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CRATERS OF THE MOON NATIONAL MONUMENT

RESOURCES MANAGEMENT PLAN

AND ENVIRONMENTAL ASSESSMENT

RECOMMENDED BY:

3-8-82

Superintendent Date

APPROVED BY:

4/12/82

Regional Director Date

ANNUAL REVISION

Superintendent Submitted

ANNUAL REVISION

Regional Director Approved

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 April 12, 1982

Approved _____
Regional Director
Pacific Northwest Region

4373A-0098A

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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

The primary resource of Craters of the Moon National Monument 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 in the Monument are examples of nearly all known features of basaltic volcanism. The significance of the area lies not so much in individual features as in the existence of the many diverse features of basaltic volcanism compressed within a remarkably small geographic area.

Wildlife is surprisingly abundant, although not seen in large numbers by the average visitor. The most common are mule deer, coyote, marmot,

ground squirrel, chipmunk, mountain bluebird, Clark's nutcracker, Lewis woodpecker, and black-billed magpie. There are no known threatened or endangered species.

Vegetation is varied on both the cinder slopes and lava flows. Over 300 species of plants are native to the Monument. The most common are big sagebrush, antelope bitterbrush, rubber rabbitbrush, and limber pine in the older flows and cones. The geologically younger areas support mock orange, tansybush, and dwarf buckwheat. The Little Cottonwood Canyon drainage, north of the highway, supports Douglas-fir and aspen. There are no known threatened or endangered species.

There are archeological sites within the monument, which consist mainly of sparsely scattered artifacts on the ground surface, and are of limited cultural significance.

Purpose of the Monument

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 movement 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."

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 the development of a deer management program.

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.

OVERVIEW AND NEEDS

Collection and utilization of accurate resource knowledge and data is the keystone to the development of a successful Resource Management Plan for Craters of the Moon. When this resource knowledge has been collected and assimilated, specific action plans can be implemented in conjunction with an aggressive operational program of resource protection to provide an effective long-range management plan. This program will insure the perpetuation of the resources and still allow for the continued use and enjoyment of the monument by the public. These resource management operations and the required research are detailed in the project statements section of this document. This narrative section summarizes those project statements and justifies the selected priority and preferred management action. The majority of the project statements address problems that require research or document reoccurring resource protection standards and activities. These project statements detail the research needs and the interpretation, protection, and maintenance operations necessary to carry out the preferred resource management actions.

Critical Resource Problem:

Priority No. 1: CRYSTAL FISSURE SPATTER CONE DETERIORATION - CRMO-N-1 - 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 phenomena. They are extremely fragile and the impact from visitor use is reaching the point of irreversible resource destruction.

The need is to rehabilitate the area and construct a trail system that will control foot traffic and ensure minimal impact and visitor safety.

Schedule of Accomplishments:

FY 84

1.	Construct 2,000 feet of new trail base	$ 4,000
2.	Install new handrail and steps	1,500
3.	Install barriers and signs	1,000
4.	Resurface 1,000 feet of trail	1,500
	TOTAL	$ 8,000 *

FY 85

1.	Eliminate unnecessary trails	$ 5,000
2.	Resurface remaining 1,000 feet of trail	1,500
3.	Install new wayside exhibit (locally constructed)	1,500
	TOTAL	$ 8,000 *

FY 86

1.	Final site rehabilitation and elimination of unnecessary trails	$ 6,000 *

FY 87

1.	Monitor for visitor compliance	$ 1,000 *

FY 88

1.	Monitor for visitor compliance	$ 1,000 *

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

Significant Resource Problem:

Priority No. 2: FIRE ECOLOGY - CRMO-N-2.

Craters of the Moon has a Fire Management Plan that calls for natural prescription burning within the wilderness area and full suppression of fires in all other zones. Before this plan can be approved 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 84

1. Contract with University of Idaho NPS-CPSO for development and production of prescriptions for allowing/control burning of wildfires. $10,000

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

Priority No. 3: BASELINE RESOURCES INVENTORY - CRMO-N-3.

Essential to the preservation and use of the monument is the identification and documentation of all resources and their existing conditions. It is imperative that the current status of the resource be inventoried for two purposes: 1) to provide a base for measuring the results of management actions and 2) detecting changes within the resource.

The need is for a project to identify, inventory and document the existing condition of the natural resources.

Schedule of Accomplishments:

FY 84

1. Contract with University of Idaho NPS-CPSU for conducting Baseline Resource Inventory and data storage system. $10,000

FY 85

1. Contract with University of Idaho NPS-CPSU for conducting Baseline Resource Inventory and data storage system. $10,000

FY 86

1. Contract with University of Idaho NPS-CPSU for conducting Baseline Resource Inventory and data storage system. $10,000

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

Priority No. 4: CAVE MANAGEMENT PLAN - CRMO-N-4.

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. They vary in management requirements.

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

FY 84

1. Develop and produce Cave Management Plan work to be accomplished by park staff. $ 1,800

Priority No. 5: PHYSICAL REMOVAL OF THE RESOURCE - CRMO-N-5.

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 84

1. Continue a program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions. $ 3,400

FY 85

1. Continue a program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions. $ 3,400

FY 86

1. Continue a program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions. $ 3,400

FY 87

1. Continue a program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions. $ 3,400

FY 88

1. Continue a program of on-site interpretive activities, articles and regulations in handouts, signing and exhibits, personal contacts and law enforcement actions. $ 3,400

Priority No. 6: VEGETATIVE TRANSECT ANALYSIS - CRMO-N-6.

Craters of the Moon has established permanent sites for the purpose of monitoring vegetation to determine its use and resulting changes. Although this information would be used in other management considerations, it is schedule to become a component in a cooperative agreement with the Idaho Fish and Game.

The need is to continue the scheduled reading and analysis of the vegetative transects. Without this data, changes in the vegetation would be speculative.

FY 84

Not Scheduled

FY 85

1. Conduct first year of three year cycle reading and analysis of transects. $ 800

FY 86

1. Conduct second year of three year cycle reading and analysis of transects. 800

FY 87

1. Conduct third year of three year cycle reading and analysis of transects. $ 800

FY 88

Not Scheduled

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

Priority No. 7: FOOT TRAILS - CYCLIC MAINTENANCE AND UPGRADING - CRMO-N-7.

The most effective tool in management 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 comprehensive program that will continue upkeep of the trail system.

FY 84

1. Funds to implement program. $ 3,200

FY 85

1. Funds to implement program. $ 3,200

FY 86

1. Funds to implement program $ 3,200

FY 87

1.	Funds to implement program	$ 3,200

FY 88

1.	Funds to implement program.	$ 3,200

Priority No. 8: AIR POLLUTION MONITORING - CRMO-N-8.

The majority of the monument (43,243 acres) is designated Class I for air quality management. The region surrounding the monument is experiencing rapid development and population growth. With increasing pressures on the adjacent lands and the development of more service facilities, overall degradation of the air quality is likely. The CRMO particulate air sampler station has been established for collecting background data as a national standard due to the low level of measurable affluents. Currently, it is the "cleanest" air being measured in the contiguous United States.

The need is to fund a telephoto meter system and continue to monitor the air quality.

