Data into the Information Management and Geographic Information Systems**	Resources Management and Research Information Management	Currently, there are no mechanisms for integrating and incorporating new cultural and natural resources management and research information into a synthesis report with which to expedite and facilitate management's ability to make difficult resource decisions.	A multidisciplinary team will be created to integrate and evaluate new information, and incorporate this data into the information management and geographic information systems. Research models will be updated and reevaluated on a periodic basis if natural and cultural resources inventorying and monitoring and research data indicate the need.
ORPI-I-059	**Conduct Feasibility Study to Link the Geographic Information System with the Maintenance Management System**	Resources Management and Research Information Management	A linkage needs to be made between the monument's geographic information (GIS) and maintenance management systems (MMS) to improve the effectiveness and usefulness of both programs.	A feasibility study will be conducted to evaluate the feasibility of linking GIS with MMS. MMS and GIS protocols, hardware, and software systems will be evaluated, and the cost effectiveness of various computer linkages examined and delineated.

INTEGRATED PEST MANAGEMENT

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-100	**Monitor and Control Africanized Honey Bees**	Degradation of Park Resources Due to Non-Native Animals	There is serious concern for visitors and the natural environment when the expected Africanized honey bee becomes established, most likely by the year 1994. Organ Pipe Cactus offers many nest sites, thus it is water and available nectar and pollen plants that will be crucial for this bee. Most colonies are expected to chose nest sites near water sources, and so will have potentially severe impacts on humans and animals.	A program to address the safety and environmental issues posed by Africanized honey bees will be developed. Research monitoring for the eventual arrival of the Africanized honey bees will be continued. An integrated pest management action plan for the control of the species will be developed. An aggressive public health and safety effort will be conducted. An Africanized honey bee coordinator will be established to coordinate the monument's integrative pest management effort for this species.
ORPI-I-101	**Develop an Integrated Pest Management Plan**	Degradation of Park Resources Due to Non-Native Species	The monument has several occasions where plant and animal species become pests. In order to comprehensively deal with problems, a monument-wide Integrated Pest Management (IPM) Plan is needed to deal with pests occurring in households, museums, and campgrounds, as well as those creating public health problems.	An Integrated Pest Management Plan will be developed to provide a comprehensive and unified approach to addressing IPM issues. This alternative will ensure that management will be in compliance with NPS guidelines for integrated pest management.
ORPI-I-102	**Manage Pest Species**	Degradation of Park Resources Due to Non-Native Species	Pests are generally a low level problem at Organ Pipe Cactus, but they are a persistent problem requiring constant attention.	Monument resources management staff will continue to manage pest species using IPM techniques. Staff will continue to develop skills through training and experience to become aware of and treat problems. They will implement the IPM plan and update it as necessary. Monitoring and documentation will continue to be standard practices. This action will ensure compliance with NPS guidelines and policies.
ORPI-I-103	**Develop and Implement a Comprehensive Boundary Fence Maintenance Program**	Degradation of Park Resources Due to Non-Native Animals	Without adequate fence maintenance along the monument's southern, northern and eastern boundaries, livestock, will gain access to park lands. This encroachment, as evidenced in the past, will lead to resource degradation and possible displacement of native species.	A program outlining a schedule of routine fence inspections, repairs and cyclic replacement of older and damaged sections will be developed.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-104	**Monitor and Control Trespass Grazing**	Degradation of Park Resources Due to Non-Native Animals	A monitoring program is needed to analyze impacts of trespassed livestock. Guidelines need to be developed to control this intrusion.	Trespass locations and frequencies will be inventoried and monitoring plots will be established to record impacts and trends. The monument will continue to work with neighbors for solutions. A report will be prepared outlining the situations and recommendations for change. Plots will be read and a schedule for rereading proposed.

FIRE MANAGEMENT

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-150	**Develop a Fire Management Plan**	Disruption of Natural Fire Regime Inadequate Planning Documents	The monument does not have a plan for comprehensively managing fires and, consequently, is not in compliance with Western Region policies and Guideline NPS 18 - Wildland Fire Management.	A Fire Management Plan will be developed for the monument in accordance with NPS guidelines and policies. Appropriate research will be undertaken to ensure a comprehensive and effective product. By writing and implementing a Fire Management Plan, the monument will be in compliance with Western Region policies and NPS 18.
ORPI-N-151	**Conduct a Fire Management Program**	Disruption of Natural Fire Regimes Control of Environmental Impacts	Following the approval of comprehensive plan to manage wildfires and prescribed natural fires, staff must implement the program. Qualifications and certifications must be raised to a level to operate the full program. Training is needed in managing and monitoring natural fires as well as to expand wildfire capabilities.	As a follow up to the approved Fire Management Plan, staff will implement the plan and work with other agencies to manage fires in and around the monument. Staff will be trained and certified to meet the requirements set forth in the plan. Joint suppression agreements and possibly prescribed natural fire agreements will be completed with adjacent agencies in the United States and Mexico, as appropriate. Complete fire records and an atlas will be maintained for documentation and future research. Safety, prevention, and hazard reduction programs will be conducted. Research will be identified and supported to assess and monitor fire effects and history.
ORPI-I-152	**Conduct Fire History and Ecology Research**	Disruption of Natural Fire Regimes Control of Environmental Impacts	Information about fire history and ecology is inadequate for a true comprehension of the role of fire in this desert ecosystem. Only limited research has been done in Sonoran desert communities, so there is an inadequate databank to draw upon. Site specific research is needed for Organ Pipe Cactus National Monument.	A monument-wide fire history study using field evidence of fire occurrence and records will be completed. The occurrence, location and spread will be mapped in a fire atlas. Frequency will be determined per given site.

WILDERNESS MANAGEMENT

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-200	**Develop a Wilderness Management Plan**	Visitor Use Impacts on Backcountry Park Resources Inadequate Planning Documents	A Wilderness Management Plan for the monument does not exist. There are no guidelines for research, search and rescue and other activities that occur within designated wilderness. Guidance is needed to promote and protect wilderness ethics.	A Wilderness Management Plan will be developed to guide activities and provide for long-term program direction at Organ Pipe Cactus National Monument. Development of a wilderness plan will detail everything from wilderness history, laws, and special uses to specific park policies and uses. Issues that must be addressed include: limits of acceptable change (especially for areas of critical habitat and sensitive ecosystems), wilderness ethics, signing, wilderness values and experiences, impacts from aircraft overflights, trails and levels of maintenance, and impacts from research, management and visitor use activities.
ORPI-I-201	**Develop a Trail Use Management Plan**	Visitor Use Impacts on Backcountry Park Resources Inadequate Planning Documents	There is currently no formal program for managing trails, or assessing their impacts on monument resources. Currently, there is minimal maintenance of trails. Sheet and gully erosion occur in some areas as a result of no maintenance or poor layout of trails. It is unknown if any of these trails cut through critical threatened and endangered species or sensitive species required habitat. Some trails cut through cultural sites and are a source of erosion.	A Trail Use Management Plan will be prepared. The plan will outline a comprehensive program for trail management in the monument. Issues to be addressed in the plan include trail sustainability, design and construction, and maintenance and monitoring.
ORPI-I-202	**Develop a Cave Management Plan**	Visitor Use Impacts on Backcountry Park Resources Inadequate Planning Documents	A comprehensive plan for managing cave resources at Organ Pipe Cactus National Monument is needed. There are several caves in the monument, but inventory and mapping details are incomplete.	A Cave Management Plan will be developed for the monument. An inventory of all cave resources will be conducted. The vulnerability of each will be assessed, particularly regarding vandalism. The plan will define research and detail a monitoring system to protect resources and document trends.
ORPI-I-203	**Determine Visitor Impacts and Use Limits**	Visitor Use Impacts on Backcountry Park Resources	No comprehensive study of visitor impacts, use, and limits has been conducted for the monument. Increasing numbers of visitors are using backcountry trails and roads. Potential overcrowding greatly lessens recreational experiences and threatens natural and cultural resources. Visitor impacts and use limits need to be determined.	A study of visitor impacts, uses, and limits will be conducted. Survey data will serve to determine the physical, biological, cultural, environmental, and social conditions that define the monument's recreational uses. Emphasis will be placed on use in designated wilderness areas. Once the ideal use conditions and limits are established, they can be continuously reviewed and updated with long term monitoring.

ABANDONED MINE LANDS

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-250	**Conduct Comprehensive Monitoring and Maintenance of Abandoned Mine Safety Features**	Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities	Ninety-two hazardous mine and well openings within the monument pose a threat to visitors and wildlife.	An annual monitoring program of the fences, signs, and wildlife use for all hazardous abandoned mine and well sites will be conducted. Repair of fencing and replacement of signs will be done on a cyclic basis, thereby maintaining a high standard for public safety.
ORPI-I-251	**Conduct Study of Wildlife Use of Abandoned Mines**	Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities	Abandoned mine sites need to be evaluated to determine their impacts on or value to wildlife. Wildlife including an endangered species of bat is known to use some abandoned mine sites. Evidence also suggests that mine holes not hazardous to humans are fatal to species such as the desert tortoise. With increasing impacts on the monument's fauna, it is imperative to determine how vital these mines are to the present and continued existence of wildlife species.	An inventory of all abandoned mine lands will be conducted to evaluate use by wildlife. Those abandoned mine sites upon which wildlife may be dependent for survival, or at hazard from, will be studied. Wildlife censusing and observation techniques will be utilized and a report prepared from the findings. The results of this report will be used to make management recommendations concerning appropriate actions defining the role of these sites as park resources for wildlife protection and preservation.
ORPI-I-252	**Develop Mine Hazards Safety Program**	Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities	Abandoned hazardous mines and wells within Organ Pipe Cactus National Monument pose safety threats to park visitors and employees. Many park employees, visitors and illegal aliens encounter these abandoned mines and wells in the backcountry. It is important that safety information be provided to all affected groups who may encounter these features.	An educational program will be developed to make the hazards of abandoned mines and wells known to park visitors and staff.
ORPI-I-253	**Rehabilitate Selected Mines**	Disruption of Park Resources Due to Mineral Extraction and Geothermal Activities	With increasing visitor use and a better understanding of wildlife use at Organ Pipe Cactus National Monument, steps must be taken to protect both visitors and wildlife from hazardous and non-hazardous abandoned mine lands.	Mine sites that have been determined not to have cultural or natural resource of significance values will be closed using existing spoils and the sites will be rehabilitated. This alternative presents a permanent solution to the problem of aesthetics and visitor safety.

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-300	**Develop and Implement Aircraft Overflight Monitoring Program**	Noise, Visual, and Biological Impacts Related to Aircraft Overflights	The monument needs to develop and implement an aircraft overflight monitoring program to assess the impact of aircraft use. The monitoring program will provide data on the impacts of overflights on natural and cultural features and on visitor experiences.	An aircraft overflight monitoring program will be developed. Means will be identified to cooperate and communicate with the Air Force, Marines, and National Guard. The program will also outline management's use of aircraft outside and inside wilderness.

MAN AND THE BIOSPHERE PROGRAM

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-350	**Develop a Man and the Biosphere Action Program for the Sonoran Desert**	Other Issues	The Sonoran Desert Biogeographic Region in southern Arizona and northern Sonora, Mexico, is an area exposed to a multitude of threats and issues, impacting both natural and cultural resources and the people living in the region. Land is managed by an array of governmental, private and tribal organizations. Adverse land management practices in one area affect other areas as well. While preservation of resources is a high priority in one region, economic needs drive management in another. Issues are not only cross-boundary, they are cross-cultural and international in scope as well.	An integrated regional program of cooperation for the Sonoran Desert will be established and developed by monument staff and MAB program specialists. This plan will deal with identified problems and communication network, that must be developed among neighbors within the Sonoran Desert Biogeographic Region.
ORPI-I-351	**Conduct Man and the Biosphere Multi-cultural Interpretive Programs**	Other Issues	The monument currently does not have a domestic or international environmental education program.	Man and the Biosphere multi-cultural interpretive programs will be developed. It will include in-park education programs for students from the U.S. and Mexico, and an outreach program to the local schools in Ajo, Sonoyta, and on the Tohono O'odham reservation. This program will be conducted through the coordinated efforts of the monument's Resources Management and Visitor Protection & Interpretation divisions.

MUSEUM/LIBRARY/ARCHIVES

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-400	**Develop a Collection Management Plan**	Need for Collection Management Plan	The monument currently does not have a Collections Management Plan. Management of the collection of archeological, ethnological, and historical materials is an on-going concern. To assist in this work, a Collection Management Plan as required by NPS 28 - Cultural Resources Management, must be written.	A Collections Management Plan in conformance with NPS-28 will be developed to guide the preservation and protection of museum specimens.
ORPI-I-401	**Manage Library and Museum**	Insufficient Professional Staff	A curatorial position is needed to manage the museum, archives, photos, maps and library materials. These collections continue to grow as resources management programs expand.	A curatorial position will be established to manage the library and museum.
ORPI-I-402	**Automate Library Catalog System**	Need to Automate and Professionalize the Resource Center's Library Catalog System (Other)	The Sonoran Desert Biosphere Reserve Center has a scientific library collection of over 1400 accessions and continues to grow. No computerized accessioning and retrieval system is used for the cataloguing of library items.	The monument's resources management and research library will be automated using the software program Librarian's Assistant. This computer application is a library management/on line software program which is capable of cataloging, searching databases, and indexing literature and collection information.
ORPI-I-403	**Obtain and Maintain Historic Photograph Collection**	Other	A complete and continuing photo collection is needed as a pictorial baseline for reference and to illustrate changes. There has been no systematic search of libraries, historical societies, museums, university biology, anthropology, and archeology departments, or other repositories to obtain copies of early historic photographs.	To make the best use of photographs to manage and protect natural and cultural resources, a systematic inventory of photos on file plus a search for off-site pictures will be developed. Significant pictures will be added to the collection. The result will be a more complete and valuable collection that will serve as historic reference as well as a monitoring baseline.
ORPI-I-404	**Update and Maintain Automated National Catalog System Program**	Incomplete Cataloging of Museum Collections	The Automated National Catalog System (ANCS) for the Organ Pipe Cactus National Monument museum needs cyclic update and maintenance.	Monument staff will enter collection data into ANCS. While most of the data entry has been completed additional actions will completed for system maintenance. These activities include: review hard copies of all museum catalog cards produced with ANCS to verify information; inventory museum collection and verify information on labels with ANCS records; integrate the WACC ANCS database with the monuments; and, prepare and catalog into ANCS specimens acquired since 1992.

