RESOURCES MANAGEMENT PLAN

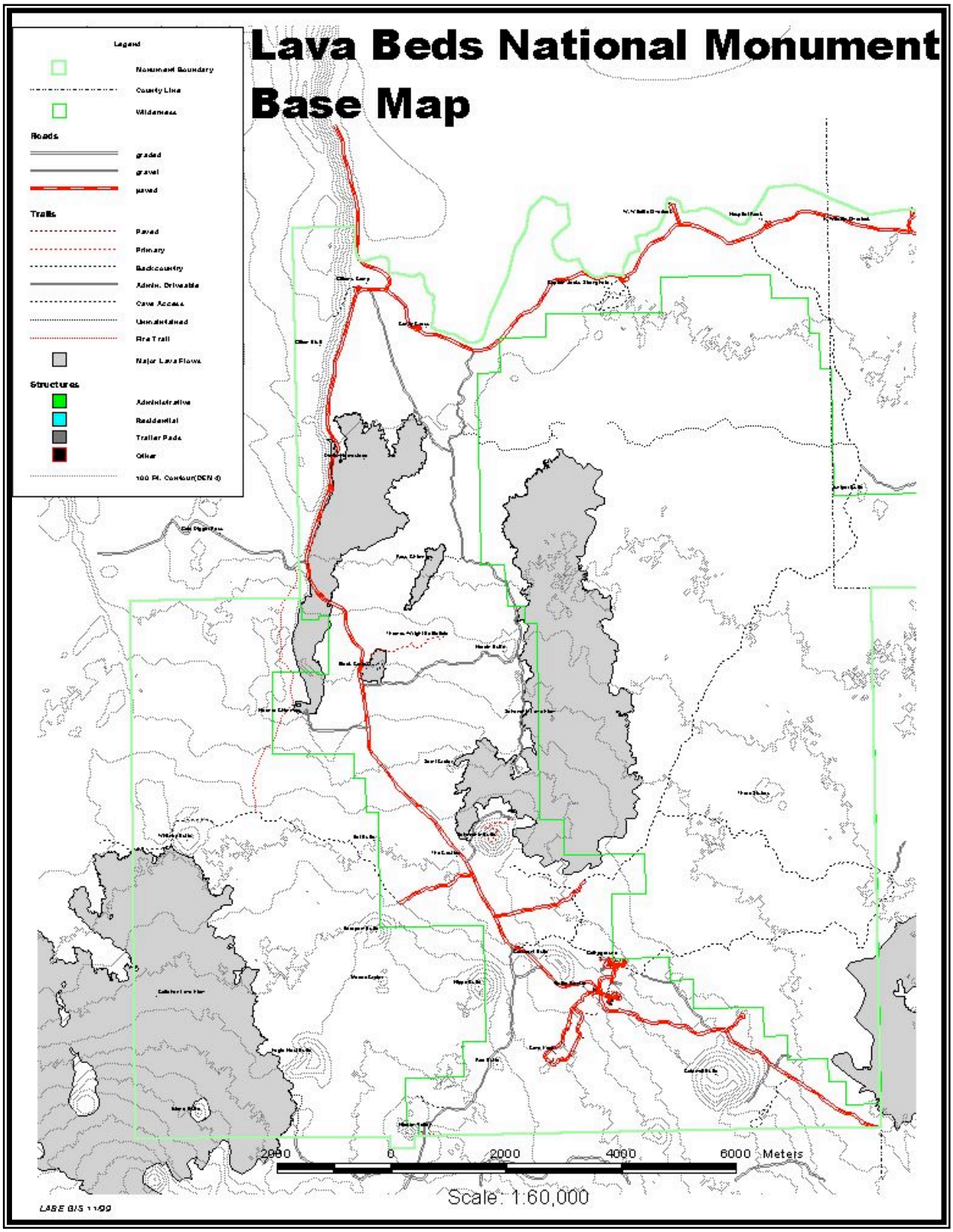
LAVA BEDS NATIONAL MONUMENT

Recommended by: _____ **Date:** _____
Chief of Resources Management

Approved by: _____ **Date:** _____
Superintendent

December 1999

TABLE OF CONTENTS


Lava Beds National Monument
Base Map
Legend
Monument Boundary
County Line
Wilderness
Roads
graded
gravel
paved
Trails
Paved
Primary
Backcountry
Admin. Driveable
Cave Access
Undistributed
Fire Trail
Major Lava Flows
Structures
Administrative
Residential
Trailer Pads
Other
100 Ft. Contour(DEM-I)
2000
0
2000
4000
6000 Meters
Scale: 1:60,000
LASE GIS 11/99

INTRODUCTION

Park Purpose and Significance

Lava Beds National Monument is a unit of the National Park System and is managed by the National Park Service. As part of the National Park System, Lava Beds' mandate includes the protection and preservation of natural and cultural resources. The mandate is derived from the National Park Service Organic Act of 1916 which outlines the fundamental purposes of the National Park System. The mandate also directs the National Park Service to allow for public use and enjoyment of national parks, provided that the resources therein remain unimpaired for future generations. The conservation of resources, both natural and cultural takes primacy over all other activities.

Lava Beds National Monument was established by Presidential Proclamation (No.1755, November 21, 1925, 44 Stat. 2591), which recognized the significance of the area's natural and cultural resources. The Proclamation stated:

"Whereas, lands of the United States within the area herein described…contain objects of such historic and scientific interest as to justify their reservation and protection as a National Monument;……"

The proclamation did not specify any one feature or ecosystem as being most important. Therefore, the management of the monument's resources are guided by the provisions of the 1916 Organic Act and the amendment to the Act establishing Redwood National Park. NPS Management Policies state that:

"…The National Park Service will manage the natural resources of the National Park System to maintain and perpetuate their inherent integrity."

"…The National Park Service will preserve and foster appreciation of the cultural resources in its custody through appropriate programs of research, treatment, and interpretation."

The Lava Beds National Monument Strategic Plan (1997) identifies the monument's Mission Statement as follows:

"Lava Beds preserves and protects the natural and cultural resources of the unique 'volcanic' fields and associated features, and perpetuates the ecosystem in which they are found, for the benefit of present and future generations, for traditional cultural uses and for long term scientific inquiry."

The "Statement for Management" (April, 1990) identifies a number of resource management objectives including:

To restore and maintain natural terrestrial, subsurface, and atmospheric ecosystems so they may operate unimpaired by:

- Conducting and supporting appropriate research;
- Restoring altered ecosystems as nearly as possible to conditions that would have existed had natural balances not been disturbed;
- Identifying and perpetuating natural processes wherever feasible;
- Protecting sensitive species and their habitat, and where practical and success probable, reintroducing displaced native species;
- Protecting sensitive cave resources through comprehensive and user-interactive management programs;
- Limiting unnatural sources of air, noise, visual and water pollution to the greatest extent possible;
- Reducing the spread of non-native species by rehabilitating sites disturbed by construction or maintenance of facilities or by other management activities.

To identify, evaluate, preserve, restore and protect prehistoric and historic cultural resources in accordance with applicable laws and executive requirements by:

- Conducting and supporting appropriate research to determine the extent, context, and significance of cultural resources;
- Providing for maximum protection through appropriate public interpretation, physical storage of artifacts, and enforcement of laws, regulations and National Park Service policies.

Description of the Natural Environment

The 46,560 acre monument is located in northeastern California, approximately 155 miles northeast of Redding, California, and 50 miles southeast of Klamath Falls, Oregon. Ninety-four percent of the monument lies within Siskiyou County in the 2nd Congressional District. The remaining six percent is in Modoc County in the 14th Congressional District. The monument provides an ecosystem rich in natural and cultural resources.

Lava Beds National Monument is on the western margin of the Modoc Plateau and southern edge of the Tule Lake basin. The Modoc Plateau is characterized by extensive lava flows, numerous north-south trending block escarpments and broken mountain ranges. The monument incorporates a portion of the Medicine Lake shield volcano, a 900-square-mile highland created by various types of volcanic eruptions, including extensive smooth *pahoehoe* and rough *aa* lava flow surfaces. Some of these flows were the origin

of the hundreds of lava tube caves found within the monument. The lava within the monument is believed to date to the Pleistocene and Holocene periods.

With an average annual precipitation of 15.56", the monument's arid environment is host to a diverse group of plant and animal species. Three major vegetation associations (38 plant communities) represent approximately 283 species of plants, which in turn supports 51 species of mammals, 217 species of birds, 12 species of reptiles, two species of amphibians, and an unknown number of species of insects and invertebrates.

Relatively well-developed soils in the northern section of the monument support the bunchgrass-sagebrush plant community, which is dominated by fire-tolerant grasses and shrubby sagebrush. The most common small mammals of this plant community include Belding's ground squirrels, kangaroo rats, yellow-bellied marmots, black-tailed jackrabbits and cottontail rabbits. Large migratory mammals within this zone include mule deer and pronghorn antelope. Characteristic bird species are California quail, meadowlarks, and red-tailed hawks.

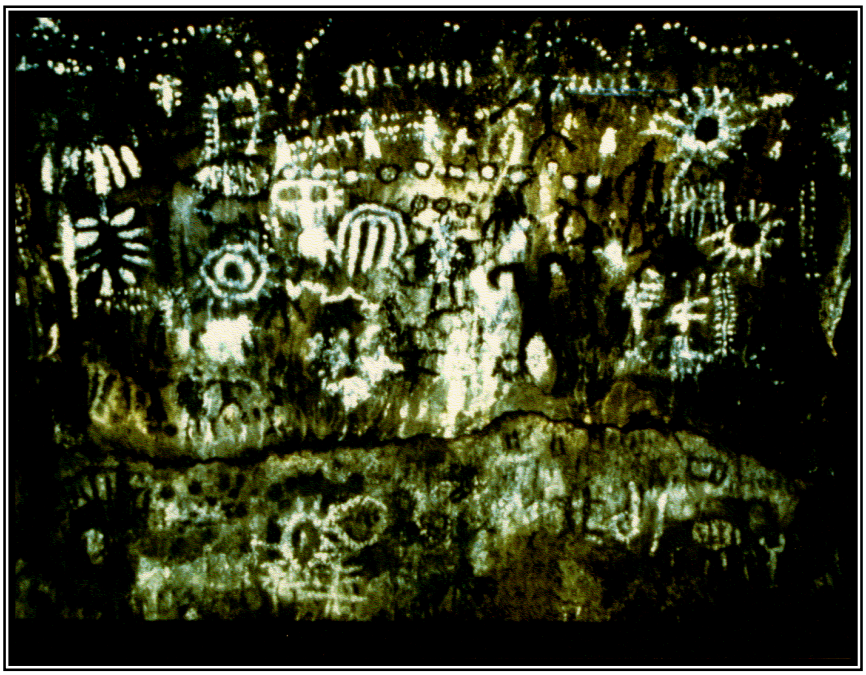
More poorly-developed soils containing a great deal of volcanic pumice underlie the juniper-brushland community located throughout the mid-elevations. Other than juniper, associated plants include bitterbrush and desert mountain mahogany which provide the food that attract large numbers of wintering mule deer. Animal species endemic to this zone include coyote, bobcat, California ground squirrel, woodrat, scrub and pinyon jays, and western robin.

Ponderosa pine is present in the upper elevations of Lava Beds, where temperatures are cooler, and in the past, fires created an open park-like forest with scattered shrubs and grasses. Deer forage in this zone during the summer months. The golden-mantled ground squirrel and yellow pine chipmunk are common as are Steller's jays, Clark's nutcrackers, and the somewhat less abundant mountain quail and blue grouse.

Lava Beds National Monument boundary is adjoined by Modoc National Forest, Klamath National Forest, Lower Klamath Basin National Wildlife Refuges (Tulelake Refuge), Bureau of Reclamation, and Bureau of Land Management, as well as private lands. The natural and cultural resource issues of the area are similar for each agency and require an interagency approach for positive solutions.

Situated on the lower northeastern slope of the Medicine Lake volcano, the monument's terrain is of recent geologic origin. Due to its volcanic nature, the park is laced with lava flows, resulting in the formation of well over 450 lava tube caves. The caves are notable in their abundance, length of

passage, and excellent preservation of many primary (volcanic) and secondary (mineralization) features. Many also contain resources such as ice formations, pictographs, or unusual biotic communities or populations.



Lava Beds National Monument is situated in a region well suited for outdoor recreation and is renowned for its scenic resources and recreational opportunities. Lava Beds is a component of a recreational complex that offers public facilities, including six national park units, national forests, Scenic Byways, vast man-made and natural lakes, state parks, and several major rivers, all within a 200 mile radius. Lands within this region, administered by federal, state and local agencies, provide for the diversity of leisure activities desired by the public. Historically the primary commercial activities in the region were resource extraction. Today, agriculture and tourism are the dominant commercial enterprises.

Ten thousand years of human occupation throughout the Klamath Basin has provided an extensive array of cultural resources associated with Lava Beds National Monument. The Modoc Indians were hunters and gatherers, living in semi-permanent villages in and around the Tule Lake basin. Spiritual ties to the land are also acknowledged, especially to Fern Cave, one of the monument's lava tube caves.

As European settlement moved westward, conflicts between cultures escalated culminating in the Modoc Indian War of 1872-1873. Native Americans, clinging to their homeland, took refuge within what is now called "Captain Jacks Stronghold". This rugged terminus of the Modoc Crater lava flow provided protection from U.S. Army troop assaults in the forms of rock outcroppings that were effective rifle pits, connecting trenches, cover from mortar fire, and small residential shelters.

Land Management Zones

Management policies in the National Park System are aimed at providing visitors with the opportunity to enjoy and benefit from contact with natural and cultural environments, while causing minimal impacts to those resources. Management of natural and cultural environments in a National Park System unit is based on management zones identified by the park's General Management Plan, and derived from the classification system found in the NPS Management Policies. Lava Beds National Monument is divided into three management zones:

- Natural Zone
- Historic Zone
- Development Zone

In natural zones, emphasis is placed on protection of natural resources and processes, and the accommodation of uses that do not adversely affect these resources and processes. Natural resources are managed with concern for fundamental ecological processes as well as individual species and features. The goal of park management is to maintain all components and processes of naturally evolving park ecosystems. Within the natural zone at Lava Beds there is 28,460 acres of Designated Wilderness. As the entire monument is designated as an archeological district, there is also a cultural component associated with the natural zone. Prescribed fire may be used as a tool to achieve resource management goals within this zone.

In historic and cultural zones, emphasis is placed on the preservation of and appreciation for the monument's cultural resources. Within this zone, physical development is limited to the minimum necessary to protect, preserve or interpret cultural values. Activities permitted include sightseeing and the study of cultural and natural features. Prescribed fires may also be conducted within this zone.

Park development zones are managed for intensive visitor use and contain facilities such as walkways, buildings, and parking lots intended to attract and benefit park users. The natural aspects of the land within these zones are altered. Major development at Lava Beds occurs only within the Headquarters area, including Indian Well Campground, a maintenance and residential area for the monument staff, the Visitor Center and nearby Cave Loop Drive. Prescribed fire may be used in this zone to reduce accumulations of hazardous fuel.

Purpose of the Resources Management Plan

The primary purpose of this Resources Management Plan (RMP) is to describe and document a coordinated program to identify, protect, preserve and enhance the natural and cultural resources associated with Lava Beds National Monument. The RMP is an action plan that describes the natural and cultural resources within the monument, threats to the resources and ongoing, planned, and necessary activities required to preserve and protect the resources. The plan provides the basis for undertaking a comprehensive, multi-disciplinary approach to resources management throughout the monument. Management activities are directed towards restoration and/or preservation of natural ecosystems and processes, as well as cultural resources and values. A wide range of research initiatives, baseline studies, Vital Sign monitoring, and manipulative and protective techniques are integrated into a comprehensive resources management program to meet long term strategic park management objectives.

Resources Management at Lava Beds National Monument requires a long-term perspective and commitment to preserve cultural resources and natural ecosystem processes. The protection of resources mandates that land managers seek to avoid alteration of or interference with natural ecosystem processes and cultural resources.

Resource values and purposes for the establishment of the park are summarized in the RMP. Resources management challenges and issues are analyzed and prioritized, and specific actions, including funding and staffing levels are proposed to address significant resource issues. The plan outlines a multi-year program designed to allow measurable progress on proposed actions, and to measure the effectiveness of those actions.

The RMP draws upon appropriate legislation and National Park Service policies and guidelines as well as knowledge of the resources and special needs of the park. The Plan provides the basis for measuring resource accomplishments against documented inventory, Vital Signs monitoring, research, mitigation and enforcement needs and for making budget requests.

Resource management actions in the monument will continue to be coordinated with other park activities, and federal, state and county agencies. The Plan is a flexible document, and the proposals, priorities, and funding strategies are intended to be used as guidelines. Specific components of the Plan will be reviewed and updated periodically to meet changing requirements.

The RMP sets priorities for park programs and provides the rationale for the allocation of funding and staff by the Pacific West Region and the Washington Office. The Plan is also intended as a general guide for universities to direct student and volunteer researchers toward projects that enhance park purposes.

The Resources Management Plan provides the details for actions to meet the objectives of the Statement for Management and the goals set forth in the General Management Plan. Specific initiatives are addressed in various Action Plans such as the Fire Management Plan, Cave Management Plan, Wilderness Plan, etc. that form addenda to the RMP.

Compliance and Consultation

The Resources Management Plan is not the document through which environmental compliance is accomplished. Environmental compliance is accomplished on a case-by-case basis as projects are about to be implemented. The National Environmental Policy Act (NEPA) requires analysis of actions that have the potential to cause environmental impact or may be controversial.

Some actions requested in this RMP are continuations of existing programs that have previously been the subject of compliance actions. Those actions called for within this plan which have not been previously implemented are only proposals and are not subject to environmental compliance actions under NEPA at this time.

For cultural landscapes or natural areas containing cultural resources, cultural resource compliance actions may be required. When compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966 is required, individual projects or group of projects will be reviewed to insure compliance requirements are met.

The NHPA requires that federal agencies consider the effects of their undertakings on cultural resources that meet the criteria of the National Register of Historic Places (NRHP), to give the

Advisory Council on Historic Preservation opportunities to comment on federal undertakings, and to establish programs for identifying, evaluating, nominating and protecting eligible properties.

This Resources Management Plan was prepared in conjunction with other park documents in order to maintain a consistent theme regarding operational plans and legislation stating the purpose for establishment of the monument. This plan complies with environmental and cultural legislation.

I. Natural Resources Baseline Information

Lava Beds National Monument is lacking good baseline data for most resource areas. Good baseline data can be found in geology, vegetation, fire history for contemporary times, and on some plant and animal species high in the food pyramid. Very little data exists on specific life histories on mammals, on specific species of flora, and on insects or invertebrates, and no data exists on soils found specifically within the monument. Additional inventory and monitoring studies need to be completed and descriptive and analytical information on ecosystem processes and relationships need to be acquired. A recently completed (11/98) Vital Signs Inventory and Monitoring scoping session will form the foundation of the monument's I&M program.

Vegetation Resources

The recommended minimal natural resources information includes:

1. Lists of the following biota identified as occurring in the park:
   - Vascular plants
   - Federal and state listed threatened and endangered species
   - Species of special concern within the monument including endemic and exotic species

2. Surveys to confirm occurrence of reported species and to discover new species of:
   - Vascular plants
   - Federal and state listed threatened and endangered species
   - Species of special concern

3. Species status and distribution information for:
   - Federal and state listed threatened and endangered species
   - Species of special concern

4. Digital maps of vegetation associations in the monument and environs

Baseline Data Inventory for Vegetation includes:

- A vascular plant list has been developed for Lava Beds National Monument.

- Herbarium collections document the majority of vascular plants within the monument.

- Two species of endangered vascular plants have been identified.

- A dated vegetation map exists which was completed in 1979. It is the only source of vegetation distribution data in existence for the monument.

