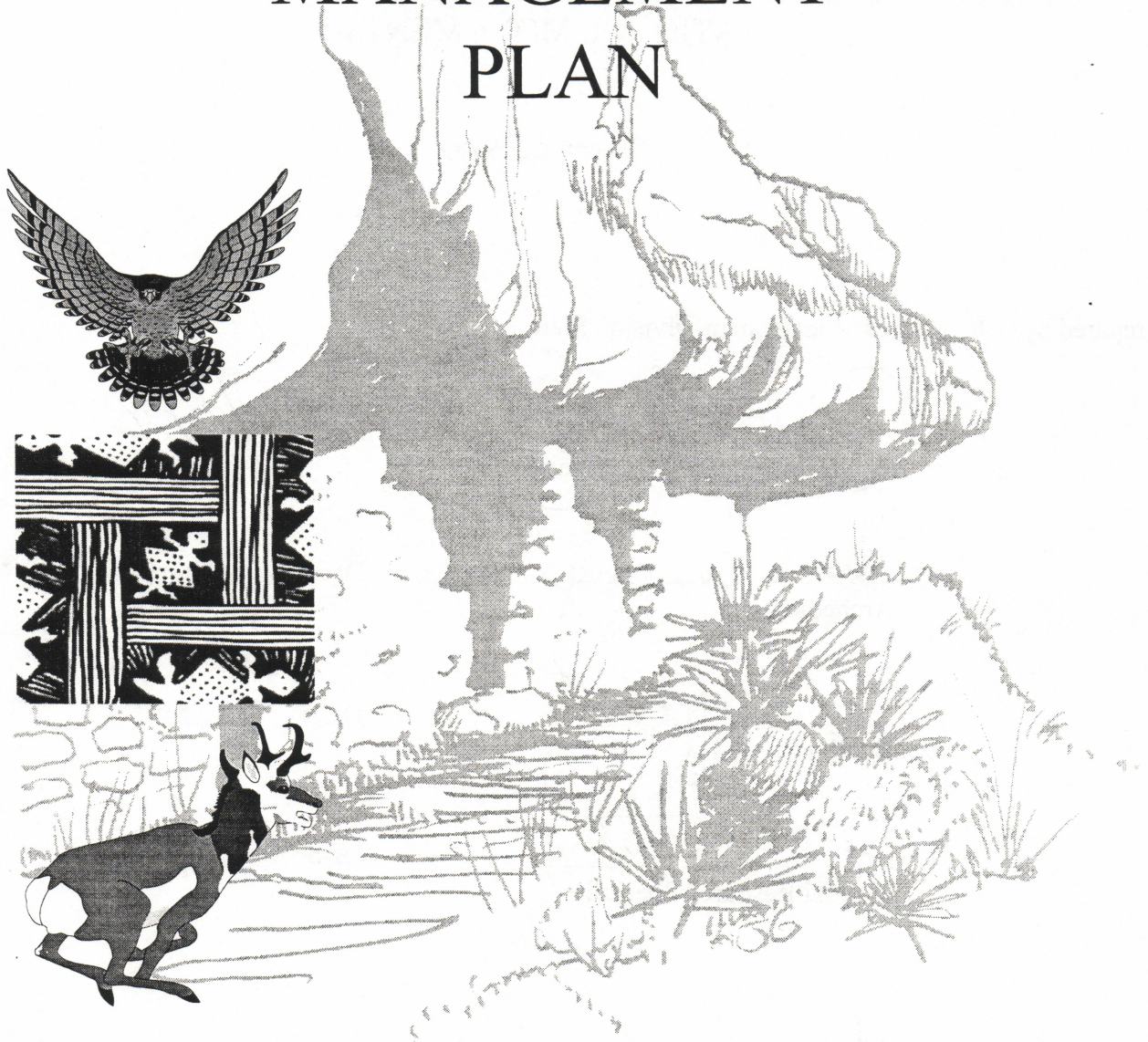
RESOURCES MANAGEMENT PLAN



Flagstaff Areas National Monuments:
Wupatki National Monument
Sunset Crater Volcano National Monument
Walnut Canyon National Monument

RESOURCES MANAGEMENT PLAN

FLAGSTAFF AREA NATIONAL MONUMENTS: WUPATKI, SUNSET CRATER VOLCANO, AND WALNUT CANYON NATIONAL MONUMENTS

December, 1996

Prepared by: Resources Management Division Staff

Chief, Resources Management — Date: 12/20/96

Archeologist — Date: 12-20-96

Exhibit Specialist — Date: 12/20/96

Natural Resource Specialist — Date: 12/20/96

Approved by: Sam R. Henderson — Date: 12-20-96

Sam R. Henderson
Superintendent

TABLE OF CONTENTS

I. INTRODUCTION 1
A. Administration and Management 2
B. Regional Setting 4
C. Visitation 7
D. Purpose and Significance 9
E. Resource Management Goals and Objectives 10
1. Cultural Resources 11
2. Collections of Natural and Cultural Objects 12
3. Natural Resources 14
F. Management Issues 16

II. RESOURCE STATUS 18
A. Cultural Resource Information 18
1. Archeological Sites and Historic Structures 18
a. Archeological Sites with Standing Architecture 20
b. Historic Structures with Standing Architecture 22
2. Objects and Collections 23
a. Museum Object Storage 23
b. Collections on Exhibit 25
3. Cultural Context/Themes 26
B. Cultural Resource Baseline Information 28
1. Archeological Sites and Historic Structures 28
2. Impacts to Archeological Resources 31
3. Planning Documents, Catalogs, and Inventories 31
C. Natural Resource Information 35
1. Geology and Physiography 35
2. Soils 36
3. Climate 37
4. Vegetation 37
5. Mammals 39
6. Avifauna 40
7. Herptofauna 41
8. Exotic Plants 41
9. Threatened, Endangered and other Special Category Species 42
10. Air Resources 45
11. Aesthetic Resources 45
12. Water and Riparian Resources 46

13. Paleontological Resources 53
14. Quaternary Resources 54
15. Related programs 54
a. Fire Management 54
b. Geographical Information System (GIS)/Global Positioning Systems (GPS) 55
D. Natural Resources Baseline Information 56
1. Geology and Physiography 56
2. Soils 57
3. Climate 57
4. Vegetation 57
5. Mammals 57
6. Avifauna 58
7. Herptofauna 58
8. Exotic Plants 59
9. Threatened, Endangered and other Special Category Species 59
10. Air Resources 59
11. Aesthetic Resources 59
12. Water and Riparian Resources 59
13. Paleontological Resources 60
14. Quaternary Resources 60
15. Related Programs 60
a. Fire Management 60
b. Geographic Information Systems (GIS) and Global Positioning Systems (GPS) 60

III. RESOURCE MANAGEMENT PROGRAMS 62
A. Overview of current programs 62
B. Summary of Major Resource Programs 66
C. Current Resource Management Staff 95
D. Resource Management Staffing Needs 95

IV. REFERENCES CITED 98

V. APPENDICES 112
Appendix A: Wupatki Baseline Resource Information 113
Appendix B: Sunset Crater Volcano Baseline Resource Information 122
Appendix C: Walnut Canyon Baseline Resource Information 130
Appendix D: Resource Management Proposed Staffing. 137
Appendix E: Resource Management Project Statements. 139

I. INTRODUCTION

This plan describes, documents, and prioritizes resource management issues, problems, and actions needed to manage, protect, and preserve the cultural and natural resources of the Flagstaff Area National Monuments and to meet stated objectives. This is a dynamic document designed to meet or begin addressing the stated goals and objectives from 1996 to 1998. It will be reworked as information and expertise is advanced. The RMP is intended for use primarily by the staff of the Flagstaff Areas, Field Directorate, and WASO staffs; however, the RMP is also a public document.

This document represents the first RMP produced for the Flagstaff Areas since its inception in 1990. A combined RMP was produced for Wupatki and Sunset Crater Volcano National Monuments in 1988. Prior to Walnut Canyon National Monument coming into the Southwest Region and the Flagstaff Areas in 1990, the RMP for the monument was being revised by Kathy Davis of the Southern Arizona Group. This current document represents a merging of the two above mentioned RMPs, with of course, the necessary revisions, modification, and updates.

This plan was prepared in conjunction with other management documents in existence for the Flagstaff Areas and each monument in order to be consistent with the legislative purposes for establishment and with operational plans. The primary accompanying documents include the Statement for Management for the Flagstaff Areas (1994), The Interpretive Prospectus for Wupatki (1995), the Interpretive Prospectus for Walnut Canyon (draft 1996), the Comprehensive Interpretive Plan (draft 1996), and the Land Protection Plan for Walnut Canyon (1985). Other relevant documents consulted were the Walnut Canyon Fire Management Plan (1991) and the Wupatki Backcountry Management Plan (draft 1994) and the Grazing Management Plan (1993). Of course, the preparation of this document was based on the guidelines established in the NPS Management Polices (1988), NPS-28 Guideline: Cultural Resources Management (1994), and NPS-77 Guideline: Natural Resources Management (1991).

The production of this plan represents a collaborative effort on the part of the staff of the Division of Resources Management as well as the staff of each of the individual monuments and Division Chiefs of the Flagstaff Areas. Many of the resource management issues and concerns presented in this document are the result of "Scoping Sessions" held with various staff members at each monument. A preliminary version of this document was also reviewed by the staff of each monument to insure that the issues raised in the scoping sessions were appropriately addressed.

External participation consisted of soliciting input from the U.S. Forest Service, Coconino National Forest, Northern Arizona University, the Friends of Walnut Canyon, Arizona State Parks, Arizona Game and Fish, Navajo and Hopi Tribes, the State Historic Preservation Office, the City of Flagstaff, and adjacent land owners to the parks. Input was initially sought through letter correspondence inviting interested parties to provide the areas with a list of their concerns, desired futures, etc. In-house drafting of the document resulted in an incorporation of the information provided.

This plan goes from broad to specific. Initially, legislative mandates and management objectives are introduced. The plan then identifies the present status or condition of resources in the monuments, describes cultural and natural resource management programs currently operating, and identifies management actions that are needed to preserve, protect and conserve cultural and natural resources. Finally, funding needs and potential funding sources are identified using programming sheets which are updated annually.

As with the previous RMP versions, the project statements still make up the bulk of the document. These statements, however, have been prepared according to national guidelines and are generally more concise than in past versions. Most resource management activities conducted in the Flagstaff Areas are now accounted for in the RMP, including administrative activities. This means that the Plan has a more programmatic approach and achievements will be tracked. In-depth exploration of management issues and alternatives has been relegated to topic specific action plans, which are developed on an as needed basis. Some of the action plans are currently in preparation. These actions plans will become addenda to the RMP. Compliance needs for specific actions are identified within each project statement; this RMP is not subject to a single cultural and environmental review process as it has been in the past.

A. Administration and Management

Walnut Canyon and Wupatki are listed on the National Register of Historic Places; consequently, with the exception of developed areas within the parks, the monuments are classified as cultural zones, as described in "Management Policies, U.S. Department of the Interior/National Park Service, 1988." Walnut Canyon's 2,249 acres and Wupatki's 35,253 acres are therefore managed ". . . for the preservation, protection, and interpretation of cultural resources and their settings and to provide for their use and enjoyment by the public."

Sunset Crater Volcano National Monument, with the exception of developed areas, is classified as a natural zone, as described in "Management Policies, U.S. Department of the Interior/National Park Service 1988." The monument's 3,040 acres are therefore managed ". . . to conserve natural resources and ecological processes and to provide for their use and enjoyment by the public in ways that do not adversely affect these resources and processes."

There is a District Ranger at each of the three monuments who directs and oversees the day-to-day operations of each area. General management of overall operations is supervised by the Superintendent and Division chiefs who work at the headquarters office.

In 1984, a headquarters office was established in Flagstaff, Arizona to serve Wupatki and Sunset Crater Volcano National Monuments. In 1990, Walnut Canyon was moved to the former Southwest Region and consolidated with Wupatki and Sunset Crater Volcano to form the Flagstaff Area National Monuments.

Wupatki National Monument

Wupatki is located in Coconino County, Arizona 34 miles northeast of Flagstaff. The monument in north-central Arizona is part of a region lying between extensive high-altitude national forest lands to the southwest and semidesert mesas of the Hopi and Navajo Indian Reservations to the northeast. The latter forms the largest block of Indian tribal lands in the United States. The monument encompasses 35,253 acres. All areas within the fenced and posted boundaries beyond developed roads and trails are closed to unauthorized entry except by permit. Permits can be obtained from NPS staff at Wupatki Visitor Center. In 1994 480 "Back Country" permits were issued. In 1995 396 permits were issued.

Wupatki is bounded by the Navajo Reservation on the east; Forest Service, public domain, and private land on the south; and public domain and private land on the west and north.

Sunset Crater Volcano National Monument

Sunset Crater Volcano is located in Coconino County, Arizona, approximately 18 miles northeast of Flagstaff and 20 miles southwest of Wupatki. The monument includes 3,040 acres completely surrounded by the Coconino National Forest. No permits are required at Sunset Crater Volcano; however, access to Sunset Crater Volcano Cinder Cone is closed above the 7,020 foot contour. The dominant vegetation at Sunset Crater Volcano is a mature open ponderosa pine forest. Approximately 50 percent of the monument is barren or semi-barren cinder fields. Other tree species include limited numbers of quaking aspen, Utah juniper and pinyon pine. The vegetation also includes shrubs and other plants typical of a transition zone.

Walnut Canyon National Monument

Walnut Canyon is located in Coconino County, Arizona, approximately 7 miles southeast of Flagstaff. The monument is in central northern Arizona on the Mogollon Rim in the Little Colorado River Watershed. The monument encompasses 2,249 acres including a private inholding of approximately 238 acres on the east boundary.

The monument straddles approximately five miles of Walnut Canyon in addition to numerous side canyons of various sizes. The main canyon has a maximum depth of 400 feet. Walnut Canyon National Monument encompasses a riparian zone on the bottom, mixed conifer community on the north facing slope, semiarid vegetation on the south facing slope, and extensive stands each of ponderosa pine and pinyon and juniper on both rims. Except by permission of the Superintendent all areas within the fenced and posted boundaries beyond designated public roads and trails are closed to unauthorized entry.

B. Regional Setting

The Flagstaff Area National Monuments are located east (Walnut Canyon) and north (Sunset Crater Volcano and Wupatki) of the City of Flagstaff, Arizona (see maps pages 6 and 7).

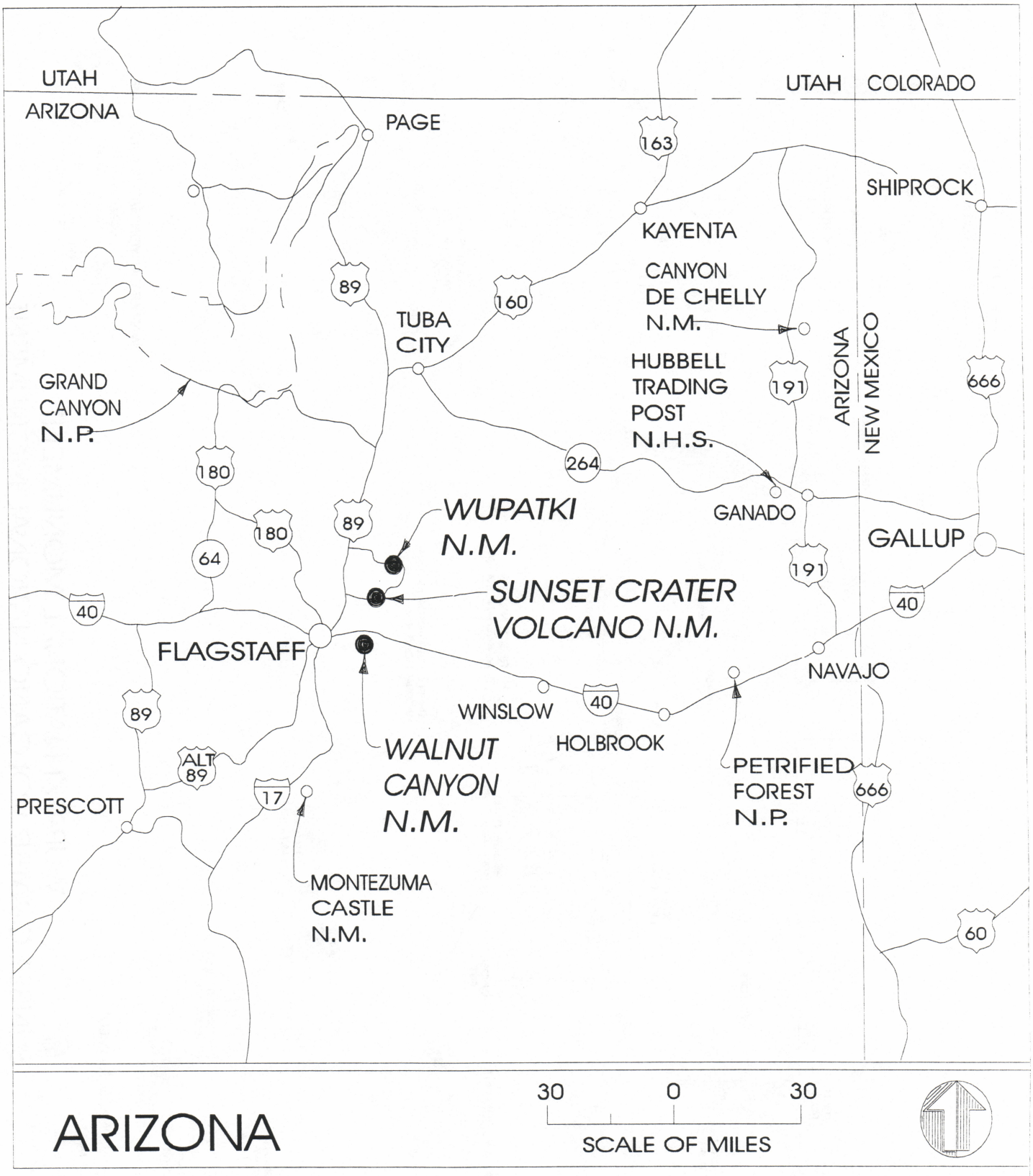
Phoenix, a rapidly growing metropolitan complex of over two million people is located 150 miles south of Flagstaff. Flagstaff, a major community of northern Arizona, has a population of approximately 55,000. Flagstaff offers numerous services for the extensive ranching, lumber and tourist activities of northern Arizona. The area between Flagstaff and Sunset Crater Volcano and Walnut Canyon is being subjected to increasing residential and business development. The remainder of the region surrounding the monuments is sparsely populated, although a private development (called "Alpine Ranchos") is increasing in population northeast of Sunset Crater Volcano, leading to substantial increases in non-park travel on park roads.

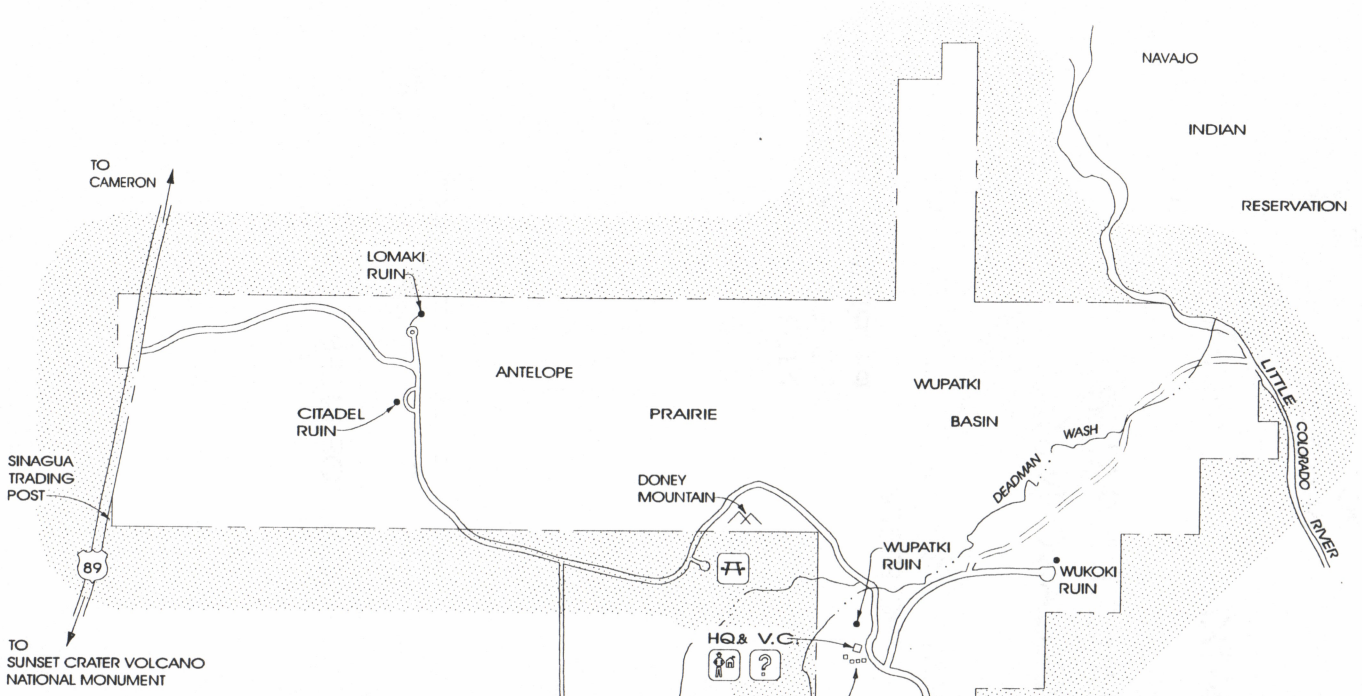
Land use in the region varies from the expanding urban influences of Flagstaff near Sunset Crater Volcano and Walnut Canyon to low-intensity grazing at Wupatki. The Coconino National Forest, surrounding Sunset and Walnut, and bordering Wupatki on the south and west, is under multiple-use management. The primary uses near the monuments are recreation and grazing.

Information from the U.S. Geological Survey indicates that some lands in the area of the monuments are prospectively valuable for oil and gas, geothermal steam, and associated geothermal resources. Based on present information, there are no additional valuable leasable minerals. Because of the lack of surface indications and drilling data, the potential for geothermal energy development and for discovery of oil and gas in the area is unknown at the present time. The Coconino National Forest and adjacent region are currently being studied by the U.S. Geological Survey and private corporations for potential geothermal development. Permits have been granted by the U.S. Forest Service to energy-related firms for research on Forest Service lands adjacent to the Wupatki boundary. Minerals, including cinder, pumice, gypsum, miscellaneous clays, sulphur, and uranium, have been reported in the area surrounding the parks, and the findings of meteorites and meteorite diamonds have been reported in the vicinity. It is unknown to what extent, if any, these minerals exist at commercially valuable levels in the monuments. A cinder quarry operation is located outside Sunset Crater Volcano, northwest of the visitor center. The haul road for this operation crosses the main park road (Forest Service road 545) near U.S. 89.

Wood cutting, shooting/hunting, and ORV activities are evident throughout Forest Service areas adjacent to the monuments. Occasionally, these activities spill over onto monument property, and present illegal and incompatible use.

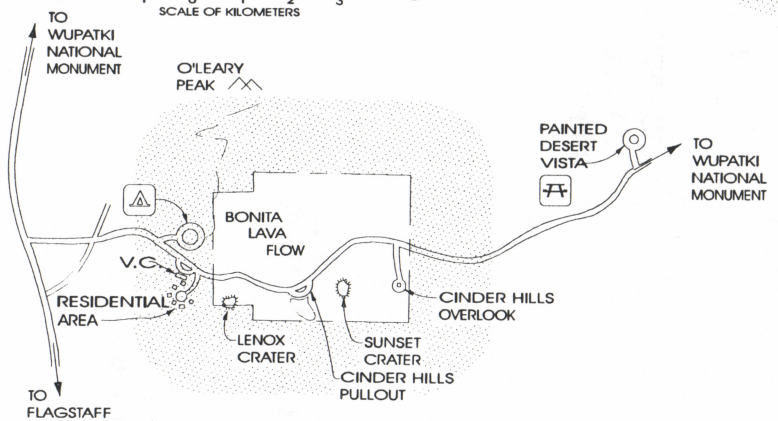
The location of the monuments within this regional complex of public lands is one of the most important aspects determining its visitation pattern, as well as its resource management problems and programs.


UTAH
ARIZONA
UTAH
COLORADO
PAGE
163
SHIPROCK
KAYENTA
CANYON
DE CHELLY
N.M.
89
160
TUBA
CITY
HUBBELL
TRADING
POST
N.H.S.
191
ARIZONA
NEW MEXICO
666
GRAND
CANYON
N.P.
264
180
WUPATKI
N.M.
GANADO
GALLUP
180
89
64
191
SUNSET CRATER
VOLCANO N.M.
40
40
FLAGSTAFF
NAVAJO
WINSLOW
40
89
HOLBROOK
WALNUT
CANYON
N.M.
ALT
89
PETRIFIED
FOREST
N.P.
666
PRESCOTT
17
MONTEZUMA
CASTLE
N.M.
60
ARIZONA
30
0
30
SCALE OF MILES



WUPATKI NATIONAL MONUMENT

SCALE OF MILES
1 0 1 2
1 0 1 2 3
SCALE OF KILOMETERS

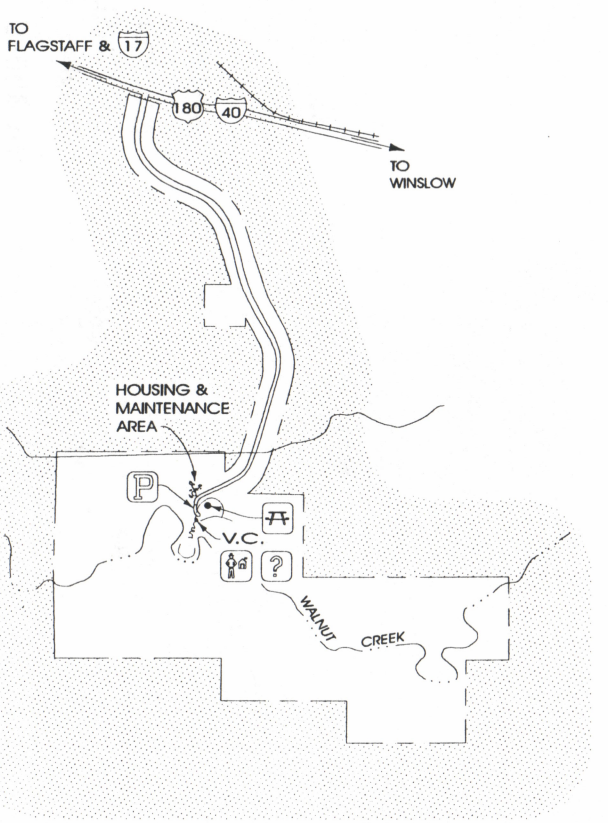


SUNSET CRATER VOLCANO NATIONAL MONUMENT

SCALE OF MILES
1 0 1 2
1 0 1 2 3
SCALE OF KILOMETERS

LEGEND

PARK BOUNDARY	V.C. VISITOR CENTER
STATE LINE	HQ. PARK HEADQUARTERS
PAVED ROAD	RANGER STATION
UNPAVED ROAD	INFORMATION CENTE
TRAIL	PICNIC AREA
CREEK OR WASH	CAMPGROUND
	PARKING



WALNUT CANYON NATIONAL MONUMENT

SCALE OF FEET
1,500 0 1,500 3,000
250 0 250 500 750
SCALE OF METERS

WUPATKI NATIONAL MONUMENT
SUNSET CRATER VOLCANO NATIONAL MONUMENT
WALNUT CANYON NATIONAL MONUMENT

FL RMP

There is no public transportation to any of the national monuments. Sightseeing bus tours are operated by Nava-Hopi Tours, Inc., Grayline Tours, and smaller commercial companies throughout the year.

U.S. 89, a major north-south route through Arizona and Utah, and Interstate 40, provide access to the parks from Flagstaff, which is served by Amtrak rail service, bus service, commercial airlines and private vehicles via Interstates 40 and 17.

C. Visitation

Visitation to the Flagstaff Area National Monuments in 1984 numbered 727,887. By 1993, visitation increased 42 percent to 960,137. Visitation in 1994 to the monuments was 909,173 and in 1995 visitation totaled 915,729. The majority of visitation (89%) to the Flagstaff Area National Monuments occurs from March to October. Wupatki receives 91% of its visitation during these months while Sunset Crater Volcano receives 87% and Walnut Canyon 89%. The following table presents a breakdown of visitation for each of the three monuments since 1983.

Table 1. Visitation Flagstaff Area National Monuments

(Annual = Fiscal Year, Monthly = calendar year)

Year	Wupatki	Sunset	Walnut	FLAG Total
1984	214,499	419,303	94,085	727,887
1985	198,481	422,692	90,501	717,674
1986	214,482	436,645	116,334	767,461
1987	215,484	459,614	109,441	784,539
1988	250,254	525,275	122,945	898,474
1989	252,386	508,873	135,609	896,868
1990	256,485	512,917	134,909	904,311
1991	240,653	530,678	157,626	928,957
1992	273,678	609,675	168,467	1,051,820
1993	269,300	525,134*	165,703	960,137

(* = total reflects a change in formula used to determine visitation)

10 Year Increase

Wupatki	Sunset	Walnut	FLAG Total
+25%	+26%	+76%	+42%

1993 Monthly

Month	Wupatki	Sunset	Walnut	FLAG Totals
Jan	6,746	14,343	3,089	24,178
Feb	7,120	14,332	3,428	24,880
Mar	17,612	31,347	10,489	59,448
Apr	31,120	81,725	19,287	132,132
May	30,906	52,301	18,781	101,988
Jun	32,771	60,345	20,076	113,192
Jul	35,901	81,960	26,201	144,062
Aug	35,523	73,790	22,457	131,770
Sep	30,888	66,511	16,759	114,158
Oct	20,889	30,502	13,686	65,007
Nov	11,259	24,752	6,718	42,729
Dec	8,545	17,980	4,615	31,140

10 Year Increase in March - October Visitation

Wupatki	Sunset	Walnut	FLAG Total
91%	87%	89%	89%

1994 Monthly

Month	Wupatki	Sunset	Walnut	FLAG Total
Jan	6,914	20,165	4,533	31,612
Feb	7,539	18,151	4,032	29,722
Mar	21,239	37,476	12,903	71,618
Apr	26,023	42,982	17,525	86,530
May	29,027	62,919	19,122	111,068
Jun	32,678	27,405	18,412	78,495
Jul	36,722	68,475	24,096	129,293
Aug	34,116	58,963	21,069	114,148
Sep	30,781	57,859	15,680	104,320
Oct	24,928	42,515	14,061	81,504
Nov	11,763	21,625	5,947	39,335
Dec	9,548	17,065	4,915	31,528

1995 Monthly

Month	Wupatki	Sunset	Walnut	Flag Totals
Jan	5,971	14,660	2,912	23,543
Feb	9,878	20,494	5,205	35,577
Mar	21,722	32,509	10,965	65,196
Apr	30,584	46,357	16,038	92,979
May	29,174	58,049	16,078	103,301
Jun	32,961	37,876	20,803	91,640
Jul	36,771	69,802	23,836	130,409
Aug	33,508	78,744	19,040	131,292
Sep	30,879	59,463	13,662	104,004
Oct	23,996	41,989	12,513	78,558
Nov	12,322	19,926	6,638	38,886
Dec	1,440	17,473	1,431	20,344

D. Purpose and Significance

The purpose of Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments is generally defined in the National Park Service Organic Act of 1916 as: ". . . To conserve the scenery and the natural and historic objects and the wildlife 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."

Specific purposes are defined in the individual monument's establishment legislation.

Wupatki National Monument

Wupatki National Monument was established by Presidential Proclamation No. 1721 of December 9, 1924 (43 Stat. 1977) to preserve ". . . two groups of prehistoric ruins [Wupatki and Citadel ruins] built by the ancestors of a most picturesque tribe of Indians still surviving in the United States, the Hopi or People of Peace . . ."; and later, ". . . It appears that the public interest would be promoted by reserving these prehistoric remains as a National Monument together with as much land as may be necessary for the proper protection thereof . . . " Because of its cultural significance, the entire monument is listed on the National Register of Historic Places.

Sunset Crater Volcano National Monument

Sunset Crater Volcano National Monument was established by Presidential Proclamation No. 1911 of May 26, 1930 (46 Stat. 3123) to preserve "certain geologic formations [an extinct 1,000-foot high cinder cone and surrounding black lava and cinder fields, illustrating the dramatic effects of the violent eruption and aftermath upon the prehistoric peoples who lived in the area] on lands within the Coconino National Forest, in the State of Arizona, which are of scientific and public interest."

Walnut Canyon National Monument

Walnut Canyon National Monument contains many prehistoric Indian sites which are spectacularly located in cliffs and along the rim of Walnut Canyon. Its purpose is stated in the following excerpts from the Presidential Proclamation which established the Monument (No. 1318. November 30, 1915 - 39 Stat. 1761). ". . . Whereas certain prehistoric ruins of ancient cliff dwellings situated upon public lands of the United States, and located in what is commonly known as Walnut Canyon." ". . . are of great ethnologic, scientific, and educational interest, and it appears that the public interests would be promoted by reserving these relics of vanished people with as much land as may be necessary for the proper protection thereof, as a National Monument."

