CRATERS OF THE MOON NATIONAL MONUMENT

RESOURCES MANAGEMENT PLAN

AND ENVIRONMENTAL ASSESSMENT

RECOMMENDED BY:

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FINDING OF NO SIGNIFICANT IMPACT
CRATERS OF THE MOON NATIONAL MONUMENT
RESOURCES MANAGEMENT PLAN AND
ENVIRONMENTAL ASSESSMENT

The Resources Management Plan and Environmental Assessment for Craters of the Moon National Monument discusses proposed actions for managing the natural and cultural resources of the park.

The major environmental consequences of these actions were described in the environmental assessment portion of the plan. This document should be attached to the plan and accompanying environmental assessment in order to complete the planning record for the proposal.

The environmental assessment indicated that no endangered or threatened species, floodplains, or wetlands would be impacted by the proposal. In addition, because the proposed actions are conceptual, they have no potential to affect properties on or eligible for the "National Register of Historic Places." Prior to implementation of any project which may affect properties on or eligible for the Register, the views of the State Historic Preservation Officer will be requested.

It has been determined that this is not a highly controversial Federal action that would cause a significant impact upon the quality of the human environment. This determination was based on the following: (a) the recommended alternatives would provide for the preservation and protection of natural and cultural resources in the park; (b) there would be no irreversible commitment of resources or irretrievable loss of resource productivity; (c) there would be no long-term cumulative or secondary social, economic, or environmental effects; and (d) there are no endangered plants or animals, no cultural resources, and no critical habitats that would be adversely affected. Thus an environmental impact statement will not be prepared.

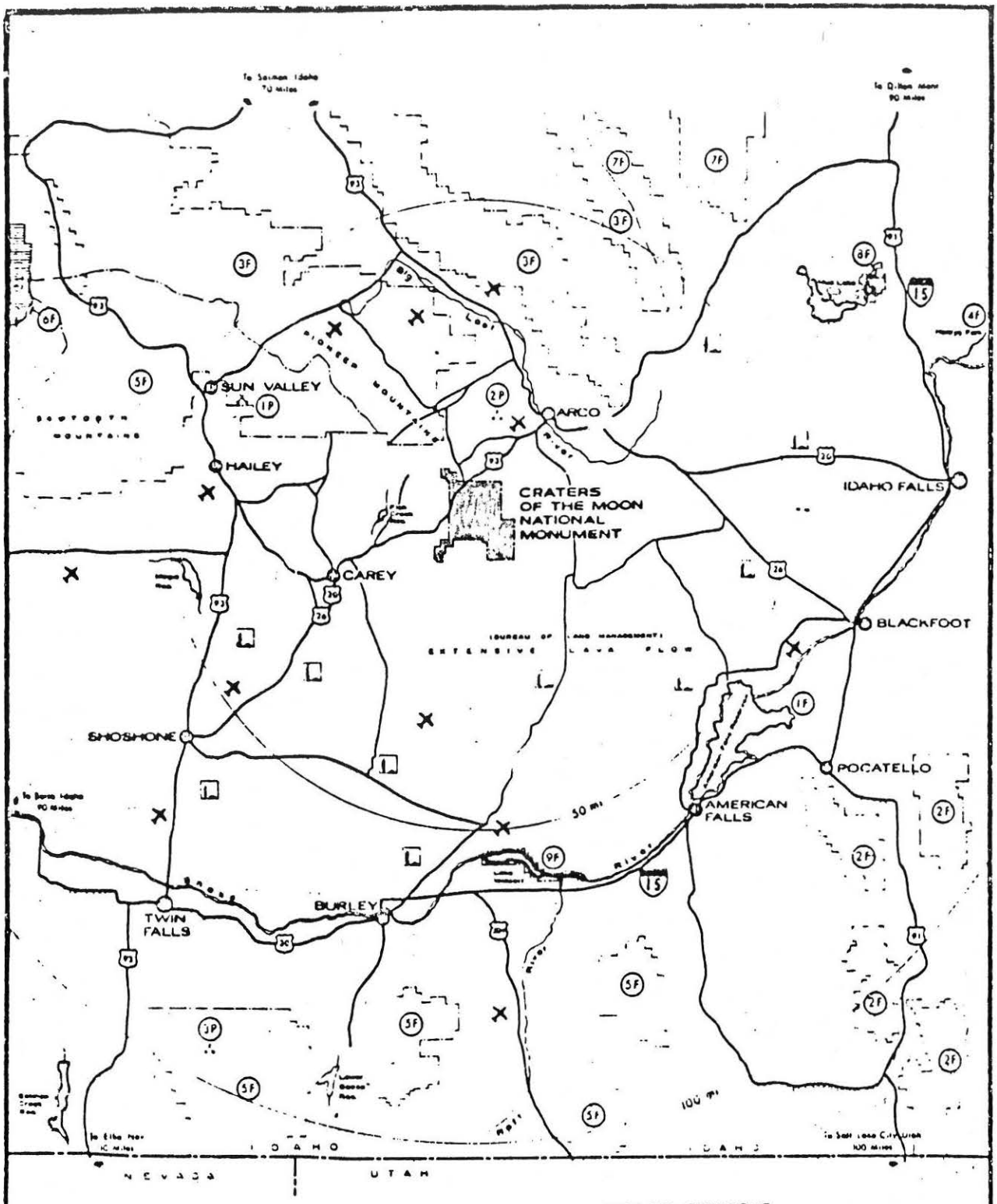
DATE: 4/14/87

Charles V Depfenbach

REGIONAL DIRECTOR
PACIFIC NORTHWEST REGION

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KEY TO AREAS

- (A) AMERICAN FALLS RESERVOIR
- (C) CARIBOU NATIONAL FOREST
- (CH) CHALLIS " "
- (H) HENRYS FORK - SNAKE RIVER
- (S) SAWTOOTH NATIONAL FOREST
- (ST) SAWTOOTH PRIMITIVE AREA
- (T) TARGHEE NATIONAL FOREST
- (CA) CAMAS NATIONAL WILDLIFE REFUGE
- (M) MINIDOKA " " "
- (SV) SUN VALLEY
- (BM) BLIZZARD MTN. } SRI AREA
- (MM) MAGIC MTN.

KEY TO SYMBOLS

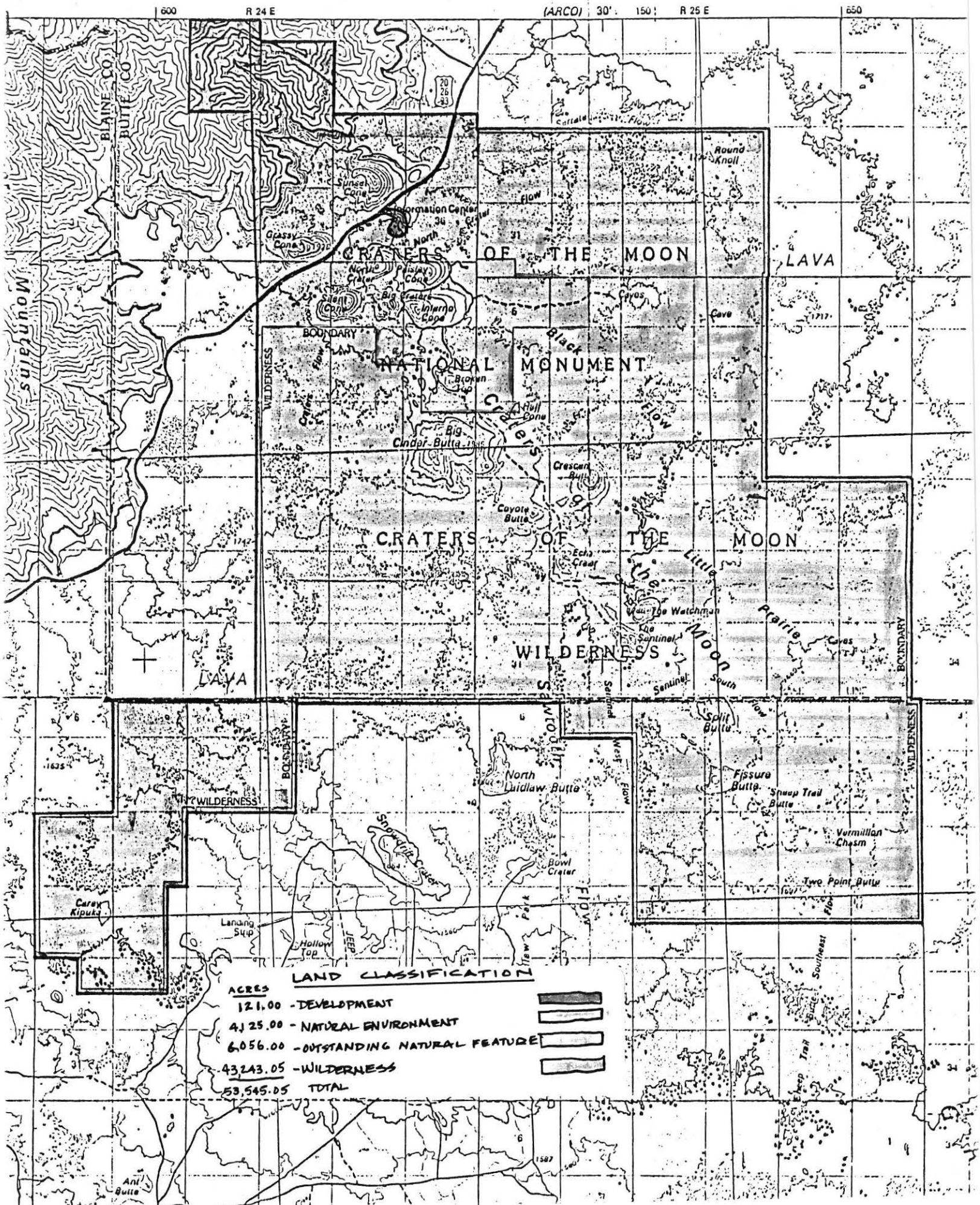
- ROADS
- CITY OR TOWN
- AIR STRIP
- AGRICULTURE AND GRAZING
- MONUMENT BOUNDARY
- NATIONAL FOREST
- NATIONAL WILDLIFE REFUGE
- FOREST SERVICE PRIMITIVE AREA
- RECREATION FACILITY
  - FEDERAL (4F)
  - PRIVATE (3P)

CRATERS OF THE MOON NATIONAL MONUMENT

REGIONAL MAP

SCALE

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE



LAND CLASSIFICATION

ACRES	
121.00	- DEVELOPMENT
4,125.00	- NATURAL ENVIRONMENT
6,056.00	- OUTSTANDING NATURAL FEATURE
43,243.05	- WILDERNESS
53,545.05	TOTAL

NATURAL RESOURCE MANAGEMENT

RESOURCE MANAGEMENT PLAN

CRATERS OF THE MOON NATIONAL MONUMENT

INTRODUCTION

This Resource Management Plan (RMP) provides for a comprehensive resource management, monitoring and research program for the Craters of the Moon's natural and cultural resources. It documents and describes the current resource management program, identifies inadequacies in related activities and knowledge, and provides for the resolution of the needs and the specific deficiencies necessary to implement a program that will allow and encourage the preservation and use of the monument.

The RMP is a fundamental element used in preparing budgets and allocation of staffing and operational support resources. It is based on the National Park Service's Management Policies, Executive Orders, legislative mandates and the approved Statement for Management.

Significance of the Monument

Nature of resource
extent of resource
variety of resource

The primary resource of Craters of the Moon National Monument (CRMO) is the vast basaltic lava flows and associated features which resulted from extensive fissure type eruptions from 2,000 to 15,000 years ago. Included are examples of nearly all major features of basaltic volcanism. The significance of the area lies not so much in individual volcanic features as in the existence of so many diverse features of basaltic volcanism compressed within a remarkably small geographic area.

These geological features include: vast lava flows with three distinct categories of lava, (pahoehoe, aa, and blocky), cinder cones, monoliths, vents, fissure cracks, spatter cones, lava tubes (caves), and tree molds. Collectively, these features comprise the Great Rift that bisects the Snake River Plain through the monument.

The monument is 53,545.05 acres, 83.66 square miles.

Land classifications are as follows:

	Acres
Development Zone.....	121.00
Natural Environment.....	4,125.00
Wilderness.....	43,243.05
Outstanding Natural Features.....	6,056.00

(See Land Classification map)

The eleven year (1975-86) annual visitation average is 222,537 visitors, with approximately 90% of the visitors between May and October. On a busy July day, which is peak visitation month, 510 vehicles or 1,785 visitors will enter the monument. Most park users stay in the monument less than 3 hours and the 52 unit campground is usually less than 80% capacity. Wilderness overnight users are less than 350 persons annually, although use has been gradually increasing for the past decade.

Most park users remain within the Outstanding Natural Feature Zone, which includes the seven mile loop drive with 8 major visitor use areas serviced by approximately 7 miles of designated foot trails. There are two visitor use areas that have accompanying self-guide pamphlets. Wayside exhibits are located throughout the monument.

Wildlife resources are surprisingly abundant and varied, although not seen by most visitors.

Resident species include: a variety of rodents such as the yellow-bellied marmot, beaver, chipmunks, golden-mantled ground squirrel, deer mouse, voles, porcupine, red squirrel, cottontail, whitetail and blacktail jackrabbits, and pika.

Major predators include: coyotes, red fox, bobcat, mountain lion, black bear, longtail weasel and badger.

Numerous species of birds include: bald and golden eagles, great horned owl, raven, black-billed magpie, and a variety of other raptors including the red tail hawk, marsh hawk, prairie falcon, American kestrel, and Swainson's hawk. Also present are sage and forest grouse, Clark's nutcracker and chickadee.

Characteristic reptiles include horned lizard, Great Basin rattlesnake, rubber boa, gopher snake and western skink.

Migratory species include: mule deer, elk, pronghorn and various migratory birds such as mourning dove, mountain bluebird, violet-green swallow, warbler, finch, towhee, woodpecker, hummingbird, jay and wren.

Several species are known to be extirpated, all previous to the establishment of the monument. As little research has been conducted, it is not known if the extirpated species listed here is an inclusive listing. These include: grizzly bear, wolf, bighorn sheep and bison.

Vegetation is varied throughout the monument, with over 300 species of native plants. A total of 26 vegetation community types have been identified and mapped. These can be broadly combined into six major categories, which are:

Cinder garden/lava flows - 70.10% - some of the most common species found here are: dwarf buckwheat, dwarf monkeyflower, dwarf onion, bitterroot, tansybush, mockorange, lava phlox, desert parsley, sandberg bluegrass, rubber rabbitbrush, mountain big sagebrush, needle grass and Indian rice grass.

Sagebrush/bitterbrush/grasses - 22.50% - sagebrushes include: mountain big sagebrush, big sagebrush, low sagebrush, early low sagebrush, and three-tip sagebrush. Antelope bitterbrush, bluebunch wheat grass, serviceberry, arrowleaf balsamroot, sulfur buckwheat, Idaho fescue, wax current and great basin wildrye are some of the more common plants.

Limber pine - 7.10% - dominant plants are: limber pine, antelope bitterbrush, and many of the plants associated with the cinder gardens.

Douglas-fir - 10% - found only on steep north-facing slopes in moist areas. Other associated species are: chokecherry, willow and slender wheatgrass.

Quaking aspen - .07% - found in draws mostly in the north end of the monument. Associated species include: lupine, columbine, Kentucky bluegrass, wheatgrasses and needle grass.

Riparian - .13% - found only in the north end of the monument along the water drainages. Species include: aspen, chokecherry, cottonwood, willow, mountain alder, bog birch and bigsting nettle.

clarify

There are no threatened or endangered species known to reside within the monument.

There are archeological sites within the monument, which consist mainly of sparsely scattered surface lithics and are of limited significance. One small section of a cutoff on the Oregon Trail system travels along the northern end of the monument.

Purpose of the Monument

The purpose for which the monument was established was to preserve for the educational, inspirational enjoyment and use of the public, certain portions of the volcanic geological features and other areas of scenic, scientific, natural and recreational values.

A Proclamation of May 2, 1924, President Calvin Coolidge - The purpose of the Monument is based on the following relevant portions of the presidential proclamation, Public Law (No. 1694 - May 2, 1924 - 43 Stat. 1947) establishing Craters of the Moon National Monument.

". . . remarkable fissure eruption together with its associated volcanic cones, craters, rifts, lava flows, caves, natural bridges and other phenomena characteristic of volcanic action which are of unusual scientific value and general interest . . . for educational values and to administer the area in accordance with the act of August 25, 1916, establishing the National Park Service."

The CRMO Wilderness Area was established in 1970 as part of the National Wilderness System, with 43,242 acres comprising approximately 80% of the monument area. The wilderness area is a harsh environment with no reliable water sources. The qualities of the area are subtle and diverse yet it remains true wilderness with very light visitor use. Less than 350 overnight permits are issued annually. The wilderness is managed under an approved Backcountry Management Plan with visitors required to obtain a free overnight use permit.

Management Objectives

It is important to recognize the deceptively fragile characteristics of the volcanic structures and their associated natural features found within the monument. Careful management of human use of the area is necessary to prevent permanent and irreversible damage to the resources and to ensure that the natural state of the monument will be perpetuated for future generations. To accomplish these goals, specific management objectives and guidelines are provided in the Statement for Management.

The objectives that are applicable to this document are:

Preservation of geological resources - to preserve to the greatest extent possible the basaltic volcanism features of the Monument through effective interpretation and protection programs.

Preservation of natural resources - to preserve and perpetuate the natural ecosystems and biological communities within the park.

Preservation of archeological sites - to identify, evaluate, protect, and preserve the park's archeological and historic resources in a manner consistent with historic preservation law and National Park Service policies.

Interpretation - to foster an understanding and appreciation of the environmental forces that formed the present-day landscape of the Columbia Plateau as well as an understanding of the plants and animals which have adapted to this harsh habitat.

Recreational use - to promote and regulate camping, picnicking, hiking, and other recreational uses by providing quality facilities for a more meaningful experience for the visitor.

Cooperation - to promote perpetuation and compatible use of Monument and regional resources through cooperation in planning and management activities with other governmental agencies as well as private interests.

Wildlife - to promote a continuing program of scientific research and study to gather information that will lead to a better understanding of the ecology of the native fauna and enable the Monument to deal with any potential management problems.

Grazing - to work on a cooperative basis with other government agencies, primarily the Bureau of Land Management and the Idaho Department of Fish and Game in matters of mutual concern, such as the effect of stock grazing in the vicinity of the monument and its impact on management of park wildlife.

Wilderness preservation and management - to establish a backcountry management plan that will ensure a strong and definite commitment by park management to the preservation of the monument's wilderness.

NATURAL RESOURCE MANAGEMENT

OVERVIEW AND NEEDS

AND

SCHEDULE OF ACCOMPLISHMENTS

NATURAL RESOURCES MANAGEMENT

Overview and Needs

A. Narrative Summary: CRMO is divided into two distinct units. The North Unit, which is 4,125 acres classified as Natural Environment, is a scrub/grassland with scattered aspens and douglas-fir on steeply rising foot hills. The South Unit, which includes the rest of the monument, is a volcanic landscape that is the primary visitor use area.

Although both areas are ecologically different and receive distinct people use influences, they share a common problem. The most significant resource management problem at CRMO is the lack of baseline information that relates to all major components that collectively comprise the infrastructure for the ecosystem. These major resource components are: atmosphere, aquatic organisms, geology, hydrology, soils, terrestrial vertebrates and invertebrates, vegetation and wildfire.