- A preliminary non-vascular plant list has been established and further research is being conducted.

- Fire plot vegetation monitoring work is completed on an annual basis in conjunction with prescribed burning activities.

- An alien plant inventory is ongoing in the park and distribution maps for specific species are in development. Monitoring and control of these species is being conducted on a seasonal basis.

A survey of the fern diversity present in caves and cave entrances was completed in 1993

Inventory

- Survey of the Fern Component of Select Cave Entrances; 1993
- Plant communities and habitat types of Lava Beds National Monument; 1979
- Plants of Lava Beds National Monument; 1989
- Alien plant management program
- Bryophyte inventory in progress

Monitoring

- Alien plant management program
- Pre/post fire vegetation monitoring program
- Landscape photomonitoring project being planned

The NPS Minimum Guidelines have not been satisfied.

Lava Beds National Monument contains approximately 287 species of plants as described in the only organized plant inventory done within the monument (Applegate, Elmer I; 1938). The Lava Beds plant list is in need of updating to include surveys during the shoulder (spring and fall) seasons as well as the summer growing season. There has been one isolated fern survey and one lichen and moss survey, but very little else for fungi, mycorrhizae and other non-vascular plants.

There is a vegetation map of the park (Erhard, 1979), identifying 38 plant communities, with 23 determined through transect-sampling analysis and 13 through prominence-rated analysis. The monument's antiquated vascular plant list was used to create two herbariums: one incomplete herbarium for field use and a more inclusive one in the museum collection.

The monument has identified six primary non-native plants of concern. They are cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola iberica*), bull thistle (*Cirsium vulgare*), sweet clover (*Melilotus sp.*), woolly or common mullein (*Verbascum thapsus*), and several mustards

(*Cruciferae*). The monument has baseline information on the location of just one species, mullein. During the summers since 1991, mullein infestations have been controlled using a combination of hand-pulling and herbicide applications.

Wildlife Resources

The recommended minimal natural resources information includes:

1. Lists of the following biota identified as occurring in the monument:
    - Vertebrate animals
    - Federal and state listed threatened and endangered species
    - Species of special concern including endemic and exotic species

2. Surveys to confirm occurrence of reported species and to discover new species of:
    - Vertebrate animals
    - Federal and state listed threatened and endangered species
    - Species of special concern

3. Species status and distribution information for:
    - Federal and state listed threatened and endangered species
    - Species of special concern

Basline Data Inventory for Wildlife includes:

- A wildlife database has been established and functions as an inventory storehouse for all wildlife observations in the monument.

- Species lists exist that date back t o the 1960's for birds, reptiles, amphibians and mammals.

- Monitoring activities are conducted on a seasonal basis for resident and migratory species of bats (Townsend's Big-eared bat (*Corynorhuinus townsendii*) and Mexican Free-tail bat (*Tadarida Brasiliensis*) to determine population dynamics. The Townsend's Big-eared Bat is categorized as a species of special concern for the state of California.

- Bald eagle(*Haliaeetus leucocephalis*)winter roost site monitoring is conducted annually to estimate returning populations.

- A Monarch butterfly, (*Danaus plexippus*) migratory study has been conducted each year during the month of August from 1991 – 1999.

Inventory

- Mammals - species list for monument (53 species)
- Birds - species list for monument (223+ species)
- Reptiles - species list for monument (12+ species)

- Amphibians - species list for monument (2+ species)
- Endangered/threatened wildlife - species list

Monitoring

Bat Colonies

- Tadarida colony population dynamics monitored since 1988
- Corynorhinus colony population dynamics and cave preferences monitored since 1988

Birds

- Bald eagle roost sites near Caldwell Butte and Eagle Nest Butte monitored since 1977
- Breeding bird study; 1980
- Prairie Falcon study; 1998
- Breeding bird census; 1979-1980
- Petroglyphs bird nest site map

Mule Deer

- Deer herd forage survey and population trends; 1970-1976
- Deer herd sickness; 1991, 1993-1994

Pika

- Low Elevation populations of Pikas, 1995
- Vocalizations of Pikas; 1992 (no final report)

Invertebrates

- Monarch Butterfly migratory patterns; 1996-1999
- Cave invertebrate study; 1993 (no final report)

NPS Minimum Guidelines have not been satisfied.

Species lists developed over the years by interested individuals and wildlife observations have identified 224 species of birds including 24 species of raptors, (two eagles, four falcons, nine owls), 14 reptile and amphibian species and 51 species of mammals. Most of the baseline research within the monument has been conducted on it's raptors, deer, and bats. The monument also has over 3,160 observation records on the species of wildlife found within its boundaries dating back to 1941.

Lava Beds contains critical habitat for and represents one of the last few bastions in California for Townsend's big-eared bat (*Corynohinus townsendii*), a species of special concern. It is also one of six species of bats found in the monument listed in the President's Forest Plan as species to protect associated with old growth forests.

Since 1996, big-eared bat colonies have been monitored using specific monitoring and survey protocol established for the monument. Bat foraging research has recently been conducted and each

year the monument is making progress towards protecting sensitive maternal colonies using a combination of interpretive means and administrative/physical cave closures.

A cave within the monument contains a summer population of approximately a quarter million Mexican free-tailed bats (*Tadarida brasiliensis*). This is the largest known colony of any bat species in California and the Northwest. It is the most northerly known maternity colony for this migratory species, and as such, is particularly important for the maintenance of the species population.

The only known species found within the monument listed on the endangered/threatened species list are the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*). A Draft Bald Eagle Winter Roost Management Plan was written and submitted in March 1991 to the U.S.Forest Service, Modoc National Forest, and Doublehead Ranger District for review. It was approved and put into place in 1992. This is a comprehensive plan providing a summary of information on the bald eagle, its activities, and its habitat within the monument and on adjoining forest lands.

Studies have also been conducted on the Caldwell/Cougar Butte Bald Eagle Winter Roost by Stohlgren, 1990, and Stohlgren and Farmer, 1991, each supporting the importance of this roost.

Cave Resources

Baseline information on caves includes the documentation of approximately 435 caves totaling 28 miles of passageway that are numbered and named, with 346 having maps on file. Thirty-three caves have been completely inventoried based upon the standards established by the 1990 Lava Beds National Monument Cave Management Plan.

As of March 1, 1999, 390 caves have been geo-referenced and 216 of them have been uniquely and permanently identified on the ground using brass survey monuments.

A three year contract with Cave Research Foundation provided baseline cave information on cave reconnaissance with 100 cards completed, inventorying and mapping of 24 caves, photo-monitoring of 15 caves with over 5000 slides, monitoring of speleothem breakage in two caves, monitoring of dust and sedimentology in two caves, monitoring of ice levels in six caves, and conducting a mineral analysis on 120 samples from 50 caves. In addition, a professionally-prepared nine page inventory form with instructions was presented to the monument.

Baseline Data Inventories for Cave Resources includes:

- 435 caves have been located within the monument boundary, making Lava Beds National Monument the site of the highest concentration of lava tube caves within the 48 contiguous United States.

- All known caves have GPS coordinates.

- Ten lava tube trench systems have been identified and five of the ten trenches have had trench maps drawn for them.

- A numbering system protocol has been set up for locating caves in each trench system. 294 caves have been numbered.

- A monumenting protocol has been established for marking all park caves with an identifying name and number. 227 caves have been monumented.

- Cave mapping activities have included the underground survey of 163 caves in the monument. An additional 226 caves have draft maps associated with them. Mapping standards are in the process of being developed.

- 57 caves have been inventoried using the cave inventory standards established by the Cave Research Foundation in 1990.

- Photomonitoring stations have been established in 15 caves since 1992 and retaken in 1998-1999.

- Ice levels in six ice caves have been monitored since 1990 by the Cave Research Foundation. These results have been incorporated into a spreadsheet showing trends of ice level fluctuations.

Inventory

Ongoing reconnaissance of cave resources has located **435** lava tube caves, bridges, grottos, etc. associated with the lava tube systems present in Lava Beds National Monument.

Lava Tube Systems
- 10 trench systems identified
- trench maps produced for 5 trenches with cave locations

Numbering
- numbering system protocol in place
- 294 caves numbered

Monumenting
- Monumenting protocol in place
- 227 caves monumented

Mapping
- Mapping standards established
- 163 caves mapped
- 226 caves have associated draft maps

Cave Resource Inventory

- Biological inventory protocol established
- 57 caves inventoried

Georeference Location

- GPS protocol established
- All known caves georeferenced

Monitoring

- Cave invertebrate inventory and monitoring; 1993 (no final report) (CRF)
- Cave internal photomonitoring (continuing)
  15 caves completed; 1992, 1998
- Cave entrance photomonitoring - being planned
- Dust Monitoring and Sedimentology of Select Caves; 1992 (CRF)
- Ice Level Monitoring; 1989- present (continuing) (CRF)
- Monitoring of Speleothem Breakage; 1992 (CRF)
- Impact Studies of Post Office Cave; 1990 (CRF)
- Inventory and Monitoring of Cave Roosting Bats;1992 (CRF)
- Rock Art Photo Documentation; 1991 (CRF)
- Merrill Ice Cave Ice Floor Hole; 1998 (continuing)
- Crystal Ice Cave Temperature Dynamics Study; 1989-1990 (no final report)(CRF)
- Rock Art Associated With Select Lava Tube Caves; 1998 (independent)
- Minerology of Lava Tubes; 1992 (CRF)
- Fleener Chimney Project; 1993 (CRF)
- Fossil Cave fossil collection and identification; 1931

Air Quality Resources

The recommended minimal natural resources information includes:

a. Location of existing emission sources and air quality monitoring stations
b. List of:

- Air-quality related values
- Visibility goal
- Atmospheric gases
- Atmospheric particulates

Monitoring

- Monitored 1982-1986; 1994- present(PM10)
- Visibility study done 1983-1986
- Ozone monitored since 1995 (summer season only)

The NPS Minimum Guidelines have not been satisfied

Baseline information includes fine particulate sampling data from 1982-1986 and photo-monitoring data from 1986 to 1991. The specific data is on file at the Air Quality Division at Fort Collins. A PM10 monitoring station (installed by Siskiyou County) located at the Headquarters weather station has been in operation since 1994. Lava Beds has also been collecting Ozone data since 1995.

Geology/Soils

The recommended minimal natural resources information includes:

a. Digital soils maps
b. Digital geology maps (bedrock and surficial)

Inventory

- Surface geology map (1987) of Lava Beds National Monument
- Digital GIS map from 1987 version
- Digital GIS map of Medicine Lake Volcano and surrounding area including Lava Beds forthcoming
- Subsurface cave resource and lava tube trench system maps and inventories

Monitoring

- Lake Shore Historic Geomorphology Study; 1994
- Petroglyph Point Geologic Study; 1992
- Use of remotely sensed data imagery to determine composition of lava flows; 1995
- Geology of the Medicine Lake volcano; 1979-1994 (9 reports)
- Dating Basalt Samples; 1990
- Landscape photomonitoring project being planned

The NPS Minimum Guidelines have not been satisfied.

The monument has digitized soils maps using data from surrounding surveys (Modoc National Forest). The maps are insufficient, since the data is only interpolated from these maps and no soils survey has actually been conducted for Lava Beds.

Using the "Geology Map of Lava Beds National Monument, Northern California", 1987 by Donnelly-Nolan and Champion, the monument has digitized a map of the surface geology. An updated USGS digitized map of the area is in process and will be delivered to the monument upon completion.

Surface Geology of Lava Beds National Monument

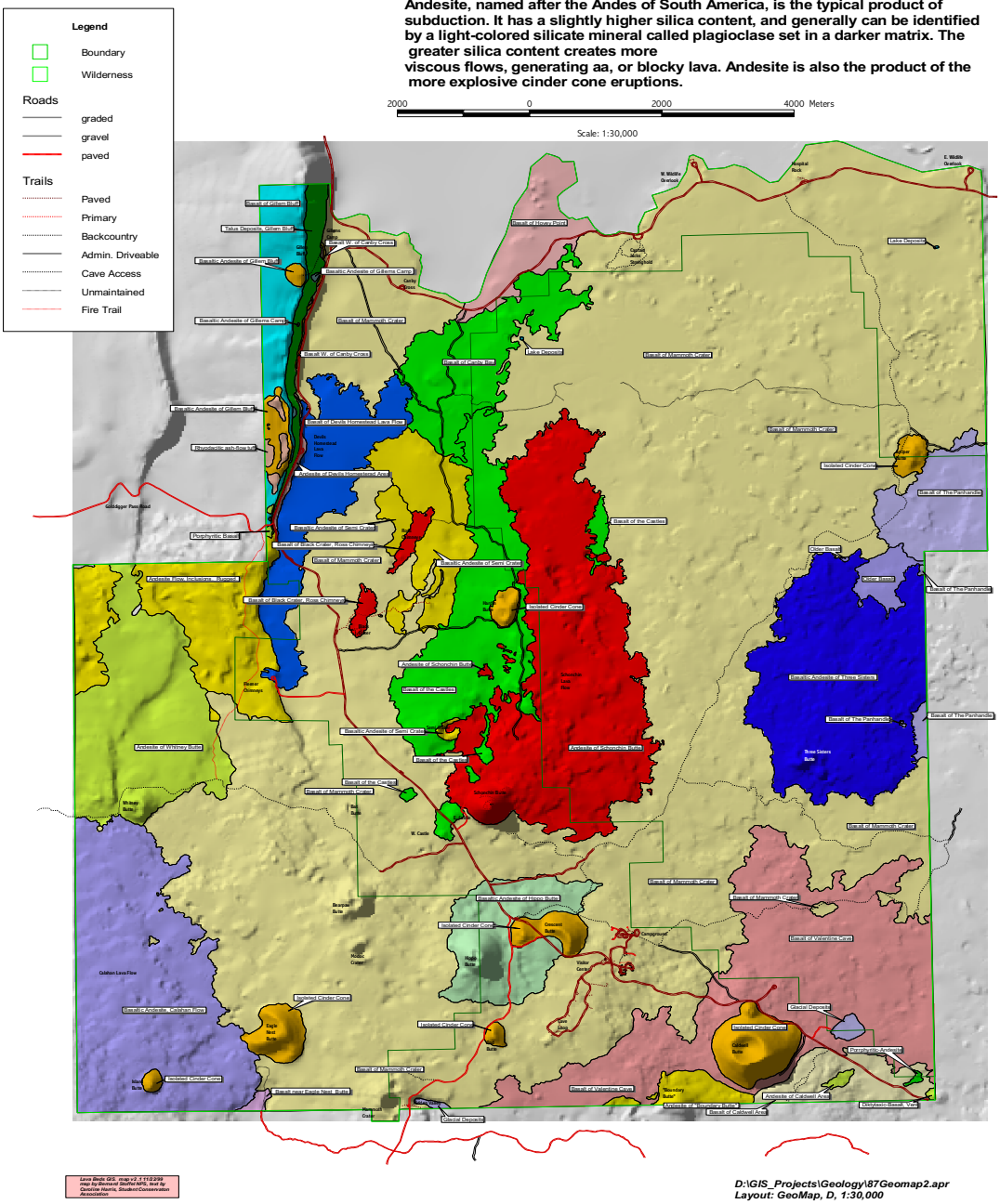
Adapted from,
"Geologic Map of Lava Beds National Monument,"
By Dr. Julie Donnelly-Nolan, 1987

Basic Explanation of Lava Beds Geology

Exposed units in Lava Beds National Monument are primarily lava flows of basaltic and andesitic composition.

Basalt is a dark-colored lava with a silica content of less than 53%. Its fluid characteristic can create pahoehoe, or "ropy" lava, which facilitates the formation of lava tube caves.

Andesite, named after the Andes of South America, is the typical product of subduction. It has a slightly higher silica content, and generally can be identified by a light-colored silicate mineral called plagioclase set in a darker matrix. The greater silica content creates more viscous flows, generating aa, or blocky lava. Andesite is also the product of the more explosive cinder cone eruptions.



Lava Beds GIS, map v2.1 11/2/99
map by Bureau of Stoffel NPS, text by Caroline Harris, Student Conservation Association

D:\GIS_Projects\Geology\87Geomap2.apr
Layout: GeoMap, D, 1:30,000

Geographic Information System

The recommended minimal natural resources information includes:

a. Digital elevation models/digital line graphs (DEM/DLGs)
b. Digital vegetation maps
c. Digital soils map
d. Digital geology maps
e. Digital cartographic data (hydrography, boundaries, transportation)

The NPS Minimum Guidelines have not been satisfied.

A Geographic Information System (GIS) program at Lava Beds National Monument has been implemented. ArcView, with the Spatial Analyst Extension, is the primary GIS software in use. PC ArcInfo is available for specialized functions and visiting experts who know how to use it. Lava Beds has no dedicated GIS specialist. Both raster and vector data is available, including regional SPOT satellite imagery (one meter resolution grayscale aerial photograph imagery for Lava Beds only). Digital Raster Graphics scanned topographic maps of Lava Beds and the surrounding tier of topo. Map quads, and vector data for boundaries, roads, trails, structures, and other basic map data for Lava Beds and the surrounding Modoc National Forest also exist. A 30-meter Digital Elevation Model (DEM) is available for Lava Beds and the Modoc National Forest.

Basic information for soil, vegetation, fuels, surface geology, fire history, and burn units have been digitized. Much of this is based on original sources that are old, incomplete, and/or inaccurate. They are of limited utility. For example, the DEM is of poor quality and the fuels coverage is too divorced from reality to be of any actual use in predicting fire behavior with FARSITE.

Additional GIS assets are a Desk Jet color printer, a 26”x32” digitizing tablet, and a 36-inch-wide Design Jet Plotter.

The GIS is used in conjunction with GPS to create and update coverages on cave resources, alien plants, and fires. The GIS is used regularly in planning trail projects and prescribed burns.

Future efforts will be toward making non-sensitive data available to all monument divisions through a new LAN, improving the quality of basic datasets, extending the coverage of aerial photograph imagery beyond the monument boundary, and acquiring a higher quality 10-meter DEM and high resolution color aerial photo or satellite imagery. The functionality of ArcView will be increased with additional add-on extensions such as Three-D Analyst.

Global Positioning System

A Global Positioning System (GPS) at Lava Beds has been implemented and is in regular use collecting information in the field and bringing it into the GIS. Maps showing the accurate

locations of caves, archeological sites, alien plants, new trails constructed or planned, and fire perimeters are totally dependent on GPS/GIS.

Lava Beds has an in-house GPS base station for differentially-corrected GPS, and two hand held GPS receivers for field observations. Fixed points are easily located with sub-meter accuracy and decimeter accuracy is possible. Presently GPS is used routinely by the Resource Management Division and extensively by the Fire Management Branch. Future efforts will be toward making GPS a tool used by all divisions and improving the quality and ease of use of the GPS base station.

Integrated Pest Management

Baseline information for the monument includes over 30 years of records on the outbreaks of the bubonic plague disease. This specific data is on record at the California Department of Public Health, Vector Surveillance Unit and will be transferred to the monument in the near future for inclusion into the monument's database. An increased occurrence of rodent problems within the employee residential area prompted management to ban the use of bird feeders as they were identified as a major unnatural food source that potentially could increase rodent populations.

Records are kept on the use of approved pesticides as part of the 10-21A process.

Fire Management Resources

Since the initiation of effective fire control efforts in the monument in the late 1920's, fires have been well documented. Baseline information on wildfires includes 73 years of records dating back to 1925. Fire weather data has been collected since 1941.

The monument has good baseline data on the effects of prescribed fire on vegetation. Fire research conducted by Olson, Johnson, and Martin (1979-1982) established seven general fire prescriptions. Fifty-six burn units were identified involving three agencies, Modoc National Forest, Klamath Basin National Wildlife Refuges and Lava Beds National Monument. Forty-nine of those burn units fell within the monument. From 1974-1999, 56 prescribed fires were conducted to meet monument fire management objectives. In 1997, the fire management program has combined many of these small units into larger units.