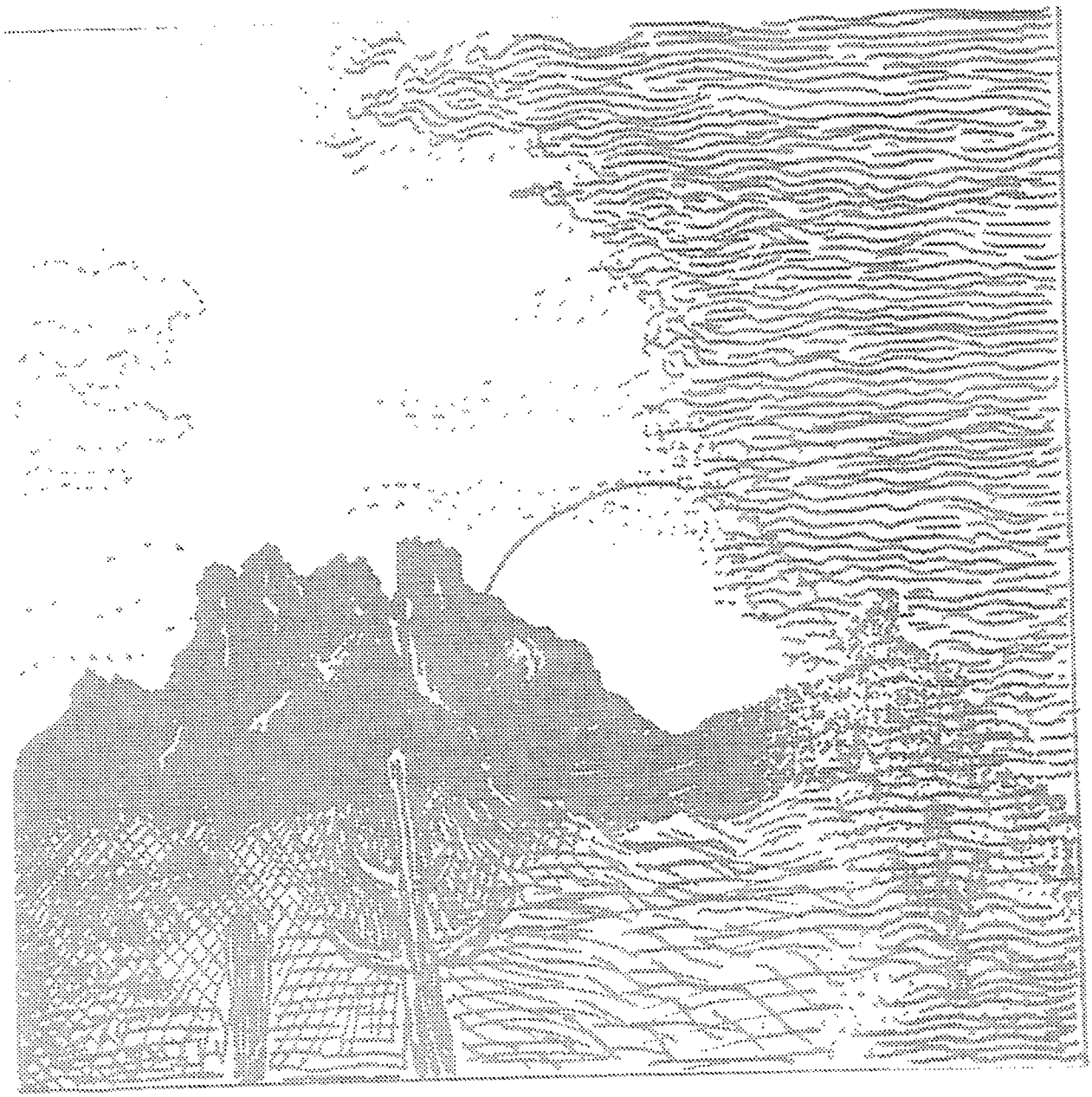
OTHER

PROJECT #	NAME	ISSUES	PROBLEM	ACTIONS
ORPI-I-450	**Develop An Integrated Management Plan for the Quitobaquito Resource Management Area**	Lack of Basic Understanding of Resources and Threats	An integrated plan is needed to guide the management of the valuable natural and cultural resources of the Quitobaquito Resource Management Area (QMA). Three hundred years of grazing and ranching caused profound ecological change before the National Park Service assumed control of the QMA in 1956. Attempts to clean up, restore, and improve the situation exacerbated rather than mitigated situation.	An integrated management plan for the Quitobaquito Resource Management Area will be developed. This will provide in-depth information on the status of rare species and cultural resources in the Quitobaquito spring and pond are as well as some aspects of their life history, and will integrate QMA into the rest of Organ Pipe resource management program.
ORPI-I-451	**Prepare and Implement Plan to Comply with Special Directive 91-6 (Borrow Materials Plan)**	Impacts on Threatened, Endangered and Other Sensitive Plants and Animals; Degradation of Park Resources Due to Non-Native Plants and Animals; Loss of Cultural Landscapes; Loss of Paleontological Resources.	The monument does not have a plan or established guidelines to govern the use of borrow material sources and spoil areas inside the monument as required by NPS Special Directive 91-6.	A borrow material and spoil area plan will be developed to establish legitimate sources for borrow extraction and spoil disposal in compliance with NPS Special Directive 91-6, Chapter 9 of the 1988 NPS Management Policies, and related natural and cultural resources management policies, guidelines and legislation.
ORPI-I-452	**Develop Road Maintenance Standards and Procedures**	Other Issues	After years of maintaining the Ajo Mountain and Puerto Blanco Loop Drives in a graded gravel condition, serious channeling and loss of road beds have occurred to the point where road beds are 12 or more inches below the desert floor. This channeling becomes an increasing problem with successive rain events as additional soil material is lost.	Road maintenance standards will be developed. This action will provide procedures for use by monument road and trails crews to use in the routine maintenance of these roads. The standards will help to mitigate and prevent to the extent possible, continuing widening and deepening and loss of material. Standards would also outline maintenance procedures to ensure that negative impacts to road-side resources do not occur.
ORPI-I-453	**Establish Carrying Capacity for Loop Drives**	Impacts on Threatened, Endangered and Other Sensitive Plants and Animals; Visitor Use Impacts on Backcountry Park Resources; Lack of Basic Understanding of Resources and Threats	The carrying capacities of the two monument drives needs to be established to protect resources and visitor experiences. Heavy use, combined with the variety of activities along the routes, can create undesirable and unsafe congestion, which also detracts from the visitor's experience. The popularity of the drives demands that the roads be kept open, which puts pressure on maintenance staff to grade roads after flooding.	The carrying capacity for monument loop drives will be established. This will provide a definitive daily use level for the loop drives based on sociological, cultural and natural resource considerations. It would aim to protect resources and preserve a quality visitor experience.

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX D: CULTURAL RESOURCES CHECKLISTS



ORGAN PIPE CACTUS NATIONAL MONUMENT

SUMMARY CHART FOR STRUCTURES

SIGNIFICANCE		CONDITION				IMPACTS				DOCUMENTATION		
	Total	Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	0											
State and Regional	5	1	2	2		2	2	1		3	2	
Local	0											
Not Evaluated	2	1	1				1	1		2		
TOTALS	7	2	3	3		2	3	2		5	2	

ORGAN PIPE CACTUS NATIONAL MONUMENT

SUMMARY CHART FOR ARCHEOLOGICAL SITES

SIGNIFICANCE		CONDITION				IMPACTS				DOCUMENTATION		
	Total	Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State and Regional	12	3	2	7			12					
Local												
Not Evaluated												
TOTALS	12	3	2	7			12					

ORGAN PIPE CACTUS NATIONAL MONUMENT

SUMMARY CHART FOR OBJECTS

DOCUMENTATION*	ARCH	ETHNO	HIST	ARCHV	BIOL	PALEO	GEOL	TOTAL
Registration Data Only								
Registration and Catalog Data	7707	21	527	2758	10795	12	368	22188
Total Items Cataloged								
Backlog to be Cataloged	10	-	-	2800	400	-	-	3210
TOTAL COLLECTION SUMMARY	7717	21	527	5558	11195	12	368	25398

CONDITION**	ARCH	ETHNO	HIST	ARCHV	BIOL	PALEO	GEOL
Excellent							
Good	7717	21	527	5558	11195	12	368
Fair							
Poor							
Unknown							

ORGAN PIPE CACTUS NATIONAL MONUMENT

SUMMARY CHART FOR CULTURAL LANDSCAPES

SIGNIFICANCE		CONDITION				IMPACTS				DOCUMENTATION		
	Total	Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State and Regional												
Local												
Not Evaluated												
TOTALS												

CULTURAL LANDSCAPES HAVE NOT BEEN EVALUATED.

CULTURAL RESOURCES DOCUMENTATION CHECKLIST

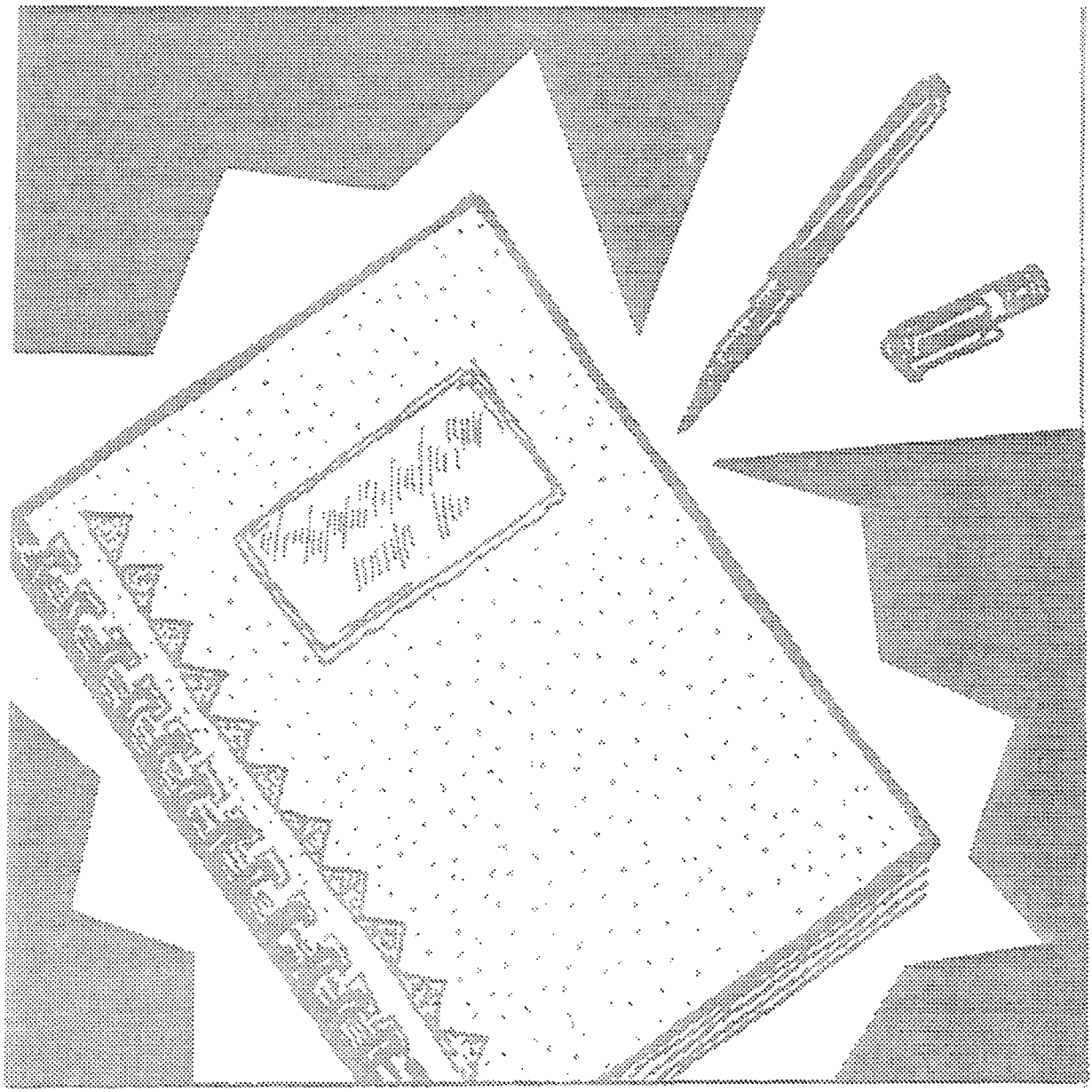
TITLE	CURRENT; APPROVED	NEEDS REVISION	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization	X		
Statement for Management (SFM)	X		
Outline for Planning Requirements (OPR)	X		
General Management Plan (GMP)			X
Development Concept Plan (DCP)			X
Resources Management Plan (RMP)		X	
Interpretive Prospectus (IP)	X		
SERVICEWIDE INVENTORIES, LISTS, CATALOGS, AND REGISTERS			X
Cultural Resources Bibliography (CRBIB)			X
Archeological Site Management Information System (ASMIS)		X	
List of Classified Structures (LCS)		X	
National Catalog of Museum Objects		X	
National Register of Historic Places	X		
BASIC CULTURAL RESOURCE DOCUMENTS			
Archeological Overview and Assessment		X	
Archeological Identification Studies			X
Archeological Evaluation Studies			X
Ethnographic Overview and Assessment			X
Ethnographic Oral History and Life History			X
Ethnographic Program			X
Historical Base Map			X
Historic Resource Study Map (HRS)			X
Park Administrative History			X

TITLE	CURRENT; APPROVED	NEEDS REVISION	NEEDED
Scope of Collection Statement	X		
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological and Ethnographic Collections Studies			X
Archeological Data Recovery Studies			X
Collection Management Plan			X
Collection Storage Plan			X
Collection Condition Survey			X
Cultural Landscape Report (CLR)	NA		
Ethnohistory			X
Exhibit Plan	X		
Historic Furnishings Report	NA		
Historic Structures Preservation Guide (HSPG)			X
Historic Structures Report			X
Social Impact Study			X
Special History Study			X
Traditional Use Study			X

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX E: RMP REFERENCES



APPENDIX E - REFERENCES

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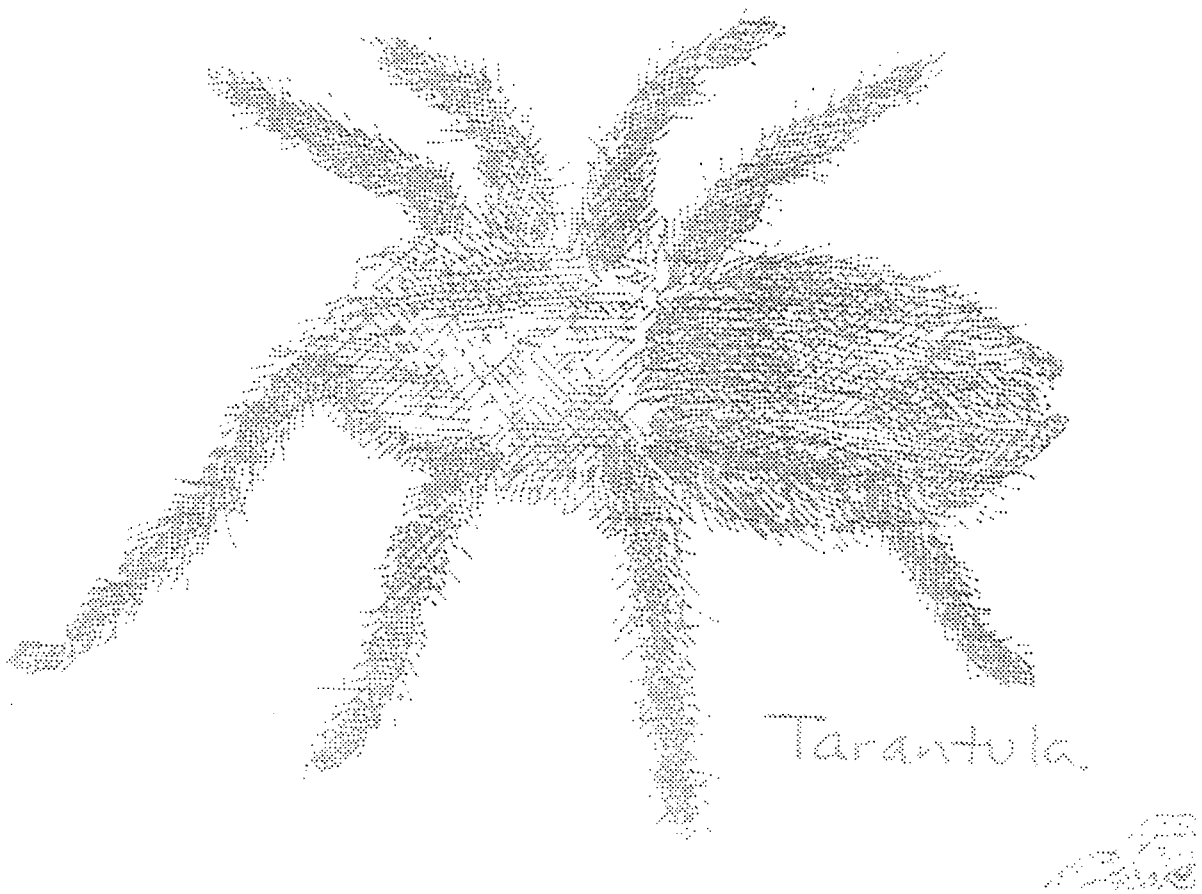
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APPENDIX F - PROGRAMMING SHEETS

ORGAN PIPE CACTUS NATIONAL MONUMENT

NATURAL AND CULTURAL RESOURCES MANAGEMENT PLAN

APPENDIX F: PROGRAMMING SHEETS



12/08/94 TABLE 1 FY: 94

16:42:51 NPS RESOURCE PERSONNEL PARK: ORPI

(current year only) REGION: WRO

TYPE OF NPS EMPLOYEE	FTEs OF RESOURCES WORK		
	Natural	Cultural	Total
Research Scientists	0.0	0.0	0.0
Resources Specialists	8.0	0.0	8.0
025 Park Rangers Res Mgmt	0.0	0.0	0.0
025 Park Rangers Res Prot	0.0	0.0	0.0
025 Park Rangers Res Interp	0.0	0.0	0.0
Maintenance Personnel	0.0	0.0	0.0
Total of RES Personnel	8.0	0.0	8.0
TOTAL PARK FTE: 29.5			
PERCENT	27.1%	0.0%	27.1%

End of data

FUNDING SOURCE	TOTAL	RES	MIT	MON	PRO	INT	ADM
ROTH	2.00	0.00	0.00	0.00	0.00	0.00	2.00
PNR1	383.11	65.86	23.40	178.97	11.20	0.00	103.68
NFED	70.00	70.00	0.00	0.00	0.00	0.00	0.00
RNSR	52.00	0.00	0.00	0.00	0.00	0.00	52.00
NPRF	9.91	9.91	0.00	0.00	0.00	0.00	0.00
TOTAL	517.02	145.77	23.40	178.97	11.20	0.00	157.68