Each of these major eco-components must have baseline inventories and status documentation. Methods to maintain long term ecological monitoring plots need to be established and implemented as an integral part of ongoing/routine park resource management operations.

Project work to accomplish the Baseline Resource Inventory (BRI), (CRMO-N-003) has been ongoing since 1983. Currently, CRMO has a three year contract, Cooperative Agreement No. CA-9000-3-0002, (87-89), with the Cooperative Parks Study Unit, University of Idaho (CPSU/UI) that will provide the major portion of the needed information as well as a data management system to utilize the acquired information.

Once the BRI is completed, Standard Operating Procedures (SOP's) will be established and the data will then be available to managers. This information can be applied by managers when making decisions on planning, park management, and determining appropriate resource management actions. The application of the basic data will vary according to the individual situation or problem.

As a critical component in the BRI, air quality monitoring (CRMO-N-020 and CRMO-N-008) activities were determined to be of primary importance in resource management planning activities. One recent concern is that several gaseous pollutants such as ozone, fluoride and sulphur dioxide are present in sufficient amounts to damage vegetation. On-site investigation in 1985 (Trip Report, N3615, 9/16/85, from Dr. J. Bennett, Ecologist, Air Quality Division (AQD) NPS) revealed red-banded tipburn on limber pine, dark stippling on chokecherry, and black bifacial necrosis on aspen. No gaseous monitoring is currently being conducted within the monument; air quality monitoring is limited to visibility and particulate monitoring.

Additional information is required on fire ecology (CRMO-N-002) to determine the exact role of fire within the vegetative communities, including the fire's influence on exotic weeds (CRMO-N-015) which are expanding within the monument, primarily in the north unit. All wildfires are currently being suppressed; in contrast, the BLM adjacent to the monument has a natural burn program. Fire ecology is identified as a significant resource issue and is funded under the same contract with CPSU/UI along with the BRI project as stated above.

Some studies are being conducted on the vegetation. A cover type map, completed in 1985, provides a good base reference for the distribution and composition of the primary ecosystems.

The other major category of significant concern in resource management planning are impacts to the geological features. Impacts from visitor use caused by trampling, associated erosion, and illegal specimen collecting. The degree of threat to the resource ranges from minor effects to irreversible damage.

The Crystal Fissure Spatter Cones (CRMO-N-001) are a unique volcanic feature that represents a nationally significant volcanic phenomenon. These features are extremely delicate and fragile. Decades of visitor use has caused irreversible damage. A major rehabilitation project was completed in 1984 to recontour the spatter cones and to prevent further deterioration. Immediate efforts are to hard surface all of the trail system and install a new safety railing.

Illegal collecting of souvenir samples of the geological features is a long standing and continuing problem (CRMO-N-005). The impacts are primarily in heavy visitor use areas. Through aggressive interpretive and law enforcement efforts, this illegal visitor activity is being controlled.

Inferno Cone (CRMO-N-009) receives heavy visitor use and the access trail is showing erosion. Impacts are being monitored and after sufficient data collection, long-range management alternatives will be developed to mitigate any adverse damage.

Wildlife problems do not exist at this time but one could develop with the mule deer population (CRMO-N-010). The deer population is stable, and the current population within the monument totals about 600 animals from April through November. Present management places emphasis on the collection of trend data and the enforcement of regulations in cooperation with the State of Idaho Fish and Game Department. It would be helpful, however, to obtain additional information on migration patterns to determine the overall significance of the population within the region, and the importance of the monument to these migrations for summer range.

Extirpated species have been documented through literature searches and the reintroduction of the grizzly bear (CRMO-N-019) and the big horn sheep (CRMO-N-020) have been considered. Both have been determined as not feasible due to the limited habitat and size of the park.

Livestock impacts (CRMO-N-013) are a long standing problem. After attempting several solutions, adjustments to the north end unit boundary and construction of a livestock fence are the only realistic long term solutions.

A recent study by the USGS resulted in the addition of a project statement on seismic monitoring. It received a relatively high priority since the monitoring involved visitor safety as well as information on seismic activities along the Great Rift. The USGS predicts that volcanic activity will occur in the near future and recommends a seismic monitoring system to ensure the earliest possible detection. In terms of geologic history, however, adequate research has been accomplished.

B. Schedule of Accomplishment:

CRMO-N-003, BASELINE RESOURCES INVENTORY

The identification and the documentation of the condition of all resources is an essential part of a resources management program. The current status of a resource can provide a baseline against which to measure changes that may be attributable to specific management actions or other factors either within or external to the monument.

As part of this program, permanent plots in representative and sensitive vegetation types will be established in which all plants will be mapped and the changes therein monitored over time. A series of at least ~~60~~ 20 photo-points will also be established illustrating representative plant communities throughout the Monument. Where possible, these photo-points will be established to duplicate previous photos, thus providing a ready record of and a method of monitoring future changes. A similar effort will be undertaken to document conditions and monitor changes in unique geologic features such as the spatter cones and lava tubes. Another segment of this program is a series of permanent transects which were established in 1982 and are read semi-annually. These transects were primarily established to monitor vegetation changes which might be attributable to mule deer browsing and other animal activities. Existing baseline data collection activities also include an annual effort to census the mule deer population and classify the age and sex composition of the herd.

Additional proposed baseline data collection activities include a survey of the Monument's small and medium size mammal populations, an inventory

of the avian communities, and the establishment of a system to monitor the water quality of the streams on the north end.

A second key component of a baseline inventory is a written synthesis of the existing information on all pertinent resource categories. Most of this information will come from park files and the libraries and researcher files at adjacent universities. Following this synthesis, and evaluation of the material by disciplinary experts will be undertaken in order to identify the quality of the information and important gaps in our knowledge of park resources. This information can be used in turn to guide future research efforts.

All funds are in $1,000.00 ($60.6 = $60,600.00)

Schedule of Accomplishments:

FY 87-89

1.	Cooperative Agreement with University of Idaho NPS-CPSU for Baseline Resources Inventory	$60.6

FY 90-92

1.	Annual data collection and monitoring of photo points, vegetation plots and transects, and small mammal populations	$ 4.5

CRMO-N-020, AIR QUALITY MONITORING - GASEOUS POLLUTANTS

Though visibility has been monitored at Craters of the Moon for several years, no EPA recognized criteria pollutants have been monitored. Preliminary investigations suggest that adverse impacts may be occurring due to vegetation damage from fluoride and ozone.

The need is to implement a set of studies that address these issues and monitors for gaseous pollution impacts.

Schedule of Accomplishments:

FY 88

1.	Implement sulfate and fluoride monitoring	$35.0
2.	Lichen and moss monitoring/analysis as an indicator species	$15.0
		$50.0

FY 89

1.	Operate ozone monitoring station	$30.0
2.	Operate permanent pine plots	$10.0
3.	Determine composition of fly ash from INEL coal fired steam plant	$ 3.0
		$43.0

continue O3, S, fluoride monitoring in subsequent years?

FY 90

1.	Test for trace elements in wildlife and vegetation	$30.0

FY 91

1.	Establish aspen, chokecherry and lichen permanent plots	$15.0

FY 92

1.	Test for trace elements in tree rings	$20.0

CRMO-N-008, AIR QUALITY MONITORING - VISIBILITY

The majority of the monument (43,243 acres) is designated Class I for air quality management. With increasing pressures on the adjacent lands and the development of more service and research facilities at DOE, INEL, overall degradation of the air quality is likely. A visibility monitoring program for air quality is in place. The entire air monitoring program is designed to collect baseline data for visibility, particulate fallout and acid rain.

The need is to maintain current monitoring and plot visibility trends from these data.

FY 88

1.	Continue present monitoring program	$ 8.0

FY 89

1.	Continue monitoring program	$ 8.0

FY 90

1.	Continue monitoring program	$ 8.0

FY 91

1.	Continue monitoring program	$ 8.0

FY 92

1.	Continue monitoring program	$ 8.0

NOTE: The above funds requirements represent resources beyond park capabilities to accomplish task as outlined and presently funded from National Air Quality program and BLM.

CRMO-N-002, FIRE ECOLOGY

Craters of the Moon does not have an approved Fire Management Plan. Before this plan can be developed and implemented, the exact role of fire within the vegetative community must be determined. Until the role of fire is defined, all wilderness fires are suppressed. This is not cost effective and there are reasons to believe it may be in conflict with the natural processes.

The need is for a research project to determine the ecological role of wildfire and to prescribe the condition under which fires would be allowed to burn. The approval and implementation of the Fire Management Plan is contingent upon what this research determines.

Schedule of Accomplishments:

FY 87-89

1. Cooperative Agreement with University of Idaho NPS-CPSU for fire ecology studies and development and production of prescription for allowing/controlling wildfires. $10.0

NOTE: The above funds requirements represent resources beyond park capabilities to accomplish the task as outlined.

CRMO-N-001, SPATTER CONES: IMPACTS

The area of concern is a series of spatter cones that are of great interest to the visiting public and have national recognition as an outstanding example of this type of volcanic phenomenon. They are extremely fragile. A three year PRIP program has realigned trails, installed safety barriers, rehabilitated impacted areas, eliminated trails and greatly improved the overall aesthetic value and opportunities for visitor enjoyment.

The need is to maintain the geologic integrity of the geological features and the trail system. This will ensure visitor enjoyment and safety and minimize impact.

FY 87

1.	Hard surface 120 feet of visitor use trail to second spatter cone	$ 2.0
2.	Replace safety hand rail around snowcone to channel foot traffic	$ 4.0
3.	Establish vegetation barricade between park lot and spatter cones	$ 2.0
	To be accomplished with cyclic maintenance funds	$ 8.0

FY 88-92

1.	Maintain geological features through maintenance protection and interpretive activities.	$ 4.5

CRMO-N-005, REMOVAL OF GEOLOGICAL FEATURES

This project statement documents the incessant threat of deterioration due to physical removal of the resource. Lava rocks and all other geological features are a curiosity to the general public and researchers. Without an active program of control and abatement, preservation of the resource would not be possible. The need is to continue to fund the current level of park operations for resource protection activities on a reoccurring annual schedule to ensure compliance with management policies and regulations.

FY 88-92

1.	Continue an aggressive program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions to protect the resource	$ 4.5

CRMO-N-013, LIVESTOCK: IMPACTS

CRMO has a long history of livestock trespass on park lands, primarily in the North End Unit. Due to extremely steep terrain and heavy snowpack, fencing the existing boundary line is not possible. Over the years, various solutions have been attempted, all with less than satisfactory results. In 1976, a fence was constructed along the ridgeline. The fence does not follow the boundary line but has functioned very well for that particular section of the park.

The recommended course of action is to change the boundary line to conform to the ridgetops. A fence could be constructed on the boundary line and livestock would be excluded from the park. This would include within the park all lands that drain into Little Cottonwood Canyon.

FY 88

1.	Legislatively establish a new boundary line around the North End Unit to conform to the ridgetops.	
2.	Post and mark newly designated boundary	$ 3.0
3.	Construct barbed-wire sheep fence along boundary line (approximately eight miles of new fence)	$20.0
		$23.0

FY 89-92

1.	Maintain fence liaison with livestock users and enforcement patrols	$ 2.0

CRMO-N-010, MULE DEER MANAGEMENT

The research study showed that the CRMO mule deer herd was one of the most productive on record. Those deer that leave the Monument in the

fall also provide an important resource for local hunters. Little is known about movements of the mule deer off the monument in the winter. (The monument does not serve as winter range). Scattered records from deer that have been marked on the Monument show that part of the herd migrates to winter range northeast of the monument while others apparently move south across a broad expanse of the Snake River Plain. A better definition of these movements as well as surveys of winter range conditions would complete the ecological picture of the herd and help explain yearly fluctuations in the population. This information is not only of high scientific value, but would help the Monument better coordinate its present program of enforcement and education in order to prevent illegal killing of mule deer on park lands.

A Memorandum of Understanding with Idaho Fish and Game for cooperation on managing the deer herd was approved on September 12, 1984. Both the Idaho Fish and Game and the BLM are interested in obtaining a further understanding of the Monument's mule deer winter movements, range conditions, and population dynamics, and may potentially contribute funding to this project. The funds requested below, however, are not predicated on this eventuality.

FY 89-90

1.	Initiate and complete a comprehensive study of winter range movements and distribution through a Cooperative Agreement with the University of Idaho NPS-CPSU	$40.0

FY 88-92

1.	Education and poaching patrol activities	$ 4.5

CRMO-N-015, EXOTIC SPECIES: PLANTS

Invasion of native plant communities by exotic species is a potential problem with less than half a dozen known undesirable species presently within the park.

The need is to continue monitoring and to exert controls over exotic species. Controls will be implemented when an exotic species poses a known threat and when success for control is high. Actions will be initiated and carried out on a case-by-case basis.

FY 89-92

1. Monitoring and control activities $ 2.0

CRMO-N-016, SEISMIC MONITORING SYSTEM

The geological history of the volcanic activity of the Craters of the Moon has been adequately researched. The USGS has predicted more volcanic activity in the headquarters area within the next two centuries and have recommended immediate implementation of a seismic monitoring program.

The need is to install and operate a seismic recording system for the purpose of detecting activity associated with impending volcanic activity.

FY 88

1. Install and operate seismic monitoring system $10.0

CRMO-N-009, INFERNO CONE: IMPACTS

Inferno Cone receives heavy use from visitors walking from the parking lot up the southwest face. The foot trail is visually obvious, but not defined by any marking system or barriers. Over the years the trail has become wider and is beginning to show surface erosion. The extent and specific cause of the erosion is unknown at present.

The need is to monitor the trail and determine what is happening to cause the erosion. Then appropriate alternative actions can be developed for long-term management.

FY 88-92

1. Monitor trail erosion $ .5

CRMO-N-011, BACKCOUNTRY MANAGEMENT

Craters of the Moon has an approved Backcountry Management Plan. The purpose of the plan is to insure visitor safety and minimal impact from overnight users through a registration permit system.

The need is to approve and implement the plan.

FY 88-92

1. Implement Backcountry Management Plan $ 1.0

CRMO-N-021, DATA MANAGEMENT SYSTEM

Craters of the Moon has an active ongoing resources management program. A great deal of data, both of a numerical and map variety have already been collected or are contemplated to be gathered in the near future. It is essential for the Monument to consider the establishment of a long-term program that will enable these data to be efficiently stored, retrieved and analyzed. A complete data management system would include the capability of handling both numerical and geographic data. The survey and initial organization of data for a data management system would be accomplished under the baseline resources inventory project (CRMO-N-003).

FY 88

1.	Purchase and install microcomputer hardware for numerical data analysis	$ 7.5
2.	Purchase and/or develop appropriate software	$ 1.5
3.	Begin a program to organize and code appropriate resource data	$10.0
4.	Train park personnel on the system	$ 2.0
		$20.0

FY 89-91

1.	Update and/or add additional information to the system	$ 9.0

FY 89

1.	Purchase hardware and software for a GIS	$30.0
2.	Code and store geographic data	$10.0
		$40.0

CRMO-N-007, FOOT TRAILS THROUGH GEOLOGICAL FEATURES

The most effective tool in managing of the landscape is the construction and maintenance of a trail system. Craters of the Moon has an established foot trail system that allows adequate access to the monument and still minimize the impacts. There are existing sections of trails that need upgrading and other sections that need to be obliterated and the area rehabilitated.

The need is to develop and implement a cyclic maintenance program that will continue upkeep of the trail system.

FY 88-92

1.	Implement maintenance program for trail system	$ 3.5

CRMO-N-022, EXTERNAL THREATS

The potential for impacts on the monument from external influences are numerous.

The need is to continue administrative cooperation with other agencies and landowners, monitor activities and implement various action plans. No costs are directly involved under this project statement.

CRMO-N-004, CAVE MANAGEMENT

Craters of the Moon has many caves that are of great interest to the general public and scientific community. The enabling legislation mentions caves specifically as a feature of the monument. The caves vary in management requirements.

Development and implementation of a Cave Management Plan are necessary to comply with NPS policies and to ensure proper resource management. Its purpose would be to identify research needs and to detail specific management actions for individual cave sites.

FY 88

1. Develop and implement Cave Management Plan $ 2.0

CRMO-N-014, BOUNDARY SURVEY

The southern monument boundary is not marked and has never been surveyed. Activities on adjacent lands, such as geothermal exploration, livestock grazing, and poaching, all require that a legal and visual marking of the boundary delineate the park.

The need is to fund a project for the purpose of surveying and marking the boundary.

FY 91

1. Conduct survey and mark boundary $60.0

CRMO-N-12, NOISE: IMPACT

Low flying aircraft intrude upon the park setting and wilderness solitude. The aircraft, primarily military, are apparently using the Great Rift for visual navigation.

The need is to continue to document these aircraft and identify the military base of origin. Through liaison directly with the appropriate military command, continue cooperation in diverting the aircraft away from the monument area.

Contacts have been established and the results have been a marked decrease in low flying aircraft that impact the park setting. This liaison with Mountain Home Air Base will need to be continued to ensure a lasting solution to this problem.

Continuous No Costs

NATURAL RESOURCE MANAGEMENT

FIVE-YEAR PROGRAM

Attachment 1

RESOURCES PROGRAMMING SHEET

CRMO / Park | PNRO / Region | IDAHO / State

X Natural ___ Cultural

_____ Date

Page ___ of ___

Area Priority	RMP Ref. No.	Pack. No.	PROJECT TITLE	Funding Source	Action Type*	YEAR 1 NPS M.Y.	YEAR 1 Cost/ $1000	YEAR 2 NPS M.Y.	YEAR 2 Cost/ $1000	YEAR 3 NPS M.Y.	YEAR 3 Cost/ $1000	YEAR 4 NPS M.Y.	YEAR 4 Cost/ $1000	YEAR 5 NPS M.Y.	YEAR 5 Cost/ $1000
	N-003		BASELINE RESOURCE INVENTORY	NRPP	2	-	20.2	-	20.2	-	20.2	-	-	-	-
				PB								.3	4.5	.3	4.5
	N-020		AIR QUALITY: GASEOUS POLLUTANTS	AQ	O	-	50.0	-	43.0	-	30.0	-	15.0	-	20.0
	N-008		AIR QUALITY: VISIBILITY	AQ	O	.3	4.0	.3	4.0	.3	4.0	.3	4.0	.3	4.0
				PB		.3	4.0	.3	4.0	.3	4.0	.3	4.0	.3	4.0
	N-002		FIRE ECOLOGY	NRPP	R	-	10.0	-	10.0	-	10.0	-	-	-	-
	N-001		SPATTER CONES	MAINT	M	.15	8.0	-	-	-	-	-	10.0	-	-
				PB	P	.3	4.5	.3	4.5	.3	4.5	.3	4.5	.3	4.5
	N-005		REMOVAL OF GEOLOGICAL RESOURCES	PB	P	.3	4.5	.3	4.5	.3	4.5	.3	4.5	.3	4.5
	N-013		LIVESTOCK: IMPACTS	NPS	P	-	-	-	23.0	-	-	-	-	-	-
				PB	P	.3	4.5	.3	4.5	.3	4.5	.3	4.5	.3	4.5
	N-010		MULE DEER MANAGEMENT	NRPP		-	-	-	-	-	24.5	-	24.5	-	-
				PB	P&R	.3	4.5	.3	4.5	-	~~24.5~~	-	~~24.5~~	-	-
	N-015		EXOTIC SPECIES: PLANTS	PB	P	.07	2.0	.07	2.0	.07	2.0	.07	2.0	.07	2.0
	N-016		SEISMIC MONITORING	NPS	O	-	10.0	-	-	-	-	-	-	-	-
	N-009		INFERNO CONE: IMPACTS	PB	O	.03	.5	.03	.5	.03	.5	.03	.5	.03	.5
	N-011		BACKCOUNTRY MANAGEMENT	PB	P	.07	1.0	.07	1.0	.07	1.0	.07	1.0	.07	1.0
	N-021		DATA MANAGEMENT SYSTEM	NPS	A	-	-	-	20.0	-	40.0	-	-	-	-
				NPS	A	-	-	-	-	.15	9.0	.15	9.0	.15	9.0
	N-007		FOOT TRAILS THROUGH ECOLOGICAL FEATURES		N&P	.2	3.5	.2	3.5	.2	3.5	.2	3.5	.2	3.5
	N-022		EXTERNAL THREATS		O	N O	C O S T S								
	N-004		CAVE MANAGEMENT		A	-	-	.07	2.0	-	-	-	-	-	-
	N-014		BOUNDARY SURVEY		A&P	-	-	-	-	-	-	-	60.0	-	-
	N-012		NOISE: IMPACTS		A	N O	C O S T S								

29.0 31.0 29.0

FUNDING SOURCE

NRPP - Natural Resource Preservation Program
MAINT - Cyclic Maintenance Funds
AQ - Air Quality Project Funds
PB - Funds currently included in park base
NPS - ONPS base funding request for increased funds

ACTION TYPE

R - Research
O - Monitoring
M - Maintenance
P - Protection

25B

NATURAL RESOURCE PROJECT STATEMENTS

PROJECT STATEMENT: CRMO-N-003, BASELINE RESOURCES INVENTORY

Statement of Issue or Problem:

Statement of Condition - As presented in the Statement for Management the purpose of the monument is "to preserve for the educational, inspirational and recreational use of the public, certain portions of the volcanic geological features and other areas of scenic, scientific, and natural . . . values".