The cultural significance of these National Monuments is further recognized by the Archaeological Resources Protection Act of 1979 (Public Law 96-95), acknowledging the fragile nature of archaeological resources as an irreplaceable part of our heritage. The law further implies that existing laws (the Antiquities Act of 1906) do not provide "adequate protection to prevent the loss and destruction of the resources," and further recognizes the wealth of information to be gained from the protection of such resources.

E. Resource Management Goals and Objectives

Based on Public Law 88-590, as well as on the various mandates and policies of the National Park Service (NPS), the overriding objective of the Resource Management Division of the Flagstaff Area National Monuments is to preserve, protect and conserve natural and cultural resources of the park, and to comply with Federal laws and mandates such as the National Environmental Policy Act, the National Historic Preservation Act, the Threatened and Endangered Species Act, the Archaeological Resources Protection Act, and various NPS policies. These mandates and policies dictate the specific program components and management objectives for the resource management program. The following sections list some of the more important objectives for the natural and cultural resource management programs. Since museum and archival collections include both cultural and natural resources, objectives for collection management are listed separately.

1. Cultural Resources

Objectives for cultural resource management are to preserve, conserve, and protect cultural resources of the monuments, while allowing present and future generations to enjoy their cultural heritage, as stated in the enabling legislation for the monuments and in the NPS Organic Act of 1916. Within this broad objective, specific components of the cultural resource management program are determined by Federal laws and Department of the Interior and National Park Service policies. These mandates and policies require program components in specific areas such as public education and participation, direct and indirect protection of sites, etc. Some of the more important management objectives for the cultural resource management program are listed below in Table 2.

Table 2. Management Objectives for Cultural Resources

- ☐ Comply with the National Historic Preservation Act by ensuring all licensed or approved undertakings take into account the effects of the undertaking on properties included in or eligible for the National Register of Historic Places and, prior to approval of an undertaking, afford the Advisory Council on Historic Preservation and the Arizona State Historic Preservation Officer an opportunity to comment on the undertaking.

- ☐ Intensively inventory the park and document, assess and evaluate its historic, prehistoric, and ethnographic cultural resources as mandated by Executive Order 11593, the National Historic Preservation Act, the Historic Sites Act, NPS-28.

- ☐ Indirectly protect significant cultural resources through nomination of sites and districts to the National Register of Historic Places, as mandated by the National Historic Preservation Act.

- ☐ Indirectly protect cultural resources of the park through maintaining and updating the site disclosure policy, (a Superintendent's Directive) in compliance with section 304 of the National Historic Preservation Act, as amended in 1992.

- ☐ Physically protect sites and districts by having trained, uniformed, Archeological Resources Protection Act (ARPA) patrol rangers.

- ☐ Physically protect sites by installing physical protection devices that serve as a proxy for patrol rangers, e.g. signs, barriers, register boxes, etc.

- ☐ Physically protect sites by performing regular stabilization and maintenance on the stabilized sites in the park, and expand the number of stabilized sites to protect sites from the increasing impacts of visitors.

Table 2 (cont'd)

- ☐ Coordinate management of cultural resources within the park with other Federal and state land managing agencies, and regularly exchange information between agencies as directed by the Secretary of the Interior's Federal Strategy for Federal Archeology.

- ☐ Ensure preservation of cultural resources through visitor education and through expansion and improvement of the interpretation of cultural resources in the park. The interpretive program should teach visitors how to behave when visiting non-renewable cultural resources. The interpretive program should also teach visitors why cultural resources are worth preserving and protecting.

- ☐ Consult Native Americans and other park-associated communities and ensure their involvement in management decisions for sites or properties which may have traditional, religious, sacred, or cultural importance, as mandated by the National Historic Preservation Act, the Native American Religious Freedom Act, the Native American Graves Protection and Repatriation Act, etc.

- ☐ Encourage public participation in historic preservation programs.

2. Collections of Natural and Cultural Objects

Since museum objects and collections from the monuments include both natural and cultural objects, collections management involves both natural and cultural resource branches of the Resource Management Division.

The overriding objective in collection management is to meet NPS Museum Handbook standards and conserve the diverse natural and cultural resources of the monuments. Some of the more important objectives of the collections management program are listed in Table 3.

Table 3. Management Objectives for Collections

- ☐ Contract for qualified specialists to examine, identify and conserve objects in existing collections. For example, prehistoric baskets need to be examined and removed from damaging Rycher mounts. Natural specimens such as snakes, birds, plants, etc., need to be identified to current taxonomic levels. Wet specimens need to be rehoused in the proper storage solution.

- ☐ Obtain a new facility to centralize collections and provide an environment that is appropriate and necessary for the long term preservation of objects and specimens as mandated by the NPS.

Table 3 (Cont'd)

- ☐ Accession, catalog and digitize the historic photographic archive for all three monuments. Copy all nitrate negatives to a more stable medium.
- ☐ Undertake appropriate preservation steps such as storage. A search should be made to augment the existing photograph collections, specifically, historic photos of each monument should be obtained.
- ☐ Locate all off-site collections. Assess whether off-site collections should be brought together in a single repository meeting Federal curation standards.
- ☐ Establish an archive with finding aid. Search for relevant archival documents within the monuments and in outside repositories and private collections; then prepare a finding aid and ensure appropriate curation of the archive. Encourage historians to use the archive when it is complete.
- ☐ Prepare administrative and legislative histories based on the archives.
- ☐ Reduce the backlog of uncataloged archival, natural and cultural objects.
- ☐ Bring all accession and loan files up to date. Work with cultural and natural resource specialists and researchers to ensure accountability for on-going cultural and natural resource collections and projects.
- ☐ Work with Interpretive Division to ensure that exhibit specimens receive appropriate care.
- ☐ Maintain museum records. Update or prepare all museum planning documents such as the Scope of Collection Statement, Collection Management Plan, Integrated Pest Management Plan, etc.
- ☐ Monitor and maintain collection environments. Ensure appropriate security standards for collections. Work on Integrated Pest Management plan for storage and exhibit areas.
- ☐ Meet the requirements of NAGPRA mandated by the NPS.
- ☐ Develop and implement an archival finding aid.
- ☐ Map/Document all sites with standing architecture (primarily those rapidly deteriorating from the weather, i.e., Navajo forked-stick hogans).

3. Natural Resources

Management objectives for the natural resource branch of the Resource Management Division of the monuments are to preserve and protect the diverse ecosystems of the three monuments, including plants, animals, soil, air quality, water, quiet, Quaternary and paleontological resources, etc. Some of the specific management objectives for the natural resource program are listed below.

Table 4. Management Objectives for Natural Resources

- ☐ Minimize visitor impacts on natural resources of the monuments.
- ☐ Protect the diverse ecosystems (including rare, threatened, endangered and endemic species as well as pristine, disjunct and uncommon plant communities).
- ☐ Encourage applied research in ecosystem processes and natural resources within the monuments.
- ☐ Provide the interpretive staff with information about ecological processes occurring within the monuments.
- ☐ Restore natural condition of lands and plant communities altered by human activities.
- ☐ Control exotic species by feasible, approved control methods wherever natural communities are threatened or where control methods are likely to be successful.
- ☐ Protect the air quality of the monuments. Preserve and protect the viewsheds and natural vistas of the monuments.
- ☐ Protect surface aquatic resources in the monuments such as seeps and springs.
- ☐ Provide for the continued inventory and monitoring of major natural resources (vegetation, wildlife, soils, clean air, water, etc.) so management practices can be modified promptly to reverse and mitigate adverse impacts to those resources.

Table 4 (Cont'd)

- ☐ Maintain liaison and cooperative relationships with groups such as the Navajo and Hopi Nations, United States Forest Service, Arizona Game and Fish, Northern Arizona University, Museum of Northern Arizona, Arizona Land Department, Coconino County, City of Flagstaff, and others who share interests in the monuments and surrounding area.

- ☐ Coordinate planning, development and management activities with others to share expertise and insure compatible uses of adjacent lands.

- ☐ Provide adequate funding to ensure initial preparation and cataloging of specimens and field generated records resulting from future natural history research projects.

- ☐ Air and Water Resource Management Plans for all three areas need to be prepared and implemented. Air quality monitoring, once conducted in Wupatki, should be continued.

- ☐ Changes in water sources should be documented and appropriate management actions taken to restore and preserve those sources. Changes in air and water quality may be indicators of regional events, not limited to the monuments themselves.

- ☐ Vegetation management plans need to be developed for each area to document the recommended treatments for housing areas, visitor use areas and cultural resources. Specific plans may be needed to restore historically correct environments around historical structures in the monuments.

- ☐ Management ignited prescribed fires are needed to reduce hazardous, unnatural fuel accumulations at Walnut Canyon and Sunset Crater Volcano; and to restore fire's role in the ecosystem. At Wupatki, the absence of fire on the Antelope Prairie grasslands, along with years of grazing, has promoted the invasion of juniper. Restoring fire's role in this grassland will help perpetuate the native vegetation.

- ☐ A comprehensive Integrated Pest Management Plan should be prepared, with specific attention to rodent control, and put into effect to mitigate the threats from hantavirus. Such a plan should include a positive public education element. This plan should also address infestation of forest resources.

- ☐ A plan for reclamation of abandoned borrow pits and roads in Wupatki National Monument needs to be prepared.

Table 4 (Cont'd)

- ☐ Information is needed to support management decisions regarding earth fissures, "blowholes", and ice caves. In addition to our resource management concerns of these features, they are also considered very special places by the Hopi and Navajo Indians. We will strive to maintain excellent working and consultation relationships with these American Indian groups.

- ☐ Documentation and management of American Indian uses of natural resources needs to be undertaken. We need to identify what resources are being utilized, and manage that use to accommodate needs, but not to the detriment of the resource.

- ☐ A landscaping plan needs to be prepared and implemented for the three areas to screen support facilities (maintenance shops, housing, outbuildings) from visitor views. This specifically needs to be done at the housing area at New Heiser (Wupatki), not only to screen the residences, but to provide a pleasant living environment for those residents.

- ☐ Management plans should be implemented that identify and monitor the activities and dynamics of the large animals that live in or use monument resources.

- ☐ Ongoing monitoring and documentation of sheep grazing (life-time authorization for one individual) and resulting impacts to park resources needs to be implemented.

F. Management Issues

There are several critical issues facing management in protecting, preserving, and interpreting cultural and natural resources. They include the following:

- ☐ **Fiscal Erosion and FTE Ceiling** - Park Base funding and FTE allotments have not increased with the increased resource management requirements of the three parks. Adequate funding is not available to support minimally acceptable resource management activities, maintenance of inter-agency relationships, adequate community involvement, and protective patrols. The requirements placed on staff time and resources, by new and changing policies, programs, and procedures, has reduced the time and staffing available to fulfill basic park needs.

- ☐ **Lack of Basic Data** - Baseline information is inadequate as well as comprehensive knowledge of specific topics. Archeological surveys have been conducted in two out of the three parks (Wupatki and Walnut Canyon), but the information on the natural history and other aspects of cultural resources is lacking. Basic information needs to be gathered

on the flora, fauna, and geology to identify components of the natural resources, ecosystems, related processes, and individual threats that may be present. All of the existing data needs to be developed into a usable computer data base program (such as dbase V) for ease of access, reporting, and information retrieval. Deficiencies in cultural resources include collections, ethnohistorical and ethnobotanical uses, relations of historic and prehistorical people with their environment, and ruins preservation needs. Bibliographical data is lacking for both categories of resource management.

- **Increasing Visitation** - Ever increasing numbers of visitors continue to impact the integrity of cultural and natural resources. Human erosion of archeological resources is increasing, requiring more frequent ruins preservation. Primary and other purposes of visitor uses need to be determined and appropriate services provided accordingly. An evaluation of current and expected impacts to resources should be performed, with recommendations for conservation.

- **Adjacent Land Uses** - Increasing recreational uses of surrounding lands for camping, recreational vehicles, hunting, and wood gathering impact the boundary areas of all three monuments. They also disrupt the movement of larger animals in, out, and through the monuments. Forest Service programs (logging, fire management, grazing, and forest management) may have an impact to the resources of each monument: prescribed fire has the potential for entering each monument, herbicide applications alter adjacent sites, logging operations alter the vista and open areas for increased wood cutting and recreational uses. Residential developments have expanded ever closer to Sunset Crater Volcano and Walnut Canyon.

- **Growth of Flagstaff and Adjacent Communities** - The increasing growth of Flagstaff, population 55,000, causes effects through visitation and recreational uses of adjacent land. Residential development has spread to within a few miles of both Sunset Crater Volcano and Walnut Canyon. With the possibility of Forest Service land exchanges and available State land, development could be within a few hundred feet of each monument in future years.

II. RESOURCE STATUS

This section is an overview of the current status of significant cultural and natural resources and resource values found in the Flagstaff Areas, and an assessment of their general condition. The major focus of this section is the need to acquire more complete baseline data for the parks in order to evaluate, monitor and manage these resources .

A. Cultural Resource Information

NPS Cultural Resource Management Guideline, NPS-28, is a comprehensive guideline developed to aid managers, planners, staff and cultural resource specialists in the protection, preservation and interpretation of cultural resources. NPS-28 identifies standards and a recommended minimal set of cultural resource information which should be available in all cultural resource parks. These guidelines have not been met for the Flagstaff Area National Monuments.

Following the Archeological Resources Protection Act (ARPA), cultural resources are defined as any material remains of past human life or activities which are of archeological interest and are at least 100 years of age. Following the National Historic Preservation Act (NHPA), cultural resources can be as young as 50 years of age. Historic resources, as well as prehistoric resources, are referred to as archeological resources by ARPA and in the following discussion of resource status in the park.

Existing conditions for the management of cultural resources in Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments are defined by the current state of knowledge of the resources and by the plans in place for managing cultural resources. These will be reviewed in the next sections and on the appended Cultural Resource Documentation Checklist.

1. Archeological Sites and Historic Structures

The monuments contain nonrenewable resources left by prehistoric Paleoindian, and Archaic people, by protohistoric and historic Hopi and Navajo; as well as by historic explorers, cattlemen, miners, park staff, and park visitors. These cultural historical people and periods are briefly described below, but this is only a summary and is not intended to be a comprehensive description of the monuments' cultural history.

Wupatki National Monument

Wupatki National Monument contains 2,678 archeological sites, including pithouse villages, unit pueblos, fieldhouses, lithic and ceramic scatters, rock art, dams, reservoirs, field alignments, hogans and historic trash dumps. The prehistoric sites date from 8,000 B.C. to A.D. 1225 and contain material culture and architecture that reflects the growth, development and departure of at least three groups of prehistoric people. Archeologists believe that members of the Sinagua, Cohonina, and Kayenta Anasazi occupied the lands now designated as Wupatki National Monument. The interaction of these three distinct cultures with each other and with the Hohokam to the south have

earned 12th and 13th century Wupatki the reputation of "a cultural frontier." During this time period a large agricultural population worked, traded, and worshiped with their neighbors.

During the period between 1981 and 1987 a 100% archeological resource inventory survey was conducted of Wupatki National Monument (Anderson 1993). Prior to that survey it was estimated that as many as 800 archeological sites were present within the boundaries. The survey however, recorded 2,668 sites. Of those sites 132 were petroglyph sites and 2,397 had prehistoric components (Anderson 1990).

The majority of prehistoric sites at Wupatki date from A.D. 1070 to A.D. 1250 (information based on NPS 1987 survey estimates). A total of 2,209 sites have some surface or subterranean construction (Downum and Sullivan 1990). Of this total, 288 are classified as "enclosure" sites, lacking any construction with a maximum 1,921 sites with "architectural spaces" exceeding two meters in width. 1,080 sites consist of a single space, either a single masonry room or a single indication of a pit structure (Downum and Sullivan 1990).

In addition to the prehistoric sites at Wupatki, there are 67 historic Navajo residential sites and over 250 historic sites that can be attributed to Hopi, ranchers, miners, traders, herders, film makers and others. A blowhole near the western boundary of the monument is still used today by local Hopi and Navajo medicine men.

The Navajo occupation of the area can be traced to the 1850s when Navajo families fearing for their lives fled from their homelands in northeastern Arizona to the remote safety of the Wupatki basin. The first Navajo moved into the Wupatki area around 1850, and descendants of those early settlers still live in the area surrounding Wupatki National Monument. One Navajo family resides on the monument and through a "Letter of Authorization" continues to herd sheep.

The CO Bar ranch was founded by the pioneering Babbitt family in the late 1800s and ranch holdings originally included almost all of what is now Wupatki National Monument. During the same period Anglo ranchers, prospectors, traders, and railroad workers competed with the Navajos for control and use of the land.

Wupatki National Monument is listed on the National Register of Historic Places.

Sunset Crater Volcano National Monument

While intensive inventory and assessment of cultural resources is mandated by law and NPS policy, Sunset Crater Volcano has not been intensively inventoried. Nevertheless, adjacent Forest Service lands contain remains of prehistoric pithouses, dating prior to and after the eruptions of Sunset Crater Volcano in A.D. 1064 to 1250. The greatest concentration of these pithouse sites is west of Sunset Crater Volcano, outside the monument. Due to the lack of inventory data, the monument does not have any cultural resources listed on or determined eligible for the National Register of Historic Places. Sunset Crater Volcano and associated ice caves and other features today have religious significance to the Navajo and Hopi people.

Walnut Canyon National Monument

An inventory of archeological sites was completed in 1985 and 1987, documenting 233 sites, excluding those on 238 acres of privately owned inholdings. A total of 251 archeological sites have been recorded in the monument. The archeological sites in the monument belong to the Northern Sinagua tradition, dating from A.D. 500 to A.D. 1250. In addition to the cliff dwellings for which the monument was established, there are a variety of other sites: pit house villages, multi-room pueblos, single room field houses, "forts", check dams and artifact scatters. The monument boundaries protect an arbitrarily defined block of land encompassing a sample of archeological sites representing Sinagua occupation of the San Francisco Peaks region. The sites clustering in and around Walnut Canyon are part of a prehistoric settlement complex subject to changes in demographics and land use from A.D. 500 to A.D. 1400. The primary resource in the monument consists of sites of the Elden phase (A.D. 1100-1250), a time of maximum population expansion in the Southwest. The organization of the Walnut Canyon settlement complex and its relationship to other Sinagua communities is far from understood. Many contemporary related sites are preserved on National Forest Service land adjacent to the monument.

Walnut Canyon National Monument is listed on the National Register of Historic Places. One historic structure, the Old Headquarters, or Old Ranger Cabin, and Santa Fe dam are also listed properties.

a. Archeological Sites with Standing Architecture

Wupatki National Monument

A Park Historical Architecture Division printout, dated 1987, identifies 93 sites at Wupatki which have been entered on the List of Classified Structures (LCS). This list needs to be updated, however, there are some basic issues which need to be addressed before this can be accomplished. The most critical issue pertains to the recording format. The format is oriented towards Euro-American architecture not Native American-Pueblo Architecture prevalent in the park. Completing the forms, consequently, is difficult.

A list of sites which have been stabilized and which are actively monitored is presented in Table 5. Wupatki currently maintains five front country sites (Wupatki, Wukoki, Citadel, Box Canyon, and Lomaki). All of these sites receive active visitation.

Table 5. Monitored and Stabilized Sites in Wupatki National Monument

Site No.	Site No.	Site No.
WS-0075	WS-1089	WS-1636
WS-0081	WS-1096	WS-1637
WS-0082	WS-1111	WS-1638
WS-0124	WS-1132	WS-1664
WS-0136	WS-1213	WS-1679
WS-0239	WS-1258	WS-1680
WS-0249	WS-1259	WS-1685
WS-0323	WS-1316	WS-1692
WS-0329	WS-1356	WS-1695
WS-0355	WS-1357	WS-1723
WS-0404	WS-1361	WS-1736
WS-0459	WS-1378	WS-1742
WS-0463	WS-1390	WS-1744
WS-0467	WS-1395	WS-1748
WS-0473	WS-1396	WS-1762
WS-0623	WS-1400	WS-1772
WS-0746	WS-1403	WS-1801
WS-0769	WS-1405	WS-1805
WS-0787	WS-1413	WS-1806
WS-0815	WS-1434	WS-1807
WS-0816	WS-1435	WS-1808
WS-0831	WS-1444	WS-2000
WS-0833	WS-1449	WS-2001
WS-0834	WS-1466	WS-2002
WS-0839	WS-1486	WS-2059
WS-0886	WS-1487	WS-2199
WS-0890	WS-1494	WS-2260
WS-0891	WS-1495	WS-2277
WS-0895	WS-1497	WS-2286
WS-0944	WS-1507	WS-2304
WS-1020	WS-1524	WS-2371
WS-1027	WS-1525	WS-2377
WS-1043	WS-1556	WS-2378
WS-1067	WS-1574	WS-2424
WS-1081	WS-1634	WS-2430
WS-1082	WS-1635	WS-2662

Walnut Canyon National Monument

Only 56 prehistoric sites with standing architecture and one historic site were entered in the LCS in 1975. This list was updated as a component of the 1994-95 Walnut Canyon ruins preservation assessment. Ranger Cabin, 89 cliff dwellings, and 2 stabilized rim sites will be included in the LCS update.

A list of sites which have been stabilized and which are actively monitored is presented in Table 6. Walnut Canyon currently maintains nine front country sites (two unnamed rim sites and seven Island Trail sites). All of these sites receive active visitation.

Table 6. Monitored and Stabilized Sites in Walnut Canyon

Site No.	Site No.
WACA-090	WACA-195
WACA-147	WACA-196
WACA-152	WACA-197
WACA-154	WACA-198
WACA-155	WACA-199
WACA-156	WACA-203
WACA-157	WACA-204 & 207
WACA-158	WACA-205
WACA-159	WACA-206
WACA-160	WACA-210
WACA-161	WACA-211
WACA-162	WACA-212
WACA-163	WACA-213
WACA-164	WACA-214
WACA-165	WACA-215
WACA-166	WACA-216
WACA-175	
WACA-176	
WACA-177	
WACA-193 & 194	

b. Historic Structures with Standing Architecture.

The Flagstaff Areas maintains four Historic Structures; two at Wupatki and four at Walnut Canyon. All structures relate to the development of and operations of each area as a National Monument. All Historic Structures at Wupatki (Historic Building No. 1 and the Library Portion of the Visitor Center) are presently in use. Historic Building No. 1 is currently being used as a residence. The

historic portion of the Visitor Center is being used as administrative space for library material and collections.

At Walnut Canyon, two historic structures are being used as residences. Another historic structure is a "buffalo" fence. The other historic structure is the Old Ranger Cabin. It is not habitable in its present condition. It can, however, be repaired and stabilized for adaptive use and interpretation.

2. Objects and Collections

The collections of Sunset Crater Volcano include approximately 100 geological specimens, 220 historical objects, and 407 archival items. The collections at Wupatki include approximately 8,000 archeological items, 200 historical objects, 100 ethnographic objects, 400 natural specimens, and over 12,000 archival items. The collections of Walnut Canyon include approximately 200 archeological items, 800 natural specimens, 30 ethnographic objects, and 4,000 archival items. Also there are approximately 143,000 objects from Wupatki National Monument at the Western Archeological and Conservation Center (WACC) in Tucson, and about 150,000 items stored at the Museum of Northern Arizona (MNA) in Flagstaff. WACC has approximately 5,000 items from Walnut Canyon National Monument, and MNA has approximately 3,000 specimens.

Known off-site collections are housed at the Western Archeological Conservation Center, Tucson; Arizona State University, Phoenix; the Museum of Northern Arizona; Northern Arizona University, Flagstaff; the Milwaukee Public Museum, Wisconsin; and the Intermountain Cultural Resource Center, Santa Fe, New Mexico. Given the number of objects stored in off-site repositories, a priority is assessing the off-site collections and repositories and determining whether the objects would be better managed by bringing them together in a single curatorial facility.

Individual libraries are located at each monument. The libraries are managed separately from the collections, but are cared for by the park archeologist. The Flagstaff Area National Monuments has approximately 1,000 books and periodicals in its libraries. These items must be documented, protected, and preserved to Department of Interior standards as stated in the DOI Checklist for Preservation, Protection, and Documentation of Museum Property, the Museum Handbook, Parts I & II and NPS-28, Cultural Resources Management Guideline. Current staffing and funding are inadequate to accomplish work necessary to correct existing catalog backlogs, bring library collections management up to DOI and NPS standards and continue to manage the library. Only a small portion of the library collection is computerized. Consequently, access to library material for research and interpretive purposes is limited.

a. Museum Object Storage.

Wupatki National Monument

The museum collections are stored in a wing of the Visitor Center. They are stored in a locked room located off the library. A solid core wood door and deadbolt lock were installed during the summer of 1994. There are no environmental controls on the room; however, the environment is being

monitored with a hygrothermograph on a monthly basis. Temperatures during the winter months range between 50° F and 60° F and during the summer months between 75 F to 80 F. Extreme relative humidity fluctuations were recorded during the months of May and June, 1994. To combat the fluctuations, the swamp cooler was turned off. However, without the cooler the collections/library area was uncomfortably warm. In October, 1994, an infestation of moths and dermestids was noted. Objects were transported to the Museum of Northern Arizona to undergo a series of freezing; cabinets were cleaned. The objects were later returned to their original location.

A variety of objects are stored in 10 standard specimen cases. Housed in the cases are herbarium and other biological specimens, geologic specimens, perishable prehistoric materials, prehistoric and historic ceramics; prehistoric stone artifacts; and ethnographic materials. Museum records are stored in four fire-resistive filing cabinets. Fire-resistive cabinets need to be obtained for proper storage of the monument's photograph collection.

Sunset Crater Volcano National Monument

No objects are stored at Sunset Crater Volcano. Artifacts and specimens collected from Sunset Crater Volcano have been traditionally cataloged as Wupatki objects. The Collections Management Plan (1996) suggests deacessioning and recataloging material belonging to Sunset Crater Volcano.

Walnut Canyon National Monument

The collections at Walnut Canyon are stored in two small closets in the lunchroom of the Visitor Center and at the Wupatki collection room. Environmental conditions are monitored with a hygrothermograph. Sticky traps monitor pest movement. Temperature and relative humidity levels fluctuate wildly. A heating vent empties into the collection room causing temperatures to rise abruptly and relative humidity temperatures to drop (the vent has been closed). The Collections Management Plan suggests that "proper storage of museum artifacts is the most important defense in preventing the deterioration of objects. In order to provide a more stable environment for sensitive archeological collections, several specimens have been centralized to Wupatki.

The park archeologist/curator has concentrated on improving object storage as well as improving security, environment, and pest controls of the curatorial facilities. A housekeeping program needs to be developed and implemented. A permanent full-time Museum Technician is needed to assist with daily curatorial duties.

In order to meet curatorial standards mandated by the NPS a new facility, centrally located, should be constructed. The facility would centralize collections making access and accountability easier and provide the proper environment for all collections.

An Integrated Pest Management (IPM) plan needs to be written and implemented for the Flagstaff Areas' Collection Management program. Pests have been and continue to be a problem in all storage areas including libraries (pests are monitored with sticky traps). The IPM plan is the responsibility of the natural resource specialist.

b. Collections on Exhibit.

NPS standards for the display of collections states exhibit cases should be sturdy and tamper-resistant, but also easily accessible for curatorial and maintenance needs. The exhibit cases should maintain a stable micro-environment for museum objects, be dust and pollutant free, and provide adequate light while protecting objects from damaging visible and ultra-violet radiation and heat build-up from lighting. Ventilated cases are used only when exterior ambient conditions are acceptable for the preservation of objects.

A Flagstaff Areas Comprehensive Interpretive Plan is currently in draft form (1996). Exhibits for all three monuments were constructed during and prior to the Mission 66 program. Each museum needs substantial modification to include new information, new technology, and new methodology to provide visitors with current, accurate information about the cultural and natural history of the areas. Exhibit cases are difficult to access in case of emergency or for routine cleaning. Substantial work needs to be conducted to update information, object mounts, and environmental conditions.

Wupatki National Monument

Relative humidity strips and a data logger monitor conditions in exhibit cases at Wupatki National Monument. NAGPRA objects from these cases have been taken off display and returned to storage or the Western Archeological and Conservation Center or Museum of Northern Arizona. All of the cases at Wupatki provided very little protection for the objects from environment, light and insects; cases are also difficult to open for house cleaning purposes and objects would be difficult to remove in case of an emergency.

Sunset Crater Volcano National Monument

Sunset Crater Volcano's exhibits building shows evidence of previous roof leaks. Of special note are radiators beneath the exhibit cabinets which have an immediate effect on the internal temperature and relative humidity in each exhibit case. Environmental conditions at Sunset Crater Volcano are monitored with a hygrothermograph.

Walnut Canyon National Monument

Walnut Canyon's exhibits are housed in a large room protected from harmful rays of natural sun light. Most of the exhibit cases have their own light sources (which can be damaging to objects); the exhibit cases do not seal tightly and many of the interiors are dusty; many of the cases contain food products which can attract pests; objects are placed directly on supports without benefit of padding or inert separation; some cases do not have tamper proof screws; cases are difficult to open for house keeping needs and in case of emergencies. Relative humidity strips and a data logger monitor environmental conditions in all exhibit cases and NAGPRA objects have been returned to storage or the Western Archeological and Conservation Center or Museum of Northern Arizona.

3. Cultural Context/Themes

NPS defines cultural contexts as the framework within which the significance of a resource can be evaluated as it relates to an ethnographic, historic, or prehistoric theme, a particular geographic area, or a specific time period.

Table 8. Historic Themes Flagstaff Areas National Monuments

Early Cattle and Sheep Industries
Early Lumbering
Livestock Raising and Settlement late 1800s early 1900s
The Conservation Movement
Development of northern Arizona's National Parks

Based on the History Division of the NPS's *History and Prehistory in the National Park System and the National Historic Landmarks Program* (1987), historic themes which are probably pertinent to sites in the Flagstaff Area National Monuments are listed in the next table.

Table 9. Historic Themes

Westward Expansion of the British Colonies and the United States, 1763-1989: The Mining Frontier
The Cattlemen's Empire
Science: Earth Sciences
Conservation of Natural Resources: Formation of the Conservation Movement, 1870-1908; The Conservation Movement Matures, 1908-1941
Historic Preservation: Federal Government Enters the Movement, 1884-1949

Based on the History Division of the NPS's *History and Prehistory in the National Park System and the National Historic Landmarks Program* (1987), prehistoric themes pertinent to sites in Flagstaff Area National Monuments are listed in the next table.

Table 10. Prehistoric Themes

The Earliest Inhabitants: Archaic Adaptations of the Southwest; Archaic Adaptations in Arid Lands
Post-Archaic and Pre-Contact Developments: Post-Archaic Adaptations
Prehistoric Archeology, Topical Facets:
Prehistoric Architecture
Prehistoric Technology
Prehistoric Social and Political Developments Prehistoric Arts/Handicrafts
Prehistoric Economics/Trade
Prehistoric Religion, Ideology, and Ceremonialism
Prehistoric Settlements and Settlement Patterns Prehistoric Agriculture/Plant Domestication and Horticulture
Prehistoric Demographics
Prehistoric Cultural Change
Major Contributions to the Development of Culture Histories
Paleoecology
Ethnohistory of Indigenous American Populations: Native Adaptations to Southwestern Environments; Forced and Voluntary Population Movements; The New Demographics

B. Cultural Resource Baseline Information

Cultural resource data collection at the Flagstaff Area National Monuments is incomplete. Basic and applied research has been sporadic. Consequently identification, evaluation and registration of historic properties is inadequate, ethnographic and archeologic resources are unknown, and cultural landscapes are undefined. Inventory and monitoring studies need to be completed and descriptive and analytical information needs to be acquired. Specific plans remain to be written, maps must be generated, and all data must be entered into the GIS.

Many of the cultural resource project statements listed within this plan are designed to provide baseline data for the parks. Information on resource identification, evaluation and registration is lacking for Sunset Crater Volcano. Ethnographic Overview and Assessments, Cultural Affiliation Studies, and Historic Resource Studies need to be conducted at each park. Data needs to be sorted, organized, and made available in GIS format to render it accessible to resource management employees as well as other divisions.

Cultural Resource Management at the Flagstaff Area National Monuments is affected by the lack of data in the following ways:

1) Baseline monitoring or research information on a parkwide level is inadequate or nonexistent to permit development of cultural resource planning activities or to guide cultural resource management operations. Key areas in need of data collection are resource identification and evaluation, identification of ethnographic and ethnobotanical resources, identification and evaluation of cultural resources within historic contexts, and identification and evaluation of cultural affiliation.

2) As a result of inadequate funding, many cultural resource management operations are not addressed in a meaningful way. Examples include maintenance on historic structures, preservation of historic properties, baseline archeological inventories, baseline research, collection management, resource monitoring and protection.

3) Resource management program design and implementation are hindered by the absence of baseline data upon which to base hypotheses, develop models and provide accurate interpretation.