The Fire Management Plan (an action plan tiered off the RMP) is the document that provides overall direction and guidance for the Fire Management program. It is scheduled for a re-write in 2001.

The monument also has collected pre-burn fire effects data on seven monitoring types involving 70 brush plots and 22 forest plots. The monitoring types are: 1) FPIPO1D09 (Pinus ponderosa, forest type), 2) FPUTR1D06 (Bitterbrush/Juniper, forest type), 3) BPSSP1D02 (Bluebunch Wheatgrass, brush type), 4) BCHNA1T05 (Rabbitbrush, brush type), 5) BCELE1D06 (Mountain Mahogany, brush type), 6) BARTR1D05 (Sagebrush, brush type), and 7) BACTH1T05 (Thurber's Needlegrass, brush type). Prescribed fires, as well as fire effects plots, have been plotted on 1:24,000 map format; however, this information needs to be more accurately plotted

using GPS and GIS. At least one research burn needs to be conducted to refine prescriptions in areas of critical wildlife habitat concern in cooperation with California Fish and Wildlife Service. Additionally, a research burn is necessary in the north end of the monument to determine how best to treat acres infested with cheat grass.

Aerial Photo/Map Resources

Lava Beds National Monument has two sets of color aerial photographs at 1:15,600 (1974) and two sets of color aerial photos at 1:15,600 (1984). Resources Management also maintains files of over 2000 maps on the monument including topographic maps, special project maps, boundary information, etc.

II. PRESENT RESOURCE STATUS

This section is an overview of the current status of significant natural and cultural resources found within Lava Beds National Monument and an assessment of their general condition. The major focus of this section is the need to acquire a more comprehensive set of baseline data for the monument.

Natural Resources

There is a general lack of basic data concerning the natural resources found within Lava Beds National Monument. To date, there has been no organized system established to collect, manage, analyze integrate or display resource data. Natural resources are dynamic, and continual status changes make it impossible to predict future resource conditions and trends without first compiling the necessary baseline data sets to use for comparison.

The Resource Management staff at Lava Beds has an incomplete understanding of the interrelationships that exist between the biological communities and their responses to ecosystem stressors. Knowledge of baseline conditions is essential in order to design and interpret basic ecosystem models for the monument. The lack of this baseline data makes it difficult to determine changes that occur as a result of anthropogenic influences or to design plans to mitigate those influences. Therefore, the lack of baseline natural resource data is a major threat to the viability of the monument's ecosystems.

The Resources Management staff postulates that the most profound anthropogenic influences on the natural resources have been the disruption of the natural fire regime, introduction of exotic plant species, decline or extirpation of native species, concentrated visitor use within certain caves, and historic consumptive uses such as grazing.

Lava Beds National Monument has no inholdings or other internal threats to the integrity of the ecosystems. The monument is almost entirely bounded by other land management agencies and to date, there has been minimal pressure on ecological integrity from outside park boundaries. These pressures are in the form of the encroachment of exotic plant species and the use of agricultural pesticides on lands just north of the monument. The potential for a catastrophic wildfire due to an

unnatural accumulation of fuels has been significantly reduced in the past 10 years through the implementation of an aggressive prescribed fire program.

The natural resources found within Lava Beds National Monument are described below.

Vegetation Resources

Lava Beds National Monument covers 72 square miles within Siskiyou and Modoc counties in northeastern California. Precipitation averages approximately 15 inches yearly , but very little water is present due to the fractured surface rock and porous pumice-rich soils. Snow melt and rain immediately percolate through the soils and out of the reach of most plants. For this reason, there are no springs, streams or surface water. Most plants found within the monument have adapted to semi-arid conditions. However, in the highest elevations within the monument, exceeding 5,000 feet, one finds a more typical coniferous forest community. Along the northern boundary is the Tule Lake Wildlife Refuge. Here, the elevation is 4,040 feet, where a typical bunchgrass community existed in the past, but has given way to a cheatgrass/mustard community. As you travel south through the monument, the typical bunchgrass community remains, for the most part, intact.

Although the monument appears to be a desert type at first glance, none of the extremes of a desert are found. Temperatures are seldom over 90 degrees F. during the summer, and the winters are quite moderate. The 15 inches of precipitation a year are quite adequate for a higher climactic community, but due to the porous nature of the soils much of this moisture is lost before it can be used by the plants.

The monument is divided into a number of recognizable plant communities: Bunchgrass-Sagebrush; Juniper-Chaparral, and Ponderosa Pine. A plant list has been compiled over the years containing over 280 different species. The monument maintains a working herbarium.

Lava Beds National Monument was originally administered by the U.S. Forest Service. It was established under Presidential Proclamation in November, 1925 and subsequently transfered to the National Park Service to administer in 1933. The land within the monument was heavily grazed by sheep and some cattle, continuing through 1974, with only one life lease granted after 1947. The grazing of the monument had a significant negative impact upon the native vegetation. The park is beginning to recover; however the intrusion of exotic plant species, such as cheatgrass (*Bromus tectorum*) and woolly mullein (*Verbascum thapsus*), are found throughout the monument.

Wildlife Resources

The monument supports an abundant and diverse wildlife community including over 250 vertebrates. There are 51 known species of mammals, 217 known bird species and at least 12 species of reptiles.

The lands within the monument provide preferred winter habitat for mule deer (McCloud Herd). During a normal winter season, snow depth at the upper elevations of the Medicine Lake Highlands forces the deer to move down the eastern slope and into the monument. Small populations of

pronghorn are also observed in the monument's northern extent, where the terrain is rolling shrub/grassland.

The monument has always provided habitat for mountain lions (*Felis concolor*). Until recently, very few sightings have occurred (2-5/yr.). A substantial increase in lion sightings since 1994 has prompted management to initiate a mountain lion awareness program that informs and educates visitors to the potential hazards of living and recreating in lion country. Information is readily available at the visitor center and the staff actively educates visitors to the potential hazards of recreating in lion country.

Endangered/Threatened Species

Lava Beds National Monument has currently identified two federally protected species within the monument. They are the bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus*). The bald eagle is listed as a Federal Threatened and California Endangered Species and is protected under the Bald and Golden Eagle Protection Act, as amended in 1962. Because of its recent reproductive success, there are some thoughts about removing the species in Washington and Oregon from the list. The bald eagle uses the monument for winter roosting cover. The sites identified are the Caldwell/Cougar Butte and Eagle Nest Butte Roosts.

Also within the monument, the great grey owl (*Strix nebulosa*) is listed as a California endangered species.

Species on the California threatened list that are rare visitors to the monument include the sandhill crane (*Grus canadensis*) and the bank swallow (*Riparia riparia*). Other Species of Special Concern in California are: Northern Goshawk (*Accipiter gentilis),* Cooper's Hawk (*Accipiter cooperii)*, Sage Grouse (*Centrocercus urophasianus),* Swainson's Hawk (*Buteo swainsoni)*, and Golden Eagle

(*Aquila chrysaetos)*.

The monument contains seven bat species which were category 2 candidate species until recently, when this category was eliminated. They are now Species of Special Concern. Those species are: The Townsends Big-eared bat (*Corynorhinus townsendii*), Fringed myotis (*Myotis thysanodes)*, Long-eared myotis (*Myotis evotis)*, Long-legged myotis (*Myotis volans)*, Pallid bat (*Antrozous pallidus*), Silver-haired bat (*Lasionycteris noctivagans*), and the Western small-footed myotis (*Myotis ciliolabrum*).

Other mammals include the American badger (*Taxidea taxus*), and the Oregon snowshoe hare (*Lepus americanus klamathensis*). There are no reptiles, amphibians, or plants listed as threatened or endangered within the monument. However, an inventory of all species has yet to be completed.

Cave Resources

Caves are recognized as nationally significant resources. The Federal Cave Resources Protection Act of 1988 (FCRPA) was enacted to secure, protect, and preserve significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people, and scientific/educational purposes. The Act also states that federal lands be managed in a manner which protects and maintains significant caves. The FCRPA defines a cave as any naturally occurring void, cavity or system of interconnected passages which occurs beneath the surface of the earth…and which is large enough to permit an individual to enter. An area of total darkness does not have to be achieved within the cavity or system for it to meet the definition of a cave.

The monument's 1990 Statement for Management lists these management objectives:

To restore and maintain natural terrestrial, subsurface, and atmospheric ecosystems so they may operate essentially unimpaired by: 1; Conducting and supporting appropriate research, 2; Restoring altered ecosystems as nearly as possible to conditions that would have existed had natural balances not been disturbed, 3; Protecting sensitive cave resources through comprehensive and user-interactive management programs, 4; Permitting only those types and levels of use or development that do not significantly impair natural resources, and directing development and use to environments least vulnerable to deterioration.

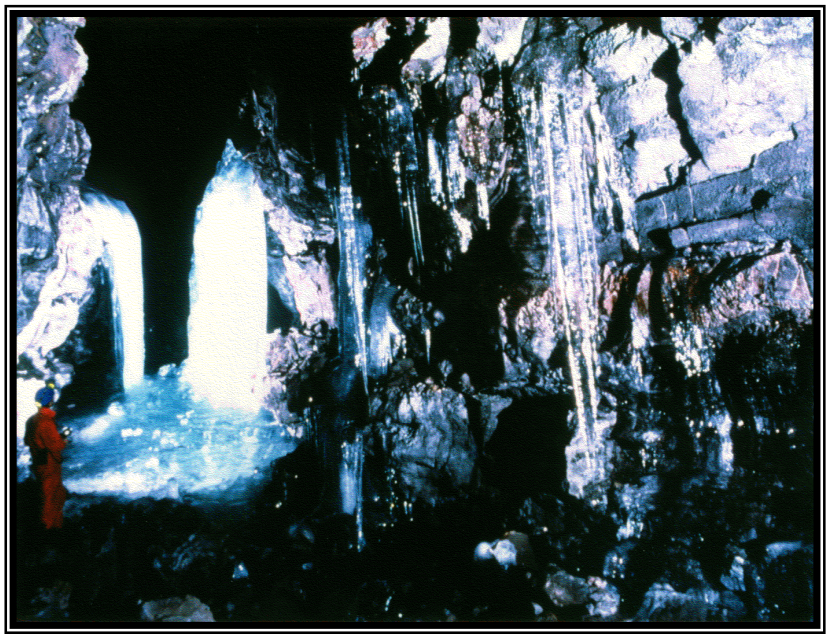
Direction relative to the cave resource is specifically defined by NPS Management Policies (1988):

> *Caves will be managed to perpetuate their atmospheric, geologic, biological, ecological, and cultural resources in accordance with approved cave management plans.... Caves, or portions of caves, may be closed to public use or restricted to access by conducted tours when such actions are required for human safety and the protection of cave resources.*

The vast majority of the monument is overlaid with volcanic rock, most of which erupted within the past 40,000 years from various vents associated with the Medicine Lake shield volcano. Many of these lava flows were distributed downstream by lava tubes, which eventually emptied, forming an intricate system of lava tube caves. The monument has the greatest concentration of lava tube caves in the continental United States. Most caves are segments or branches of ten major distribution tube systems. There are over 435 named, described and spatially located caves but there remains an unknown number of caves yet to be discovered and described. The caves range from pristine examples with intact walls, very little breakdown and no signs of human disturbance to collapsed tubes with no intact walls and everything in between. Many popular, heavily visited caves exhibit extensive damage from vandalism and foot traffic.

Many of the monument's caves exhibit excellent examples of primary (volcanic) features such as dripstone, benches, shelves, ribbed walls, lava falls, lava stalactites and stalagmites, stacked linings, and multi-level/tube-in-tube structures. A large number of the caves contain extensive secondary (mineralization) formations, resulting from mineral-laden water seeping through the caves' walls and ceilings; secondary formations include delicate cave coral, mineral washes, and stalactites. A very small percentage of the caves contain permanent ice speleothems (ice floors and other formations) which are a function of the cave's depth, structural orientation, and airflow patterns.

Approximately thirty caves have been developed to various degrees to allow for a safer caving experience for the general public. These developments include ladders, metal and wooden steps, walkways, improved trails and in one cave, lighting, interpretive signs and an underground theater to present cave orientation slide programs.



Most of the development in the caves can be traced to the Civilian Conservation Corps's presence at Lava Beds between the early 1930's and early 1940's. Stairways, ladders, and smooth-surfaced trails with imported tread material were constructed by CCC crews in

many caves to facilitate foot travel. These cave developments have been maintained or improved upon as needed over the years.

The monument has a Cave Management Plan, completed in 1990, that provides the direction needed to protect these resources. It has been used throughout the Service as an example for other cave parks. The plan is scheduled for a re-write in FY2000.

Air Resources

Air is considered a natural resource in all NPS units and many park values and resources are dependent on good air quality. The Federal Clean Air Act (CAA), amended in 1990, was enacted to preserve, protect, and enhance air quality in regions of the United States, which are of special national or regional natural, recreational, scenic or historic value. The CAA identified a classification scheme to facilitate the prevention of significant deterioration (PSD) of air quality. Lava Beds is a Class I Airshed. Class I areas receive the highest degree of protection with only a small amount of certain kinds of additional air pollution allowed. Mandatory Class I areas were designated by Congress and include national wilderness areas over 5,000 acres. Lava Beds falls into this category.

The CAA declares a "National Visibility Goal" to prevent and remedy visibility impairment in Mandatory Class I areas caused by human air pollution. Visibility refers to the clarity of the atmosphere and is typically measured as the distance one can see at a particular location and time. The absorption and scattering of light by both gasses and particles in the atmosphere restricts visibility. Natural factors which contribute to decrease visibility include fog, precipitation, blowing dust and snow, and relative humidities above 70%. Human activities that reduce visibility include the combustion of fossil fuels which transforms emissions into tiny visibility-reducing particles termed "aerosols".

The CAA has identified national ambient air quality standards (NAAQS) to protect public health and welfare. NAAQS have been set for six pollutants: particulate matter less than 10 microns (PM10), carbon monoxide, nitrogen oxide, sulfur dioxide, ozone, and lead. These pollutants are called "criteria pollutants", because the standards satisfy criteria specified in the CAA. NAAQS are identified in Table 1. The three main air pollutants of concern at Lava Beds are ozone, sulfur dioxide, and PM10. Lava Beds has, at various times, monitored all three criteria. Table 2 identifies the human health effects of "criteria pollutants".

Wildland Fire

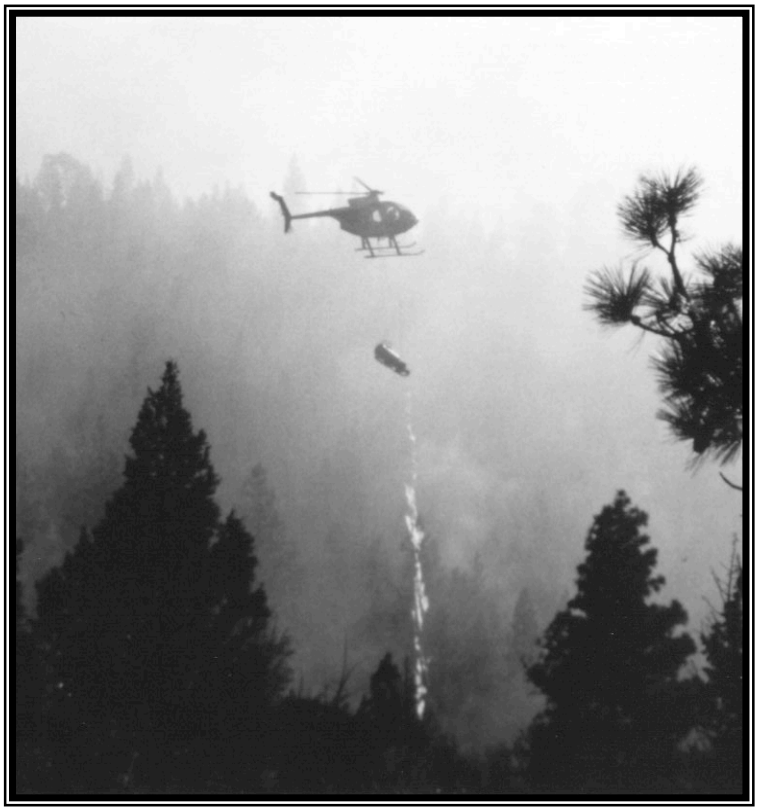
Fire, historically, has been and is recognized as a part of the ecosystem at Lava Beds National Monument. Fire Management activities designed to mitigate the effects of wildfires and promote resource management objectives are important for the protection of life, property, and natural and cultural resources.

Fire is also recognized as a naturally occurring force in the evolution of plant communities within the monument. During pre-settlement times natural (lightning) fires would burn in a mosaic pattern guided only by climatic conditions, natural barriers (lakes and bluffs), and available fuels. Tule

marshes, bunchgrass prairies, sagebrush flats, mountain mahogany/juniper associations, and ponderosa pinelands represent ecosystems that are dependent and/or tolerant of fire.

The most critical fire month is July with 34 percent of all fires since 1934 occurring in this month. Fires have been known to occur in every month of the year, except November, December and January. The critical months for lightning caused fires are May, June, July, August, and September with 14, 10, 39, 21, and 16 percent of the fires occurring in those months, respectively. Forty-one percent of all human-caused fires were started in the month of August. Over the years, 72 percent of all fires within the monument have been lightning caused. However, in the 1960's, 1970's, and 1980's, lightning caused 80, 76 and 83 percent of all fires, respectively, indicating a reduction in human-caused fires.

The observed fire frequency in the monument is low (ranging from 0 to 10 fires/year; averaging 2.5 fires/year from 1934 - 1998) and these are typically Class A and B fires. Fire behavior in the monument can be quite variable. Each summer, weather conditions usually create extreme fire danger. Fires during these periods can spread rapidly and are difficult to control. Much of the year, normally in late fall, winter, and early spring, fire is unable to spread because of cold, moist conditions.



Fires have burned large portions of the monument despite vigorous control efforts. Fires in 1941 and 1949 swept over 25,600 acres (10,667 hectares) and 17,000 acres (7,083 hectares), respectively. Both of these fires occurred in July and were driven by winds of 10 to 22 m.p.h. (16 to 35 kilometers per hour). In the summer of 1983, the Ross Fire which was ignited by lightning at about 1630 hours, had spread to about 1,000 acres by 1900 hours. In 1990, the Ross fire, a lightning-caused holdover, started seven days after the last lightning storm and burned over 3200 acres in three days. Both this fire and the 1990 Fossil Fire (200 acres) exhibited extreme fire behavior well into the early morning hours. Warm, dry winds make it nearly impossible to suppress wildfires of this intensity.

Management-ignited prescribed fires at Lava Beds National Monument will be used as a management tool to reduce hazardous fuel loadings and to perpetuate natural systems. A priority for the monument has been to use prescribed fire to reduce hazardous fuel conditions in and around developed areas and in areas having special natural and cultural values. These areas include lands

along the northeast boundary near the Panhandle, the Indian Well Developed Area, and the Bald Eagle Roost Area. Prescriptions have been developed to reduce hazardous fuel loadings and encourage the natural role of fire within biotic communities.

The use of management-ignited prescribed fire as a tool at Lava Beds National Monument has been an integral part of the fire management program. From 1974-1993, 39 management-ignited prescribed fires were implemented to meet the above objectives. Many of these fires were conducted as part of a fire research program in the 1970's. At that time, prescriptions were fine-tuned to reflect as closely as possible a fire that would occur naturally.