The identification and the documentation of the condition of all resources is an essential part of a program to preserve and protect the resources of the Monument. The current status of a resource can provide a baseline against which to measure changes that may be attributable to specific management actions or other factors either within or external to the monument.

Several important facets of an inventory of the resources at the Monument have been completed. These include a comprehensive vegetation map (1985), the start of a park herbarium, a study of the Monument's mule deer herd as well as a technique to annually census and classify this herd, and the establishment of specific transects to monitor vegetation in certain areas of the monument. In addition, a geologic base map is currently in preparation by the U.S. Geologic Survey.

Much remains to be done however. Future proposed work includes the establishment of permanent (e.g., .25 ha) plots in representative and sensitive vegetation types in which all plants will be mapped and the changes therein monitored over time. A series of at least 60 photo-points

will also be established illustrating representative plant communities throughout the Monument. Where possible, these photo-points will be established to duplicate previous photos, thus providing a ready record of and a method of monitoring future changes. Photographs taken by the pioneer explorer Robert Limbert in the 1920's will be used as part of this effort. They will be supplemented by other photos from the park files and from other sources as available. A similar effort will be undertaken to document conditions and monitor changes in unique geologic features such as the spatter cones or lava tubes.

Little information is available on most mammal, reptilian, and amphibian populations in the monument. An inventory of the pertinent species aimed toward developing an index of abundance will be undertaken. Various counting and survey techniques will be tested in order to yield an optimum and cost-efficient method. A program to periodically monitor the key species will also be developed.

Water is a scarce and valuable commodity in this semi-desert environment. The streams of the north end of the Monument provide its drinking and irrigation water as well as supporting much of the mammal populations, particularly in late summer. A project to evaluate the quality of these resources and to periodically monitor them will be established as part of this program. Similar in scope to the biotic requirements, an inventory of the various geologic structures and features and their condition will be undertaken. An analysis of historic and current photographs as described above, will help to determine whether any structure damage in key features is due to physical visitor impact, from erosion due to natural

weathering, or as a combination of both. Based on this analysis, management plans will be formulated for resource protection.

A key component of the inventory to be undertaken in this program is a written synthesis of the existing information on all pertinent resource categories. This synthesis will follow the outline of a similar study done by the University of Idaho CPSU for Glacier National Park. Categories in which information will be grouped include:

1. Faunal Resources
2. Vegetation
3. Hydrologic Resources
4. Climate
5. Cultural Resources
6. Soils
7. Air Quality
8. Caves
9. Fire
10. Archeologic Resources
11. Geology
12. Visitor Use

Most of this information will be synthesized from technical reports and other material in the park files and from the libraries and researcher files at adjacent universities. A written detailed report of the information available in each category will be produced, along with an accompanying bibliography. Following this synthesis, an evaluation of the material in the respective reports will be sought by disciplinary experts in local universities and other agencies in order to identify the quality of the information and gaps in our knowledge of park resources. This information will be used in turn to help prioritize future research efforts. This study will also be used to identify and organize data suitable for inclusion in the park's resource data management system (N-21).

Alternative Actions and Their Probable Impacts:

1. Conduct Survey and Inventory. Through cooperation with a University of Idaho CPSU, conduct a comprehensive inventory and analysis of each biotic and geologic ecosystem component. All information would be mapped, cataloged, and prepared for storage in a retrievable data system for use in various management plans and action programs.

   Impacts are not anticipated in conducting activities for collection and analysis of these data.

2. No Action. Any suspected changes in vegetation or geologic features would be subjective and impact due to natural or human influences could not be measured. Of consequence, management actions are difficult to formulate.

Recommended Course of Action:

Alternative No. 1 is recommended. It is obvious that without these basic resource inventories, it would be impossible for the park to develop long range management plans and strategies regarding their environments and coexistences. This baseline data is necessary to insure the integrity of any decisions made with regard to the role of these forces in the monument's ecological web. As stated in alternative two, without this baseline data specific management plans are subject to actions with unmeasurable and even subjective results.

Without the necessary assessment of what the biologic/geologic state of the resource was in the past and is at present, there is no mode or manner for evaluating changes. Indeed, without baseline data it is impossible to determine what or where management programs are required to bring the resource to a natural or acceptable ecological state.

PROJECT STATEMENT: CRMO-N-020, AIR QUALITY MONITORING - GASEOUS POLLUTANTS

Statement of Issue or Problem:

Statement of Condition - Eighty-one percent of CRMO is designated Class I air shed by the 1977 Clean Air Act, with 43,243 acres established as wilderness on October 23, 1970. The air quality is an inherent component of the ecosystem and requires active management. As such, the monument's interest is further defined by legislative mandate. The 1977 Clean Air Act: Prevention of Significant Air Quality Deterioration, June 19, 1978, Part V, and all applicable amendments, specify a direct responsibility for management of Class I lands.

Section 160 - The purposes of this part are as follows:
"(1) to protect public health and welfare from any actual or potential adverse effect which in the administator's judgment may reasonably be anticipated to occur from air pollution or from exposures to pollutants. . . ."

"(2) to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value;"

Section 162(a - Areas designated as Class I
Upon the enactment of this part, all---"(2) national wilderness areas which exceed 5,000 acres in size."

Section 165

"(B) The Federal Land Manager and the Federal official charged with direct responsibility for management of such lands shall have an affirmative responsibility to protect the air quality related values (including visibility) of any such lands within a Class I area and to consider, in consultation with the Administrator, whether a proposed major emitting facility will have an adverse impact on such values."

No gaseous pollutant monitoring has been done at the monument.

CRMO has had and continues an active visibility monitoring program (CRMO-N-008). The trend results have indicated that the air quality is pristine, with Total Suspended Particulate (TSP) monitoring measurements among the lowest in the contiguous United States.

However, recent visual observation and preliminary field investigations suggest adverse impacts due to possible air pollution injury to vegetation.

The first line of suggestive evidence is observations of an occasional yellow plume coming from the Idaho National Engineering Laboratory where a chemical processing plant and a coal-fired steam generation plant operate only 25 miles northeast of the monument. Also, visual observations have been made of a cloud of brown smog entering the area from the east and southeast when winds are from that direction. This suggests that sulfur dioxide, nitrous oxides, sulfates and photo-chemical oxidants (including ozone) are present.

The other line of evidence stems from observations concluded by Dr. James P. Bennett, Ecologist, Research Branch, Air Quality Division, National Park Service, during on-site investigations conducted on August 13, 1985. Red-banded tipburn on limber pines, dark stippling on chokecherry and black bifacial necrosis on aspen were found by Dr. Bennett. The suspected injury found on the limber pine are indicative of adverse effects due to hydrogen fluoride. The observations on the chokecherry and aspen are symptoms of ozone injury.

A review of the flora and fauna has identified the following as biological Air Quality Related Values (AQRV) for the monument. The species listed are either known to be sensitive to gaseous pollutants or are important ecologically.

BIOLOGICAL AQRV LIST

Ozone	Hydrogen Fluoride
Pinus flexilis	Pinus flexilis
Populus tremula tremuloides	
Populus balsamifera trichocarpa	
Prumus virginiana	

Sulfur Dioxide	Heavy Metals
Populus tremula tremuloides	Lichens
Populus balsamifera trichocarpa	Mosses
Agropyron spicatum	Deer
Oryzopsis hymenoides	
Acer glabrum	
Lichens	
Mosses	

The need is to implement a set of studies that addresses these issues and monitors for gaseous pollution impacts.

Alternative Actions and Their Probable Impacts:

1. Implement and Maintain a Monitoring and Data Collection Program for Gaseous Pollutants. This program would provide the necessary background information to establish a baseline on applicable biological AQRV's and possible impacts from various gaseous pollutants.

   Studies to demonstrate damage(s) to these monitoring activities would include vegetation, trace element detection and sample collection for gaseous contaminants. The results would show conclusive data as to specific categories of pollution and the impacts to biological indicator species would also be specific.

2. No Action. Presently, no gaseous pollutant monitoring is being conducted. It is not known whether vegetative injury is present nor existing background levels of the various pollutants. Under this alternative, adverse impacts to biological AQRV's can not be determined and would remain unknown.

Recommended Course of Action:

Alternative 1 is recommended. This action will allow the measurement of any adverse impacts on the vegetation and establish a background information base. Without this information it is not possible to meet specific 1977 Clean Air Act criteria pertinent to the affirmative responsibilities ~~of managers~~ of Class I area land managers.

PROJECT STATEMENT: CRMO-N-008, AIR QUALITY MONITORING - VISIBILITY

Statement of Issue or Problem:

Statement of Condition - Eighty-one percent of CRMO is designated Class I air shed by the 1977 Clean Air Act, with 43,243 acres established as wilderness on October 23, 1970. Air quality is an inherent component of the ecosystem and requires active management. In general, CRMO has ". . . the most pristine visual air quality of all NPS monitoring sites in the contiguous 48 United States," as stated December 22, 1986, memorandum (N3615) from Chief, Permit and Review and Technical Support Branch, Air Quality Division (AQD), NPS. As such, the monument's interest is further defined by legislative mandate. The 1977 Clean Air Act: Prevention of Significant Air Quality Deterioration, June 19, 1978, Part V, and all applicable amendments, specify a direct responsibility for management of Class I lands.

Section 160 - The purposes of this part are as follows:
"(1) to protect public health and welfare from any actual or potential adverse effect which in the administrator's judgment may reasonably be anticipated to occur from air pollution or from exposures to pollutants. . . ."

"(2) to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value;"

Section 162(a - Areas designated as Class I
Upon the enactment of this part, all---"(2) national wilderness areas which exceed 5,000 acres in size."

Section 165

"(B) The Federal Land Manager and the Federal official charged with direct responsibility for management of such lands shall have an affirmative responsibility to protect the air quality related values (including visibility) of any such lands within a class I area and to consider, in consultation with the Administrator, whether a proposed major emitting facility will have an adverse impact on such values."

The Upper Snake River Plain has relatively low population and development densities. However, the Department of Energy (DOE) operates the Idaho National Engineering Laboratory (INEL) approximately 25 miles northeast of the monument. INEL applied for and received a Prevention of Significant Deterioration (PSD) permit for construction and operation of a Coal-Fired Steam Generation Facility, which became operational in 1984. In 1986 DOE made application for another PSD permit for a proposed Fuel Processing Restoration Facility, which is currently in process. Projections are for at least two additional PSD permits in the near future.

It is assumed that the visual air quality at CRMO will trend toward degradation. CRMO has an active visibility monitoring program. Data collection and monitoring activities include the following:

- CRMO is an official NOAA weather observation station (#10-2260 9). The station has been active for more than a decade.

- High-Volume Particulate Air Samples have been collected in cooperation with the State Department of Health since 1974. This data has received national interest due to the relatively low level readings taken at the monument and is used as national background for TSP by the EPA.

- National Atmospheric Deposition Samples (NADP) are currently being taken on a weekly basis. This is a program to collect precipitation samples for acid rain analysis. Through a Cooperative Agreement with the Bureau of Land Management, Craters of the Moon has been designated an official NADP sampling site (130300). We have been active since October, 1980.

- A series particulate sampler was operated in 1984 and 1986.

- Manual teleradiometer readings were collected in the summer of 1983 and 1984 and automatic telephotometer readings collected from May 1985 through May 1986.

- Under a cooperative agreement with BLM, Craters of the Moon operates an official AFIRMS fire weather station during the fire season.

- A 40 foot wind/speed continuous recorder has been operational since 1985.

- An automatic 35mm photo visibility monitoring station has been operational since 1985.

Alternative Actions and Their Probable Impacts:

1. No Action: Under this alternative monitoring activities will continue. Data collected will be analyzed to demonstrate trends in visibility and management will be capable of detecting degradation.

2. Discontinue Atmospheric Monitoring. Under this alternative we would not collect baseline data or document current conditions. If a suspected problem became apparent the monument would not have the background data to use as evidence of change. If a major pollutant were present, visibility changes could occur before management was aware and further deterioration would continue.

Recommended Course of Action:

Alternative 1 is recommended. With increased development and industrial activity on adjacent land, air quality and a strong commitment by the NPS to protect the Class I area within the monument is paramount. Monitoring of the atmosphere and collection of background data is imperative as required by the 1977 Clean Air Act.

Monitoring visibility and particulate sampling would be continuing. Increases in pollutants would be detected before adverse impacts on flora and fauna were noticeable, and perhaps permit corrective action before losses occur. The cooperative activities of BLM with Craters of the Moon as an official NADP sampling site would continue. Baseline data collection would cease and long term environmental changes would not be recognizable until irreversible, if we do not continue monitoring efforts.

PROJECT STATEMENT: CRMO-N-002, FIRE ECOLOGY

Statement of Issue or Problem:

Statement of Condition - The current fire management program at CRMO calls for suppression of all wildfire, irrespective of cause. The importance of naturally-caused (lightning) fires in plant communities similar to those found in the Monument is well recognized. However, because of differences in plant community composition and substance unique to CRMO, the specific role of fire and its effect on the biological components of the Monument can only be obtained through research of historic fire records, and on-site studies. A recent (October 1985) fire on BLM land adjacent to the monument provides a unique opportunity to monitor the effects of fire on plant communities similar to those found on the Monument.

At present little is known about the past frequency of fires on the Monument. Fire scars found in several areas of the Monument indicate that fires have burned different areas within the past 100 years. The research program will attempt to develop a chronology of past fire in the Monument.

A fire ecology research program will also allow specific fire management techniques for natural fire to be prescribed in accordance with vegetation types for more cost-efficient fire management, perpetuation of the ecosystems under natural conditions, and compatibility with BLM natural prescribed fire practices on surrounding lands.

Alternative Actions and Their Probable Impacts:

1. Conduct Research. Determine the role of natural fire in the monument to provide data for development of a fire management plan that is compatible with the area's fire history. This would provide the basis for a comprehensive management program of the monument's flora and fauna. With such data, more cost efficient fire management would result, and the ever changing biotic mosaic would be a reality without human manipulation of the environment. Areas requiring suppression of fire would be identified and fire management plans would be adjusted accordingly.

   The development of an allowable natural burn program would be in conformance with the program of Bureau of Land Management, the adjacent land owner.

2. No Action. Suppression of all fires in the monument would continue. The cost effectiveness of a full suppression operation is doubtful.

   Fire determined plant and animal species are removed from the ecosystem through fire suppression and such loss could be irreversible.

   Full suppression is costly, and in an area of sparse vegetative cover, wasteful and contradictive of natural biotic maintenance where fire has been a part of the ecosystem's development. Suppression of all fire does not conform with adjacent BLM land management policy.

Recommended Course of Action:

Alternative No. 1 is recommended. The monument biota evolved without protection from naturally occurring fire. Research will indicate which areas in CRMO require protection from fire and which areas require natural fire. Full fire suppression activities are costly and contrary to the adjacent landowner's (BLM) fire suppression policies. Human safety of developed areas are given immediate, precedent protection.

PROJECT STATEMENT: CRMO-N-001, VISITOR PHYSICAL IMPACT - SPATTER CONES

Statement of Issue or Problem:

Statement of Condition - A spatter cone is a steep-sided and generally small cone built of clots of spatter (pasty type of lava) that have accumulated around a vent. The Crystal Fissure Spatter Cone Chain represents one of the most perfectly formed chains in the world. These features are extremely delicate and fragile. Because of their fragility, they are very susceptible to damage. Decades of visitor use has eroded the cones to the point where they have actually become smaller in size. Geologically, the impacts are irreversible; it will be impossible to restore the integrity of the features to the original detail and structure. Old photographs compared with the present conditions attest that erosion from human use has taken its toll.

A major three year rehabilitation project on the spatter cones was completed in 1984. Social trails were eradicated and the impacted areas rehabilitated to the best possible natural appearance. Two existing designated trails were removed and one trail realigned. New hand railings were installed around the snow cone. Visitor use is limited to only designated trails. The visual impact of the trail system was greatly improved. A new wayside exhibit explaining the resource management problem and frail nature of the spatter cones was installed. Erosion due to human impact has been eliminated. The spatter cone rehabilitation project was completed by YCC.

In addition, the area receives considerable attention and efforts to provide resource protection and visitor safety. The area is closed to all travel other than on designated trails and it is well signed.

Alternative Actions and Their Probable Impacts:

1. Continue Upgrading and Resource Protection of the Area. Although the majority of project work has been successfully completed, several small projects must be accomplished in order to prevent future impacts on these geological features. The new trail entering the second spatter cone must be hard surfaced with asphalt material (approximately 120 ft.). The railing around the first spatter cone, Snow Cone, has proven to be inadequate, both visually and as a functional safety barrier. It needs to be replaced with something more compatible with the environment as well as serving as a sturdy safety railing. Also, transplanted and seedling planting of native vegetation needs to be accomplished along the southern edge of the parking lot to provide channeling of foot traffic into the trail system.

   The area is closed to all travel except on designated trails. Daily patrols are scheduled to ensure visitor compliance and the trail system is maintained. Efforts to educate the public include wayside exhibits, information in handout material and personal contacts.

2. Close the Spatter Cone Area. This would require intensive and increased law enforcement efforts and control of the area. Additional funding would be necessary to obliterate the existing trail system and rehabilitation of the spatter cones after trail removal. Impacts from visitors would be minimal. Impacts to the visitor would be major. Visitors would not be able to experience the spatter cones except from a distance.

3. Open All Spatter Cones For Visitor Use. This would require additional funding and major operational costs increase as well as new trail construction. It would also require the irreversible commitment of the entire spatter cone chain. Physical and aesthetic impacts would be major and non-reversible. These impacts would be extended to an area that presently has minimal negative impacts.