End of data

Sorted by: Priority + Park

12/[redacted]/94 PROJECT LIST Page: 0001
16[redacted]3

PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
0	ORPI-N-001.000	94	IMPLEMENT AND MANAGE VEGETATION MANAGEMENT PROGRAM		204.00	0.00
0	ORPI-N-100.000	94	DIRECT NAT. RES. INVENTORY & MONITORING PROGRAM		28.00	0.00
0	ORPI-N-101.000	94	MANAGE NATURAL RESOURCES MONITORING PROGRAM		81.00	0.00
0	ORPI-N-102.000	94	DEV. DATABASE MGNT. SYSTEM FOR NR MONITORING PROG.		80.00	0.00
0	ORPI-N-106.000	94	PUB. & DIST. NR INVEN. & MONITORING FINAL REPORTS		52.00	0.00
0	ORPI-N-120.000	94	IMPLEMENT CLIMATE MONITORING PROTOCOL		49.20	0.00
0	ORPI-N-121.000	94	IMPLEMENT LAND USE TRENDS MONITORING PROTOCOL		26.00	0.00
0	ORPI-N-122.000	94	IMPLEMENT NOCTURANL RODENT MONITORING PROTOCOL		38.40	0.00
0	ORPI-N-123.000	94	IMPLEMENT LIZARD MONITORING PROTOCOL		44.00	0.00
0	ORPI-N-124.000	94	IMPLEMENT ECHINOMASTUS ERECTROCENTRUS MONT. PROT.		29.00	0.00
0	ORPI-N-125.000	94	IMPLEMENT MONT. PROT. FOR VEG. STRUCT. & DIVERSITY		36.00	0.00
0	ORPI-N-126.000	94	IMPL. S.THURBERI & L.SCHOTTII MONITORING PROTOCOL		18.40	0.00
0	ORPI-N-127.000	94	IMPLEMENT P.STRIATUS MONITORING PROTOCOL		2.00	0.00
0	ORPI-N-128.000	94	IMPLEMENT A.EMARGINATA MONITORING PROTOCOL		2.00	0.00
0	ORPI-N-212.000	94	MONITOR CHEMISTRY OF MONUMENT PRECIPITATION		8.00	0.00
Resource Type Sub-total					698.00	0.00
0	ORPI-C-001.000	94	COMPLETE ARCH. SURVEY REPORT: 1989-1991; CURATION		2.00	0.00
Resource Type Sub-total					2.00	0.00
0	ORPI-I-002.000	94	MANAGE NAT. & CUL. RES. MGNT. & RESEARCH PROGRAM		244.00	0.00
[redacted]	ORPI-I-050.000	94	DEVELOP AND MANAGE RES. INFORMATION MGNT. PROGRAM		193.80	0.00
[redacted]	ORPI-I-051.000	94	IMPLEMENT GEOGRAPHIC INFO. SYSTEM PROGRAM		139.68	0.00
0	ORPI-I-150.000	94	DEVELOP A FIRE MANAGEMENT PLAN		1.20	0.00
Resource Type Sub-total					578.68	0.00
0	ORPI-N-051.000	94	IMPLEMENT AND MANAGE WILDLIFE MANAGEMENT PROGRAM		193.80	0.00
0	ORPI-N-265.000	94	EVALUATE AND MONITOR SONORAN PRONGHORN		35.20	0.00
0	ORPI-N-266.000	94	EVALUATE STATUS OF MASTIFF BATS		4.93	0.00
1	ORPI-N-250.000	94	DEVELOP A TES SPECIES MANAGEMENT PLAN		0.00	15.00
Resource Type Sub-total					233.93	15.00
2	ORPI-I-001.000	94	DEV. & DIRECT NAT. & CUL. RM & RESEARCH PROGRAM		22.00	0.00
Resource Type Sub-total					22.00	0.00
3	ORPI-N-103.000	94	PREPARE AND PUB. NR MONITORING HANDBOOK & VIDEO		0.00	37.00
4	ORPI-N-202.100	94	MONITOR GRDWATER RES. IN RIO SONOYTA WATERSHED		26.04	47.00
Resource Type Sub-total					26.04	84.00
5	ORPI-I-003.000	94	PROVIDE NAT. & CUL. RM & RESEARCH ADMIN. SUPPORT		0.00	160.00
Resource Type Sub-total					0.00	160.00
6	ORPI-N-111.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-BIGHORN SHEEP		8.00	144.00
7	ORPI-N-300.000	94	DEV. & IMP. AMBIENT AIR QUALITY MONITORING PROGRAM		0.00	106.00
8	ORPI-N-301.000	94	DEV. & IMPLEMENT VISIBILITY MONITORING PROGRAM		0.00	181.00
9	ORPI-N-104.000	94	REPLACE AND SUPPLEMENT CLIMATE MONITORING EQUIPMENT		0.00	75.00
[redacted]	ORPI-N-003.000	94	EVAL. EFFECT. & DEVELOP STNDS. FOR REVEG. PROGRAM		0.00	65.00
[redacted]	ORPI-N-002.000	94	DEVELOP A VEGETATION MANAGEMENT PLAN		0.00	17.60
12	ORPI-N-007.000	94	MONITOR & MITIGATE WOODCUTTING		0.00	272.00

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FU..DED	UNFUNDE^
Resource Type Sub-total----------					8.00	860.60
13	ORPI-C-002.000	94	PREPARE PREHISTORIC SITE PRESERVATION GUIDES		0.00	20.(
14	ORPI-C-003.000	94	DEVELOP ARCH. BASE MAP/DATABASE IN GIS		0.00	21.(
15	ORPI-C-050.000	94	MAINTAIN STABLIZED RUINS AND HISTORIC STRUCTURES		0.00	13.60
Resource Type Sub-total----------					0.00	54.6
16	ORPI-I-006.000	94	DEV. & IMP. COMP. NAT. & CUL. RES. INTERP. PROGRAM		0.00	1272.00
17	ORPI-I-100.000	94	MONITOR AND CONTROL AFRICANIZED HONEY BEES		12.00	0.00
Resource Type Sub-total----------					12.00	1272.(
18	ORPI-N-050.000	94	DEVELOP A WILDLIFE MANAGEMENT PLAN		0.00	17.60
19	ORPI-N-200.000	94	IDENTIFY & INVENTORY WATER RELATED RES. ATTRIBUTES		0.00	40.0
20	ORPI-N-201.000	94	MONITOR LAND SUBSIDENCE		0.00	32.0
21	ORPI-N-202.200	94	INVES. GROUNDWATER USE ON TOHONO O'ODHAM LANDS		0.00	12.50
22	ORPI-N-202.300	94	CONDUCT SUR. WATER INV. OF RIO SONOYTA WATERSHED		0.00	26.0^
23	ORPI-N-202.400	94	CONDUCT LAND USE SURVEY OF RIO SONOYTA WATERSHED		0.00	56.(
24	ORPI-N-202.500	94	EVAL. TRENDS IN WATER RES. IN RIO SONOYTA WATERSHED		0.00	25.00
25	ORPI-N-251.000	94	EXPAND & IMPLEMENT QBQ DES. PUPFISH MONT. PROGRAM		20.00	15.00
26	ORPI-N-252.000	94	EXPAND & IMPL. LONG-NOSED BAT MONITORING PROGRAM		20.00	15.0
27	ORPI-N-253.000	94	EVALUATE EFFECTS OF POACHING ON MONUMENT RESOURCES		0.00	80.0
28	ORPI-N-116.000	94	COND. INVENT. & DEV. MONT. PROT.-DESERT TORTOISE		0.00	154.5(
29	ORPI-N-117.000	94	COND. INVENT. & DEV. MONT. PROT.-FERR. PYGMY-OWL		0.00	8(
Resource Type Sub-total----------					40.00	553.8
30	ORPI-C-004.000	94	DATA BANK MGNT: CORRECT PLOTTING OF SITE LOCATIONS		0.00	11.00
31	ORPI-C-005.000	94	DEVELOP AND FUND PUBLIC ARCHEOLOGY PROGRAM		0.00	32.0
32	ORPI-C-051.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION PLAN		0.00	10.0(
33	ORPI-C-052.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION GUIDES		0.00	25.00
Resource Type Sub-total----------					0.00	78.0
34	ORPI-I-004.000	94	DEVELOP RESEARCH OPPORTUNITIES & NEEDS ASSESSMENT		0.00	15.00
35	ORPI-I-005.000	94	ESTABLISH EDITORIAL ASSISTANT POSITION		0.00	82.8
36	ORPI-I-052.000	94	UPDATE INFORMATION MANAGEMENT PLAN		0.00	5.3
37	ORPI-I-053.000	94	CONDUCT GIS/AIRBORNE VIDEO MONITORING RESEARCH		0.00	86.00
38	ORPI-I-101.000	94	DEVELOP AN INTEGRATED PEST MANAGEMENT PLAN		0.00	6.00
39	ORPI-I-151.000	94	CONDUCT A FIRE MANAGEMENT PROGRAM		0.00	100.0
40	ORPI-I-200.000	94	DEVELOP A WILDERNESS MANAGEMENT PLAN		0.00	14.0(
41	ORPI-I-201.000	94	DEVELOP A TRAIL USE MANAGEMENT PLAN		0.00	30.00
42	ORPI-I-250.000	94	CONDUCT MONT. & MAIN. OF ABAND. MINE SAFETY FEAT.		0.00	36.9
43	ORPI-I-251.000	94	CONDUCT STUDY OF WILDLIFE USE OF ABANDONED MINES		0.00	70.0
44	ORPI-I-300.000	94	DEV. & IMP. AIRCRAFT OVERFLIGHT MONITORING PROGRAM		0.00	24.00
45	ORPI-I-350.000	94	DEVELOP MAB ACTION PROGRAM FOR THE SONORAN DESERT		0.00	80.0^
46	ORPI-I-400.000	94	DEVELOP A COLLECTIONS MANAGEMENT PLAN		0.00	10.0
47	ORPI-I-402.000	94	AUTOMATE LIBARY CATALOG SYSTEM		0.00	5.50
48	ORPI-I-450.000	94	DEVELOP AN INTEGRATED MGNT. PLAN FOR QUITOBAQUITO		0.00	70.00
Resource Type Sub-total----------					0.00	635.5
49	ORPI-N-004.000	94	REVEGETATE ABANDONED ROAD PORTALS		0.00	90
50	ORPI-N-005.000	94	DEV. & IMP. SITE RES.-DOWLING RANCH & STACK PROP.		0.00	175.0(

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
51	ORPI-N-105.000	94	MAP NATURAL RESOURCES MONITORING STUDY SITES		0.00	55.00
52	ORPI-N-107.000	94	DEVELOP AN AVIAN MONITORING PROTOCOL		0.00	80.00
53	ORPI-N-108.000	94	DEVELOP A TERRESTRIAL INVERT. MONITORING PROTOCOL		0.00	100.00
54	ORPI-N-109.000	94	UPDATE MONUMENT FLORA		4.98	10.00
55	ORPI-N-203.000	94	DEVELOP & IMPLEMENT WATER CONSERVATION PLAN		0.00	35.00
56	ORPI-N-204.000	94	DEFINE CHARACTERISTICS OF REGIONAL ACQUIFERS		0.00	18.00
57	ORPI-N-205.000	94	UPDATE WATER RESOURCES INVENTORY AND MONITORING		0.00	47.00
58	ORPI-N-254.000	94	I.D. SONORAN MUD TURTLE MORTALITY SOURCE-QUITOBAQ.		0.00	4.00
59	ORPI-N-255.000	94	SURVEY RIO SONOYTA POP. OF SONORAN MUD TURTLE		0.00	5.00
60	ORPI-N-257.000	94	SURVEY AND MONITOR MOISTURE-SENSITIVE HERPETOFAUNA		0.00	28.50
61	ORPI-N-258.000	94	DETERMINE STATUS OF ORGAN PIPE SHOVELNOSED SNAKE		0.00	34.00
Resource Type Sub-total					4.98	681.50
62	ORPI-C-006.000	94	DEVELOP AND FUND ARCH. SITE PROTECTION PROGRAM		0.00	40.00
63	ORPI-C-007.000	94	ETHNOGRAPHIC RESEARCH		0.00	120.00
64	ORPI-C-008.000	94	CONDUCT ORAL HISTORY PROJECT		0.00	32.00
65	ORPI-C-009.000	94	WRITE QUITOBAQUITO MANAGEMENT AREA HUMAN HISTORY		0.00	115.00
Resource Type Sub-total					0.00	307.00
66	ORPI-I-401.000	94	MANAGE LIBRARY & MUSEUM		15.52	180.00
67	ORPI-I-054.000	94	DEVELOP CUSTOM GIS AUTOMATED QUAD INDEXING SYSTEM		0.00	8.90
68	ORPI-I-055.000	94	IMPLEMENT GLOBAL POSITIONING SYSTEM DATA AQUISITION		10.20	121.00
[illegible]	ORPI-I-056.000	94	DEVELOP COMPUTERIZED BIBLIOGRAPHIC INFO. SYSTEM		0.00	37.85
[illegible]	ORPI-I-102.000	94	MANAGE PEST SPECIES		8.00	0.00
71	ORPI-I-103.000	94	DEVELOP & IMP. BOUNDARY FENCE MAINTENANCE PROGRAM		0.00	148.00
72	ORPI-I-104.000	94	MONITOR & CONTROL TRESPASS GRAZING		14.20	32.80
73	ORPI-I-152.000	94	CONDUCT FIRE HISTORY AND ECOLOGY RESEARCH		0.00	100.00
74	ORPI-I-252.000	94	DEVELOP MINE HAZARDS SAFETY PROGRAM		0.00	8.00
75	ORPI-I-253.000	94	REHABILITATE SELECTED MINES		0.00	228.00
76	ORPI-I-351.000	94	CONDUCT MAB MULTICULTURAL INTERPRETIVE PROGRAMS		0.00	200.00
77	ORPI-I-403.000	94	OBTAIN & MAINTAIN HISTORIC PHOTOGRAPH COLLECTION		0.00	30.00
78	ORPI-I-404.000	94	UPDATE AND MAINTAIN AUTOMATED NAT. CATALOG SYSTEM		0.00	17.00
79	ORPI-I-451.000	94	PREPARE & IMPLE. PLAN TO COMPLY-SPEC. DIRECT. 91-6		0.00	2.10
80	ORPI-I-452.000	94	DEVELOP ROAD MAINTENANCE STANDARDS & PROCEDURES		0.00	10.00
81	ORPI-I-453.000	94	ESTABLISH A CARRYING CAPACITY FOR LOOP DRIVES		0.00	17.00
Resource Type Sub-total					47.92	1140.65
82	ORPI-N-006.000	94	DEV. & IMP. A PROGRAM TO MANAGE HAZARDOUS TREES		0.00	35.00
83	ORPI-N-112.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-JAVEINA		0.00	150.00
84	ORPI-N-113.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MOUNTAIN LION		0.00	150.00
85	ORPI-N-114.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MULE DEER		0.00	150.00
86	ORPI-N-115.000	94	EVAL STATUS & DEV MONITORING PROG-WHITE-TAILED DEER		0.00	52.00
87	ORPI-N-118.000	94	COND. INV. AND DEV. MONT. PROT.-MICROPHYTIC CRUSTS		0.00	80.00
88	ORPI-N-119.000	94	COND. INV. & DEV. MONT. PROTOCOL-AQUATIC INVERTS.		0.00	100.00
89	ORPI-N-129.000	94	DEVELOP LONG-TERM POPULATION MONITORING OF SNAKES		0.00	62.00
90	ORPI-N-130.000	94	DEV. MEXICAN LEAFCUTTING ANT POP. MONITORING PROG.		0.00	9.20
91	ORPI-N-206.000	94	DEVELOP A GIS COMPONENT FOR WATER RESOURCES		0.00	50.00
[illegible]	ORPI-N-207.000	94	MONITOR RIPARIAN ECOSYSTEMS		0.00	45.00
[illegible]	ORPI-N-208.000	94	ID. POLL. THREATS-KUAKATCH & CUERDA DE LENA WASHES		0.00	24.00
94	ORPI-N-209.000	94	CONTROL ACCELERATED EROSION		0.00	93.00