FY 84

1.	Continue present monitoring program.	$ 1,500
2.	Install and maintain a manual telephoto meter system.	$34,210*

FY 85

1.	Continue present monitoring program.	$ 1,500
2.	Maintain and operate a manual telephoto meter system.	$30,250*

FY 86

1.	Continue present monitoring program.	$ 1,500
2.	Maintain and operate a manual telephoto meter system.	$30,250*

FY 87

1.	Continue present monitoring program.	$ 1,500
2.	Maintain and operate a manual telephoto meter system.	$30,250*

FY 88

1.	Continue present monitoring program.	$ 1,500
2.	Maintain and operate a manual telephoto meter system.	$30,250*

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

Priority No. 9: VISITOR PHYSICAL IMPACT - CRMO-N-9.

The access trail to the top of Inferno Cone is becoming wider each season without a defined pathway. Visitors walk casually abreast as they descend back to the parking lot and it continues to widen. This alternative defining pathway would have the least impact on the visitor and still provide protection to the cinder cone.

The need is to break up the trail edges on a reoccurring maintenance schedule.

FY 84

1.	Break up trail edges on a reoccurring basis.	$ 600

FY 85

1. Break up trail edges on a reoccurring basis. $ 600

FY 86

1. Break up trail edges on a reoccurring basis. $ 600

FY 87

1. Break up trail edges on a reoccurring basis. $ 600

FY 88

1. Break up trail edges on a reoccurring basis. $ 600

Priority No. 10: MULE DEER - CRMO-N-10.

Craters of the Moon has a deer herd of approximately 600 animals. We are concluding a two-year research project that will determine the present population and develop methods for monitoring future population fluctuations and impact on vegetation. The goal of the program is to develop a cooperative agreement with Idaho Fish and Game and Bureau of Land Management for a long range management plan for the deer herd.

More information on habitat use and winter ranges is necessary before a cooperative agreement and management plan can be developed and implemented. This additional research would be continued through a research program conducted by University of Idaho CPSU.

FY 84

1. Conduct research necessary to provide information. $ 5,000

FY 85

1. Conduct research necessary to provide information. $ 5,000

Priority No. 11: BACKCOUNTRY MANAGEMENT PLAN - CRMO-N-11.

Craters of the Moon has developed a 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 84

1. Manage backcountry as per approved plan. $ 1,200

FY 85

1. Manage backcountry as per approved plan. $ 1,200

FY 86

1. Manage backcountry as per approved plan. $ 1,200

FY 87

1. Manage backcountry as per approved plan. $ 1,200

FY 88

1. Manage backcountry as per approved plan. $ 1,200

Priority No. 12: NOISE POLLUTION - CRMO-N-12.

Low flying aircraft continuously 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 document these aircraft and identify the military base of origin. Through liaison directly with the appropriate military command, seek cooperation in diverting the aircraft away from the monument area.

No costs.

Priority No. 13: SPECIAL USE PERMIT - CRMO-N-13.

As a solution to a long standing sheep trespass problem, Craters of the Moon has had a special user permit in effect with the sheep owner for 4 years. A fence has been constructed and the user pays grazing fees on approximately 120 acres of park land. This action was necessary to prevent sheep trespass and possible contamination of the monument's water source.

The need is to continue this cooperative effort, monitor the problem and keep the special user permit operational.

FY 84

1. Continue special use permit and monitor area. $ 800

FY 85

1. Continue special use permit and monitor area. $ 800

FY 86

1. Continue special use permit and monitor area. $ 800

FY 87

1. Continue special use permit and monitor area. $ 800

FY 88

1. Continue special use permit and monitor area. $ 800

Priority No. 14: BOUNDARY SURVEY - CRMO-N-14.

The southern monument boundary is not marked and apparently 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 85

1. Conduct survey and mark boundary. $20,000*

FY 86

1. Conduct survey and mark boundary. $20,000*

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

Priority No. 15: EXOTIC ENCROACHMENT - CRMO-N-15.

Although not currently a serious threat there are several exotic species of plants and animals that are gaining footholds within the monument.

The need is to develop and implement program to monitor problem species, physically remove flannel mullen and use a biological control on Russian thistle.

FY 84

1. Develop and implement program. $ 800

FY 85

1. Develop and implement program. $ 800

FY 86

1. Develop and implement program. $ 800

FY 87

1. Develop and implement program. $ 800

FY 88

1. Develop and implement program. $ 800

Priority No. 16: SEISMIC MONITORING SYSTEM - CRMO-N-16.

The geological history of the volcanic activity of the Craters of the Moon has been adequately researched. The U.S.G.S. has predicted more volcanic activity in the headquarters area within the next two centuries.

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

FY 86

1. Install and operate seismic monitoring system. $40,000.00

FY 87

1. Install and operate seismic monitoring system. $40,000.00

FY 88

1. Operate seismic monitoring system. $ 3,000.00

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

RESOURCES PROGRAMMING SHEET

CRMO Park | Pacific Northwest Region | Idaho State | X Natural | Cultural | Date |

Area Priority	RPM Ref. No.	Pack. No.	Project Title	Action Type	FY 84 NPS M/Y	FY 84 Cost/ $1000	FY 85 NPS M/Y	FY 85 Cost/ $1000	FY 86 NPS M/Y	FY 86 Cost/ $1000	FY 87 NPS M/Y	FY 87 Cost/ $1000	FY 88 NPS M/Y	FY 88 Cost/ $1000
1	CRMO N-1	CRMO NI-002	CRYSTAL FISSURE SPATTER CONE DETERIORATION	A & B	.8	8.0	.6	8.0	.2	6.0	.1	1.0	.1	1.0
2	CRMO N-2		FIRE ECOLOGY	C		10.0								
3	CRMO N-3		BASELINE RESOURCES INVENTORY	C		10.0		10.0		10.0				
4	CRMO N-4		CAVE MANAGEMENT PLAN	A	.1	1.8								
5	CRMO N-5		PHYSICAL REMOVAL OF THE RESOURCE	A	.1	3.4	.1	3.4	.1	3.4	.1	3.4	.1	3.4
6	CRMO N-6		VEGETATIVE TRANSECT ANALYSIS	B			.05	.8	.05	.8	.05	.8		
7	CRMO N-7		FOOT TRAILS	A & B	.1	3.2	.1	3.2	.1	3.2	.1	3.2	.1	3.2
8	CRMO N-8		AIR POLLUTION MONITORING	B	.1 .2	1.5 4.2	.1 .2	1.5 30.2	.1 .2	1.5 30.2	.1 .2	1.5 30.2	.1 .2	1.5 30.2
9	CRMO N-9		VISITOR PHYSICAL IMPACT	A	.05	.6	.05	.6	.05	.6	.05	.6	.05	.6
10	CRMO N-10		MULE DEER	C	.2	5.0	.2	5.0						
11	CRMO N-11		BACKCOUNTRY MANAGEMENT PLAN	A & B	.1	1.2	.1	1.2	.1	1.2	.1	1.2	.1	1.2
12	CRMO N-12		NOISE POLLUTION	A	NO FUNDS REQUIRED									
13	CRMO N-13		SPECIAL USE PERMIT	A & B	.05	.8	.05	.8	.05	.8	.05	.8	.05	.8
14	CRMO N-14		BOUNDARY SURVEY	A & B				20.0		20.0				
15	CRMO N-15		EXOTIC ENCROACHMENT	A & B	.05	.8	.05	.8	.05	.8	.05	.8	.05	.8
16	CRMO N-16		SEISMIC MONITORING SYSTEM	A & B						40.0		40.0	.2	3.0

NATURAL RESOURCES PROJECT STATEMENTS

PROJECT STATEMENT - CRMO-N-1

Project Title: VISITOR PHYSICAL IMPACT-Crystal Fissure Spatter Cone Chain Deterioration

Statement of Issue or Problem:

Statement of Condition - Under the Antiquities Act of 1906, President Coolidge established Craters of the Moon National Monument for the purpose of preserving,

". . . an area which contains a remarkable fissure eruption together with its associated volcanic cones, . . . and other phenomena characteristic of volcanic action which are of unusual scientific value, and general interest; . . .".