1. Archeological Sites and Historic Structures

Wupatki National Monument

Most archeological research in Wupatki National Monument was done more than 50 years ago; the types of data recovered, as well as the conclusions reached, reflect the research interests and archeological methodology of the time. The first scientific site recording at Wupatki was conducted by the Sitgreaves expedition in 1851. Lieutenant Sitgreaves described the ruins along the Little Colorado River (Sitgreaves 1853). In 1900, Jesse Walter Fewkes conducted a "cursory examination" of the larger, standing sites now located within the monument (Fewkes 1900 and 1904). Fewkes

photographed sites, described Citadel and Wupatki Pueblos and collected artifacts for the Smithsonian Institution. Just prior to the creation of the monument Samuel A. Barrett, Director of the Milwaukee Public Museum, surveyed and made collections in the Citadel area (Barrett 1927). Andrew E. Douglas, Harold S. Colton and J.C. Clarke excavated rooms 35, 36, and 45 of Wupatki Peublo in 1926-27 for the purpose of removing beams for dendrochronological analysis (Stanislawski 1963). Heiser Spring Ruin (NA1754) was excavated by the Museum of Northern Arizona in 1931 - no report was produced. The first fully documented excavation at the Monument began in 1933 when the Museum began excavation on Wupatki Pueblo (Hargrave 1933). A. Ten Broeck Williamson and James W. Brewer excavated two structures located just north of Wupatki Pueblo in late 1933 (Williamson 1933). Excavation at Nalakihu began in December 1933 under the direction of Dale S. King (1949). This project also provided intensive survey of 20 quarter sections in the Citadel region. Excavations at Wupatki Pueblo continued in December 1933 exposing an additional 21 rooms (Wupatki Collection n.d.). In 1936 Erik K. Reed and James A Brewer excavated Wupatki Pueblo Room 7. In 1939 material recovered from Room 7 was thoroughly analyzed (Reed and Brewer 1937). The last excavation at Wupatki Pueblo took place in 1940-41. Ranger David L. Jones excavated Rooms 11 and 12 (U.S.D.I 1953a).

The first work at Wupatki with true methodological orientation was undertaken in 1948 by the Museum of Northern Arizona. The Museum conducted an expedition in the Big Hawk Valley on the western edge of the Monument (Smith 1952). In 1953, the Museum excavated NA5701 and NA5702 near Wupatki Pueblo. In 1957 a further excavation was conducted at NA6301, located near Doney Mountain (Bradley 1959).

During a joint investigation of the Wupatki blowhole system, sponsored by the Rand Corporation and the Museum of Northern Arizona, NA7824 was excavated in 1961 (Schley 1962). Michael B. Stanislawski completed the first analysis of the architecture and material remains of Wupatki Pueblo in his 1963 doctoral dissertation. The Museum of Northern Arizona excavated the Wupatki Ball Court in May 1965; the project was under the supervision of Alexander J. Lindsay and George J. Gumerman. Only a preliminary report was produced (Lindsay 1965). In 1968, small site, NA2077 was excavated by park service employees (Ward 1976). In 1973, Museum of Northern Arizona archeologists James Bradford and Dana Hartman excavated a burial at NA12,512, a small alcove site near the Citadel (Hartman 1973). WS1432 was excavated by Northern Arizona University in 1989. The field school was conducted to determine suitability of different methods of archeological excavation and data recovery (Braun 1989).

Structural preservation of prehistoric sites with standing architecture has been an ongoing activity in Wupatki since the early 1930s (Metzger 1989 as amended). Colton, Hargrave, Brewer, Williams, Van Valkenburgh, and Motz excavated and stabilized several rooms in Wupatki Pueblo during 1933 and 1934 (Colton et. al. 1933 and 1934). In 1941 Albert Schroeder conducted initial maintenance stabilization on several sites within the monument including NA202, NA203, NA355, NA377, NA378, NA379, NA404, NA405, NA407, and NA1770 (Schroeder 1941). During the 1950s stabilization on several sites was conducted by Roland Richert and Gordon Vivian (Richert 1953, 1954a-c, 1956; Vivian and Richert 1953; Richert n.d.). Charles Voll and Martin Mayer and Joel

Shiner, during the 1960s, were responsible for initial stabilization as well as maintenance stabilization on sites throughout the monument (Mayer 1965a-b; Shiner 1961; Voll 1965; Voll and Mayer 1964a-d). George Chambers, James Trott, Patricia Gilman, Barrie Thornton and Bruce Anderson conducted preservation activities in 1976 and 1978 (Anderson 1980; Chambers 1976; Gilman and Thornton 1976; Trott 1978a-c, 1981). In 1979 Stephen Adams developed a ruins preservation guide for Wupatki Resource Management staff. During the 1980s preservation treatment was conducted annually on various sites throughout the monument (Adams 1981, 1982a-b, 1983; Chandler 1986; Cinnamon 1988 and 1989; Davis 1984a-b; Healy 1982a-c; Henderson 1988; Matlock 1988; Metzger 1989; Nickens and Associates 1985; Protiva 1983a-d, 1985, 1986, 1987 and 1988; Trott and Sulam 1987; Welton 1986). Preservation treatment continues as funding and staffing become available (Firor 1991; Neal 1991; Morgart 1994 and 1995).

Walnut Canyon National Monument

The majority of excavation at Walnut Canyon was associated with vandalism or stabilization. Walnut Canyon cliff dwellings were first described by Stevenson who traveled through the Flagstaff area in 1883 and 1884 (Powell 1887). The first archeological work at Walnut Canyon was done by Harold S. Colton in 1921 (Colton 1932a). Colton recorded 120 sites including pueblos, cliff dwellings, "forts" and a few pithouses. In 1932, the first excavation was conducted in Walnut Canyon. The project was undertaken to stabilize cliff dwelling NA739 (Hargrave 1932; Colton 1946). In 1940, Paul Ezell stabilized NA311, NA312, and NA313. Although Ezell's main focus was stabilization, his crew recovered several artifacts (Ezell 1940). Ezell's uncompleted work was finished by Superintendent Paul Beaubien in October 1940 (Beaubien 1940). In late 1948 Raymond Rixey, National Park Service Ruins Stabilization Unit, stabilized rooms in five reported cliff dwellings on the Island Trail (Rixey n.d.; 1948b; 1948c; Rixey and Voll 1962). Rixey's primary goal was stabilization and scientific data collection secondary. No further work was done in Walnut Canyon until 1955, when Gordon Vivian and Roland Richert, National Park Service, stabilized rooms in NA331, NA333 and NA334 (Richert 1958).

Sally Van Valkenburgh recorded 78 sites on the north rim of Walnut Canyon during the years 1955, 1957 and 1958 (Van Valkenburgh 1958). In 1961, Robert Euler in conjunction with the Arizona State College Archaeological Survey conducted a survey of the south rim of Walnut Canyon (Euler 1964). John Cramer conducted an intensive survey of the northwest corner of the monument in 1965 (Cramer 1965). Cramer recorded 28 ravine terraces or checkdams in three tributary canyons. A limited List of Classified Structures was compiled by the National Park Service for Walnut Canyon during the 1970s and 1980s. In 1976 Pat Gilman wrote an archeological overview of the monument, and in 1977 completed a survey of the monument's boundaries (Gilman 1976; 1977). Anne R. Baldwin and J. Michael Bremer completed the most comprehensive survey of the monument in 1985 (Baldwin and Bremer 1986). Eighty-three percent of the monument was surveyed relocating or recording 242 sites. Seven more sites were recorded by Baldwin and Bremer during a short survey in 1987 (Bremer 1987). A total of 251 sites have been recorded in Walnut Canyon. Preservation treatment has been ongoing in Walnut Canyon as funding and staff become available (Morgart 1994 and 1995). In 1994, a Ruins Stabilization Assessment was conducted at the monument through a

cooperative agreement with the National Park Service and Northern Arizona University (Harper 1995).

2. Impacts to Archeological Sites.

The site monitoring program at Wupatki and the 1994 inventory and assessment of sites at Walnut Canyon have established that adverse impacts to sites are caused by both natural and human induced forces.

Natural agents of deterioration include direct precipitation, general effects of weather over time, and burrowing rodents. The exposed sites at Wupatki are subject to the effects of weather more than the protected cliff dwellings at Walnut Canyon. However, runoff and drips into the alcoves at Walnut Canyon are a major source of architectural deterioration. The alcoves and architecture at Walnut Canyon also provide shelter for burrowing rodents, notably packrats, which build nests and middens in walls, undermining their stability.

Park visitors at both monuments impact the primary interpretive sites, on the Island trail at Walnut Canyon and the four, primary interpretive areas at Wupatki (Wupatki, Wukoki, Citadel, and Lomaki ruins) through both inadvertent actions and intentional vandalism. Inadvertent impacts include knocking loose top course stones by walking on ruin walls, touching original plasters, picking up pottery sherds or other surface artifacts, and the cumulative effects of thousands of visitors walking around and through the rooms. Intentional vandalism includes removing pottery sherds and other surface artifacts, graffiti inscribed on boulders, in alcoves, on ruin walls and rock art panels, and probing and digging in the sites, i.e. looting.

Visitors also adversely effect backcountry sites through unauthorized access, vehicular access, and sometimes through intentional vandalism. Intentional vandalism including probing, digging and looting in sites can be more extensive in backcountry sites than interpretive sites due to the absence of other visitors and the irregularity of ranger patrols.

Graffiti and looting of surface and subsurface artifacts is increasing. Flagstaff Areas management and staff need to apply all means available from public education to ARPA enforcement, to halt the looting of cultural resources.

3. Planning Documents, Catalogs, and Inventories

A *General Management Plan* (GMP) for the Flagstaff Area National Monuments will be initiated in 1996.

A *Development Concept Plan* (DCP) is needed for the Flagstaff Area National Monuments.

The *Statement for Management* was approved in September 1994 and should be revisited in 1997.

An *Interpretive Prospectus* for Wupatki National Monument was completed in 1995.

An *Interpretive Prospectus* for Walnut Canyon is in draft form.

The *Comprehensive Interpretive Plan* for the Flagstaff Area National Monuments is currently being written.

An *Interpretive Prospectus* needs to be initiated for Sunset Crater Volcano National Monument.

2. Servicewide Inventories, Lists, Catalogs, and Registers:

Cultural Resource Bibliographies have been completed for both Wupatki and Walnut Canyon National Monuments. CRBIB has not been updated for Wupatki National Monument since 1987. Walnut Canyon's CRBIB was last updated in 1991. The CRBIBs need to be updated to reflect cultural resource progress in the monuments.

Cultural Sites Inventory (CSI) needs to be updated for Wupatki and Walnut Canyon. A CSI needs to be initiated for Sunset Crater Volcano.

The *List of Classified Structures* is a list of historic and prehistoric structures which meet a slightly variable scale of preservation. This list was updated in 1996.

The *National Register of Historic Places* includes all cultural/historic National Monuments. The National Register was created in 1966 as part of the National Historic Preservation Act. This Act, as well as Executive Order 11953, dictates the evaluation and documentation of all sites on Federal land which may qualify for inclusion either individually or as a portion of an areas thematic nomination to the National Register. The evaluations and nominations for archeological sites are generally based on the potential of a site to produce useful research data. Baseline maps and documents need to be completed for each monument. Listed properties include the Ranger Cabin. Nominations need to be completed for Wupatki, Walnut Canyon and the Santa Fe Dam.

The *National Catalog of Museum Objects* is located in the National Catalog Records Center maintained by the National Park Service in Harper's Ferry, West Virginia.

3. Basic Cultural Resource Documents:

The *Archeological Overview and Assessment* needs to be updated for Wupatki. An *Archeological Overview and Assessment* needs to be initiated for Walnut Canyon and Sunset Crater Volcano.

An *Ethnographic Overview and Assessment* needs to be initiated for Wupatki, Walnut Canyon and Sunset Crater Volcano. Oral histories should be documented for Native Americans traditionally associated with the parks, as well as for other people and communities traditionally or historically associated with the parks.

A *Scope of Collections Statement* was written in 1986 for Walnut Canyon. The document was well written but does not include necessary information required in the 1994 Revised NPS Guidance on Scope of Collection Statements.

A *Scope of Collections Statement* (SOCS) was written for Wupatki and Sunset Crater Volcano in 1982. The current SOCS does not meet revised NPS guidelines.

The *Departmental Checklist for Preservation, Protection and Documentation of Museum Property* (formerly Special Directive 80-1) was updated in 1996 for the three monuments.

4. Special Resource Studies and Plans:

A survey of 100 percent of Wupatki National Monument's 35,253 acres was completed in 1987 (Anderson 1990).

Approximately 83 percent of Walnut Canyon National Monument (excluding 238 acres of inholding) was surveyed in 1985 by Baldwin and Bremer (1986). The remainder of the park needs to be surveyed. An additional 1,300 acres of newly acquired land also needs to be surveyed.

An intensive inventory and assessment of cultural resources at Sunset Crater Volcano National Monument has not been conducted as mandated by law and NPS policy.

Specific historic landscape reports are required for all potential historic landscapes within the monuments. An *Historic Landscape Study* is technically required (NPS-28) to establish the appropriate landscape maintenance strategies for the monuments.

Ethnographic Resource Assessments and comprehensive studies of oral histories are needed for each monument.

The *Collections Management Plan* was completed in 1996. A Museum Collection Maintenance/Housekeeping plan needs to be completed.

A *Conservation Needs Assessment Survey* is needed for Wupatki, Walnut Canyon, and Sunset Crater Volcano.

A *Collection Storage Plan* is needed for the Flagstaff Area National Monuments.

A *Ruins Preservation Plan* is being developed for Wupatki and Walnut Canyon National Monuments.

Historic Structure Preservation Guides need to be evaluated and updated for Wupatki and Walnut Canyon. Preservation guides were completed in 1977.

Historic Resource Studies need to be conducted for each monument. The HRS identifies the need for special history studies, cultural landscape reports, and other detailed studies.

A Visitor Use Survey needs to be conducted at highly visited sites throughout the parks. Such a survey would identify visitor's actual behavior at specific sites, focusing on inappropriate and damaging behavior. After identifying both inappropriate behaviors and the subpopulations responsible for such behaviors, site specific plans can be developed to prevent adverse impacts of visitors to sites.

C. Natural Resource Information

1. Geology and Physiography

Wupatki National Monument

Wupatki lies within the Grand Canyon section of the Colorado Plateaus physiographic province. The monument is an area of high plateaus, mesas, plains, breaks, canyons and valleys. Elevations range from 5,720 feet in the southwest corner of the monument to 4,280 feet on the Little Colorado River on the northeast corner. Gently sloping to steep plains on basalt bedrock are found in the west end of the monument. The central part of the monument lies on almost level plains of limestone of the Kaibab Formation. Drainage is east and northeastward to the northward flowing Little Colorado River.

The oldest formation found at the monument is the Coconino Sandstone, a layer found only on the bottom of Antelope Wash and exposed in the bottom of Sipapu Earth Crack. This sandstone has been interpreted as a desert deposit of huge sand dunes that once covered all of present northern Arizona during the Permian period over 250 million years ago. Also of Permian age, but slightly younger is the Kaibab limestone. Fossils that have been found in the Kaibab formation are typical of a marine limestone. Included in this layer are brachiopods, molluscs and occasional teeth of sharks and other primitive fish.

Moenkopi shales and sandstones, deposited by rivers in the Triassic period, form a slightly younger rock layer in the monument. The Triassic period of earth history dates from 225 to 190 million years ago. The tracks of Chirotherium, a primitive reptile are present in the Moenkopi Formation. The Formation has been removed from most parts of the monument because its soft shales and siltstones are much more easily eroded than the underlying limestone of the Kaibab Formation. Four different lava flows, of Pleistocene age, cover portions of the Moenkopi sandstone. Woodhouse Mesa is the oldest (1.1 million years), while the Doney Crater flow is the most recent (fifteen thousand years). River terrace gravel deposits, transported by the Little Colorado River over the last two million years, also cover the bedrock in some areas east of the cliffs. Remnants of four terrace levels can be seen as grayish, flat-topped caps of gravel over red Moenkopi hills.

Sunset Crater Volcano National Monument

Sunset Crater Volcano National Monument is situated in two physiographic subprovinces: (1) the San Francisco Plateau and; (2) the Little Colorado River Valley, both of which are part of the Colorado Plateau. The San Francisco Plateau is a highland bordered by several deep canyons and is characterized by expanses of lava flows and cinder cones. Extensive volcanic flows, domes and cinder cones form the San Francisco Peaks and associated volcanic field. Sunset Crater Volcano, a recent cinder cone, is located on the eastern edge of the San Francisco Peaks. The terrain in the area is rugged and dominated by volcanos.

Sunset Crater Volcano is the youngest dated volcano in Arizona. The volcano is approximately 1,000 feet high and over a mile wide at the base. The crater at the top of the volcano is about 400

feet deep and 2,250 feet from rim to rim. Sunset Crater Volcano began erupting in A.D. 1064 or 1065 through fault lines or fissures in the earth's crust. Volcanic rocks called pyroclastics were ejected into the air and formed cinders, which fell to the ground around the vent to build a cone-shaped, cinder cone volcano. The Kana-a lava flow, at about this same time, extruded from a fissure near the eastern base of Sunset Crater Volcano. In A.D. 1180, the Bonito lava flow, a composite pahoehoe (pa-hoy-hoy) and aa (ah-ah) lava flow, extruded form the western base of the volcano. In all, the eruption extruded a billion tons of material.

Walnut Canyon National Monument

Walnut Canyon National Monument is located on the Coconino Plateau, which is that portion of the vast Colorado Plateau lying north of the Mogollon Rim and south of Grand Canyon. Within a few miles north of the monument is the extensive San Francisco volcanic field, topped by a large crater that forms the San Francisco Peaks.

A seabed over 200 million years ago, the Coconino Plateau is mainly composed of sedimentary material with a cap rock of Kaibab limestone. Many drainages of varying depths and lengths have carved this plateau. Some are deeply incised canyons exposing several layers of sedimentary deposit and characterized by major water courses with year-round flow. Others, like Walnut Canyon, feature ephemeral streams that are tributary to the Little Colorado River, which eventually joins the Colorado River.

Walnut Canyon, the major geologic feature, bisects the monument from west to east and is 400 feet deep and one-quarter mile wide. Two formations are exposed, the Kaibab limestone and Coconino Sandstone. The lower formation is the cross-bedded sandstone formed as dunes on the edge of the Kaibab Sea. The upper formation is limestone deposited during a late expansion of the same sea that contains many fossil remains of freshwater molluscs. This formation averages 250 feet in depth and is the cap rock within the monument.

2. Soils

Soils in the basalt areas of Wupatki are on gently sloping to steep slopes and are shallow to moderately deep. Basalt rock outcrops are common on the steep slopes and as cliffs. Cinders blown from nearby volcanic cones and drifted by the wind have formed a thin mulch over much of the area of the monument. Locally, wind action has formed drifts more than one foot thick. Limestone areas have shallow to very shallow soils over bedrock. Areas of sandstone and shale are very complex in slope, generally have thin soils and are influenced by cinders.

Soil surveys have not been conducted for Sunset Crater Volcano or Walnut Canyon National Monuments.

3. Climate

Wupatki National Monument

June at Wupatki is normally dry and windy. Brief thunderstorms occur almost on a daily basis from July through September providing the majority of Wupatki's 8.5 inches of annual precipitation. Daytime summer temperatures average 88.6 degrees F, with some days exceeding 100 degrees the average low is 55.6 degrees. Precipitation during the winter months falls in the form of rain with one or two small snow showers. Daytime temperatures are mostly mild (average is 50 degrees) with few days below freezing. Nighttime temperatures are colder and often below freezing (average is 20 degrees). Spring is an unpredictable time of year at Wupatki with mild to warm days mixed with rain and occasionally with a small snow shower. The monument is often windy from sunrise to sundown. Fall is generally very pleasant at Wupatki with warm to mild daytime temperatures, some precipitation and light winds.

Sunset Crater Volcano National Monument

Average daily temperatures for Sunset Crater Volcano during the summer months are from 47° F to 82° F and during the winter months from 14° F to 47° F. Average annual precipitation is 15.7 inches. Afternoon thunderstorms are common during the monsoon season (July through September). Autumn days are warm and mild with some precipitation and light winds. Winter days are cold to mild with a possibility of snow. The average snowfall at Sunset Crater Volcano is 63.5 inches.

Walnut Canyon National Monument

Walnut Canyon's climate is generally moderate with average daily temperatures from 52° F to 86°F in the summer and 17° F to 44° F in the winter. Average annual precipitation is 18 inches. July and August are the wettest months (accounting for two-thirds of the precipitation) due to monsoons. The remaining moisture occurs primarily as winter snowfall. The average annual snowfall is 58 inches.

4. Vegetation

Wupatki National Monument

Three major vegetational units occur at Wupatki National Monument. These are the Cold Desert Shrub, Grassland and Juniper/Grassland communities. This classification scheme is tentative, more research needs to be conducted in order to assess relationships. The Cold Desert Shrub community, for example, may require subdivision or at least qualification to reflect local fascinations which exist.

The plant communities of Wupatki National Monument are diverse and tend to be less continuously distributed. Grassland comprises about nine percent of the monument and in various areas is dominated by galleta (*Hilaria jamesii*), New Mexico feathergrass (*Stipa neomexicana*), and black grama (*Boutelou eriopoda*). In some areas the Grassland has significant densities of shrubs, especially rabbitbrush (*Chrysothamnus nauseosus*) and broom snakeweed (*Gutierrezia sarothrae*).

Juniper/Grassland comprises nine percent of Wupatki National Monument and tends to lie adjacent to the upper Grassland sites. One-seed juniper (*Juniperus monosperma*) dominates the community

while pinyon pine (*Pinus edulis*) is very sparse. Snakeweed and rabbitbrush occur also in this community, their densities apparently somewhat related to soil type and perhaps, intensity of grazing. A variety of grasses occurs in this community; galleta appears to be dominant.

The Cold Desert Shrub community is the most complex and largest of any in Wupatki, comprising roughly 54 percent of the total. Elevationally this is the lowest community and it occurs from 5036 to 4331 feet in the eastern part of the monument. Four-wing saltbush (*Atriplex canescens*), broom snakeweed (*Gutierrezia sarothrae*) and apache plume (*Fallugia paradoxa*) are important components of the shrub community. Other important shrubs are several species of *Ephedra* and *Brickellia.* Herbs in this community are many and include globemallow (*Sphaeralcea subhastata*), prince's plume (*Stanleya pinnata*), buckwheats (*Eriogonum spp.*) and several spurges (*Euphorbia spp.*).

Grasses found in the Cold Desert Shrub community constitute less than five percent of ground cover and include galleta (*Hilaria jamesii*), threeawns (*Aristida spp.*) and bush muhly (*Muhlenbergia porteri.*

Sunset Crater Volcano National Monument

Sunset Crater Volcano National Monument is dominated by a forest of ponderosa pine (*Pinus ponderosa*). This community is scattered with shrubs such as cliffrose (*Cowania mexicana*) and apache plume (*Fallugia paradoxa*). Other vascular plants present at the monument include spleenwort (*Asplenium septentrionale*), Douglas fir (*Pseudotsuga menziesii*), wheatgrass *(Angropyron smithii*), sedge (*Carex occidentalis)*, buckwheat (*Eriogonum aureum*) and filaree (*Erodium cicutarium*).

Walnut Canyon National Monument

The western two-thirds of Walnut Canyon National Monument is dominated by ponderosa pine (*Pinus ponderosa*). The eastern portion is covered with a Rocky Mountain pinyon (*Pinus edulis*) and juniper woodland. Juniper species present in the monument include Utah juniper (*Juniperus osteosperma*), one-seed juniper (*Juniperus monosperma*), Rocky Mountain juniper (*Juniperus scopulorum*) and alligator juniper (*Juniperus deppeana*). The canyon varies with predominantly pinyon and juniper on the south facing slope and mixed conifer dominated by ponderosa pine and Douglas fir (*Pseudotsuga menziesii*) on the north facing slope. Riparian trees and shrubs cover the stream channel, primarily New Mexican locust (*Robinea neomexicana*), boxelder maple (*Acer negundo ssp. californicum*), Arizona walnut (*Juglans major*), quaking aspen (*Populus tremuloides*), Gambel oak (*Quercus gambelii*), red osier dogwood (*Cornus stolonifera*), desert olive (*Forestiera pubescens*) and Arizona rose (*Rosa arizonica*).

The ponderosa community is characterized by an overstory of mature, widely-spaced pines. The understory is more varied with dense thickets of pine regeneration and ecotones of pinyon and juniper overlapping with the ponderosa stands. Gambel oak is found interspersed throughout the forest. On the south rim, Douglas fir is found in the drainages. The understory is sparse small shrubs and grasses.

The pinyon and juniper woodland is characterized by maturing stands of trees. Fully mature specimens are the exception. Often either pinyon or one of the juniper species dominates a stand. Occasionally, ponderosa pine will be found in drainages or in specific locations that have the appearance of small ecotones. There is very little tree or shrub understory in this woodland. Ground cover is sparse grass. In clearings, however, there usually is dense growth of annuals, grasses, small trees, and shrubs.

The inner canyon is a composite of the rim vegetation. Scattered pinyon and juniper dot the south facing slope. Dense stands of primarily Douglas fir occur under the lip of the south rim and extend into the canyon bottom. Ponderosa pine occurs on the north facing slope and is abundant on the more exposed, drier sites. In the stream channel, boxelder maple, quaking aspen, and Arizona walnut grow with several shrub species in dense thickets. Desert shrub and succulent species dominate the south facing slope and occur with pinyon and juniper.

5. Mammals

Wupatki National Monument

Wupatki National Monument is an important habitat for pronghorn (*Antilocapra americana*). In addition to this large mammal mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), elk (*Cervus elaphus*), badger (*Taxidea taxus*), bobcat (*Lynx rufus*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*) are also found. Other small mammals include desert shrew (*Notiosorex crawfordi*), small-footed Myotis (*Myotis leibii*), Townsend's Big-eared bat (*Plecotus townsendii*), spotted ground squirrel (*Spermophilus spilosoma*), silky pocket mouse (*Perognathus flavus*) and deer mouse (*Peromyscus maniculatus).*

Sunset Crater Volcano National Monument

Mammals found at Sunset Crater Volcano include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), elk (*Cervus elaphus*), bobcat (*Lynx rufus*), mountain lion (*Felis concolor*) and coyote (*Canis latrans).* Other smaller mammals found include the western spotted skunk (*Spilogale gracilis*), pinyon mouse (*Peromyscus truei*), porcupine (*Erethizon dorsatum*), little brown bat (*Myotis lucifugus*) and western pipistrelle (*Pipistrellus hesperus*).

Walnut Canyon National Monument

Frequently observed mammals at Walnut Canyon National Monument include mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), and a variety of small mammal and rodent species. Species infrequently observed include pronghorn (*Antilocapra americana*), peccary (*Tayassu tajacu*), black bear (*Ursus americanus*), and badger (*Taxidea taxus*).

6. Avifauna

Wupatki National Monument

Common bird species likely to be found at Wupatki National Monument are the Goshawk (*Accipiter gentilis*), Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Red-tailed Hawk (*Buteo jamaicensis*), Rough-legged Hawk (*Buteo lagopus*), Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Common Flicker (*Colaptes auratus*), Lewis's Woodpecker (*Melanerpes lewis*), Yellow-bellied Sapsucker (*Sphyrapicus varius*), Williamson's Sapsucker (*Sphyrapicus thyroideus*), Hairy Woodpecker (*Picoides villosus*), Western Kingbird (*Tyrannus verticalis*), Cassin's Kingbird (*Tyrannus vociferans*), Ash-throated Flycatcher (*Myiarchus cinerascens*), Black Phoebe (*Sayornis nigricans*), Say's Phoebe (*Sayornis saya*), Gray Flycatcher (*Empidonax wrightii*), Western Wood Pewee (*Contopus sordidulus*), Horned Lark (*Ermophila alpestris*), Scrub Jay (*Aphelocoma coerulescens*), Common Raven (*Corvus corax*), Common Crow (*Corvus brachyrhynchos*), Pinyon Jay (*Gymnorhinus cyanocephalus*), Clark's Nutcracker (*Nucifraga columbiana*), Mountain Chickadee (*Parus gambeli*), White-breasted Nuthatch (*Sitta carolinensis*), Crissal Thrasher (*Toxostoma crissale*), Blue-gray Gnatcatcher (*Polioptila caerulea*), Mourning Dove (*Zenaida macroura*), Common Nighthawk (*Chordeiles minor*), Black-chinned Hummingbird (*Archilochus alexandri*), Cedar Waxwing (*Bombycilla cedrorum*), Gray Vireo (*Vireo vicinior*), Black-headed Grosbeak (*Pheucticus melanocephalus*), Rock Wren (*Salpinctes obsoletus*), Robin (*Turdus Migratorius*), Brown-headed Cowbird (*Molothrus ater*), Common Bushtit (*Pasltriparus minimus*), Mockingbird (*Mimus polyglottos*), and House Finch (*Carpodacus mexicanus*).

Sunset Crater Volcano National Monument

Bird species found at Sunset Crater Volcano National Monument include the Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Red-tailed Hawk (*Buteo jamaicensis*), Rough-legged Hawk (*Buteo lagopus*), Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Sparrow Hawk (*Falco sparverius*), Common Flicker (*Colaptes auratus*), Yellow-bellied Sapsucker (*Sphyrapicus thyroideus*), Hairy Woodpecker (*Picoides villosus*), Western Kingbird (*Tyrannus verticalis*), Cassin's Kingbird (*Tyrannus vociferans*), Ash-throated Flycatcher (*Myiarchus cinerascens*), Black Phoebe (*Sayornis nigricans*), Say's Phoebe (*Sayornis saya*), Western Wood Pewee (*Contopus sordidulus*), Horned Lark (*Ermophila alpestris*), Stellers Jay (*Cyanocitta stelleri*), Common Raven (*Corvus corax*), Common Crow (*Corvus brachyrhynchos*), Pinyon Jay (*Gymnorhinus cyanocephalus*), Clark's Nutcracker (*Nucifraga columbiana*), Mountain Chickadee (*Parus gambeli*), White-breasted Nuthatch (*Sitta carolinensis*), Morning Dove (*Zenaida macroura*), Common Nighthawk (*Chordeiles minor*), Black-chinned Hummingbird (*Archilochus alexandri*), Cedar Waxwing (*Bombycilla cedrorum*), Black-headed Grosbeak (*Pheucticus melanocephalus*), and House Finch (*Carpodacus mexicanus*).

Walnut Canyon National Monument

Bird species commonly found at Walnut Canyon National Monument include the Cooper's Hawk (*Accipiter cooperii*), Goshawk (*Accipiter gentilis*), Sharp-shinned Hawk (*Accipiter striatus*), Red-tailed Hawk (*Buteo jamaicensis*), Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Peregrine Falcon (*Falco peregrinus*), Spotted Owl (*Strix occidentalis*), Flammulated

Owl (*Otus flammeolus*), Morning Dove (*Zenaida macroura*), Black-chinned Hummingbird (*Archilochus alexandri*), Broad-tailed Hummingbird (*Selasphorus platycercus*), Lewis's Woodpecker (*Melanerpes lewis*), Western Kingbird (*Tyrannus verticalis*), Say's Phoebe (*Sayornis saya*), Black Phoebe (*Sayornis nigricans*), Horned Lark (*Eremophila alpestris*), Canyon Wren (*Catherpes mexicanus*), Rock Wren (*Salpinctes obsoletus*), Robin (*Turdus migratorius*), Mountain Bluebird (*Sialia currucoides*) Evening Grosbeak (*Hesperiphona vespertina*), Cassin's Finch (*Carpodacus cassinnii*), Pine Siskin (*Carduelis pinus*) and Red Crossbill (*Loxia curvirostra*).

7. Herptofauna

Wupatki and Sunset Crater Volcano National Monuments

Common herptofauna of Wupatki and Sunset Crater Volcano are the Tiger Salamander (*Ambystoma tigrinum*), Western Spadefoot (*Scaphiopus hammondi*), Woodhouse's Toad (*Bufo woodhousei*), Great Plains Toad (*Bufo cognatus*), Red-spotted Toad (*Bufo punctatus*), Lesser Earless Lizard (*Holbrookia maculata*), Leopard Lizard (*Crotaphytus wislizeni*), Collared Lizard (*Crotaphatus collaris*), Desert Spiny Lizard (*Sceloporus magister*), Short Horned Lizard (*Phrynosoma douglassi*), Great Plains Skink (*Eumeces obsoletus*), Many-lined Skink (*Eumeces multivirgatus*), Western Whiptail (*Cnemidophorus tigris*), Plateau Whiptail (*Cnemidophorus velox*), Little Striped Whiptail (*Cnemidophorus inornatus*), Striped Whipsnake (*Masticophis taeniatus*), Western Patch-Nosed Snake (*Salvadora hexalepsis*), Gopher Snake (*Pituophis melanoleucus*), Glossy Snake (*Arizona elegans*), Milk Snake (*Lampropeltis triangulum*), Common Kingsnake (*Lampropeltis getulus*), Black-necked Garter Snake (*Thamnophis cyrtopsis*), Western Terrestrial Garter Snake (*Thamnophis elegans*), Night Snake (*Hypsiglena torquata*), Black-tailed Rattlesnake (*Crotalus molossus*) and Western Rattlesnake (*Crotalus viridis*), Hopi Rattlesnake (*Crotalus viridus nuntius*).

Walnut Canyon National Monument

Common herptofauna of Walnut Canyon include Southern Plateau Lizard (*Sceloporus undulatus tristichus*), Desert Side-blotched Lizard (*Uta stansburiana stejnegri*), Mountain Short-horned Lizard (*Phrynosoma douglassi hernandesi*), Arizona Mountain Kingsnake (*Lampropeltis pyromelana pyromelana*), and Sonoran Gopher Snake (*Pituophis melaneleucus affinis*). Less commonly seen herptofauna include Collard Lizard (*Crotaphytus collaris*), Tree Lizard (*Urosaurus ornata*), and Arizona Black Rattlesnake (*Crotalus viridis cerberus*).