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
95	ORPI-N-210.000	94	EVALUATE FLOOD HAZARDS AT BATES WELL		0.00	6.00
96	ORPI-N-211.000	94	EVALUATE ABANDONED MINE TAILING		0.00	6.50
97	ORPI-N-213.000	94	MANAGE WASTEWATER		0.00	8.0
98	ORPI-N-256.000	94	COND. A STUDY ON BIO./HYD. REL.-RIO SONOYTA WTRSHED		0.00	262.0
99	ORPI-N-259.000	94	DETERMINE STATUS OF THE MEXICAN ROSY BOA		0.00	85.00
100	ORPI-N-260.000	94	ANALYZE MEXICAN LEAFCUTTING AT POP. SIZE AND STRUCT		0.00	20.0
Resource Type Sub-total					0.00	1387.7
101	ORPI-I-203.000	94	DETERMINE VISITOR IMPACTS AND USE PERMITS		0.00	60.00
102	ORPI-I-057.000	94	PREPARE ADMIN. HISTORY OF NAT. & CUL. RM & RESEARCH		0.00	30.0
Resource Type Sub-total					0.00	90.00
103	ORPI-N-261.000	94	EXPAND LONG-TERM ECOL. STUDIES-STENOCEREUS THURBERI		0.00	115.0
104	ORPI-N-262.000	94	EXPAND LONG-TERM ECOL. STUDIES-E.ERECTROCENTRUS		0.00	90.0
105	ORPI-N-263.000	94	EXPAND LONG-TERM ECOL. STUDIES-LOPHCEREUS SCHOTTII		0.00	90.00
106	ORPI-N-264.000	94	EXPAND LONG-TERM ECOL. STUDIES-BURSERA MICROPHYLLA		0.00	90.0
Resource Type Sub-total					0.00	385.0
107	ORPI-C-010.000	94	DATA RECOVERY PROJECTS		0.00	32.00
108	ORPI-C-011.000	94	ARCHEOLOGICAL SURVEY OF USE ZONES		0.00	240.0
109	ORPI-C-012.000	94	WRITE OVERVIEW/SYN. OF ARCH. & HIST. RESOURCES		0.00	48.5
110	ORPI-C-013.000	94	DEVELOP ARCH. SITE LOCATION PREDICTIVE MODEL		0.00	24
111	ORPI-C-014.000	94	RECORD ROCK ART SITES		0.00	50
112	ORPI-C-015.000	94	COMPLETE ARCH. SAMPLE SURVEY & ASSESSMENT		0.00	270.0
113	ORPI-C-016.000	94	INTENSIVE TRANSECT RECORDING/MAPPING OF LARGE SITES		0.00	89.00
114	ORPI-C-017.000	94	TEST EXCAVATION OF "RESERVOIR" AT AZ Z:13:1(ASM)		0.00	33.5
115	ORPI-C-018.000	94	ARCHIVAL RES. RELATED TO EARLY ARCH./ETHNO. SURVEYS		0.00	27.0
116	ORPI-C-019.000	94	SPECIALIZED ARTIFACT STUDIES		0.00	35.00
117	ORPI-C-020.000	94	RE-ANAL. PREVIOUS COLL. AT WACC, ORPI & OTHER INST.		0.00	35.50
118	ORPI-C-021.000	94	PREPARE NAT. REG. NOMINATIONS FOR ARCH. SITES/DIST.		0.00	46.0
119	ORPI-C-022.000	94	DEVELOP & FUND ARCHEOLOGICAL JOB TRAINING PROGRAM		0.00	30.0
120	ORPI-C-023.000	94	ASS. OF HUMAN IMP. & NAT. DIST. AND MONT. CUL. RES.		0.00	208.40
Resource Type Sub-total					0.00	1168.9
121	ORPI-N-110.000	94	CONDUCT SURVEY OF STUDY SITE SOILS, GEO. & HYDRO.		0.00	60.00
Resource Type Sub-total					0.00	60.00
122	ORPI-I-058.000	94	INCORPORATE & INT. NEW DATA INTO INFO. MGNT./GIS		0.00	44.00
123	ORPI-I-059.000	94	CONDUCT FEASIBILITY STUDY TO LINK GIS WITH MMS		0.00	20.00
124	ORPI-I-202.000	94	DEVELOP A CAVE MANAGEMENT PLAN		0.00	51.0
Resource Type Sub-total					0.00	115.0
Grand Total					1673.55	9049.1

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Sorted by: Resource Type + Priority

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
0	ORPI-C-001.000	94	COMPLETE ARCH. SURVEY REPORT: 1989-1991; CURATION		2.00	0.00
13	ORPI-C-002.000	94	PREPARE PREHISTORIC SITE PRESERVATION GUIDES		0.00	20.00
14	ORPI-C-003.000	94	DEVELOP ARCH. BASE MAP/DATABASE IN GIS		0.00	21.00
15	ORPI-C-050.000	94	MAINTAIN STABLIZED RUINS AND HISTORIC STRUCTURES		0.00	13.60
30	ORPI-C-004.000	94	DATA BANK MGNT: CORRECT PLOTTING OF SITE LOCATIONS		0.00	11.00
31	ORPI-C-005.000	94	DEVELOP AND FUND PUBLIC ARCHEOLOGY PROGRAM		0.00	32.00
32	ORPI-C-051.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION PLAN		0.00	10.00
33	ORPI-C-052.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION GUIDES		0.00	25.00
62	ORPI-C-006.000	94	DEVELOP AND FUND ARCH. SITE PROTECTION PROGRAM		0.00	40.00
63	ORPI-C-007.000	94	ETHNOGRAPHIC RESEARCH		0.00	120.00
64	ORPI-C-008.000	94	CONDUCT ORAL HISTORY PROJECT		0.00	32.00
65	ORPI-C-009.000	94	WRITE QUITOBAQUITO MANAGEMENT AREA HUMAN HISTORY		0.00	115.00
107	ORPI-C-010.000	94	DATA RECOVERY PROJECTS		0.00	32.00
108	ORPI-C-011.000	94	ARCHEOLOGICAL SURVEY OF USE ZONES		0.00	240.00
109	ORPI-C-012.000	94	WRITE OVERVIEW/SYN. OF ARCH. & HIST. RESOURCES		0.00	48.50
110	ORPI-C-013.000	94	DEVELOP ARCH. SITE LOCATION PREDICTIVE MODEL		0.00	24.00
111	ORPI-C-014.000	94	RECORD ROCK ART SITES		0.00	50.00
112	ORPI-C-015.000	94	COMPLETE ARCH. SAMPLE SURVEY & ASSESSMENT		0.00	270.00
113	ORPI-C-016.000	94	INTENSIVE TRANSECT RECORDING/MAPPING OF LARGE SITES		0.00	89.00
114	ORPI-C-017.000	94	TEST EXCAVATION OF "RESERVOIR" AT AZ Z:13:1(ASM)		0.00	33.50
115	ORPI-C-018.000	94	ARCHIVAL RES. RELATED TO EARLY ARCH./ETHNO. SURVEYS		0.00	27.00
[redacted]	ORPI-C-019.000	94	SPECIALIZED ARTIFACT STUDIES		0.00	35.00
[redacted]	ORPI-C-020.000	94	RE-ANAL. PREVIOUS COLL. AT WACC, ORPI & OTHER INST.		0.00	35.50
118	ORPI-C-021.000	94	PREPARE NAT. REG. NOMINATIONS FOR ARCH. SITES/DIST.		0.00	46.00
119	ORPI-C-022.000	94	DEVELOP & FUND ARCHEOLOGICAL JOB TRAINING PROGRAM		0.00	30.00
120	ORPI-C-023.000	94	ASS. OF HUMAN IMP. & NAT. DIST. AND MONT. CUL. RES.		0.00	208.40
Resource Type Sub-total					2.00	1608.50
0	ORPI-I-002.000	94	MANAGE NAT. & CUL. RES. MGNT. & RESEARCH PROGRAM		244.00	0.00
0	ORPI-I-050.000	94	DEVELOP AND MANAGE RES. INFORMATION MGNT. PROGRAM		193.80	0.00
0	ORPI-I-051.000	94	IMPLEMENT GEOGRAPHIC INFO. SYSTEM PROGRAM		139.68	0.00
0	ORPI-I-150.000	94	DEVELOP A FIRE MANAGEMENT PLAN		1.20	0.00
2	ORPI-I-001.000	94	DEV. & DIRECT NAT. & CUL. RM & RESEARCH PROGRAM		22.00	0.00
5	ORPI-I-003.000	94	PROVIDE NAT. & CUL. RM & RESEARCH ADMIN. SUPPORT		0.00	160.00
16	ORPI-I-006.000	94	DEV. & IMP. COMP. NAT. & CUL. RES. INTERP. PROGRAM		0.00	1272.00
17	ORPI-I-100.000	94	MONITOR AND CONTROL AFRICANIZED HONEY BEES		12.00	0.00
34	ORPI-I-004.000	94	DEVELOP RESEARCH OPPORTUNITIES & NEEDS ASSESSMENT		0.00	15.00
35	ORPI-I-005.000	94	ESTABLISH EDITORIAL ASSISTANT POSITION		0.00	82.80
36	ORPI-I-052.000	94	UPDATE INFORMATION MANAGEMENT PLAN		0.00	5.30
37	ORPI-I-053.000	94	CONDUCT GIS/AIRBORNE VIDEO MONITORING RESEARCH		0.00	86.00
38	ORPI-I-101.000	94	DEVELOP AN INTEGRATED PEST MANAGEMENT PLAN		0.00	6.00
39	ORPI-I-151.000	94	CONDUCT A FIRE MANAGEMENT PROGRAM		0.00	100.00
40	ORPI-I-200.000	94	DEVELOP A WILDERNESS MANAGEMENT PLAN		0.00	14.00
41	ORPI-I-201.000	94	DEVELOP A TRAIL USE MANAGEMENT PLAN		0.00	30.00
42	ORPI-I-250.000	94	CONDUCT MONT. & MAIN. OF ABAND. MINE SAFETY FEAT.		0.00	36.96
43	ORPI-I-251.000	94	CONDUCT STUDY OF WILDLIFE USE OF ABANDONED MINES		0.00	70.00
44	ORPI-I-300.000	94	DEV. & IMP. AIRCRAFT OVERFLIGHT MONITORING PROGRAM		0.00	24.00
[redacted]	ORPI-I-350.000	94	DEVELOP MAB ACTION PROGRAM FOR THE SONORAN DESERT		0.00	80.00
[redacted]	ORPI-I-400.000	94	DEVELOP A COLLECTIONS MANAGEMENT PLAN		0.00	10.00

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDE
47	ORPI-I-402.000	94	AUTOMATE LIBARY CATALOG SYSTEM		0.00	5.50
48	ORPI-I-450.000	94	DEVELOP AN INTEGRATED MGNT. PLAN FOR QUITOBAQUITO		0.00	70.00
66	ORPI-I-401.000	94	MANAGE LIBRARY & MUSEUM		15.52	180.0
67	ORPI-I-054.000	94	DEVELOP CUSTOM GIS AUTOMATED QUAD INDEXING SYSTEM		0.00	8.5
68	ORPI-I-055.000	94	IMPLEMENT GLOBAL POSITIONING SYSTEM DATA AQUISITION		10.20	121.00
69	ORPI-I-056.000	94	DEVELOP COMPUTERIZED BIBLIOGRAPHIC INFO. SYSTEM		0.00	37.8
70	ORPI-I-102.000	94	MANAGE PEST SPECIES		8.00	0.0
71	ORPI-I-103.000	94	DEVELOP & IMP. BOUNDARY FENCE MAINTENANCE PROGRAM		0.00	148.00
72	ORPI-I-104.000	94	MONITOR & CONTROL TRESPASS GRAZING		14.20	32.80
73	ORPI-I-152.000	94	CONDUCT FIRE HISTORY AND ECOLOGY RESEARCH		0.00	100.0
74	ORPI-I-252.000	94	DEVELOP MINE HAZARDS SAFETY PROGRAM		0.00	8.00
75	ORPI-I-253.000	94	REHABILITATE SELECTED MINES		0.00	228.00
76	ORPI-I-351.000	94	CONDUCT MAB MULTICULTURAL INTERPRETIVE PROGRAMS		0.00	200.0
77	ORPI-I-403.000	94	OBTAIN & MAINTAIN HISTORIC PHOTOGRAPH COLLECTION		0.00	30.0
78	ORPI-I-404.000	94	UPDATE AND MAINTAIN AUTOMATED NAT. CATALOG SYSTEM		0.00	17.00
79	ORPI-I-451.000	94	PREPARE & IMPLE. PLAN TO COMPLY-SPEC. DIRECT. 91-6		0.00	2.1
80	ORPI-I-452.000	94	DEVELOP ROAD MAINTENANCE STANDARDS & PROCEDURES		0.00	10.0
81	ORPI-I-453.000	94	ESTABLISH A CARRYING CAPACITY FOR LOOP DRIVES		0.00	17.00
101	ORPI-I-203.000	94	DETERMINE VISITOR IMPACTS AND USE PERMITS		0.00	60.00
102	ORPI-I-057.000	94	PREPARE ADMIN. HISTORY OF NAT. & CUL. RM & RESEARCH		0.00	30.0
122	ORPI-I-058.000	94	INCORPORATE & INT. NEW DATA INTO INFO. MGNT./GIS		0.00	44.0
123	ORPI-I-059.000	94	CONDUCT FEASIBILITY STUDY TO LINK GIS WITH MMS		0.00	20.
124	ORPI-I-202.000	94	DEVELOP A CAVE MANAGEMENT PLAN		0.00	51
Resource Type Sub-total					660.60	3413.2
0	ORPI-N-001.000	94	IMPLEMENT AND MANAGE VEGETATION MANAGEMENT PROGRAM		204.00	0.00
0	ORPI-N-100.000	94	DIRECT NAT. RES. INVENTORY & MONITORING PROGRAM		28.00	0.0
0	ORPI-N-101.000	94	MANAGE NATURAL RESOURCES MONITORING PROGRAM		81.00	0.00
0	ORPI-N-102.000	94	DEV. DATABASE MGNT. SYSTEM FOR NR MONITORING PROG.		80.00	0.00
0	ORPI-N-106.000	94	PUB. & DIST. NR INVEN. & MONITORING FINAL REPORTS		52.00	0.0
0	ORPI-N-120.000	94	IMPLEMENT CLIMATE MONITORING PROTOCOL		49.20	0.0
0	ORPI-N-121.000	94	IMPLEMENT LAND USE TRENDS MONITORING PROTOCOL		26.00	0.00
0	ORPI-N-122.000	94	IMPLEMENT NOCTURANL RODENT MONITORING PROTOCOL		38.40	0.0
0	ORPI-N-123.000	94	IMPLEMENT LIZARD MONITORING PROTOCOL		44.00	0.0
0	ORPI-N-124.000	94	IMPLEMENT ECHINOMASTUS ERECTROCENTRUS MONT. PROT.		29.00	0.00
0	ORPI-N-125.000	94	IMPLEMENT MONT. PROT. FOR VEG. STRUCT. & DIVERSITY		36.00	0.00
0	ORPI-N-126.000	94	IMPL. S.THURBERI & L.SCHOTTII MONITORING PROTOCOL		18.40	0.0
0	ORPI-N-127.000	94	IMPLEMENT P.STRIATUS MONITORING PROTOCOL		2.00	0.00
0	ORPI-N-128.000	94	IMPLEMENT A.EMARGINATA MONITORING PROTOCOL		2.00	0.00
0	ORPI-N-212.000	94	MONITOR CHEMISTRY OF MONUMENT PRECIPITATION		8.00	0.0
0	ORPI-N-051.000	94	IMPLEMENT AND MANAGE WILDLIFE MANAGEMENT PROGRAM		193.80	0.0
0	ORPI-N-265.000	94	EVALUATE AND MONITOR SONORAN PRONGHORN		35.20	0.00
0	ORPI-N-266.000	94	EVALUATE STATUS OF MASTIFF BATS		4.93	0.00
1	ORPI-N-250.000	94	DEVELOP A TES SPECIES MANAGEMENT PLAN		0.00	15.0
3	ORPI-N-103.000	94	PREPARE AND PUB. NR MONITORING HANDBOOK & VIDEO		0.00	37.00
4	ORPI-N-202.100	94	MONITOR GRDWATER RES. IN RIO SONOYTA WATERSHED		26.04	47.00
6	ORPI-N-111.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-BIGHORN SHEEP		8.00	144.0
7	ORPI-N-300.000	94	DEV. & IMP. AMBIENT AIR QUALITY MONITORING PROGRAM		0.00	106
8	ORPI-N-301.000	94	DEV. & IMPLEMENT VISIBILITY MONITORING PROGRAM		0.00	181
9	ORPI-N-104.000	94	REPLACE AND SUPPLEMENT CLIMATE MONITORING EQUIPMENT		0.00	75.0