The Crystal Fissure Spatter Cones could not be more to the point of the enabling legislative mandate authorizing the monument. They are visually and geologically one of the primary features within the monument. The entrance sign at the monument headquarters exhibits a logo design of the spatter cones, and the Natural History Association offers a "Craters of the Moon" poster that features the spatter cones.

The area of concern is located on the loop road, with foot trails providing access. It is classified as within the outstanding natural feature subzone under the Statement for Management. The geologic features are spatter cones, which are characteristic products of Hawaiian-type eruptions; they are the result of low-intensity lava ejection of spatter bombs welded to adjacent cooling fragments surrounding a vent. These particular spatter cones are referred to as the Crystal Fissure Spatter Cone Chain. They are unusual, and represent the best known example of this type of volcanic activity within the continental United States. Because of their extreme fragility,

they are very susceptible to damage. Easy accessibility to the majority of park visitors and a major attraction, susceptibility to adverse impact is almost inherent. Old photographs compared with the present conditions attest that erosion from human use has taken its toll and may be approaching the critical point of irreversibility. Sloughed trail edges in precipitous areas also constitute a safety hazard.

Current Management Action. The present trail system is the result of upgrading old "social" trails, and they are not necessarily located and constructed for the advantage of providing protection for the area. That condition has been documented since 1979 in the form of a Development Study Package Proposal (10-238), #CRMO-N1-0002, to rehabilitate the area and provide a safe trail system that will insure minimal impact and still allow the visitor to safely experience the spatter cones.

An active program of (stop-gap) trail maintenance has been ongoing since the trails were not constructed on a prepared surface or footing, and maintenance operations have been limited to constantly rebuilding the shoulder with slough material. In addition, the area receives considerable attention and energy efforts to provide resource protection and visitor safety. The trails are well signed and regulations enforced. Recently, a temporary interpretative display was posted at the trailhead to point out the visitor impact in the area, and to solicit public input and voluntary compliance with the regulations and management actions. Interpretive tours are conducted in the area daily during the summer season.

Results of Management Action. Increasing visitor use will require increasing protection activities and continual stop-gap maintenance operations to maintain trail safety and area protection.

A substantial rehabilitation of the inadequate trail system is mandatory to assure spatter cone integrity and visitor safe use of a select number of the Crystal Fissure cones.

Alternative Actions and Their Probable Impacts:

1. Close the Spatter Cone Area. This would require increased law enforcement efforts and control of the area. The existing trail would be obliterated and the spatter cones rehabilitated. Impact would be minimal. (Visitor would experience these geological features from a distance or be required to visit other more remote and less spectacular spatter cones.

2. Open All Crystal Fissure Spatter Cones to Restricted Visitation. This alternative would require additional operational funding and trail construction. Also, it would require the irreversible commitment of the individual spatter cones. Impact would be extended to an area that presently has moderate to minimal physical visitor impact. Physical visitor impact on the area would be major and irreversible.

3. Upgrade the Exisiting Trail System and Rehabilitate Erosion Areas. This alternative would fund a construction project to remove safety hazards and build a surfaced foot trail on a concrete footing. In addition, areas that have experienced human erosion and impact would be rehabilitated by hand, utilizing on-site slough material. Specific problem

sections could be realigned or modified to eliminate unwanted traffic flow patterns. Protection and maintenance would continue at a recurring commensurate level after the project was complete. The result would be controlled impact of selected spatter cones and a portion viewed from a distance without observing obvious human encroachment.

4. No Action. Continue current management. The trail system would continue to deteriorate and visitors would be in an unsafe environment with identified safety hazards. The Crystal Fissure spatter cones could not be preserved as significant geological features in a safe manner.

Recommended Course of Action:

Alternative 3 is recommended. This action will require the construction of 2000 feet of new trail base, and resurfacing of 2000 feet of trail. Barriers and signs will be implaced, and handrails and stairs will be installed where required for visitor safety and resource protection. Impromptu visitor trails will be obliterated and interpretive devices added along the reconstructed trail to enlist visitor cooperation in area protection. Monitoring of visitor use of new trails for compliance with design will be conducted and normal maintenance will be done.

PROJECT STATEMENT - CRMO-N-2

Project Title: FIRE ECOLOGY

Statement of Issue or Problem:

Statement of Condition - The current fire management plan for Craters of the Moon National Monument is approved for suppression of all wildfire, human or naturally caused. Additionally, that plan proposes a potential need for naturally-caused (lightning) fire as a vegetation management tool in the monument wilderness zone. However, at present, little is known about the role of natural wildfire on the various plant communities of the monument.

The role of fire and its effect on the monument ecosystem can be obtained through research of historic fire records and by on-ground botanical and soil studies.

Once determined, specific fire management techniques for natural fire can be prescribed in accord with vegetation types for more cost-efficient fire management, perpetration of the ecosystem under natural conditions, and compatibility with the surrounding landowner (BLM) natural prescribed fire practices.

All fires, man-caused or natural, occurring within the monument are supressed at the earliest possible time. This type of fire management may or may not be the most cost efficient or ecologically sound approach to the protection of the area's biotic resource.

There is a need for research into the historical role of fire in the shaping and maintenance of the area's vegetation cover types and fauna. On-ground botanical and soil studies, plus research of historical records of fire in the area will greatly assist in determining the course of fire management within that ecosystem.

It is realized that fire protection will be afforded where human safety or developed areas are concerned; but as indicated, there is a need for determining its role in the ecosystem.

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 could be adjusted accordingly.

   The development of an allowable natural burn program would be in conformance with the fine 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 (Bureau of Land Management) land management policy.

Recommended Course of Action:

Alternative No. 1 was selected because:

Monument biota evolved without protection from naturally occurring fire.

Research will indicate which areas in CRMO require protection from 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-3

Project Title: BASELINE RESOURCES INVENTORY-Inventory and Documentation of Biotic Resources and Geologic Features

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, natural. . .values".

It is imperative that the resources be identified and their existing conditions documented. This baseline information is essential to detect changes in the resource and develop management plans and strategies. The two resource classifications of concern are 1) biotic, and 2) geologic. Each classification category represents a wide range of sub-topics that interact with one another. The interrelationships must be recognized so that a carefully balanced ecosystem can be maintained. There must be a focal point from which this knowledge can be gained, and a starting base comes from the inventory of resources data.