8. Exotic Plants

Wupatki National Monument

Exotic plants such as Tamarisk (*Tamarix pentandra*), Russian thistle (*Salsola kali var. penuifolia*), and camelthorn (*Alhagi camelorum*) have invaded Wupatki National Monument.

Sunset Crater Volcano National Monument

Exotic plant species that have invaded Sunset Crater Volcano include mullein (*Verbascum thapsus*), and butter and eggs (*Linaria dalmatica).*

Walnut Canyon National Monument

Several exotic species have invaded Walnut Canyon National Monument. These include horehoud (*Marrubiun bulgare*), mullein (*Verbascum thapsus*), butter and eggs (*Linaria dalmatica*), goats beard (*Tragopogon dubius*), white sweet clover (*Melilotus alba*), yellow sweet clover (*Melilotus officinalis*), and Russian thistle (*Salsola kali var. penuifolia*). Several brome grasses have also invaded Walnut Canyon National Monument. These include *Bromus porteri*, *Bromus rigidus*, and *Bromus tectorum*.

9. Threatened, Endangered and other Special Category Species

The Endangered Species Act (ESA) species categories have recently been revised (1996). Former "category species" designations have been eliminated. The following lists of special category species reflect these new classifications.

Also included in these tables are species which have been designated special category species by the Arizona Department of Game and Fish, U.S. Forest Service and the Navajo Nation. These species have been found in the monuments and according to NPS Management Policies (1988) and in the interest of ecosystem management, should be managed in a similar manner on NPS lands. Following is an explanation of the codes used in the tables.

KEY

ESA - **Endangered Species Act** (1973 as amended)
- **LE**: Listed Endangered: imminent jeopardy of extinction.
- **LT**: Listed Threatened: imminent jeopardy of becoming Endangered.
- **C**: Candidate.
- **SC**: Species of Concern (or Species at Risk)
- **PE**: Proposed Endangered
- **PT**: Proposed Threatened

CH - **Critical Habitat**
- **Y**: Yes, critical habitat has been designated.
- **P:** Proposed, critical habitat has been proposed.

USFS - **US Forest Service**, Region 3 (1988 Animals, 1990 Plants)
- **S:** Sensitive

NESL - **Navajo Endangered Species List** (1994)
- **3:** Any species or subspecies which is likely to become an endangered species, within the foreseeable future, throughout all or a significant portion of its range on the Navajo Nation.

4: Any species or subspecies for which the Navajo Fish and Wildlife Department (NF&WD) does not currently have sufficient information to support their being listed in Group 2 or Group 3 but has reason to consider them. The NF&WD will actively seek information on these species to determine if they warrant inclusion in a different group or removal from the list.

NPL - Arizona Native Plant Law (1993)
HS: Highly Safeguarded: no collection allowed.
SR: Salvage Restricted: collection only with permit.

Walnut Canyon National Monument

Scientific Name	Common Name	ESA	C H	USFS	NESL	NPL
Accipiter gentilis	Northern Goshawk	SC		S	4	
Strix occidentalis lucida	Mexican Spotted Owl	LT	Y	S	3	
Falco peregrinus anatum	American Peregrine Falcon	LE	Y	S	3	
Erigeron saxatilis				S		
Cimicifuga arizonica		C		S		HS
Clematis hirsutissima arizonica	Arizona Leather Flower	C		S	4	HS
Hedeoma diffusum	Flagstaff Pennyroyal			S	4	SR
Aquilegia desertorum	Mogollon columbine			S	4	SR

Sunset Crater Volcano National Monument

Scientific Name	Common Name	ESA	C H	USFS	NESL	NPL
Accipiter gentilis	Northern Goshawk	SC		S	4	
Penstemon clutei	Sunset Crater Beardtongue	SC		S		SR
Phacelia serrata	Cinder Phacelia	SC				
Phacelia welshii	Welsh Phacelia	SC		S	4	

Wupakti National Monument

Scientific Name	Common Name	ESA	C H	USFS	NESL	NPL
Amsonia peeblesii *	Peebles Blue Star					
Errazurizia rotundata	Roundleaf Errazurizia				4	SR
Pediocactus simpsonii	Simpson Plains Cactus					SR
Perognathus amplus cineris	Wupatki Arizona Pocket Mouse	SC		S		
Phacelia welshii	Welsh Phacelia	SC		S	4	
Psorothamnus thompsonae +	Thompson Indigo Bush					
Phacelia serrata	Cinder Phacelia	SC				
Pediocactus peebiesianus var. fickeiseniae	Fickeisen Plains Cactus	C				
Puccinellia parishii	Alkali Grass	PE				
Cymopterus megacephalus	Cameron Water-Parsley	SC				
Astragalus lentiginosus var. ambiguus	Milk Vetch	SC				
Camissonia specuicola hesperia	Evening Primrose	SC				
Euderma maculatum	Spotted Bat	SC		S	4	
Buteo regalis	Ferruginous Hawk	SC		S	3	

+ S2: Rare: 6 to 20 occurrences in the State or few individuals or acres within the state.

* S3: Uncommon or Restricted: 21 to 50 occurrences in the State, either rather rare throughout a fairly wide range, or fairly common in a rather restricted range within the State.

10. Air Resources

Provisions of the National Park Service Organic Act of 1916, laws establishing individual parks, the Wilderness Act of 1964, the National Environmental Policy Act of 1969, and the Endangered Species Act of 1973 had already established National Park Service responsibility for management of air resources. The 1977 amendments to the Clean Air Act made this management part of a national effort, affecting activities inside as well as outside park boundaries. All three monuments have been designated as Class II areas and the Arizona Department of Environmental Quality is the designated regulatory agency.

Visibility was monitored at Wupatki National Monument from 1978 to 1982. A teleradiometer was employed sighting five different targets three times a day. From 1981 through 1982, Wupatki was one of nine parks selected to participate in a particulate matter air monitoring program. A combination of sampling, chemical analysis and data evaluation was used to determine the distribution and composition of atmospheric particles. Air quality monitoring should be continued at Wupatki and implemented at Sunset Crater Volcano and Walnut Canyon.

11. Aesthetic Resources

NPS Management Policies (NPS 1988: Chapter 1:3) states that "parks contain various tangible natural and cultural features . . . [and] also have intangible qualities, such as natural quiet, solitude, scenery, a sense of history, sounds of nature, and clear night skies, that are important components of the overall park experience and have received congressional recognition."

Ambient Noise Levels

Ambient noise levels in Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments have not been measured. Presumably, ambient noise levels have increased dramatically since these monuments were established. Walnut Canyon's proximity to Interstate 40 has added a continual highway noise that can be heard from any location within the monument at any time of day. Aircraft overflights at various altitudes are also common.

Wupatki's solitude and significant cultural landscape are frequently interrupted by highway noise from Highway 89, Forest Service (FS) 545 and a gravel road connecting FS 545 with the Navajo Reservation. Most aircraft noise comes from relatively high altitude flights with only occasional low elevation aircraft overflights. Nonetheless, aircraft noise is a regular disruption to the solitude here.

Sunset Crater Volcano National Monument ambient noise levels are relatively high. The natural quiet of this area is continuously interrupted by road noise from Highway 89 and FS 545. The monument's solitude is interrupted by aircraft overflights like the other areas. In addition to these interruptions, the off-road vehicle area on the monument's south and east boundaries provides a major disruption of natural quiet. On a haul road adjacent to Sunset's western boundary, an almost continual line of large trucks involved with various mining activities generate a great deal of noise.

Land Use Issues and Disruption of Scenic Views

Areas north and west of Wupatki have been identified for possible inclusion in the Navajo/Hopi Land Issue Settlement. Ownership of land could change, land uses could change, populations could change, and the results could pose negative threats to park resources and visitor experiences.

City of Flagstaff development continues to spread toward Walnut Canyon National Monument. Arizona State Trust sections are one mile from the monument boundary and are available for sale and development. Several home/residential area developers are interested in acquiring these properties. The NPS needs to work with the State of Arizona to negotiate easement and/or development restrictions that will insure compatible development. Like Walnut Canyon National Monument, Sunset Crater Volcano National Monument is also threatened by the encroachment of the City of Flagstaff.

A cinder quarry operation located outside Sunset Crater Volcano National Monument, northwest of the visitor center, threatens the viewshed. The haul road for this operation crosses the main park road (Forest Service road 545) near U.S. 89. A pumice mining operation, located on Forest Service property, at the base of the San Francisco Peaks also impacts the viewshed of the monument.

The National Forest adjacent to Sunset Crater Volcano, along the east boundary, is a major Off Road Vehicle (ORV) recreational use area. Visitors to the monument rarely recognize the boundary and are confused by access restrictions within the area of the volcanic cinder cone and destructive recreational use permitted on others all around it. Joint planning between the two agencies is needed and should help alleviate this problem by moving ORV activities (including NPS) to areas beyond the immediate view shed of the monument.

12. Water and Riparian Resources

Wupatki and Sunset Crater Volcano National Monuments

Wupatki and Sunset Crater Volcano National Monuments are located in an area drained by the Little Colorado River and its tributaries. Prominent tributaries west of the river are Kana'a, Deadman, Cedar, and San Francisco Washes. All streams are intermittent or ephemeral. Flow generally occurs only after heavy summer rainstorms or due to snowmelt in the highlands. In places, channels of the tributaries are clogged with dunes and small alluvial fans. Little precipitation and rapid infiltration of surface waters accounts for the lack of surface water. Precipitation that falls as snow or rain is usually evaporated or absorbed.

The principal water producing unit in the area of Sunset Crater Volcano and Wupatki National Monuments is the Coconino aquifer. The aquifer consists of three hydraulically connected stratigraphic units of Permian age. The units include the Schnebly Hill Formation, the Coconino Sandstone and Kaibab Formations. Minor perched aquifers occur above the Coconino aquifer in the Moenkopi Formation, the Shinarump Member of the Chinle Formation, basin fill and in the alluvium and volcanics along the course of the Little Colorado River.

Water enters the Coconino aquifer from the west, south and east. Groundwater descending from the west and south is deflected towards the northwest and follows the general direction of the Little Colorado River. Flow of groundwater in the aquifer into the Black Mesa basin in accordance with the dip of the aquifer rocks is inhibited by the combination of low aquifer permeability and a large concentration of highly saline water, which is more resistant to movement than fresh water. Low aquifer permeability is due to the great depth of burial which decreases effective porosity. Grabens and faults influence the direction and quantity of water flowing in the aquifer, particularly in the area of Wupatki National Monument.

Hydraulic conductivity of the Coconino aquifer varies. Where the aquifer is fractured and faulted, a significant increase in hydraulic activity results. The average stratigraphic thickness of the aquifer is 1,700 feet. Saturated thickness ranges from 500 to 1,600 feet. The aquifer supplies water to wells of Wupatki and Sunset Crater Volcano National Monuments.

Structural features such as the Black Point segment of the East Kaibab monocline and the general northeastward trend of the Coconino aquifer influences the saturated thickness and occurrence of water in the aquifer. Primary areas of recharge for the aquifer occurs in the highlands of the San Francisco Plateau, Mogollon Plateau and Mogollon Rim. Precipitation falling at lower elevations of the Little Colorado River is relatively unimportant for recharge since most precipitation falls during the heat of the summer and early fall.

Natural discharge for the aquifer occurs near the mouth of the Little Colorado River. The area is heavily fractured and faulted. Groundwater percolates downward leaving the aquifer dry. Several springs emit water from the Muav Limestone. The discharge also includes groundwater from several aquifers in the Black Mesa area.

Approximately 40 wells withdraw from the Coconino aquifer over discontinuous periods. The heaviest user of the groundwater in the aquifer is the City of Flagstaff. The well fields which are located southwest and southeast of the City withdraw water from the recharge area of the aquifer.

Five wells have been drilled by the National Park Service at Wupatki and Sunset Crater Volcano for the exploitation of groundwater. Two of the wells are currently in use. The wells are identified as Sunset Crater Volcano well no. 1, Sunset Crater Volcano well no. 2, Sunset Crater Volcano exploration well, Wupatki Ruin well and Citadel well. The wells all demonstrate the non-flowing artesian nature of the Coconino aquifer from which they withdraw water. Each of the wells partially penetrates the aquifer.

In 1973, the Sunset Crater Volcano exploration well was drilled to search for a shallow water source near Sunset Crater Volcano in Bonito Park. The hole was drilled to a depth of 604 feet; no water was encountered.

Sunset Crater Volcano well no. 1 was completed in 1965 to supply water for park facilities at the monument. The well is located at the eastern end of Bonito Park. The well was utilized from 1965

to 1978. Fine particles of volcanic rock caused pump breakdowns. The well was replaced by Sunset Crater Volcano well no. 2. The second well is located 25 feet away from well no. 1.

Sunset Crater Volcano well no. 2 has a total depth of 2,210 feet, and was completed in 1979. To avoid the problem of fine volcanics entering the hole near the surface, 720 feet of 12 3/4 inch steel diameter casing were placed in the hole. The casing rests in the Kaibab Formation.

Static water level at the Sunset Crater Volcano National Monument well is 1,960 feet below surface level and is derived from the Schnebly Hill Formation. Artesian conditions exist. The aquifer is possibly fractured due to the proximity to the volcanic and structural activity that produced the nearby volcanic features. Sunset Crater Volcano's well penetrates 680 feet of sediments and volcanics overlying the Kaibab Formation.

Groundwater occurs at the eastern boundary of Wupatki National Monument along the course of the Little Colorado River. At present, groundwater is not exploited. Water quality in these units, however, is poor to very poor. Five geologic units occurring along the river affect porosity and groundwater accumulation. The five geologic units are alluvium, basalt, gravel terraces, Chinle Formation and Moenkopi Formation.

The fracturing of partially solidified lava in the last stages of movement, shrinkage cracking and rubble at the base of the lava accounts for most of the effective porosity of a basalt flow. Large quantities of water could be exploited from beneath and at the base of the flow.

The Moenkopi Formation acts as an aquitard, deterring the movement of water downwards out of the alluvium and basalt. Water infiltrates through the river channel into the volcanics and alluvium. Surface water flowing down the washes disappears into the alluvium. Discharge occurs through the migration of water downstream in the alluvium and volcanics, through leakage into the Moenkopi Formation and through evapotranspiration.

Flow in the Little Colorado River, which is the primary source of recharge for the alluvial and volcanic aquifer along the river, fluctuates greatly. Heaviest flows occur in winter due to snowmelts or heavy rainfall in the summer. The river bed is often dry, but does contain some small ponds that cattle utilize as a water source.

Wupatki's Citadel Ruin well derives water from the Schnebly Hill Formation. Static water level for this well is 1,593 feet below surface level. Artesian conditions exist. A second well, the Wupatki Ruin well, produces water from the Coconino Sandstone Formation. The aquifer is artesian and static water level occurs 781 feet below surface level.

Three springs occur on Wupatki National Monument: Heiser, Wupatki and Peshlaki Springs. Coyote Spring is located just off the southern boundary of the monument. Heiser and Wupatki Springs previously served as the water source for park operations at Wupatki. Heiser Spring has

supplied water for a Navajo household on the monument. An attempt to increase the flow of Wupatki Spring disrupted the fragile environment of the spring to the extent that it no longer flows.

All of the springs in Wupatki National Monument issue from the Moenkopi Formation located below the lower massive sandstone of the Wupatki Member in a zone of inter-alated thin-bedded silty sandstones and sandy siltstones. The aquifer is perched, and groundwater movement occurs in joints, bedding planes and fractures.

Discharge fluctuates greatly in the springs. Flow is highest in spring and winter, and lowest in fall and summer. Peshlaki Spring yields small quantities of water, generally less than a few gallons per hour. Highest flows were recorded for Heiser and Wupatki Springs.

No direct relationship exists between annual precipitation and spring discharge. Heavier rains of late summer do not increase discharge rates because of high evaporation rates and low intensity storms. A correlation does exist between the discharge rates of springs and snowfall on the ground. The recharge area for Wupatki's springs is local and limited. The surface of the recharge area is covered with basalt flows. Recharge waters percolate through the volcanics of the Moenkopi Formation. The water is conducted along the lower massive sandstone of the Wupatki Member.

The gypsiferous Moqui Member significantly influences the chemistry of the waters of the springs. Each spring has a different water chemistry, suggesting different paths and duration of migration of the waters emitted. Water quality ranges from excellent to fair. The volcanic and alluvial aquifer along the course of the Little Colorado River is located on Moenkopi mudstones and gypsiferous beds, and may produce large quantities of poor to very poor quality water.

Walnut Canyon National Monument

Walnut Creek water flows through the canyon were first impounded in 1885, when the Santa Fe Railway constructed a dam for water supply at what is now the downstream end of the monument. However, the "Santa Fe Dam" stored much less water in Walnut Canyon than the railroad anticipated. It was no longer used as a water source after 1904, and was breached in the 1930s by downstream cattle ranchers. In 1904-1905, the Arizona Lumber and Timber Company built a dam upstream of the present monument to impound water for the Flagstaff area (Lake Mary). Sedimentation in the reservoir led the City of Flagstaff to construct a second water supply reservoir (Upper Lake Mary) further upstream in 1940-1941. The Upper Lake Mary Dam was doubled in height in 1951, and the lake now supplies about 75% of Flagstaff's water supply.

No streamflow records exist for Walnut Creek prior to construction of the water supply dams. It is assumed, based upon the characteristics of comparable undammed basins in the area, that pre-dam flow was intermittent. While melting snow probably maintained constant streamflow in spring, summer flow most likely occurred as relatively short-term responses to periodic rainstorms. Still, reports by early travelers indicate that water remained in pools along the stream course even in dry periods. Subsequent construction of upstream dams has limited flow in Walnut Creek to dam

releases in wet years, surface runoff from local precipitation and seepage from the geologic formations comprising the canyon walls.

Methods have been developed for estimating streamflow in ungaged basins of southern Coconino County. Two of these appear to cover most or all of Walnut Canyon: multiple regression equations for use in estimating peak flows for recurrence intervals of 2, 5, 10, 25, 50, 100 and 500 years, and a regression equation to estimate 1-day, 3-day, 7-day and annual mean flow volumes. The U.S. Geological Survey (USGS) has limited streamflow data (1967-1970) from a gaging station just upstream of Upper Lake Mary. These methods and data may prove useful in developing flow restoration requirements for Walnut Creek.

Surface water quality in the monument is protected through state water quality standards. Such standards consist of designated "uses" to be protected for each stream segment or other water body, water quality "criteria" designed to protect those uses, and an anti-degradation provision. At present, water quality criteria applied to Walnut Creek are designed to protect domestic, agricultural irrigation/livestock, full body contact, and aquatic organism/wildlife uses. Some degradation of Walnut Creek waters could occur as long as these uses are fully protected. Additional protection could be achieved through state designation of Walnut Creek as a "unique water of exceptional recreational or ecological significance" or as a water which constitutes an "outstanding public resource". Under this designation, no further water quality degradation is allowed. As part of its natural resources management program, Walnut Canyon National Monument will work with the Office of Water Quality, Arizona Department of Environmental Quality, to determine the potential for such "unique waters" designation for Walnut Creek. Negotiations with the City of Flagstaff concerning water rights issues for Walnut Creek are continuing (see page 50).

At present there is no water quantity or quality monitoring in Walnut Creek. Such information is needed for a variety of reasons, including inventory and status of water resources, baseline information for evaluating future impacts of external actions or flow restoration efforts, compliance with state water quality standards, and evidence to support designation as a "unique water" of the state.

Walnut Canyon Groundwater Resources

Walnut Canyon National Monument taps the underlying Coconino aquifer for its consumptive water needs. The water table in the aquifer slopes from southwest to northeast, and is approximately 1500 feet below the land surface in the vicinity of the monument. Aquifer recharge occurs primarily in the areas of high precipitation, which generally are at altitudes about 7000 feet along the Mogollon Rim to the south. Data available from the USGS, Flagstaff Sub-district, indicates that over the long-term, the aquifer water level tracks closely with area precipitation. Although local drawdowns occur at area well fields during summer (peak withdrawals, low recharge), the data do not appear to indicate that the withdrawals, including those by the City of Flagstaff at its well field near Lower Lake Mary, are having any long-term, significant effects on water levels at this time (personal communication, Donald Bills, USGS Flagstaff Sub-district). The monument's water supply well, located near the visitor center is 2007 feet deep and produces at least 25 gallons per minute. No data

are presently available to determine if the periodic drawdowns at the Lake Mary well field affect the monument's well.

Water quality at the time of well installation was good, with dissolved solids measured at 214 mg/l and pH = 8.0. No water quality problems are known to occur in the portion of the aquifer from which the monument withdraws water, and upgradient land use status (Coconino National Forest) and the direction of flow in the aquifer make contamination of monument water supplies unlikely in the foreseeable future.

Hydro-geologic information available from the USGS indicates that seeps in the canyon walls probably derive from locally-recharged, minor groundwater systems (personal communication, Donald Bills, USGS, Flagstaff Sub-district Office). It is possible, however, that flow in these seeps may be enhanced by the presence of the upstream reservoirs. Water quality in these localized flow systems is probably not affected significantly by regional development and, therefore, is not considered a resource issue at this time. Nevertheless, the monument would benefit from a survey of existing seeps (location, hydrologic characteristics, water quality and biological resources associated with them) as part of its water resources information base.

Walnut Canyon Floodplain Management

The National Park Service Floodplain Management and Wetlands Protection Guidelines require the NPS to avoid, to the extent practicable, the adverse impacts associated with the occupancy or modification of floodplains. Cultural resources located in floodplains must be managed to assure their on-site preservation, and, where applicable as outlined in the Guidelines, harm to human life must be prevented by clearly marking the floodplain boundaries, providing flood warning systems, and so on. At present, there does not appear to be justification to conduct a full floodplain assessment in Walnut Canyon. That the cliff-dwellings appear to have avoided flood damage in the past is indication that they are outside the 100-year floodplain, and the "critical actions" in the park (as defined in the Guidelines) are confined to the canyon rim, well away from flood danger.

One flood-related issue that bears watching, however, is the potential for floods associated with breaks in the upstream dam system. In a recent state-wide survey by the Arizona Department of Water Resources, problems with slope stability in the Upper Lake Mary Dam and unexplained seepage losses from the reservoir were identified. While the agency refers to these problems as relatively minor and not posing safety issues at this time (personal communication, Bill Jenkins, Arizona Department of Water Resources, Safety of Dams Division), identification of the causes of these structural problems and proposals for their resolution have not been completed. The monument should keep abreast of this issue and participate in any planning decisions affecting dam safety. Should a dam safety problem be verified, Walnut Canyon would be classified as a "high hazard area" under the NPS Guidelines and, thus, would be subject to additional regulations requiring delineation of the hazardous area.

Walnut Canyon Wetlands Management

The NPS Floodplain Management and Wetlands Protection Guidelines require the NPS to avoid actions with the potential for adversely impacting wetlands unless there is no practicable alternative. In addition, the Guidelines establish requirements for NPS management plans to inventory wetlands, to develop restoration plans for impacted wetlands, and to specify monitoring requirements needed to protect wetlands or assess the success of restoration efforts. The U.S. Fish and Wildlife Service's National Wetland Inventory maps have been completed for the monument and will be obtained as a "base inventory" for wetlands. Project Statements included in this plan address needs for more fine-tuned inventories and assessments of wet/land riparian areas and for establishment of monitoring programs to protect monument water resources, including wetlands. The NPS Water Resources Division is addressing wetland restoration by claiming, in the on-going Little Colorado River adjudication, the reserved water rights necessary to fulfill the purposes for which the monument was established.

Water rights claims have been submitted for Walnut Canyon National Monument. Claims on the Walnut Canyon drainage have been submitted by the National Park Service, the City of Flagstaff, and Warren Smith (inholder at Walnut Canyon National Monument). The Water Rights Office (Fort Collins, Colorado) is working with the Solicitor's Office (Attorney Bill Swan) regarding negotiations with the City.

Walnut Canyon Water Rights

The United States, National Park Service, presently holds Federal reserved water rights in Walnut Canyon National Monument. With future acquisitions, the monument may also acquire State appropriative water rights. State water rights in Arizona are based on the Doctrine of Prior Appropriation. Under this Doctrine, the party who first utilizes water for a beneficial use has a prior right to use against all other appropriators (i.e. "first in time, first in right"). The water must be put to beneficial use as defined by the State. In Arizona, beneficial uses include irrigation, domestic, stock watering, municipal, commercial, industrial, mining, recreation, fish and wildlife, and other uses. An appropriative water right is a property right; under State law it can be bought, sold, and its place of use, purpose, and point of diversion may be changed without loss of priority provided there is no injury to the water rights of others.

Federal reserved water rights arise from the purpose for the reservation of land by the Federal Government. When Federal Government reserves land for a particular purpose it also reserves by implication, enough water unappropriated at the time of the reservation as is necessary to accomplish the purposes for which Congress or the President authorized the land to be reserved, without regard to the limitations of State law. The rights vest as of the date of the reservation whether or not the water is actually put to use, and are superior to the rights of those who commence the use of water after the reservation date. General basin-wide adjudications are the means by which the Federal Government claims its reserved water rights. The McCarran Amendment (66 Stat. 560, 43 U.S.C. 666, June 10, 1952) provides the mechanism by which the United States, when properly joined, consents to be a defendant in an adjudication.

Once adjudicated by the State, the water rights of the United States, reserved and appropriated, fit into the State priority system along with those of all other appropriators. In general, when it is brought into a general adjudication, the United States is given its only opportunity to assert its claim to water rights. Unless legally absent from the proceedings, it is generally understood that failure to assert a claim to water rights in such a proceeding may result in forfeiture of these rights.

In 1985, in a general water rights adjudication of the Little Colorado River (which also includes Wupatki and Sunset Crater Volcano water rights), the United States Department of Justice, on behalf of the National Park Service, submitted a claim for Federal reserved water rights for instream flows and consumptive and non-consumptive uses at Walnut Canyon National Monument. Federal reserved water rights were claimed for water necessary to fulfill reservation purposes. The Federal reserved water rights have not yet been quantified.

In addition to these claims, non-NPS (alien) claims for rights to water from sources within and near Walnut Canyon National Monument occur. The status and validity of these claims, as well as their potential impacts on management of the monument resources are unknown.

In recent development related to water rights, the City of Flagstaff and the Arizona Department of Water Resources have begun studying alternatives for resolving flooding problems in the adjacent Rio de Flag basin. The Rio de Flag originates in the San Francisco Peaks area north of Flagstaff, passes through the city, and eventually flows into the Little Colorado River. One proposal that has received considerable local media attention involves diverting a portion of the basin's flood flows into Walnut Canyon upstream of the monument. The diversion would occur at a point south of the city where the two streams are only about one mile apart. Despite the obvious potential for increasing flows in Walnut Creek, the park has strong reservations related to water quality (stormwater runoff from Flagstaff), volume and timing of flow (the basins differ in size and runoff characteristics), and impacts upon water resources related attributes. As appropriate, Walnut Canyon staff will participate in the planning effort and will keep the Water Resources Division's Water Rights Branch informed on this issue.

13. Paleontological Resources

Wupatki National Monument

Little is know of Wupatki's paleontological resources. Formations exposed range from the Permian Kaibab limestone to the Moenkopi shales and sandstones of the Triassic. Fossils such as brachiopods, molluscs and occasional teeth of sharks are likely to be found in the Permian Kaibab Formation.

Paleontological projectile points have been recovered within Wupatki and fossils of mammoth bones have been discovered near the Monument.

Walnut Canyon National Monument
Little too is known of Walnut Canyon's Paleontological resources. Formations exposed at Walnut Canyon National Monument range from Kaibab limestone to Coconino sandstone. Fossils likely to be found in the Kaibab Formation in Walnut Canyon include fresh water molluscs from the Kaibab Sea.

14. Quaternary Resources
Woodrat middens from Wupatki National Monument have been used to reconstruct and interpret climatic conditions, human impacts and associated vegetation differences of four prehistoric time periods: pre-Sunset Crater Volcano eruption (A.D. 850-1064), occupation (ca. A.D. 1100-1250), post occupation prior to livestock grazing (ca. A.D. 1250-1850), and historic (ca. 1850 to present). Cinnamon (1988) examined the pre-occupation environment and whether it differed from the present due to altered edifice conditions and climatic disturbances. He also examined effects on the plant community resulting from human occupation, associated farming and subsistence activities, and a century of domestic livestock grazing.

15. Related programs

a. Fire Management
Fire and the suppression of fire often significantly impact all ecosystems. Major plant communities have evolved with fire, resulting in many plant species which are fire-adapted or fire dependent. Fire is a major factor in controlling nutrient cycles and energy pathways, and is a major contributor to the maintenance of diversity, productivity and stability of ecosystems. Vegetation and wildlife communities evolved over millions of years in partial response to periodic lightning-caused fires and Native American manipulative burning. The role of fire has been notably changed in the past century by logging and effective fire suppression. In some vegetation types, regeneration will not occur until a stand alteration is reversed by prescribed burning or mechanical means.

Walnut Canyon National Monument
The combination of logging, mining, grazing and effective fire suppression in the twentieth century has altered the forest community on the rim of Walnut Canyon. Prior to 1900, fires occurred regularly within ponderosa pine forest (average fire frequency = 1 fire every 4-7 years). In the period from 1900 to 1985 only 6 were recorded. This clearly reflects the change in fire frequency resulting from a combination of settlement, suppression and grazing. Focused work on pinyon-juniper was inconclusive in regards to fire frequency. However, size class structure and the scarcity of senescent trees and decaying logs suggests that pinyon and juniper stands were much more open in the past and have only recently come to their current dense and closed state. Under more open canopies, understory vegetation would have been more abundant, perhaps allowing fires to carry through the area without greatly affecting the understory. Assuming the woodland was much more open when the Sinagua Indians occupied, the stands may have never been in a condition similar to today's. European settlement also impacted the woodland with grazing, wood getting and homesteading. The desert component of the pinyon-juniper woodland has not been studied, nor has the inner canyon fire history.

A Fire Management Plan has been completed for Walnut Canyon. Prescribed burning activities have been undertaken in the past few years. A report by Brown and Folb (1996) investigated the impact that the removal of vegetation and detritus by fire has on the discovery of cultural resources in the pine forest of Walnut Canyon.

Sunset Crater Volcano and Wupatki National Monuments
Fire management strategies at both Wupatki and Sunset Crater Volcano National Monuments are restricted to full suppression as directed by the current Fire Management Plan (1982).

Very little is known about fire histories of either of these monuments. A 1982 fire management plan calls for full suppression of natural fires. Given the importance of the cultural resources of Wupatki, full suppression activities will lead to damage or destruction of many prehistoric and historic sites. A recent wildland fire (1995) which spread rapidly and involved more than 900 acres in less than 4 hours, illustrates the kind of extreme fire behavior that can occur in the grassland-savannah areas of Wupatki. Brown and Folb (1996) investigated the impacts of fire on the removal of grassland vegetation from archeological sites within Wupatki.

Sunset Crater Volcano is experiencing increasing fuel loading with continued suppression activities. This monument contains primarily ponderosa pine vegetation type and expected natural fire frequencies have been affected by suppression, logging, mining and settlement activities. No cultural resource surveys have been completed at Sunset Crater Volcano and suppression activities may well be damaging unknown archeological sites.

It is imperative that a fire management plan be completed for these two monuments and that fire history studies be undertaken as soon as possible.

b. Geographical Information System (GIS)/Global Positioning Systems (GPS)
All three monuments will eventually be included under the Flagstaff Areas GIS. The Flagstaff Areas are beginning the process of assembling a functional GIS for use in the near future. This system will greatly facilitate the organization, integration, analysis, evaluation, and storage of data. Good data collection and management are needed to guide proper , long-term resource management for Sunset Crater Volcano, Wupatki, and Walnut Canyon National Monuments.

GIS is a tool for management and practical hands-on activities. Data entry will be project-oriented. GIS will allow management to integrate thematic data composites derived from natural and cultural resource information. GIS will be vital for recording new information, mapping existing conditions, detecting changes, analyzing trends, and projecting potential problems resulting from external pressures such as conflicting land use practices, demographic changes and pollution.

Some of the basic GIS themes include boundaries, developed areas, hydrology, utilities, elevation models, fire records, slope and aspect, vegetation communities, geology, soil types, plant pathologies, hazard trees, exotic species, wildlife, eroded areas, roads, trails, historical and archeological resources, threatened, endangered and sensitive species, precipitation and other

weather parameters, sensitive areas, demographic trends, fuel loads, fire caches, fuel breaks, medical incidents and traffic accidents.

D. Natural Resources Baseline Information

Natural resource baseline information for all three monuments is sorely lacking. The collection of baseline data is one of the highest priorities for the Natural Resource Program. Generally speaking, for both Wupatki and Sunset Crater Volcano National Monuments, natural resource information on many topics is limited to a single, general natural resource survey (Bateman 1976, 1979).

For a summary of the completeness (based on NPS-77) of natural resource baseline information for Wupatki, Sunset Crater Volcano and Walnut Canyon see Appendices A, B and C respectively.

1. Geology and Physiography

Wupatki National Monument

The geology of Wupatki National Monument has been documented. McCormack (1989) mapped the geology of the monument in detail 1 to 24,000 scale, by compiling previous work and extensive field mapping. McCormack's work produced a geologic base map for the monument. Christensen (1982) conducted an intensive examination of the hydrogeology of both Sunset Crater Volcano and Wupatki. Breed (1976) also describes the geology of Wupatki and Sunset Crater Volcano.