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
10	ORPI-N-003.000	94	EVAL. EFFECT. & DEVELOP STNDS. FOR REVEG. PROGRAM		0.00	65.00
11	ORPI-N-002.000	94	DEVELOP A VEGETATION MANAGEMENT PLAN		0.00	17.60
12	ORPI-N-007.000	94	MONITOR & MITIGATE WOODCUTTING		0.00	272.00
18	ORPI-N-050.000	94	DEVELOP A WILDLIFE MANAGEMENT PLAN		0.00	17.60
19	ORPI-N-200.000	94	IDENTIFY & INVENTORY WATER RELATED RES. ATTRIBUTES		0.00	40.00
20	ORPI-N-201.000	94	MONITOR LAND SUBSIDENCE		0.00	32.00
21	ORPI-N-202.200	94	INVES. GROUNDWATER USE ON TOHONO O'ODHAM LANDS		0.00	12.50
22	ORPI-N-202.300	94	CONDUCT SUR. WATER INV. OF RIO SONOYTA WATERSHED		0.00	26.00
23	ORPI-N-202.400	94	CONDUCT LAND USE SURVEY OF RIO SONOYTA WATERSHED		0.00	56.00
24	ORPI-N-202.500	94	EVAL. TRENDS IN WATER RES. IN RIO SONOYTA WATERSHED		0.00	25.00
25	ORPI-N-251.000	94	EXPAND & IMPLEMENT QBQ DES. PUPFISH MONT. PROGRAM		20.00	15.00
26	ORPI-N-252.000	94	EXPAND & IMPL. LONG-NOSED BAT MONITORING PROGRAM		20.00	15.00
27	ORPI-N-253.000	94	EVALUATE EFFECTS OF POACHING ON MONUMENT RESOURCES		0.00	80.00
28	ORPI-N-116.000	94	COND. INVENT. & DEV. MONT. PROT.-DESERT TORTOISE		0.00	154.50
29	ORPI-N-117.000	94	COND. INVENT. & DEV. MONT. PROT.-FERR. PYGMY-OWL		0.00	80.00
49	ORPI-N-004.000	94	REVEGETATE ABANDONED ROAD PORTALS		0.00	90.00
50	ORPI-N-005.000	94	DEV. & IMP. SITE RES.-DOWLING RANCH & STACK PROP.		0.00	175.00
51	ORPI-N-105.000	94	MAP NATURAL RESOURCES MONITORING STUDY SITES		0.00	55.00
52	ORPI-N-107.000	94	DEVELOP AN AVIAN MONITORING PROTOCOL		0.00	80.00
53	ORPI-N-108.000	94	DEVELOP A TERRESTRIAL INVERT. MONITORING PROTOCOL		0.00	100.00
54	ORPI-N-109.000	94	UPDATE MONUMENT FLORA		4.98	10.00
55	ORPI-N-203.000	94	DEVELOP & IMPLEMENT WATER CONSERVATION PLAN		0.00	35.00
[illegible]	ORPI-N-204.000	94	DEFINE CHARACTERISTICS OF REGIONAL ACQUIFERS		0.00	18.00
[illegible]	ORPI-N-205.000	94	UPDATE WATER RESOURCES INVENTORY AND MONITORING		0.00	47.00
58	ORPI-N-254.000	94	I.D. SONORAN MUD TURTLE MORTALITY SOURCE-QUITOBAQ.		0.00	4.00
59	ORPI-N-255.000	94	SURVEY RIO SONOYTA POP. OF SONORAN MUD TURTLE		0.00	5.00
60	ORPI-N-257.000	94	SURVEY AND MONITOR MOISTURE-SENSITIVE HERPETOFAUNA		0.00	28.50
61	ORPI-N-258.000	94	DETERMINE STATUS OF ORGAN PIPE SHOVELNOSED SNAKE		0.00	34.00
82	ORPI-N-006.000	94	DEV. & IMP. A PROGRAM TO MANAGE HAZARDOUS TREES		0.00	35.00
83	ORPI-N-112.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-JAVEINA		0.00	150.00
84	ORPI-N-113.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MOUNTAIN LION		0.00	150.00
85	ORPI-N-114.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MULE DEER		0.00	150.00
86	ORPI-N-115.000	94	EVAL STATUS & DEV MONITORING PROG-WHITE-TAILED DEER		0.00	52.00
87	ORPI-N-118.000	94	COND. INV. AND DEV. MONT. PROT.-MICROPHYTIC CRUSTS		0.00	80.00
88	ORPI-N-119.000	94	COND. INV. & DEV. MONT. PROTOCOL-AQUATIC INVERTS.		0.00	100.00
89	ORPI-N-129.000	94	DEVELOP LONG-TERM POPULATION MONITORING OF SNAKES		0.00	62.00
90	ORPI-N-130.000	94	DEV. MEXICAN LEAFCUTTING ANT POP. MONITORING PROG.		0.00	9.20
91	ORPI-N-206.000	94	DEVELOP A GIS COMPONENT FOR WATER RESOURCES		0.00	50.00
92	ORPI-N-207.000	94	MONITOR RIPARIAN ECOSYSTEMS		0.00	45.00
93	ORPI-N-208.000	94	ID. POLL. THREATS-KUAKATCH & CUERDA DE LENA WASHES		0.00	24.00
94	ORPI-N-209.000	94	CONTROL ACCELERATED EROSION		0.00	93.00
95	ORPI-N-210.000	94	EVALUATE FLOOD HAZARDS AT BATES WELL		0.00	6.00
96	ORPI-N-211.000	94	EVALUATE ABANDONED MINE TAILING		0.00	6.50
97	ORPI-N-213.000	94	MANAGE WASTEWATER		0.00	8.00
98	ORPI-N-256.000	94	COND. A STUDY ON BIO./HYD. REL.-RIO SONOYTA WTRSHED		0.00	262.00
99	ORPI-N-259.000	94	DETERMINE STATUS OF THE MEXICAN ROSY BOA		0.00	85.00
100	ORPI-N-260.000	94	ANALYZE MEXICAN LEAFCUTTING AT POP. SIZE AND STRUCT		0.00	20.00
103	ORPI-N-261.000	94	EXPAND LONG-TERM ECOL. STUDIES-STENOCEREUS THURBERI		0.00	115.00
[illegible]	ORPI-N-262.000	94	EXPAND LONG-TERM ECOL. STUDIES-E.ERECTROCENTRUS		0.00	90.00
[illegible]	ORPI-N-263.000	94	EXPAND LONG-TERM ECOL. STUDIES-LOPHCEREUS SCHOTTII		0.00	90.00

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDE
106	ORPI-N-264.000	94	EXPAND LONG-TERM ECOL. STUDIES-BURSERA MICROPHYLLA		0.00	90.00
121	ORPI-N-110.000	94	CONDUCT SURVEY OF STUDY SITE SOILS, GEO. & HYDRO.		0.00	60.00
Resource Type Sub-total----------					1010.95	4027.4
Grand Total==========					1673.55	9049.11

147 projects printed

Sorted by: Resource Type + Project Number + Priority

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
0	ORPI-C-001.000	94	COMPLETE ARCH. SURVEY REPORT: 1989-1991; CURATION		2.00	0.00
13	ORPI-C-002.000	94	PREPARE PREHISTORIC SITE PRESERVATION GUIDES		0.00	20.00
14	ORPI-C-003.000	94	DEVELOP ARCH. BASE MAP/DATABASE IN GIS		0.00	21.00
30	ORPI-C-004.000	94	DATA BANK MGNT: CORRECT PLOTTING OF SITE LOCATIONS		0.00	11.00
31	ORPI-C-005.000	94	DEVELOP AND FUND PUBLIC ARCHEOLOGY PROGRAM		0.00	32.00
62	ORPI-C-006.000	94	DEVELOP AND FUND ARCH. SITE PROTECTION PROGRAM		0.00	40.00
63	ORPI-C-007.000	94	ETHNOGRAPHIC RESEARCH		0.00	120.00
64	ORPI-C-008.000	94	CONDUCT ORAL HISTORY PROJECT		0.00	32.00
65	ORPI-C-009.000	94	WRITE QUITOBAQUITO MANAGEMENT AREA HUMAN HISTORY		0.00	115.00
107	ORPI-C-010.000	94	DATA RECOVERY PROJECTS		0.00	32.00
108	ORPI-C-011.000	94	ARCHEOLOGICAL SURVEY OF USE ZONES		0.00	240.00
109	ORPI-C-012.000	94	WRITE OVERVIEW/SYN. OF ARCH. & HIST. RESOURCES		0.00	48.50
110	ORPI-C-013.000	94	DEVELOP ARCH. SITE LOCATION PREDICTIVE MODEL		0.00	24.00
111	ORPI-C-014.000	94	RECORD ROCK ART SITES		0.00	50.00
112	ORPI-C-015.000	94	COMPLETE ARCH. SAMPLE SURVEY & ASSESSMENT		0.00	270.00
113	ORPI-C-016.000	94	INTENSIVE TRANSECT RECORDING/MAPPING OF LARGE SITES		0.00	89.00
114	ORPI-C-017.000	94	TEST EXCAVATION OF "RESERVOIR" AT AZ Z:13:1(ASM)		0.00	33.50
115	ORPI-C-018.000	94	ARCHIVAL RES. RELATED TO EARLY ARCH./ETHNO. SURVEYS		0.00	27.00
116	ORPI-C-019.000	94	SPECIALIZED ARTIFACT STUDIES		0.00	35.00
117	ORPI-C-020.000	94	RE-ANAL. PREVIOUS COLL. AT WACC, ORPI & OTHER INST.		0.00	35.50
118	ORPI-C-021.000	94	PREPARE NAT. REG. NOMINATIONS FOR ARCH. SITES/DIST.		0.00	46.00
[redacted]	ORPI-C-022.000	94	DEVELOP & FUND ARCHEOLOGICAL JOB TRAINING PROGRAM		0.00	30.00
[redacted]	ORPI-C-023.000	94	ASS. OF HUMAN IMP. & NAT. DIST. AND MONT. CUL. RES.		0.00	208.40
15	ORPI-C-050.000	94	MAINTAIN STABLIZED RUINS AND HISTORIC STRUCTURES		0.00	13.60
32	ORPI-C-051.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION PLAN		0.00	10.00
33	ORPI-C-052.000	94	PREPARE HISTORIC STRUCTURES PRESERVATION GUIDES		0.00	25.00
Resource Type Sub-total					2.00	1608.50
2	ORPI-I-001.000	94	DEV. & DIRECT NAT. & CUL. RM & RESEARCH PROGRAM		22.00	0.00
0	ORPI-I-002.000	94	MANAGE NAT. & CUL. RES. MGNT. & RESEARCH PROGRAM		244.00	0.00
5	ORPI-I-003.000	94	PROVIDE NAT. & CUL. RM & RESEARCH ADMIN. SUPPORT		0.00	160.00
34	ORPI-I-004.000	94	DEVELOP RESEARCH OPPORTUNITIES & NEEDS ASSESSMENT		0.00	15.00
35	ORPI-I-005.000	94	ESTABLISH EDITORIAL ASSISTANT POSITION		0.00	82.80
16	ORPI-I-006.000	94	DEV. & IMP. COMP. NAT. & CUL. RES. INTERP. PROGRAM		0.00	1272.00
0	ORPI-I-050.000	94	DEVELOP AND MANAGE RES. INFORMATION MGNT. PROGRAM		193.80	0.00
0	ORPI-I-051.000	94	IMPLEMENT GEOGRAPHIC INFO. SYSTEM PROGRAM		139.68	0.00
36	ORPI-I-052.000	94	UPDATE INFORMATION MANAGEMENT PLAN		0.00	5.30
37	ORPI-I-053.000	94	CONDUCT GIS/AIRBORNE VIDEO MONITORING RESEARCH		0.00	86.00
67	ORPI-I-054.000	94	DEVELOP CUSTOM GIS AUTOMATED QUAD INDEXING SYSTEM		0.00	8.90
68	ORPI-I-055.000	94	IMPLEMENT GLOBAL POSITIONING SYSTEM DATA AQUISITION		10.20	121.00
69	ORPI-I-056.000	94	DEVELOP COMPUTERIZED BIBLIOGRAPHIC INFO. SYSTEM		0.00	37.85
102	ORPI-I-057.000	94	PREPARE ADMIN. HISTORY OF NAT. & CUL. RM & RESEARCH		0.00	30.00
122	ORPI-I-058.000	94	INCORPORATE & INT. NEW DATA INTO INFO. MGNT./GIS		0.00	44.00
123	ORPI-I-059.000	94	CONDUCT FEASIBILITY STUDY TO LINK GIS WITH MMS		0.00	20.00
17	ORPI-I-100.000	94	MONITOR AND CONTROL AFRICANIZED HONEY BEES		12.00	0.00
38	ORPI-I-101.000	94	DEVELOP AN INTEGRATED PEST MANAGEMENT PLAN		0.00	6.00
70	ORPI-I-102.000	94	MANAGE PEST SPECIES		8.00	0.00
[redacted]	ORPI-I-103.000	94	DEVELOP & IMP. BOUNDARY FENCE MAINTENANCE PROGRAM		0.00	148.00
[redacted]	ORPI-I-104.000	94	MONITOR & CONTROL TRESPASS GRAZING		14.20	32.80

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDE
0	ORPI-I-150.000	94	DEVELOP A FIRE MANAGEMENT PLAN		1.20	0.00
39	ORPI-I-151.000	94	CONDUCT A FIRE MANAGEMENT PROGRAM		0.00	100.00
73	ORPI-I-152.000	94	CONDUCT FIRE HISTORY AND ECOLOGY RESEARCH		0.00	100.0
40	ORPI-I-200.000	94	DEVELOP A WILDERNESS MANAGEMENT PLAN		0.00	14.0
41	ORPI-I-201.000	94	DEVELOP A TRAIL USE MANAGEMENT PLAN		0.00	30.00
124	ORPI-I-202.000	94	DEVELOP A CAVE MANAGEMENT PLAN		0.00	51.0
101	ORPI-I-203.000	94	DETERMINE VISITOR IMPACTS AND USE PERMITS		0.00	60.0
42	ORPI-I-250.000	94	CONDUCT MONT. & MAIN. OF ABAND. MINE SAFETY FEAT.		0.00	36.96
43	ORPI-I-251.000	94	CONDUCT STUDY OF WILDLIFE USE OF ABANDONED MINES		0.00	70.00
74	ORPI-I-252.000	94	DEVELOP MINE HAZARDS SAFETY PROGRAM		0.00	8.0
75	ORPI-I-253.000	94	REHABILITATE SELECTED MINES		0.00	228.00
44	ORPI-I-300.000	94	DEV. & IMP. AIRCRAFT OVERFLIGHT MONITORING PROGRAM		0.00	24.00
45	ORPI-I-350.000	94	DEVELOP MAB ACTION PROGRAM FOR THE SONORAN DESERT		0.00	80.0
76	ORPI-I-351.000	94	CONDUCT MAB MULTICULTURAL INTERPRETIVE PROGRAMS		0.00	200.0
46	ORPI-I-400.000	94	DEVELOP A COLLECTIONS MANAGEMENT PLAN		0.00	10.00
66	ORPI-I-401.000	94	MANAGE LIBRARY & MUSEUM		15.52	180.0
47	ORPI-I-402.000	94	AUTOMATE LIBARY CATALOG SYSTEM		0.00	5.5
77	ORPI-I-403.000	94	OBTAIN & MAINTAIN HISTORIC PHOTOGRAPH COLLECTION		0.00	30.00
78	ORPI-I-404.000	94	UPDATE AND MAINTAIN AUTOMATED NAT. CATALOG SYSTEM		0.00	17.00
48	ORPI-I-450.000	94	DEVELOP AN INTEGRATED MGNT. PLAN FOR QUITOBAQUITO		0.00	70.0
79	ORPI-I-451.000	94	PREPARE & IMPLE. PLAN TO COMPLY-SPEC. DIRECT. 91-6		0.00	2.1
80	ORPI-I-452.000	94	DEVELOP ROAD MAINTENANCE STANDARDS & PROCEDURES		0.00	10
81	ORPI-I-453.000	94	ESTABLISH A CARRYING CAPACITY FOR LOOP DRIVES		0.00	17
Resource Type Sub-total					660.60	3413.2
0	ORPI-N-001.000	94	IMPLEMENT AND MANAGE VEGETATION MANAGEMENT PROGRAM		204.00	0.00
11	ORPI-N-002.000	94	DEVELOP A VEGETATION MANAGEMENT PLAN		0.00	17.6
10	ORPI-N-003.000	94	EVAL. EFFECT. & DEVELOP STNDS. FOR REVEG. PROGRAM		0.00	65.00
49	ORPI-N-004.000	94	REVEGETATE ABANDONED ROAD PORTALS		0.00	90.00
50	ORPI-N-005.000	94	DEV. & IMP. SITE RES.-DOWLING RANCH & STACK PROP.		0.00	175.0
82	ORPI-N-006.000	94	DEV. & IMP. A PROGRAM TO MANAGE HAZARDOUS TREES		0.00	35.0
12	ORPI-N-007.000	94	MONITOR & MITIGATE WOODCUTTING		0.00	272.00
18	ORPI-N-050.000	94	DEVELOP A WILDLIFE MANAGEMENT PLAN		0.00	17.6
0	ORPI-N-051.000	94	IMPLEMENT AND MANAGE WILDLIFE MANAGEMENT PROGRAM		193.80	0.0
0	ORPI-N-100.000	94	DIRECT NAT. RES. INVENTORY & MONITORING PROGRAM		28.00	0.00
0	ORPI-N-101.000	94	MANAGE NATURAL RESOURCES MONITORING PROGRAM		81.00	0.00
0	ORPI-N-102.000	94	DEV. DATABASE MGNT. SYSTEM FOR NR MONITORING PROG.		80.00	0.0
3	ORPI-N-103.000	94	PREPARE AND PUB. NR MONITORING HANDBOOK & VIDEO		0.00	37.00
9	ORPI-N-104.000	94	REPLACE AND SUPPLEMENT CLIMATE MONITORING EQUIPMENT		0.00	75.00
51	ORPI-N-105.000	94	MAP NATURAL RESOURCES MONITORING STUDY SITES		0.00	55.0
0	ORPI-N-106.000	94	PUB. & DIST. NR INVEN. & MONITORING FINAL REPORTS		52.00	0.0
52	ORPI-N-107.000	94	DEVELOP AN AVIAN MONITORING PROTOCOL		0.00	80.00
53	ORPI-N-108.000	94	DEVELOP A TERRESTRIAL INVERT. MONITORING PROTOCOL		0.00	100.0
54	ORPI-N-109.000	94	UPDATE MONUMENT FLORA		4.98	10.0
121	ORPI-N-110.000	94	CONDUCT SURVEY OF STUDY SITE SOILS, GEO. & HYDRO.		0.00	60.00
6	ORPI-N-111.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-BIGHORN SHEEP		8.00	144.00
83	ORPI-N-112.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-JAVEINA		0.00	150.0
84	ORPI-N-113.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MOUNTAIN LION		0.00	150
85	ORPI-N-114.000	94	EVAL. STATUS & DEV. MONT. PROGRAM-MULE DEER		0.00	150
86	ORPI-N-115.000	94	EVAL STATUS & DEV MONITORING PROG-WHITE-TAILED DEER		0.00	52.0