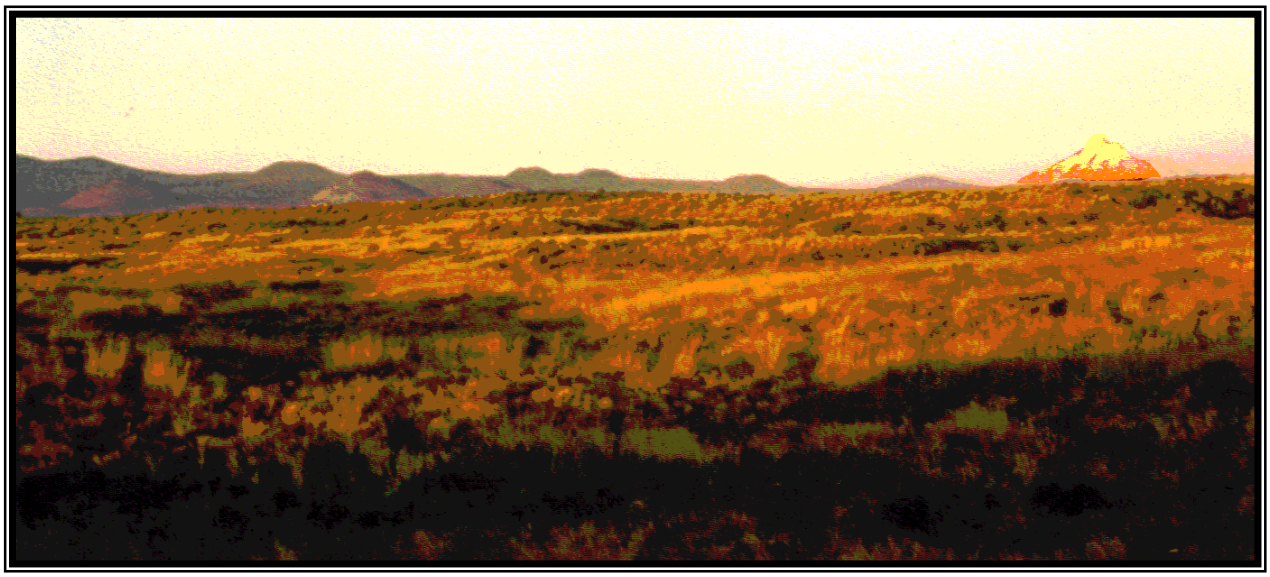
From the 1920's to the late 1970's all fires within Lava Beds National Monument were actively suppressed. In the 1940's, almost two thirds of the monument burned from wildfire. By suppressing these fires, humans interrupted the normal ecological effects of fire upon the monument's plant communities and permitted an increase in fuel loading. Portions of the ponderosa pine, mountain mahogany/juniper, and sagebrush communities are becoming over mature with little young growth. The recruitment of seedling plants is uncommon, resulting in understory shrubs being old and decadent.

Litter and other ground fuels, which were once reduced by periodic wildfires, have accumulated to unnatural levels. These unnaturally heavy fuel loadings now support wildfires that have greater intensities and are more resistant to control. Wildfires that occur during periodic droughts represent a threat to natural and cultural resources, to public and private property, and to human life.

Most of the monument (28,460 acres) is designated Wilderness. Lightning-caused wildland fires will be evaluated on a case by case basis to determine if they should be allowed to burn to return the natural role of fire to these areas to the extent practical. Designated Wilderness requires higher standards of protection than would normally be found in backcountry areas.

Backcountry/Wilderness

Lava Beds National Monument contains 28,460 acres of federally designated Wilderness. A unit of the National Wilderness Preservation System is a site designated by Congress and legally protected as Wilderness in perpetuity. The Wilderness Act defines Wilderness as follows: "…generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable…" The NPS Management Policies states that: The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Management will include the protection of these areas, the preservation of their wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as wilderness. Public purposes of wilderness will include recreation, scenic preservation, scientific study, education, conservation, and historical use.



The scientific value of wilderness areas is derived from their undisturbed natural condition and from the wealth of biological diversity they contain. Only those resource management actions compatible with preservation of wilderness values are permissible. Primitive trails for foot and horse travel are permissible. Improvements for the convenience of users are not permitted. Only those structures necessary for meeting the purpose of maintaining the wilderness resource values are permissible.

All trails within the Lava Beds Wilderness are signed and explain the special restrictions associated with travel within designated Wilderness Areas.

Most of the monument not managed as a Wilderness Area is managed as backcountry except for specific sites where there are developed facilities such as the headquarters area, trails, campgrounds, waysides, or those areas specifically zoned as historic. Backcountry is defined as primitive, undeveloped portions of parks. Developments within backcountry areas are generally limited to trails, unpaved roads, and administrative facilities associated with dispersed recreational use.

III. Natural Resources Issues

This Resources Management Plan documents the natural resources contained within Lava Beds National Monument and the baseline data that is available for each component listed in the NPS-75 guideline. Other significant issues include the lack of baseline resource data and the alteration or destruction of natural systems and processes. These issues are summarized below.

1. Lack of Basic Natural Resources Data and Insufficient Understanding of Park Ecosystems.

The lack of basic natural resources data and lack of understanding of ecosystem processes constitutes a major threat in itself. Assumptions regarding changes in ecosystems are not valid without documented baseline data. Threats and damage to resources may occur without management awareness. Collection of ecological information on a scale comparable to the size and complexity of the monument is a significant issue. The Vital Signs of Ecosystem Health

(Vital Signs) monitoring initiative has identified a suite of critical ecosystem components to monitor which is a small subset of the monument's potential monitoring inventory. The collection and organization of data and full implementation of the GIS will facilitate the monitoring program.

As a result of inadequate staffing, many natural resources management programs are not being implemented. Examples include wildlife management and the re-introduction of extirpated species, restoration of disturbed lands, natural plant community preservation, and the "Vital Signs" (of ecosystem health) I&M program.

Many of the natural resource management project statements listed within this Plan are designed to provide needed baseline data sets for the monument. Adequate baseline information is available for geology, fire history, and gross vegetation communities. Some information is available concerning soils, plants (lists), mammals (lists), lichen and mosses, cave resources, and air quality. New, comprehensive inventories need to be conducted and the data sorted, organized and made available in GIS format that will make it manageable and accessible to resource management staff and other divisions.

The management policy of the NPS reflects legal mandates and directs that management be based on knowledge of and the condition of the resources found within each unit. NPS policy also states that "the National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and monitor those resources…to detect or predict changes". The resulting information will be analyzed "to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments".

The collection of ecological information on a parkwide scale is needed to monitor trends in ecological conditions and to develop plans to guide management operations to maintain the natural resources of the monument in as natural a condition as possible. Park stewardship requires that resource managers observe and document the changes in ecosystem processes to the degree necessary to interpret and analyze the causes of change.

The National Park Service attempts to preserve and manage its natural resources and ecosystems by inventorying and monitoring park resources and processes. The primary purposes of inventories are to:

- Document the occurrence, location and current condition of physical habitat components such as water, air, soils, and major associated plant and wildlife species;
- Identify locally rare or threatened and endangered species, locate fragile or rare habitat and to identify "indicator species" or Vital Signs of ecosystem health; and
- Assess the full range of populations, ecosystem components, processes and stressors from which to sample for later long-term monitoring.

Park inventories include general or specific descriptive data and historical records regarding natural resources. Information collected should include: legal descriptions, climate, land classification, topographic map quadrangle, watershed delineation, geology, soils, hydrology, water and air

quality, flora, fauna, general site characteristics and a listing of other related studies in or near park ecosystems.

Natural resources monitoring is designed to detect changes and quantify trends in resource conditions. Monitoring is designed to provide feedback between natural resource conditions and management objectives and can serve both to trigger management actions and to evaluate their effectiveness. Resource monitoring is conducted to specifically determine compliance with environmental standards or to evaluate impacts of visitor and management activities.

The purpose of a natural resource ecological monitoring system is to provide a rational basis for taking management actions. Actions based on sound scientific data from monitoring will engender a high level of confidence and will better ensure that natural resources and ecosystem functions remain unimpaired for future generations.

The recommended minimal set of natural resource information which should be available in all natural resource parks is contained in NPS-75, Natural Resources Inventory and Monitoring Guideline. NPS-75 is a comprehensive guideline developed to assist parks in the definition and implementation of inventory and monitoring techniques. Information required by NPS-75 and the status of each component at Lava Beds National Monument is discussed in the following sections.

The Pacific West Region has developed an approach to Inventory and Monitoring resources called "Vital Signs". This process has been likened to "taking the pulse of an ecosystem". Vital signs are defined as those key resource components necessary for an understanding of ecosystem and resource functioning, which provide adequate surrogates for the full range of components to develop an assessment of ecosystem health. "Key" processes and "Keystone" species (defined as when a change in these components causes a disproportionately large change to other aspects of the ecosystem) are identified, and monitoring protocol including evaluations of whether the resources are within their normal or acceptable range of variation are determined. The park then is able to focus on this subset of the entire array of monitoring possibilities and will have a manageable suite of ecosystem components to monitor.

Natural resources management at Lava Beds is affected by the lack of baseline data in the following ways:

- Baseline monitoring and research information on a monument-wide level is inadequate or nonexistent and does not permit development of long-range strategic planning activities for natural resource management operations. Key areas in need of baseline data collection are soils, invasive plant species control, cave fauna, rare threatened and endangered species, human impacts on sensitive resources, fire effects history and the successional effects of fire and suppression on vegetation communities.

- The lack of baseline data has limited the ability to evaluate the effects of management actions and broad scale human activities.

- Resource management program design and implementation is hindered by the lack of baseline ecological data upon which to define and detect problems, base hypotheses, and to develop

ecosystem models. Basic questions on species health and distribution, and species-environment relationships cannot be examined within the framework of the current knowledge base.

Professionally organized data collection and management is needed to guide proper long-range strategic resource management at Lava Beds. A fully functional Geographic Information System, the development of a research atlas, and a bibliographic retrieval system are critical to organize databases, detect changes, analyze trends and predict potential future conditions.

2. Disruption of Natural Fire Regimes

Most fire in the monument and the surrounding area have been suppressed over the past 90 years, resulting in alterations of plant communities. Fire and fire suppression significantly alter all ecosystems. Plant communities have evolved with fire, resulting in many plant species that are fire-adapted or fire-dependant. Fire is a major factor in controlling nutrient cycles and energy pathways, and contributes to the diversity, productivity and stability of ecosystems. Vegetation and wildlife communities evolved over millions of years in response to lightning-caused fires.

The role of natural fire has been notably influenced in the past century by logging and effective fire suppression. Regeneration of some vegetation types will not occur until stand alteration is reversed by prescribed burning. Plant succession and plant diversity will increase as the natural fire cycle is re-established. Ecological impacts of prescribed burning will need to be monitored over time to determine the long-range impacts on the various plant communities affected.

Effective fire suppression in the twentieth century has altered most forest and sagebrush communities and natural processes in and around the monument. Suppression of fire delays the rejuvenation of fire-adapted or fire-dependent trees, shrubs, and grasses. Many plants produce prolific sprouts in response to fire.

Many plant species have become adapted to a fire return interval of between seven and fifty years. When natural fires are suppressed, many shrubs and brush plants become over-mature and decadent, fail to reproduce, and crowd out conifer seedlings that would have the opportunity to grow if the brush occasionally burned, as in a natural fire regime. Many areas of the monument contain decadent undergrowth and doghaired, crowded and dying ponderosa pine stands, indicators of an altered fire regime.

Wildlife species is also affected by fire suppression because old stands of decadent brush provide little browse. Following fire, regeneration of forbs and shrubs, and the creation of open spaces provide essential wildlife habitat and food sources.

The exclusion of fire has also resulted in dangerously high fuel accumulation levels and altered fire-related processes in all biotic communities at Lava Beds. Fires that do occur are larger and more intense that they would otherwise have been due to the unnaturally high fuel loads. An aggressive prescribed burn program over the past fifteen years has reduced the loading in many areas of the monument, but the program must continue to simulate, as near as possible, the natural fire return intervals.

The Fire Management Plan for Lava Beds, an Action Plan tiered off of this RMP, is due for revision in 2000. It will remain essentially intact, providing for the use of prescribed fire as well as wildland fire to be managed for resources management purposes. The ecological impacts of the program will continue to be monitored using the NPS fire effects monitoring protocols to determine the success of the program.

3. Exotic Plant Infestations

Vegetation communities provide food, shelter, and sustenance for animals and synthesize environmental factors such as geology, soils, exposure and climate. The alteration of plant communities at Lava Beds and an overall lack of baseline data require the following vegetation-related issues be addressed:

- Inventory of plant communities.
- Control exotic plant species infestations.
- Obtain baseline data for rare, threatened, and endangered species.
- Development of a digitized vegetation map.
- Increase the restoration and re-vegetation program.

Inventory of Plant Communities

Lava Beds National Monument contains diverse vegetation communities, including sagebrush lands, forest communities and bunchgrass communities. The composition of, and relationships between, plant communities is a critical research need at Lava Beds.

Basic biological data on the diversity and distribution of flora is needed. The monument's herbarium is incomplete with many small, herbaceous plants missing from the collection.

Control Exotic Plant Species Infestations

Lava Beds, like many areas in California, continues to be invaded by exotic plant species. Alien plants are often able to out-compete native species, and subsequently have become well established and have completely replaced certain native plant species. An accurate and complete inventory and assessment of the abundance and extent of exotics has not been completed resulting in significant information gaps regarding the magnitude and distribution of infestations. Their impact on vegetation communities and ecosystem processes is also unknown. Planning for

the monitoring and systematic control of exotic plant species will be a component of the Action Plan for Vegetation Management.

Many exotic plants are highly invasive, crowding out native species and altering the natural fire regimes. The alien plant species currently being treated at Lava Beds are:

woolly (common) mullein	(*Verbascum thapsus*)
cheatgrass (not treating)	(*Bromus tectorum*)
yellow sweet clover	(*Melilotus sp*.)
bull thistle	(*Cirsium vulgare*)

Mandates that require direct action to monitor and control the spread of exotics include the 1916 Organic Act, Lava Beds General Management Plan, Government Performance Review Act, and NPS-75.

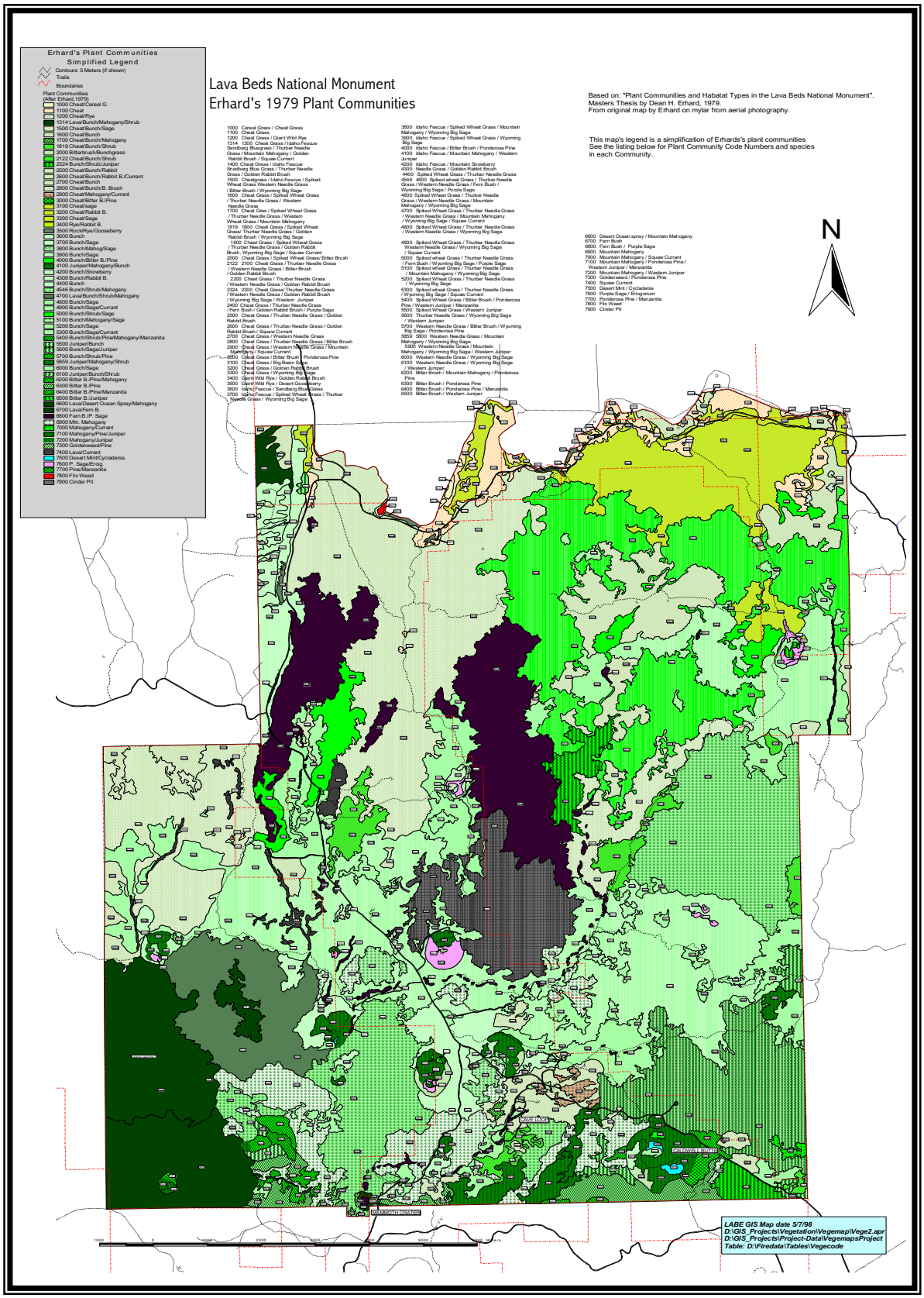
Obtain Baseline for Rare, Threatened, and Endangered Plant Species

NPS Management Policies and the Endangered Species Act mandate protection of special status plants and their habitats on NPS managed lands. The NPS is also responsible for providing information to the Endangered Species office on the status of candidate or proposed candidate plants within their jurisdiction. The establishment of I&M protocol are needed to acquire this information. There has been no comprehensive inventory for Rare, Threatened and Endangered species at Lava Beds, so their presence, abundance and distributions are presently unknown. Impacts to plants or habitat from visitor use, park development, fire suppression, prescribed fire, air pollution, etc. will need to be assessed once the requisite inventories are completed.

Digitized Vegetation Map

An inventory of plant communities is needed to quantitatively describe plant associations and to measure presence, abundance, and distribution of plant species. Lava Beds currently has a vegetation map (Erhard, 1979) that shows gross plant communities. It needs to be ground-truthed and displayed as USFS fuel models as well to facilitate wildland fire applications such as the FARSITE program, a fire spread modeling program.

Vegetation mapping is linked to all other vegetation projects as well as prescribed fire, GIS, wildlife, RT&E plant and animal species projects.