Sunset Crater Volcano National Monument

Specific studies at Sunset Crater Volcano have focused on the timing of the eruption of Sunset Crater Volcano (Smiley, 1958; Colton,1947). The aforementioned geology and hydrogeological studies completed by Breed (1976) and Christensen (1982), are the only baseline information available for this monument. Geologic mapping has not been completed.

Walnut Canyon National Monument

Walnut Canyon's geology has also been documented. A number of studies have focused on the geology of this unique resource. Darton (1910) studied the geology of Walnut Canyon area. Benfer (1971) completed a study which focused on the petrology of the Toroweap formation of the canyon. Vandiver (1936)completed a geologic report on Walnut Canyon for USGS. Geologic mapping has not been completed.

2. Soils

Soil information is lacking for all three monuments. No information has been generated concerning the soils of either Walnut Canyon or Sunset Crater Volcano. The soils of Wupatki National Monument were surveyed by Schurig (1971) working for the Soil Conservation Service. A soil map was produced from this survey.

3. Climate

Weather information has been collected at the Visitor Centers for all three monuments.

4. Vegetation

Wupatki National Monument
There is a paucity of information concerning vegetation of Wupatki. The only published report is again Bateman (1976). In this thesis the author classified vegetation into broad categories. Specific information on the distribution of species and in-depth community analyses have not been completed. Cinnamon (1988) studied vegetation change in Cedar Canyon at Wupatki. No information exists concerning the change vegetation following the removal of grazing in 1989.

Sunset Crater Volcano National Monument
Bateman's natural resource survey (1976) is the only existing work on vegetation at Sunset Crater Volcano.

Walnut Canyon National Monument
As with many of the natural resources, vegetation has been more completely studied at Walnut Canyon than the other two monuments.

A taxonomic and ecological examination of the vegetation at Walnut Canyon was completed by John Joyce (1974). A vegetation inventory by Philip Jenkins et al. (1991) also exists. Clark (1968) compared vegetation on archeological sites with that on non-site areas. Davis (1985) studied fire history of ponderosa pine and Despain and Mosley (1990) examined fire history and stand structure in pinyon-juniper woodland at this monument. Brian's (1985) work focused on riparian vegetation. There are also two informal papers that deal with vegetation specific to WACA. They are Les Arnberger's (1947) *Flowering Plants and Ferns* and Barbara Phillips' *Riparian Inventory of Walnut Canyon.*

5. Mammals

Wupatki National Monument
Bateman's (1976) survey recorded species present and population densities within each of the plant communities for all three areas. Bateman and Schwartz (1978) survey covers density topics for Wupatki and Sunset Crater Volcano. Steven Carothers and Nancy Goldberg's (1976) article covers the biology for both Wupatki and Sunset Crater Volcano National Monuments. A checklist of mammals found at Wupatki and Sunset Crater Volcano is by Vaughan (1976). A study specific to Wupatki is Fisher's (1986) report titled *Mircohabitat Selection by Small Mammals on the Basis of Temperature.*

Sunset Crater Volcano National Monument
Many of the reports that specify mammals at Sunset Crater Volcano are included in reports written for all three areas Bateman (1976) or part of a Wupatki-Sunset Crater Volcano survey Bateman and Schwartz (1978), Goldberg (1976) and Vaughan (1976). See Wupatki section above for more information. No exclusive studies involving the mammals of Sunset Crater Volcano have been undertaken.

Walnut Canyon National Monument
The only sources of information regarding Walnut Canyon's mammal species and populations is Bateman's (1976) survey which examined selected species present and population densities and Salomonson (n.d.) unpublished report on the mammals of Walnut Canyon.

6. Avifauna

Wupatki National Monument
Descriptions of the life zones of Wupatki and the 10 most common birds found are included in How's (1985) paper. Research was also done regarding Wupatki's avifauna occurrence and abundance by Bala (1976 &1984). A citation exists for Hargrave's (1935) *Birds of Wupatki* , which is on file at the Museum of Northern Arizona. Beatty's (1978) survey of Avian communities covers both Wupatki and Sunset Crater Volcano National Monuments. Balda and Beatty's (1976) checklist covers both monuments as well.

Sunset Crater Volcano National Monument
Beatty's (1978) survey and analysis of avian communities found in Sunset Crater Volcano and Wupatki. The research focuses on birds found within each plant communities and comparisons of their populations to other communities. Balda and Beatty's (1976) checklist of Birds is drawn from available published literature and covers both Wupatki and Sunset Crater Volcano National Monuments.

Walnut Canyon National Monument
Hadleman's (1969) article focuses on the relationship of plant and avian communities. Spangle (1954) describes each of the birds found in Walnut Canyon including clear drawings of each. Salmonson's (n.d.) also covers the plant-avian relationship resulting from the nest investigation of the Black-chinned Sparrow.

7. Herptofauna

Wupatki National Monument
Bateman's (1976) report includes a list of all the herptofauna for both Wupatki and Sunset Crater Volcano National Monument. There also exists herptofauna information in the 1980 Natural Resource Survey and Analysis of Wupatki and Sunset Crater Volcano National Monuments. Fowlie's (1965) book *Snakes of Arizona* has pages that are pertinent of Wupatki. Bergeson (n.d.) produced a checklist of reptiles.

Sunset Crater Volcano National Monument
There is no information that is exclusive to Sunset Crater Volcano National Monument. There is however Bateman's (1976) report and the 1980 Natural Resource Survey and Analysis that covers Sunset Crater Volcano National Monument in its survey.

Walnut Canyon National Monument
Damron's (n.d.) checklist of reptiles at Walnut Canyon is an informal source. The 1976 and 1982 Addendum to the Natural and Cultural Management Plan and Environmental Assessment seems to be the only comprehensive source to date regarding herptofauna at Walnut Canyon National Monument.

8. Exotic Plants

Wupatki and Sunset Crater Volcano National Monuments
The only survey of the presence and location of some exotic plant species for Sunset Crater Volcano and Wupatki are included in Bateman's report (1976). Yacoub (1988)produced a report on camelthorn and prescribed a removal program for Wupatki.

Walnut Canyon National Monument
The presence and extent of exotic plant species has not been investigated for Walnut Canyon.

9. Threatened, Endangered and other Special Category Species

Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments
No formal surveys for threatened or endangered species, or other special category species have been undertaken. Bateman (1976) included federally listed species in his report, but this information is dated and no longer accurate.

10. Air Resources

Visibility was monitored at Wupatki National Monument from 1978 to 1982. Particulate matter air monitoring occurred at Wupatki from 1981 to 1982. No air quality monitoring has been undertaken at either Walnut Canyon or Sunset Crater Volcano.

11. Aesthetic Resources

Baseline data on ambient noise levels have not been collected at any of the three monuments. Viewshed analyses have not been undertaken, but should be included in future GIS project funding. Visitor use surveys, including the expectations visitors have about viewsheds, natural quiet, solitude and other aesthetic factors need to be undertaken.

12. Water and Riparian Resources

Wupatki and Sunset Crater Volcano National Monuments
The hydrogeology of Sunset Crater Volcano and Wupatki National Monuments has been studied in-depth by Christensen (1982). This work included an investigation of the various springs and wells at each monument. Other work is lacking and riparian investigation is non-existent.

Walnut Canyon National Monument
Brian (1985) traced the history of Walnut Creek flow and riparian vegetation in the vicinity of Walnut Canyon National Monument. Mc Gavock et al (1986) have studied the characteristics of comparable undammed basins in southern Coconino County. The monument's water supply well, located near the visitor center produces at least 25 gpm (Mc Gavock and Mann 1974) this same study examined the water quality at the time of well installation.

13. Paleontological Resources

Wupatki, Sunset Crater Volcano and Walnut Canyon National Monument
Very few studies have focused on paleontological resources of any of the three monuments. Chronic (1952) completed an investigation of the molluscan fauna from the Permian Kaibab formation at Walnut Canyon.

14. Quaternary Resources

Cinnamon's (1988) research focusing on climatic conditions, human impacts and associated vegetation differences of four prehistoric time periods focused on the Cedar Canyon area of Wupatki National Monument. Work covering other areas of this monument or any areas in both Sunset Crater Volcano National Monument and Walnut Canyon has not been completed.

15. Related Programs

a. Fire Management

Walnut Canyon National Monument
A Fire Management Plan has been completed for Walnut Canyon (1991). The plan provides the use of management-ignited prescribed fire to be used as tools to mimic natural fire regimes and reduce hazard fuel accumulations. The plan outlines the various fire management units(FMUs) within the Monument and calls for the suppression of all wildfires. This plan was based largely upon fire history research completed by Davis (1985) for ponderosa pine type, and Despain (1990) for pinyon-juniper type. The fire management plan has been implemented with a number of management-ignited prescribed burns being conducted in the past few seasons.

Wupatki and Sunset Crater Volcano National Monuments
An existing fire management plan for these two monuments was completed in 1982 and fire management activities are still limited by this inadequate document. The use of prescribed fire is not included and fire management activities will continue to be limited to full suppression until such time that a new plan and appropriate environmental compliance documentation are completed.

b. Geographic Information Systems (GIS) and Global Positioning Systems (GPS)
Some digital base cartographic information is currently available for the three monuments. Digital elevation models for the 7.5 minute quadrangles covering Sunset Crater Volcano and Walnut Canyon National Monuments are currently available, but all quadrangles are not available for Wupatki.

The Flagstaff Areas currently has ArcView v. 3.01 installed on a Pentium-based (166 mhz) computer. Additionally, the areas have IDRISI for Windows installed on the same computer. However, new hardware will be necessary to properly run this program. Short term efforts will be focused upon obtaining base cartographic data for each of the three monuments.

The Flagstaff Areas has recently purchased a Trimble GeoExplorer GPS unit and is also utilizing equipment from the Colorado Plateau Research Station at Northern Arizona University.

III. RESOURCE MANAGEMENT PROGRAMS

A. Overview of Major Programs

There are fourteen major resources management programs for the Flagstaff Area National Monuments which are briefly described below.

- *Program Administration and Management*

  Administering and managing natural and cultural resources has become more complex due to the amount of information needed about resources to understand, protect, and preserve them. Service wide resources programs have increased and compel superintendents to improve management and administration. A comprehensive program is needed to address the entire magnitude of cultural and natural resources issues facing the Flagstaff Area National Monuments. One program statement in this major program category states that basic resources administration and management is extremely difficult and inadequate due to lack of staff and support. Not changing the current situation will let resources continue to deteriorate and fail to comply with NPS mission and policies. The plan proposes to hire additional resources management staff including an archeological technician, a museum technician, and a natural resource technician.

- *National Historic Preservation Act (NHPA) and National Environmental Policy Act (NEPA) Compliance*

  In compliance with Section 106 of the National Historic Preservation Act, when undertakings are planned, the areas are inventoried for cultural resources and the appropriate reports and documentation are submitted to the State Historic Preservation Office, the Advisory Council on Historic Preservation, and the public for their comments and concurrence. Additional compliance inventories and report writing, such as environmental assessments and environmental impact statements, are performed in compliance with NEPA.

  To be in full compliance with NHPA, NEPA, and other Federal mandates, a complete, intensive inventory for Sunset Crater Volcano needs to be performed so the Flagstaff Areas can fulfill its legal mandates to evaluate and monitor cultural resources for the National Register of Historic Places. Nomination of sites and districts to the register is a form of indirect protection since the State Historic Preservation and the Advisory Council on Historic Preservation and the public must be allowed to comment on any action which would impair a National Register eligible property. Standard Operating Procedures for compliance have been developed and implemented for the Flagstaff Area National Monuments.

- *Resources Protection*

  Humans have lived in and around the areas that today comprise the Flagstaff Area National Monuments for hundreds of years and their influences have varied from seemingly untouched to harsh impacts. Some resources have been permanently destroyed. Adjacent land uses included ranching, mining, camping, hiking, hunting, and off road driving. Vandalism does occur in the parks. Visitation has increased over the past decade. There are management questions about the threshold of human impacts and profile of visitor use patterns. Generation of social trials and erosion caused by visitors leaving the trails, as well as, inadequate fencing, are also concerns for cultural and natural resources. This plan identifies programs to examine adjacent land uses, determine human impacts and use thresholds, conduct visitor use surveys, and improve boundary protection.

- *Information Management*

  Research, projects, planning, documents, and activities within the monuments and on adjacent lands manufacture information which should be routinely collected. It should be stored and handled with methods that are accessible and functional. The ability to manipulate data makes it more valuable and applicable to all aspects of daily operations. Partial bibliographies have been done, but an extensive search for additional literature, reports, and other documents is needed to complete that database. This plan proposes developing an on site GIS operation to identify existing and essential information. Material would be converted into a GIS database in order to create useable products for management awareness and decisions.

- *Archeology*

  An ethnographic overview and assessment including an ethnobotanical study will be conducted which will enhance management's ability to comply with the Native American Graves Protection and Repatriation Act and the National Historic Preservation Act. Work will be done to maintain stabilized prehistoric ruins. Complete oral history interviews will yield information about the lesser known activities during the past century and provide a continuum of human use. An archeological survey and inventory of Sunset Crater Volcano will be conducted. An inventory is needed to identify cultural resources within the Monument and provide information for management decisions.

- *Preservation*

  Prehistoric structures require regular monitoring and routine annual and cyclic preservation maintenance programs. These are necessary to prevent loss of historic fabric and structural failure principally caused by weathering as discussed in the program statements. The prehistoric structures are the primary resources and the purpose for the

creation of Walnut Canyon and Wupatki. Stabilization and preservation work has been done since the 1930s and has improved with better techniques and more skilled labor. Preservation has been done all these years without the essential documents. This plan calls for preparing historic structure preservation guides required by NPS guidelines and essential to prescribing long term maintenance activities.

- *Native American Consultation*

In compliance with the Native American Religious Freedom Act, the Native American Graves Protection and Repatriation Act, the National Historic Preservation Act, and NPS policies, NPS must consult with Native American traditional religious leaders to develop and implement policies and procedures that will aid in determining how to protect and preserve Native American cultural and spiritual traditions. NPS must also assure Indian tribes that undertakings and policies do not impact properties of traditional religious or cultural importance. Under NAGPRA, consultation about Native American human remains and associated grave goods is also mandated. Inventories of human remains and grave goods have already been completed, so compliance with NAGPRA is already in progress.

A major problem with beginning a program of consultation is that funds are unavailable to pay Native Americans for travel to the monuments. In addition, administrative staff find it difficult to pay for consultation services, given NPS procurement regulations. Changes are needed in procurement policy and funds need to be made available so consultation can be carried out.

- *Collections Management*

Existing collections of natural specimens and cultural artifacts are valuable data to interpret and understand resources. Proper conservation of museum objects preserves them for future uses and lessens the urge to collect live natural specimens for impending studies. A few years ago, NPS seriously began to improve collections management nationwide as a result of congressional attention to the state of NPS collections. It has become a heightened responsibility of parks to take care of collections and rectify past problems. This plan addresses several needs for this subject. Improve management by securing adequate staff and funding. Program for conservation and preservation treatment. Program for a Collection Storage Plan to be conducted by qualified professional. Update the scope of collection statements to guide preservation and future acquisitions. Expand and maintain the ANCS database. Comprehensive photographic documentation would be compiled from existing collections, and routine scientifically based pictures would be taken to record changes. Program for a new storage facility to be constructed. A new facility is needed to centralize Flagstaff Area collections and provide a secure and environmentally stable location for proper management and long-term preservation.

- *Vegetation Management*

  This plan has several projects for vegetation management. Principal among them are the statements for development and implementation of a vegetation management plan and an inventory and assessment of vegetation communities. Partial surveys have been conducted, but complete inventories are needed for comprehensive understanding and protection. Vegetation mapping needs to be completed or refined for all monuments. In some situations, vegetation will be manipulated to provide landscaping that represents the period of the prehistoric ruins, creates an aesthetic environment, provides a setting, and removes plants that may be harmful to the ruins. A statement identifies conducting an ethnographic overview and assessment including an ethnobotanical study.

- *Wildlife Management*

  The diversity of terrestrial habitats is notable for the three Flagstaff area monuments. Habitats range from desert scrub to ponderosa pine. Birds are commonly observed wildlife, and breeding densities in riparian habitats and snag-rich ponderosa pine areas are reported as being very high. Other fauna include the coyote, fox, bat, bobcat, mountain lion, elk, pronghorn, javelina, mule deer, ground squirrels, prairie dogs and other common rodents. Pronghorn utilize Wupatki's relatively pristine grasslands and interest in the grassland birds of this Monument is making it the focus of proposed research. Reptiles include many species of snakes and lizards. Aquatic invertebrates occupy the ephemeral pools of both Wupatki and Walnut Canyon. Endangered, threatened and sensitive species include the peregrine falcon, Mexican spotted owl, northern goshawk, spotted bat, and ferruginous hawk and monitoring of these species is needed.

- *Water Resources Management*

  Water is limited in this arid environment; a fact that elevates its value to humans, plants, and animals. Limited data has been kept regarding human consumption of water in developments, and no complete survey of water resources has been conducted. The plan calls for a survey of subsurface water resources and water-related resource attributes. Monitoring protocols will be designed to document trends in quantity and quality for groundwater. Water rights would be thoroughly evaluated so management would be better prepared to protect them from outside requests for use of park water.

- *Geologic Resources Management*

  Baseline information about soils and geology is essential to understanding ecological components inherent to terrain features. There are broad scale maps for soils and geology for the parks. The plan describes the need to continue the inventory and assessment of soils and geology to acquire in-depth, site-specific soils information for special purposes and to improve geological data.

- *Air Resources Management*

  Baseline information concerning the air quality of the Flagstaff Area National Monuments is currently limited to visibility information collected at Wupatki National Monument in the late 1980s. Baseline information on gaseous pollutants and particulates is needed for all three monuments. Air quality is subject to external factors, including the urban development of the Flagstaff, electrical generating facilities, mining activities and other regional influences. An active monitoring program is needed.

- *Fire Management*

  Although the Fire Management Program is administered by the Protection Division, Fire Management is nonetheless an important aspect of Resources Management. Fire affects both cultural and natural resources. Resource management will be cooperatively involved with the production of the Fire Management Plan to ensure that fire activities do not adversely impact cultural resources, to initiate research into fire histories, to assist in setting resource objectives for prescribed fires, and to monitor fire effects.

B. Summary of Major Programs

The following summary sheets provide a quick glance at the topics in each program. The problems and recommended actions described in detail in the program statements are briefly summarized here. Specific project statements are referred to and can be reviewed in the project statement section (Appendix E). Those problems/needs which have been identified, but do not yet have completed project statements, have no references to project numbers. These project statements will be developed as time permits, as will new projects that have not yet been identified.

A. PROGRAM ADMINISTRATION AND MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-I-001.001	**Develop, Manage, and Administer Cultural and Natural Resources Program**	ISSUE: Lack of Resources Staff and Fiscal Support PROBLEM: Basic management of cultural and natural resources is extremely difficult due to lack of staff. Continuing with present staff level may allow park resources to deteriorate and fails to comply with NPS mission and policies.	Acquire resources management staff to expand and operate program. Use the RMAP database to identify the type of positions to acquire and develop a long term program. The RMAP analysis will be consolidated when developing the resources management function since the Flagstaff Areas Monuments are jointly staffed and administered by one superintendency. Sub-project statements address natural (FLAG Areas-I-001.001) and cultural (FLAG Areas-I-001.002; will be prepared after RMAP-CR analysis completed) staff.
	Develop, Manage, and Administer Natural Resources Program	ISSUE: Lack of Resources Staff and Fiscal Support PROBLEM: There is a single, dedicated natural resources management position for the Flagstaff Areas. Much of the limited amount of work accomplished in natural resources is done by the ranger and maintenance staff in conjunction with other duties. Research and some management projects have been contracted, and they absolutely depend on whether money is available.	
	Develop, Manage, and Administer Cultural Resources Program	ISSUE: Lack of Resources Staff and Fiscal Support PROBLEM: The current staffing for the cultural resource program is limited to three positions, despite the fact that the most recent CR-MAP analysis indicated a need for 52 FTEs to fully carry out all phases of the program.	Acquire cultural resources management staff to expand and operate program.

B. RESOURCE PROTECTION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Design Monitoring Program and Train Staff in Monitoring Aircraft Overflights	ISSUE: Lack of Basic Resource Data PROBLEM: Aircraft frequently fly over the visitor use area, headquarters, and residential areas, posing a safety hazard and creating noise intrusions which detract from visiting and working in the monument. Future study is needed to identify the magnitude of the impacts on park resources, and to develop ways to mitigate.	A monitoring program to document occurrence, type, ownership, etc., of overflights and assess impacts to prehistoric structures, people, and wildlife will be developed. Documented occurrence of flights, visitor and employee complaints, legal ramification of FAA rulings, and implementation of new regulations will attempt to stop illegal overflights.
	Monitor Aircraft Overflights	ISSUE: Lack of Basic Resource Data PROBLEM: Aircraft frequently fly over the visitor use area, headquarters, and residential areas, posing a safety hazard and creating noise intrusions which detract from visiting and working in the monument. On-going monitoring is needed to identify the magnitude of the impacts on park resources, and to develop ways to mitigate.	Monitor effects on cultural and natural resources. Use wall monitoring systems to identify walls most likely to be negatively impacted by engine and rotor vibrations. Consult with historic architects and ruins stabilization archeologists to determine what mitigation is necessary to reinforce walls to desired stability. Monitor wildlife using the appropriate monitoring system resulting from project to design monitoring program. Document the occurrence of overflights.
	Evaluate and Define Fencing and Patrol Needs	ISSUE: Adjacent Land Use Visitor Use Impacts PROBLEM: The park's cultural and natural resources are more vulnerable to vandalism and other illegal uses due to increased development adjacent to the park. An assessment is needed to determine the types of fences, security systems, and/or management activities that would provide the most effective boundary protection.	A boundary protection program will be developed following an assessment of present security conditions. Suitable fences will be evaluated to combine effectiveness in prohibiting trespass, aesthetics, and protection of cultural and natural resources, including wildlife movement. Boundary patrols and other management activities will be examined.

B. RESOURCE PROTECTION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Construct/Upgrade Fencing	ISSUE: Adjacent Land Use Visitor Use Impacts PROBLEM: The park's cultural and natural resources are more vulnerable to vandalism and other illegal uses due to increased development adjacent to the park. Fences and security systems must be installed, and management activities must be implemented to provide the most effective boundary protection.	The effectiveness of boundary fences for protecting valuable cultural resources for which the monuments was created and the effects of fencing itself on archeological cultural landscape values will be determined in the previous project. Replace fencing as needed. NPS markers should be maintained.
	Increase Boundary Patrols and Monitor Effectiveness	ISSUE: Adjacent Land Use Visitor Use Impacts PROBLEM: The park's cultural and natural resources are more vulnerable to vandalism and other illegal uses due to increased development adjacent to the park. Management activities must be implemented to provide the most effective boundary protection.	Increase boundary patrols and monitor effectiveness of boundary fences.
FLAG-N-110.011	**Manage Pest Species and Conditions**	ISSUE: Pest Management PROBLEM: Unchecked insect, plant, and animal pest problems have the potential to escalate and may affect public health, cost of maintenance, and degrade cultural and natural resources.	Pest conditions will be managed with integrated pest management techniques. This involves preventative maintenance and regular, periodic monitoring of cultural and natural resources in the park. An Integrated Pest Management (IPM) Plan will be developed.
	Conduct Visitor Use Survey	ISSUE: Visitor Use Impacts PROBLEM: Knowledge of visitor characteristics including demographics, perceptions, expectations, satisfactions, and behavior, enhances the managers' abilities to provide the user public with high quality recreational experiences, and preserve and protect the values which attract visitors and for which the monument was established. A comprehensive visitor survey must be designed and implemented.	Regular visitor surveys will be conducted which will document changing visitation, travel, and use patterns for the park. This will enable management to monitor visitation trends and respond to changes in a timely manner.

B. RESOURCE PROTECTION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-20-006	**Improve Security Systems**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: The exhibit cases contain a number of monetarily and intrinsically valuable ethnographic and archaeologic objects. The park staff must implement modern equipment and strategies to be certain the artifacts are not vulnerable to theft or damage.	Install upgraded electronic security systems and implement other modern technology. This would offer the most effective protection for the artifacts.
	Analysis of Adjacent Land Use and Status	ISSUE: Adjacent Land Use PROBLEM: An analysis of adjacent land use is necessary to determine the degree of factors that influence management's ability to resolve potential resource utilization conflicts. Recent habitat conversions have already resulted in a loss of biological diversity and are impacting the adjacent riparian corridor. The historic and cultural scenes cannot be maintained adequately without the basic baseline information for assessing future changes in the area's hydrological regime and proximate land utilization factors.	A contract will be drawn to document and map existing land uses, evaluate historical patterns of land use, and identify external threats resulting from adjacent land use practices. Historical and present use patterns will be compared, and present utilization conflicts and resource concerns will be evaluated.
	Implement Long-Term Monitoring and Management Strategies to Protect from Potential Threats of Adjacent Land Uses	ISSUE: Adjacent Land Use PROBLEM: Basic baseline information assessing future changes in the area's proximate land utilization factors affecting the historic and cultural scenes will be obtained in the previous project . A long-term monitoring program must be implemented to alert management to changing conditions and allow for execution of management strategies to protect monument resources.	Implement research program to quantify and evaluate potential threats resulting from land use conflicts from previous project. Train monument staff to reevaluate external threats on a periodic basis. When necessary perform management actions to mitigate, or if possible eliminate, external threats stemming from external land uses.

B. RESOURCE PROTECTION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Establish Program for Long-Term Monitoring of Cultural Setting	ISSUE: Lack of Basic Resource Data Deterioration of Cultural and Natural Resources PROBLEM: This resources management plan calls for a wide variety of studies to delineate and quantify cultural and ecological values of the Flagstaff Area National Monuments. Studies recommend long-term monitoring protocols for each of the respective components. However, if these individual protocols are not integrated into a coherent and unified program for the monument the value of these studies will be greatly depreciated.	The results from inventory and assessment projects and cultural resources protection studies will be integrated into a carefully designed program for long-term monitoring of cultural resources. Such a monitoring program will put the monument in conformance with NPS policy and make it possible for staff to gather empirical data to ensure that ecosystems are functioning properly in the atmosphere of urban encroachment and industrial activities that surround the parks today.
FLAG-I-003.001 FLAG-I-001.001	**Determine Visitor Impacts and Use Limits and Develop Long-Term Monitoring Protocols**	ISSUE: Visitor Use Impacts PROBLEM: Visitor impacts on park resources must be clearly identified and assessed, along with a determination of the maximum number of visitors that can be accommodated per day under the current limits of park facilities and management.	Conduct a study of visitor impacts and use limits and develop long-term monitoring protocols. A combination study of visitor impacts on monument resources, both current and anticipated, and the determination of use limits for the monument, would provide staff with definitive tools with which to more effectively manage the heavy visitation they are experiencing.
FLAG-I-001.003 FLAG-I-001.001	**Implement Long-Term Monitoring of Visitor Impacts and Use Limits**	ISSUE: Visitor Use Impacts PROBLEM: Visitor impacts on monument resources must be clearly identified and assessed, along with a determination of the maximum number of visitors that can be accommodated per day under the current limits of monument facilities and management.	Staff will be trained to implement long-term monitoring program that will be established in the previous project. Threats of increased visitation on visitor safety, logistics, impacts on facilities, and natural and cultural resources will be analyzed. Data will be collected to determine maximum visitation levels allowable before damage occurs to cultural and natural resources or to the visitor experience.

B. RESOURCE PROTECTION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-N-100.001	**Produce Reclamation Plan for Borrow Pits**	ISSUE: Impacts From Previous Land Uses PROBLEM: Abandoned borrow pits exist and detract from the natural and cultural landscape of Wupatki.	Areas of former borrow pits will be identified and a strategy will be developed to reclaim these areas. All reclamation efforts will be subject to historical resource compliance prior to action being taken.
FLAG-N-100.002	**Perform Reclamation of Borrow Pits**	ISSUE: Impacts From Previous Land Uses PROBLEM: Abandoned borrow pits exist and detract from the natural and cultural landscape of Wupatki.	Action to reclaim borrow pits will be taken following the plan developed in the above project statement.

C. INFORMATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-010.011	**Conduct Ethnographic Overview and Assessment Including Ethnobotanical Study**	ISSUE: Lack of Basic Resource Data PROBLEM: The parks do not have an ethnographic overview and assessment, which is a basic cultural resources document necessary to identify and establish traditional uses by Native American groups. Documenting prehistoric, historic, and current Native American use is essential to manage, interpret, and restore relationships with appropriate tribes.	An ethnographic overview and assessment, including an ethnobotanical study will be conducted for each park. This will allow management to comply with the Native American Graves Protection and Repatriation Act and the National Historic Preservation Act.
	Conduct Literature Search, Compile & Annotate Reference List in Computerized Bibliographic Information Retrieval System	ISSUE: Lack of Basic Resource Data PROBLEM: Currently, the parks do not have the ability to efficiently track the 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 resource or respond to developing resource issues.	A computerized bibliographic system will be developed and an annotated bibliography produced. Adequate and effective access to informational resources can prevent duplication of effort and costly mistakes, and will increase management's ability to respond effectively to cultural and natural resource issues.

C. INFORMATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Update Bibliographic Information Retrieval System	ISSUE: Lack of Basic Resource Data PROBLEM: Researchers and other professionals routinely depend upon and utilize the parks' information base as the first step in addressing management concerns. Annually updating the computerized bibliographic information retrieval system will place the parks in a better position to assess past actions, evaluate current programs, and identify potential resource management problems.	Update bibliographic database annually. Management will have the ability to respond effectively to cultural and natural resource issues using the most current data.
	Prepare a Geographic Information Plan	ISSUE: Lack of Basic Resource Data Lack of Information Management System PROBLEM: The park's resources are in a continual state of change which makes it difficult to predict future resource conditions and quantify effects from external threats. Flagstaff Areas National Monuments do not have access to a GIS system which would be instrumental in recording new information, detecting changes, analyzing trends, and projecting possible future conditions resulting from these external resource pressures.	The monument staff will write and implement the actions outlined in a GIS plan. A GIS Specialist may be detailed to assist in the implementation of 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.
FLAG-N-130.051	**Implement a Geographic Information Plan**	ISSUE: Lack of Basic Resource Data Lack of Information Management System PROBLEM: Implementing a GIS plan, resulting from 202.000, is necessary to detect changes, analyze trends, and project possible future conditions resulting from these external resource pressures.	Implement GIS plan and apply GIS techniques to management operations. An NPS multidisciplinary GIS task force would be created to develop and standardize the GIS protocols that would be used by the monument staff.

C. INFORMATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-010-013	**Update the Administrative History**	ISSUE: Lack of Information Management System PROBLEM: An administrative history, required by NPS policies, is a succinct source of briefings on past milestones, agreements, commitments, etc. that affect daily operations. The administrative histories for Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments must be updated yearly.	The administrative histories will be updated to include comprehensive information on events that have occurred in the parks. This will help the superintendent understand the public and private interactions that have occurred since the earliest days of the parks. Staff will update it annually with a summation of significant events to keep it current.
	Compile and Maintain Comprehensive Photographic Documentation	ISSUE: Lack of Information Management System PROBLEM: No comprehensive searches of historic photographs have been done for cultural or natural resources. Without baseline data, undesirable changes in resources and land development may remain undetected. Long-termed photos are invaluable as a tool for conducting inventories and mapping occurrences and distributions.	Scientifically based photographic documentation will be compiled and maintained. Photographs and airborne video will be taken, aerial photographs will be digitized and put into GIS format, photographs will be curated and cataloged, and a schedule defined for routine retaking of photographs.
FLAG-C-010.012	**Complete Oral Interviews of People With Historical Knowledge of the Monuments**	ISSUE: Lack of Information Management System PROBLEM: Interviews with individuals knowledgeable about the history of each park are incomplete. Many former employees and citizens of the area may provide valuable information regarding the history of the parks and early programs and operations.	Former employees, longtime local families, and others who have information about the historical and developmental periods of the parks will be identified. Oral interviews will be conducted and documented with appropriate media. A report of new information gathered by this project will be prepared and findings will be integrated with the administrative histories
	Develop an Annotated Natural Resources Bibliographic Database	ISSUE: Lack of Basic Resource Data PROBLEM: Natural resources of the monument have been addressed in various documents; however, the park does not have an exhaustive list of references. Therefore, duplication of research efforts may occur. An annotated natural resources bibliographic database would be useful for interpretive services, research, and management references.	Develop a natural resources bibliographic database by a search of NPS and other agency files, college, and university graduate theses and dissertations, electronic reference systems, and popular literature. Selected references will be acquired and others will be listed by source.

C. INFORMATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Update Annotated Natural Resources Bibliographic Database Annually	ISSUE: Lack of Basic Resource Data PROBLEM: Natural resources of the monument have been addressed in various documents; however, the park does not have an exhaustive list of references. Therefore, duplication of research efforts may occur. An annotated natural resources bibliographic database would be useful for interpretive services, research, and management references.	Update annotated natural resources bibliographic database annually. Park staff will be responsible for keeping the database current; nationwide searches may be required periodically.
	Develop Program to Continually Integrate Long-Term Monitoring of Ecosystems	ISSUE: Lack of Basic Resource Data PROBLEM: This resources management plan calls for conducting a wide variety of studies to delineate and quantify cultural and ecological values of the Flagstaff Area National Monuments. If individual long-term monitoring protocols are not integrated into a coherent and unified program for the park, the value of these studies will be greatly depreciated.	The monitoring protocols will be periodically evaluated with the oversight of an advisory group of scientists and managers. The best of the protocols will be integrated into an overall long-term monitoring program for the park to provide an empirical assessment of general ecosystem health and trends.