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
28	ORPI-N-116.000	94	COND. INVENT. & DEV. MONT. PROT.-DESERT TORTOISE		0.00	154.50
29	ORPI-N-117.000	94	COND. INVENT. & DEV. MONT. PROT.-FERR. PYGMY-OWL		0.00	80.00
87	ORPI-N-118.000	94	COND. INV. AND DEV. MONT. PROT.-MICROPHYTIC CRUSTS		0.00	80.00
88	ORPI-N-119.000	94	COND. INV. & DEV. MONT. PROTOCOL-AQUATIC INVERTS.		0.00	100.00
0	ORPI-N-120.000	94	IMPLEMENT CLIMATE MONITORING PROTOCOL		49.20	0.00
0	ORPI-N-121.000	94	IMPLEMENT LAND USE TRENDS MONITORING PROTOCOL		26.00	0.00
0	ORPI-N-122.000	94	IMPLEMENT NOCTURANL RODENT MONITORING PROTOCOL		38.40	0.00
0	ORPI-N-123.000	94	IMPLEMENT LIZARD MONITORING PROTOCOL		44.00	0.00
0	ORPI-N-124.000	94	IMPLEMENT ECHINOMASTUS ERECTROCENTRUS MONT. PROT.		29.00	0.00
0	ORPI-N-125.000	94	IMPLEMENT MONT. PROT. FOR VEG. STRUCT. & DIVERSITY		36.00	0.00
0	ORPI-N-126.000	94	IMPL. S.THURBERI & L.SCHOTTII MONITORING PROTOCOL		18.40	0.00
0	ORPI-N-127.000	94	IMPLEMENT P.STRIATUS MONITORING PROTOCOL		2.00	0.00
0	ORPI-N-128.000	94	IMPLEMENT A.EMARGINATA MONITORING PROTOCOL		2.00	0.00
89	ORPI-N-129.000	94	DEVELOP LONG-TERM POPULATION MONITORING OF SNAKES		0.00	62.00
90	ORPI-N-130.000	94	DEV. MEXICAN LEAFCUTTING ANT POP. MONITORING PROG.		0.00	9.20
19	ORPI-N-200.000	94	IDENTIFY & INVENTORY WATER RELATED RES. ATTRIBUTES		0.00	40.00
20	ORPI-N-201.000	94	MONITOR LAND SUBSIDENCE		0.00	32.00
4	ORPI-N-202.100	94	MONITOR GRDWATER RES. IN RIO SONOYTA WATERSHED		26.04	47.00
21	ORPI-N-202.200	94	INVES. GROUNDWATER USE ON TOHONO O'ODHAM LANDS		0.00	12.50
22	ORPI-N-202.300	94	CONDUCT SUR. WATER INV. OF RIO SONOYTA WATERSHED		0.00	26.00
23	ORPI-N-202.400	94	CONDUCT LAND USE SURVEY OF RIO SONOYTA WATERSHED		0.00	56.00
24	ORPI-N-202.500	94	EVAL. TRENDS IN WATER RES. IN RIO SONOYTA WATERSHED		0.00	25.00
[illegible]5	ORPI-N-203.000	94	DEVELOP & IMPLEMENT WATER CONSERVATION PLAN		0.00	35.00
[illegible]6	ORPI-N-204.000	94	DEFINE CHARACTERISTICS OF REGIONAL ACQUIFERS		0.00	18.00
57	ORPI-N-205.000	94	UPDATE WATER RESOURCES INVENTORY AND MONITORING		0.00	47.00
91	ORPI-N-206.000	94	DEVELOP A GIS COMPONENT FOR WATER RESOURCES		0.00	50.00
92	ORPI-N-207.000	94	MONITOR RIPARIAN ECOSYSTEMS		[illegible].00	45.00
93	ORPI-N-208.000	94	ID. POLL. THREATS-KUAKATCH & CUERDA DE LENA WASHES		.00	24.00
94	ORPI-N-209.000	94	CONTROL ACCELERATED EROSION		0.00	93.00
95	ORPI-N-210.000	94	EVALUATE FLOOD HAZARDS AT BATES WELL		0.00	6.00
96	ORPI-N-211.000	94	EVALUATE ABANDONED MINE TAILING		0.00	6.50
0	ORPI-N-212.000	94	MONITOR CHEMISTRY OF MONUMENT PRECIPITATION		8.00	0.00
97	ORPI-N-213.000	94	MANAGE WASTEWATER		0.00	8.00
1	ORPI-N-250.000	94	DEVELOP A TES SPECIES MANAGEMENT PLAN		0.00	15.00
25	ORPI-N-251.000	94	EXPAND & IMPLEMENT QBQ DES. PUPFISH MONT. PROGRAM		20.00	15.00
26	ORPI-N-252.000	94	EXPAND & IMPL. LONG-NOSED BAT MONITORING PROGRAM		20.00	15.00
27	ORPI-N-253.000	94	EVALUATE EFFECTS OF POACHING ON MONUMENT RESOURCES		0.00	80.00
58	ORPI-N-254.000	94	I.D. SONORAN MUD TURTLE MORTALITY SOURCE-QUITOBAQ.		0.00	4.00
59	ORPI-N-255.000	94	SURVEY RIO SONOYTA POP. OF SONORAN MUD TURTLE		0.00	5.00
98	ORPI-N-256.000	94	COND. A STUDY ON BIO./HYD. REL.-RIO SONOYTA WTRSHED		0.00	262.00
60	ORPI-N-257.000	94	SURVEY AND MONITOR MOISTURE-SENSITIVE HERPETOFAUNA		0.00	28.50
61	ORPI-N-258.000	94	DETERMINE STATUS OF ORGAN PIPE SHOVELNOSED SNAKE		0.00	34.00
99	ORPI-N-259.000	94	DETERMINE STATUS OF THE MEXICAN ROSY BOA		0.00	85.00
100	ORPI-N-260.000	94	ANALYZE MEXICAN LEAFCUTTING AT POP. SIZE AND STRUCT		0.00	20.00
103	ORPI-N-261.000	94	EXPAND LONG-TERM ECOL. STUDIES-STENOCEREUS THURBERI		0.00	115.00
104	ORPI-N-262.000	94	EXPAND LONG-TERM ECOL. STUDIES-E.ERECTROCENTRUS		0.00	90.00
105	ORPI-N-263.000	94	EXPAND LONG-TERM ECOL. STUDIES-LOPHCEREUS SCHOTTII		0.00	90.00
106	ORPI-N-264.000	94	EXPAND LONG-TERM ECOL. STUDIES-BURSERA MICROPHYLLA		0.00	90.00
[illegible]	ORPI-N-265.000	94	EVALUATE AND MONITOR SONORAN PRONGHORN		35.20	0.00
[illegible]0	ORPI-N-266.000	94	EVALUATE STATUS OF MASTIFF BATS		4.93	0.00

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PRIORITY	PROJECT NUMBER	YEAR	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED
7	ORPI-N-300.000	94	DEV. & IMP. AMBIENT AIR QUALITY MONITORING PROGRAM		0.00	106.00
8	ORPI-N-301.000	94	DEV. & IMPLEMENT VISIBILITY MONITORING PROGRAM		0.00	181.00
Resource Type Sub-total----------					1010.95	4027.4
Grand Total==========					1673.55	9049.11

147 projects printed

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
001.000	COMPLETE ARCH. SURVEY REPORT: 1989-1991; CURATION			SITE C02	REG-OTHER ADM		2.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.00	0.1
1 projects printed																
					Grand Total		2.00	0.1	0.00	0.0	0.00	0.0	0.00	0.0	2.00	0.1

End of data

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
001.000	DEV. & DIRECT NAT. & CUL. RM & RESEARCH PROGRAM	COMB	N24	C26	PKBASE-NR	ADM	5.50	0.1	5.50	0.1	5.50	0.1	5.50	0.1	22.00	0.4
002.000	MANAGE NAT. & CUL. RES. MGNT. & RESEARCH PROGRAM	COMB	N24	C26	PKBASE-NR	ADM	30.50	0.5	30.50	0.5	30.50	0.5	30.50	0.5	122.00	2.0
					PKBASE-NR	MON	12.20	0.2	12.20	0.2	12.20	0.2	12.20	0.2	48.80	0.8
					PKBASE-NR	RES	12.20	0.2	12.20	0.2	12.20	0.2	12.20	0.2	48.80	0.8
					PKBASE-NR	PRO	6.10	0.1	6.10	0.1	6.10	0.1	6.10	0.1	24.40	0.4
					Subtotal		61.00	1.0	61.00	1.0	61.00	1.0	61.00	1.0	244.00	4.0
050.000	DEVELOP AND MANAGE RES. INFORMATION MGNT. PROGRAM	COMB	N24	C26	PKBASE-NR	ADM	10.20	0.2	10.20	0.2	10.20	0.2	10.20	0.2	40.80	0.8
					PKBASE-NR	MON	10.20	0.2	20.40	0.4	20.40	0.4	20.40	0.4	71.40	1.4
					PKBASE-NR	RES	20.40	0.4	20.40	0.4	20.40	0.4	20.40	0.4	81.60	1.6
					Subtotal		40.80	0.8	51.00	1.0	51.00	1.0	51.00	1.0	193.80	3.8
051.000	IMPLEMENT GEOGRAPHIC INFO. SYSTEM PROGRAM	COMB	N24	C26	PKBASE-NR	MON	23.28	0.6	23.28	0.6	23.28	0.6	23.28	0.6	93.12	2.4
					PKBASE-NR	ADM	3.88	0.1	3.88	0.1	3.88	0.1	3.88	0.1	15.52	0.4
					PKBASE-NR	RES	7.76	0.2	7.76	0.2	7.76	0.2	7.76	0.2	31.04	0.8
					Subtotal		34.92	0.9	34.92	0.9	34.92	0.9	34.92	0.9	139.68	3.6
055.000	IMPLEMENT GLOBAL POSITIONING SYSTEM DATA AQUISITION	COMB	N24	C26	PKBASE-NR	RES	10.20	0.3	0.0	0.0	0.0	0.0	0.0	0.0	10.20	0.3
100.000	MONITOR AND CONTROL AFRICANIZED HONEY BEES	COMB	N04	C26	PKBASE-NR	MON	2.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	8.00	0.4
					PKBASE-NR	MIT	1.00	0.0	1.00	0.0	1.00	0.0	1.00	0.0	4.00	0.0
					Subtotal		3.00	0.1	3.00	0.1	3.00	0.1	3.00	0.1	12.00	0.4
102.000	MANAGE PEST SPECIES	COMB	N04	C17	PKBASE-NR	MIT	2.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	8.00	0.4
104.000	MONITOR & CONTROL TRESPASS GRAZING	COMB	N04	C17	PKBASE-NR	MON	5.80	0.1	2.80	0.1	2.80	0.1	2.80	0.1	14.20	0.4
150.000	DEVELOP A FIRE MANAGEMENT PLAN	COMB	N07	C17	PKBASE-NR	ADM	1.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.20	0.0
401.000	MANAGE LIBRARY & MUSEUM	OBJC	N24	C16	PKBASE-NR	MON	3.88	0.1	3.88	0.1	3.88	0.1	3.88	0.1	15.52	0.4

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PROGRAMMING SHEET 1
NATURAL and CULTURAL
CURRENT YEAR FUNDED ACTIVITIES
($ in thousands)

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
10 projects printed																
	Grand Total						168.30	3.5	164.10	3.4	164.10	3.4	164.10	3.4	660.60	13.7

End of data

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
001.000	IMPLEMENT AND MANAGE VEGETATION MANAGEMENT PROGRAM	N06			PKBASE-NR	ADM	10.20	0.2	10.20	0.2	10.20	0.2	10.20	0.2	40.80	0.8
					PKBASE-NR	MON	15.30	0.3	15.30	0.3	15.30	0.3	15.30	0.3	61.20	1.2
					PKBASE-NR	RES	5.10	0.1	5.10	0.1	5.10	0.1	5.10	0.1	20.40	0.4
					PKBASE-NR	MIT	20.40	0.4	20.40	0.4	20.40	0.4	20.40	0.4	81.60	1.6
					Subtotal		51.00	1.0	51.00	1.0	51.00	1.0	51.00	1.0	204.00	4.0
051.000	IMPLEMENT AND MANAGE WILDLIFE MANAGEMENT PROGRAM	N04 N17			PKBASE-NR	ADM	10.20	0.2	10.20	0.2	10.20	0.2	10.20	0.2	40.80	0.8
					PKBASE-NR	MON	15.30	0.3	25.50	0.5	25.50	0.5	25.50	0.5	91.80	1.8
					PKBASE-NR	PRO	5.10	0.1	5.10	0.1	5.10	0.1	5.10	0.1	20.40	0.4
					PKBASE-NR	RES	10.20	0.2	10.20	0.2	10.20	0.2	10.20	0.2	40.80	0.8
					Subtotal		40.80	0.8	51.00	1.0	51.00	1.0	51.00	1.0	193.80	3.8
100.000	DIRECT NAT. RES. INVENTORY & MONITORING PROGRAM	N20			PKBASE-NR	ADM	7.00	0.0	7.00	0.0	7.00	0.0	7.00	0.0	28.00	0.0
101.000	MANAGE NATURAL RESOURCES MONITORING PROGRAM	N20			PKBASE-NR	ADM	15.00	0.5	22.00	0.5	22.00	0.5	22.00	0.5	81.00	2
102.000	DEV. DATABASE MGNT. SYSTEM FOR NR MONITORING PROG.	N20			FED-OTHER	RES	70.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.00	0.0
					PKBASE-NR	ADM	10.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.1
					Subtotal		80.00	0.1	0.00	0.0	0.00	0.0	0.00	0.0	80.00	0.1
106.000	PUB. & DIST. NR INVEN. & MONITORING FINAL REPORTS	N20			RG-NS-RES	ADM	52.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	52.00	0.1
109.000	UPDATE MONUMENT FLORA	N20			NON-PROFI	RES	4.98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.98	0.0
111.000	EVAL. STATUS & DEV. MONT. PROGRAM-BIGHORN SHEEP	N20			PKBASE-NR	MON	8.00	0.2	0.0	0.0	0.0	0.0	0.0	0.0	8.00	0.2
120.000	IMPLEMENT CLIMATE MONITORING PROTOCOL	N20			PKBASE-NR	MON	12.30	0.3	12.30	0.3	12.30	0.3	12.30	0.3	49.20	1.2

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PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
121.000	IMPLEMENT LAND USE TRENDS MONITORING PROTOCOL		N20		PKBASE-NR	MON	6.50	0.1	6.50	0.1	6.50	0.1	6.50	0.1	26.00	0.4
122.000	IMPLEMENT NOCTURANL RODENT MONITORING PROTOCOL		N20		PKBASE-NR	MON	9.00	0.2	9.80	0.2	9.80	0.2	9.80	0.2	38.40	0.8
123.000	IMPLEMENT LIZARD MONITORING PROTOCOL		N20		PKBASE-NR	MON	9.80	0.2	11.40	0.2	11.40	0.2	11.40	0.2	44.00	0.8
124.000	IMPLEMENT ECHINOMASTUS ERECTROCENTRUS MONT. PROT.		N20		PKBASE-NR	MON	6.50	0.1	7.50	0.1	7.50	0.1	7.50	0.1	29.00	0.4
12[illegible]	IMPLEMENT MONT. PROT. FOR VEG. STRUCT. & DIVERSITY		N20		PKBASE-NR	MON	6.00	0.2	10.00	0.2	10.00	0.2	10.00	0.2	36.00	0.8
126.000	IMPL. S.THURBERI & L.SCHOTTII MONITORING PROTOCOL		N20		PKBASE-NR	MON	4.60	0.1	4.60	0.1	4.60	0.1	4.60	0.1	18.40	0.4
127.000	IMPLEMENT P.STRIATUS MONITORING PROTOCOL		N20		PKBASE-NR	MON	0.50	0.0	0.50	0.0	0.50	0.0	0.50	0.0	2.00	0.0
128.000	IMPLEMENT A.EMARGINATA MONITORING PROTOCOL		N20		PKBASE-NR	MON	0.50	0.0	0.50	0.0	0.50	0.0	0.50	0.0	2.00	0.0
202.100	MONITOR GRDWATER RES. IN RIO SONOYTA WATERSHED		N12		PKBASE-NR	MON	6.51	0.1	6.51	0.1	6.51	0.1	6.51	0.1	26.04	0.4

[illegible]d...

PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	CURRENT YEAR 1994 $$	CURRENT YEAR 1994 FTE	OUTYEAR 1 1995 $$	OUTYEAR 1 1995 FTE	OUTYEAR 2 1996 $$	OUTYEAR 2 1996 FTE	OUTYEAR 3 1997 $$	OUTYEAR 3 1997 FTE	TOTAL $$	TOTAL FTE
212.000	MONITOR CHEMISTRY OF MONUMENT PRECIPITATION	N20		PKBASE-NR	MON		2.00	0.0	2.00	0.0	2.00	0.0	2.00	0.0	8.00	0.0
251.000	EXPAND & IMPLEMENT QBQ DES. PUPFISH MONT. PROGRAM	N02		PKBASE-NR	MON		5.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	20.00	0.4
252.000	EXPAND & IMPL. LONG-NOSED BAT MONITORING PROGRAM	N02		PKBASE-NR	MON		5.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	20.00	0.4
265.000	EVALUATE AND MONITOR SONORAN PRONGHORN	N02		PKBASE-NR	MON		8.80	0.1	8.80	0.1	8.80	0.1	8.80	0.1	35.20	0.4
266.000	EVALUATE STATUS OF MASTIFF BATS	N20		NON-PROFI	RES		4.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.93	0.0
23 projects printed																
					Grand Total		346.72	4.3	221.41	4.1	221.41	4.1	221.41	4.1	1010.95	16.6

End of data

PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
13	002.000	PREPARE PREHISTORIC SITE PRESERVATION GUIDES		SITE	C12	CRPP	ADM	20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.00	0.0
14	003.000	DEVELOP ARCH. BASE MAP/DATABASE IN GIS		COMB	C01	GIS	ADM	13.50	0.5	2.50	0.1	2.50	0.1	2.50	0.1	21.00	0.8
15	050.000	MAINTAIN STABLIZED RUINS AND HISTORIC STRUCTURES		STRC	C12	RG-CR-MTN	MIT	7.30	0.2	3.30	0.2	1.50	0.2	1.50	0.2	13.60	0.8
30	004.000	DATA BANK MGNT: CORRECT PLOTTING OF SITE LOCATIONS		COMB	C01	GIS	ADM	5.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	11.00	0.4
31	005.000	DEVELOP AND FUND PUBLIC ARCHEOLOGY PROGRAM		COMB	C20	REG-OTHER	MIT	8.00	0.1	8.00	0.1	8.00	0.1	8.00	0.1	32.00	0.4
32	051.000	PREPARE HISTORIC STRUCTURES PRESERVATION PLAN		STRC	C01	REG-OTHER	ADM	10.00	0.3	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.3
33	052.000	PREPARE HISTORIC STRUCTURES PRESERVATION GUIDES		STRC	C01	REG-OTHER	ADM	10.00	0.3	15.00	0.4	0.0	0.0	0.0	0.0	25.00	0.7
62	006.000	DEVELOP AND FUND ARCH. SITE PROTECTION PROGRAM		SITE	C20	CRPP	MIT	10.00	0.3	10.00	0.3	10.00	0.3	10.00	0.3	40.00	1.2

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
63	007.000	ETHNOGRAPHIC RESEARCH	ETHN	C04		CRPP	RES	30.00	0.0	30.00	0.0	30.00	0.0	30.00	0.0	120.00	0.0
64	008.000	CONDUCT ORAL HISTORY PROJECT	COMB	C04		CRPP	ADM	8.00	0.2	8.00	0.2	8.00	0.2	8.00	0.2	32.00	0.8
65	009.000	WRITE QUITOBAQUITO MANAGEMENT AREA HUMAN HISTORY	ETHN	C02		CRPP	RES	70.00	1.5	45.00	1.0	0.0	0.0	0.0	0.0	115.00	2.5
107	010.000	DATA RECOVERY PROJECTS	COMB	C14		CRPP	RES	8.00	0.3	8.00	0.3	8.00	0.3	8.00	0.3	32.00	1.2
108	011.000	ARCHEOLOGICAL SURVEY OF USE ZONES	COMB	C02		CONSTRUCT	RES	60.00	2.0	60.00	2.0	60.00	2.0	60.00	2.0	240.00	8.0
109	012.000	WRITE OVERVIEW/SYN. OF ARCH. & HIST. RESOURCES	COMB	C02		REG-OTHER	RES	38.50	1.0	10.00	0.2	0.0	0.0	0.0	0.0	48.50	1.2
110	013.000	DEVELOP ARCH. SITE LOCATION PREDICTIVE MODEL	SITE	C02		GIS	ADM	9.00	0.2	5.00	0.1	5.00	0.1	5.00	0.1	24.00	0.5
111	014.000	RECORD ROCK ART SITES	SITE	C02		CRPP	RES	12.50	0.5	12.50	0.5	12.50	0.5	12.50	0.5	50.00	2.0
112	015.000	COMPLETE ARCH. SAMPLE SURVEY & ASSESSMENT	COMB	C15		CRPP	RES	65.00	2.0	65.00	2.0	70.00	2.0	70.00	2.0	270.00	8.0
113	016.000	INTENSIVE TRANSECT RECORDING/MAPPING OF LARGE SITES	COMB	C02		CRPP	RES	20.50	0.7	35.50	1.5	16.50	0.5	16.50	0.5	89.00	3.2

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
114	017.000	TEST EXCAVATION OF "RESERVOIR" AT AZ Z:13:1(ASM)	COMB	C26		CRPP	RES	33.50	1.0	0.0	0.0	0.0	0.0	0.0	0.0	33.50	1.0
115	018.000	ARCHIVAL RES. RELATED TO EARLY ARCH./ETHNO. SURVEYS	ETHN	C26		CRPP	RES	9.00	0.3	9.00	0.3	9.00	0.3	0.0	0.0	27.00	0.9
116	019.000	SPECIALIZED ARTIFACT STUDIES	OBJC	C02		CRPP	RES	15.00	0.5	6.00	0.1	7.00	0.1	7.00	0.1	35.00	0.8
117	[illegible]0.000	RE-ANAL. PREVIOUS COLL. AT WACC, ORPI & OTHER INST.	COMB	C26		REG-OTHER	RES	9.50	0.3	9.50	0.3	9.50	0.3	7.00	0.3	35.50	1.2
118	021.000	PREPARE NAT. REG. NOMINATIONS FOR ARCH. SITES/DIST.	SITE	C26		REG-OTHER	ADM	19.00	0.7	9.00	0.3	9.00	0.3	9.00	0.3	46.00	1.6
119	022.000	DEVELOP & FUND ARCHEOLOGICAL JOB TRAINING PROGRAM	COMB	C26		REG-OTHER	MIT	7.50	0.2	7.50	0.2	7.50	0.2	7.50	0.2	30.00	0.8
120	023.000	ASS. OF HUMAN IMP. & NAT. DIST. AND MONT. CUL. RES.	COMB	C23		CRPP	MON	52.10	1.2	52.10	1.2	52.10	1.2	52.10	1.2	208.40	4.8
	25 projects printed																
						Grand Total		550.90	14.4	412.90	11.4	328.10	8.8	316.60	8.5	1608.50	43.1

End of data

PROGRAMMING SHEET 2
NATURAL and CULTURAL
UNFUNDED ACTIVITIES
($ in thousands)

PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
5	003.000	PROVIDE NAT. & CUL. RM & RESEARCH ADMIN. SUPPORT		COMB	N24	PKBASE-NR	ADM	40.00	1.0	40.00	1.0	40.00	1.0	40.00	1.0	160.00	4.0
16	006.000	DEV. & IMP. COMP. NAT. & CUL. RES. INTERP. PROGRAM		COMB	N24 C26	PKBASE-NR	INT	318.00	7.0	318.00	7.0	318.00	7.0	318.00	7.0	1272.00	28.0
34	004.000	DEVELOP RESEARCH OPPORTUNITIES & NEEDS ASSESSMENT			N20	RG-NS-RES	ADM	15.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.00	0.0
35	005.000	ESTABLISH EDITORIAL ASSISTANT POSITION			N24	?	ADM	20.70	0.0	20.70	0.0	20.70	0.0	20.70	0.0	82.80	0.0
36	052.000	UPDATE INFORMATION MANAGEMENT PLAN		COMB	N24 C26	PKBASE-NR	ADM	5.30	0.1	0.0	0.0	0.0	0.0	0.0	0.0	5.30	0.1
37	053.000	CONDUCT GIS/AIRBORNE VIDEO MONITORING RESEARCH		COMB	N20 C26	GIS	RES	27.00	0.0	38.50	0.0	20.50	0.0	0.0	0.0	86.00	0.0
38	101.000	DEVELOP AN INTEGRATED PEST MANAGEMENT PLAN		COMB	N04 C01	PKBASE-NR	ADM	6.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	6.00	0.1
39	151.000	CONDUCT A FIRE MANAGEMENT PROGRAM		COMB	N07 C17	FIRE-$	MIT	25.00	1.0	25.00	1.0	25.00	1.0	25.00	1.0	100.00	4.0

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES	SYSTEM-WIDE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
40	200.000	DEVELOP A WILDERNESS MANAGEMENT PLAN		COMB	N18 C01	PKBASE-NR	ADM	3.50	0.1	3.50	0.1	3.50	0.1	3.50	0.1	14.00	0.4
41	201.000	DEVELOP A TRAIL USE MANAGEMENT PLAN		COMB	N18 C01	REG-OTHER	ADM	30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.00	0.0
42	250.000	CONDUCT MONT. & MAIN. OF ABAND. MINE SAFETY FEAT.		COMB	N10 C26	ENER-MIN	MON	9.24	0.2	9.24	0.2	9.24	0.2	9.24	0.2	36.96	0.8
43	251.000	CONDUCT STUDY OF WILDLIFE USE OF ABANDONED MINES		COMB	N10 C26	RG-NS-RES	RES	25.00	0.0	25.00	0.0	10.00	0.0	10.00	0.0	70.00	0.0
44	300.000	DEV. & IMP. AIRCRAFT OVERFLIGHT MONITORING PROGRAM		STRC	N02 C26	REG-OTHER	MON	6.00	0.1	6.00	0.1	6.00	0.1	6.00	0.1	24.00	0.4
45	350.000	DEVELOP MAB ACTION PROGRAM FOR THE SONORAN DESERT		COMB	N24 C26	REG-OTHER	ADM	40.00	0.0	40.00	0.0	0.0	0.0	0.0	0.0	80.00	0.0
46	400.000	DEVELOP A COLLECTIONS MANAGEMENT PLAN		OBJC	N24 C09	REG-OTHER	ADM	10.00	0.5	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.5
47	402.000	AUTOMATE LIBARY CATALOG SYSTEM		COMB	N24 C26	PKBASE-NR	ADM	5.50	0.1	0.0	0.0	0.0	0.0	0.0	0.0	5.50	0.1

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PK PRI	PROJECT NUMBER	PROJECT TITLE	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
48	450.000	DEVELOP AN INTEGRATED MGNT. PLAN FOR QUITOBAQUITO		SITE	N24 C01	RG-NS-RES	ADM	50.00	0.0	10.00	0.0	10.00	0.0	0.0	0.0	70.00	0.0
66	401.000	MANAGE LIBRARY & MUSEUM		OBJC	N24 C16	PKBASE-NR	ADM	45.00	1.0	45.00	1.0	45.00	1.0	45.00	1.0	180.00	4.0
67	054.000	DEVELOP CUSTOM GIS AUTOMATED QUAD INDEXING SYSTEM		COMB	N24 C26	GIS	ADM	8.90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.90	0.0
68	055.000	IMPLEMENT GLOBAL POSITIONING SYSTEM DATA AQUISITION		COMB	N24 C26	GIS	ADM	60.50	2.0	60.50	2.0	0.0	0.0	0.0	0.0	121.00	4.0
69	056.000	DEVELOP COMPUTERIZED BIBLIOGRAPHIC INFO. SYSTEM		COMB	N24 C26	PKBASE-NR	ADM	31.25	2.0	2.20	0.1	2.20	0.1	2.20	0.1	37.85	2.3
71	103.000	DEVELOP & IMP. BOUNDARY FENCE MAINTENANCE PROGRAM		COMB	N04 C17	REP-REHAB	MIT	20.00	0.7	20.00	0.7	20.00	0.7	20.00	0.7	80.00	2.8
						REP-REHAB	MON	17.00	0.3	17.00	0.3	17.00	0.3	17.00	0.3	68.00	1.2
						Subtotal		37.00	1.0	37.00	1.0	37.00	1.0	37.00	1.0	148.00	4.0
72	104.000	MONITOR & CONTROL TRESPASS GRAZING		COMB	N04 C17	REG-OTHER	MIT	32.80	0.1	0.0	0.0	0.0	0.0	0.0	0.0	32.80	0.1
73	152.000	CONDUCT FIRE HISTORY AND ECOLOGY RESEARCH		COMB	N07 C17	FIRE-$	RES	25.00	0.1	25.00	0.1	25.00	0.1	25.00	0.1	100.00	0.4

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
74	252.000	DEVELOP MINE HAZARDS SAFETY PROGRAM		COMB	N10 C26 ENER-MIN	INT	2.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	8.00	0.4
75	253.000	REHABILITATE SELECTED MINES		COMB	N10 C26 ENER-MIN	MIT	57.00	0.1	57.00	0.1	57.00	0.1	57.00	0.1	228.00	0.4
76	351.000	CONDUCT MAB MULTICULTURAL INTERPRETIVE PROGRAMS		COMB	N24 C26 REG-OTHER	MIT	50.00	1.0	50.00	1.0	50.00	1.0	50.00	1.0	200.00	4.0
77	403.000	OBTAIN & MAINTAIN HISTORIC PHOTOGRAPH COLLECTION		COMB	N24 C10 REG-OTHER	ADM	10.00	0.0	10.00	0.0	10.00	0.0	0.0	0.0	30.00	0.0
78	404.000	UPDATE AND MAINTAIN AUTOMATED NAT. CATALOG SYSTEM		COMB	N24 C03 PKBASE-NR	ADM	11.00	0.2	2.00	0.1	2.00	0.1	2.00	0.1	17.00	0.5
79	451.000	PREPARE & IMPLE. PLAN TO COMPLY-SPEC. DIRECT. 91-6		STRC	N24 C26 PKBASE-NR	ADM	1.50	0.1	0.20	0.0	0.20	0.0	0.20	0.0	2.10	0.1
80	452.000	DEVELOP ROAD MAINTENANCE STANDARDS & PROCEDURES		COMB	N24 C18 RG-REG-MT	ADM	10.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.0
81	453.000	ESTABLISH A CARRYING CAPACITY FOR LOOP DRIVES		COMB	N24 C18 RG-REG-MT	ADM	7.00	0.0	10.00	0.0	0.0	0.0	0.0	0.0	17.00	0.0
101	203.000	DETERMINE VISITOR IMPACTS AND		COMB	N21 C01 REG-OTHER	RES	40.00	0.0	20.00	0.0	0.0	0.0	0.0	0.0	60.00	0.0

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
		USE PERMITS															
102	057.000	PREPARE ADMIN. HISTORY OF NAT. & CUL. RM & RESEARCH	COMB N24	C08	REG-OTHER	RES		30.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.00	0.0
122	058.000	INCORPORATE & INT. NEW DATA INTO INFO. MGNT./GIS	COMB N24	C26	PKBASE-NR	ADM		11.00	0.2	11.00	0.2	11.00	0.2	11.00	0.2	44.00	0.8
123	059.000	CONDUCT FEASIBILITY STUDY TO LINK GIS WITH MMS	COMB N24	C26	GIS	RES		20.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.00	0.0
124	202.000	DEVELOP A CAVE MANAGEMENT PLAN	COMB N21	C01	REG-OTHER	ADM		20.00	0.0	20.00	0.0	0.0	0.0	0.0	0.0	40.00	0.0
					REG-OTHER	MON		0.0	0.0	0.0	0.0	5.50	0.1	5.50	0.1	11.00	0.2
					Subtotal			20.00	0.0	20.00	0.0	5.50	0.1	5.50	0.1	51.00	0.2
	37 projects printed																
					Grand Total			1146.19	18.1	887.84	15.1	709.84	13.2	669.34	13.2	3413.21	59.6