Recommended Course of Action:

Alternative 1 is recommended. This action will provide the visitor with access to a limited area and still allow them to experience the spatter cones while protecting the majority of these unique geological features. Monitoring the area for visitor compliance, educating the public and active trail maintenance will ensure resource protection and visitor safety. Once the additional minor projects are accomplished, the long-term management of this fragile area will be assured.

PROJECT STATEMENT: CRMO-N-005, REMOVAL OF GEOLOGICAL RESOURCE

Statement of Issue or Problem:

Statement of Condition - Lava rocks and other geologic features are of interest and a great curiosity to the scientist, to the public and schools. Examples of geological phenomenon are sought after as souvenirs by the casual visitor and to investigators of scientific research and study.

Specimens are removed under authorized permit or by illegal actions. Collecting of scientific specimens through a permit is not a problem, as policy and guidelines are well defined.

The removal of the resource by unauthorized collecting is the problem. Specifically, it is the removal of specimens by the souvenir seeking visitor that constitutes the greatest threat to the resource. The threat is limited to areas adjacent to trailheads, pullouts, etc., and to certain geological specimens, such as bombs, lava fragments, etc. Removal under authorized permit (scientific) is controlled but minimal souvenir gathering continues.

Alternative Actions and Their Probable Impacts:

1. No Action. Through an aggressive interpretive program and intensive resource protection activities, the monument visitor is made aware of regulations and the reasons for preserving the resource. Interpretive and protection efforts will include: on-site interpretive programs, articles and regulations in handout material, signing,

personal contacts and law enforcement actions. Continued operation of these activities, at the present standard, will ensure the control of illegal souvenir collecting within an acceptable level.

This alternative offers the least impact on the resource.

2. Provide Souvenir Samples. A source outside the monument could be located to provide the monument with a supply of lava rock to be distributed to interested visitors in lieu of souvenir collecting. However, providing a specimen does not ensure the control of illegal collecting; in fact it could lead to increased collecting activity.

   The NPS should not concern itself with providing samples for visitors - our mission is to preserve the resource.

Recommended Course of Action:

Alternative No. 1 is recommended. It is vitally important to both the preservation of the resource and for the enjoyment of the monument by the visitor that the park continue an aggressive program to control the physical removal of the resource. Interpretive programs are extremely important to the overall effectiveness of curbing souvenir collecting. When combined with law enforcement activities, it offers the best possible control for this problem.

This alternative offers the least impact and the only means available to maintain this situation within acceptable limits.

PROJECT STATEMENT: CRMO-N-013, LIVESTOCK: IMPACTS

Statement of Issue or Problem:

Statement of Condition - Livestock (sheep, cattle and horses) have trespassed on park lands since the monument's establishment in 1924. Livestock use in the area predates the park and our records indicate that trespass was more or less tolerated by past park officials until the early 1970's. From that time until the present, a constant battle between the park and one adjacent rancher has persisted. Several different solutions have been applied over the years to solve the problem. There are three livestock operators adjacent to the park boundary, but only one has presented a constant problem. Although the two other ranchers do have occasional trespass, they have always made immediate efforts to remove the livestock and a continuous effort to keep them out. The one problem rancher has never really cooperated and we have a trespass file on him that represents literally hundreds of documented trespass incidents, violation notices and communications with PNRO, BLM, the U.S. Attorney, the U.S. Solicitor and the Federal Magistrate. Legal efforts to resolve the problem have not been very successful. Thousands of NPS man hours have been spent in efforts to resolve the problem.

Primarily, the trespass has been sheep that begin grazing on the BLM allotment adjacent to the park and then cross the ridge top into the Little Cottonwood drainage that houses the park's sole water supply. This water supply consists of four surface springs with collection boxes that feed into a water storage system. They are easily

contaminated by the presence of livestock. In 1976, a fence was constructed along the ridge top to prevent sheep entry into the park. The fence was constructed in the only possible location due to extremely steep terrain and heavy snowpack. It is not possible to construct and maintain a fenceline on the boundaryline. The existing fence travels from within the park, to outside, to back inside the boundary. It must be realized that because this project was proposed, funded and constructed by the NPS, a precedent was established and has been operational since 1976. Actually, the fence was a logical solution and has functioned very well for that particular problem and area of the park. The sheep grazing was allowed on 148 acres of NPS land outside the fence under a special use permit until 1984. The present problem in this area of the park was created when the CFR was revised in 1984 and grazing use at park units, with some specific exceptions that are not applicable at CRMO, was prohibited. The option of issuing a special use permit was precluded and has been prohibited since 1984.

Thus, the problem: how can livestock be kept out of this small 148 acres of park land. It is important to note that this entire section of the park was added by Congress in 1928 (Executive Order 2959) for the ". . .purpose of including within said monument certain springs for the water supply. . .". The significance of the area is for administrative purposes and not as a prime natural resource intended for visitor enjoyment. The 148 acres are barren ridge top. At the time when the fence was constructed in 1976 a determination was made that no adverse impacts would be made to park values. That situation has not changed. However all livestock use is currently illegal.

It is not possible to construct and hold a fence around the 148 acre section, as the terrain is too steep and heavy snowpack would annually destroy the fence.

It is not possible to require the rancher to ensure that they do not trespass. Idaho statutory law requires that the land owner fence the livestock out, and there is no law requiring a sheep herder in constant attendance with the animals. In addition, the area is relatively remote and would require a full time patrol ranger to enforce compliance.

The BLM has stated on numerous occasions that the problem is exclusively between the NPS and the rancher.

In addition to the above problem, another situation has recently developed that further complicates the entire matter and apparently is not solvable at the local level, despite several attempts to work out an agreement with BLM, NPS and the rancher.

In 1985, the BLM changed the allotment grazing authorization and use pattern. The result is that the rancher is using the area located west of Highway 20/26/93 between Blizzard Mountain Road and the north boundary of the park (immediately north of sections 25 and 26). This land consists primarily of cattle use. Between August 17, 1985 and September 29, 1985, we documented six separate trespass incidents. This section of the park must be patrolled daily at the present time to ensure compliance. In two separate meetings with BLM, we discussed the possibility of constructing a fence on the boundary line to prevent livestock trespass. They agreed and programed, contingent upon funding, to a fencing project. This is

documented in the NOTICE OF AREA MANAGER'S DECISION, item 2, par. 5. However, in a letter dated July 22, 1986, they state that the fencing project is not currently justified and that the trespass problem is exclusively between the NPS and the livestock user.

Alternative Actions and Their Probable Impacts:

1. No Action. This action would place emphasis on intensive ranger patrol efforts, legal actions against violators after the fact and maintain an adversary relationship with the local rancher. The park's domestic water supply would be in continuous threat from contamination and adverse impacts to the ecosystem could result.

2. Allow Grazing. Promulgation of a special regulation, under CPR 36, Section 7, to allow grazing of livestock. Under this action, livestock use would be regulated and adverse impacts to the ecosystem would be tolerated.

3. Change the Boundary Line. Under this alternative, the boundary line would be legislatively adjusted to include only those lands within the hydrographic drainage of Little Cottonwood Canyon. A livestock fence would be constructed on the hydrographic divide to around the North End Unit.

Recommended Course of Action:

Alternative 3 - Change the Boundary Line is recommended. This is the most effective long-term solution and the most cost efficient action. To allow further trespass, either legal or illegal, is not acceptable. The primary reason is that the protection of the domestic water supply can only be assured if livestock is not present or by implementation of a major construction project to physically prevent livestock contamination. Also, any livestock use could have adverse impacts on the entire ecosystem.

PROJECT STATEMENT: CRMO-N-010, MULE DEER MANAGEMENT

Statement of Issue or Problem:

Statement of Condition - Little information is available on the historical use of the Monument by mule deer and other ungulates. There is reason to believe however that mule deer populations have increased since the creation of the Monument in 1924. This increase may be attributed to several factors, including habitat alteration caused by early livestock grazing on the Monument, the elimination of predators which probably included the grizzly bear and wolf, and the protection from hunting afforded by the Monument.

A research study conducted through the University of Idaho NPS-CPSU between 1980-1983 showed that the CRMO mule deer herd was one of the most productive on record. It also identified some unique movement patterns within the Monument which have been attributed to the water requirements of the animals. The current population consists of approximately 600 animals that spend 7 to 8 months (April-November) in the Monument. Winter use movements are complex and not totally understood. Scattered records from deer that have been marked on the monument show that part of the herd migrates to winter range northeast of the monument while others apparently move south across a broad expanse of the Snake River Plain.

The regulation of hunting outside the Monument's boundaries is a function of the Idaho Department of Fish and Game. They have traditionally managed wildlife with the goal of sustaining the

maximum harvest while maintaining a stable population. Those deer that leave the Monument in the fall are an important resource for local hunters. A better definition of these movements, as well as surveys of winter range conditions, would complete the ecological picture of the herd and help explain yearly fluctuations in the population. This information is not only of high scientific value, but would help the Monument better coordinate its present program of enforcement and education in order to prevent illegal killing of mule deer on park lands.

A Memorandum of Understanding with Idaho Fish and Game for cooperation on managing the deer herd was approved on September 14, 1984. Both the Idaho Fish and Game and the BLM are interested in having a further understanding of the Monument's mule deer winter movements, range conditions, and population dynamics. A research program is proposed which will mark a representative sample of the Monument's mule deer and intensively survey all potential winter range areas to ascertain use by these deer. A range survey will also be undertaken where feasible to estimate the forage quality on these areas.

Current Management Action. In response to management concerns, a research investigation was initiated in May, 1980. The project was completed in 1983. The product of the study was to develop methods to monitor the deer herd and vegetation plots to establish trend data. A Standard Operating Procedure for annual spring and fall census was established in 1983 and biological data is collected from hunter harvest

during the fall Big Game Season on lands immediately adjacent to the Monument. Four permanent vegetative transects were established to monitor deer vegetation usage. This is published in STANDARD OPERATING PROCEDURES: Mule Deer Population Monitoring and Permanent Vegetation Transect Monitoring, CRMO, Brad Griffith, CPSU/UI B84-1. Data was collected to determine population density and forage community trends.

Three major factors must be considered in managing the herd. They are: 1) range condition, 2) hunting mortality, and 3) illegal activities such as poaching and livestock trespass. Hunting mortality is the most consistent and easiest component to manipulate or predict. This is not to say that other factors such as weather or range condition are not significant, rather, hunting mortality is the one factor that management regulates with some degree of control over the net results. Year-round patrols, and concentrated backcountry monitoring during the fall, are necessary to insure compliance with regulations and the prevention of illegal activities that would result in a serious threat to the long term stability of the deer herd.

Only conscientious and aggressive law enforcement actions prevent illegal killing of deer from becoming a major factor in the population dynamics of the herd.

There are no resident ungulates that exist within the monument in direct competition with the mule deer. Although, within the last several years, elk are observed for short periods of time and in increasing numbers.

Results of Current Action. Investigations demonstrate that the Craters deer herd is extremely productive and very healthy. Presumably, the vitality of the herd is due to excellent summer and adequate winter ranges, population regulation through hunting on lands outside the monument, and efforts to restrain illegal activity. These three factors form a cause-and-effect triangle, each one dependent upon the others.

Hunting seasons and bag limits are set by the state, based primarily on information collected on the winter range. They do not gather data on the summer range. Without continuous monitoring, the deer herd population could fluctuate and impacts on the summer range would be subjective and unmeasurable.

Alternative Actions and Their Probable Impacts:

1. Discontinue Current Actions. Under this alternative, the Craters deer herd would be managed through state regulated activities, outside NPS boundaries, without regard to any possible consequence on monument lands or NPS objectives. Craters deer population trends and vegetative transect analysis data would not be collected and information necessary to detect changes would not be available.

   Law enforcement activity would be reactionary and limited. A significant number of animals would be illegally killed, adding an unquantified variable to the deer herd population dynamics. The deer herd status would be unknown from year to year.

2. No Action (Current Action). Present management places emphasis on collection of trend data and enforcement of regulations. Deer census are conducted annually and vegetative transects are analyzed on a reoccurring basis. This information is processed and used as a baseline for determining population and forage community trends.

The key to this alternative is cooperation with the Idaho Department of Fish and Game and BLM. They have been involved in the planning and setting of standards for collection of the necessary data; and they will accept our information as being valid. The Idaho Fish and Game also play a major role in any successful law enforcement program.

The product of this cooperation is an approved Memorandum of Understanding (September 14, 1984) concerning the management of the deer herd and continued exchange of information and cooperation. This agreement will be facilitated and supported by data collected by NPS routine operations.

As new information is received, concern for the surrounding environments and how they relate to the Craters deer herd becomes an increasingly important issue for park management. The fact that the deer winter on lands outside the monument requires further cooperation with appropriate land managers (BLM). Exchange of information and cooperation will continue with BLM.

Recommended Course of Action:

Alternative 2 is recommended. These management actions are necessary to ensure the perpetuation of the Craters mule deer herd and a natural ecosystem.

The collection of data, enforcement of regulations and conducting research will result in:

- Knowledge of population dynamics.
- Change and impact on range and habitat.
- Control illegal activity (i.e. poaching and livestock trespass).
- Cooperative agreements for managing the deer herd.

To accomplish these objectives the NPS must continue an aggressive resource protection program based on data collection and analysis, law enforcement and cooperation with appropriate agencies. If the actions are not carried out, the monument vegetative quality and quantity could be damaged by overuse, and the stability of deer population could be adversely affected by incorrect management actions. The recommended course of action will insure communications between all concerned agencies and allow management to minimize impacts through long-range planning based on sound information.

PROJECT STATEMENT: CRMO-N-015, EXOTIC SPECIES - PLANTS

Statement of Issue or Problem:

Statement of Condition - Invasion by exotic plant species at Craters of the Moon can be characterized as intentional and unintentional. The former type has occurred in the visitor center/housing area where bluegrass lawns and non-native shrubberies have been intentionally cultivated to provide an aesthetically pleasing landscape.

Unintentional invasion has occurred in disturbed areas, particularly in the north end. A common invader throughout the west, cheatgrass (Bromus tectorum) was introduced in the early 1900's when domestic sheep grazed surrounding areas. Common mullein (Verbascum thapsus) has gained a stronghold along the dirt road and old Martin Mine site in the north end. Native wildrye (Elymus cinereus) stands composed of largely decadent plants run the risk of being invaded by adjacent Canadian thistle (Cirsium vulgare) plants that follow Little Cottonwood Creek.

Currently the park has a revegetation plan which outlines steps for reducing further thistle and mullein spread and for the possibility of using fire to control cheatgrass. The plan also outlines steps to reduce appropriate areas of bluegrass lawns to native vegetation.

The Idaho Falls and Shoshone BLM districts both administer lands adjacent to monument boundaries. They each have weed control plans which address control measures for plants other than those addressed here, but with which we have the potential of developing problems. The Idaho Falls district is planning in the summer of 1987 to spray

individual leafy spurge (Euphorbia esula) plants in the Antelope Creek drainage, approximately 15 miles from the park's northern boundary. The Shoshone district is attempting to annihilate patches of leafy spurge outside of Laidlaw Park in an area about 15 miles from the Craters southern boundary. Both agencies use Tordon, an EPA-restricted chemical, to control leafy spurge. The Butte County Agricultural Extension office has a noxious week control program which outlines plans to control leafy spurge in areas north of monument boundaries. County experiments with biological control agents will continue. A county survey indicates that leafy spurge is present in areas in Antelope Valley and in the Appendicitis Hills. A portion of the Craters of the Moon mule deer herd winters on Appendicitis Hill, thus causing concern about the spread of leafy spurge. Deer also winter in the Laidlaw Park area, discussed above as having a leafy spurge problem. Leafy spurge is not currently known to be present within monument boundaries, but the potential for its becoming a threat exists. Sheep and cattle graze on BLM-administered lands adjacent to monument boundaries, perhaps spreading spurge.

Spotted knapweed (Centaurea maculosa), also not known to be present in the monument, exists in areas outside of park boundaries. The Shoshone BLM south of Craters of the Moon is attempting some controls over knapweed but is hampered by pesticide restrictions.

The Idaho Transportation Department is currently treating its rights-of-way, a portion of which extends through the monument, every three years.

There are no known threatened or endangered plant species in Craters of the Moon.

Alternative Actions and Their Probable Impacts:

1. Monitor Encroachment Species. Remaining aware of population densities of exotic plants is a cost-effective action, but exerts no control over numbers. This action would not prevent the spread of exotic species but would provide a record of location and rate of spread.

2. Exert Controls Over Exotic Species. The National Park Service has approved integrated pest management plan which allows managers to manipulate exotic plant numbers under certain circumstances. Generally, control programs will be undertaken when an exotic species threatens protected park resources and when control success is likely. When exotic species have almost no impact on park resources and control is unlikely, control programs will not be undertaken. Such programs need to be carefully reviewed and planned on a case-by-case basis. Herbicide use is approved under this program as a last resort to first considering no action, physical and biological controls. At Craters of the Moon, the plant species least likely to be affected by a control is cheatgrass, due to its high numbers. Use of fire as a management tool can be considered when the basic fire ecology work is completed and a wildlife management plan implemented.

   Considering thistle, leafy spurge and spotted knapweek, potentially, damaging results could occur to native grass and shrub stands if exotic spread continues unchecked. Native wildrye stands could significantly deteriorate if thistle is allowed to penetrate the

stand. The monument supports dense stands of bitterbrush (Purshia tridentata), an important mule deer forage item. The bitterbrush suffer natural periods of extreme defoliation by tent caterpillars. If a fierce competitor such as leafy spurge gained entry during one of these periods, extremely damaging results could occur.

Mullein stands are thick enough in some places in northern sections of the monument that potential spread through sagebrush (Artemisia tridentata) stands is likely. Physical controls such as clipping and chemical controls are warranted for this species.

This alternative is least cost-effective, yet ensures overall health of native plant and thus animal species. Implementation of this alternative requires further research and the ability to be flexible with and to comply with adaptions of national resource management goals.

3. No Action. This alternative is least costly in the short-term, but could become the most costly and damaging in the long term. Managers need to be aware of park goals in keeping with national goals and management strategies. Specific actions such as the integrated pest management plan have been authored in an effort to utilize sound judgment, and such plans should be utilized and adhered to. The "no action" alternative would not make good use of current management schemes borne out of past errors.

Recommended Course of Action:

A combination of alternatives 1 and 2 should be implemented. Control no longer remains effective if managers are not aware of new developments and problems, and monitoring alone is not effective at thwarting the spread of potentially-damaging plants. Physical and chemical controls have been considered and discussed in the revegetation plan, and are currently being tested. Methods of monitoring have also been considered. Implementation of permanent monitoring plots has been scheduled for the summer of 1987.

An area not scheduled for exotic plant eradication is the housing/visitor center lawn area. Plans to convert portions of the visitor center lawn to native vegetation area currently being implemented. Well-established non-native shrubs and trees will not be removed; nor will any be added in the future.

PROJECT STATEMENT: CRMO-N-016, SEISMIC MONITORING SYSTEM

Statement of Issue or Problem:

Statement of Condition - The geologic history of Craters of the Moon is of primary importance in the management of the monument. The enabling act establishing the monument deals almost exclusively with geological phenomena in its description of the merits of the area.

In general, the geological history of the monument has been adequately researched. Scientific investigations of the area began in the early 1900's and resulted in publication of I.C. Russell's work ("Geology and Water Resources of the Snake River Plains of Idaho", U.S. Geological Survey Bulletin 199, 1902). Research has continued on an intermittent basis up to the present time. The latest study was just recently completed by the U.S. Geological Survey ("Time, Volume, and Whole-Rock Composition Relations of Holocene and Late Pleistocene Basalt Volcanism Along the Great Rift, Idaho", by Kuntz, M.A. Champion, D.E., Spiker, E., and Lefebrve, R.H., 1981). It has not been published yet.