Erhard's Plant Communities
Simplified Legend
Contours: 5 Meters (if shown)
Trails
Boundaries
Plant Communities
(After Erhard,1979)
1000 Cheat/Cereal G.
1100 Cheat
1200 Cheat/Rye
1314 Lava/Bunch/Mahogany/Shrub
1500 Cheat/Bunch/Sage
1600 Cheat/Bunch
1700 Cheat/Bunch/Mahogany
1819 Cheat/Bunch/Shrub
2000 Bitterbrush/Bunchgrass
2122 Cheat/Bunch/Shrub
2324 Bunch/Shrub/Juniper
2500 Cheat/Bunch/Rabbit
2600 Cheat/Bunch/Rabbit B./Currant
2700 Cheat/Bunch
2800 Cheat/Bunch/B. Brush
2900 Cheat/Mahogany/Currant
3000 Cheat/Bitter B./Pine
3100 Cheat/sage
3200 Cheat/Rabbit B.
3300 Cheat/Sage
3400 Rye/Rabbit B.
3500 Rock/Rye/Gooseberry
3600 Bunch
3700 Bunch/Sage
3800 Bunch/Mahog/Sage
3900 Bunch/Sage
4000 Bunch/Bitter B./Pine
4100 Juniper/Mahogany/Bunch
4200 Bunch/Snowberry
4300 Bunch/Rabbit B.
4400 Bunch
4548 Bunch/Shrub/Mahogany
4700 Lava/Bunch/Shrub/Mahogany
4800 Bunch/Sage
4900 Bunch/Sage/Currant
5000 Bunch/Shrub/Sage
5100 Bunch/Mahogany/Sage
5200 Bunch/Sage
5300 Bunch/Sage/Currant
5400 Bunch/Shrub/Pine/Mahogany/Manzanita
5500 Juniper/Bunch
5600 Bunch/Sage/Juniper
5700 Bunch/Shrub/Pine
5859 Juniper/Mahogany/Shrub
6000 Bunch/Sage
6100 Juniper/Bunch/Shrub
6200 Bitter B./Pine/Mahogany
6300 Bitter B./Pine
6400 Bitter B./Pine/Manzanita
6500 Bitter B./Juniper
6600 Lava/Desert Ocean Spray/Mahogany
6700 Lava/Fern B.
6800 Fern B./P. Sage
6900 Mtn. Mahogany
7000 Mahogany/Currant
7100 Mahogany/Pine/Juniper
7200 Mahogany/Juniper
7300 Goldenweed/Pine
7400 Lava/Currant
7500 Desert Mint/Cyclademia
7600 P. Sage/Eriog.
7700 Pine/Manzanita
7800 Flix Weed
7900 Cinder Pit
Lava Beds National Monument
Erhard's 1979 Plant Communities
1000 Cereal Grass / Cheat Grass
1100 Cheat Grass
1200 Cheat Grass / Giant Wild Rye
1314 1300 Cheat Grass / Idaho Fescue
Sandberg Bluegrass / Thurber Needle
Grass / Mountain Mahogany / Golden
Rabbit Brush / Squaw Current
1400 Cheat Grass / Idaho Fescue
Shadberg Blue Grass / Thurber Needle
Grass / Golden Rabbit Brush
1500 Cheatgrass / Idaho Fescue / Spiked
Wheat Grass Western Needle Grass
/ Bitter Brush / Wyoming Big Sage
1600 Cheat Grass / Spiked Wheat Grass
/ Thurber Needle Grass / Western
Needle Grass
1700 Cheat Grass / Spiked Wheat Grass
/ Thurber Needle Grass / Western
Wheat Grass / Mountain Mahogany
1819 1800 Cheat Grass / Spiked Wheat
Grass/ Thurber Needle Grass / Golden
Rabbit Brush / Wyoming Big Sage
1900 Cheat Grass / Spiked Wheat Grass
/ Thurber Needle Grass / Golden Rabbit
Brush, Wyoming Big Sage / Squaw Current
2000 Cheat Grass / Spiked Wheat Grass/ Bitter Brush
2122 2100 Cheat Grass / Thurber Needle Grass
/ Western Needle Grass / Bitter Brush
2300 Golden Rabbit Brush
2324 2300 Cheat Grass / Thurber Needle Grass
/ Western Needle Grass / Golden Rabbit Brush
2324 2300 Cheat Grass/ Thurber Needle Grass
/ Western Needle Grass / Golden Rabbit Brush
/ Wyoming Big Sage / Western Juniper
2400 Cheat Grass / Thurber Needle Grass
/ Fern Bush / Golden Rabbit Brush / Purple Sage
2500 Cheat Grass / Thurber Needle Grass / Golden
Rabbit Brush
2600 Cheat Grass / Thurber Needle Grass / Golden
Rabbit Brush / Squaw Current
2700 Cheat Grass / Western Needle Grass
2800 Cheat Grass / Thurber Needle Grass / Bitter Brush
2900 Cheat Grass / Western Needle Grass / Mountain
Mahogany / Squaw Current
3000 Cheat Grass / Bitter Brush / Ponderosa Pine
3100 Cheat Grass / Big Basin Sage
3200 Cheat Grass / Golden Rabbit Brush
3300 Cheat Grass / Wyoming Big Sage
3400 Giant Wild Rye / Golden Rabbit Brush
3500 Giant Wild Rye / Desert Gooseberry
3600 Idaho Fescue / Sandberg Blue Grass
3700 Idaho Fescue / Spiked Wheat Grass / Thurber
Needle Grass / Wyoming Big Sage
3800 Idaho Fescue / Spiked Wheat Grass / Mountain
Mahogany / Wyoming Big Sage
3900 Idaho Fescue / Spiked Wheat Grass / Wyoming
Big Sage
4000 Idaho Fescue / Bitter Brush / Ponderosa Pine
4100 Idaho Fescue / Mountain Mahogany / Western
Juniper
4200 Idaho Fescue / Mountain Snowberry
4300 Needle Grass / Golden Rabbit Brush
4400 Spiked Wheat Grass / Thurber Needle Grass
4548 4500 Spiked wheat Grass / Thurber Needle
Grass / Western Needle Grass / Fern Bush /
Wyoming Big Sage / Purple Sage
4600 Spiked Wheat Grass / Thurber Needle
Grass / Western Needle Grass / Mountain
Mahogany / Wyoming Big Sage
4700 Spiked Wheat Grass / Thurber Needle Grass
/ Western Needle Grass / Mountain Mahogany
/ Wyoming Big Sage / Squaw Current
4800 Spiked Wheat Grass / Thurber Needle Grass
/ Western Needle Grass / Wyoming Big Sage
4900 Spiked Wheat Grass / Thurber Needle Grass
Western Needle Grass / Wyoming Big Sage
/ Squaw Current
5000 Spiked wheat Grass / Thurber Needle Grass
/ Fern Bush / Wyoming Big Sage / Purple Sage
5100 Spiked wheat Grass / Thurber Needle Grass
/ Mountain Mahogany / Wyoming Big Sage
5200 Spiked Wheat Grass / Thurber Needle Grass
/ Wyoming Big Sage
5300 Spiked wheat Grass / Thurber Needle Grass
/ Wyoming Big Sage / Squaw Current
5400 Spiked Wheat Grass / Bitter Brush / Ponderosa
Pine / Western Juniper / Manzanita
5500 Spiked Wheat Grass / Western Juniper
5600 Thurber Needle Grass / Wyoming Big Sage
/ Western Juniper
5700 Western Needle Grass / Bitter Brush / Wyoming
Big Sage / Ponderosa Pine
5859 5800 Western Needle Grass / Mountain
Mahogany / Wyoming Big Sage
5900 Western Needle Grass / Mountain
Mahogany / Wyoming Big Sage / Western Juniper
6000 Western Needle Grass / Wyoming Big Sage
6100 Western Needle Grass / Wyoming Big Sage
/ Western Juniper
6200 Bitter Brush / Mountain Mahogany / Ponderosa
Pine
6300 Bitter Brush / Ponderosa Pine
6400 Bitter Brush / Ponderosa Pine / Manzanita
6500 Bitter Brush / Western Juniper
Based on: "Plant Communities and Habatat Types in the Lava Beds National Monument".
Masters Thesis by Dean H. Erhard, 1979.
From original map by Erhard on mylar from aerial photography.
This map's legend is a simplification of Erhards's plant communities
See the listing below for Plant Community Code Numbers and species
in each Community.
6900 Desert Ocean spray / Mountain Mahogany
6700 Fern Bush
6800 Fern Bush / Purple Sage
6900 Mountain Mahogany
7000 Mountain Mahogany / Squaw Currant
7100 Mountain Mahogany / Ponderosa Pine /
Western Juniper / Manzanita
7200 Mountain Mahogany / Western Juniper
7300 Goldenweed / Ponderosa Pine
7400 Squaw Current
7500 Desert Mint / Cyclademia
7600 Purple Sage / Eriogonum
7700 Ponderosa Pine / Manzanita
7800 Flix Weed
7900 Cinder Pit
N
CAVE LOOP
WILDCAT CRATER
MAMMOTH CRATER
LABE GIS Map date 5/7/98
D:\GIS_Projects\Vegetation\Vegemap\Vege2.apr
D:\GIS_Projects\Project-Data\VegemapsProject
Table: D:\Firedata\Tables\Vegecode

4. TES and Extirpated Plants and Animals

Little is known about the abundance, population densities, distribution and ecology of the wildlife species found within Lava Beds National Monument. Data is available for a few charismatic species of interest. Human-induced habitat alterations have resulted in changes in species composition, population densities, degradation of resources, and impacts to rare, threatened, and endangered species and other special status species. These changes occurred as a result of encroachment and development by humans, hunting, trapping, logging, fire suppression and watershed manipulation on adjacent lands.

Projects designed to supplement and develop baseline data for wildlife species within the monument, in conjunction with long-term Vital Signs monitoring, will provide resource managers with the information needed to develop effective wildlife management programs. Baseline population data will enable managers to respond to changes and justify intervention in disruptive management practices both within and outside park boundaries.

Wildlife management issues that need to be addressed are:

- The need for a comprehensive wildlife inventory.
- The need for additional information on Rare, Threatened, Endangered and other Special Status species.

5. Anthropogenic Effects on Cave Resources

Lava Beds National Monument receives an average of approximately 110,000 visitors per year. Surveys and trail counters have shown that at least 43% of those visitors enter one or more caves. Cave visitation is concentrated in 25 developed caves; the 10 most popular caves receive 75% of the documented use. Many of these caves are showing signs of heavy use (graffiti, campfire rings, litter, vandalism of cave formations, etc.) which, over time, transforms pristine cave resources into trampled, resource-poor shadows of their former condition.

Park Management is considering physically closing certain caves (using gates) and providing interpreter-guided tours in an effort to reduce resource impacts related to uncontrolled access to caves.

Sensitive bat species use some of these same caves to give birth and raise their young. Management must determine where the bat colonies are each year and decide when and where to close the caves to public use to protect the colonies.

Developments located directly over, or proximal to caves need to be removed as they have been shown to negatively impact the sensitive underground resources by altering groundwater infiltration, concentrate pollutants and slowly degrade the cave environments. Additionally, no new developments will be constructed over known underground resources.

IV. Cultural Resources Baseline Information

Lava Beds National Monument has a diverse and valued suite of cultural resources including archeological sites, numerous rock art sites, ethnographic sites, historic structures, cultural landscapes, an extensive museum collection and an extensive array of fortifications from the Modoc War.

A number of cultural resources projects have been conducted at Lava Beds. These include archeological surveys and excavations, ethnographic overview, archeologica research design (FY00), museum collection plan (outdated), Scope of Collection Statement, and various cultural cyclic maintenance projects.

Prehistoric archeological sites have been recorded throughout the monument in a variety of settings, but centered predominantly along the historic lakeshore. These sites represent approximately 10,000 years of human occupation within the monument. They include habitation sites, house pits (found in habitation sites), spiritual "vision quest" sites, resource procurement sites, sites with rock imagery, and burial/crematorium sites.

Zones

Archeological surveys conducted at Lava Beds have contributed to the delineation of three environmental zones of sensitivity for prehistoric archeological sites. They are described as follows:

Lakeshore Zone: The northern boundary area near the former south shore of Tule Lake is the most archeologically sensitive area within the monument. Ethnographic descriptions for the Modoc locate a major village named *Gu'mbat*, within the monument boundaries. Permanently established principal villages were occupied during the cold winter months and abandoned during the warm season for subsistence hunting and gathering. The Lakeshore Zone archeological manifestations observed during recent surveys demonstrate a relatively continuous scatter of flaked lithic material (mostly obsidian), occasional bedrock mortars, vision quest sites, areas of concentrated stone artifacts associated with a number of cultural features defined as archeological "sites".

Ice Cave Zone: The second most sensitive environmental zone within the monument is the "Ice Cave Zone" defined spatially by a 1.5 mile radius around each ice cave. Apart from Tule Lake, ice caves provide the only source of fresh water to the aboriginal inhabitants of the Lava Beds. Prehistoric sites have been identified near all permanent ice caves, and pictographs have been recorded in association with ice cave multi-use sites.

Intermediate Zone: The third and least archeologically sensitive area of the monument is described as the "intermediate zone" by Eidsness and Smith (1990). It includes all areas outside of the Lakeshore and Ice Cave zones where archeological sensitivity is lowest. This area has had very little survey work done except for management clearances for roads, trails prescribed fires, etc. Results of recent surveys suggest great variation in the distribution of archeological materials within this zone that may be related to such factors

as preferred routes of travel and the heterogeneity of biotic resources across the landscape.

Staffing

The Chief of Resources Management is responsible for overseeing the cultural resources management program at Lava Beds National Monument. Until the proposed staffing plan is implemented (see staffing plan, Addendum #___), archeological resources support is provided by the staff of Redwood National and State Park. Additional assistance is provided by cultural resource specialists from the Pacific Great Basin Support Office and the Columbia Cascades Support Office.

Archeological Resources

Large-scale archeological surveys and excavations by Squier and Grosscup (1952), Swartz (1961), Eidsness and Smith (1992), Eidsness (1988, 1997, 1998) Fitzgerald (1991), Griffen (1996a, 1996b), and Smith (1988) detailed that Lava Beds National Monument has such a concentration of sites spread throughout the park, that the entire monument was officially designated the Modoc Lava Beds Archeological District. Another significant factor in the District's designation is the exceptional integrity of the archeological resources found at Lava Beds as compared to those found on adjoining USFS and USFWS lands.

There is no easily accessible water within the monument, so sites are concentrated along the ancient lakeshore where Native Americans lived in small, permanent villages. Every few years they would move the villages to other sites. After 10,000 years of habitation, the entire lakeshore is essentially one continuous archeological site.

Southward, into the monument, the Modoc traveled on hunting and foraging expeditions. They went on vision quests and participated in other spiritual activities. They recorded their prayers by stacking rocks into cairns, still visible today throughout the monument. The Modoc sat in the shade of large trees, chipping projectile points and other tools. Today, scatters of flakes can be found under nearly every old juniper.

The power of spiritual sites attracts many visitors today. Native Americans still come on quests, add rocks to ancient cairns, record their prayers alongside those of their ancestors, and leave offerings. Likewise, many non-Native visitors of varying cultures visit sites such as Captain Jacks Stronghold, Fern Cave, and Symbol Bridge, seeking similar connections and experiences.

Baseline information on petroglyphs within the monument includes recorded rock art research and documentation at Petroglyph Point. Documentation was done in 1988 by Georgia Lee, William D. Hyder, and Arlene Benson. Sixty-nine panels of rock art were recorded to scale and are accessioned within the monument's collections.

Baseline information on pictographs found within the monument was completed in 1998 by New South Associates, Inc., which included rock art within 8 widely scattered caves. Research and documentation was completed and the final documentation will be added to the park collection once received.

There are approximately 500 sites identified with corresponding site records. Only 15% of the monument has been surveyed and it is estimated that hundreds, if not thousands, of additional sites remain unrecorded within the monument.

Petroglyph Point, separated from the contiguous boundary of the main park, is 208 acres in size and is on the National Register of Historic Places. This site is known today to be a maar volcano, a cinder cone that was formed under the ancient lake. Centuries of the undercutting action of waves allowed huge sheets of rock to fall, forming sheer cliffs. Wave action eroded them away; the volcano now appears to have had a huge slice cut from it. The inner construction of the volcano is seen in both longitudinally and in cross section. The honeycomb-like texture of the cliff faces, formed by erosion of softer pockets of rock, provides cavities for nesting and roosting sites for hundreds of birds such as raptors and swallows. Wave cuts at different elevations reveal great fluctuations in ancient Lake Modoc. In recent history the lake was much lower and became known as Tule Lake. The dry lakebed adjacent to the cliff face now provides parking and access to the base of the cliff where more than 5000 petroglyphs are etched into its wave cut sections. This largest concentration of rock art in California represents non-renewable, irreplaceable cultural resources.

The management of cultural resources relating to historic period at Lava Beds need to be studied. Early exploration and settlement (ca. 1820-1872), the Modoc War (1872-1873), and Monument Administration (1925 - present) are categories of cultural resources which have not been adequately evaluated for significance under the National Register of Historic Places criteria.

Evidence of vandalism and surface collecting is widespread. A recent ARPA case at Petroglyph Point has resulted in an increased awareness of the archeological significance of the area and the publicity has further compromised the security of the monument's archeological resources. New interpretive media has been added to present an updated resource protection message.

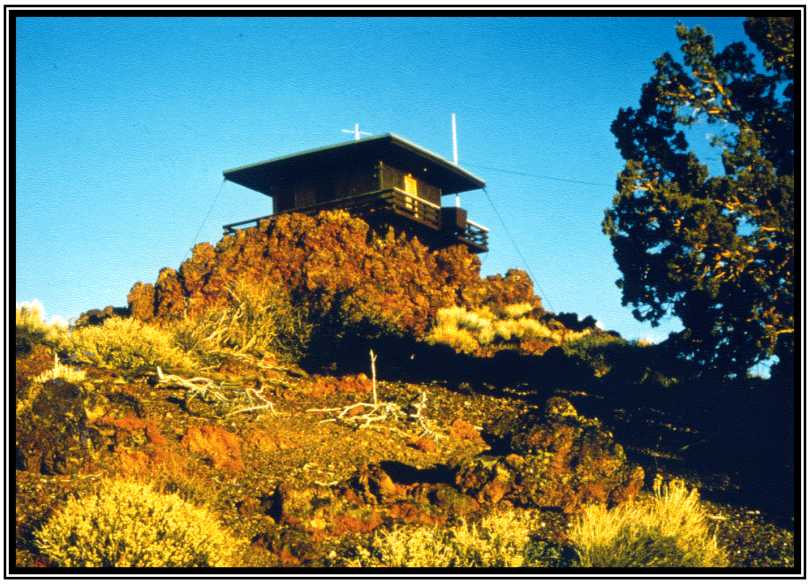
Historic Structures

A number of structures within Lava Beds National Monument are historic and are included on the List of Classified Structures (LCS). The prehistoric structures consist of numerous pithouse foundations located along the ancient shoreline of Tule Lake.

The LCS contains the following structures:

- "Gillems Camp" which served as the base of the Army's second attack on the Modoc stronghold;
- "Hospital Rock Army Camp" which served twice as an encampment for U.S. troops attacking Captain Jacks Stronghold in the Modoc War of 1873;
- "Captain Jacks Stronghold"; where Modocs took advantage of the land's topography and held off a U.S. Army force 20 times their size for 5 months;
- "Superintendent's Residence", built by the CCC using local materials such as lava stone to blend with the setting;
- "Garage/Shop", a rustic style structure built by CCC using local lava rock to blend in with natural setting;
- "Service Station", Built by CCC, the best and least altered example of a rustic automobile service station in the Western Region;
- "Indian Well Pumphouse", built by CCC, displays great craftsmanship in selection and placement of stone;
- "Schonchin Butte Fire Lookout", one of 3 surviving rustic fire lookouts in the Western Region, built by CCC displaying little alteration since it was constructed;
- "18 Rustic Picnic Tables", built by CCC using local stone and Oregon logs;
- "Gillems Camp Rock Circle" is a structure of unknown use at Gillems Camp. It may have served as a howitzer ring or corral;
- "Canbys Cross Monument" marks the site of the murder of Brig. General Canby, the only general killed in the United States Indian Wars;
- "Thomas-Wright Battle Site" is the site where the Modoc soundly defeated the U.S. Army in a surprise attack during the 1873 Modoc War;
- "Devils Homestead CCC Memorial" commemorates the contributions of the CCC to the early development of Lava Beds National Monument.

Objects



Lava Beds National Monument has an extensive museum with an inventory of 8061 cataloged objects. Historic objects from the Modoc War era, prehistoric objects from Native American occupation, items from the Japanese Internment camp at Newell, CA, and specimens of the area's plants and animals are available as reference.