D. ARCHEOLOGY			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-010.001	**Archeological Testing**	ISSUE: Lack of Basic Resource Data PROBLEM: Limited information is available from only a few sites at both Wupatki and Walnut Canyon National Monuments. The interpretive program is based on data from these few sites. Additional site specific testing is needed to provide a more complete data base of the archeological and historical stories of the parks. Project is contingent upon Native American consultation and compliance with NAGPRA. Priority is assigned to address preexisting NAGPRA issues first.	Testing of specific archeological features within sites to provide information about the prehistory of both areas. This information would be added to data collected from the few sites that were excavated almost 50 years ago. Modern archeological techniques would provide maximum information with minimum impact to the sites. Project could be accomplished by contract.
FLAG-C-010.002	**Prepare Cultural Landscape Inventory**	ISSUE: Lack of Basic Resource Data PROBLEM: Because the landscape at the three parks has changed repeatedly over the years, and continues to change, individual studies for each monument are needed to determine significant landscape elements. Management of cultural landscapes within park lands should take into account the need for preservation of the integrity of these areas. Many management and maintenance activities take place in the parks which could impact integrity.	The cultural landscape inventory will inventory cultural landscape elements and relationships according to NPS 28. The project will involve inventorying and mapping all cultural landscape sites in the parks and will include a narrative history of each site with the inventory. The sites should be described as one of the parks' GIS resource overlays so that it can be used for management purposes.
FLAG-C-010.003	**Conduct an Archeological Survey - Sunset Crater Volcano National Monument**	ISSUE: Lack of Basic Resource Data PROBLEM: An archeological survey has not been completed for Sunset Crater Volcano National Monument. A survey is needed to identify cultural resources in the park. This information is required for planning, preservation, maintenance, and interpretive purposes and to support American Indian consultation and involvement in park management.	A complete archeological survey of the park's 3,040 acres will be conducted, involving identification and location of archeological and historical sites within the park. A survey report, including management recommendations, will be completed.

D. ARCHEOLOGY			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-010.005	**Conduct Architectural Documentation Program**	ISSUE: Lack of Basic Resource Data PROBLEM: Implement Architectural Documentation Program. The project will consist of thorough and systematic documentation of architectural and condition of a select group of primary prehistoric architectural sites in Wupatki and Walnut Canyon National Monuments in anticipation of long-term ruins preservation treatment.	Thorough architectural documentation will be compiled prior to preservation treatment. These efforts will (1) mitigate the effects of the treatment process, (2) identify the characteristics that pertain to construction, use, and maintenance of the original architectural remains, (3) identify the type, rate, and intensity of deterioration affecting the preservation of original remains, (4) create a baseline against which all future treatments are based, (5) allow prioritization of sites in need of preservation treatment.
FLAG-C-010.008	**Update Archeological Overview and Assessment**	ISSUE: Lack of Basic Resource Data PROBLEM: A general archeological overview was done in the mid 1970s for both Wupatki and Walnut Canyon National Monuments. These documents provided a general context for each park, however, there has been several surveys and studies conducted since. New information resulted from the 100% surveys, surveys outside each park, and extensive research of Sinagua and Kayenta Anasazi sites.	An archeological overview and assessment will be conducted using previous, and current, data and reports from archeological investigations inside and outside each park. This study will provide valuable scientific and interpretive data on the settlement of and prehistoric landscape of each park and surrounding area..
FLAG-C-010.010	**Conduct Historic Resource Study**	ISSUE: Lack of Basic Cultural Resource Data PROBLEM: The historic resources at Wupatki, Walnut Canyon and Sunset Crater Volcano have not formally been studied. Without further study age, complexity, and significance of sites in the parks and surrounding areas cannot be adequately known or fully interpreted. Future projects/programs at the Flagstaff Area National Monuments such as vegetation management could impact the integrity of each park's resources.	The historic resource study will be conducted according to NPS standards and guidelines. The studies will identify historic resources and provide management with a framework for long-term planning. The project will involve comprehensive data collection including documentary research and field investigations to determine and describe the integrity, authenticity, associative values, and significance of resources.

E. PRESERVATION			
PROJECT #	TITLE	ISSUE & PROBLEM STATEMENT	ACTION PLAN
FLAG-C-030.003	**Conduct Ruins Preservation**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: Cyclic maintenance must be performed on 80 front country sites , including 13 which are actively interpreted, in both Wupatki and Walnut Canyon. These nationally significant resources, which have been directly and indirectly identified in the enabling legislation for both parks, retain high interpretive and scientific integrity but are in poor to fair condition as a result of visitor use impacts, exposure to the elements, and the lack of preservation maintenance.	Ongoing ruins stabilization/preservation will be conducted at Wupatki and Walnut Canyon, funded exclusively through the Cultural Cyclic Maintenance and/or Cultural Resource Preservation Program and staffed from local labor sources, including temporary masonry workers, AmeriCorps enrollees, Student Conservation Association enrollees and volunteers.
FLAG-C-030.007	**Prepare Historic Structure Preservation Guide: Wupatki and Walnut Canyon**	ISSUE: Lack of Information Management System Deterioration of Cultural and Natural Resources PROBLEM: One National Register property is at Walnut Canyon (Ranger Cabin). Two other houses at Walnut Canyon, a split rail fence, one house and the library section of the visitor center at Wupatki are on the List of Classified Structures and may be eligible for nomination. Information about these structures, their construction, and modifications is scattered and/or undocumented. A preservation guide is needed to insure these structures are maintained in historical condition and that any modifications or alterations be reversible.	A historic structures preservation guide will be prepared by park maintenance personnel, a historical architect, and engineers as required. A task directive, outlining the requirements and goals of the project, will be prepared by the Flagstaff Areas Exhibit Specialist. The completed document will contain three major sections: instructions, schedules, and reference materials.

E. PRESERVATION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-030.005	**Conduct Comprehensive Stabilization of Ranger Cabin - Walnut Canyon National Monument**	ISSUE: Lack of Information Management System Deterioration of Cultural and Natural Resources PROBLEM: In 1991 emergency stabilization was conducted on the historic log cabin. This emergency project was only a protective action. Comprehensive repair and rehabilitation are required to insure the long-term integrity of the building. This is a National Register property, originally built by the U.S. Forest Service and used by that organization and the National Park Service as administrative headquarters for Walnut Canyon National Monument for over 50 years.	Repair by replacement in kind and preserve the structure in conditions that represent it's original appearance during the historic period of use by the USFS and NPS. Preservation will be directed by and restricted to recommendation of a Historic Structure Report and Historic Structures Preservation Guide. The HSPG will be a working document, produced in loose-leaf format with the pages dated to facilitate updating without reprinting the entire document.
FLAG-C-030.002	**Develop Ruins Preservation Guides: Wupatki and Walnut Canyon**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: Develop a Ruins Preservation Guide for approximately 50 sites within Wupatki and Walnut Canyon National Monuments which have been previously treated. The majority of these resources are considered to be the primary resources of the parks, all of which are considered nationally significant. Over the years there has been considerable preservation/stabilization work on these resources. However, there has never been a long range plan developed to "direct" preservation maintenance activities on these resources. This document would serve as a reference for programming and implementing continued housekeeping, and routine and cyclic maintenance for park preservation personnel.	Complete Ruins Preservation Guides for both Wupatki and Walnut Canyon covering the sites within each park that have been actively maintained. The initial effort of this project would be initiated within the first year. Each year thereafter the document would be updated to reflect completed preservation actions as well as updates on preservation techniques and material specifications.

F. COLLECTIONS MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-020.003	**Upgrade Museum Storage**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: The current storage furniture, supplies, security hardware and systems, fire detection/suppression, and environmental controls in the museum storage spaces are inadequate and do not meet NPS standards. Deficiencies noted in Special Directive 80-1 include: water seeping into one of the storage closets at Walnut Canyon; extreme fluctuations in temperature and relative humidity; cabinets contaminated with PDB; and current storage space is inadequate for anticipated growth.	Purchase and install upgrades including fire-safe files, museum storage cabinets and metal shelving. To supplement funding pursue alternative means of equipment acquisition such as (1) advertise equipment needs in the Clearing House Classifieds; (2) program funding and priorities to request new equipment; and (3)inquire at other institutions about surplus equipment.
FLAG-C-020.010	**Complete Collection Storage Plan**	ISSUE: Lack of Information Management System PROBLEM: Proposed changes in the storage area for museum collections require that new storage plans be designed. Currently the Flagstaff Area National Monuments contains approximately 20,000 objects on site. 108 objects are on exhibit as noted in the current Collections Management Plan. The Collections Storage Plan will evaluate the parks' storage needs by assessing current storage, the status of the existing collection, possible expansion of the collections. The Collections Storage Plan is a site specific document and it will aid the park in correcting deficiencies in the DOI Checklist.	Complete the Collection Storage Plan following instructions in the Museum Handbook, Part I. Program funding and priorities to request a plan be initiated at the Field Area or Washington Office level. Park Curator will assist with the completion of the plan, and follow through on action plan based upon Collection Storage Plan findings and recommendations.

F. COLLECTIONS MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-020.012	**Conduct Collection Condition Survey**	ISSUE: Lack of Information Management System PROBLEM: The museum objects at the Flagstaff Area National Monuments are composed of various materials such as archeological objects, biological specimens, ethnographic and historical objects, and archival material. Inferior environment with fluctuating temperatures and relative humidity as well as out-dated storage cabinets hasten deterioration of objects. Some deterioration of objects is obvious, however most is not. A professional conservator is needed to survey the physical condition of the parks' museum collections.	Program funding and priorities to request that a survey be initiated at the Field Area or Washington Office level. Park Curtor will assist with site visit of conservator, and follow through on action plan based upon survey findings and recommendations. This survey will result in the production of a narrative report detailing general needed improvements, object condition reports with proposals for treatment, the cost estimates for conservation, and priorities for treatment. The survey will also provide information on methods to slow the rate of deterioration by changes in storage techniques and conditions.
FLAG-C-020.015	**Manage/Upgrade ANCS Museum Database**	ISSUE: Lack of Information Management System PROBLEM: The Flastaff Area National Monuments have approximately 20,000 objects in its collection. Approximately 10-15 percent of these objects are cataloged and entered in the NPS Automated National Catalog System (ANCS) database. Present staff are unable to eliminate the backlog and maintain the ANCS database without additional staff or contractual assistance. Incomplete data in ANCS affects the efficiency of the program and misrepresents the collection information used by the park. This should be corrected to meet standards established by the NPS.	Program adequate staff and computer system to accession and catalog complete museum collection to standards. Backup databases on archival tape. Print out catalog cards and distribute according to the Museum Handbook, Part II. Publish catalog of collections and distribute to libraries, universities, and groups with research and exhibit interest.

F. COLLECTIONS MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-	**Survey and Inventory Collections for Flagstaff Area National Monuments Cultural Objects.**	ISSUE: Lack of Information Management System PROBLEM: It is likely that archeological collections from the Flagstaff Area National Monuments exist in institutions outside the National Park Service. It is not known how many objects are located at the Smithsonian Institution and the Milwaukee Public Museum. There is no information of the location of any artifacts from the prehistoric sites within the monument not currently in NPS possession.	An archeologist or a curator with archeological experience will conduct a survey of the most pertinent institutions and longtime local families to determine the number and types of artifacts and information related to the sites and early excavations.
FLAG-C-010.009	**Update/Correct Cultural Resources Bibliography**	ISSUE: Lack of Information Management System PROBLEM: The Cultural Resources Bibliography has not been systematically updated for the park as required by Guideline NPS 28. Without an up-to-date bibliography, it is cumbersome to locate scattered information and there is a potential for unnecessary duplication.	The Cultural Resources Bibliography will be updated with archeological reports and other types of cultural resource literature. Libraries of other parks, universities, museums, and private collections will be surveyed for relevant references and entered into CRBIB. Park staff, SCA, and/or volunteers will complete annual updates.
FLAG-C-020.018	**Construct New Museum Facility**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: The Flagstaff Area National Monuments has approximately 20,000 museum objects stored on-site. The current storage space and its environment, security, and fire detection/suppression systems are inadequate for meeting NPS museum storage standards. Deficiencies include overcrowded storage space, growing collections, inappropriate storage of archival material in unsecured areas, and integrated pest management problems. A new facility is needed to meet storage space needs and deficiencies.	A new museum storage facility will be built to meet the needs of expected growth in collections. A new facility will be constructed to provide the proper storage and security environment for collections. An area for processing incoming artifacts will also be included in the facility as well as a place for NAGPRA consultation. Currently no space exists for an appropriate consultation setting. Space for researchers will also be included.

F. COLLECTIONS MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-020.008	**Establish Exhibit Maintenance**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: All exhibits need work from time to time to maintain them in good order. This includes installation of new photographs, cleaning of exhibit panels and cases, replacement of worn-out or damaged equipment, and, occasionally, the replacement of labels due to former inaccuracies or results of new research.	A program of exhibit maintenance will be established that includes replacement of damaged or worn material and cleaning of all exhibits as necessary. This will ensure that the exhibits meet all NPS standards and convey correct information to the public.
FLAG-C-040.001	**Provide Resources to Manage Park Library Collection**	ISSUE: Lack of Information Management System PROBLEM: The Flagstaff Area National Monuments have approximately 1,000 books and periodicals. Current staffing and funding are inadequate to accomplish work necessary to correct existing catalog backlogs, bring library collections management up to DOI and NPS standards. Preservation treatments must be accomplished and the library space maintained.	Deficiencies must be identified and funding secured for staff, supplies, and equipment needed to manage library collections. Responsibility for the libraries has been designated, however, lack of staff and funding do not permit appropriate care. Internships with Northern Arizona University will be pursued as well as volunteers and Student Conservation Association members. Staff will receive proper training in library procedures and management.
FLAG-C-040.002	**Upgrade Library/Archival Property**	ISSUE: Lack of Information Management System PROBLEM: Currently many books and other recorded information in the Flagstaff Area National Monuments' libraries is not organized or accounted for and does not show clearly established NPS ownership. Not all items are cataloged, inventories are not complete, and not all information is included in the NPS libraries union catalog. This project is necessary to bring library property accountability and documentation to standards as per NPS Special Directive 94-1. Lack of staff and funding limit the amount of attention directed towards this effort.	Program adequate staff and funding to update library catalog and accession records. Bring all reference and library material to standards defined by the NPS. Create catalog records for each item using approved computer software (System Support Office can provide assistance). Make library easily accessible.

F. COLLECTIONS MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-040.003	**Upgrade Library Storage**	ISSUE: Deterioration of Cultural and Natural Resources PROBLEM: The current storage furniture, supplies, security hardware and systems, fire detection/suppression, and environmental controls in the library spaces are inadequate for meeting NPS museum storage standards. Deficiencies include insufficient storage space, vertical file material not properly stored, books and other library materials share a closet with interpretive materials and other equipment at Sunset Crater Volcano. Security and accountability are lacking, pests destroy and or damage library materials, and computers are needed to retrieve electronically cataloged information.	Program funding and priorities to request new shelving/cabinets, two new computers (surplus), environmental monitors and increase security through better policy and check out system. Purchase and install upgrades. Use student interns, SCA or volunteers to help assist park staff in upgrading and maintaining park libraries.
FLAG-C-040.004	**Update Library Operating Policy**	ISSUE: Lack of Information Management System PROBLEM: A Library Operating Policy defines and disseminate the standards and procedures, under which the Park Libraries will operate. It is intended to guide and support decisions of the users about library operations. It documents library accountability as required by NPS 28. The complex nature of the library at the Flagstaff Area National Monuments requires a thorough Library Operating Policy and the library manager may need the help of someone outside the parks as well as staff members from various divisions in the parks.	Program funding and priorities to request the plan be updated at park level. Follow current guidelines for the Library Operating Policy as outlined by NPS 28. Park Curator will initiate policy and other park staff members will assist in its implementation.

G. VEGETATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-C-010.007	**Assess Relationship of Prehistoric cultures with their Environment**	ISSUE: Understanding Prehistoric Environment PROBLEM: No comprehensive study of the prehistoric environment has ben conducted Walnut Canyon, Wupatki or Sunset Crater Volcano. We do not know what the environment was like or how the Sinagua and Anasazi altered (impacted) their environment, through farming practices, hunting, gathering, development of habitation sites etc.	Perform the needed research to determine the prehistoric environment, and the uses and impacts on that environment by the Sinagua and Anasazi. Information gathered will enhance the interpretation of the prehistoric uses of Walnut Canyon, Sunset Crater Volcano and Wupatki and immediate areas, and provide information about the people who lived there. Research could be conducted through contract with Northern Arizona University, or by graduate students working on theses or dissertations. Other institutions such as NOAA could also be involved.
FLAG-I-	**Manage Vegetation: Rehabilitation, Landscaping, and Hazard Tree Removal**	ISSUE: Lack of Basic Resource Data Lack of Comprehensive Vegetation Management PROBLEM: A number of needs exist in identifying an approritate vegetation managment program. These include revegetation, hazardous tree evaluation and removal, fire management, managing vegetation in the vicinity of archeological sites, landscaping in developed areas, etc. At present, no vegetation management program exists to deal with these issues.	A vegetation management program will be developed and implemented. Areas that need revegetation and landscaping will be identified, botanical information about specific species gathered, seed stock for demonstration gardens obtained, and hazardous trees identified and removed. It will be designed for maintenance personnel without background in landscape management to be trained to properly care for the plantings.

G. VEGETATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-N-20.001	**Develop Vegetation Management Plan**	ISSUE: Lack of Comprehensive Vegetation Management PROBLEM: Vegetation must be managed to enhance the cultural setting, protect cultural resources, and preserve native vegetation. The monument has heavy visitation, past site excavation, past grazing, social trailing, work access, and facilities development that result in occasional impacted areas needing restoration. Landscaping is also needed to maintain native plant compositions that align with the prehistoric and historic land uses.	Identify issues and gather existing information on the full range of topics involved in vegetation management. Obtain staff input and produce a paln that can be utilized by a wide variety of staff including resource management, protection, and maintenance.
FLAG-N-020.011	**Inventory Sensitive and Threat-ened/ Endangered Flora**	ISSUE: Lack of Basic Resource Data PROBLEM: There has not been a systematic survey to identify all rare plants at FLAG Areas National Monuments. It is probable that additional rare life forms occur in the monuments and may require protective management. Of special concern are federally listed threatened, endangered or candidate species which require protection under the Endangered Species Act and its amendments. State protected species are also of concern.	A systematic survey for rare species will be conducted. By assessing occurrence and distribution of rare species, the superintendent can properly manage these species in accordance with NPS management policies, monument enabling legislation, and the Endangered Species Act.
FLAG-N-	**Monitor Sensitive and Threatened/Endangered Flora**	ISSUE: Lack of Basic Resource Data PROBLEM: Sensitive, threatened and endangered species in the monument may require protective management. Of special concern are federally listed threatened, endangered or candidate species which require protection under the Endangered Species Act and its amendments. State protected species are also of concern. Monument staffs must continually be aware of any rare plants potentially near the monuments' boundaries.	Monitor sensitive, threatened, and endangered flora. By assessing occurrence and distribution of rare species, the superintendent can properly manage these species in accordance with NPS management policies, monument enabling legislation, and the Endangered Species Act. A thorough search of monuments' habitats must be conducted periodically.

G. VEGETATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Conduct Inventory and Assessment: Vegetation and Flora and Develop Long-Term Monitoring Protocols	ISSUE: Lack of Basic Resource Data PROBLEM: Vegetation is the keystone of natural ecosystems, serving as a basis for animal life and as a synthesizer of environmental factors, including geology, soils, slope, exposure, and climate. Thus, vegetational analyses can be used as a tool for examining potential environmental problems. Existing vegetation and floral inventories are inadequate for full understanding of plant species and communities.	A vegetation and floral assessment will be conducted and a long-term monitoring program will be designed. Close monitoring of the vegetation and flora can serve as an early warning system for undesirable changes and increase management's ability to respond effectively.
	Implement Long-Term Monitoring Protocols for Vegetation and Flora	ISSUE: Lack of Basic Resource Data PROBLEM: Vegetation is the keystone of natural ecosystems, serving as a basis for animal life and as a synthesizer of environmental factors, including geology, soils, slope, exposure, and climate. Thus, data must be current to provide management the ability to protect these resources.	Implement long-term monitoring protocols for vegetation and flora. A long-term monitoring program for these ecological factors as designed in other projects will be implemented. Monument staff will be trained to operate the monitoring program. This will increase management's ability to assess changes in the natural resources of the monument.
FLAG-N-010.010	**Inventory, Assess, and Evaluate Control of Non-Native Flora Species and Develop Long-Term Monitoring Protocols**	ISSUE: Pest Management PROBLEM: Little is known about the abundance, distribution, and population trends of non-native flora species in the monument. Without the inventory, gradual or rapid expansion of non-native species and damage will remain unknown. Natural communities will be altered in some cases. NPS management policies require removal of non-native species where control is practicable.	An inventory and assessment of non-native flora species will be conducted and long-term monitoring protocols and management strategies will be developed. Management will have the ability to determine which species need to be controlled and which will be tolerated. Staff will also become aware of situations outside the monument which could affect lands under their jurisdiction (e.g., roadside seeding, farming, grazing, development).

G. VEGETATION MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Implement Long-Term Monitoring Protocols for Non-Native Flora Species	ISSUE: Pest Management PROBLEM: The National Park Service is aware of some non-native flora species that occur at FLAG Areas National Monument. Less is known, however, about their abundance, distribution, and population trends. A long-term monitoring program for these components of the ecosystem is necessary.	A long-term monitoring program will be implemented for non-native flora following protocols designed in the initial inventory and assessment. The monument staffs will be trained in the implementation of these protocols.

H. WILDLIFE MANAGEMENT			
PROJECT #	TITLE	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Monitor Sensitive and Threatened/Endangered Fauna	ISSUE: Lack of Basic Resource Data PROBLEM: Rare life forms in the monument may require protective management. Of special concern are federally listed threatened, endangered or candidate species which require protection under the Endangered Species Act and its amendments. State protected species are also of concern. Monument staff must be continually aware of any rare animals potentially near the monument boundaries.	Monitor rare species. By assessing occurrence and distribution of rare species, the superintendent can properly manage these species in accordance with NPS management policies, monument enabling legislation, and the Endangered Species Act.
	Assess Habitat Requirements of Aquatic Organisms Inhabiting Permanent Seeps and Ephemeral Pools at Flagstaff Area National Monuments		

H. WILDLIFE MANAGEMENT			
PROJECT #	TITLE	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-N-020.003	**Conduct Inventory and Assessment: Invertebrates and Develop Long-Term Monitoring Protocols**	ISSUE: Lack of Basic Resource Data PROBLEM: Invertebrates are critical to basic and widespread ecosystem functions such as pollination, decomposition, soil aeration and churning. They are extremely important and numerous, and to better understand and appreciate insects the park must expand the existing knowledge beyond the limited study and collection.	Inventory, assessment, and monitoring of invertebrates will be conducted. Information will be gathered about insects as individual species, family, or genera, their habitats, and ecological roles. Long-term monitoring protocols will be developed.
	Implement Long-Term Monitoring of Invertebrates	ISSUE: Lack of Basic Resource Data PROBLEM: Invertebrates are critical to basic and widespread ecosystem functions such as pollination, decomposition, soil aeration and churning. They are extremely important and numerous, and to better understand and appreciate insects the park must expand the existing knowledge beyond the limited study and collection.	Implement long-term monitoring of the native invertebrates at Flagstaff Areas. A long-term monitoring program designed in the inventory and assessment of invertebrates, project 020.003, should be implemented. Monument staff will be trained in the implementation of these protocols.
FLAG-N-020.002	**Conduct Inventory and Assessment of Reptiles and Amphibians and Develop Long-Term Monitoring Protocols**	ISSUE: Lack of Basic Resource Data PROBLEM: Amphibians and reptiles are commonly the most poorly understood of the vertebrates, yet they are probably the most reliable vertebrate indicators of habitat change. Venomous reptiles, such as rattlesnakes, can constitute a safety hazard to visitors and staff. Thus, distribution and relative stability of these species are important biological elements for management and interpretation.	Conduct inventory and assessment of amphibians and reptiles and develop long-term monitoring protocols. This will provide additional information to aid management in maintaining biological diversity in the monument as well as providing information for interpretive exhibits and presentations. Species richness and relative densities for amphibians and reptiles in the monument will be determined.

H. WILDLIFE MANAGEMENT			
PROJECT #	TITLE	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Implement Long-Term Monitoring for Amphibians and Reptiles	ISSUE: Lack of Basic Resource Data PROBLEM: Understanding distribution and relative stability of amphibian and reptile species is thus an important element of vertebrate biology in relation to resource management and interpretation. A long-term monitoring program for these components of the ecosystem is needed.	Implement long-term monitoring protocols for amphibians and reptiles. This will provide current information to aid management in maintaining biological diversity in the monument as well as providing information for interpretive exhibits and presentations.
FLAG-N-20.001	**Conduct Inventory and Assessment of Birds and Develop Long-Term Monitoring Protocols**	ISSUE: Lack of Basic Resource Data PROBLEM: Changes in avian species diversity, population densities, and habitat have occurred and will continue with development, increased recreational activities, and changes in riparian and upland ecosystems. Therefore, there is a need for a comprehensive survey of birds.	Conduct inventory and assessment of birds and develop long-term monitoring protocols. This study will provide information that can serve as an additional management tool for examining the ecological health of the monument, especially riparian ecosystems. Species richness and relative densities for avian species will be examined.
	Implement Long-Term Monitoring of Birds	ISSUE: Lack of Basic Resource Data PROBLEM: This project is designed to keep the basic avifaunal information current by providing updated information about the interaction of key avian species (indicator species) with the rest of the monument environment. It is a long-term monitoring program for these components of the ecosystem.	Implement long-term monitoring of birds. This study will provide current information that can serve as an additional management tool for examining the ecological health of the monument, especially riparian ecosystems. The monument staff will be trained in the implementation of these protocols.
	Conduct Inventory and Assessment: Mammals and Develop Long-Term Monitoring Protocols	ISSUE: Lack of Basic Resource Data PROBLEM: Mammals are significant, integral ecosystem components and to better understand and appreciate them, the monument must continue research beyond the limited work done to date. Documented occurrence of native and non-native mammals and their relative abundance within desert upland and riparian habitats, will serve as an additional management tool for examining the ecosystem health.	A mammalian inventory and assessment will be conducted. This includes a literature search, consultation with museum collections, test study design, field study, and a written report with long-term monitoring protocols.

H. WILDLIFE MANAGEMENT			
PROJECT #	TITLE	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Implement Long-Term Monitoring Protocols for Mammals	ISSUE: Lack of Basic Resource Data PROBLEM: This project is designed to keep baseline information on mammals within Flagstaff Areas current and provide up-to-date information about the interaction of key mammalian species (indicator species) with the rest of the monument environment, and document the biological diversity of mammals. A long-term monitoring program for these components of the ecosystem will be implemented.	Implement long-term monitoring protocols for mammals. This will provide current information on native mammals which will serve as an additional management tool for examining the ecological health of the monument ecosystems. A long-term monitoring program will be implemented following the protocols developed in the initial inventory and assessment, 705.000. The monument staff will be trained in the implementation of these protocols.
	Inventory, Assess, and Evaluate Control of Non-Native Fauna Species and Develop Long-Term Monitoring Protocols	ISSUE: Pest Management PROBLEM: Little is known about the abundance, distribution, and population trends of non-native fauna species in the monument. Without the inventory, gradual or rapid expansion of non-native species and damage will remain unknown. Natural communities will be altered in some cases. NPS management policies require removal of non-native species where control is practicable.	An inventory and assessment of non-native species will be conducted and long-term monitoring protocols and management strategies will be developed. Management will have the ability to determine which species need to be controlled and which will be tolerated. Staff will also become aware of situations outside the monument which could affect lands under their jurisdiction (e.g., roadside seeding, farming, grazing, development).
	Implement Long-Term Monitoring Protocols for Non-Native Fauna Species	ISSUE: Pest Management PROBLEM: The National Park Service is aware of some non-native fauna species that occur at Flagstaff Areas National Monument. Less is known, however, about their abundance, distribution, and population trends. A long-term monitoring program for these components of the ecosystem is necessary.	A long-term monitoring program will be implemented for non-native fauna following protocols designed in the initial inventory and assessment project. The monument staff will be trained in the implementation of these protocols.

I. NEPA and NHPA Sec. 106 Compliance			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Develop, Manage, and Administer NEPA and NHPA Sec. 106 Compliance Program	ISSUE: Lack of Resources Staff and Fiscal Support Resource Protection PROBLEM: Basic management of cultural and natural resources is extremely difficult due to lack of staff. An important part of this overall goal is NEPA and Sec. 106 compliance.	Seek additional funding and staffing to adequately address NEPA anf NHPA compliance for Flagstaff Area projects. Develop cooperation and provide guidelines for existing staffs of all divisions to assist the limited resource staff in properly adressing compliance needs.

J. FIRE MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Develop Fire Management Program: Produce Plan, Develop Fire Effects Monitoring Program	ISSUE: Lack of Resources Staff and Fiscal Support Resource Protection PROBLEM: No fire management plan exists for the Flagstaff Areas. Only Walnut Canyon has an approved plan. Fire management activities are limited to suppression responses at both Sunset Crater Volcano and Wupatki. The effect of prescribed fire on the vegetation and fuels is limited to work that can be completed by existing staff.	Develop a fire management plan which will address the full range of desired activities including management iginited prescribed fire for all three monuments. Develop a long-term strategy to deal with current staffing and funding shortages and develop cooperative relationships with other agencies and park areas to enable the fire program to be effective.

K. WATER RESOURCES MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Measure Flows in Walnut Canyon	ISSUE: Lack of Basic Resource Data Groundwater Withdrawal Alteration of Flow Regimes PROBLEM: Natural spring flows from Flagstaff Well are monitored through an agreement with the US Geological Survey, which maintains the flow records and reports the results to the NPS on a annual basis. The NPS takes daily readings according to a protocol developed by the USGS and sends these data to the Survey for compilation and summary.	The current monitoring agreement with USGS will be continued. NPS will continue to take daily readings and send data to the USGS for compilation and summary.
FLAG-N-040.00	**Identify and Inventory Water-Related Resources**	ISSUE: Lack of Basic Resource Data Groundwater Withdrawal Alteration of Flow Regimes PROBLEM: The water-related resources of the monuments, particularly Walnut Canyon, have not been fully identified. An inventory is needed to both identify 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 monuments for the purposes for which they were created.	A thorough inventory of all water-related resources in the monuments will be conducted. Such a broad survey will give the superintendent an adequate data base from which to make informed management decisions and to protect water rights. Results will also be of use to all other resource related inventories conducted at the monuments.

K. WATER RESOURCES MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-N-	**Conduct Riparian Ecosystem Research and Develop Monitoring Protocols**	ISSUE: Lack of Basic Resource Data Alteration of Flow Regimes The riparian areas of the Flagstaff Areas are limited primarily to Walnut Canyon and Wupatki (Little Colorado River). Both of these systems have been extremely altered by dams and other water uses. There is a need to study these systems and determine the affects of these alterations.	Riparian ecosystem research will be conducted. This will provide management with alternatives, proposed actions, and probable results, based on solid research findings. In addition to vegetation and faunistic implications of proposed management actions, attempts will be made to integrate information on soils, hydrology and flood regimes, and supporting information from current and past research programs in the area. Long-term monitoring protocols for these components of the ecosystem.

L. GEOLOGIC RESOURCES MANAGEMENT			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
FLAG-N-060.021	**Conduct Survey and Assessment: Soils**	ISSUE: Lack of Basic Resource Data PROBLEM: The soils of Flagstaff Areas National Monument have not been surveyed or mapped to detail. No site specific information exists that can be used by management to make informed decisions regarding management of the developed and landscaped areas, natural areas, siting of visitor use facilities, protection of cultural sites and critical habitats, or prevention of soil erosion.	The Soil Conservation Service, the U.S. Forest Service, a university researcher, or a private consultant will conduct a level III soil survey. Products of this survey will include a detailed soils map, soil series descriptions, and an assessment of the significant properties of these soils as related to cultural site preservation, prehistoric landscape scene preservation, ecological protection, and visitor services development.
FLAG-N-060.011	**Conduct Cave Reconnaissance and Inventory**	ISSUE: Lack of Basic Resource Data Visitor safety The extensive lava flows at Sunset Crater Volcano have never been completely surveyed for existence of caves other than the Ice Cave. Cave resources at Sunset and Wupatki have not been fully identified or inventoried. Visitor safety may be jeopardized by the existence of unknown caves which are unsafe or obscured.	
FLAG-N-060.015	**Install Seismograph and Monitor Seismic Activity**	ISSUE: Lack of Basic Resource Data Visitor education	

M. NATIVE AMERICAN CONSULTATION			
PROJECT #	**TITLE**	**ISSUE & PROBLEM STATEMENT**	**ACTION PLAN**
	Administer Native American Consultation Program		

C. Current Resource Management Staff

1. Cultural Resources Staff

GS-12 Supervisory Archeologist (Division Chief) - The Division Chief's responsibilities include assessing the status, progress, needs, and effectiveness of all research, inventory, evaluation, and preservation activities within the monuments; preparing compliance documents for all actions affecting cultural and natural resources; conducting research projects and producing articles and technical papers for publication in professional journals. The Division Chief is also responsible for supervising all mitigation of effects of management activities on cultural and natural resources, and preparing and updating the park's resource and research management plans. This position is base funded through ONPS money which is allocated to the Resource Management Division.