Opportunities for further research in specific areas do exist. The latest U.S. Geological Survey report predicts volcanic activity in the northern developed part of the monument within the next few hundred years. The establishment of a seismic monitoring system to detect renewed activity is justified. USGS has informally recommended that we begin to collect seismic data and will formally recommend seismic monitoring when they publish a hazards assessment document for CRMO sometime in the near future.

In addition, new developments in remote sensing technology have opened new avenues of research, especially in the realm of planetary and lunar geologic analogs.

The need is to establish and maintain a network for monitoring seismic activity on the Great Rift.

Alternative Actions and Their Probable Impacts:

1. Install Seismic Monitoring System. All present actions would continue. In addition, because of the threat of renewed volcanic activity in the developed section of the monument, and the consequent danger to life and property, a seismic monitoring system would be established to give warning of impending volcanic activity. Impacts would include long-term research operations and establishment of a number of seismic detectors at various locations throughout the monument. Ranger duties would be required to monitor such devices on a periodic basis.

2. No Action. Seismic monitoring would not be a concern to park management. This would be against several management policies, one of which states that: "The Service will develop, gather, compile, store, analyze, update, and employ adequate natural . . . data relevant to planning and management of each park. Such data will serve as an information base for formulating proposals and administrative decisions in planning for the achievement of park objectives. This information is required for the preparation of general management plans, environmental impact statements, and specific plans."

(Management Policies, II-1). Impacts would affect all levels of management decision-making.

Recommended Course of Action:

Alternative 1 is recommended. It is recognized that ". . . natural and social science information is necessary for management of the National Park Service." (Management Policies, IV-2), and agrees with management policy to ". . . conduct a program of natural and social science, to support management in carrying out the mission of the Service and provide accurate scientific data upon which all aspects of planning, development, and management of the units of the System may be based." (Management Policies, IV-2). In terms of geologic history, it is felt that adequate research has been accomplished to meet these objectives. However, the USGS has stated that volcanic activity is likely in the near future. Without some monitoring device in the monument there is no extant warning system for the protection of human life. The seismic monitoring system would provide such capabilities and ensure the earliest possible detection of volcanic activity.

PROJECT STATEMENT: CRMO-N-009, INFERNO CONE: IMPACTS

Statement of Issue or Problem:

Statement of Condition - Inferno Cone is one of more than twenty-five (CINDER CONES such geological features) along the Great Rift. A cinder cone is a conical mound built by the accumulation of volcanic cinders around a vent. The significance of Inferno Cone is not that it is a cinder cone - rather that it presents the best opportunity for the park visitor to view both the Snake River Plain and the entire chain of volcanic features along the Great Rift. The geologic diversity that can be seen from this cinder cone is unique. In addition to the Great Rift and the Snake River Plain, several mountain ranges are visible. Included are the Pioneer Mountains, the White Knob Mountains, the Lost River Range, the Lemhi Range, the Caribous, and Big Southern Butte, which is a designated national landmark as well as the target for all CRMO visibility monitoring since 1983. The most spectacular view is to the southwest, overlooking the Spatter Cones. Visitor access to the Spatter Cones was greatly reduced in 1984 when a major three year rehabilitation project was concluded (see CRMO-N-1). The scene from atop Inferno Cone is the only overview possible since the Spatter Cones project was completed.

Inferno Cone receives heavy use from visitors walking from the parking lot up the southwest face. The foot trail is visually obvious, but not defined by any marking system or barriers. Over the years the trail has become wider and is beginning to show surface erosion. The extent and specific cause of the erosion is unknown at present.

A physical monitoring system was initiated in the fall of 1985 and revised in the fall of 1986. The purpose of the monitoring is to determine if human use will continue to erode the natural surface after the cinders are compacted. This data will measure trail depth for 5 years. Efforts to prevent the trail from increasing in width have been ongoing since 1983 through manually spading up and overturning the trail surface annually. This has been successful in preventing the trail edges from expanding further into the cinders, however, this method has been suspended while the monitoring program is in place.

Three possibilities are suspected as cause(s) of the impact — or, more likely, a combination of the three are anticipated.

1) As people walk on the cinders, they depress the surface through compaction of the cinders. If this is the case, then there will be a limit to the compaction and thus impact will reach a point of equilibrium.

2) The cinders are disturbed by foot pressure and airborn by the constant wind and transported to another location. We know that this is happening, but it is unknown to what extent this is taking place and what the long term effects will be.

3) The cinders are traveling down slope due to physical laws of downward pressure from the weight of people as they walk down hill. This seems unlikely to be a primary component of the problem, but monitoring will detect any major down hill shifting of the surface.

The one consistent factor throughout the problem is compaction. The critical question is: will the surface continue to erode once the area is compacted. This can only be determined by collecting data through monitoring efforts. Each fall, trail measurements are recorded that will detect further surface erosion and trail expansion. Each measurement is referenced to a permanent datum point affixed in the ground. The monitoring program is expected to take a minimum of five years before any conclusive results are possible, perhaps longer.

Alternative Actions and Their Probable Impacts:

1. Close Inferno Cone To All Foot Traffic. The entire area could be closed to all visitor use except for viewing from a distance. This would require additional funding and manpower for visitor education, law enforcement, and rehabilitation. To be effective, the parking lot at the bottom of Inferno Cone would need to be obliterated and rehabilitated. Closure would prevent physical impact on the cinder cone, but it would also prevent visitors from one of the more spectacular viewpoints within the accessible section of the monument. Inferno Cone would then become "another cinder cone". Visitor reaction to closure of this area is anticipated to be extremely negative, as it is very popular and a positive visitor experience.

2. Continue To Monitor Trail For Surface Erosion. Collection of data will determine if the trail surface will continue to erode after maximum compaction has taken place. A specific plan of action would be developed after the causes and extent of the problems are fully understood.

3. No Action. Continue to allow visitors to use this area without any monitoring to determine the extent of impact or the reasons why it is occurring. The trail would become wider and surface erosion might continue. If surface erosion continues, impacts could eventually become irreversible and incorrectable.

Recommended Course of Action:

Alternative 2 is recommended. This action will allow for the collection of information for the development of a long term management action plan that will ensure the best use of this area. Various management actions will be considered once the problem is fully understood and documented.

PROJECT STATEMENT: CRMO-N-011, BACKCOUNTRY MANAGEMENT - WILDERNESS AND NORTH END UNIT

Statement of Issue or Problem:

Statement of Condition - CRMO backcountry includes land within and outside of the area designated as wilderness. The term wilderness refers to congressionally determined and designated areas which are subject to regulations as set forth in the 1964 Wilderness Act and NPS guidelines and policies regarding such designated areas. The term backcountry refers to land which is undeveloped and essentially natural in character. Therefore, backcountry includes, but is not limited to that portion of the monument designated as wilderness.

Most of the backcountry lies within the wilderness area (established October 23, 1970) south of the Outstanding Natural Features Zone, along the Great Rift. The wilderness is 43,243 acres (67 square miles) and comprises about 80% of the monument's total area. The wilderness is mostly semi-barren lava fields, with extremely limited water. The other primary backcountry area is the North End of the monument, classified as Natural Environment with 4,125 acres.

The entire backcountry currently experiences extremely light visitor use with an average of approximately 250 overnight backpackers per year from 1975 to present. Moderate day use of the backcountry is estimated at less than 3,000 persons annually. Resource impact is minimal.

Overnight use is limited to the wilderness area and requires a back-country permit. Backpacking parties are small, usually less than four persons, and seldom stay out more than two nights. This is primarily

due to the fact that all water must be packed in. There are no reliable water holes and no sources of surface water. Visitor use of the scarce supply of water is discouraged and reserved for the existing wildlife.

There are no designated campsites and users are free to choose camping sites, with the following restrictions: camping must be at least one mile within the boundary and open fires are prohibited. Day use of the wilderness is unrestricted other than the existing regulations that apply to the entire monument.

Visitor use of the North End is limited to day use and presently requires a backcountry permit. As this area is the sole domestic water supply for the monument, and is fed by surface springs, overnight use is not compatible. Use of this area is almost nonexistent with less than a dozen permits issued per year.

Alternative Actions and Their Probable Impacts:

1. No Action. Presently, a free backcountry use permit is required to camp overnight in the wilderness area and to day hike in the North End. The purpose of the permit system is to ensure that the user fully understand the regulations and requirements for backcountry users and to provide the user with the information necessary to ensure that they are aware of the inherent dangers of hiking in the lava fields without water. Because the wilderness is a harsh environment it is also desirable to have the backpacker check out with the rangers. The permit system for the North End is necessary to control use because of the domestic water system.

2. Eliminate Permit System. The park visitor would be allowed to use the backcountry without a permit. They would not be informed of the inherent dangers of hiking in the wilderness area and park management would have no idea of use patterns or potential problems. Also, wilderness users would not be assured of assistance if they needed help. The very limited supply of water could be adversely impacted.

Recommended Course of Action:

Alternative 1 is recommended. The continued use of the permit system will ensure the safety of the public, protect the domestic water supply, and prevent adverse impacts to the environment.

PROJECT STATEMENT: CRMO-N-021, DATA MANAGEMENT SYSTEM

Statement of Issue or Problem:

Statement of Condition - A system to store, retrieve, manipulate and analyze information is paramount in any successful management program; it is imperative in resources management. The components of resources management are:

- Collection of background information to establish a baseline datum point.
- Identification of key indicator ecological elements for long-range monitoring to measure change(s).
- A method to integrate individual ecological elements for demonstrating significant relationships.
- The ability to analyze and evaluate specific management action effects on the resource.

This type of systematic approach to resources management is best accomplished through a data management program, relying on the development and use of a computerized data management system at the park level. It would include not only information from the Baseline Resources Inventory (BRI), but also historic and cultural resources data, data collected from vegetation maps and transects, mule deer monitoring, wildfires, cave management, exotic plant control programs, air quality monitoring, and other relative information.

The need is to develop and implement a computerized data management system.

Alternative Actions and Their Probable Impacts:

1. Develop a Data Management System. Through the use of a micro-computer, develop a fully integrated program to store and manipulate resources information/data. This system would assimilate all pertinent resource knowledge and allow management to analyze and compare the various information components during the decision making processes. It would also allow tracking of management actions, charting of relevant long-range trends and provide an effective method for comparing documented monitoring programs.

2. No Action. Implementation of the Resource Management Plan would continue without an electronic storage system. This would not allow for cross-reference of the individual ecological elements and long-range analysis of collected data would be difficult. At best, it would not be cost effective.

Recommended Course of Action:

Alternative No. 1 is recommended. It is critical to the overall management of the monument that a data management program for resources management be established and utilized. Without such a system, specific cause/effects can not be measured and a fully integrated approach to management of the entire ecosystem will not be possible.

PROJECT STATEMENT: CRMO-N-007, FOOT TRAILS THROUGH GEOLOGICAL FEATURES

Statement of Issue or Problem:

Statement of Condition - Craters of the Moon has 12.60 miles of foot trails. The only maintained trails are within the outstanding natural feature subzone. There are two self-guiding interpretive trails—the Devil's Orchard and North Crater Flow trails. There is one unmarked trail which is used by rangers conducting the Buffalo Caves Walk. All other trails connect points of interest. Approximately one-half are constructed requiring continuous maintenance. Surfaced trails do not presently conform to management policies that provide for the surfacing and maintenance as necessary to conform with visitor safety, resource protection, and erosion. The remaining trails are non-constructed with very little improvement or maintenance.

In addition to the maintained trails, there are several miles of old, unmaintained trails leading to such features as the Great Owl Cavern and the caves east of the developed cave area. Although still marked in the field by rock cairns, these trails are in varying stages of deterioration and disrepair. Partial obliteration of trailheads and removal of trailhead directional signing has kept the casual visitor from using these trails.

An old fire road leading south from Broken Top for five miles into the Craters of the Moon Wilderness is also used as a trail by wilderness hikers. This cinder road has not been maintained since 1970, and is being allowed to revert to its natural state although its trace will be visible for decades.

Numerous well-defined and prominent deer trails cross the cinder slopes and are occasionally used by visitors who mistake them for park trails.

Off-trail travel by visitors in certain locations (mainly the Spatter Cone/Big Craters area, and open cinder slopes) has produced an adverse impact on these volcanic phenomena. The impacted areas are easily identified by the broken surfaces as contrasted with the oxidized natural surface of the undisturbed surroundings. On cinder fields, footprints are vividly painted in wildflowers due to plant preference for disturbed and compacted cinders.

Because they are non-regenerative, unlike a biological resource, the volcanic features require a tightly managed trail system. This requires intensive educational and maintenance protection. The use of ranger patrols, reminders in interpretive programs of the need to stay on trails in order to preserve the natural environment, signing, and proper maintenance contribute to this goal.

A trail system is designed to control the impact of off-road visitor use on the environment. It also provides safe access to interesting park features not accessible by road. Management policies clearly state that ". . . trails and walks will be planned and provided as an integral part of the park access and circulation system. Trails, like roads, should provide enjoyable access to interesting park environments without endangering fragile resources or ecological patterns. Trailheads and trail access points, from which trail use

can begin, should be carefully tied into other elements of the park development and circulatory system to facilitate trail use and management." (Management Policies III. 4)

The need is to develop and implement a program that will ensure the continued upkeep of the trail system.

Alternative Actions and Their Probable Impacts:

1. No Action. Continue present management. All trails would be inspected and maintained at a prescribed standard. Trails that are not presently adequate are not upgraded to meet standards. Trails would be patrolled on a regular basis. Reminders of the need to stay on trails would be stressed in interpretive programs and in visitor contacts. Trails would neither be constructed nor maintained in the wilderness area. Develop and implement a cyclic maintenance program to bring all trails up to standard and provide routine maintenance.

2. Construct More Trails. The trail system would be expanded to include more points of interest. Old, unmaintained trails would be rehabilitated and brought back into the maintained trail system. Loop trails would be established wherever possible to avoid the problems of visitor dispersion at the end of "dead-end" trails. Trails would be constructed to accommodate special uses, such as a special handicapped accessible trail (wheelchair usable, and/or a trail for the blind). Trails in the wilderness would be maintained and/or constructed to provide access. Actions would require expenditures of cyclic maintenance. Opening some of the unmaintained trails

would cause adverse impact and deterioration in environmentally sensitive areas (Crystal Fissure Spatter Cone chain). Constructing and maintaining trails in the wilderness would concentrate rather than disperse backcountry use and would go against present backcountry management policy.

3. Obliterate Trail System and Allow to Revert to Natural State. The trail system would be allowed to revert back to a natural state. Trail improvements, paving, and signing would be removed. This would restrict public enjoyment of the park by restricting their range of allowable activity. Geological features would suffer impact thru development of impromptu trails by visitor. Erosion and compaction would be accelerated. Management policy which clearly states that trails will be planned and provided as an integral part of the circulation and access system of the park.

Recommended Course of Action:

Alternative No. 1 is recommended. The park should develop and implement a trail maintenance program as funded under the cyclic maintenance system. This calls for specific corrective action approximately every three years on the surfaced (paved) trails and routine annual maintenance. Trails would be maintained in a safe condition. Popular features and areas of established use would be protected from the impact of casual trails. There would be no impact of new trails. Trails would be maintained at established and prescribed standards on a cyclic basis. Regular ranger patrol would be conducted. No trails would be constructed in wilderness areas and those present would be of wilderness character.

PROJECT STATEMENT: CRMO-N-022, EXTERNAL THREATS

Statement of Issue or Problem:

Statement of Condition - Craters of the Moon has 53,545.05 acres with 43,243.00 acres designated as wilderness. BLM lands border the monument boundary. The State owns three school sections. There are 37 acres of private land adjacent to the park boundary. There are no private inholdings.

The potential for impacts on the monument from external influences are numerous. These include: degradation of air quality, mining on adjacent lands, recreational development, exotic plant encroachment, poaching, livestock trespass, and noise from aircraft. Although adverse impacts from each of these categories are possible, only four are presently represented as an immediate threat. These are degradation of the air quality, mining on adjacent lands, invasion by exotic plants and poaching.

Air Quality

Degradation of the air quality is perhaps the most significant threat. Impacts on visibility are documented and adverse impacts to vegetation are suspected.

Visibility monitoring for the past several years indicate relatively pristine conditions, with the trend toward deterioration.

No gaseous pollutant monitoring has been done at the monument. However, recent visual observation and preliminary field investigations suggest adverse impacts due to possible air pollution injury to vegetation (see CRMO-N-8 and CRMO-N-20).

Mining

Mining of precious metals, primarily silver, is a major industry in Idaho. Southern Idaho was first settled by miners. Although mining activity has greatly declined since the turn of the century, there are still many active mineral claims adjacent to the monument. The number of mineral claims filed by large corporations within the past several years has dramatically increased.

One locally owned mineral claim, directly adjacent to the monument boundary, has recently been leased to a mining corporation. Presumably, mining operations will begin in the immediate future. The type of mining activity at this site is not presently known. Historically, mining in this area has consisted of both open pit and underground excavations. At present it is difficult to predict what impacts would result from modern mining operations. However, the potential for erosion, visibility impairment, impacts on vegetation and wildlife and increased local traffic are possible. The degree of increased mining activity is most directly influenced by the international silver market, which is currently at low value. If the price of silver increases mining activity will surely follow.

Exotic Plants

There are several exotic plant species that have invaded the monument and continue to spread onto park lands from neighboring lands (see CRMO-N-015). The extent of this problem is unknown, as exotic species were not assessed in the vegetative map for CRMO. Presently, five exotic species have been identified that constitute a known or potential threat for impacting the natural system.

Poaching

CRMO has a large herd of mule deer (400-600). Poaching and illegal hunting is a continuing problem with the annual number of incidents increasing. As the lands adjacent to the monument are public, big-game hunting is allowed as regulated by the Idaho State Fish and Game. Hunting pressure along the boundary line of the North End Unit is very heavy. Illegal killing of mule deer within the monument range from individuals that are simply ignorant of the monument boundary and regulations, to the dedicated professional poacher. The threat is not so much the actual number of deer that are killed (6-12 per year) as is the potential impacts if aggressive efforts are not assured. If law enforcement activity is not continuous and effective, the deer herd will suffer significant adverse impacts due to illegal killing.

Other Threats

Recreational Development - Two separate areas adjacent to the North End Unit offer potential for development as recreational sites. Winter recreation seems the most likely activity.

On the east side, Blizzard Mountain ski area is a small privately owned rope-tow operation that has limited developmental potential. It has been operational only two winters out of the last eight and does not present the opportunity for a major ski area. Improvements would have very minor impacts on the monument.

On the west side, the Big Cottonwood drainage has been the discussion for development of a major winter and summer recreational area for the past ten years. There are 2,700 acres of private land surrounded by BLM land in the valley. Potential for downhill skiing, snowmobiles, cross-country skiing and a summer "dude ranch" operation have all been proposed intermittently by various individuals. No action beyond conceptual discussions has ever been taken. Under present economical conditions, development of the area seems unlikely. However, a major recreational facility in this area would have significant impacts on the monument.

Livestock trespass has a long history and various actions have been taken to provide long-term solutions to the problem. Although the impacts are minor, two separate actions are necessary to resolve this continuing problem. Boundary line changes and construction of approximately eight miles of fence are necessary. Efforts are underway to implement both of these projects.