Currently, there is no full time or temporary curatorial staff at Lava Beds. The Lead Interpreter acts as collateral duty curator. Recent evaluations of the collection by visiting curators have illuminated the need for extensive work organizing the history and provenience of park collection and library.

There are a total of 8061 cataloged objects in the museum collections in the following classifications:

Archaeology…….5390
- Stone.....……....4991
- Clay.....……..…17
- Metal.....…….….2
- Glass.....……..37
- Vegetal.....……....10
- Animal.....…….……316

Human.....…….…….17
Ethnology.....…….....43
History....……..1271
- Structures.....……...31
- Building furnishing..…….29
- Personal artifacts...……26
- Tools & Equipment...……..522
- Communication artifacts……..……...440
- Transportation artifacts……..……...13
- Art objects.....……....13
- Recreational artifacts……..7
- Societal artifacts....…….4
- Packages/containers..…….167
- Unclassified artifacts……19

Biology.....……1286
- Animalia.....……..258
- Plantae.....……..1084

Paleontology..……....6
Geology.....…….25

All objects have been cataloged and are on the ANCS system. The collections are housed in a Bally building that is adequate for the current collection size. The monument plans to add substantially to the collection in future years, especially the Biological Collection, at which time additional space will be required.

In 1988, all human remains were re-interred in traditional ceremonies conducted by the tribe. No funerary objects have been identified as currently existing within the collections; however, two medicine men have blessed the collections and the Visitor Center exhibits in case there may be something that was not properly identified by the original archeologist.

Cultural Landscapes Context/Theme Resources

Lava Beds National Monument has identified a number of cultural themes. They include the following:

I. Cultural Developments: Indigenous American Populations

A. The Earliest Inhabitants

1. The Early Peopling of North America
7. Western Archaic Adaptations (California Area)
9. Archaic Adaptations of the Great Basin
22. Human Osteological Evidence of Early Inhabitants

B. Post-Archaic and Pre-Contact Developments

6. Great Basin Hunters and Gatherers
18. Post-Archaic Adaptations in Montane Regions
19. Post-Archaic Adaptations in Arid Lands
22. Physical Anthropology of the American Indian

C. Prehistoric Archeology: Topical Facets

1. Prehistoric Archaeology/Shelter/Housing
2. Prehistoric Technology
5. Prehistoric Arts/Handicrafts
12. Prehistoric Settlements & Settlement Patterns
15. Prehistoric Transportation and Travel
24. Prehistoric Human Physical Remains

D. Ethnohistory of Indigenous American Populations

1. Native Cultural Adaptations at Contact

g. Native Adaptations to Great Basin Environments

2. Establishing Intercultural Relations

d. Guiding Explorers Across New Territories
e. Defending Native Homelands
f. Defending Native Religious Systems

3. Varieties of Early Conflict, Conquest, or Accommodation

b. Forced and Voluntary Population Movements

2. The Changing Cultural Geography of the Great Basin

4. Military Removal and Concentration

d. Changing Settlement Types

6. Reservations

X. Westward Expansion of the British Colonies and the United States, 1763-1898

B. The Fur Trade

6. Hudson's Bay Company and the Northwest Coast Fur Trade

C. Military-Aboriginal American Contact and Conflict

6. The Pacific Coast

D. Western Trails and Travelers

3. Oregon Trail and Settlement of Oregon
4. California Trails and Settlement of California

F. The Farmers' Frontier

3. Later Settlements and Farming in the California Valley, Oregon, and Washington

XXXII C. The Conservation Movement

10. CCC and Conservation

National Register Sites

Lava Beds National Monument has six sites listed on the National Register of Historic Places. These sites are Captain Jacks Stronghold, Hospital Rock, Thomas-Wright Battlefield, Fern Cave, Petroglyph Point, and the entire monument combined with some of the U.S.Fish & Wildlife lands identified as the "Modoc Lava Beds Archeological District."

Ethnographic Resources

Ethnographic literature and consultations with local Native Americans, primarily the Modoc Indians and Klamath Tribe, suggest that numerous ethnographic sites exist within Lava Beds National Monument. Numerous spiritual ties to the land are also claimed, especially to Fern Cave. An ethnographic overview is currently being conducted in conjunction with Crater Lake National Park and should be complete in early 2000.

Cultural Landscapes

Cultural landscapes provide the physical environment associated with historical events and reveal aspects of our country's origins and development through their form, features and use. They also illustrate the relationships among cultural and natural resources.

Lava Beds does not have a basic Cultural Landscape Plan. Through a recent Servicewide initiative, a Level 0 Cultural Landscape Inventory (CLI) was completed in 1998. The CLI stated that "Lava Beds National Monument contains five cultural landscapes that are listed, eligible, or potentially eligible for the National Register of Historic Places (NRHP)." The three highest priority landscapes are as follows:

Landscape Name:	Modoc Lava Beds Archaeological District
Landscape Types:	Historic Site/Historic Vernacular Landscape/Historic Designed Landscape/Ethnographic Landscape
Historic Contexts:	Peopling Places Shaping the Political Landscape Transforming the Environment
Periods of Significance:	5000 B.C.-A.D.; 1872-1873;1930-1940
Areas of Significance:	Archaeology, Military, Recreation

Importance:

The Modoc Lava Beds Archaeological District is a cultural landscape that is significant in Modoc prehistory and American military history. It also is an ethnographic landscape that is important in the traditional lives of the contemporary Modoc people, who still use it. This landscape contains over 200 archaeological sites located throughout an area characterized by ancient lava flows, rugged, rocky terrain with sparse vegetation, and Tule Lake to the north. These features were instrumental, for example, in protecting the Modoc stronghold during the war with the United States Army in 1872-1873.

Among the contributing cultural features on the landscape are prehistoric village and food processing sites, burial and ceremonial sites, and an important trade network location. During the Modoc War, volcanic rocks on the landscape were used to build fortifications by both the Modoc and the U. S. Army. Among the important features that date from this event are Gillems Camp, Hospital Rock, Canbys Cross, and Captain Jack's Stronghold.

Natural and cultural features of the landscape remain essentially intact from the periods of significance. With the exception of reclamation of the southernmost portion of Tule Lake that forms the northern boundary of the landscape, the area has not been substantially altered by development.

Landscape Name:	Thomas-Wright Battle Site
Landscape Types:	Historic Site
Historic Contexts:	Peopling Places Shaping the Political Landscape
Periods of Significance:	1872-1873
Areas of Significance:	Archaeology, Military

Importance:

The Thomas-Wright Battle Site is historically significant as the site of the Modoc defeat of the U.S. Army during the Modoc War of 1872-73. The cultural landscape includes the portion of land on which the battle was fought and the surrounding natural features that helped the Modocs defeat the soldiers. The natural features that played an important part in the battle were Black Crater, Hardin Butte (formerly Sand Butte), and the rugged, rocky terrain of the Schonchin and Ross lava flows that spread out around the butte. The natural and cultural features of the landscape remain essentially unaltered since the historic event, giving the landscape a high degree of historic integrity.

Landscape Name: CCC Development
Landscape Types: Historic Designed Landscape
Historic Contexts: Transforming the Environment
Periods of Significance: 1930-1940
Areas of Significance: Conservation, Recreation

Importance:

The Civilian Conservation Corps (CCC) was responsible for much of the initial facilities at LABE in the 1930s. Many of these buildings, structures, and landscaping are concentrated at the Indian Well Headquarters area. All of them were constructed in the park's prevailing Rustic style, using local materials. Exemplary craftsmanship is displayed in the stone pump house and service station, for example, and in the novel use of large split logs set over volcanic boulders for picnic tables. Together, the CCC components may comprise a historic district within the monument.

V. RESOURCES MANAGEMENT PROGRAM

A. Overview of Natural Resources Current Program and Future Needs

The management of the park is guided by laws, policies, and various planning documents. The monument came under the administration of the National Park Service in 1933. A General Management Plan (GMP) was written and approved in 1996 which provides the short and long-term planning necessary to guide the development, interpretation, and protection of the natural and cultural resources. Tiering off of the GMP is the monument's Strategic Plan, approved in 1997, which further identifies and focuses the monument's mission, purpose, and long-term strategic goals. It is based on the Pacific West Region's Resource Stewardship Strategic Plan which details specific mission and long-term goals for the Region related to resources stewardship.

Lava Beds National Monument has a complex and diverse Resource Management Program with the goals of gaining knowledge of, restoring, maintaining and protecting the nationally significant resources the monument was established to protect. The primary limiting factors to the program are insufficient funding and a woefully inadequate number of staff to manage a comprehensive

program. Current staffing levels enable the monument to implement only a small fraction of the programs necessary to professionally manage the resources. The programs that are being minimally implemented include prescribed burning, cave inventory, bat monitoring, exotic vegetation control, GIS/GPS, and preparing correspondence, reply- dues, and planning and compliance documents.

Measures outlined within the Resources Management Plan (RMP) are aimed at perpetuating natural ecosystems, natural forces, and native species; preserving our cultural heritage of activities, events, and peoples; and, collecting accurate and comprehensive resources baseline data for effective management decisions **(LABE-I-002)**. The RMP is designed to guide the protection of all monument resources from degradation both from internal and external impacts--i.e. non-native species; pollutants to air and water; noise; viewshed disruption; and inappropriate visitor uses. These programs, where necessary, will also include actions for the protection of the public's life and property--i.e. wildfire suppression, vector control, and safety.

Base ONPS funding includes salary and benefits for the Resources Management Division Chief, one permanent Biological Technician, one term Biological Technician and a .5 FTE seasonal position. This staff also is responsible for managing the cultural resources program.

An increase in the resource ONPS base funding is critically needed to adequately institute programs to inventory, monitor, preserve or conserve, mitigate, and protect the monument's outstanding natural resources **(LABE-I-001)**.

An important component of an effective resources management program is the support of a strong research program. Lassen Volcanic National Park, Whiskeytown National Recreation Area, and Lava Beds National Monument jointly recognize a need for an organized natural science program. A Science Advisor or research scientist assigned to northern California is needed to provide the scientific expertise, guidance, and interagency coordination for the development of an effective research program **(LABE-I-004)**.

B. Natural Resources Program

The Resources Management Program involves all monument divisions. The Division of Resource Protection and Visitor Services and the Maintenance Division need to be actively involved in natural and cultural resources programs and projects. The following sections provide a more in-depth description of the natural resources programs and the fully funded program as identified by the Natural Resources Management Assessment Program (NR-MAP).

Current activities are focused on gathering baseline data concerning the monument's natural resources. The Vital Signs Monitoring Plan, when in place, will provide the framework necessary to maximize the inventory and monitoring (I&M) program. Staffing levels currently allow for very little progress to be made in this area.

The FY99 natural resources management programs only partially address the issues discussed throughout this Plan. Programs that are currently underway include vegetation management (exotic plant removal, re-vegetation), wildlife management (Rare, T&E species monitoring and

management), wildland fire management (prevention, pre-suppression, prescribed and wildland), integrated pest management, GIS/GPS, and program administration.

The lack of dedicated positions for I&M, GIS/GPS, and research limit the implementation of the majority of natural resource programs included within this Plan. This deficiency has created a situation wherein the public expects the National Park Service to protect resources for future generations, but the necessary management actions are not possible at current funding levels. The monument's goal is to employ a "team" approach to bring to bear all monument divisions in a coordinated effort to implement a comprehensive resources management program.

Division of Resource Protection and Visitor Services

The Division of Resource Protection and Visitor Services plays a critical role in the protection of the monument's resources. This division is tasked with interacting with both the field resources and the visitors on a daily basis. This function is a critical component of the monument's resources protection. A recent shift in emphasis has enabled the division to concentrate its patrol efforts on caves and backcountry areas. The protection function, though hampered by a lack of resource-dedicated staff, conducts protection patrols, site monitoring and roving resource education on a regular basis.

An invigorated "outreach" program is reaching countless numbers of elementary school children and exposing them, many for the first time, to the nationally-significant natural and cultural resources found throughout the monument. The school children are provided insights into ecosystem management and resources stewardship that will lead to understanding and, hopefully, a life-long appreciation of our natural resources and rich cultural heritage.

Division of Maintenance

The Maintenance Division is responsible for front and backcountry grounds, roads, trails, routine maintenance and construction activities which supports the monument. Proper maintenance and restoration of grounds, roads and trails decreases natural resource damage. Maintenance also maintains and constructs backcountry/wilderness signage and repairs ladders, walkways and railings within caves, all of which reduce the resource damage caused by visitors.

C. Natural Resources Strategies

Lava Beds National Monument lacks baseline natural resources inventory data. Programs and strategies for dealing with the natural resource issues mentioned earlier are described below with project statement numbers referenced.

1. Lack of Basic Natural Resources Data and Insufficient Understanding of Park Ecosystem Processes.

As was discussed earlier, Lava Beds lacks both baseline resources inventory data and long-term monitoring capability to adequately understand and manage its natural resources. The monument's long-range strategies to address these issues include:

A. Complete Basic Inventories
B. Enter Natural Resource spatial data into GIS to make it fully accessible for inquiry
C. Complete Vital Signs Monitoring Plan
D. Develop Monitoring protocols identified in Vital Signs Monitoring plan to enable monument to assess long-term health of ecosystem
E. Conduct Vital Signs monitoring
F. Analyze Vital Signs monitoring results and effectiveness of program

- Obtain an increase in park base funding to implement a comprehensive resources management program.
- Inventory monument resources in a systematic method.
- Develop long-term monitoring methodology for natural resources and visitor use and impacts using the Vital Signs Monitoring Plan.
- Develop the Geographic Information System.
- Develop a natural science program in conjunction with Lassen Volcanic National Park and Whiskeytown National Recreation Area.

Lava Beds is in the developmental stage of its GIS program. The ultimate goal of this initiative is to help create, organize, integrate, manage, analyze, evaluate, and display spatial data. When all thematic layers are digitized and integrated into the GIS, managers will have the capacity to more easily solve complex resource management problems. The collection, storage and retrieval of resource data will be standardized and made available to all divisions. The monument will be unable to fully implement this program without a staff GIS specialist **(LABE-I-007)**.

Basic GIS themes include park boundaries, developed areas, designated Wilderness boundaries, utilities, roads and trails, digital elevation models (DEM), fire history, fuel models, slope/aspect, vegetation, geology, geologic features, caves, soils, alien plants, historical and pre-historic sites, climatic zones, RT&E species, and developed zones.

Lava Beds National Monument, Whiskeytown National Recreation Area and Lassen Volcanic National Park have proposed the development of a Natural Science Research Program **(LABE-I-004)** to develop and implement a research program within the 3 units to further the long-range strategic resources management goals.

Administering and managing natural and cultural resources has become more complex due to the volume of information needed in order to understand, protect, and preserve the resources. Servicewide resource programs have increased, compelling Superintendents to improve management and administration. A comprehensive program is needed to address the entire spectrum of natural and cultural resource issues facing Lava Beds National Monument. Conducting the basic administrative/management operations is difficult due to the lack of resource and support staff. **(LABE-C-001, LABE-I-001).**

A substantial base increase for natural resources management will be needed **(LABE-I-007)** to fully implement GIS programs and a comprehensive resources management program. An increase in staff and support costs will allow a wider range of resource management programs and projects

identified within this Plan to be undertaken. Many of the positions identified in this Plan are intended to implement the Vital Signs monitoring initiative, and to integrate the individual protocols into an institutionalized long-term program. Increased base funding will also allow for the purchase of necessary supplies and equipment, vehicles, and for professional training of the resources management staff.

2. Disruption of Natural Fire Regimes

Lava Beds National Monument encompasses lands once inhabited and used by Native Americans. Changes in natural ecosystems and fire regimes within and adjacent to the monument can be attributed to multiple causes. One of the most significant is the suppression policy used to manage wildland fire during the twentieth century. Effective fire prevention and suppression programs have altered the character of the forests and brushlands, resulting in significant increases in fuel loading, combustibility, and the disruption of native plant communities. Strategies to restore the natural role of fire back into the fire dependant ecosystems at Lava Beds include:

A. Revise Fire Management Plan
B. Conduct fire research identified in Fire Management Plan
C. Conduct burns, monitor, analyze monitoring data, and redirect program as needed

- Expand the Prescribed Fire program to restore native plant communities and simulate natural fire return intervals.
- Continue Fire Effects Monitoring program.
- Conduct fire ecology research to determine how best to use fire to maintain natural processes.
- Incorporate all fire-related data sets into the monument's GIS.

A revised Fire Management Plan (FMP) was completed in 1992 to meet the then-current servicewide requirements of NPS-18. The plan provided for an increased application of prescribed fire to reduce hazardous fuel loads and to restore the natural role of fire in the ecosystem. The 1992 plan called for an aggressive prescribed natural fire program to be implemented within the monument. In 1998, the nationwide fire management program was substantially changed to better reflect the current fire management philosophy. Under the new policy, non-human-caused ignitions will be evaluated to determine if they should be allowed to achieve resources management objectives; the term "prescribed natural fire" is no longer used. All human-caused ignitions will be suppressed using confine, contain, and control strategies.

Given the major policy changes and the Servicewide Strategic Planning Initiative, the FMP is in need of a major rewrite. It is scheduled to be rewritten within one year of the approval of this Plan and will function as an Action Plan tied to the RMP.

Monitoring is critical in determining the success of any management program. Monitoring prescribed fires gives managers insights into fire's effects on the landscape and its role in maintaining ecosystem processes. Protocols from the Western Region Fire Effects Monitoring Handbook (1992) have been implemented at Lava Beds. Monitoring plots have been established for

most vegetation types. The plots are read pre- and post-burn, and occasionally they are used to monitor fire behavior during prescribed fires and to measure intensities post-fire.

All fire-related data sets will be incorporated into the monument's GIS. GIS thematic layers will include current and previous prescribed fires, fire history, vegetation, RT&E species and prescribed fire planning.

Fire plays a significant role in determining the type, distribution, and abundance of vegetation at Lava Beds National Monument. Prior to the initiation of a total fire exclusion policy in the 1920's, human- and lightning-caused fires frequently burned throughout the monument (Johnson and Smathers, 1976). For 75 years the suppression of all fires, the grazing of domestic livestock, and a major infestation of the western pine beetle have drastically altered the distribution and abundance of many plant species. These past events have caused many portions of the monument to have unnaturally heavy fuel accumulations, expanded populations of non-native plant species, and a significant reduction of ponderosa pine forest.

Because fire has historically played a major part in ecosystem processes it is important that natural fire be returned to as much of the monument as possible. Wilderness policy also advocates a return of natural fire to established wilderness areas within the monument. Planning efforts have been initiated to build on previous successes related to the return of an enhanced prescribed fire and "wildland fire for resource benefits" program.

Lava Beds National Monument, in compliance with laws, servicewide policies, and guidelines, establishes the following goals involving the management of fire:

1. Protect human life and property both within and adjacent to the monument.

2. Reduce fuel loadings, which have accumulated as a result of past fire exclusion, for the purpose of minimizing the chances of a catastrophic wildfire.

3. Recognize the major role fire plays as a natural force within the monument's ecosystems and encourage this process through the use of management-ignited prescribed fire (MIPF), and to access each wildland fire to determine if it should be either permitted to achieve resource goals or immediately suppressed.

4. Mitigate unacceptable environmental impacts on biotic communities and historical and cultural resources due to fire suppression efforts.

5. Provide for the safe, aggressive, and efficient suppression of all fires that do not meet resources management objectives by defining suppression responsibilities, organization levels, and decision-making processes.

6. Maintain the historic scenes as identified in the Statement for Management and General Management Plan, and Cultural Landscape Inventories (when completed).