End of data

PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
1	250.000	DEVELOP A TES SPECIES MANAGEMENT PLAN	N02			RG-RM-NAT	ADM	15.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.00	0.0
3	103.000	PREPARE AND PUB. NR MONITORING HANDBOOK & VIDEO	N20			PKBASE-NR	ADM	32.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.00	0.0
4	202.100	MONITOR GRDWATER RES. IN RIO SONOYTA WATERSHED	N12			WATER-RES	MON	18.50	0.6	9.50	0.4	9.50	0.4	9.50	0.4	47.00	1.8
6	111.000	EVAL. STATUS & DEV. MONT. PROGRAM-BIGH ORN SHEEP	N20			NRPP	RES	64.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	144.00	0.0
7	300.000	DEV. & IMP. AMBIENT AIR QUALITY MONITORING PROGRAM	N14			AIR-QUAL	RES	45.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.00	0.0
						AIR-QUAL	MON	10.00	0.2	17.00	0.2	17.00	0.2	17.00	0.2	61.00	0.8
						Subtotal		55.00	0.2	17.00	0.2	17.00	0.2	17.00	0.2	106.00	0.8
8	301.000	DEV. & IMPLEMENT VISIBILITY MONITORING PROGRAM	N14			AIR-QUAL	RES	115.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	115.00	0.0
						AIR-QUAL	MON	16.50	0.5	16.50	0.5	16.50	0.5	16.50	0.5	66.00	2.0
						Subtotal		131.50	0.5	16.50	0.5	16.50	0.5	16.50	0.5	181.00	2.0
9	104.000	REPLACE AND SUPPLEMENT CLIMATE MONITORING EQUIPMENT	N20			REG-OTHER	MON	75.00	0.2	0.0	0.0	0.0	0.0	0.0	0.0	75.00	0.2
10	003.000	EVAL. EFFECT. & DEVELOP STNDS. FOR REVEG. PROGRAM	N06			PKBASE-NR	MIT	10.00	0.2	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.2
						PKBASE-NR	MON	25.00	0.5	10.00	0.5	0.0	0.0	0.0	0.0	35.00	1.0
						PKBASE-NR	ADM	12.00	0.3	8.00	0.5	0.0	0.0	0.0	0.0	20.00	0.8
						Subtotal		47.00	1.0	18.00	1.0	0.00	0.0	0.00	0.0	65.00	2.0

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
11	002.000	DEVELOP A VEGETATION MANAGEMENT PLAN		N06		PKBASE-NR	ADM	17.60	0.3	0.0	0.0	0.0	0.0	0.0	0.0	17.60	0.3
12	007.000	MONITOR & MITIGATE WOODCUTTING		N06		RG-RM-NAT	PRO	68.00	0.0	68.00	0.0	68.00	0.0	68.00	0.0	272.00	0.0
18	050.000	DEVELOP A WILDLIFE MANAGEMENT PLAN		N04	N17	PKBASE-NR	PRO	17.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.60	0.0
19	200.000	IDENTIFY & INVENTORY WATER RELATED RES. ATTRIBUTES		N13		WATER-RES	ADM	20.00	0.0	20.00	0.0	0.0	0.0	0.0	0.0	40.00	0.0
20	201.000	MONITOR LAND SUBSIDENCE		N12		WATER-RES	MON	8.00	0.2	8.00	0.2	8.00	0.2	8.00	0.2	32.00	0.8
21	202.200	INVES. GROUNDWATER USE ON TOHONO O'ODHAM LANDS		N12		WATER-RES	RES	5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.00	0.0
						PKBASE-NR	MON	1.50	0.0	2.00	0.1	2.00	0.1	2.00	0.1	7.50	0.3
						Subtotal		6.50	0.0	2.00	0.1	2.00	0.1	2.00	0.1	12.50	0.3
22	202.300	CONDUCT SUR. WATER INV. OF RIO SONOYTA WATERSHED		N12		WATER-RES	RES	26.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.00	0.0
23	202.400	CONDUCT LAND USE SURVEY OF RIO SONOYTA WATERSHED		N12		WATER-RES	RES	56.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.00	0.0
24	202.500	EVAL. TRENDS IN WATER RES. IN RIO SONOYTA		N12		WATER-RES	RES	25.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.00	0.0

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PK PRI	PROJECT NUMBER	PROJECT TITL WATERSHED	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
		Project Total						113.50	0.0	2.00	0.1	2.00	0.1	2.00	0.1	119.50	0.3
25	251.000	EXPAND & IMPLEMENT QBQ DES. PUPFISH MONT. PROGRAM	N02	RG	NS-RES	RES		15.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.00	0.0
26	252.000	EXPAND & IMPL. LONG-NOSED BAT MONITORING PROGRAM	N02	RG	NS-RES	RES		15.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.00	0.0
27	[illegible]000	EVALUATE EFFECTS OF POACHING ON MONUMENT RESOURCES	N18	RG	NS-RES	RES		40.00	0.0	40.00	0.0	0.0	0.0	0.0	0.0	80.00	0.0
28	116.000	COND. INVENT. & DEV. MONT. PROT.-DESERT TORTOISE	N20	NRPP		RES		51.50	0.0	51.50	0.0	51.50	0.0	0.0	0.0	154.50	0.0
29	117.000	COND. INVENT. & DEV. MONT. PROT.-FERR. PYGMY-OWL	N20	NRPP		RES		60.00	0.0	20.00	0.0	0.0	0.0	0.0	0.0	80.00	0.0
9	004.000	REVEGETATE ABANDONED ROAD PORTALS	N06	RG	RM-NAT	MIT		40.00	1.0	5.00	0.1	0.0	0.0	0.0	0.0	45.00	1.1
				RG	RM-NAT	MON		5.00	0.1	10.00	0.3	5.00	0.1	5.00	0.1	25.00	0.6
				RG	RM-NAT	ADM		5.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	20.00	0.4
		Subtotal						50.00	1.2	20.00	0.5	10.00	0.2	10.00	0.2	90.00	2.1

nti[illegible].

PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
50	005.000	DEV. & IMP. SITE RES.-DOWLING RANCH & STACK PROP.	N06			RG-RM-NAT	MIT	50.00	2.0	40.00	1.8	30.00	1.4	5.00	0.1	125.00	5.3
						RG-RM-NAT	MON	0.0	0.0	5.00	0.1	15.00	0.3	15.00	0.3	35.00	0.7
						RG-RM-NAT	ADM	0.0	0.0	5.00	0.1	5.00	0.1	5.00	0.1	15.00	0.3
						Subtotal		50.00	2.0	50.00	2.0	50.00	1.8	25.00	0.5	175.00	6.3
51	105.000	MAP NATURAL RESOURCES MONITORING STUDY SITES	N20			GIS	ADM	55.00	0.3	0.0	0.0	0.0	0.0	0.0	0.0	55.00	0.3
52	107.000	DEVELOP AN AVIAN MONITORING PROTOCOL	N20			RG-NS-RES	RES	40.00	0.0	40.00	0.0	0.0	0.0	0.0	0.0	80.00	0 0
53	108.000	DEVELOP A TERRESTRIAL INVERT. MONITORING PROTOCOL	N20			RG-NS-RES	RES	50.00	0.0	50.00	0.0	0.0	0.0	0.0	0.0	100.00	0.0
54	109.000	UPDATE MONUMENT FLORA	N20			PKBASE-NR	RES	5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.00	0.0
						PKBASE-NR	ADM	5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.00	0.0
						Subtotal		10.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	10.00	0.0
55	203.000	DEVELOP & IMPLEMENT WATER CONSERVATION PLAN	N24			WATER-RES	MIT	10.00	0.2	5.00	0.1	0.0	0.0	0.0	0.0	15.00	0.3
						WATER-RES	ADM	10.00	0.2	10.00	0.2	0.0	0.0	0.0	0.0	20.00	0.4
						Subtotal		20.00	0.4	15.00	0.3	0.00	0.0	0.00	0.0	35.00	0.7
56	204.000	DEFINE CHARACTERISTICS OF REGIONAL ACQUIFERS	N12			WATER-RES	RES	18.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.00	0.0
57	205.000	UPDATE WATER RESOURCES INVENTORY AND MONITORING	N12			WATER-RES	RES	28.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.00	0.0
						PKBASE-NR	MON	4.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	19.00	0.4
						Subtotal		32.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	47.00	0.4

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
58	254.000	I.D. SONORAN MUD TURTLE MORTALITY SOURCE-QUITO BAQ.		N20	RG-NS-RES	RES		4.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.00	0.0
59	255.000	SURVEY RIO SONOYTA POP. OF SONORAN MUD TURTLE		N20	RG-NS-RES	RES		5.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.00	0.0
60	257.000	SURVEY AND MONITOR MOISTURE-SENSITIVE HERPETOFAUNA		N20	RG-NS-RES	RES		10.00	0.0	15.00	0.0	1.50	0.0	2.00	0.0	28.50	0.0
61	258.000	DETERMINE STATUS OF ORGAN PIPE SHOVELNOSED SNAKE		N20	RG-NS-RES	RES		16.50	0.0	13.50	0.0	2.00	0.0	2.00	0.0	34.00	0.0
82	006.000	DEV. & IMP. A PROGRAM TO MANAGE HAZARDOUS TREES		N24	PKBASE-NR	MIT		5.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	5.00	0.1
					PKBASE-NR	MON		5.00	0.1	5.00	0.1	5.00	0.1	5.00	0.1	20.00	0.4
					RG-RM-NAT	ADM		10.00	0.2	0.0	0.0	0.0	0.0	0.0	0.0	10.00	0.2
					Subtotal			20.00	0.4	5.00	0.1	5.00	0.1	5.00	0.1	35.00	0.7
83	112.000	EVAL. STATUS & DEV. MONT. PROGRAM-JAVELINA		N20	NRPP	RES		70.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	150.00	0.0
84	113.000	EVAL. STATUS & DEV. MONT. PROGRAM-MOUNTAIN LION		N20	NRPP	RES		70.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	150.00	0.0
85	114.000	EVAL. STATUS & DEV. MONT. PROGRAM-MULE DEER		N20	NRPP	RES		70.00	0.0	40.00	0.0	40.00	0.0	0.0	0.0	150.00	0.0

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PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
86	115.000	EVAL STATUS & DEV MONITORING PROG-WHITE-TAILED DEER	N20		RG-NS-RES	MON		52.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.00	0.0
87	118.000	COND. INV. AND DEV. MONT. PROT.-MICROPHYTIC CRUSTS	N20		RG-NS-RES	RES		80.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.00	0.0
88	119.000	COND. INV. & DEV. MONT. PROTOCOL-AQUATIC INVERTS.	N20		RG-NS-RES	RES		50.00	0.0	50.00	0.0	0.0	0.0	0.0	0.0	100.00	0.0
89	129.000	DEVELOP LONG-TERM POPULATION MONITORING OF SNAKES	N20		RG-NS-RES	MON		19.00	0.0	15.00	0.0	14.00	0.0	14.00	0.0	62.00	0.[redacted]
90	130.000	DEV. MEXICAN LEAFCUTTING ANT POP. MONITORING PROG.	N20		$-DONATE	MON		2.30	0.0	2.30	0.0	2.30	0.0	2.30	0.0	9.20	0.0
91	206.000	DEVELOP A GIS COMPONENT FOR WATER RESOURCES	N12		GIS	ADM		25.00	0.0	15.00	0.0	10.00	0.0	0.0	0.0	50.00	0.0
92	207.000	MONITOR RIPARIAN ECOSYSTEMS	N12		WATER-RES	RES		22.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.00	0.0
					PKBASE-NR	MON		5.00	0.1	6.00	0.1	6.00	0.1	6.00	0.1	23.00	0.4
					Subtotal			27.00	0.1	6.00	0.1	6.00	0.1	6.00	0.1	45.00	0.4
93	208.000	ID. POLL. THREATS-KUAKATCH & CUERDA DE LENA WASHES	N11		WATER-RES	MON		6.00	0.1	6.00	0.1	6.00	0.1	6.00	0.1	24.00	0.4

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
94	209.000	CONTROL ACCELERATED EROSION	N06			REG-OTHER MIT		81.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.00	0.0
						PKBASE-NR MON		0.0	0.0	4.00	0.1	4.00	0.1	4.00	0.1	12.00	0.3
						Subtotal		81.00	0.0	4.00	0.1	4.00	0.1	4.00	0.1	93.00	0.3
95	210.000	EVALUATE FLOOD HAZARDS AT BATES WELL	N20		RES	WATER-RES RES		6.00	0.1	0.0	0.0	0.0	0.0	0.0	0.0	6.00	0.1
96	211.000	EVALUATE ABANDONED MINE TAILING	N10		RES	ENER-MIN RES		6.50	0.1	0.0	0.0	0.0	0.0	0.0	0.0	6.50	0.1
97	213.000	MANAGE WASTEWATER	N24			PKBASE-NR MIT		2.00	0.1	2.00	0.1	2.00	0.1	2.00	0.1	8.00	0.4
98	[redacted]000	COND. A STUDY ON BIO./HYD. REL.-RIO SONOYTA WTRSHED	N20		RES	NRPP RES		105.00	0.0	64.00	0.0	54.00	0.0	39.00	0.0	262.00	0.0
99	259.000	DETERMINE STATUS OF THE MEXICAN ROSY BOA	N20		RES	RG-NS-RES RES		33.00	0.0	22.00	0.0	16.00	0.0	14.00	0.0	85.00	0.0
100	260.000	ANALYZE MEXICAN LEAFCUTTING AT POP. SIZE AND STRUCT	N20		RES	RG-NS-RES RES		6.00	0.0	4.00	0.0	4.00	0.0	6.00	0.0	20.00	0.0
103	261.000	EXPAND LONG-TERM ECOL. STUDIES-STEN OCEREUS THURBERI	N03		RES	RG-NS-RES RES		60.00	0.0	20.00	0.0	5.00	0.0	0.0	0.0	85.00	0.0
						RG-NS-RES MON		0.0	0.0	10.00	0.5	10.00	0.5	10.00	0.5	30.00	1.5
						Subtotal		60.00	0.0	30.00	0.5	15.00	0.5	10.00	0.5	115.00	1.5

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PK PRI	PROJECT NUMBER	PROJECT TITL	PKG NUM	CULT RES TYPE	SYSTEM-WIDE ISSUE	FUNDING SOURCE	ACT TYP	STARTING YEAR $$	STARTING YEAR FTE	OUTYEAR 1 $$	OUTYEAR 1 FTE	OUTYEAR 2 $$	OUTYEAR 2 FTE	OUTYEAR 3 $$	OUTYEAR 3 FTE	TOTAL $$	TOTAL FTE
104	262.000	EXPAND	N03			RG-NS-RES	RES	50.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.00	0.0
		LONG-TERM				RG-NS-RES	MON	10.00	0.5	10.00	0.5	10.00	0.5	10.00	0.5	40.00	2.0
		ECOL.															
		STUDIES-E.ER				Subtotal		60.00	0.5	10.00	0.5	10.00	0.5	10.00	0.5	90.00	2.0
		ECTROCENTRUS															
105	263.000	EXPAND	N03			RG-NS-RES	RES	60.00	0.0	10.00	0.0	0.0	0.0	0.0	0.0	70.00	0.0
		LONG-TERM				RG-NS-RES	MON	0.0	0.0	10.00	0.5	5.00	0.2	5.00	0.2	20.00	0.9
		ECOL.															
		STUDIES-LOPH				Subtotal		60.00	0.0	20.00	0.5	5.00	0.2	5.00	0.2	90.00	0.9
		CEREUS															
		SCHOTTII															
106	264.000	EXPAND	N03			RG-NS-RES	RES	60.00	0.0	10.00	0.0	0.0	0.0	0.0	0.0	70.00	0.0
		LONG-TERM				RG-NS-RES	MON	0.0	0.0	10.00	0.5	5.00	0.2	5.00	0.2	20.00	0.9
		ECOL.															
		STUDIES-BURS				Subtotal		60.00	0.0	20.00	0.5	5.00	0.2	5.00	0.2	90.00	0.9
		ERA															
		MICROPHYLLA															
121	110.000	CONDUCT	N20			RG-NS-RES	RES	60.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.00	0.0
		SURVEY OF															
		STUDY SITE															
		SOILS, GEO.															
		& HYDRO.															
	59 projects printed																
						Grand Total		2255.50	8.4	914.30	7.8	559.30	5.4	293.30	4.1	4022.40	25.7

End of data