Noise from aircraft has been a problem at CRMO. Primarily military aircraft present the greatest threat. CRMO has a good working relationship with the local military air base and the problem is currently under control.

Alternative Actions and Their Probable Impacts:

1. No Action (Current Action). The present management program is primarily administrative cooperation, monitoring activities and implementation of various action plans.

A close working liaison with the BLM, Butte County Commissioners, INEL, military air bases, livestock users and private land owners, whose actions could affect the monument will be maintained. Since the park has no jurisdiction outside its boundaries, we can only suggest that consideration be given to our concerns.

Various monitoring activities, such as air quality, would continue. This information would be shared with the cooperators and interested organizations. Action plans and daily operations would continue. These actions, such as law enforcement activities and control of exotic plant species, would ensure that certain threats are held in check and appropriate actions taken when necessary.

Overall, the most effective tool for park management is to remain constantly aware of neighborhood activities and to maintain a working relationship with all concerned parties and management organizations.

Other alternatives are not being considered. It is totally unrealistic to consider a posture that would require the monument to simply react to various outside threats after the fact.

PROJECT STATEMENT: CRMO-N-004, CAVE MANAGEMENT

Statement of Issue or Problem:

Statement of Condition - Craters of the Moon has many caves that are of great interest to the general public and scientific community. They include lava tubes, fissure caves, and spatter cone vents (cave-like features). The enabling act establishing the monument specifically mentions caves (lava tubes), rifts (location of fissure caves), and volcanic cones (location of spatter cone vents) as being ". . . of unusual scientific value and general interest." They vary in origin, size, length, and accessibility, as well as management requirements. The majority have no truly unique or fragile resources that dictate special management needs.

There are inherent dangers in exploring any lava cave. Specifically, masses of unstable breakdown, loose ceiling blocks, ice, total darkness, low ceilings, uneven walking surfaces, and equipment failure are potential hazards. Because of their nature the caves will continue to be a site of minor injuries, some requiring first aid treatment. There will always be the potential for major injuries in such an environment. Safety messages regarding cave safety are an integral part of interpretive programs and visitor contacts.

Current Management Action. Most of the caves are managed as wilderness caves, (NPS Management Policies IV, page 21), available to those visitors who find and wish to explore them. Aside from being marked with rock

cairns, and sometimes marked on a map, there is no publicity given to them. However, there are several sites that require special attention and management.

There is one developed cave area which consists of five lava sections of a tube connected by a maintained surface trail system. This area is one of the most popular visitor destinations in the monument. The largest lava tube, Indian Tunnel, has interpretive signs, a marked travel route, and a metal stairway to provide access. It is easily accessible to visitors and does not require an artificial light source, although parts of the cave trail have very dim natural lighting. The other caves are undeveloped and require an artificial light source for exploration. Guided cave walks and a self-guiding pamphlet are available in this area during the summer months. Ranger patrols and maintenance cleanup details are conducted daily. Almost all of the lava tubes in the monument allow visitor access without specialized spelunking equipment or skills. Two exceptions are Arco Tunnel and Great Owl Cavern. Since June of 1961 Arco Tunnel has been accessible only by registration and special use permit to qualified and properly equipped groups. Access is controlled primarily for the purpose of insuring public safety, although protection of the resource is also a factor. Arco Tunnel has several thousand feet of surveyed passage with numerous side tunnels, some low crawlways, and a complex branching system of passages. Visitors without a good map and proper caving experience and equipment could easily get lost and/or injured in such a cave.

The lockable metal gate prevents the casual visitor from entering the cave. Only by obtaining a Special User Permit can a visitor enter Arco Tunnel. Issuing such a permit guarantees personal contact with the user. This provides an opportunity to evaluate equipment and caving experience, plus the occasion to communicate safety messages and pertinent regulations.

Another exception is Great Owl Cavern, once accessible by a marked trail and stairway. The stairway was removed in 1972. After the cave was included in the Craters of the Moon Wilderness the stairway was dismantled and the access trail partially obliterated. Access can only be accomplished by using climbing ropes or a climbing ladder.

Fissure caves were formed by extensional cracking associated with the Great Rift in the southern part of the monument not covered by more recent volcanic deposits. Such caves sometimes contain waterholes (e.g. Bearsden Waterhole) and ice deposits (ice caves southeast of Vermillion Chasm), which are an important source of water for wildlife. Fissure caves average one to six feet wide and extend vertically downward to varying depths. A fissure cave south of the monument (South Grotto) has been descended to a depth of 800 vertical feet, making it the deepest open rift on earth. Because of their vertical nature, specialized equipment, ropes, and climbing skills are essential for safe exploration of most fissure caves. The fissure caves of the monument are rarely visited due to their isolated location and difficulty of transporting climbing equipment to those sites.

Management has discouraged visitors from utilizing the water from these fissure caves because of public health concerns and to sustain water supplies for native animal populations.

Spatter cone vents are cave-like features which consist of an open, chimney-like volcanic vent, and, occasionally, the associated magma chamber. They extend downward to varying depths and may contain snow or ice (Snow Cone). Some contain mineral deposits such as gypsum, mirabilite, and jarosite.

Not all spatter cones have open vents. Many have had their vents plugged with pieces of spatter during the eruption, or from eroding cone material falling back into the vent. Easily accessible open vents tend to gradually fill up with rocks either thrown in by visitors or dislodged by visitors climbing on the fragile cone surfaces.

Several spatter cone chains occur in the monument, along with a few scattered, solitary cones. Almost all are located in the Craters of the Moon Wilderness and are infrequently visited. Most spatter cone vents can only be safely explored using specialized climbing equipment and ropes. The difficulty of transporting such equipment to the vents in the Wilderness area is, in itself, a deterrent to exploration.

The Crystal Fissure spatter cone chain is the only easily accessible area of spatter cone volcanism. It is one of the most popular visitor destinations in the monument. Several open vents are found in this area.

Management of this area consists of the following actions: 1) the installation of safety railings around two vents to allow safe viewing, 2) prohibition of off-trail travel by signing, thus discouraging visitation to the other spatter cone vents, 3) periodic ranger patrols to monitor visitor use and control off-trail violations, 4) periodic cleaning of trash thrown into vents by visitors, 5) the installation of a metal grating over the Crystal Pit. This inconspicuous vent (3 feet in diameter) is 90 feet deep and before closure constituted a very real hazard in this heavily visited area. The grate was installed in August of 1963. Later management decisions have closed this vent to all exploration, in part to protect the fragile mineral deposits of gypsum, mirabilite, and jarosite which are found inside. This follows specific management policy guidelines which state that "caves, or portions of caves, may be closed to public use. . . when such actions are required for human safety and the protection of cave resources." (Management Policies, IV-22).

The caves of Craters of the Moon have received minimal scientific study. The locations of most caves are known but only a few of the major caves have been surveyed. A "Lava Tube Atlas" contains descriptions of several of the caves but is incomplete. Studies have been made on the Idaho lava tube beetle and the unusual mineralogy in some of the lava tubes. Research on such topics as aerosol rabies and radioactivity, both of current concern in cave management, has not been initiated.

Alternative Actions and Their Probable Impacts:

1. Develop and Implement a Cave Management Plan. This document would specify management policies for caves and identify research needs.

2. No Action. Management of the caves would follow a reactionary approach. Problem sites would be dealt with as the need arose. Most of the caves would continue to be self-exploring for the general public. Certain caves would require registration and special permits based on current Standard Operating Procedures. No cohesive plan would be available for managing the cave resources. Use impacts would not be documented.

Recommended Course of Action:

Alternative No. 1 is recommended. This alternative will require staff action to develop a Cave Management Plan (CMP) that details specific management programs for individual cave sites. These management programs will vary according to the resource needs and use classifications of each cave.

Certain caves will require active management and/or research; others are simply documentation of the resource. Impacts will be negative.

PROJECT STATEMENT: CRMO-N-014, BOUNDARY SURVEY

Statement of Issue or Problem:

Statement of Condition - A properly surveyed and marked boundary is essential to the proper management of the monument. There are situations in which park rangers must take legal actions to enforce federal and state laws and regulations. These involve such activities as livestock trespass (sheep and cattle), poaching by hunters, mining activities, and relations with adjacent landowners, with approximately 50 miles of boundary. Without an official survey and clearly visible boundary markers, disputes arising from such situations may place the National Park Service on questionable shakey legal ground.

Records indicate that the earliest survey at Craters of the Moon was conducted between 1925-1930. 1883-1931 It could not be determined whether this covered the entire monument boundary or only a portion. The Bureau of Land Management resurveyed 10 miles of boundary north and west of U.S. 20 in 1965, and established 165 steel posts and boundary signs. At that time it had been impossible to locate the boundary line from any previous markings. Rock cairns have been constructed in this area to further delineate the boundary. Ranger patrols are required on a periodic basis to maintain these markings, which suffer yearly damage from soil creep, heavy snowfall, snow creep, and vandalism.

A complete boundary survey was requested in 1973 because of the establishment of the Craters of the Moon Wilderness in 1970. This survey was never initiated. The area of the monument south of U.S. 20 is in need of an official survey and boundary marking in order to properly manage the area.

The need is to have an official boundary survey conducted, and to properly mark the boundary with clearly visible materials appropriate to the site.

Alternative Actions and Their Probable Impacts:

1. Conduct Official Boundary Survey and Clearly Mark Boundary. An official boundary survey will be initiated on all sections of boundary not previously surveyed and marked. Previously surveyed boundaries which cannot be located on the ground will be resurveyed and properly marked. The entire boundary will be suitably marked with materials easily visible but appropriate to the site and it will be costly to mark the boundary. Impacts will consist of the initial cost of surveying and boundary marking materials, periodic ranger patrols to maintain boundary markers in good condition, and annual material replacement costs. The potential trespass threat remains but prosecutions for trespass will be less difficult.

2. No Action. The only section of boundary maintained will be north and west of U.S. 20. This will be accomplished through periodic ranger patrols and an annual material replacement budget. Traditionally, this boundary accounts for most "incidents" concerning federal and state laws and regulations. Continued maintenance of this section of boundary will allow park rangers to effectively manage the area.

   The majority of the monument's boundary will continue to be unsurveyed and unmarked. However, the cost of sign/marker maintenance will be less and the cost of survey and marking obviated. Potential impacts of poaching, livestock and mineral/energy resource exploration would remain.

When boundary disputes do occur, the Park Service would be hampered when prosecuting for trespass. Although this boundary suffers little adverse impact from livestock trespass or poaching, situations with adjacent landowners may arise in the future, particularly concerning geothermal exploration and fire control management accountability.

Recommended Course of Action:

Alternative 1, Conduct Survey and Mark Boundary, is recommended. It is clearly in the best interest of the monument to have an official boundary survey and easily visible boundary markers. Enforcement of state and federal regulations would be enhanced and prosecution of trespass cases would be less difficult. Boundary visibility would forestall accidental trespass and dissuade known illegal entry. Ranger patrols and contacts along marked boundaries would be more effective.

PROJECT STATEMENT: CRMO-N-012, NOISE POLLUTION

Statement of Issue or Problem:

Statement of Condition - Low flying aircraft often intrude upon the park setting and wilderness solitude of the monument. The aircraft, mostly military, are apparently using the Great Rift for visual navigation. They usually fly from the north to the south at ground level. Because they are low flying and jet powered the noise level is tremendous. The aircraft noise is an exotic intrusion rather than resource threatening.

The need is to document these flights, identify the military base from which they originate and develop liaison with that command to encourage a flight use pattern that would not encroach upon the monument and traditional park values. Currently, we have a good relationship with the military and incidents are down to only an occassional intrusion (less than 6 per year).

Alternative Actions and Their Probable Impacts:

1. No Action (Current Action). Through liaison with the military, establish the Great Rift as a non-use area for low level flights. This relationship has been effective and must be maintained.

2. Allow Liaison with Military to Expire. Allow aircraft to intrude upon the monument. Efforts to prevent military aircraft from impacting the monument would be discontinued. Under this alternative, exotic encroachment (noise) would continue and the wilderness values would be violated.

Recommended Course of Action:

Alternative 1 is recommended. It has just been in recent years that the flyover of military aircraft has reached a point where it is seriously impacting on the enjoyment of those visitors utilizing the park area. These low level flights and their sudden, unexpected roar are very disturbing and in conflict with park values. Liaison with the military bases involved is necessary and would continue. To continue to tolerate such intrusions in the park can only further downgrade the experiences of those visitors trying to enjoy the park and its resources.

PROJECT STATEMENT: CRMO-N-018, REINTRODUCTION OF NATIVE SPECIES - BIG HORN SHEEP

Statement of Issue or Problem:

Statement of Condition - Historical accounts show that bighorn sheep once inhabited the great rift area and what is presently Craters of the Moon National Monument. The most recent records are from the 1920's. It is suspected that market hunting and domestic livestock contributed to the local extinction of the sheep by 1925. It is not known whether bighorn sheep were permanent residents of the monument area or only summer residents. Currently, mule deer are summer residents only, presumably due to unacceptable snow depths which accumulate in winter. It is reasonable to assume that bighorn sheep would be limited in the same manner. Highly exposed, windblown ridges with suitable forage are not common enough along the great rift in winter to provide sufficient area for wintering bighorn. Thus, free ranging bighorns would be expected to leave the monument in winter. Also, it is unknown as to the subspecies, the possibility being either Ovis canadensis canadensis or Ovis canadensis californiana, as both groups presently exist within the immediate region.

Perhaps the most critical factor beside lack of winter range in considering a reintroduction, however, is the presence of large numbers of domestic sheep which graze lands adjacent to the monument. Bighorn sheep are particularly susceptible to scabies, blue tongue ringworm, and pneumonia which are carried by domestic sheep.

Reintroduction of Bighorn Sheep at CRMO was investigated by NPS Wildlife Biologist Brad Griffith in 1982 in cooperation with Idaho Fish and Game

and BLM. The unamimous conclusion was that a reintroduction attempt would fail due to the above stated reasons.

Alternative Actions and Their Probable Impacts:

1. Reintroduce Bighorn Sheep. This strategy would call for the reestablishment of the bighorn sheep. Initially, they would have to be confined to large enclosures and water guzzlers constructed. Additionally, at least during hard winters, they would require supplemental feeding due to the accumulation of snow. The entire herd would have to be confined year-around. This program would be tremendously expensive and it seems likely that, eventually, the bighorn would be exposed to the domestic sheep and almost certainly contact diseases. The social behavior of the bighorn would facilitate transmission of the diseases and the entire herd would more than likely be lost. Nearly every instance of bighorn reintroduction attempted on range with overlapping use (even if restricted to illegal trespass) by domestic sheep has ended in failure. Also the bighorn would be in direct competition with the mule deer. The characteristics of the monument, which include regular sheep grazing adjacent to most of the boundary, do not seem to offer much hope of a successful reintroduction.

2. No Action. The National Park Service would not undertake a program for reestablishing a herd of bighorn sheep. This alternative would not introduce stress on the existing mule deer population nor require supporting funds.

Recommended Course of Action:

Alternative 2 - No Action is recommended. The reintroduction of the bighorn sheep is desirable from a conceptual viewpoint. However, the realities of the situation are that it would be very expensive and probably result in total failure. In discussions with the Idaho State Department of Fish and Game and BLM personnel, they share this view and concur with a no action alternative.

To reintroduce the bighorn would require manipulation of the resources within the monument beyond the mission of the NPS and sound management judgment.

PROJECT STATEMENT: CRMO-N-019, EXTIRPATION OF THE GRIZZLY BEAR

Statement of Issue or Problem:

Statement of Condition - The grizzly bear was formerly widespread throughout Idaho. It is now confined to the wilder regions of the mountains of the state. It is believed that there were grizzly bears in the Snake River Plain region and in the vicinity of the monument. Era Martin had killed a number of grizzly and black bears in the monument between 1884 and 1920. Stearns noted denning of bears in the lavas and extensive bear grazing of the wild parsley. Era Martin was attempting to live trap a bear near inferno cone in 1921. Limbert (1924) states that grizzly bears were inhabitants of the monument. No one knows for sure why the grizzly disappeared. Due to the fact that there is cattle and sheep grazing in the surrounding area it is very possible that the grizzly was exterminated by ranchers. The plains grizzly depended on the bison (buffalo) for its food, so with the elimination of the buffalo the grizzly soon became extinct.

Alternative Actions and Their Probable Impacts:

1. Reestablish the Grizzly Into the Monument. This idea is not practical. The bear would undoubtedly extend its range up into the mountains outside the park boundary. In a dry area the grizzly needs up to 168 square miles to roam. Crossing the highway would pose a threat to both the bear and the motorist. With cattle and sheep grazing these bears would more than likely be seen as a threat to the grazing population. The food and water sources in the wilderness area of the park are questionable. The park visitor

may oppose this plan because of the safety factor. However, a few people might prefer to see the grizzly in a wild and natural state. Impacts on livestock, visitation and costs of reintroduction would be significant.

2. No Action. The park would not attempt to reestablish the grizzly. The grizzly was not an important feature of the area when it was declared a monument. According to the Park Service management policies, the reintroduction of native species into parks is encouraged provided that--the species, based on an effective management plan, does not pose a serious threat to the safety of park visitors or park resources, or to persons or property outside of park boundaries. Adequate habitat should exist in the park and on adjacent public lands and waters to support the species. Also, it would be difficult to find a viable genetic population of the plains grizzly.

Recommended Course of Action:

Alternative 2 - No Action is recommended. The park would not attempt to reestablish the grizzly bear. It would probably pose a serious threat to the safety of the park visitors or park resources, persons or property outside of park boundaries. As previously mentioned, the food and water sources may be limited, especially since there are no bison left in the monument. The grizzly would probably prefer to live in an area where there is little contact with park visitors.

NATURAL RESOURCE MANAGEMENT

ENVIRONMENTAL ASSESSMENT

ENVIRONMENTAL ASSESSMENT MATRIX

Discussion

The following matrix displays summarize and highlight evaluations outlined in the individual project statements for natural resources. All alternative actions are evaluated in light of impact categories (vegetation, wildlife, soil, visual impact, visitor use, etc.) and resultant alternatives are discussed separately.

The overall guidance document used in preparation of this matrix is "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (November 29, 1978), Council of Environmental Policy, Executive Office of the President. Reference is to Part 1501 - NEPA and Agency Planning.

Other documents cited for reference are:

- NPS Organic Act, 1916
- Presidential Proclamation No. 1694 - May 2, 1924
- Antiquities Act, 1916
- Executive Order 11593
- Statement for Management, CRMO
- Wilderness Act, 1964
- NPS Management Policies

Impacts

There are no negative or adverse impacts resulting from the cumulative impacts on any impact category as a result of these alternative actions.