7. Promote an interagency approach to managing fires and minimizing costs of suppressing wildfire.

8. Promote public understanding of fire management programs and objectives.

The monument's Statement for Management, supporting the policy of the agency, states:

1. "One of the monument's goals is to reduce hazardous fuels..."

2. "...and to restore the natural role of fire by prescribed burning."

Prior to this time, the only fire record consisted of verbal accounts and charred vegetation. The role of Native Americans as an ignition source for wildfires is not clear. There is virtually no information available that addresses this issue for the Lava Beds area. Although fire history prior to fire suppression is not well known, enough is known to provide a basis for future planning.

The use of management-ignited prescribed fire as a tool at Lava Beds National Monument has been an integral part of the fire management program. From 1974-1998, 55 management-ignited prescribed fires were implemented to meet the above objectives. Many of these fires were conducted as part of a fire research program in the 1970s. At that time, prescriptions were fine-tuned to reflect as closely as possible a fire that would occur naturally.

A good history of fire events has been recorded in the fire-scarred boles of old ponderosa pine (*Pinus ponderosa*). This record, dating as far back as 1644, indicates that the ponderosa pine forests in the south end of the monument had an average fire return interval of 5.4 to 21.4 years. The shortest average fire return interval of 5.4 years occurred just south of Crescent Butte. A site south of Eagle Nest Butte had the longest fire return interval, 21.4 years.

Through examination of 87 ponderosa pine windfalls and snags, it has been determined that more than 50% of the time, fire returned to burned stands within 8 years. In nearly 100% of the time, fire returned to burned stands within 50 years.

Ponderosa pine slabs taken from the north side of Bearpaw, Crescent, and Hippo Buttes show that fires occurred with an average return interval of 9.7, 7.7, and 15.8 years, respectively. These sites are contiguous with shrub-grass plant communities of the lower monument, which suggests that at least portions of the lower monument had similar fire return intervals.

During the fire season the minimum fire personnel and equipment necessary to meet program goals include a Fire Management Officer, Fire Clerk, 1 subject-to-furlough fire engine operator, a prescribed fire specialist, 3 seasonal firefighters, 2 fire lookouts, 3 engines and 1 water tender.

The monument has identified the following fire related projects:

1. Lava Beds National Monument has a complex fire management program that includes wildfire pre-suppression and suppression activities, management-ignited prescribed fire, and a fire effects monitoring program. The monument is currently

working towards setting specific resources goals to determine when a wildland fire can be permitted to attain certain natural and cultural resource objectives. The monument also has an interagency agreement for the staffing of a U.S. Forest Service engine crew at Lava Beds. These positions are currently being funded by Washington; however, if this funding source is ever eliminated or reduced, the Resources Management Plan recognizes the need for this support **(LABE-N-200, 201,202,203,204,205,206,207)**.

2. The suppression of wildfire requires the use of people and equipment in various combinations. The Fire Management Plan provides a step-up plan, which recommends the application of the minimum tool necessary to minimize the impacts to resources and yet successfully control the wildfire. The use of water is preferred over retardants; however, conditions may exist with extended years of drought that may require the application of retardants from air tankers. The actual effects of retardants upon cave resources (i.e., flora, fauna, and formations) are not clearly known. It is important that the monument identify, through research, what possible impacts there might be from the use of fire retardants in wildfire suppression on cave resources **(LABE-N-415)**.

3. Wildfires and management-ignited prescribed fires in certain areas of the monument create conditions favorable for the invasion of exotic vegetation. In order to combat these problems, an effort to grow and store genetic seed stock specific to this area is required for use in rehabilitation and restoration efforts.

3. Exotic Plant Infestations

Management of the monument's vegetative communities is one of the most important aspects of the natural resource program. Lava Beds lacks basic data concerning the composition and interrelationships among plant communities and the effects of human activities on the monument's native plant communities. Strategies to obtain data include:

A. Complete inventory, assessment, and mapping of exotic plants
A. Prepare Vegetation Management Plan (Plan will identify strategy for addressing each exotic plant species with control techniques and/or monitoring; plans for systematically monitoring likely introduction routes such as road corridors; SOPs to minimize introduction or spread of exotics through park management actions; native plant restoration and reintroduction plans and associated native plant nursery needs; research needs)
B. Conduct recurring exotic plant control and associated native plant restoration
C. Augment recurring exotic plant control with cyclic control efforts
D. Monitor likely exotic plant introduction routes
E. Implement SOPs minimizing introduction or spread of exotics by monument staff
F. Develop nursery facilities
G. Operate nursery
H. Conduct research identified in Vegetation Management Plan

The primary objectives will be to (l) maintain or re-establish native communities and (2) eradicate exotic species which are interfering with native species propagation. Several resource management and research projects are recommended in this five-year program which will strive to achieve progress towards these goals.

Primary in the vegetation management program will be the monument's fire management program. An extensive prescribed burning program will be intertwined with the wildfire suppression program to produce observable progress towards reintroducing natural fire to the monument. The two programs will work toward a similar objective to provide protection from destructive, unnatural wildfires and attempt to restore natural vegetation regimes and control exotic species.

Lava Beds National Monument was originally administered by the U.S. Forest Service. Under Presidential Proclamation, the monument was established in November, 1925, and turned over to the National Park Service in 1933. The land within the monument was heavily grazed by sheep and some cattle continuing through 1974, with only one life lease granted after 1947. This repeated grazing of the monument had a significant impact upon the native vegetation. Most of the native bunchgrasses were selectively grazed out from the northern one-half of the monument with non-native plants filling the niche.

Lava Beds National Monument has identified the following needs concerning the vegetation management program.

1. Develop a vegetation management plan **(LABE-N-003)**, which would address the management of native and non-native plant species, and the establishment of a revegetation management program. This plan would also identify the primary GIS database formats and themes for the gathering of plant species information. The plan will include proposals for the collection of basic data on the composition and relationships between plant communities; the presence and distribution of threatened, endangered, and sensitive plant species; restoration of disturbed lands; and the reduction of exotic plant populations. This plan will also address the role of fire as a tool to maintain natural ecosystem processes.

   A comprehensive vegetation survey will be conducted and will include distribution, health and status, plant-soil relationships, pest management, plant-wildlife interactions, and the collection of new voucher specimens for the herbarium.

   The monument, being in an arid environment, has an ecosystem that may have many unique plants that sprout, bloom, and go to seed within weeks or even days, totally unnoticed by the untrained eye. The monument needs a survey of flowering plants (forbs) **(LABE-N-005)** and non-flowering plants **(LABE-N-006)**. These special populations of plants need to be located and mapped, so that management can take these species into consideration, especially in the program application of management-ignited prescribed fire.

2. Mitigate the impacts of invasions of non-native plant species by providing the funding necessary to bring in a seasonal crew **(LABE-N-004, 007, 008)** to locate, remove, treat, and monitor non-native species. Ideally, a permanent increase to the resource management base funding should be secured to address this need. The long-term goal of the exotic plant program is to significantly reduce exotic plant populations that threaten native plant communities. A comprehensive inventory of exotic plant populations will be conducted (currently ongoing) and specific priority zones will be identified for eradication efforts.

1. The monument lacks baseline information on rare plants and/or habitats. To provide this information, the monument needs a rare plant/habitat survey **(LABE-N-009)** to identify any endangered, threatened, or sensitive species found within the park.

4. The monument also lacks good maps identifying historic vegetation. Literature searches, military files, and Modoc National Forest files should be thoroughly checked for any maps depicting past vegetation. Based upon the information found, historic base maps need to be created to scale and entered into the monument's GIS for analysis **(LABE-N-002)**.

5. The monument lacks a reliable soils map **(LABE-N-001)** that will be instrumental in correlating vegetative communities and site potentials when determining management actions.

6. The monument lacks a viable natural plant and seed source in large enough quantities to provide for the rehabilitation of disturbed sites after a variety of Management-related projects and natural disturbances such as wildfire in order to reduce the invasion of exotic species and promote natural processes. The monument needs to establish a small nursery operation to propagate native plant species for restoration projects.

4. Threatened, Endangered, Sensitive and Extirpated Plants and Animals

Lava Beds National Monument has a tremendous diversity of flora and fauna, but lacks basic data on the distribution and abundance of most species and the impacts of human activities on native plant and wildlife communities. The monument supports an estimated 51 species of mammals, 217 species of birds, 12 species of reptiles, two species of amphibians, and an unknown number of species of insects and invertebrates. There are 38 plant communities with at least 283 species identified. Very little is known concerning TES species. The monument's long-range strategies to address these issues include:

A. Complete inventory and assessment of all TES plants and animals
B. Monitor TES plants and animals as a component of Vital Signs Monitoring program
C. Conduct research needed to develop management actions to protect or recover TES species
D. Develop TES management or recovery plans as needed
E. Implement TES management or recovery plans
F. Evaluate monument's habitat for potential reintroduction of bighorn sheep and sage grouse

Wildlife Management Plan needs to be written to address wildlife management issues. Issues include the ecological relationships between wildlife; the occurrence, distribution, and management of threatened, endangered and sensitive species; and inventory/monitoring of native wildlife populations. The plan will include methods to document the condition of wildlife resources, and to conduct inventory and monitoring programs for species identified as Vital Signs. The plan will also address restoration of altered systems and species reintroduction.

The monument has signed several agreements with other agencies involving the management of wildlife species. They are:

1) The California Bighorn Sheep Recovery and Conservation Guidelines for Northeastern California (1991) serves as a basis for evaluating the potential for bighorn sheep reintroduction into northern California. The document provides guidance for reintroduction, habitat management, and monitoring/research opportunities.

2) The Klamath Basin Habitat Management Plan: A plan for the re-introduction of peregrine falcons into a historic territory in the Klamath Basin in northern California (1986). The plan encourages the cooperation of participating agencies in the reestablishment of the species through introduction of captively-hatched eyasses, manage to improve nesting and foraging habitats, provide for disturbance-free habitats, and apply species management to insure long-term viability of the breeding pairs.

3) The McCloud Flats Deer Herd (CDF&G, 1985) agreement specifies that the participating agencies cooperate to encourage the development of specific action plans for each sub-herd.

The lands within the monument provide preferred winter habitat for mule deer. During a normal winter season, snow depth at the upper elevations of the Medicine Lake Volcano forces the deer to move down the eastern slope and into the monument. Deer populations according to the California Fish & Game are lower than in past years and are continuing to decline. This may be attributed to widespread vegetative habitat age and species structural changes due to seven successive drought years; to the exclusion of fire; and/or to some other problems in herd health. Since 1996, it seems that deer populations are slowly rebounding; however no population studies have been initiated to confirm or refute this observation. Deer are readily observed within the monument throughout the year.

Populations of pronghorn are observed within the northern and eastern portions of the monument. They prefer the more open habitats, and indications are that the monument may be used as an important kidding ground. Again, no research has been conducted to study pronghorn within the monument.

In the past, populations of sage grouse were found within the monument, however, since the late 1970's only unconfirmed sightings have been made near Hovey Point. Changes in habitat due to the lowering of the water tables, the retreating of the Tule Lake shoreline, removal of sagebrush through fire/grazing, and invasion of cheatgrass have disrupted this native species.

Reptiles, amphibians, and many insect and invertebrate species are found within the monument. The baseline data on these wildlife species is very limited. With numerous specialized microclimates such as cave entrances and cave interiors, the potential for rare, threatened and endangered species is quite high.

Lava Beds National Monument needs to work with Federal and State agencies to identify and implement wildlife research projects. Projects currently identified are as follows:

1. The monument provides important winter habitat for mule deer. Region-wide mule deer population levels have, until recently been declining. The reasons for this decline (and suspected recovery) are not known. An inter-agency cooperative health and population dynamics study for the deer herd is necessary to determine the causes of the population declines. **(LABE-N-115, 117)**

2. The monument contains well over 400 known caves. Many of these are critical habitat for sensitive bat species. The two primary species of special concern are the Brazilian free-tailed bat (*Tadarida brasiliensis*) and the Townsend's big-eared bat (*Corynorhinus townsendii*). Lava Beds National Monument is the summer home for the northernmost maternity colony of the Brazilian free-tailed bat, with population estimates of 250,000. Annual population surveys indicate that the number of bats using the cave has decreased. Free-tailed bats are known for their ability to forage 15 to 20 miles each night. This colony, upon exiting the cave, travels northwest and forages over agricultural lands within the Klamath Basin. It is suspected that the decline in bat numbers may be the result of an accumulation of pesticides within the fatty tissue of the bats. A research study is necessary to determine if the bats are impacted by pesticides. A cooperative effort with the U.S. Fish and Wildlife Service should be funded to support the capture and analysis of this species to determine if pesticides similar to those used throughout the basin could be contributing to the population declines. **(LABE-N-119)**

3. Lava Beds National Monument has a small herd of pronghorn that frequent the north and east portions of the park. This species can be observed in summer, foraging in areas near the main park road. It has been noted that the monument provides excellent kidding habitat, however, no research has been conducted on pronghorn distribution and behavior within the monument. **(LABE-N-112, 115)**

4. Amphibians, primarily frogs, have been observed at various small caves located far from natural water sources. Pacific tree frogs live and breed within Fern Cave which is located within the sagebrush country and is two miles from the nearest surface water source. This population, because of its isolation, may represent a distinct genetic population. A comprehensive amphibian survey should be conducted near and within moist cave zones, as these areas may be critical habitat for T&E species. **(LABE-N-105)**

5. Sage grouse is a species that was commonly found within the monument at the turn of the century. However, since that time, sightings have been uncommon. The exact reasons for this decline are unknown. Past activities such as over-hunting, the lowering of water tables, removal of sagebrush through fire/grazing, and subsequent invasion of cheatgrass all probably have contributed to the decline. Hunting and grazing have been eliminated from the monument, and

there is a growing interest in reintroducing the sage grouse to the monument. Healthy, breeding populations exist nearby and could serve as a source of birds for Lava Beds. An evaluation of the monument's habitat for the potential reintroduction of the sage grouse should be conducted. **(LABE-N-114)**

6. The monument has amassed very little comprehensive data concerning its mammals. Information on the existence of rare mammals is less known. A comprehensive mammal survey is needed to acquire baseline data for mammals and to examine the monument for sensitive species and critical habitat. **(LABE-N-100, 110, 114, 116)**

7. Lava Beds National Monument has the highest concentrations of the threatened Townsend's big-eared bat within the region. There are three sub-species of the Townsend's big-eared bat (*Corynorhinus townsendii*; *townsendii*, *virginianus*, and *ingens*) that may be found within the monument. Several bat experts (Cross & Pierson) feel that all subspecies should be federally listed as threatened. C. v*irginianus* and *C. ingens* are currently listed as endangered. To determine the exact subspecies found within Lava Beds National Monument a DNA genetic analysis of several individuals would be necessary.

8. Large populations of the Brazilian free-tailed and Townsend's big-eared bats use the monument for raising young and/or hibernating through winter. The day-to-day activities, movements, and needs of these two species is not clearly known. To better understand and protect these species a research project is needed to capture, tag, and monitor these bats. **(LABE-N-104, 106, 107, 108)**

Two endangered/threatened species have been identified within the monument, the bald eagle (*Haliaeetus leucocephalus)* and the peregrine falcon (*Falco peregrinus)*. The monument contains two areas used by the bald eagle for roosting and the protection from cold winter weather. These roosts have been identified as Caldwell/Cougar Butte and Eagle Nest Butte. The Caldwell/Cougar Roost is one of four major bald eagle winter roosts located in the Klamath Basin of northern California and south-central Oregon. More than 600 bald eagles annually winter in the Klamath Basin. These eagles represent nearly one-half (depending upon their distribution) of the California bald eagle winter population in any given year. The eagles roost communally during the night in forest stands near the Tule Lake and Lower Klamath National Wildlife Refuges which support large waterfowl populations. Roost sites are in mature ponderosa pine (*Pinus ponderosa*) and mixed-conifer forests that offer perch sites, protection from severe winter weather, isolation from human disturbance, and a food supply within 13 to 25 kilometers (5-15 mi.).

Studies within the Caldwell/Cougar Butte roost have been conducted by Keister (1981), Stohlgren (1990), and Stohlgren and Farmer (1991), that identified the importance of the large mature ponderosa pine trees as roosting sites. Very little pine seedling recruitment is occurring, which is necessary to perpetuate these old growth trees for the future. Management-ignited prescribed fire is recommended to reduce fuel loadings, to minimize the impacts from wildfire, and encourage the regeneration of ponderosa pine.

Over the past 15 years bald eagle winter roost surveys have been conducted. The survey records the number of eagles leaving the roosts to feed, the times they depart, the numbers that stay within the

roost, and their preferences for roosting trees. Maximum and minimum observation counts of bald eagles at the roost from 1981-1991 were 278 and 6, respectively. The highest count was in 1983-84, the lowest count in 1996-97.

The monument has identified the following projects associated with endangered/threatened species.

1. Research on the movements, use, and importance of the area's winter roosts needs to be conducted through an interagency approach. It is unknown whether eagles have fidelity to a specific roosting site or whether they move freely from one roost to another, or if/how weather affects their uses of the roosting areas. The monument, Modoc National Forest, and U.S. Fish & Wildlife Service are each looking at population numbers, but no one is examining the needs of the bald eagle on a regional basis. The Bald Eagle Winter Roost Management Plan identifies this need **(LABE-N-111, 118)**.

2. The monument is still conducting bald eagle winter roost surveys, however staff and funding is limited and a future decision will need to be made to determine whether the monitoring of this species should continue. The monument needs funding support to continue the monitoring of this species **(LABE-N-111)**.

3. The continued funding of management-ignited prescribed fire is required to reduce fuel loading within the eagle roost areas. **(LABE-N-201, 203, 206)**

5. Anthropogenic Effects on Cave Resources

Lava Beds National Monument is an area of basaltic lava flows containing well over 450 caves. The caves are notable in their abundance, length of passage, and excellent representation of primary volcanic features. Many also contain resources such as ice formations, pictographs, and/or unusual biotic communities or populations. The monument's long-range strategies to address these issues include:

A. Complete reconnaissance survey to identify all cave resources
B. Inventory, map and categorize cave resources
C. Develop long term cave resource monitoring protocols as a component of Vital Signs Monitoring Program
D. Conduct Vital Signs monitoring
E. Restore damaged resources
F. Manage caves and protect them from inappropriate use (negative impacts)
G. Augment ONPS base cave maintenance with cyclic maintenance funding
H. Conduct research as needed to direct management of cave resources

Opportunities for unsupervised cave exploration by the general public, including caving organizations, have been provided. While this open-door policy has given visitors opportunities for very special experiences, it has caused negative impacts to many caves. The monument has an approved Cave Management Plan that encourages cave exploration opportunities, while controlling

impacts to the cave environment. The Plan also provides for scientific research, limits development, and outlines management responsibilities.

Data on cave visitor use in the popular Cave Loop caves has been collected weekly since 1982. Most of the pre-1989 data resulted from querying visitors as they re-entered the Visitor Center to return their borrowed lanterns. Then, in 1988, break-beam infrared trail counters were installed in three caves. These counters were difficult to install and maintain, and were gradually phased out. They were replaced with seismic or passive-infrared trail counters by 1992. Currently, twelve caves are monitored using these trail counters. The number of caves that can be monitored in this way is limited by cost (about $500 per counter) and personnel (it takes approximately half a day to visit the twelve caves).

Lava Beds National Monument, because of a lack of funding and personnel, depends heavily on the Cave Research Foundation (CRF) to continue the initiative to identify, map, inventory, monitor, and recommend ways to protect caves. As part of a 30-month research contract, the CRF has completed 10 professional projects for the monument. The projects included cave reconnaissance inventory, cave mapping, general cave inventory, photo-monitoring, ice level monitoring, speleothem breakage monitoring, bat inventory and monitoring, mineral deposit analysis, invertebrate inventory and monitoring, and dust monitoring and sedimentology. The contract ended as of June, 1992. Since then monitoring has continued by CRF as a volunteer effort.