Biotic. The most current vegetative compilation dates from 1968, although there has recently been some work in organizing an herbarium or the plant species of the park. The work is far from complete—the vegetative communities are not mapped. A listing of the animals (amphibians, reptiles, birds, and mammals) is currently underway, and requires cooperation with the Bureau of Land Management and other

sources for final comparison of their completed field studies before listings can be formally annotated. Both the BLM and Idaho State Fish and Game Department are in the process of completing surveys of the plants and animals of the regions surrounding the monument. This information will be a useful tool in Craters of the Moon's research.

Geologic. An inventory of the various geological structures and features in the monument must be completed. A historical search and representation of each feature must be compiled and stored in an easily retrievable data system. There have been historical geological studies but no data base containing specific information exists. This would allow us to determine progressive effects of visitor usage in the park, both in the past and for predictions of future impacts. A determination must be made whether structural damage is due solely from physical visitor impact, from erosion due to natural weathering, or as a combination of both. If caused by people and weather, it would be necessary to analyze how the greatest detriment was caused and management plans could be formulated for resource protection.

Alternative Actions and Their Probable Impacts:

1. Conduct Survey and Inventory. Through cooperation with a University of Idaho CSPU, conduct a comprehensive inventory and analysis of each biotic and geologic ecosystem component. All information would be mapped, cataloged, and stored in a retrievable data system for use in various management plans and action programs. The projects would take approximately two man-years to complete.

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-4

Project Title: CAVE MANAGEMENT PLAN-Visitor and Scientific Use of the Caves

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 which consists of five lava tubes 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 are given 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. The stair case was removed from Great Owl Cavern in 1972 and also requires a special use permit. Access is controlled primarily for the purpose of insuring public safety, although protection of the resource is also a factor. The cave 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 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 legally 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 wooden stairway. 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. Present management policy is to discourage exploration of Great Owl Cavern.

Fissure caves were formed by extensional cracking associated with the Great Rift in the southern part of the monument where it has not been covered by more recent volcanic deposits. They 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 thoese 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 (Crystal Pit).

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) daily conducted interpretive activities, and 6) 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 of the Crystal Pit. 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 simply documentation of the resource. Impacts will be negative.

PROJECT STATEMENT - CRMO-N-5

Project Title: REMOVAL OF THE RESOURCE

Statement of Issue or Problem:

Statement of Condition - Lava rocks and other geologic features are of interest and a great curiosity to the general 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 and minimal souvenir gathering is a continuing problem.

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. These 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-6

Project Title: VEGETATIVE TRANSECT ANALYSIS

Statement of Issue or Problem:

Statement of Condition - Craters of the Moon has established permanent transects for annual evaluation of deer impact and changes in the vegetation. For the past decade data has been collected and used for assessing trends in the mule deer population and their impact on vegetation. Additional sites and new methods of data collection are being used in the present mule deer research project. This study suggests that study plot evaluation should continue on a 3-year rotational basis. This data will be a component of a long-term management program that will be developed in cooperation with the Idaho Fish and Game.

The need is to continue to monitor the vegetative transects reading and analysis on a 3 year read/3 year lapse basis. Reading of transects involves funding that is not currently available through Craters of the Moon operational appropriations. This funding is a necessity so that program continuity and range/deer trends can be evaluated.

Alternative Actions and Their Probable Impacts:

1. Fund and Implement the Vegetative Habitat Monitoring System. Fund a program to conduct analysis on a 3 year read/3 year lapse basis (i.e. read in 1980, 1981, 1982; read in 1986, 1987, 1988, etc.). Range impacts and deer population trends would be addressed with sufficient frequency to indicate changes. Impacts of deer on

vegetation and/or vegetation on deer populations would be assessed on a planned and funded basis as prescribed.

2. No Action. Reading and analysis of vegetational transects must be done on a reoccurring basis and funding of a continuing program has not been a reality. Annual reading was conducted when funds and trained personnel were available. That was an infrequent, less than annual occurrance. Of consequence, deer population estimates and impact was subjective.

Recommended Course of Action:

Recommended alternative is No. 1. Conduct annual reading of reestablished vegetation plots for 3 successive years with a 3 year lapse between data collection. Funding of such a program will provide sufficient data for a continuing analysis of deer range and deer population trends. There will be no impacts on vegetation or the deer herd. An objective estimate of deer impact on vegetation and vice versa will be obtained.

The commitments made in the Cooperative Agreement with the Idaho Fish and Game will be met.

PROJECT STATEMENT - CRMO-N-7

Project Title: FOOT TRAILS-Cyclic Maintenance and Upgrading of Foot Trails

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 guided trail which is used by rangers conducting the Buffalo Caves Walk. All other trails connect points of interest. Approximately one-half are constructed requiring heavy continuous maintenance. These paved surface trails conform to management policies that provide for the surfacing and maintenance as necessary to conform with visitor safety, resource protection, and erosion conditions. The remaining six miles of trail are non-constructed with very little improvement.

In addition to the maintained trails, there are several miles of old, unmaintained trails leading to such features as the Great Owl Cavern, the Crystal Fissure/Big Sink area, and the caves east of the developed cave area. Although still marked on existing topographical maps, and in the field by rock cairns and other informational signing, 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 SpatterCone/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 protection, education and maintenance. The use of ranger patrols, reminders in interpretive programs of the need to stay on trails in order to preserve the natural environment, and proper maintenance contribute to this end.

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 would be upgraded to meet standards. Areas that present specific problems would be redesigned and trails constructed to prevent adverse impact and deterioration. Impact would be negative as all subject trails currently exist. Further impact of adjacent areas would be reduced. Trails would be patrolled on a regular basis by park staff. 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.

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 bicycle trail paralleling the Loop Drive, or 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 large expenditures of construction funds. 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 continue its present 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. Minimum trail maintenance in a general

sense is an annually occurring project on all of the unpaved trails in the developed area of the monument.

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-8

Project Title: AIR POLLUTION MONITORING SYSTEM-Atmosphere Monitoring and Data Collection Program

Statement of Issue or Problem:

Statement of Condition - Craters of the Moon National Monument is very interested in the visibility and particulate impairment of the environment. The majority of the monument is designated Class I Wilderness (43,243 acres). The entire Upper Snake River is experiencing increased population and development. More facilities are needed and developed as the demand dictates. The result is overall deterioration of the air quality. There is currently an active Department of Energy project to construct a coal-fired steam plant at the Idaho National Engineering Laboratory, approximately 25 miles east of the monument. The DOE has received a PSD permit. Completion of project is scheduled for CY 85.

The need is to collect baseline air quality data.

Alternative Actions and Their Probable Impacts:

1. Continue to maintain an active air monitoring and data collection station at the monument. This is currently being operated by RM & VP to accomplish the following:

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

   b. Particulate Air Samples have been collected in cooperation with the State Department of Health for the last 8 years. This data has received national interest due to the relatively low level readings taken at the monument as compared to heavy population/ industry areas.

c. Atmospheric Deposition Samples 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.

d. Develop and implement a visibility monitoring program utilizing manually operated telephotometer.