CRMO
ENVIRONMENTAL IMPACTS
OF PREFERRED ALTERNATIVES

SUMMARY
ENVIRONMENTAL
ASSESSMENT
MATRIX

PROJECT STATEMENT	VEGETATION	SOILS	WILDLIFE	WATER RESOURCES AND QUALITY	AIR QUALITY	AESTHETIC VALUES	GEOLOGICAL FEATURES	VISITOR USE	CULTURAL RESOURCES	OTHER AGENCIES	SAFETY
SPATTER CONES		X				X	X	X			X
FIRE ECOLOGY	X	X	X		X	X					
BASELINE RESOURCES INVENTORY	X	X	X	X			X				
AIR QUALITY - GASEOUS	X	X	X	X	X	X	X	X		X	X
DATA MANAGEMENT											
PHYSICAL REMOVAL RESOURCE	X	X				X	X	X			
MULE DEER	X	X	X			X		X		X	
AIR QUALITY - VISIBILITY	X	X	X	X	X	X	X	X		X	X
INFERNO CONE		X				X		X			X
BACKCOUNTRY MANAGEMENT	X	X	X	X		X	X	X			X
BOUNDARY SURVEY	X	X	X	X			X				
EXOTIC SPECIES - PLANTS	X	X	X								
FOOT TRAILS	X	X	X			X	X	X	X		X
CAVE MANAGEMENT PLAN	X		X			X		X			X
LIVESTOCK: IMPACTS	X	X	X	X		X					
NOISE: IMPACTS						X		X			
EXTERNAL THREATS	X	X	X	X	X	X	X	X	X	X	X
SEISMIC MONITORING							X	X			X

AGENCIES AND PERSONS CONSULTED IN ASSESSMENT PREPARATION

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ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: BASELINE RESOURCES INVENTORY - CRMO-N-003

NEED FOR THE PROPOSAL: The need is to acquire and maintain a baseline inventory of all major components of the ecosystem.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Conduct resources inventory and survey	No collection of data		
Endangered Species	Positive effect thru location of endangered plants and animals so appropriate action can be taken.	Knowledge of presence in monument would go undetected		
Water	No impact	No impact		
Wildlife	Minor impact thru local disturbance during field work	No impact		
Geological Features	Minor impact due to physical inventory of each geological feature.	No impact		
Vegetation	Minor impact thru specimen collection and local disturbance during field work	No impact		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: AIR QUALITY: GASEOUS POLLUTANTS - CRMO-N-020

NEED FOR THE PROPOSAL: To determine any adverse impacts to vegetation caused from gaseous pollution

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Monitor vegetation and air quality to collect baseline data	NO ACTION No collection of base-line data	ALTERNATIVE	ALTERNATIVE
Vegetation	Would be able to determine exact impacts of gaseous damage	Would not be aware of changes and adverse impacts to this resource		
Wildlife	Would be able to determine exact impacts of gaseous damage	Would not be aware of changes and adverse impacts to this resource		
Aesthetic Value	Would be able to determine when pollution trend is increasing. This information would be used in overall AQ management actions.	Would not be able to plan for effects of increased pollution		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: AIR QUALITY: VISIBILITY - CRMO-N-008

NEED FOR THE PROPOSAL: With the increased population and development of the Snake River Plain the air quality may begin to deteriorate. There is a need to monitor the air quality.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Monitor the air quality Collect baseline data	NO ACTION Would not collect baseline data or document current conditions	ALTERNATIVE	ALTERNATIVE
Air Quality	Would be able to detect and monitor air pollution	Would not have baseline data with which to compare pollutant levels		
Aesthetic Value	Provides for good visibility and enjoyment of the monument	Pollution level may interfere with visibility in the monument		
Vegetation	Would be able to detect the pollution before it has an adverse effect on the plant life	The vegetation may suffer from the pollution before management becomes aware of the problem.		
Wildlife	Would be able to detect the pollution before it has an adverse effect on the wildlife	The wildlife may suffer from the pollution before management becomes aware of the problem.		
Cooperation	Part of nationwide monitoring system with data being used as national baseline information	Loss of data would effect nationwide program		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: FIRE ECOLOGY - CRMO-N-002

NEED FOR THE PROPOSAL: To determine the role of natural fire within the monument ecosystem and develop prescriptions for burning

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Alternative #1 Conduct research	Fire suppression - no research		
Air Quality	No effect	Minimal impact		
Wildlife	No effect	Impact during suppression activities		
Vegetation	Minor impact to small number of plants, trees and scrubs during research. Areas of fuel loading are identified.	Impact by fire and suppression activities. Fire depending species lost from ecosystem. Fuel building continues with resulting hot fire not controllable.		
Soil	Removal of soil samples by shovel/drill causes almost imperceptible localized disruption	Heavy impact along fireline. Potential for erosion after fire. Fuel buildup without natural fire results in hotter fire and soil loss in heavy fuel areas.		
Water	No impact	Minimal impact		
Personnel	Knowledge of fires role and effect on ecosystem	Impacts of fire not known		

ENVIRONMENTAL ASSESSMENT MATRIX
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RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: SPATTER CONES: IMPACTS - CRMO-N-001

NEED FOR THE PROPOSAL: The spatter cones are unique and represent the best known example of this type of volcanic activity within the continental United States. They are extremely fragile geologic features.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Upgrade existing trails and rehabilitate eroded areas	NO ACTION Continue use of present trail system	ALTERNATIVE Close spatter cone area and obliterate trails	ALTERNATIVE Open all Crystal Fissure Spatter Cones to unrestricted visitation
Visitor Use and Safety	Impacts would be controlled and safe viewing would be provided thru select areas.	Safety hazards would be unabated. Unofficially, areas would continue to develop and impact would spread.	Distant viewing only. No close safe contact with spatter cones.	Complex and costly trail system construction and maintenance. Visitor enjoyment enhanced. Protection costs increase.
Geologic Feature	Impact minimal. Trails restricted to certain areas. Feature would be protected and other cones of Crystal fissure not impacted.	Trail sloughing and erosion would continue, resulting in overall deterioration of area. All cones would be heavily impacted.	Impact minimal. Trails removed and are rehabilitated. Complete recovery would never be possible.	Visitor impact extended to pristine spatter cones and into non-impacted areas. More trail construction necessary. Irreversible commitment of the resource.
Visual	Impromptu trails removed. Impacted and eroded areas rehabilitated, resulting in physical appearance less impacted.	Heavy impact	Improved	Seriously impacted

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PROJECT STATEMENT TITLE: REMOVAL OF GEOLOGICAL RESOURCE _ CRMO-N-005

NEED FOR THE PROPOSAL: The removal of geofacts by the casual visitor constitutes a threat to the resource.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Continue an aggressive program of abatement	NO ACTION Provide souvenir samples	ALTERNATIVE	ALTERNATIVE
Visitor Use	Provide for minimal impact by making visitor aware of regulations, prohibiting collecting.	May encourage the collection of lava rocks. Would make enforcement of existing regulations difficult.		
Visual	Minimal impact	Minimal impact		
Geologic Features	Minimal impact. Provides the best means for protecting the resource.	Minimal impact. Could encourage collecting.		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: LIVESTOCK: IMPACTS - CRMO-N-013

NEED FOR THE PROPOSAL: The need is to control trespass of domestic sheep

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Continue special use permit (No Action)	NO ACTION Revoke special use permit	ALTERNATIVE	ALTERNATIVE
Water Resources	Water resources provided maximum protection	Water supply would be threatened by sheep		
Vegetation	Minimal impact due to sheep use restricted to specific area	Adverse impact due to frequent trespass on large area of monument. Exotic species could be introduced.		
Wildlife	Minimal impact due to sheep use restricted to specific and small area	Adverse impact due to frequent trespass on large area of monument		
Soil	Minimal impact due to sheep use restricted to specific and small area. Compaction, disturbance and erosion controlled.	Adverse impact due to compaction, disturbance and erosion		

ENVIRONMENTAL ASSESSMENT MATRIX
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RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: MULE DEER - CRMO-N-010

NEED FOR THE PROPOSAL: The need is to obtain data necessary to develop and maintain an interagency cooperative agreement for long-range management of the Craters deer herd. An aggressive law enforcement program in cooperation with other agencies is necessary to control illegal killing of deer.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Continue present management actions(no action) and conduct research	NO ACTION Discontinue current management actions	ALTERNATIVE	ALTERNATIVE
Vegetation	Browse species would be identified and deer impact measurable. Vegetative transects analysis and baseline data collected.	Deer caused changes would not be detected		
Wildlife	Use of browse species known and effect on herbivores can be deduced. Population trends monitored.	Correlation of plant availability and impact on herbivores would be unknown. Population trends unknown.		
Cooperation with other Agencies	Provides for the best style of management since the deer winter on lands outside the monument. Cooperation between state and NPS necessary to effectively carry out law enforcement actions.	Goals of NPS, BLM and state could be in direct conflict. Effective law enforcement not possible without cooperation with state.		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: EXOTIC SPECIES: PLANTS - CRMO-N-015

NEED FOR THE PROPOSAL: Several exotic plants present within the monument. The need is to monitor and/or control these exotic species.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Monitor problem species, physical removal and limited control	Physical removal of plants		
Wildlife	Offers best means for protection and encouragement of native species	If exotics are not monitored and controlled displacement of browse species would have adverse impact		
Vegetation	Offers best means for protection and encouragement of native species	Action is possible only against flannel mullein. Other exotic species could cause displacement of native plants.		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: SEISMIC MONITORING SYSTEM - CRMO-N-016

NEED FOR THE PROPOSAL:

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Install and operate a seismic monitoring system	NO ACTION Volcanic activity would not be a concern of management	ALTERNATIVE	ALTERNATIVE
Visitor Safety	Would provide warning of impending volcanic activity	No extant warning system would exist		
Geological Resource	Data collected would provide knowledge and understanding of resource	Knowledge of resource would not be available		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: INFERNO CONE: IMPACTS - CRMO-N-009

NEED FOR THE PROPOSAL: Visitor hiking trail to the top of inferno cone is experiencing erosion

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Break up edges of the trail	NO ACTION Do not put up any barriers to the trail	ALTERNATIVE Provide rock barriers	ALTERNATIVE Close inferno cone
Visual	Would detract from the aesthetic value, but would be the least conspicuous	Trail will continue to widen, detracting from the aesthetic value	Would detract from the aesthetic value but no more so than the present broad compacted trail	The aesthetic value of inferno cone would be improved
Vegetation	By breaking up the soil it would destroy the vegetation next to the trail (if there is any left)	Vegetation would be trampled causing more erosion	Would protect the vegetation outside of the trail	Eventually plants would grow where the trail used to be and emphasize old trail site
Visitor Use	No impact	The trail will continue to get wider each year with visitor use	Would require greater law enforcement efforts	Since there is a parking lot at inferno cone, visitors would more than likely be enticed to climb Inferno. Increased law enforcement measures would be necessary.

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: BACKCOUNTRY MANAGEMENT - CRMO-N-011

NEED FOR THE PROPOSAL: There is a need to have a wilderness management plan to protect both the visitor and the resource

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Maintain an accurate check on visitors to the wilderness	NO ACTION Do not use the permit system	ALTERNATIVE	ALTERNATIVE
Visitor Use	Makes the visitor aware of the wilderness safety regulations, allows for the preservation of the wilderness	Visitors might not recognize possible dangers of the wilderness		
Water Resources	People are forewarned about the water situation. Water is scarce in the wilderness.	Indiscriminate use of the wilderness may contaminate the water resource		
Wildlife	Monitor the number of people using the wilderness so as not to disturb the wildlife	If great numbers of people are using the wilderness they may disturb the wildlife		
Wilderness Habitat	Make visitor aware of wilderness management goals and control use/ impact on sensitive areas	Visitor use/impact of sensitive habitat		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: FOOT TRAILS THROUGH THE GEOLOGICAL FEATURES - CRMO-N-007

NEED FOR THE PROPOSAL: Because they are non-regenerative, the volcanic features require a tightly managed trail system.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION All trails would be inspected & maintained at a prescribed standard	NO ACTION Trail system would be allowed to deteriorate	ALTERNATIVE Construct more trails	ALTERNATIVE Obliterate trail system and allow to revert to natural state
Visitor Use	Allows for the safety and enjoyment of the visitor	Does not provide for visitor enjoyment and safety	Present trail system is adequate and further construction would have heavy impact	Would not provide for the enjoyment of the visitor
Soil	Prevents erosion	Erosion may be prevalent. Impact adverse.	May cause further erosion	Eliminates soil compaction; would eventually support plant life
Vegetation	Impact minimal. Encourages visitors to use the trails rather than walking on the resource, destroying vegetation.	People may begin to make their own trails, thus trampling the vegetation	Would be destroying more vegetation	Vegetation would eventually reestablish where the trails were, but it is a very slow process.
Geologic Features	Is necessary to ensure the protection of the geologic features	Geologic features would be heavily impacted	Would cause adverse impact and lead to deterioration of the geologic resource	Minimal impact. May provide for the protection of geologic features, however, increased law enforcement would be necessary.

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: CAVE MANAGEMENT PLAN - CRMO-N-004

NEED FOR THE PROPOSAL: The need is to develop a cave management plan. The plan would specify management and visitor use policies for individual caves with detailed objects and planned actions for selected problem sites and identify research needs.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Develop a cave management plan	Management would follow a reactionary approach		
Visitor Use and Safety	Would identify individual cave sites for visitor enjoyment and provide for safe use. Certain sites would have restricted use.	Visitors would not be aware of potential safety hazards. Use would be unrestricted.		
Geological Features	Would provide guide lines for minimal impacts	Impacts could be adverse and severe		

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: BOUNDARY SURVEY - CRMO-N-014

NEED FOR THE PROPOSAL: A properly surveyed and marked boundary is essential to the proper management of the monument.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Have an official boundary survey	NO ACTION Maintain only the boundary north and west of U.S. 20	ALTERNATIVE No boundary survey would be conducted	ALTERNATIVE
Wildlife Resource	By having clearly marked boundary, will be easier to protect the wildlife and prevent poaching.	Would provide for effective management of the north end of the monument and leave remainder without protection.	Would be very difficult to enforce hunting regulations without a clearly marked boundary	
Water Resources	Marked boundary is advantageous in trespass situations where the grazing population could contaminate the water	No impact	Water resource would be in danger of contamination from the grazing population	
Park Management	Trespass regulations would be enforceable and criminal convictions more probable.	Regulations difficult to enforce and criminal convictions not possible	Regulations difficult to enforce and criminal convictions not possible	

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: NOISE: IMPACTS - CRMO-N-012

NEED FOR THE PROPOSAL: Low flying aircraft often intrude upon the park setting and wilderness solitude of the monument

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Establish the Great Rift as a non-use area for low level flights	Continue to allow existing conditions to intrude upon the monument		
Visitor Use	Provide for more enjoyment of the park, particularly in the wilderness.	Detracts from the enjoyment of the park		

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PROJECT STATEMENT TITLE: EXTIRPATION OF THE BIG HORN SHEEP - CRMO-N-020

NEED FOR THE PROPOSAL: Historical accounts indicate that bighorn sheep once inhabited the Great Rift area and what is presently known as Craters of the Moon National Monument

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION The bighorn sheep would not be reintroduced into the monument	NO ACTION Same as proposed action	ALTERNATIVE Reintroduce bighorn sheep into the monument	ALTERNATIVE
Water Resources	Negative impact	Negative impact	Water guzzlers would be constructed to prevent contamination of the domestic water supply	
Wildlife	Negative impact	Negative impact	Would be in direct competition with the mule deer for food	
Vegetation	Negative impact	Negative impact	Not enough vegetation to support the sheep in the winter because of deep snow	

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PROJECT STATEMENT TITLE: EXTIRPATION OF THE GRIZZLY BEAR - CRMO-N-019

NEED FOR THE PROPOSAL: It is believed that the grizzly bear once inhabited Craters of the Moon National Monument. The reestablishment of native species is encouraged where it is feasible.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	The park would not attempt to reestablish the grizzly	Same as proposed action	Reestablish the grizzly into the monument	
Water Resources	Negative impact	Negative impact	Water is not easily attainable, except in the north end of the monument	
Wildlife	Negative impact	Negative impact	May affect the mule deer population	
Visitor Use	Negative impact Visitor safety would be insured	Negative impact	Visitor safety may be affected	
Vegetation	Negative impact	Negative impact	Food sources may be limited. Public reaction would be strongly negative.	

CULTURAL RESOURCES MANAGEMENT PLAN

OVERVIEW AND NEEDS

The cultural and historical record of the area has never been documented. When this resource knowledge has been collected and assimilated, not only will their preservation be assured, but management actions will reflect consideration as per requirements. Without the identification of these important resources, it is a certainty that some will be lost forever.

The establishment and continued upkeep of a valid museum collection is essential to the implementation of the entire resource management plan. Many threats to the integrity of the park are very subtle. Long term change indicators, such as plant species, can only be measured via careful scrutiny as prescribed under exact scientific conditions. A viable museum collection plays a key role in the process--without such tools, park managers are reduced to decision making without hard facts. It is imperative that these cultural resources receive attention.

CULTURAL RESOURCES

Priority No. 1: BASELINE INFORMATION. The cultural history of the area has not been documented. Although a relatively high degree of activity occurred in this region and apparently records exist, a resource survey has not been accomplished.

The need is to fund a research/documentation program.

Schedule of Accomplishments:

FY 87

1.	Conduct cultural resources study. This would be accomplished through regional, in-house and contract sources.	$30,000* 2,000

FY 88

1. Conduct an Administrative History Study. This would be accomplished through regional, in-house and contract sources. $16,000*

*Funding requirements are beyond park resources to accomplish the task outlined.

Priority No. 2: MUSEUM COLLECTIONS. The existing collection is not to standard. The need is to fund a program to upgrade and organize the museum collection and herbarium.

Schedule of Accomplishments:

FY 87

1. Collections Management Statement will be implemented.

2. Bring herbarium collection up to standards and expand collection as prescribed in Scope of Collection Statement. This would be accomplished through regional, in-house and outside contract sources.

	$ 6,000*
	1,000*
	$ 7,000

FY 88

1. Prepare a Collections Preservation Guide and perform necessary preservation on present museum collection. This would be accomplished through regional, in-house and outside contract sources.

	$ 5,000*
	1,000
	$ 6,000

*Funding requirements are beyond park resources to accomplish the task outlined.

PROJECT STATEMENT: COLLECTION OF BASELINE INFORMATION CULTURAL RESOURCES STUDY - CRMO-C-001

Statement of Issue or Problem:

Statement of Condition - NPS-28, Section 110 of the National Preservation Act, requires all Federal Agencies to identify, evaluate and protect the cultural resources within their jurisdiction. NPS-28 and 36 CFR 800 also

require the establishment of data relative to archeological resources is necessary for the management of these resources in normal park activities. NPS-28 further requires an administrative history for every park in the National Park System. NEPA compliance is also applicable.

At the present time, only a brief historical Overview of the monument addresses cultural history. An archeological reconnaissance conducted in 1965 is a brief description of the archeologic sites within the monument. More extensive documentation is necessary to provide information affecting management objectives.

Current Management Action:

A overview of the history of the monument was obtained through the Craters of the Moon Natural History Association and a historian in 1983. This document would provide a starting point for further studies.

In researching the history of the monument, a significant collection of materials and artifacts of Robert Limbert, one of the early explorers of Craters of the Moon, was located. The monument was successful in working with the owner of the collection to get it donated to CRMO and Boise State University. The university has committed itself to the cataloging and preservation of the collection. The Monument cataloged its part of the collection and then loaned it to Boise State University.

Current management decisions and actions are based on these recent materials, historic items contained in the museum collection and general reference on Idaho and local history.

Alternative Actions and Their Probable Impact:

1. Conduct a Cultural Resources Study and Produce an Administrative History of the Monument. This would allow management decisions concerning the cultural, historical and archeological resources of the monument to be based on documented research.

2. No Action. Means management decisions concerning the cultural, historical and archeological resources of the monument will not be based on documented evidence.

Recommended Course of Action:

Alternative 1 is recommended. It is important that future decisions concerning cultural resource management be based on solid information and facts.

PROJECT STATEMENT: CRMO-C-2, MUSEUM COLLECTION

Statement of Issue or Problem:

Statement of Condition - All items within the collection have now been cataloged according to the FY85 revision of NPS-6. Storage of objects within cabinets was improved and is also to standards.