GS-11 Exhibit Specialist - This person has responsibility for the preservation program at the Flagstaff Area National Monuments. This position is base funded through ONPS money which is allocated to the Resource Management Division.

GS-11 Archeologist - This person has responsibility for planning, monitoring and implementing cultural resource management projects within the Flagstaff Area National Monuments. This position also has the responsibility for planning, coordination and implementation of a program of care and management for the curatorial collections and libraries of all three monuments. This position is base funded through ONPS money which is allocated to the Resource Management Division.

2. Natural Resources Staff

GS-11 Natural Resource Specialist - This person has responsibility for planning, monitoring and implementing natural resource projects. This position will support the natural resource management programs for the Flagstaff Area National Monuments as well as five additional parks in northeastern Arizona and northwestern New Mexico including Navajo, Canyon de Chelly, Aztec, and El Moro National Monuments, and Hubbell Trading Post National Historic Site. This position is base funded through ONPS money which is allocated to the Resource Management Division.

The Natural Resource Specialist will be responsible for providing professional support and coordination of natural resource planning, compliance, scientific research, inventory and long-term monitoring, overall vegetation and wildlife assessments and management, mitigation, protection, interpretation, range management, GIS, caves and mines, water and air quality.

D. Resource Management Staffing Needs

Cultural Resources

The greatest unmet needs pertain to the lack of staff available to address the divisions programmatic cultural and natural resource management responsibilities. A number of permanent positions are

needed. The most recent CR-MAP analysis of staffing needs identified 52 FTEs needed for the cultural resource management program.

With ongoing NHPA, Section 106 and 110 compliance requirements, such as compiling XIX forms for proposed development activities, monitoring projects during ground disturbance, and reporting the mitigative or negative results of such activities, a full time archeologist position is critical. In addition, Sunset Crater Volcano and the additional lands slated to be acquired around Walnut Canyon, are in the process of being programmed for an archeological survey in accordance with NPS policy. An archeological technician will be required to assist on staff personnel for planning, program coordination, project implementation, and management of the resultant data.

To protect an investment in the preservation of the Flagstaff Areas' prehistoric and historic sites and to continue to allow visitors access to the sites, a fully trained staff is needed. Recently an Exhibit Specialist was brought on staff to begin addressing the Areas' ruins preservation needs. Technical staff is needed to assist the Exhibit Specialist in addressing the enormous deferred ruins preservation maintenance backlog.

The Flagstaff Areas' ruins preservation program is in desperate need of skilled artisans for repair and rehabilitation of archeological sites. Three masonry positions (WG-05) would be supervised by a masonry work leader (WL-08) under the general direction of the Exhibit Specialist. An additional archeological technician is also needed for the ruins preservation program. This position would assist the Exhibit Specialist in assembling the necessary compliance documentation for all ruins preservation activities and in completing all archeological documentation. The technician would essentially be assigned to assist the preservation crews and would be able to initiate the appropriate level of recordation and collection of exposed architectural fabric and material culture. This would include completion of pretreatment architectural forms, architectural documentation, photographic documentation, mapping, and collection of archeological materials for analysis.

ARPA patrol rangers are supervised and paid by the Visitor Protection division, not the Resource Management Division. However, in terms of personnel needs, it is worthwhile to document that the greatest deterrent to site looting and destruction is the presence of uniformed patrol rangers. At a minimum, two seasonal patrol rangers, stationed at Wupatki and Walnut Canyon, are needed to contact visitors and educate them about appropriate behavior when visiting cultural resource sites in the monuments, as well as educate them about the cultural resources present in the parks.

Natural Resources

The need for additional permanent professional natural resource positions is also critical. A NR-MAP (Natural Resource Management Assessment Program) analysis completed in December, 1996 for the Flagstaff Area National Monuments, indicated that approximately 43 full-time positions would be required to fully implement all phases of the natural resource management program. The Areas has hired a permanent GS-11 Natural Resource Specialist that functions as a circuit rider servicing general needs of the Flagstaff Areas and five additional parks in northeastern Arizona and northwestern New Mexico. While this position will satisfy some of the basic natural resource

management needs of the monuments, additional staffing is necessary to address NEPA requirements and to perform a variety of duties aimed at natural resource protection, problem identification, monitoring, area rehabilitation, research identification and coordination, and project implementation. Obviously, basic staffing needs have certainly not been met. At a minimum, an additional Natural Resource Specialist position is needed to accomplish many of these duties and be permanently assigned to the Flagstaff Areas. This position will supervise two biological technicians and one physical science technician who will be directly involved with project implementation.

Please refer to Appendix D.

IV. REFERENCES CITED

Adams, Stephen E. and Steven K. Cinnamon.
1979 Ruins Preservation Guide, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1981 Wukoki Ruin (NA203), Emergency Stabilization, September 1981. Report on file, Wupatki National Monument, Flagstaff.

1982a Wupatki Special Projects. Report on file, Wupatki National Monument, Flagstaff.

1982b Historic Structures Report, Kaibab House Ruin, Wupatki National Monument, Arizona. Report on file Wupatki National Monument.

1983 Historic Structures Report, Northern Arizona Sites 633, 634, 635, 636, and 2222, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument.

Anderson, Bruce (compiler)
1990 *The Wupatki Archeological Inventory Survey Project: Final Report* Southwest Cultural Resources Center, Professional Paper No. 35. Santa Fe, New Mexico.

1993 Grazing Management Plan Wupatki National Monument, Flagstaff Areas, Arizona. National Park Service, U.S. Department of the Interior. Flagstaff, Arizona.

Arnberger, L.
1947 Flowering Plants and Ferns of Walnut Canyon. *Plateau*. Vol. 20 pp. 29-36.

Balda, Russell
1976 Survey and Analysis of Birds. Ms on file Northern Arizona University.

1984 Wupatki Bird Checklist: Comments, Questions, Additions and Corrections. Ms on file Wupatki National Monument.

Balda, Russell and L. Beatty
1976 Birds of Sunset Crater Volcano and Wupatki National Monuments. Ms on file Wupatki National Monument.

Beatty, L.
1978 Studies of Avian Communities. In Natural Resource Survey and Analysis of Sunset Crater Volcano and Wupatki National Monuments. Final Report (Phase II). Ms on file Wupatki National Monument.

Baldwin, Anne R., and J. Michael Bremer
1986 *Walnut Canyon National Monument: An Archeological Survey: Archeological Investigations in the Walnut Canyon Drainage, North Central Arizona.* Publications in Anthropology, No. 39. Western Archeological and Conservation Center, National Park Service, United States Department of the Interior, Washington, D.C.

Barrett, Samuel A.
1927 Reconnaissance of the Citadel Group of Pueblo Ruins in Arizona. *Yearbook of the Public Museum of the City of Milwaukee*, Vol. 6, pp. 7-58.

Bateman, Gary C.
1976 Natural Resource Survey and Analysis of Sunset Crater Volcano and Wupatki National Monuments. Ms on file Wupatki National Monument. Report prepared by Northern Arizona University, Contract No. 950134.

1976 Amphibians and Reptiles of Sunset Crater Volcano and Wupatki National Monuments. In Natural Resource Survey and Analysis of Sunset Crater Volcano and Wupatki National Monuments. Ms on file Wupatki National Monument. Report prepared by Northern Arizona University, Contract No. 950134.

1979 Natural Resource Survey and Analysis of Sunset Crater Volcano and Wupatki National Monuments, Preliminary Report (Phase III). Prepared for the Office of Natural Resource Management Southwest Region, National Park Service. Ms on file Wupatki National Monument.

Beaubin, Paul
1940 Monthly reports for Walnut Canyon National Monument to Mr. High Miller, Superintendent, Southwestern National Monuments. Report on file Wupatki National Monument.

Benfer, J.A.
1971 *The Petrology of the Eastern Phase of the Toroweap Formation, Walnut Canyon, Arizona.* Unpublished Masters Thesis. Northern Arizona University, Flagstaff.

Bergeson, B.
n.d. Reptiles of Wupatki National Monument. Checklist, on file Wupatki National Monument.

Blee, J.W.H.
1988 *Determination of Evaporation and Seepage Losses, Upper Lake Mary near Flagstaff, Arizona.* U.S. Geological Survey Water-Resources Investigations Report 87-4250. Tucson, Arizona.

Bradley, Zorro A.
1959 Three Prehistoric Farm Structures at Wupatki National Monument. *Plateau*, Vol. 32, No. 1, pp. 12-22.

Braun, David P.
1989 NAU-Summer Field School Student Papers from Archaeological Investigations at Wupatki National Monument. Department of Anthropology, Archaeology Laboratory, Northern Arizona University, Flagstaff. Ms. on file Wupatki National Monument.

Breed, William J.
1989 Molten Rock and Trembling Earth: The Story of a Landscape Evolving. *Plateau*, Vol 49 No.2, pp. 2-13. Museum of Northern Arizona, Flagstaff.

1976 Molten Rock and Trembling Earth: The Story of a Landscape Evolving. *Plateau* Vol. 49 No 2.

Bremer, J. Michael
1987 *Settlement and Land Use in the Walnut Creek Drainage of North Central Arizona during the 12th and 13th Centuries*. Unpublished Masters Thesis. Department of Anthropology, Northern Arizona University, Flagstaff.

Brian, Nancy J.
1985 Historical Review of Water Flow and Riparian Vegetation at Walnut Canyon National Monument, Arizona. Ms on file Walnut Canyon National Monument. Report to the National Park Service, Southern Arizona Group, Phoenix, Arizona.

Brown, Gregory B. and Lisa Folb
1996 West Mesa and Walnut Canyon Burn Archeological Survey Report. Anthropology Laboratories Report No. 1169. Northern Arizona University. Report on file Wupatki National Monument.

Carothers, Steven and Nancy Goldberg
1976 Biology of Wupatki and Sunset Crater Volcano Region. *Plateau*, Vol. 4. N2 pp. 14-21.

Chambers, George
1976 Stabilization Report 1976, Sites NA407, NA404, and NA2922, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Chandler, Susan M. and Joan K. Gaunt
1986 The Structural Stabilization of Nine Prehistoric Ruins in Wupatki National Monument, Northeastern Arizona, Report of the 1985 Field Season. Report on file, Wupatki National Monument, Flagstaff.

Christensen, Paul K.
1982 *Hydrogeology of Sunset Crater Volcano and Wupatki National Monuments*. Unpublished Masters Thesis. Northern Arizona University, Flagstaff.

Chronic, H.
1952 Molluscan Fauna from the Permian Kaibab Formation, Walnut Canyon, Arizona. *Geological Society of America Bulletin 63(2)*: 95-166.

Cinnamon, Steven K.
1988 Scope of Work, Cyclical Maintenance Stabilization, August, 1988, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1988 *The Vegetation Community of Cedar Canyon, Wupatki National Monument as Influenced by Prehistoric and Historic Environmental Change*. Unpublished Masters Thesis. Northern Arizona University, Flagstaff.

1988 Wupatki Pueblo, South Unit, Room 49 Drainage. Report on file, Wupatki National Monument, Flagstaff.

1989 Kaibab House (WS136), Rubble Restoration, Addendum to Stabilization Report. Report on file, Wupatki National Monument, Flagstaff.

1989 Scope of Work, Preservation Work at Nalakihu Pueblo (NA358), Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1989 Stabilization Completion Report, Wupatki Ruin (NA405), Nalakihu (NA358), and NA2765B, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

n.d. Wupatki National Monument Stabilization Assessment, "Just Do It," Users Manual. Report on file, Wupatki National Monument, Flagstaff.

Clark, Arthur
1968 Vegetation on Archeological Sites Compared with Non-Site Locations at Walnut Canyon. *Plateau*, Vol. 30, 3 pp. 77-90.

Colton, Harold S.
1932a A Survey of Prehistoric Sites in the Region of Flagstaff, Arizona. Smithsonian Institution Bureau of American Ethnology Bulletin 104.

1946 The Sinagua: A Summary of the Archeology of the Region of Flagstaff, Arizona. Museum of Northern Arizona Bulletin 22.

1947 A Revised Date for Sunset Crater Volcano. *Geological Review*, Vol 37, 1 pp. 144.

1967 *The Basaltic Cinder Caves and Lava Flows of the San Francisco Mountains Volcanic Field.* Museum of Northern Arizona, Flagstaff. Ms on file Wupatki National Monument.

Colton, H. S., L.I. Hargrave, J.W. Brewer, Jr., Ten Broeck Williams, R. Van Valkenburgh, and J.C. Fisher Motz.

1933-34 Scientific Report on the Excavation of Wupatki: F-68 C.W.A. Work Project No. 10, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Cosner, O.J.

1962 Ground water in Wupatki and Sunset Crater Volcano National Monuments, Coconino County, Arizona: U.S. Geological Survey Water-Supply Paper 1475-J, p. J357-J374.

Cramer, John O.

1965 Evidences of Prehistoric Field Systems (Terraces) at Walnut Canyon National Monument. Ms on file, Walnut Canyon National Monument, Flagstaff.

Damron, T.M.

n.d. Key to the Reptiles of Walnut Canyon National Monument. Ms on file Walnut Canyon National Monument.

Darton, N.H.

1910 *Geology of the Walnut Canyon Region.* USGS, Washington D.C. Bulletin #435.

Davis, Anthony

1984b Stabilization Report, 1984, Lomaki Ruin (NA379), Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1984b Stabilization Report, 1984, Wupatki Ruin (NA405), Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Davis, K.

1985 Fire History of Ponderosa Pine Forest of Walnut Canyon National Monument. Report presented to Walnut Canyon National Monument, National Park Service, USDI, Arizona. Ms on file Walnut Canyon National Monument.

Despain, D.W. and J.C. Mosley

1990 Fire History and Stand Structure of a Pinyon-Juniper Woodland at Walnut Canyon National Monument, Arizona. Report presented to Southern Arizona Group, National Park Service, USDI, Phoenix, Arizona. p. 28. Ms on file Walnut Canyon National Monument.

Euler, Robert C.
1964 *An Archeological Survey of the South Rim of Walnut Canyon National Monument, Arizona*. Anthropological Papers No. 1 Arizona State College, Flagstaff.

Ezell, Paul
1940 Ruins Stabilization, Walnut Canyon National Monument. Western Archeological and Conservation Center, Tucson.

Fewkes, Jesse Walter
1900 *Pueblo Ruins near Flagstaff, Arizona*. American Anthropologist (n.s.), Vol.2, pp. 422-450. 1904 *Two Summers' Work in Pueblo Ruins*. Bureau of American Ethnology, 22nd Annual Report, Part I, pp. 17-195.

Firor, James L.
1991 Ruins Preservation of Ten Sites in Wupatki National Monument, Fiscal Year 1989. Report on file, Wupatki National Monument, Flagstaff.

Fischer, J.L.
1986 Microhabitat Selection by Small Mammals on the Basis of Temperature. Ms on file Northern Arizona University, Flagstaff.

Fowlie, J.
1965 *Snakes of Arizona*. Fallbrook, California. On file Wupatki National Monument.

Gilman, Patricia
1976 *Walnut Canyon National Monument: An Archeological Overview*. Western Archeological and Conservation Center Publications in Anthropology 4. Western Archeological and Conservation Center, National Park Service, Tucson.

Gilman, Patrician A. and Barrie Thornton
1976 Prestabilization Archaeology, 1976, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Hadleman, John
1969 Walnut Canyon: An Example of the Relationship Between Birds and Plant Communities. *Plateau*, pp. 164-167.

Hargrave, Lyndon Lane
1932 The Museum of Northern Arizona Archeological Expedition, 1932. Museum Notes, Museum of Northern Arizona 5 (5): 25-28.

1933 *The Museum of Northern Arizona Archaeological Expedition, 1933: Wupatki National Monument*. Museum Notes, Vol. 6, No. 5, pp. 23-26.

1935 Birds of Wupatki National Monument. *Fauna*. Ms on file Museum of Northern Arizona, Flagstaff.

Harper, Christopher L.
1995 Preservation Assessment of Mid-Country and Back-Country Archaeological Sites within Walnut Canyon National Monument. Northern Arizona University Archaeological Report No. 1147. Submitted to the National Park Service. Subagreement 1, Cooperative Agreement CA 7029-3-0006.

Hartman, Dana
1973 Final Report for Human Burial Salvage, Prehistoric Site NA12,512, Ariz. I:7:1 (MNA). Ms. on file at Wupatki National Monument.

Hawk, N.J.
1985 Birds of Wupatki and Sunset Crater Volcano National Monuments. Southwest Parks and Monuments Association. Ms on file Wupatki National Monument.

Healy, Mike G.
1982a Stabilization Records, Wupatki Ruin (NA405), Wupatki National Monument, May 1982 Report on file, Wupatki National Monument, Flagstaff.

1982b Stabilization Report, Wukoki Ruin (NA203), Wupatki National Monument, May 1982 Report on file, Wupatki National Monument, Flagstaff.

1982c Stabilization Records, Sites NA377 and 378 [Box Canyon], Wupatki National Monument, July 1982. Report on file, Wupatki National Monument.

Henderson, Larry
1988 Amendments to Scope of Work for Wupatki Pueblo Drainage Project. Memorandum to Regional Director from the Superintendent. Memorandum on file, Wupatki National Monument, Flagstaff.

Hoffmeister, D.F., and S.W. Carothers
1969 Mammals of Flagstaff, Arizona. *Plateau* 41(4):184-188.

Jenkins, Phillips, et. al.
1991 Vegetation Inventory, Classification, and Monitoring for Walnut Canyon. Report for U.S. Department of the Interior, National Park Service. Ms on file System Support Office, Santa Fe.

Joyce, J.F.
1974 *A Taxonomic and Ecological Analysis of the Flora of Walnut Canyon, Arizona.* Unpublished Masters Thesis. Northern Arizona University, Flagstaff.

King, Dale S.
1949 Nalakihu: Excavations at a Pueblo III Site on Wupatki National Monument, Arizona. *Museum of Northern Arizona Bulletin, No. 23.*

Lindsay, Alexander J., Jr.
1965 Preliminary Report on Excavations at Wupatki Ball Court, Wupatki National Monument, Arizona. Ms on file at Museum of Northern Arizona.

Matlock, Gary
1988 A Stabilization Assessment of Archaeological Sites at Wupatki National Monument. Draft report on file Wupatki National Monument.

Magee, Donald E. (compiler)
1971 Checklist of Birds: Sunset Crater Volcano National Monument. On file Sunset Crater Volcano National Monument.

Mayer, Martin T.
1965a Stabilization Report on the Wupatki Ballcourt (NA405), Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1965b Stabilization of Wupatki Blowhole, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

McCormack, Daniel C.
1989 *The Geology of Wupatki National Monument, Northern Arizona.* Unpublished Masters Thesis. Northern Arizona University, Flagstaff.

McGavock, E.H. and L.J. Mann
1974b Pumping Test Results, Walnut Canyon National Monument, Coconino County, Arizona. U.S. Geological Survey (Flagstaff Sub-district) Memorandum Report.

McGavock, E.H., T.W. Anderson, O. Moosburner, and L.J. Mann
1986 Water Resources of Southern Coconino County, Arizona. *Arizona Department of Water Resources, Bulletin 4.* Tucson, Arizona.

Metzger, Todd R.
1989 Ruins Preservation Bibliography. Ms on file Wupatki National Monument.

1989 Task Directive: Stabilization Activities in Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1989 Project Work Plan, Fiscal Year 1989, Wupatki National Monument, Stabilization of Eleven Prehistoric Sites. Report on file, Wupatki National Monument, Flagstaff.

Moosburner, O.
1970 A Proposed Streamflow-data Program for Arizona. U.S. Geological Survey Open-File Report 70-231.

Morgart, John T.
1994 Report on Ruins Preservation Activities: Flagstaff Area National Monuments. Ms on file, Wupatki National Monument.

1995 Report on Ruins Preservation Activities: Flagstaff Area National Monuments. Ms on file, Wupatki National Monument.

Neal, Lynn A.
1991 Pretreatment Documentation of Ten Sites at Wupatki National Monument, Arizona. Report prepared for the National Park Service, Southwest Cultural Resources Center, Division of Conservation, Santa Fe. Report on file, Wupatki National Monument, Flagstaff.

Nickens and Associates
1985 Technical Proposal, Request for Proposals 7029-5-08, Masonry Repair and Stabilization Work on Archaeological Prehistoric Ruins at Wupatki National Monument, Flagstaff, Arizona. Proposal on file, Wupatki National Monument, Flagstaff.

Phillips, B.G.
1990 Riparian Inventory of Walnut Canyon National Monument: Vegetation Map, Sampling Plots, Annotated Checklist. Southwestern Parks and Monuments Association, Tucson. Ms on file Walnut Canyon National Monument.

Powell, J.W. (ed.)
1887 Explorations in the Southwest, work of Mr. Stevenson. Fifth Annual Report of the Bureau of Ethnology.

Protiva, J.D.
1983a Long Lintel House (NA635), and NA633/WS1027, September 1983. Report on file, Wupatki National Monument, Flagstaff.

1983b Campground Ruin (NA2222/WS1494), Maintenance Stabilization, July 1983. Report on file, Wupatki National Monument, Flagstaff.

1983c Kaibab House Ruin (NA342/WS136), Maintenance Stabilization, June 1983. Report on file, Wupatki National Monument, Flagstaff.

1983d Citadel Ruin (NA255), Maintenance Stabilization, July 1983. Report on file, Wupatki National Monument, Flagstaff.

1985 Maintenance Stabilization, Completion Report of Summer 1985: Wukoki Ruin (NA203) Access Trail, Lomaki Ruin (NA379), and Wupatki Ruin (NA405). Report on file, Wupatki National Monument, Flagstaff.

1986 Stabilization Report, 1986, Wukoki Ruin (NA203), Wupatki Ruin (NA405), Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1987 Wukoki Ruin (NA203) Stabilization, Summer of 1987. Report on file, Wupatki National Monument, Flagstaff.

1988 Wupatki ruin (NA405) Stabilization, 1987 Report on file, Wupatki National Monument, Flagstaff.

Reed, Erik K., and James W. Brewer

1937 The Excavation of Room 7, Wupatki Pueblo. Southwestern Monuments Monthly Report, Random Paper, March 1938. Report on file, Wupatki National Monument.

Richert, Roland

1953 Stabilization Records for Nalakihu Ruin, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1953 Stabilization Report, Wupatki National Monument, Drainage Project, 1953. Report on file, Wupatki National Monument, Flagstaff.

1954a Lomaki Ruin, Wupatki National Monument, Records for Comprehensive Stabilization. Report on file, Wupatki National Monument, Flagstaff.

1954b Wukoki, Stabilization Records, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1954c Ruins Stabilization Report, The Citadel Ruin, Wupatki National Monument, Coconino County, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1956 Stabilization Records, Wupatki National Monument, Sites NA377, and 378. Report on file, Wupatki National Monument, Flagstaff.

1958 Stabilization Records, Walnut Canyon National Monument. Western Archeological and Conservation Center, Tucson.

n.d. Excavation of 18 Rooms in Wupatki Ruin, 1952. Draft manuscript on file, Wupatki National Monument, Flagstaff.

Rixey, Raymond
n.d. Archeological Materials from Walnut Canyon National Monument, Arizona. Western Archeological and ConservationCenter, Tucson.

1948b Summary of Archeological Materials from Stabilization Work in Walnut Canyon National Monument. Western Archeological and Conservation Center, Tucson.

1948c Walnut Canyon National Monument Stabilization. Western Archeological and Conservation Center, Tucson.

Rixey, Raymond and Charles B. Voll
1962 Archeological Materials from Walnut Canyon Cliff Dwellings. Plateau 34 (3): 85-96.

Roeske, R.H.
1978 Methods for Estimating the Magnitude and Frequency of .Floods in Arizona. Arizona Department of Transportation. Phoenix, Arizona.

Salomonson, Michael
n.d. Black-chinned Sparrow Nesting of Walnut Canyon National Monument. Ms on file Walnut Canyon National Monument.

n.d. The Mammals of Walnut Canyon National Monument. Ms on file Northern Arizona University.

Schley, Robert A.
1962 *Excavation of the Wupatki Blowhole Site, NA7824.* The Rand Corporation, Memorandum RM-32-36-RC.

Schroeder, Albert H.
1941 Report of the Ruins Stabilization Project at Wupatki National Monument, October 13 - December 22, 1941. Report on file, Wupatki National Monument, Flagstaff.

Schurig, Rudolph G.
1971 Soil Survey Wupatki National Monument, Arizona. In *Soil Survey and Range Site and Condition Inventory.* Report Prepared by U.S. Department of Agriculture, Soil Conservation Service. Ms. on file Wupatki National Monument.

Schwartz, S., and Gary Bateman
1978 Studies of Selected Mammalian Population. In Natural Resource Survey and Analysis of Sunset Crater Volcano and Wupatki National Monuments. Final Report Phase II. Ms on file Wupatki National Monument.

Shiner, Joel L.
1961 Stabilization of Ten Ruins in Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Sitgreaves, Lorenzo
1853 Report of an Expedition Down the Zuni and Colorado Rivers. Senate Executive Documents, No. 59.

Smiley, Terah L.
1958 The Geology and Dating of Sunset Crater Volcano, Flagstaff Arizona. In *Guidebook of the Black Mesa Basin, N.E. Arizona*, 9th Field Conference, pp. 186-190.

Smith, Watson
1952 Excavation in Big Hawk Valley, Wupatki National Monument, Arizona. *Museum of Northern Arizona Bulletin, No. 24.*

Spangle, Paul and Elsie Spangle
1954 Birds of Walnut Canyon. Southwestern Museum Association, Globe, Arizona. Ms on file Walnut Canyon National Monument.

Stanislawski, Michael B.
1963 *Wupatki Pueblo: A Study in Cultural Fusion and Change in Sinagua and Hopi Prehistory*. Unpublished Ph.D. dissertation, University of Arizona.

Tengquist, Don
1995 Personal Communication, Walnut Canyon National Monument.

Trott, James J.
1978a Initial Stabilization of the Heiser Pithouse Site, NA1754, After Re-Excavation, Wupatki National Monument. Report on file, Wupatki National Monument.

1978b Initial Stabilization of NA632, 754, 755, and 794-796, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

1978c Field Notes, Ruins Stabilization Activities for the 1978 Field Season. Notes on file, Wupatki National Monument, Flagstaff.

1981 Maintenance Stabilization of Wupatki Pueblo, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

Trott, Jim and Barry Sulam
1987 Scope of Work, Preservation Work at Wupatki Pueblo, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1988 Scope of Work, Preservation Work at Wupatki Pueblo (NA405), Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

U.S. Department of the Interior, National Park Service

1953a Stabilization Report, Wupatki National Monument, 1952. Ms on file at Wupatki National Monument.

1988 *NPS Management Policies*. On file, Flagstaff Area National Monuments.

1994 *Statement for Management: The Flagstaff Areas, Wupatki, Sunset Crater Volcano and Walnut Canyon National Monuments*. Ms on file, Flagstaff Area National Monuments.

n.d. Oh Say Can You See . . . An Air Quality Interpretive Pamphlet. Ms on file Walnut Canyon National Monument.

Van Valkenburgh, Sallie P.

1958 Archeological Site Survey, North Rim, Walnut Canyon National Monument. Ms on file, Wupatki National Monument.

Vandiver, V.W.

1936 Geological Report on Walnut Canyon, Arizona. Western Archeological and Conservation Center Archives and Library. p. 16

Vaughan, Terry

1976 Mammals of Sunset Crater Volcano and Wupatki National Monument. In Natural Resource Survey and Analysis of Sunset Crater and Wupatki National Monuments. Report prepared by Northern Arizona University, Contract No. 950134. Ms on file Wupatki National Monument.

Vivian, Gordon and Roland Richert

1953 Comprehensive Stabilization of Wupatki Ruin, Wupatki National Monument, 1952. Report on file, Wupatki National Monument, Flagstaff.

Voll, Charles B.

1965 Stabilization Records for NA202, NA756, and NA2765b, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Voll, Charles B. and Martin Mayer

1964a Maintenance Stabilization, Nalakihu Ruin, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1964b Stabilization Report, 1964, Wupatki Ruin, NA405, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1964c Maintenance Stabilization, Lomoki Ruin, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1964d Stabilization Report, 1964, Crack-in-Rock Ruin, NA537, Wupatki National Monument, Arizona. Report on file, Wupatki National Monument, Flagstaff.

1965 Stabilization of Antelope House, NA625, Wupatki National Monument. Report on file, Wupatki National Monument, Flagstaff.

Ward, Albert E.
1976 *Sinagua Farmers Before the "Black Sand" Fell: An Example from Wupatki National Monument*. Paper Presented at the Field House-Small Site Symposium, Tucson, April 23. Ms on file Museum of Northern Arizona.

Welton, Robert
1986 Wall Investigation, East Wall of Room 41, Wupatki Ruin. Report on file, Wupatki National Monument, Flagstaff.

Williamson, A. Ten Broeck
1933 NA2765 Site File. Ms on file at Museum of Northern Arizona .

Wupatki Collection
n.d. Field notes, reports and accessions inventory from original Wupatki excavation. Ms on file at Museum of Northern Arizona.

Yacoub, Dianne
1988 The Camelthorn Challenge. Ms on file Wupatki National Monument.

V. APPENDICES

Appendix A: Wupatki National Monument Baseline Resource Information

WUPATKI NATIONAL MONUMENT
SUMMARY TABLE OF NATURAL RESOURCES BASELINE INFORMATION

Meets, does not meet, or exceeds the
recommended minimal set of natural resources information
in Appendix A of NPS-75, the *Natural Resources Inventory and Monitoring Guideline*

INVENTORY COMPONENTS	MEETS	DOES NOT MEET	EXCEEDS
Historical Data Base		X	
Species Information		X	
Species List		X	
Biologic Surveys (Species Field Inventories)		X	
Species Distribution		X	
Vegetation Maps		X	
Cartographic Maps		X	
Soils Map		X	
Geology Map		X	
Water Resources Inventory		X	
Water Quality Data		X	
Air Quality Stations		X	
Air Quality Data		X	
Precip./Meteorological Data	X		

**New inventory components not listed in NPS-75 should be added to the table as necessary to meet individual park needs.

For a description of the inventory components see NPS-75, Appendix A.

WUPATKI NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

Place an X in the appropriate column. Leave columns blank if document is not required for the park. Remember that items in the first section, PLANNING DOCUMENTS, may also apply to natural resources. See NPS-28, Chapter 2 for description of each inventory or study.

TITLE WUPATKI NATIONAL MONUMENT	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization			
Statement of Management (SFM)	X		
Outline of Planning Requirements (OPR)			
General Management Plan (GMP)			X
Development Concept Plan (DCP)			X
Resources Management Plan (RMP)		X	
Interpretive Prospectus (IP)	1995		
SERVICEWIDE INVENTORIES, LIST, CATALOGS AND REGISTERS			
Cultural Resources Bibliography (CRBIB)		X	
Cultural Sites Inventory (CSI)		X	
List of Classified Structures (LCS)		X	
National Catalog of Museum Objects		X	
National Register of Historic Places	X (1)		
BASIC CULTURAL RESOURCE DOCUMENTS			
Archeological Overview and Assessment		X	
Archeological Identification Studies			
Archeological Evaluation Studies			

(1) DRAFT 1996

FLAG RMP

WUPATKI NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
BASIC CULTURAL RESOURCE DOCUMENTS (cont.)			
Ethnographic Overview & Assessment		X(1)	
Ethnographic Oral Histories & Life Histories			X
Ethnographic Program			X
Historical Base Map	X		
Park Administrative History		X	
Scope of Collection Statement		X	
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological & Ethno. Collections Studies			X
Archeological Data Recovery Studies			X
Collection Management Plan		X	
Collection Storage Plan			X
Collection Condition Survey		X	
Cultural Landscape Report (CLR)			X
Ethnohistory			X
Exhibit Plan	X		
Historic Furnishing Report	N/A	N/A	N/A
Historic Structure Preservation Guide (HSPG)		X	
Historic Structure Report			X
Social Impact Study			X
Special History Study			X
Traditional Use Study			X

WUPATKI NATIONAL MONUMENT
SUMMARY CHART FOR ARCHEOLOGICAL SITES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	2668	2575	93					93	2575		93	2575	
State & Regional													
Local													
Not Evaluated													
TOTALS	2668	2575	93					93	2575		93	2575	

2668 SITES ON SURVEY
93 SITES ON 1986 LCS

WUPATKI NATIONAL MONUMENT
SUMMARY CHART FOR STRUCTURES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	2		2					2				2	
State & Regional													
Local													
Not Evaluated													
TOTALS	2		2					2				2	

HISTORIC BUILDING #1
VISITOR CENTER LIBRARY WING

WUPATKI NATIONAL MONUMENT
SUMMARY CHART FOR OBJECTS

DOCUMENTATION Form 10254 Submitted to National Catalog at Harper's Ferry	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology	TOTALS
Registration Data Only			218			30		405
Registration & Catalog Data	108,677	4		7899				116,576
Total Items Cataloged	108,677			7899				116,580
Backlog to be Cataloged	523		218	12,052	182	30		13,005
Total Collection Summary	109,200	4	218	19,951	182	30		129,585

CONDITION The percentage of collection in the following categories:	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology
Excellent							
Good	90%	100%	95%	40%	85%	100%	
Fair	7%		3%				
Poor	3%		2%		15%		
Unknown				60%			

WUPATKI NATIONAL MONUMENT
SUMMARY CHART FOR CULTURAL LANDSCAPES

Significance	CONDITION				IMPACTS				DOCUMENTATION		
	Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National											
State & Regional											
Local											
Not Evaluated				X				X			X
TOTALS											

WUPATKI NATIONAL MONUMENT
SUMMARY CHART FOR ETHNOGRAPHIC RESOURCES

NUMBER	DOCUMENTATION LEVEL				NATIONAL REGISTER	AUTHORITY	NON-RECREATIONAL USE
	good	fair	poor	unknown			
SITES				X			
STRUCTURES							
OBJECTS		X					
NATURAL RESOURCES				X			
ETHNOGRAPHIC LANDSCAPES				X			

Appendix B Sunset Crater Volcano National Monument Baseline Resource Information

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY TABLE OF NATURAL RESOURCES BASELINE INFORMATION

Meets, does not meet, or exceeds the
recommended minimal set of natural resources information
in Appendix A of NPS-75, the *Natural Resources Inventory and Monitoring Guideline*

INVENTORY COMPONENTS	MEETS	DOES NOT MEET	EXCEEDS
Historical Data Base		X	
Species Information		X	
Species List		X	
Biologic Surveys (Species Field Inventories)		X	
Species Distribution		X	
Vegetation Maps		X	
Cartographic Maps	X		
Soils Map		X	
Geology Map		X	
Water Resources Inventory	X		
Water Quality Data	X		
Air Quality Stations		X	
Air Quality Data		X	
Precip./Meteorological Data	X		

**New inventory components not listed in NPS-75 should be added to the table as necessary to meet individual park needs.

For a description of the inventory components see NPS-75, Appendix A.