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

2. Discontinue Atmospheric Monitoring. Under this alternative we would not collect baseline data or documentation of 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, vegetative change could occur before management was aware and further deterioration would continue as information was being collected.

Recommended Course of Action:

Alternative 1 is recommended. With the 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 baseline data is imperative.

Monitoring visibility and particulate impairment 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.

PROJECT STATEMENT - CRMO-N-9

Project Title: VISITOR PHYSICAL IMPACT-Uncontrolled Expansion of Inferno Cone Access Trail

Statement of Issue or Problem:

Statement of Condition - Visitor hiking trail to top of Inferno Cone is becoming wider each season. It can presently handle several people walking abreast, and seems destined to keep getting greater in width. The trail is not surfaced nor delineated by markers. Its size also seems to entice operators of 4-wheel drive vehicles at times to use it, which, in turn, impacts greatly on the resource.

Alternative Actions and Their Probable Impacts:

1. Break Up Edges of Trail. This would reduce the width to an acceptable limit. Impact would be limited to a contrast of cinder colors between the disturbed ground and that left compacted. This difference in coloring could be distracting to the visitor's eye when viewing the cinder cone. The narrowing of the trail would be a reoccurring project each year.

2. Define Trail. Lava rock could be placed along the trail edge to confine hikers to the main established trail as is or after the trail has been reduced to an acceptable width. The rock barrier outline could be visually distracting.

3. No Action. Hope there is a limit to how wide the trail will become. Potential for the trail to just keep widening and look more like a road than walkway. An increase in width also increases the opportunity for erosional problems due to sheet runoff during sudden rainstorms or early spring snowmelts.

4. Close Inferno Cone Trail and Pullout. Through a program of education and law enforcement, close the area to foot travel and permit viewing from overlook only. This would prevent physical impact. It would prohibit the visitor from making the popular climb to the excellent summit viewpoint. The pullout and parking lot would have to be eliminated to gain a complete closure to the area. Inferno Cone would become "another cinder cone".

Recommended Course of Action:

Alternatives 1 and 2 are recommended. These alternatives would impact the least on the cinder cone. Adoption of alternative 1, reduction of existing impromptu trail width, and defining trail route with lava rock (alternative 2) would channelize use and obviate the need for annual raking to restrict trail width, and natural weathering will allow rehabilitation of trail edge and revision to natural color.

PROJECT STATEMENT - CRMO-N-10

Project Title: MULE DEER-Population Characteristics and Habitat Use

Statement of Issue or Problem:

Statement of Condition - At the turn of the century, mule deer (Odocoileus hemoinous) began establishing a summer range along the Great Rift. Since the creation of the monument in 1924, the herd has consistently increased. Apparently, the deer are utilizing a niche formerly occupied by a subspecies of bighorn sheep. The reason why the deer became successful and are abundant today is not fully understood. However, the mule deer were not introduced into the area; rather, it seems to have been a natural population growth.

The history of the monument area relative to deer and other ungulate populations and habitat use is unclear. To be sure, there were and still exist actions taken by man that played an unknown role in the ungulate populations of the monument. Among these are extirpation of large predators, including the grizzly bear, market hunting and livestock grazing. All have influenced the surrounding eco-systems and consequently the monument.

The Craters deer herd is an inherent part of the natural resources being managed by the National Park Service. In addition to being a major component in the existing Craters ecosystem, the deer herd is an important resource to the state of Idaho.

The current population consists of approximately 600 animals that spend 7 to 8 months (April-November) on summer range within the monument. The winter use patterns are complex and not presently understood, as there appears to be multiple wintering areas, all outside the monument.

The regulation of hunting outside CRMO boundaries is a function of the Idaho Department of Fish and Game, and they have traditionally managed with the goal of sustaining the maximum harvest while maintaining a stable population. It is only coincidental that the results have not been in conflict with the mandates of the NPS.

An active program of monitoring and cooperation is necessary to avoid long-range conflicts. Changes would be detected through a program of monitoring numbers and the age structure of the population and range usage. Overpopulation, should it occur, could be controlled by removal of surplus animals on lands under state jurisdiction.

As the NPS policy is to perpetuate the native animal life for their essential role in the natural ecosystem (Management Policies IV-6), the overall welfare and status of the deer herd is a viable concern to CRMO management. The deer herd should continue to be monitored for effective cooperation in management of the animals.

Current Management Action. In response to management concerns, a research investigation was initiated in May, 1980. The project was completed December, 1981. The product of the study was to develop methods to monitor the deer herd and impacts. 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.

Results of Current Action. Investigations to date indicate 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 range, 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.

   Funds expended for current studies, installation of transects, and efforts in radio collaring and tagging during 1980/1981 would be wasted.

2. No 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 will ultimately lead to a Cooperative Agreement concerning the management of the deer herd. This agreement would 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. Communication with the BLM has also been a part of the present project as they are the primary land manager on the winter range jurisdictions. It is the intent of park management to also produce a Cooperative Agreement with the BLM. However, further information on habitat use, the dynamics of the population and winter range patterns are necessary before specific interagency management alternatives can be developed.

3. Continue to Conduct Research. Under this alternative, research on population dynamics and habitat use would be conducted cooperatively between the NPS, Cooperative Park Studies Unit (CPSU) at the University of Idaho, BLM and Idaho Fish and Game. The field work and data analysis would be accomplished by the CPSU and regional research personnel, with minimal support from the monument. This action would continue to monitor population trends and refine information on winter range patterns and utilization of the habitat. Knowledge of the population dynamics would allow management to develop long-range plans. Impacts from conducting the research project are negative.

Recommended Course of Action:

Alternatives 2 and 3 - No Action and Continue to Conduct Research are 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. Research must be conducted before Cooperative Agreements with BLM and Idaho Fish and Game can be implemented. If the actions are not carried out, the monument vegetative quality and quantity could be damaged by over use, 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-11

Project Title: BACKCOUNTRY MANAGEMENT-User Permit System

Statement of Issue or Problem:

Statement of Condition - Park Service policy encourages use by the general public of areas designated as wilderness or backcountry. With visitor safety and protection of the resource of utmost concern, the Service has set forth general guidelines for wilderness recreation. Each area must develop a plan for the management and public utilization of designated wilderness areas that is best suited to both resource and visitor protection.

Craters of the Moon's wilderness covers an area of 67 square miles and comprises about 80% of the total monument boundary. Most of the landscape is barren rock in a harsh environment seemingly devoid of much life. For this reason, use of the area is light and impact upon the environment is minimal. Hikers are made to realize when they ascend the wilderness that they must be totally self-sufficient and carry in all equipment, food, and water necessary. There are a number of non-reliable water holes that are drying up and domestic use is discouraged. These factors tend to make the area a little less than desirable for overnight use.

In order to keep a check on the environmental impact of the backcountry, Craters of the Moon has a plan that will permit both the day and overnight hikers use of the area, in harmony with the natural flow of the ecosystem.