Overall storage, security and lack of environmental control remains a problem. A facility to house the entire collection is needed.

Preservation and conservation of some items is needed.

Current Management Action:

In FY85 the recataloging of all museum objects was completed. All items were also inventoried and properly stored at this time.

Funding and planning needs of the museum collection have been identified and submitted to PNR. Cyclic maintenance funding was last provided for work on museum collections in FY84.

A "Scope of Collections" was submitted to PNR in FY85. It has subsequently been approved.

A fireproof file was obtained in which to store museum records. Four additional storage cabinets for museum objects were obtained in FY85 and FY86 to adequately house the collection. In FY87 the door seals and locks of all older storage cabinets were replaced.

Alternative Actions and Their Probable Impact:

1. Develop Management Guidelines and Bring Museum Collection to Standard. This would allow utilization of the collection in research programs addressed in the Resource Management Plan. Specific applications can be seen in the collection of Baseline Resource Inventory data, the establishment of vegetative transects, air monitoring program and development of a cultural, historical and archeological overview of the monument.

2. No Action. Museum collection remains a resource that has little effective applications. Documentation and preservation of specimens deteriorates.

Recommended Course of Action:

Alternative 1 is recommended. The development of a usable museum collection could insure many benefits when applied to future resource management studies and decisions.

Attachment 1

RESOURCES PROGRAMMING SHEET

CRMO Park | PNRO Region | IDAHO State | ___Natural ___Cultural | _____ Date | Page___of___

Area Priority	RMP Ref. No.	Pack. No.	PROJECT TITLE	Action Type*	YEAR 1 NPS M.Y.	YEAR 1 Cost/ $1000	YEAR 2 NPS M.Y.	YEAR 2 Cost/ $1000	YEAR 3 NPS M.Y.	YEAR 3 Cost/ $1000	YEAR 4 NPS M.Y.	YEAR 4 Cost/ $1000	YEAR 5 NPS M.Y.	YEAR 5 Cost/ $1000
1	CRMO-C-001		CULTURAL RESOURCES STUDY	C	1.2	30.0	-	-	.6	16.0	-	-	-	-
2	CRMO-C-002		MUSEUM COLLECTIONS	C	.6	12.0	.3	5.0	-	-	-	-	-	-

ENVIRONMENTAL ASSESSMENT MATRIX
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PROJECT STATEMENT TITLE: MUSEUM COLLECTIONS - CRMO-C-2

NEED FOR THE PROPOSAL: To bring collections to standard

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE
Natural resources	Establish a baseline data system to evaluate changes.	Existing and future collections would be of little value.	
Cultural resources	Establish a baseline data system to provide a representative collection for evaluating resources.	Resources could be lost forever.	

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PROJECT STATEMENT TITLE: COLLECTION OF BASELINE INFORMATION-HISTORICAL AND CULTURAL RESOURCES - CRMO-C-1

NEED FOR THE PROPOSAL: The cultural history of the area has not been documented

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE
Visitor use	Visitor experience will be enhanced as interpretive information becomes available.	Interpretive information would not be available.	
Cultural resources	Once identified, these resources will be considered in management decisions and afforded protection.	Without identification, resources could be lost through management action or in action.	

A P P E N D I C E S

A. Information Baseline

B. Area Bibliography

C. Action Plans

*INFORMATION BASELINE/CRMO

GEOLOGY

The Geologic Story of Big Craters, CRMO, Zink, Robert C., July 16, 1957.
Contains notes from a field survey. Big Craters is of major interest because of its size and it is easily accessible to the public. The article also describes the various eruptions that formed Big Craters.

Geological & Geophysical Investigations and Mineral Resources Potential of the Proposed Great Rift Wilderness Area, Idaho, U.S. Geological Survey, 44 pp., 1980.
The report summarizes the geophysical and mineral resource data currently available for the proposed wilderness area using field mapping and radio carbon dating.

Geology of CRMO, Stearns, Harold T., 98 pp.
The purpose of the study was to explore this area and describe in detail the numerous volcanic features; structure of the flows and other volcanic forms. The report discusses the climate, geologic history, lava tubes, types of lava, and their basalt content.

Geology of North Craters of the Moon N.M., Sidle, William C., 65 pp., 1979, Thesis for Portland State University, contains 2 maps, tables, several color prints.
Purpose of the investigation was to map the geology of the north end of CRMO and the surrounding area. Snake river plain basalts were also mapped. The sources of these flows were determined where possible.

Grooved Lava in the Cross-Section of Big Craters Idaho, Nichols, Robert L. & Stearns, Charles E., 10 pp.
At several places grooved and pock-marked lava was formed in the cross-section exposed on the inner wall of Big Crater. Some of the grooves have been formed by the bombardment of molten flows by blocks, bombs, and lapilli.

Proceedings of the Symposium on the Idaho National Engineering Laboratory Ecology Programs, O. Doyle & Arthur W. John Editors, Markham, April 1979.
Relates information presented at a symposium on ecological research being conducted at the Idaho National Engineering Laboratory Site, presented at Jackson Lake Lodge on September 10-12, 1978. The speakers talked about various research projects concerning the effects of radiation on plants and mammals.

Roadside Geology of the Northern Rockies, Alt, David D. & Hyndman, Donald W., 280 pp., 1972, Mt. Press Publishing Co.
Mentions some of the geologic features of CRMO on page 177.

Volcanic History of the Great Rift, CRMO, "A summary report of the Investigations in 1963 and 1970", Bullard, Fred M.
There is a need for more information about the Great Rift. An accurate map of the Great Rift system is needed. We need to know the extent and volume of material erupted from the Great Rift, and the age and dating of the volcanic activity.

*This represents the info base at present. A new info base summary is being written/collected as part of the ongoing BRI project.

HISTORY

An Archaeological Reconnaissance of CRMO, Sneed, Paul G., 10 pp.
Within or near the monument boundaries were found 28 archaeological sites. Analysis of the cultural material and natural setting indicated that original occupation in, and utilization of the monument was slight, reflecting a low population density. It is believed that east-west human movements across the Snake River plain were to the north end of the monument.

Natural Bridge and Amphitheater Cave Part of an Atlas of Lava Tubes, CRMO, 9 pp., Sept. 11, 1960.
Contains a description of the bridge and cave, geology, and the log of passage.

Photograph Album - Wilderness Recommendations, CRMO, Idaho, August, 1967, NPS, USDI.
Contains 17 photographs of areas within the recommended wilderness and outside the wilderness area.

A Study of the Ash Rings of Split Butte, a Major Crater of the South Central Snake River Plain, Idaho, Womer, Michael B., 53 pp., Sept. 1977, a thesis.
The objective of this study was to determine the specific processes and environmental conditions which interacted to generate the present day battle.

Journal of the Family's Trip from Wisconsin to Washington State, Jones, Harvey H., 1854-55.
A diary of the family's trip to Washington. Passed through the area close to CRMO.

Unusual Mineralogy of the Crystal Pit Spatter Cone, CRMO, Peck, Stewart B., 1974, map, pictures, The NSS Bulletin.
The purpose is to describe Crystal Pit and to bring its minerals to the attention of speleologists and mineralogists. Contains a description of the minerals and their origin.

INTERPRETATION

Craters of the Moon - Interpretive Prospectus, 16 pp., 1979.
List of products, resources, V.C. lobby, and visitor activities.

A Guide to Idaho Interpretive and Environmental Education Facilities and Sites, Spott, Diane M. & Fazio, James R., 82 pp., May 1979, University of Idaho - Department of Wildland Recreation Management.
Contains a list of interpretive and environmental education facilities and sites throughout the state. Lists nature hikes, trails, services, and facilities available at each area.

The Relationships of Satisfaction to Visitor Activities in a Park Setting, Holland, Stephan M., 137 pp., May 1979, Thesis.
The paper focuses on various aspects of leisure satisfaction among visitors to a park setting. The visitors completed a questionnaire on their expectations and accomplishments just before leaving the site. The most popular reasons for coming to the park were to learn and discover a relationship with nature, escape pressure, and to be with the family. CRMO study area.

being exposed to radioactive wastes and radiation exposure. Contains maps, tables, graphs relevant to the studies.

Ethnobotany of the Navajo, Elmore, Francis H., 12 pp., 1944, University of New Mexico.
The article describes how the Indians used the various plants for food, clothing, and medicinal purposes.

A Flora of CRMO, Werner, Robert C., 97 pp., 1967.
Lists vegetation types and divisions of plants, where they are found. Also mentions the activities which have changed the landscape. Man has disrupted the vegetation by logging (years ago), mining operations, and grazing.

Forest Insect and Disease Conditions - Intermountain Region, Lowe, C. A. and M. W. Moyer, 18 pp., 1979, USDA Forest Service, Ogden, Utah.
Discusses the various causes of tree mortality. The majority of the mortality caused by mountain pine beetle. Included are charts, pictures, and maps of the area studied.

Insects of CRMO, Horning, Donald Sherwood, Jr., 250 pp., May 1966, Thesis, University of Idaho.
During this study 20 orders, 225 families, 1054 genera, and 1844 species and subspecies were found. The study was designed primarily as an inventory of the insects within the boundaries of the monument. Efforts were made to associate insects with particular lava environments and plant associations. Contains a map of the study area.

Mammals of the Idaho Falls BLM District, USDI BLM, 4 pp., June 1976, BLM Idaho Falls.
A list of the mammals by family.

A Notebook on Records of Research from BLM, Carey Kipuka.
Contains plant lists and vegetation types from Carey Kipuka.

Notes on the Ethnobotany of the Thompson with Adaptations to the Flora of Southern Idaho, Keller, Edwin H., 7 pp., 1963.
A description on how the Indians used the plants for food, non-medical drinks, and smoking. Also mentions the poisonous plants.

Primary Succession on Volcanic Deposits in Southern Idaho, Eggler, Willis A., 21 pp., July 1941, University of Minnesota.
Primary succession on pahoehoe lava flows and cinder cones was studied. Vegetation of "aa" flows was also studied. Consideration is given to possible courses for the presence of trees on flows in certain restricted areas on the Snake River Plains and their absence from others.

Proposed Vegetation Study of the Little Cottonwood Creek Drainage CRMO, Stanford, Nancy, March 1972, Idaho State University, Pocatello, Idaho.
The objective of the study was to describe the community composition, stability, productivity, and other environmental factors of the Little Cottonwood Creek Drainage. Another objective was to evaluate the potential of the Little Cottonwood Creek Drainage for supporting bighorn sheep.

MISCELLANEOUS

Cooperative Education Guide N.P.S., 12 pp.
The objective of the program is to provide the combination of education and work experience. Provides guidelines for park personnel and the schools.

1978 Environmental Monitoring Program Report for Idaho National Engineering Laboratory Site, D.O.E. Idaho Operations Office, 38 pp., May 1979.
During the normal operation of the reactors and the fuel reprocessing plant at the site, some radioactivity is released into the environment. The environmental pathways from the site to nearby populations are by atmospheric transport, possibly via the Snake River, and indirectly through soils, food stuffs, or animals. The report includes the monitoring program and samples.

National Park Statistical Abstract, USDI, 41 pp., 1980.
A list of visitation figures for all the parks.

Shoshone - Grazing Environmental Statement, USDI BLM, tables, maps.
It is a draft environmental statement on a revised range management program for the Shoshone grazing area in Idaho. The purpose of the statement is to modify the livestock grazing management on the BLM area.

Snake River Basin - Cooperative Study, USDA SCS, Idaho and Wyoming, 192 pp., tables, maps.
Cooperative study of the water and related land resources in the Upper Snake River Basin. The purpose of the study is to develop alternative solutions to specific water and related land resource problems through USDA programs.

PLANT LIFE

An Area of Pristine Vegetation in CRMO, Tisdale, E. W., Hironaka, M., Fosberg, M. H., 4 pp., Forest, Wildlife, and Range Experiment Station University of Idaho, Moscow, Idaho.
Major study area is an 180 acre kipuka. It is a very valuable area for study because it has not been disturbed by grazing or by fire. Three major plant communities were recognized. The Kipuka provides a good area for applied studies of sagebrush-grass ecosystems.

Common Plants of CRMO, Urban, Karl A., 30 pp., 1971, CRMO NHA.
Describes some of the natural features of CRMO and has a colored picture guide to the wildflowers and other plants.

Ecological Characteristics of Old-Growth Douglas Fir Forests, USDA Forest Service, 48 pp., February 1981.
The major ecological features of old-growth coniferous forests in the Douglas Fir region are reviewed. Characteristics which distinguish old-growth forests from managed and unmanaged (natural) young stands are mentioned. Management techniques for maintenance of old-growth forests are also considered.

Ecological Studies on the Idaho National Engineering Laboratory Site, Markham, O. D., Editor, 367 pp., 1978, Department of Energy, Idaho Operations Office.
Contains a number of studies concerning plants and animals and implications of

A Provisional List of Mammals, CRMO, Blossom, Phillip, 4 pp., Associate Curater of Mammals, University of Michigan.
This list is based on field identifications and reports by residents. It is not intended as a complete list or a finished report.

A Revised Checklist of Plants, CRMO, Urban, Karl, 13 pp., 1968, NHA.
A list of the plants at Craters of the Moon.

Secondary Plant Succession at CRMO Project No. 1 Martin Road Closure Area.
In late August 1965 that portion of the Martin Road lying within the boundary of CRMO was closed. It is a suitable site to be analyzed over a long term in an attempt to determine the rates and patterns of secondary plant succession.

Secondary Plant Succession at CRMO: The First Two Years, Urban, Karl, 19pp., November 1967.
Studied the plant succession at CRMO. The composition of plant communities of the monument varies. This variation is apparently the result of extremely diverse topoedaphic conditions in exposure, substrateage, texture, and depth. Contains colored pictures, charts, and quadrant diagram.

Vegetation and Habitats in a Southwestern Volcanic Area, Lindsay, Alton A., 26 pp., July 1951, Department of Biological Sciences, Purdue University.
One of the most extensive and least known areas of recent volcanism in this country lies east of the continental divide in west-central New Mexico. The various habitats in this area were studied: lava flow surface communities, plant distribution, cinder cones, and ice caves.

RESOURCE MANAGEMENT

Management Policies, USDI NPS, 1975.
Presents policies on park planning, development, resource management, historic preservation and management, use of the parks, and concessions management.

Master Plan Brief for CRMO, 1965.
The primary resource of CRMO is geological, secondary resource is biological. Plan includes major management considerations and Wilderness Act implementation.

Proposed Road Extensions at CRMO, Lewis, J. Volney, 1936.
The proposed road extension at CRMO would extend from Inferno Cone to Echo Crater, a little more than four miles.

Range and Forest Fire Suppression Guide CRMO, 4 pp., 1975.
Contains guidelines for fighting fires at CRMO.

Recreational Impact on Wildlands, Conference proceedings, October 1978, Forest Service NPS.
This conference and its proceedings were conceived from the thought that solutions to wildland impact problems could be defined and identified by bringing together land managers, recreation users, and natural resource researchers. Conference was dedicated to understanding different perceptions of impact and their meaning to management.

Resources Management Plan for CRMO, Contor, Roger J., 53 pp., 1966.
Contains guidelines, inventory of existing resources, inventory of original conditions, and analysis of required management and research.

WILDERNESS

Backcountry Management Plan, 14 pp., January 1976.
Contains general resources description, back country use, and future use.

Children's Interpretation: A Discovery Book for Interpreters, Machlis, Gary and McDonough, Maureen, 28 pp.
A conceptral approach for better understanding children and some of their behavior. Contains ideas for children's interpretation.

Code-A-Site: A System for Inventory of Dispersed Recreational Sites in Roaded Areas, Back Country, and Wilderness, USDA, 33 pp., 1976, Portland, Oregon.
Code-a-site is a system for inventorying dispersed recreation sites that are established by users along forest roads, in back country, or in wilderness. The system uses edge-punch cards and needle sorting methods for recording, storing, and retrieving basic site information, such as location, characteristics, available resources, activities, and impacts.

Management Problems and Practices in the National Wilderness Preservation System: An Interim Summary, USDA Forest Service 17 pp., 1979, Missoula, Montana.
In January, 1979, the Wilderness Management Research Project initiated a survey of current management conditions and approachs in designated wilderness and likely additions to the National Wilderness Preservation System in the four federal managing agencies. Contains tables and charts, questionnaires that are answered by each agency.

National Wilderness Preservation System, 5 pp.
Contains a table with the number of acres of wilderness in each state, name of the wilderness description of the Wilderness Act, definition of wilderness, and uses of wilderness.

Wilderness Inventory Handbook, USDA, 30 pp., September 1978, USDA BLM.
Contains BLM policy, direction, procedures, and guidance for the inventory portion of the wilderness program. Wilderness review process has three phases: inventory, study, and reporting to Congress.

Wilderness Management, USFS, 381 pp., October 1978.
Contains information on the differences between allocation and management, the need for wilderness, and the philosophical and pragmatic bases for its management. Also discusses problems and opportunities for wilderness management.

Wilderness Management Criteria, 3 pp.
Administrative uses and developments, compatible uses on developments for the public. Contains a map of wilderness proposal and monument information folder.

Wilderness Proposal for CRMO, 3 pp.
Geographical vicinity data and description of the wilderness proposed.

WILDLIFE

Bighorn Sheep Restoration Report, Kennedy, William J., 10 pp., 1969, Lava Beds National Monument.
Lava Beds National Monument has had a history of native bighorn sheep. A program has been initiated to re-introduce sheep to the monument. This paper discusses the location of the herd and fencing.

Biology of the Idaho Lava Tube Beetle, Glacicavicola, Peck, Stewart B., 3 pp., Department of Biology, Carleton University, Ottawa, Ontario.
The report notes aspect of the biology of the unique eyeless beetle. It is found only in cold lava tube caves in Idaho, where it is usually found in association with permanent ice.

Coyotes and Mule Deer of John Day Fossil Beds National Monument: A Management Report, Griffith, Brad, 28 pp., contains charts and maps of the area studied.
The public was concerned that coyotes and mule deer utilizing the monument might have undue impact on domestic livestock and alfalfa production on adjacent private lands. As a result of the study, it is believed that no active mule deer population control is warranted and no coyote control program is needed.

Craters of the Moon National Monument, Newman, Coleman, 12 pp., 1958.
Provides a general overview of CRMO. Lists the mammals, birds, and flora likely to be found in the monument.

The Desert Bighorn, Sumner, Lowell and Manson, Gale, 1971, edited for the Desert Bighorn Council, contains charts and graphs.
A complete research paper on the ecology of the bighorn sheep.

An Ecological Appraisal of the Dwarf Mistletoe Problem at CRMO, Urban, Karl A., 85 pp., Thesis, University of Idaho.
There was very little known about the Dwarf Mistletoe infection at CRMO. The purpose of the study was to determine the age of the infection, its patterns, and the effect of the parasite on the annual radial growth of the pines. The effectiveness of the Dwarf Mistletoe Eradication program was assessed.

An Ecological Survey of the Mammals of CRMO, Fuller, Timothy Dee, 104 pp., 1969, a thesis for Idaho State University.
CRMO is typified by a variety of habitats and plant communities. Mammals occuring in this area have different ecological requirements and limiting factors. Eighteen habitats were chosed for study which were representative of the variety on the monument. Contains photographs, charts, and maps.

Flora and Fauna Distributions of the Great Rift Lava Flows and Kipukas in Southeastern Idaho, Anderson, Dr. Jay and Lovejoy, Steven H., 30 pp., August 1979, Idaho Falls District, BLM.