SUNSET CRATER VOLCANO NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

Place an X in the appropriate column. Leave columns blank if document is not required for the park. Remember that items in the first section, PLANNING DOCUMENTS, may also apply to natural resources. See NPS-28, Chapter 2 for description of each inventory or study.

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization			
Statement of Management (SFM)	DRAFT		
Outline of Planning Requirements (OPR)			
General Management Plan (GMP)			X
Development Concept Plan (DCP)			
Resources Management Plan (RMP)		X	
Interpretive Prospectus (IP)			X
SERVICEWIDE INVENTORIES, LIST, CATALOGS AND REGISTERS			
Cultural Resources Bibliography (CRBIB)			X
Cultural Sites Inventory (CSI)			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

SUNSET CRATER VOLCANO NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
BASIC CULTURAL RESOURCE DOCUMENTS (cont.)			
Ethnographic Overview & Assessment	DRAFT		
Ethnographic Oral Histories & Life Histories			X
Ethnographic Program			X
Historical Base Map			X
Park Administrative History		X	
Scope of Collection Statement		X	
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological & Ethno. Collections Studies			X
Archeological Data Recovery Studies			X
Collection Management Plan		X	
Collection Storage Plan			X
Collection Condition Survey		X	
Cultural Landscape Report (CLR)			X
Ethnohistory			X
Exhibit Plan			X
Historic Furnishing Report			
Historic Structure Preservation Guide (HSPG)			X
Historic Structure Report			
Social Impact Study			X
Special History Study			X
Traditional Use Study			X

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY CHART FOR ARCHEOLOGICAL SITES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National													
State & Regional													
Local													
Not Evaluated													
TOTALS													

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY CHART FOR STRUCTURES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National													
State & Regional													
Local													
Not Evaluated													
TOTALS													

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY CHART FOR OBJECTS

DOCUMENTATION Form 10254 Submitted to National Catalog at Harper's Ferry	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology	TOTALS
Registration Data Only								
Registration & Catalog Data	207							207
Total Items Cataloged	207							207
Backlog to be Cataloged	37		220	201				458
Total Collection Summary	244		220	201				665

CONDITION The percentage of collection in the following categories:	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology
Excellent							
Good	100%						
Fair							
Poor							
Unknown			100%	100%			

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY CHART FOR CULTURAL LANDSCAPES

Significance		CONDITION				IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State & Regional												
Local												
Not Evaluated					X				X			X
TOTALS												

SUNSET CRATER VOLCANO NATIONAL MONUMENT
SUMMARY CHART FOR ETHNOGRAPHIC RESOURCES

NUMBER	DOCUMENTATION LEVEL				NATIONAL REGISTER	AUTHORITY	NON-RECREATIONAL USE
	good	fair	poor	unknown			
SITES				X			
STRUCTURES							
OBJECTS			X				
NATURAL RESOURCES				X			
ETHNOGRAPHIC LANDSCAPES				X			

Appendix C : Walnut Canyon National Monument Baseline Resource Information

WALNUT CANYON NATIONAL MONUMENT
SUMMARY TABLE OF NATURAL RESOURCES BASELINE INFORMATION

Meets, does not meet, or exceeds the
recommended minimal set of natural resources information
in Appendix A of NPS-75, the *Natural Resources Inventory and Monitoring Guideline*

INVENTORY COMPONENTS	MEETS	DOES NOT MEET	EXCEEDS
Historical Data Base		X	
Species Information		X	
Species List		X	
Biologic Surveys (Species Field Inventories)		X	
Species Distribution		X	
Vegetation Maps		X	
Cartographic Maps	X		
Soils Map		X	
Geology Map		X	
Water Resources Inventory		X	
Water Quality Data		X	
Air Quality Stations		X	
Air Quality Data		X	
Precip./Meteorological Data	X		

**New inventory components not listed in NPS-75 should be added to the table as necessary to meet individual park needs.

For a description of the inventory components see NPS-75, Appendix A.

WALNUT CANYON NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

Place an X in the appropriate column. Leave columns blank if document is not required for the park. Remember that items in the first section, PLANNING DOCUMENTS, may also apply to natural resources. See NPS-28, Chapter 2 for description of each inventory or study.

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization			
Statement of Management (SFM)	X		
Outline of Planning Requirements (OPR)			
General Management Plan (GMP)			X
Development Concept Plan (DCP)			
Resources Management Plan (RMP)		X	
Interpretive Prospectus (IP)	DRAFT		
SERVICEWIDE INVENTORIES, LIST, CATALOGS AND REGISTERS			
Cultural Resources Bibliography (CRBIB)		X	
Cultural Sites Inventory (CSI)		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

WALNUT CANYON NATIONAL MONUMENT
CULTURAL RESOURCE DOCUMENTATION CHECKLIST

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
BASIC CULTURAL RESOURCE DOCUMENTS (cont.)			
Ethnographic Overview & Assessment			X
Ethnographic Oral Histories & Life Histories			X
Ethnographic Program			X
Historical Base Map		X	
Park Administrative History		X	
Scope of Collection Statement		X	
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological & Ethno. Collections Studies			X
Archeological Data Recovery Studies			X
Collection Management Plan		X	
Collection Storage Plan			X
Collection Condition Survey		X	
Cultural Landscape Report (CLR)			X
Ethnohistory			X
Exhibit Plan	DRAFT		
Historic Furnishing Report			
Historic Structure Preservation Guide (HSPG)		X	
Historic Structure Report			X
Social Impact Study			X
Special History Study			X
Traditional Use Study			X

WALNUT CANYON NATIONAL MONUMENT
SUMMARY CHART FOR ARCHEOLOGICAL SITES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	251	201	30	20			20	30	201		97	154	
State & Regional													
Local													
Not Evaluated													
TOTALS	251	201	30	20			20	30	201		97	154	

56 PREHISTORIC SITES ON 1976 LCS
89 SITES ASSESSED IN 1994, 20 POOR, 30 FAIR CONDITION
6 ISLAND TRAIL AND RIM SITES
97 LCS UPDATE 1994

WALNUT CANYON NATIONAL MONUMENT
SUMMARY CHART FOR STRUCTURES

Significance		CONDITION					IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	4	2		2			2	2				4	
State & Regional													
Local													
Not Evaluated													
TOTALS	4	2		2			2	2				4	

2 FENCE AND CABIN, POOR CONDITION
2 RESIDENCES

WALNUT CANYON NATIONAL MONUMENT
SUMMARY CHART FOR OBJECTS

DOCUMENTATION Form 10254 Submitted to National Catalog at Harper's Ferry	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology	TOTALS
Registration Data Only								
Registration & Catalog Data	5332							5332
Total Items Cataloged	5332							5332
Backlog to be Cataloged	1819			9958				11,777
Total Collection Summary	7151			9958				17,109

CONDITION The percentage of collection in the following categories:	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology
Excellent							
Good	97%						
Fair	3%						
Poor							
Unknown				100%			

WALNUT CANYON NATIONAL MONUMENT
SUMMARY CHART FOR CULTURAL LANDSCAPES

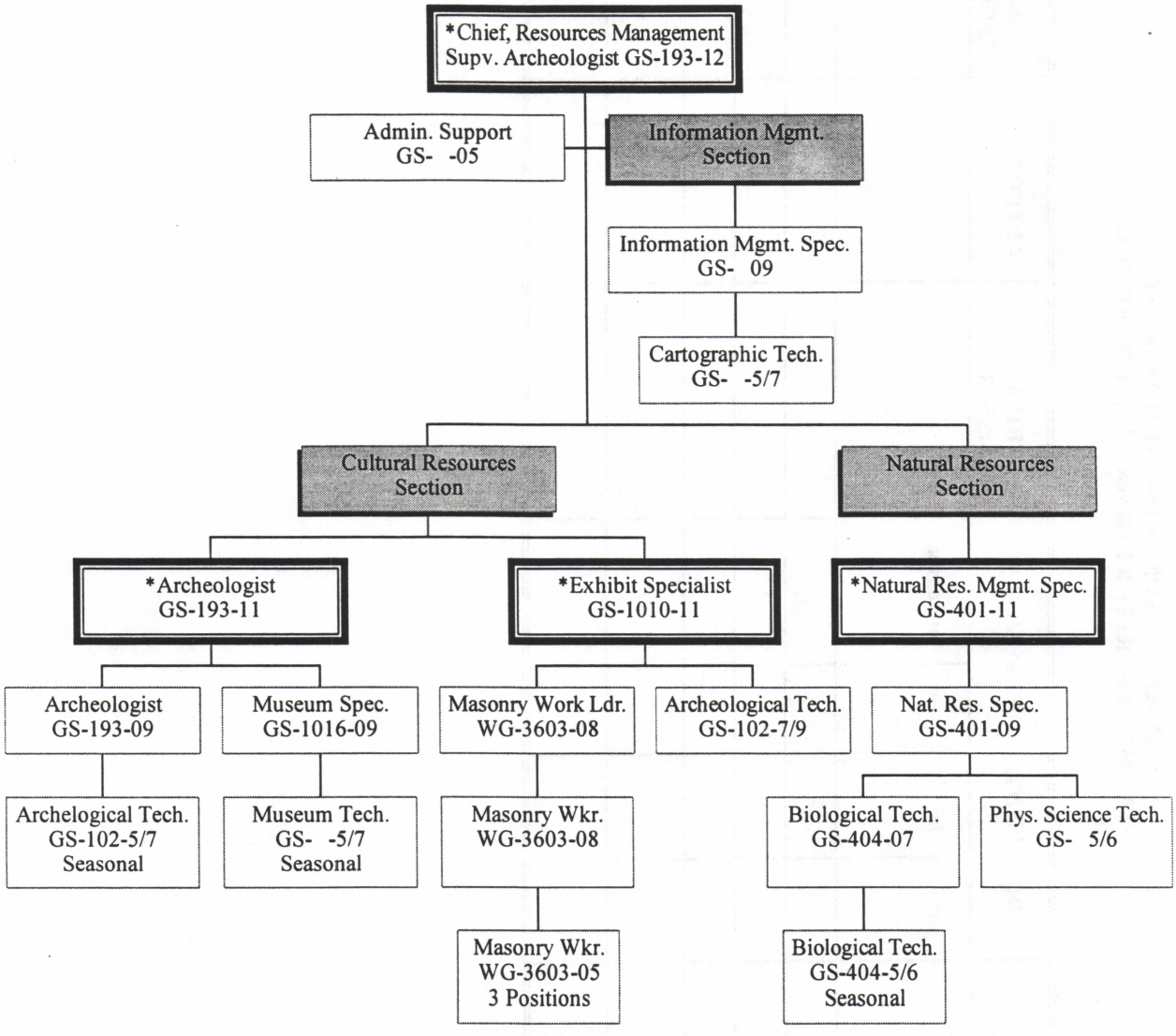
Significance		CONDITION				IMPACTS				DOCUMENTATION		
		Good	Fair	Poor	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State & Regional												
Local												
Not Evaluated					X				X			X
TOTALS												

WALNUT CANYON NATIONAL MONUMENT
SUMMARY CHART FOR ETHNOGRAPHIC RESOURCES

NUMBER	DOCUMENTATION LEVEL				NATIONAL REGISTER	AUTHORITY	NON-RECREATIONAL USE
	good	fair	poor	unknown			
SITES				X			
STRUCTURES							
OBJECTS		X					
NATURAL RESOURCES				X			
ETHNOGRAPHIC LANDSCAPES				X			

Appendix D: Resource Management Division Organizational Chart including immediate staffing needs.

Proposed Resources Management Division Staffing



* indicates existing positions

Appendix E. Resource Management Project Statements

Active Filter: (No filter)

Output Selections:
Sorted by: Resource Type + Project Number + Priority
Years: All years
Show subtotal after change in Resource Type
Show grand total

PRIORITY	PROJECT NUMBER	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED	PROP YEAR	LAST UPDATE
999	FLAG-C-010.001	ARCHEOLOGICAL TESTING	WUPA	0.00	180.00	1994	07/31/96
1	FLAG-C-010.002	PREPARE CULTURAL LANDSCAPE INVENTORY	ALL PARKS	0.00	45.00	1996	09/26/96
1	FLAG-C-010.003	CONDUCT ARCHEOLOGICAL SURVEY	SUCR	0.00	42.00	1994	09/11/96
999	FLAG-C-010.004	STUDY OF HUMAN REMAINS(BURIALS)	WACA/WUPA	0.00	28.00	1994	07/31/96
1	FLAG-C-010.005	CONDUCT ARCHITECTURAL DOCUMENTATION PROGRAM	WUPA/WACA	0.00	75.00	1995	09/11/96
0	FLAG-C-010.006	PREHISTORIC WATER AND LAND USE	WACA	5.00	0.00	1994	07/31/96
999	FLAG-C-010.007	ASSESS RELATIONSHIP OF SINAGUA WITH THEIR ENVIR	ALL PARKS	0.00	50.00	1995	09/26/96
999	FLAG-C-010.008	UPDATE ARCHEOLOGICAL OVERVIEW AND ASSESSMENT	WUPA/WACA	0.00	50.00	1995	09/26/96
999	FLAG-C-010.009	UPDATE/CORRECT THE CULTURAL RESOURCES BIBLIOGRA	ALL PARKS	0.00	35.00	1995	09/26/96
5	FLAG-C-010.010	CONDUCT HISTORIC RESOURCE STUDY	ALL PARKS	0.00	50.00	1996	09/26/96
1	FLAG-C-010.011	CONDUCT ETHNOGRAPHIC OVERVIEW AND ASSESSMENT	ALL PARKS	0.00	60.00	1996	09/11/96
14	FLAG-C-010.012	COND. ORAL INTERVIEWS OF PEOPLE W/HIST. KNOWLED	ALL PARKS	0.00	40.00	1996	09/26/96
5	FLAG-C-010.013	PREPARE ADMINISTRATIVE HISTORY	ALL PARKS	0.00	53.00	1996	09/26/96
999	FLAG-C-010.014	COMPILE AND MAINT. COMPREHENSIVE PHOTOGRAPHIC	ALL PARKS	0.00	36.00	1996	09/26/96
2	FLAG-C-010.015	DEVELOP PARK/TRIBES MEMORANDUMS OF AGREEMENTS	ALL PARKS	0.00	6.00	1996	09/11/96
3	FLAG-C-010.016	CONDUCT TREE-RING STUDY	WACA	0.00	5.50	1996	09/11/96
4	FLAG-C-010.017	DIGITIZE PRESERVATION TREATMENT PHOTOGRAPHS	ALL PARKS	0.00	5.60	1996	09/11/96
2	FLAG-C-010.018	DIGITIZE ARCHEOLOGICAL SITE DATA	ALL PARKS	0.00	31.00	1996	09/12/96
999	FLAG-C-020.001	MUSEUM COLLECTIONS MANAGEMENT	ALL PARKS	15.00	37.00	1994	09/26/96
11	FLAG-C-020.002	CONDUCT CONSERVATION TREATMENT	WUPA/WACA	0.00	15.00	1996	07/31/96
13	FLAG-C-020.003	UPGRADE MUSEUM STORAGE	WUPA/WACA	0.00	6.00	1996	07/31/96
9	FLAG-C-020.004	TRANSFER NITRATE NEGATIVES TO STABLE MEDIUM	ALL PARKS	0.00	1.00	1996	09/26/96
1	FLAG-C-020.005	CATALOG ARCHIVES AT NON-NPS REPOSITORY (MNA)	ALL PARKS	0.00	8.00	1996	09/11/96
2	FLAG-C-020.006	IMPROVE EXHIBIT SECURITY SYSTEMS	ALL PARKS	0.00	50.00	1996	09/13/96
3	FLAG-C-020.007	INSTALL TEMPORARY INSULATED MODULAR STORAGE UNI	ALL PARKS	0.00	70.00	1996	09/26/96
6	FLAG-C-020.008	CONDUCT EXHIBIT MAINTENANCE	ALL PARKS	0.00	50.00	1996	09/12/96
999	FLAG-C-020.009	PROVIDE RESOURCE TO MANAGE PARK MUSEUM COLLECTI	ALL PARKS	0.00	61.00	1996	09/26/96
1	FLAG-C-020.010	COMPLETE COLLECTION STORAGE PLAN	ALL PARKS	0.00	15.00	1996	09/11/96
999	FLAG-C-020.011	CURATORIAL TRAINING	ALL PARKS	0.00	1.00	1996	09/26/96
999	FLAG-C-020.012	CONDUCT COLLECTION CONDITION SURVEY	ALL PARKS	0.00	11.00	1996	09/26/96
999	FLAG-C-020.013	MUSEUM OBJECT/SPECIMEN RESEARCH	ALL PARKS	0.00	11.00	1996	09/26/96
999	FLAG-C-020.014	SURVEY FOR MUSEUM COLLECTIONS	ALL PARKS	0.00	12.00	1996	09/26/96
999	FLAG-C-020.015	MANAGE/UPGRADE ANCS MUSEUM DATABASE	ALL PARKS	0.00	21.00	1996	09/26/96
999	FLAG-C-020.016	PHOTOGRAPH MUSEUM COLLECTION	ALL PARKS	0.00	22.00	1996	09/26/96
999	FLAG-C-020.017	CONDUCT APPRAISAL OF MUSEUM PROPERTY	ALL PARKS	0.00	16.00	1996	09/26/96
999	FLAG-C-020.018	CONSTRUCT NEW MUSEUM STORAGE	ALL PARKS	0.00	1035.00	1996	09/26/96
999	FLAG-C-020.019	CONTROL MUSEUM ENVIRONMENT	ALL PARKS	0.00	7.00	1996	09/26/96
999	FLAG-C-020.020	ASSESS AND CATALOG PARK ARCHIVAL HOLDINGS	ALL PARKS	10.00	11.00	1996	09/26/96
999	FLAG-C-020.021	CONDUCT RESEARCH IN LOCAL/REGIONAL/NAT'L ARCHI	ALL PARKS	0.00	15.00	1996	09/26/96
999	FLAG-C-020.022	CATALOG BACKLOG OF PARK COLLECTIONS IN REPOSITO	ALL PARKS	0.00	12.00	1996	09/26/96
999	FLAG-C-020.023	UPGRADE MUSEUM PROPERTY ACCOUNTABILITY	WUPA/WACA	0.00	60.00	1996	07/31/96
2	FLAG-C-020.024	BACKLOG CATALOG DENDROCHRONOLOGICAL SAMPLES	WUPA/WACA	0.00	1.52	1996	09/11/96
999	FLAG-C-020.025	UPDATE SCOPE OF COLLECTION STATEMENTS	ALL PARKS	0.00	0.00	1996	09/26/96
1	FLAG-C-020.026	CONDUCT CULTURAL AFFILIATION STUDY	ALL PARKS	0.00	20.00	1996	09/11/96
3	FLAG-C-020.027	ARCHIVE MAPS	ALL PARKS	0.00	7.00	1996	09/12/96
999	FLAG-C-030.002	DEVELOP RUINS PRESERVATION GUIDES	WACA/WUPA	0.00	35.00	1994	06/21/96
1	FLAG-C-030.003	CONDUCT EMERGENCY RUINS PRESERVATION	WACA/WUPA	75.00	550.00	1994	09/26/96
999	FLAG-C-030.004	CONDUCT STABILIZATION OF BALLCOURT DRAINAGE	WUPA	0.00	30.00	1994	06/21/96
8	FLAG-C-030.005	CONDUCT COMPREHENSIVE STAB. RANGER CABIN	WACA	0.00	100.00	1994	06/21/96
15	FLAG-C-030.006	STABILIZE FIVE HIST. NAVAJO SITES	WUPA	0.00	50.00	1994	06/21/96
12	FLAG-C-030.007	DEVELOP HISTORIC STRUCTURES PRESERVATION GUIDE	WACA/WUPA	0.00	35.00	1994	07/31/96
999	FLAG-C-030.008	MAINTAIN AND STABILIZE PREHISTORIC RUINS	WUPA/WACA	0.00	0.00	1995	09/26/96
999	FLAG-C-030.009	ASSESS IMPORTANCE OF TWO RECENT HIST. STRUCTURE	WACA	0.00	0.00	1995	09/26/96
999	FLAG-C-030.010	RECONSTRUCT HISTORIC SPLIT-RAIL BOUNDARY FENCE	WACA	0.00	0.00	1995	09/26/96
999	FLAG-C-040.001	PROVIDE RESOURCES TO MANAGE PARK LIBRARY COLLEC	ALL PARKS	0.00	0.00	1996	09/26/96
999	FLAG-C-040.002	UPGRADE LIBRARY/ARCHIVAL PROPERTY	ALL PARKS	0.00	10.00	1996	09/26/96
999	FLAG-C-040.003	UPGRADE LIBRARY STORAGE	ALL PARKS	0.00	6.00	1996	09/26/96
999	FLAG-C-040.004	UPDATE LIBRARY OPERATING POLICY	ALL PARKS	0.00	5.00	1996	09/26/96
Resource Type Sub-total				105.00	3188.62		
999	FLAG-I-001.001	CONDUCT VISITOR IMPACT STUDY	ALL AREAS	0.00	40.00	1994	08/02/96
999	FLAG-I-001.007	EVALUATE FIRE EFFECTS	WACA	0.00	0.00	1995	09/24/96

continued...

PRIORITY	PROJECT NUMBER	PROJECT TITLE	SUB-TITLE	FUNDED	UNFUNDED	PROP YEAR	LAST UPDATE
999	FLAG-I-001.009	CONDUCT A COMPREHENSIVE FIRE MANAGEMENT PROGRAM	ALL PARKS	0.00	0.00	1995	09/24/
999	FLAG-I-001.010	ADMINISTER CURRENT NATURAL AND CULTURAL RESOURC	ALL PARKS	105.00	250.00	1995	09/2
999	FLAG-I-001.011	EVALUATE AND PROTECT SNAGS AND LOGS	WACA	0.00	0.00	1995	09/24/
999	FLAG-I-002.001	ESTABLISH GEOGRAPHIC INFORMATION SYSTEM	ALL PARKS	0.00	35.00	1995	09/24/96
999	FLAG-I-003.001	DETERMINE VISITOR IMPACTS AND USE LIMITS	WACA	0.00	0.00	1995	09/24/96
999	FLAG-I-004.001	ACQUIRE AND COMPILE COMPREHENSICE PHOTO. DOC.	WACA	0.00	0.00	1995	09/24/96
999	FLAG-I-005.001	IMPLEMENT INTEGRATED PEST MANAGEMENT PROGRAM	ALL PARKS	0.00	0.00	1996	09/24/96
999	FLAG-I-009.001	RE-EVALUATE VISITOR USE SURVEY	WACA	0.00	0.00	1995	09/24/96
999	FLAG-I-010.001	ADMINISTER NHPA AND NEPA COMPLIANCE PROGRAM	ALL PARKS	0.00	0.00	1996	09/24/96
999	FLAG-I-010.002	COORD. W\ ADJ. LAND USES TO PROTECT SENS. RESOU	WACA	0.00	0.00	1995	09/24/96
10	FLAG-I-021.001	RELOCATE SEWAGE LAGOONS AND REHAB FORMER SITES	WUPA	0.00	1500.00	1996	06/21/96
1	FLAG-I-030.010	REPAIR, REHAB. HISTORIC SPLIT-RAIL BOUNDARY FEN	WACA	0.00	48.40	1995	09/18/96
999	FLAG-I-030.011	RETROFIT, MAINTAIN, AND PATROL BOUNDARY FENCE	WACA	0.00	0.00	1995	09/24/96
999	FLAG-I-030.012	SURVEY AND FENCE EAST BOUNDARY TO DETER EXT. TH	WACA	0.00	0.00	1995	09/24/96
999	FLAG-I-040.001	VISITOR USE SURVEY	ALL PARKS	0.00	0.00	1996	09/24/96
Resource Type Sub-total----------				105.00	1873.40		
8	FLAG-N-001.001	CONDUCT MINIMUM LEVEL FIRE MGMT PROGRAM	ALL PARKS	36.00	88.00	1994	09/24/96
5	FLAG-N-001.002	DEVELOP FIRE MANAGEMENT PLAN	SUCR/WUPA	0.00	9.00	1996	09/26/96
4	FLAG-N-010.010	CONDUCT INV., ASSESSMENT OF EXOTIC PLANTS	ALL PARKS	0.00	60.00	1996	09/24/96
2	FLAG-N-010.011	CONTROL TAMARISK ALONG THE LITTLE CO. RIVER COR	WUPA	0.00	16.00	1996	06/25/96
10	FLAG-N-010.041	CONDUCT INV., ASSESSMENT AND MONITORING OF VEG.	WACA	0.00	75.00	1995	06/21/96
12	FLAG-N-020.001	CONDUCT INVENTORY AND ASSESSMENT: BIRDS	WACA	0.00	30.00	1995	07/11/96
999	FLAG-N-020.002	CONDUCT INV. AND ASSESSMENT: AMPHIBIANS AND REP	ALL PARKS	0.00	30.00	1995	09/24/96
999	FLAG-N-020.003	CONDUCT INV. AND ASSESSMENT: INVERTEBRATES	WACA	0.00	20.00	1995	06/21/96
3	FLAG-N-020.011	CONDUCT SPECIAL CATEGORY PLANT SPECIES SURVEY	ALL PARKS	0.00	30.00	1994	09/24/96
999	FLAG-N-040.001	IDENTIFY AND INV. WATER-RELATED RESOURCE ATTRIB	WACA	0.00	22.00	1995	06/21/96
999	FLAG-N-040.002	CONDUCT WATER RES. INVENTORY AND STATUS EVAL.	WACA	0.00	27.50	1995	06/25/96
999	FLAG-N-040.012	MON. WATER LEVEL IN THE MONUMENT'S SUPPLY WELL	WACA	0.00	0.00	1995	09/24/96
2	FLAG-N-050.001	EST.BASELINE OZONE DATA AND EST. PERM. BIOMONIT	ALL PARKS	0.00	31.20	1996	09/24/96
7	FLAG-N-060.011	CONDUCT CAVE RECONNAISSANCE AND INVENTORY	SUCR	0.00	30.00	1996	12/19/96
1	FLAG-N-060.012	INSTALL GATE AT ICE CAVE ENTRANCE	SUCR	4.70	10.40	1996	12/19/96
999	FLAG-N-060.021	CONDUCT SURVEY AND ASSESSMENT: SOILS	WACA	0.00	40.00	1995	09/26/96
999	FLAG-N-080.010	GRAZING MONITORING / NAVAJO SHEEP	WUPA	0.00	30.00	1994	09/26/96
999	FLAG-N-100.001	RECLAMATION PLAN FOR BORROW PITS	WUPA	0.00	5.00	1994	06/2
999	FLAG-N-100.002	RECLAMATION OF ABANDONED BORROW PITS	WUPA	0.00	25.00	1994	06/2
999	FLAG-N-110.001	HAZARD TREE PROGRAM	SUCR/WACA	8.00	5.00	1994	06/21/96
999	FLAG-N-110.010	CONDUCT INTEGRATED PEST MANAGEMENT PROGRAM	ALL PARKS	3.00	10.00	1994	09/26/96
999	FLAG-N-110.011	PRODUCE INTEGRATED PEST MANAGEMENT PLAN	ALL PARKS	0.00	10.00	1994	09/26/96
999	FLAG-N-130.051	DEVELOP GEOGRAPHICAL INFORMATION SYSTEM	ALL PARKS	0.00	145.00	1996	09/24/96
999	FLAG-N-170.006	CONDUCT PRONGHORN DYNAMICS STUDY	WUPA	0.00	12.00	1994	09/26/96
1	FLAG-N-170.010	CONDUCT RIPARIAN ECOSYSTEM RESEARCH	WACA	0.00	90.00	1995	06/21/96
1	FLAG-N-170.012	INVESTIGATE HIST. FLOOD PATTERNS & RIPARIAN ECO	WACA	0.00	38.10	1996	09/20/96
999	FLAG-N-170.013	EVAL. PRE-HIST., PRE-DAM, AND PRES. RIPARIAN EN	WACA	0.00	0.00	1995	06/21/96
999	FLAG-N-170.020	INVESTIGATE PALEOENVIRON. CONDITIONS	WUPA	0.00	25.00	1994	06/21/96
9	FLAG-N-170.021	CONDUCT RAPTOR STUDY	ALL PARKS	0.00	45.00	1994	09/24/96
2	FLAG-N-170.022	MONITOR T&E RAPTOR SPECIES AND COMPLETE SURVEY	WACA	2.75	15.80	1996	09/18/96
999	FLAG-N-170.023	FIRE HISTORY - INNER CANYON	WACA	0.00	20.00	1994	09/24/96
3	FLAG-N-170.024	ENDANGERED SPECIES SURVEY	ALL PARKS	0.00	20.00	1994	09/26/96
6	FLAG-N-170.052	CONDUCT FIRE HISTORY RESEARCH	SUCR/WUPA	0.00	60.00	1994	06/21/96
999	FLAG-N-170.054	CONDUCT FIRE HISTORY - INNER CANYON WALNUT CANY	WACA	0.00	20.00	1994	06/26/96
1	FLAG-N-170.055	INVESTIGATE FIRE EFFECTS OF NATURAL FIRES	WUPA	0.00	25.00	1996	09/18/96
11	FLAG-N-170.061	CONDUCT NATURAL RESOURCES SURVEY	WUPA	0.00	37.50	1994	07/11/96
999	FLAG-N-170.062	DEVELOP PROGRAM AND INTEGRATE LONG-TERM MONITOR	ALL PARKS	0.00	82.00	1995	09/26/96
2	FLAG-N-170.065	SURVEY EPHEMERAL POOL AND IMPOUNDMENT INVERTEBR	ALL PARKS	0.00	31.15	1997	09/24/96
Resource Type Sub-total----------				54.45	1270.65		
Grand Total==========				264.45	6332.67		

113 projects printed

PROJECT STATEMENT SHEET

PROJECT NUMBER: FLAG-C-001.001

TITLE: MUSEUM COLLECTIONS MANAGEMENT
SUBPROJECT TITLE: ALL AREAS

FUNDING STATUS: FUNDED: 16.00 UNFUNDED: 50.00

SERVICEWIDE ISSUES: C03 MUS CATALOGING C09 NEED COLL MGMT

CULTURAL RESOURCE TYPE CODE: OBJC

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

Staff time/committment has been unavailable to provide adequate care/curation for specimen and archive collections in the Flag Areas.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

Fill PFT Curator position to assume curatorial responsibilities.

BUDGET AND FTEs:

FUNDED

	Source	Act Type	Budget ($1000s)	FTEs
Year 1:	PKBASE-CR	MIT	4.00	0.1
Year 2:	PKBASE-CR	MIT	4.00	0.1
Year 3:	PKBASE-CR	MIT	4.00	0.1
Year 4:	PKBASE-CR	MIT	4.00	0.1
		Total:	16.00	0.4

UNFUNDED

	Source	Act Type	Budget ($1000s)	FTEs
Year 1:	PKBASE-CR	MIT	50.00	1.0
Year 2:				
Year 3:				
Year 4:				
		Total:	50.00	1.0

Proposal Date: 94

(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS:

Continue with current program. Collections will recieve little attention. We will be unable to provide services as required by historic preservation legislation.

COMPLIANCE CODE(s): EXCL

EXPLANATION: 516 DM2 App. 2, 1.6

Proposal Date: 94