Alternative Actions and Their Probable Impacts:

1. No Action. Presently, Craters of the Moon has a permit system for overnight campers to the wilderness. This is a free pass issued to the overnight user after careful explanation of the rules and regulations

associated with it have thoroughly been discussed and understood (i.e. no wood fires, proper sanitation practices must be strictly adhered to as there are no facilities of any kind; length of stay and destination have been determined; and whatever is packed in must be packed out). In this manner, visitor use and activity can be monitored. It is necessary to maintain this degree of supervision in wilderness designated areas, as the purpose is to preserve and allow nature to dominate the course of action.

Recommended Course of Action:

It is recommended the current course of action be the one that is selected. If the time arrives that visitor pressure steps up land degradation at an alarming rate, further restrictions can be imposed. Fees can be implemented so that it is not as conducive to camp there, privies can be constructed if human waste disposal becomes a problem, or the area could be limited to day use only. A no-action alternative would not be in keeping with the policies and guidelines for wilderness management. It would be a detriment to any sound land-use policies not to have restrictions and controls as proper guidelines to carry them out. As earlier stated, it would in the long run be a savings to implement a permit type system to educate hikers to Craters of the Moon's land use policies.

PROJECT STATEMENT - CRMO-N-12

Project Title: NOISE POLLUTION-High Level Noise Encroachment Upon the Wilderness and Park Setting From Low Flying Aircraft

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. According to the Management Policies, activities causing excessive noise or unnecessary noise in and adjacent to parks will be monitored and action taken to avoid or minimize noise which detracts from the visitor's enjoyment of the park. Maximum noise limits tolerated will, at least, be consistent with OSHA regulations and applicable State and local laws and regulations.

Alternative Actions and Their Probable Impacts:

1. Document Individual Aircraft and Locate Their Base of Operations. Through liaison with the military, establish the Great Rift as a non-use area for low level flights. A private meeting could be arranged between the military and a representative from Craters of the Moon. If this does not prove to be beneficial, perhaps a public hearing could be scheduled.

2. Current Action. Continue to allow existing conditions to intrude upon the monument. 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 —not to mention the panic situation such a noise produces in small children. Liaison with the military bases involved is necessary and will be pursued, but few, if any, regulations are in existence to deal with this type of situation. 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-13

Project Title: SPECIAL USE PERMIT-Domestic Sheep

Statement of Issue or Problem:

Statement of Condition - Trespass of domestic sheep has been a common and continuing activity for several decades in the northern section of the monument. The most recent problem has been with a specific user on adjacent lands. In 1977 a fencing project was completed in an effort to solve the problem. It was built in cooperation with YCC and the sheep user. The fence was constructed on a ridge line and does not follow the legal boundary of the monument. As the boundary line does not follow natural or geographical features, it was impossible to construct and maintain the fence except on the ridge top. Consequentially, approximately 123 acres of NPS land exists on the sheep use side of the fence, and a like amount of BLM lands have been excluded from grazing. The only workable solution to the problem was to allow sheep use on the 123 acres on park land, and per management policies a special Use Permit has been in effect since the fence was completed. The sheep users pay a fee based on adjacent BLM fee schedules and maintains the integrity of the fence.

A critical element in preventing the sheep trespass is the concern for the monuments water supply. The water for the monument comes from the north section and the area of most frequent trespass. Current management action includes liaison with the BLM, Public Health Service, and the sheep user. In addition, a constant monitoring and protection operation is necessary to insure compliance with the special use permit.

Alternative Actions and Their Probable Impacts:

1. No Action. This alternative would continue the special use permit. By allowing the special use permit to operate, general trespass is avoided, the fence maintained and a good neighbor policy is established. Routine patrols are necessary to ensure compliance. Under the special use permit, the sheep user is allowed use of approximately 123 acres of NPS land for fee, he must maintain the fence, and gives up approximately 120 acres of BLM grazing allotment on the NPS side of the fence.

   The impact is minimal due to restricting the sheep to a specific section of land and prevents general trespass.

2. Revoke Special Use Permit and Allow Fence Deterioration. Without continued maintenance of the fence and administration of the special use permit, sheep trespass is inevitable. The monuments water supply would be threatened and legal action would be necessary against the sheep user. Impact would be widespread and degradation of the water quality and erosion would result.

Recommended Course of Action:

Alternative 1 - No Action - is recommended. Present management action has been highly successful. Cooperation with the most persistent violator has produced a compromise that is working well. There are still minor difficulties, but major plant community recoveries are evident and the water supply is protected. As long as the present management action is active, the monument will be assured of only minor impacts in the north section.

PROJECT STATEMENT - CRMO-N-14

Project Title: 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. Without an official survey and clearly visible boundary markers, disputes arising from such situations may place the National Park Service on shaky legal footing.

Records indicate that the earliest survey at Craters of the Moon was conducted between 1925-1930. 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. 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 by 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 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-15

Project Title: EXOTIC ENCROACHMENT-Plant and Animal Control and Monitoring of Encroaching Exotic Species

Statement of Issue or Problem:

Statement of Condition - The most prominent exotic weed in Craters of the Moon is the Flannel Mullen (Verbascum thapsus). This plant has gotten a stronghold in the developed sections of the park, especially in the headquarters and north end areas. It has reached a point where it would be impossible to eradicate it, but there is still time to put some controls on it. Another plant that has reached overwhelming proportions is cheatgrass (Bromus tectorum), which gained entry into the park in the early 1900's when domestic sheep grazed the area. This grass is a favorite food of the chukar, introduced into the area sometime in the 1930's. Russian thistle (Salsola kali v. tenuifolia), though not nearly as numerous as either of the others, certainly has the potential of expanding its range and reaching undesirable proportions if not checked. The Hungarian partridge, a relative of the chukar and introduced at about the same time, is present although in very low population.

This compilation is only a cursory examination of the exotics within the monument boundaries.

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

Alternative Actions and Their Probable Impacts:

1. Monitor Encroachment Problem Species. Remaining aware of population densities of exotic plants (cheatgrass, flannel mullen, and Russian

thistle) and exotic birds (Hungarian and chukar partridge) is the least expensive action, but exerts no control over numbers. It would not prevent the spread of exotic species, but it would be the only effort directed towards the Hungarian and chukar partridge because no viable, acceptable control is available for them, and they do to some extent affect cheatgrass abundance through feeding on its seeds and new growth. Monitoring would have no effect on other species except to provide a more accurate record of location and rate of spread.

2. Prescribed Burning of Vegetation. Allowable prescription burning will not be permitted in Craters of the Moon National Monument until the effect of fire on the ecosystem has been determined (CRMO-2). Fire might be an effective control of cheatgrass and thistle if it occurred at the proper season, but fire would only be permitted in a wilderness where fewer exotics exist.

3. Herbicide Application. This type of control is generally prohibited under NPS policy, and until an integrated pest management program is initiated and all other methods of control are found ineffective or unacceptable, this alternative would be the last consideration.

4. Current Operation - Physical Removal of Plants. This method is currently being used for removal of flannel mullen. It is only partly successful due to the extent of the mullen problem and is partially successful if done when plants are large enough to remove by hand and before seeds have been dispersed. It is a physical impossibility with cheatgrass and a poor control for thistle.

5. Biological Control. Use of a leaf destroying moth, Chloephora, has been successful in Russian thistle control. It is specific to that plant and affects no others. Eighty to ninety percent effectiveness has been achieved in other areas. It is available through the U.S. Department of Agriculture Weed Laboratory. It is a safe and effective control.

Recommended Course of Action:

Alternatives 1, 4, and 5 are recommended. Monitor populations of Hungarian and chukar partridge and document areas of occurrence, abundance, etc., and continue to do the same with mullen and thistle. Continue the physical removal of mullen in late summer-early fall and document areas of removal to monitor effectiveness of control. Introduce Chloephora in denser Russian thistle patches and monitor for effectiveness of control and for spread of moth populations to thistles located adjacent to area(s) of introduction of control. The three selected alternatives are in compliance with National Park Service policy. No chemicals are put in the ecosystem. Documentation of exotic abundance/location and/or access of control is achieved. The plan can be modified in accord with changing status of exotics.

Hand removal cost effectiveness of mullen can be evaluated.

PROJECT STATEMENT - CRMO-N-16

Project Title: 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. 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 in the monument. Ranger patrols 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 U.S.G.S. 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-17

Project Title: 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. Re-establish the Grizzly Into the Monument. This idea does not seem to be very 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 re-establish 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 re-establish 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.

PROJECT STATEMENT - CRMO-N-18

Project Title: REINTRODUCTION OF NATIVE SPECIES-Bighorn Sheep

Statement of Issue or Problem:

Statement of Condition - Historical accounts indicate 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. High, 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.

Alternative Actions and Their Probable Impacts:

1. Reintroduce Bighorn Sheep. This strategy would call for the re-establishment 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 re-introduction 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 re-establishing a herd of bighorn sheep. This alternative would not introduce stress on the existing mule deer population not 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 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-19

Project Title: PHYSICAL IMPACT-Deterioration of a Cultural Feature - Goodale's Cutoff

Statement of Issue or Problem:

Statement of Condition - The area of concern is located in the northern section of the monument at the base of the Pioneer Mountains. The cultural feature involved is known as the Goodale's Cutoff and represents an alternate wagon trail route on the Oregon Trail system.

Historically, the trail was utilized by indians and fur trappers as a way of avoiding lava flows of the Snake River plain. Emigrant wagon train use began as early as July 20, 1852. Heavy use of Goodale Cutoff became practical with the establishment of two ferry's in the early 1860's. These allowed wagons to safely cross the Snake River. They were Gibson Ferry at the eastern end, near old Fort Hall, and Brownlee Ferry, located at the western end, which allowed the immigrants access back onto the Oregon Trail. Peak use of the trail was during the Boise Basin gold rush of the early 1860's.

The section located in the monument is presently a maintenance access road. No trace of the original trail exists in a preserved state. This roadway was the only access across the lava until the early 1940's. As it was in continuous service until the construction of the present highway system, no section was preserved as a wagon trail.

Alternative Actions and Their Probable Impacts:

1. Close the road system until a survey of the historic significance of the trail can be made. This would prevent further impact on the trail and allow time for a long-term management plan to be developed based on the findings of the study. This would greatly restrict access of management personnel who use this road to conduct boundary patrols in the northern section of the monument. Protection of the resource would be extremely difficult.

2. Continue Present Management. Continue use of the road system until the results of a historic survey can be obtained. This would allow for the use of the road for boundary patrols and allow management to develop long-term plans as soon as the study is completed. Vehicular use along this route is traditional and continued short-term use basis will have a minimal impact. If a finding of historical significance is determined, management action would be altered to comply with historical requirements.

3. Take No Action. Consider that the historic significance of this route is now beyond the point where rehabilitation is possible. The route will continue to be used for vehicular traffic and no attempt will be made to interpret or rehabilitate this feature.

Recommended Course of Action:

Alternative 3 - Take No Action is recommended. There is a minimal road system in the north unit of the monument and is necessary to carrying out

of protection and maintenance activities. Vehicular use along these road systems over the years, and before the establishment of the monument, impacted any sections of the road to a point of unidentifiability. Impact would be negative, as the resource has been extirpated.

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.

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: CRYSTAL FISSURE SPATTER CONE - CRMO-N-1

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	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Upgrade existing trails and rehabilitate eroded areas.	Continue use of present trail system.	Close spatter cone area and obliterate trails.	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 area.	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. Trail 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.

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: FIRE ECOLOGY - CRMO-N-2

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 Alternative #1 Conduct research	NO ACTION Fire suppression - no research	ALTERNATIVE	ALTERNATIVE
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 dependent 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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: BASELINE RESOURCES INVENTORY - CRMO-N-3

NEED FOR THE PROPOSAL:

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: CAVE MANAGEMENT PLAN - CRMO-N-4

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 guidelines for minimal impacts.	Impacts could be adverse and severe.		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: REMOVAL OF THE RESOURCE - CRMO-N-5

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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: VEGETATIVE TRANSECT ANALYSIS - CRMO-N-6

NEED FOR THE PROPOSAL: The need is to conduct transect analysis on a recurring cyclic basis.

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Implement the vegetation habitat monitoring system	Collection of data would not be conducted		
Vegetation	No adverse impact.	Change in vegetation would not be documented. Range overuse would go undetected.		
Wildlife	No adverse impact.	Deer herd range utilization patterns would not be documented.		
Air pollution	Could assist in long-term detection of adverse effects of air degradation.	No base of information from which to measure changes in vegetation caused by air pollution.		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: FOOT TRAILS - CRMO-N-7

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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: AIR POLLUTION MONITORING SYSTEM - CRMO-N-8

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	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Monitor the air quality, collect baseline data	Would not collect baseline data or document current conditions		
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: VISITOR PHYSICAL IMPACT - CRMO-N-9

NEED FOR THE PROPOSAL: Visitor hiking trail to the top of inferno cone is becoming wider each season.

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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: MULE DEER - CRMO-N-10

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.

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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: BACKCOUNTRY MANAGEMENT - CRMO-N-11

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	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Maintain an accurate check on visitors to the wilderness	Do not use the permit system		
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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: NOISE POLLUTION - High level noise encroachment upon the wilderness and park setting from low flying aircraft - CRMO-N-12

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.		

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: SPECIAL USE PERMIT - CRNO-N-13

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

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE
	Continue special use permit (No Action)	Revoke special use permit		
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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: BOUNDARY SURVEY - CRMO-N-14

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	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Have an official boundary survey	Maintain only the boundary north and west of U.S. 20	No boundary survey would be conducted	
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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: EXOTIC ENCROACHMENT - CRMO-N-15

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

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION Monitor problem species, physical removal and biological control	NO ACTION Physical removal of plants	ALTERNATIVE Monitor encroachment of problem species	ALTERNATIVE Prescribed burning of vegetation
Wildlife	Offers best means for protection and encouragement of native species.	If exotics are not controlled displacement of browse species would have adverse impact.	Does not offer means for control of exotic species.	Not effective due to few exotics that exist in areas where prescribed burning is allowed.
Vegetation	Offers best means for protection and encouragement of native species.	Action is possible only against flannel mullen. Other exotic species could cause displacement of native plants.	Does not offer means for control of exotic species.	Not effective due to few exotics that exist in areas where prescribed burning is allowed.

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: EXOTIC ENCROACHMENT - CRMO-N-15

NEED FOR THE PROPOSAL: Several exotic plants and two exotic species of birds are 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
			Herbicide applications	Biological control of Russian thistle
Wildlife			Against NPS policy.	Action is possible only against Russian thistle.
Vegetation			Against NPS policy.	Action is possible only against Russian thistle.

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: SEISMIC MONITORING SYSTEM - CRMO-N-16

NEED FOR THE PROPOSAL:

ALTERNATIVE ACTIONS / IMPACT CATEGORIES	PROPOSED ACTION	NO ACTION	ALTERNATIVE	ALTERNATIVE
	Install and operate a seismic monitoring system	Volcanic activity would not be a concern of management		
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
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: EXTIRPATION OF THE GRIZZLY BEAR

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.	

ENVIRONMENTAL ASSESSMENT MATRIX
FOR CRATERS OF THE MOON
RESOURCE MANAGEMENT PLAN

PROJECT STATEMENT TITLE: REINTRODUCTION OF NATIVE SPECIES – Bighorn Sheep

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	NO ACTION	ALTERNATIVE	ALTERNATIVE
	The bighorn sheep would not be reintroduced into the monument	Same as proposed action	Reintroduce bighorn sheep into the monument	
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.	

AGENCIES AND PERSONS CONSULTED IN ASSESSMENT PREPARATION

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APPENDIX - A

INFORMATION - BASELINE/BIBLIOGRAPHY

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.

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.

The major objectives of the study were to complete a survey of the flora and fauna of the lava environment. Major plant and animal communities were identified. Habitat requirements for maintaining populations of certain mammals were cited. The major study area was CRMO.

Foraging Ecology of Prairie Falcons During the Nesting Season, Lava Beds National Monument, Hoak, B.E. and Jarvis, R.L., 21 pp., 1980, Oregon State University.
The special objectives of the study included determination of prey items consumed and foraging habitats utilized. Also describes breeding behavior, home ranges, and methods of capturing prey. Contains maps, graphs, and tables.

Insects of Craters of the Moon National Monument, Horning, Donald S., Jr. and Barr, William F., 118 pp., University of Idaho, College of Agriculture.
Study consisted primarily of an inventory of the insect species inhabiting CRMO. Special attention was given to the associations of insects with particular lava and non-lava habitats. Contains one map and black and white prints.

List of the Recent Mammals of Idaho, Hall, E.R. and Nelson, K.R., 12 pp., October 1968, Idaho State University.
Lists the recent mammals of Idaho by order and family.

Lives of Game Animals, Seton, Ernest Thompson, 55 pp., 1953, Charles T. Branford Company, Boston.
An account of those land animals in America north of the Mexican Border, which are considered "Game" either because they have held the attention of sportsmen or received the protection of Law. Discusses the bighorn sheep: history, characteristics, and range. Contains charts.

A Look at the Forest Service Position on Wilderness and Wildlife, Hamre, Vern, 8 pp., January 1979, USDA, Ogden, Utah.
Presents the wilderness management plan. Sees the need for a strong statement of support of the wilderness philosophy. Also describes problems when federal land classifications were superimposed over the National Forest area.

Mountain Sheep in British Columbia, Smith, Ian and Demarchi, Ray, 4 pp., 1969, Department of Recreation and Conservation, British Columbia.
A brief paper discussing some implications of sheep management, causes of mortality, food habits, breeding habits, and habitat requirements.

Narrative of a Journey Across the Rocky Mountains to the Columbia River, Townsend, John K., 44 pp., 1839.
Contains some of the early wildlife observations from the travellers. Were in the vicinity of CRMO.

North American Fauna, Meriam, Dr. C. Hart, 20 pp.
Notes from an expedition through south central Idaho. Noted 15 species of mammals and 64 species of birds.

Observation on Wildlife and Wildlife Conditions in CRMO, Newman, Coleman C., 11 pp., 1955, 4 pp., 1956, 34 pp., 1958, (three separate reports).
Lists the mammals and birds observed, and general information on the flora of CRMO. Recommended a wildlife survey on the range, food plants, and migration traits. Information on the plants would also be of interest to the general public.

Observation on Wildlife and Wildlife Conditions in CRMO, Newman, Coleman C., 12 pp., 1955.
The primary observation of this study was the mule deer herd. A lot of evidence of mule deer was found. Mr. Newman recommended a wildlife survey to find out the range, frequency of occurrence, food plants, and migration traits of the deer. Information on the plants would be of interest and value to the public.

Observation on Wildlife and Wildlife Conditions in CRMO, Newman, Coleman, 1956.
Report covers field study, wildlife sightings, as well as signs of wildlife.

Proposal to Re-introduce Bighorn Sheep to CRMO, Murie, Adolph, 17 pp., 1970.
The plan to re-introduce bighorn sheep to the monument would not be feasible. The sheep would find the monument too limited and would go to higher country.

The Raptors of the Idaho National Engineering Laboratory, Craig, Timothy H., 27 pp., April 1979, Site, Published by Radiological and Environmental Sciences Laboratory, Idaho Falls.
Raptors are important indicators of environmental contamination, as their food consists of primary and secondary consumers which may concentrate some pollutants. Raptors may also be used as biondicators of radioactive contamination. Objectives of this study were to determine the species, abundance, nest site selection, and some specific nesting parameters of raptors on the (INEL) site. Contains productivity graphs.

The Recent Mammals of Idaho, Davis, William B., 2 pp., 1939.
Contains information on Rocky Mountain sheep and mountain goats.

Restoration of Bighorn and Beaver to CRMO, Murie, Adolph, 2 pp., 1959.
There was a proposal to re-introduce bighorn sheep and beaver to CRMO. It is believed that the monument is too limited for either population.

Return of the Bighorn to Lava Beds National Monument, Blaisdell, James A., 20 pp.
Contains general information about the bighorn sheep, their range, adaptions, breeding behavior, and future of the bighorn. Transplanting the bighorn to Lava Beds has proven to be successful.

A Review of the Invertebrate Fauna of Volcanic Caves in Western North America, Peck, Stewart B., 11 pp., Department of Biology, Carleton University, Ottawa, Ontario.
The purpose of this paper is to summarize our knowledge of the invertebrate fauna of the volcanic caves of continental North America. Very little is known about them and future research and collecting is encouraged.

Status of the CRMO Deer Herd, Ritchie, Brent, 60 pp., June 1968, A thesis for University of Idaho.
Early reports indicate that the deer population was very small in 1924, when the monument was established. Since then, livestock grazing and hunting have been prohibited and the deer population has expanded greatly. Primary purpose of the study was to determine the size of the present deer population and assess the condition of the monument range.

Volcanic Ash Problems and Concerns for Fish and Wildlife, Fish and Wildlife Service, USDI, 34 pp., June 1980.
USDI Fish and Wildlife Service is concerned about the near and long-term impacts of volcanic ash in fish, wildlife, and their habitat, as a result of Mount St. Helens. Volcanic ash control/management could minimize possible future impacts. Contains tables.

Wildlife Folder, Herberger, Mark, Park Interpreter.
Identifies the mammals likely to be seen at CRMO. Mentions habitat, life cycle, status, and interesting facts.