During 1992, Rotating Resource Base funding was allocated for the mapping, inventory, and photo-documentation on one of the Fleener Chimneys (spatter cones). The work was completed by the Cave Research Foundation, and a final report was delivered in February, 1993.

A study of the ferns located within and around caves was also completed by the Cave Research Foundation in 1993. Ferns were found at twenty cave entrances. It was determined that the relatively stable, protected environments with attenuated light levels and greater moisture availability resemble conditions typical of coastal forests and thereby provide island refuges for species not found in the surrounding hostile, semi-desert landscapes.

Needs: The monument has approximately 420 caves that are named, with approximately 80% having maps on file. It is estimated that there are still many caves within the monument that have not been clearly identified or mapped. Only 12% of the caves have been completely inventoried based upon the standards established by the 1990 Cave Management Plan. It is important that the work conducted by the Cave Research Foundation continue by providing the funding to draft another research contract. The following projects need to be funded as part of the cave program:

1. The location of monument caves has been recorded in the past by using compass bearings and distances from known landmarks. Many of the entrances and geologic shapes of caves are very similar, and due to magnetic variation within the basalt, human error, and unclear landmark descriptions, the relocation of specific caves has been difficult, especially for new employees. To clearly identify and locate the caves, a brass cap marking/numbering system was funded for 1994 and employed the use of the monument's Global Positioning System (GPS). The park secured funding for seasonal personnel and materials to complete this work through the

Rotating Resource Base funding source. This initiative is almost complete, with a majority of the cave markers having been installed. The data is compiled and entered into the monument's GIS as a separate thematic layer.

2. Mushpot Cave is a developed cave with paved walkways and electric lightning. In 1987, Ron Kerbo, Cave Management Specialist, Carlsbad Caverns (currently NPS Cave Specialist) visited the monument to review the management of Mushpot Cave. A report was submitted to the park entitled "Evaluation of and Redevelopment, Management, Maintenance, and Interpretive Recommendations for Mushpot Cave". The report recommended that 20 of the 86 lights should be removed, that the remaining lights be shielded, and specific modifications to lights and wiring be made; that the asphalt trail should be removed, corrections to the handrail design be implemented to protect speleothems; and many other valid recommendations for the control of the unnatural growth of plant life. A very few light fixtures have been purchased with cave project funds. They are being stored until the remaining fixtures can be purchased. No further actions on these recommendations can be implemented until management has secured adequate funding.**(LABE-N-407)**.

Projects that have been initiated by the Cave Research Foundation but need funding to continue are: cave inventory **(LABE-N-404, 401)**, cave mapping **(LABE-N-402)**, and ice level monitoring **(LABE-N-405)**.

6. Wilderness/Backcountry Management

Lava Beds National Monument has approximately 44,000 acres managed as backcountry. Included within this backcountry are two wilderness units totaling 28,460 acres.

Approximately 43 miles of trails and road/trails exist. There are 18 separate trails identified within the monument. Major road/trails systems include Lyons, Sheepherder, Powerline, Three Sisters, Hardin Butte, Whitney Butte, Gold Digger Pass, Gillem Bluff, and Thomas-Wright.

Trail registers were installed on five major trails years ago. In June 1991, the Resources Management Division assumed the responsibility for collecting, preparing monthly reports, and preserving this trail use data. Trail register data prior to 1991 is not available. Some indication of very limited overnight backcountry use and backcountry cave visitation is obtained and recorded from these trail registers.

The use of stock is currently permitted only on portions of four trails (Lyons, Three Sisters, Whitney Butte, and Gold Diggers Pass).

All zones, except the development zone around headquarters, are managed as backcountry (approximately 44,000 acres).

The following projects need to be addressed concerning backcountry management:

1. The monument needs to develop a Wilderness/Backcountry Management Plan and Environmental Assessment for public review, which will address all backcountry uses **(LABE-I-009)**.

2. Maintenance of backcountry/wilderness trails should be done every three to five years. It is difficult to mobilize the staff necessary to implement this program without additional funding. In an effort to provide a safer and more enjoyable hiking experience, these trails need to be maintained in a clearly-marked and safe condition. Funding is needed to adequately maintain these trails **(LABE-I-012)**.

3. A comprehensive trail study is necessary to determine if additional trails are needed and/or if some trails are redundant and should be removed.**(LABE-I-012).**

7. Air/Water Quality Management

Lava Beds National Monument has two wilderness areas totaling 28,460 acres, which are recognized as Class I quality airsheds. In an effort to comply with the 1977 and 1990 Clean Air Acts requiring that Class I & II airsheds be monitored to prevent significant deterioration in air quality, the park began collecting baseline data.

Through special funding, a fine-particulate sampler was established within the park beginning in 1982 and ending in 1986, when the sampler was then disassembled and moved to another park site.

The monument, through the support of the Air Quality Division in Fort Collins, established in 1986 an automated air quality camera located on Little Crescent Butte. Since then, three photographs were taken daily at a specific target; at 0900, 1200, and 1500 hours, to document Air Quality Related Values (AQRV's). On September 30, 1991, the automated camera was removed and mailed back to Air Resource Specialists, Inc. Over 5000 slides are on file at Fort Collins recording the air quality within the monument and Klamath Basin.

In 1994, the monument, working with Siskiyou County, installed a PM_{10} particulate sampler at the weather station and has been receiving data for five years. Also, ozone and sulfur di-oxide has been monitored on and off since 1995.

Lava Beds National Monument has a few intermittent surface water resources in the form of seeps at some caves. These sites, due to recent long-term drought, are dry. These sites should be located using GPS technology and incorporated into the park's GIS.

The sub-surface water resource of the monument is of the greatest concern. The monument has a 758-foot-deep well that provides the only source of water to visitors and employees for drinking, household use, and for wildland and structural fire protection. The water level is located approximately 23 feet above the pump in the well's bottom. After seven years of drought, local basin farmers are drilling wells into the aquifer for irrigation. The bottom of the monument well is at the same elevation as that of the surface of the basin. Exactly how this draw-down of the sub-surface water table will affect park water sources is not known.

The Klamath/Tule Lake Basin, in which the monument is situated, has for many years experienced serious air quality problems in winter. These problems are due to persistent temperature inversions which trap smoke from agricultural burning, engine exhaust, and wood stoves used for winter heating. The effects of these inversions are continuing to expand southward toward the monument, affecting the Class I airshed.

Lava Beds National Monument has expressed serious concerns over the proposed Geothermal Energy Development projects planned just south and west of the monument. One project, Four Mile Hill, proposes to develop a 49.9 megawatt (MW) geothermal power plant, with associated geothermal production and injection wells, well pads, roads, and interconnected geothermal fluid pipelines. Also included is the construction of a 230 kilovolt (KV) transmission line that would extend from the power plant site approximately 24 miles to the east to a connection with the existing Bonneville Power Administration transmission line. The second project proposes to construct and operate a 48 MW geothermal power plant with associated production and injection wells, well pads, pipelines, transmission line and access roads. This plant would be located near Glass Mountain, again just a few miles south of the monument.

These projects have the potential to negatively impact the Class I airshed, the viewshed from the monument, bald eagles, sensitive bat species, and water quality/quantity. These concerns have been articulated throughout the planning process, but to date, the concerns remain.

Potential air, water, and visual impacts to the monument need to be studied. The following projects need to be funded:

1. Impacts upon the monument's natural and cultural resources are not known, however the increased airborne particulate matter is affecting the monument's viewsheds. Lava Beds National Monument needs an ONPS funded program for air quality. Funding is needed to establish a permanent fine-particulate and ozone monitoring station **(LABE-N-300, 301, 302)**.

2. The actual effects of air pollution on natural and cultural resources is known for some plant species and for some historic objects (structures). However, this information is not readily available to the field resource manager. A park may be showing signs of vegetative or cultural resource impacts from air pollutants, but they are not recognized. A guide book needs to be developed that identifies the known characteristic impacts of specific air pollutants on natural and cultural resources **(LABE-N-303)**. An example might be the known effects of ozone on specific plants such as leaf yellowing, spotting, and burning.

3. An inventory (profile) of the sub-surface water resources within the monument needs to be completed. The external impacts from uncontrolled drilling and pumping of the basin's aquifer needs to be determined **(LABE-N-416)**.

8. Integrated Pest Management

Lava Beds National Monument has several pest-related problems. The major concern is with the disease bubonic plague. For over 30 years the California Department of Health Services' Vector Surveillance Unit (CDHS VSU) has recognized that the monument has a diverse rodent population and has periodic outbreaks of bubonic plague. In fifteen out of the past 36 years there has been a bubonic plague outbreak at Lava Beds National Monument, requiring the support and expertise of the VSU to begin a systematic monitoring and trapping program to safeguard the public's health and well-being.

The disease is carried and transmitted by fleas and poses a threat to the visiting public. One of the primary hosts for the flea is the bushy-tailed woodrat (*Neotoma cinerea*), which lives within the monument's caves. The monument is a recreational caving park and is actively used by both novice and experienced cavers. As these rodents succumb to the disease and die, the fleas begin looking for another host. Visitors, while making their way through the many thousands of lava tube passages, become prime targets.

Upon the discovery of dead rodents within any of the caves, the carcass is immediately packaged and delivered to the VSU for testing. In the mean time, the cave where the rodent was located is closed. If the testing proves positive, then a team from the VSU comes to the monument to begin trapping live rodents at the cave of discovery as well as at other caves within the immediate area. The live rodents are then trapped and flea counts conducted, with fleas also being tested for the disease.

In past years, after these control samples were taken, the rodent populations were baited into non-capture traps in order to dust them with Diazinon, an EPA-approved chemical. This chemical settled into the fur of the rodent and killed the fleas. After a week of dusting, the rodents were re-trapped and flea counts again taken. If numbers were below a predetermined threshold, then the trapping was terminated and the caves reopened.

The monument's policy with reference to "dusting" the rodents with pesticides has been revised. In the future, when monument staff discovers dead rodents within the caves, the same procedures will be followed until Vector Control positively determines that plague is present. Once that determination is made, park management will initiate one of the following two options:

- Seek emergency funding to continue monitoring the caves for plague. The caves will remain closed to the public until the monitoring program determines that the plague has run its course and no longer presents a public threat. The caves will then be re-opened.
- Option #2 is identical to the procedures used during past plague outbreaks--that is, dusting rodents with chemical pesticides (see above).

The CDHS VSU was monitoring the park semi-annually by testing and examining flea populations, however state cuts in 1992 have drastically reduced their opportunity to provide this service. In fact, this vital professional public service may be entirely eliminated, requiring the park to either contract the work out or train our staff to monitor and mitigate the spread of this disease.

The emergence of the virulent hantavirus has also caused concern throughout the western states. The Vector Surveillance Unit has determined that 25% of the monument's mouse population is

infected with the virus. Additional research is needed to determine if this condition poses a health threat to visitors and monument staff.

Other pest management problems include the trapping and relocation of rodents that enter residences, buildings, and vehicles. Live traps and snap traps are available for all employees and residents to control these periodic problems. Resource management staff oversees this program and has drafted an IPM plan for the monument.

The following projects for IPM are proposed for funding:

1. An IPM Plan needs to be written and implemented to direct and guide management actions in a coordinated fashion. **(LABE-N-500)**

2. A new technique is being proposed to address the specific problems for long-term control of bubonic plague at Lava Beds National Monument. The VSU proposes the use of a California-registered chemical titled "Evercide Intermediate Pet Dip". This chemical is 3.48% permethrin (active ingredient) and would be diluted to a .05% solution. Cotton balls soaked in this solution and dried would be placed into tamper-proof baited traps and placed at specific cave locations. The bushy-tailed woodrat is an avid packrat, gathering items (such as cotton balls) to take back to its nest. Based upon this behavior, the new technique has been tried by VSU and preliminary results have been positive.

   Lava Beds National Monument in conjunction with CDHS/VSU and CPSU, would like to conduct a one-time research project to test and determine the effectiveness of the available methodology for long term control of rodent flea populations and ultimately break the recurring cycle of the bubonic plague **(LABE-N-502)**.

3. Pesticides for pest control are only used when other IPM techniques fail and WASO approval is granted. Lava Beds National Monument does not have any state trained/certified Pesticide Use Applicators to ensure the safe use and application of approved chemicals **(LABE-N-501)**.

9. Environmental Compliance

The resources management staff is responsible for insuring that National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) compliance is completed for all management actions that may have an impact on natural or cultural resources. The monument has, since 1994, been employing an “in-house” Park Project Clearance form that is the vehicle to address project needs and potential compliance needs. Environmental Assessments are written “in-house” with assistance from the Regional Support Office staff. The staffing plan section of this RMP identifies the need for a position whose major responsibilities are compliance oriented.

10. Resources Protection

Natural and cultural resources protection at Lava Beds National Monument is the responsibility of the Resources Protection and Visitor Services Division. The division is tasked with providing all the services necessary to adequately protect the natural and cultural resources from unacceptable human impacts. The division employs front and backcountry patrols and education techniques to control resources-damaging activities such as poaching, vandalism, plant collecting, illegal fires, archeological artifact collecting and mushroom collecting. The lack of resources protection staff (as identified in VR-RAP and NR-RAP) has severely limited their ability to provided the necessary protection coverage and needs to be augmented. **(LABE-I-003, LABE-I-005, LABE-I-006)**

VI. Overview of Current Cultural Resources Program and Future Needs

Lava Beds National Monument has a wealth of cultural resources, but has had very little funding support for cultural resource program management. The Presidential Proclamation establishing the monument states:

> *"Whereas, lands of the United States within the area herein described…contain objects of such historic and scientific interest as to justify their reservation and protection as a National Monument…"*

In March, 1991, the entire monument was placed on the Federal Register of Historic Places as the "Modoc Lava Beds Archeological District", which recognizes the area's wealth of cultural resources. Cultural resources and programs are discussed below.

Lava Beds National Monument's Division of Resources Management lacks the staffing to adequately manage the various cultural resources programs under its purview. As a result, known resources are suffering due to lack of attention, and unknown resources are at risk from inadvertent management activity or from uncontrolled collectors and vandals.

Under the current divisional staffing, the Resources Management Chief serves as the monument's Section 106 compliance coordinator. The division chief supervises a collateral duty curator who is responsible for maintaining the collection, library, and archives.

The Resources Management Division routinely initiates archaeological and Section 106 clearances. Currently, projects requiring archaeological clearances are prepared by the Resources Management Division and submitted to the field archeologist duty stationed at Redwood National and State Park. Compliance documents required under the National Historic Preservation Act are prepared by the division, and then forwarded to the Pacific West Support Office for review and final approval.

Due to staffing constraints, adequate time and effort is not being provided to properly administer the cultural resources management program. Without the addition of a cultural resources management specialist and support staff outlined in the Staffing Plan section of this plan, the cultural resources at Lava Beds will continue to be adversely impacted by anthropogenic and natural actions. **(LABE-C-001)**.

Archaeological Resources Management

Lava Beds National Monument's archaeological program relies on the services of the Redwood National and State Park Archeologist, and a STF position, both shared between 4 parks. The current structure of sharing these positions between 4 parks is grossly inadequate. Funding needs to be secured to staff a minimum of two archaeologists to cover the 4 parks **(LABE-C-001)** and ideally, an archaeologist dedicated to Lava Beds as required in the CR-MAP (Cultural Resources – Management Allocation Plan).

To date, approximately 15% of the monument has been systematically surveyed. Within that 15%, approximately 500 archeological sites have been recorded indicating that a great many sites remain to be discovered. These sites include petroglyphs, pictographs, burial sites, village sites, lithic scatters, vision quest sites, as well as temporary staging sites. Most of the documented sites are located along the old Tule Lake shoreline. Numerous undocumented sites are visually present throughout the monument.

Lava Beds National Monument encompasses lands once inhabited and used by Native Americans. The Modoc people have identified a spiritual tie to these lands and desire to conduct traditional activities as their forefathers had done. Which activities are appropriate and represent traditional uses by these Native Americans is not known. This information is very important to park management to justifiably and reasonably permit ethnographic uses.

In 1988, Lava Beds National Monument consulted with the Native Americans of the area and repatriated all known human remains from its museum collection, as well as associated funerary objects, sacred objects, and objects of cultural patrimony.

Needs: The following projects have been identified involving the management of archaeological resources.

1. Lava Beds National Monument's most critical cultural resource issue is the emergency stabilization project for Petroglyph Point. Numerous professionals, including park staff, rock art consultants, authors of the Development Concept Plan for Petroglyph Point, and the General Management Planning team have identified the urgent need to stabilize the rock art which is deteriorating at an increasing rate. This is a sensitive Native American issue and the enabling legislation directs the National Park Service to protect and preserve the nationally-significant cultural resources of Petroglyph Point **(LABE-C-026)**.

2. Lava Beds National Monument does not have an accurate inventory or records of "burial sites" or "cultural items" associated with Native American cultural affiliations to the monument. To comply with the Native American Graves Protection and Repatriation Act, this project study is necessary. Since the 1988 repatriation, additional burial sites where human remains have been removed have been identified. Two sites were identified at Petroglyph Point by Archaeologist Rick Fitzgerald during the summer of 1992.

The monument needs to provide the funding to conduct a complete review of the literature and information available to identify cultural items under NAGPRA that are associated with Lava Beds National Monument, but are housed in other museums. Based on information obtained in a literature search and in consultation with Native American groups, a determination will be made concerning where such items should be placed. Once identified, the artifacts should be repatriated **(LABE-C-005)**.

3. The monument needs to have the remaining land base (85%) surveyed for archaeological sites. In addition, many of the original site surveys need to be resurveyed to meet today's more precise standards **(LABE-C-008)**. This project should be funded annually with the work being focused on high visitor use areas, i.e. along roads, trails, and historical event sites. In FY00, the monument will receive an archeological overview and research design that should provide the guidance needed to implement a comprehensive plan that may include subsurface testing and site monitoring. The monument will work closely with members of the Klamath/Modoc Tribes to identify previously unrecorded burial sites, rock imagery and Vision Quest sites.

4. Lava Beds National Monument has the most extensive rock art site in California located at Petroglyph Point. The walls upon which the petroglyphs are inscribed have been vandalized over time with other carvings, graffiti, paint, and impacts from past attempts to remove graffiti. This graffiti greatly detracts from the quality of the petroglyphs.

   Lava Beds National Monument needs to identify what graffiti should be removed or preserved, test various methods for removal and conservation, and then actually apply the proven techniques. Experts are needed to evaluate, test, and remove all unwanted graffiti.

   The monument needs to secure funding to contract with rock art specialists to: 1) examine the types and time periods of graffiti, 2) provide recommendations to the monument on what graffiti should be removed and what should be preserved, 3) test methodologies for the removal or covering up of graffiti, and 4) begin the process of restoration and conservation of the petroglyphs. This project should take several years to complete and could be done in phases **(LABE-C-004)**.

5. On November 10, 1992, Mr. Larry Swan from Winema National Forest advised the monument staff that they received notification that the Smithsonian Institution has released 1200 pages of unpublished field notes about activities and events occurring within the Klamath Basin covering the period from 1885 to 1886.

   Upon review of these notes approximately 20% of the text is directly related to Lava Beds National Monument. Apparently these notes describe traditional stories involving the monument. This information is invaluable and Mr. Swan is interested in coordinating an interagency effort to have these notes transcribed and made

available to the participating agencies. The monument needs to act upon this opportunity to obtain this valuable historical information **(LABE-C-023)**.

6. Visitors coming to the monument stop at the various waysides that describe the struggle between the Native American peoples and the United States Army. Cultural resources as well as natural resources are being impacted. How this visitation is affecting each cultural site is unknown. At the cultural resources scoping session, the participants, archeologists and historians alike, recommended that a visitor use study be conducted at specific sites i.e. Petroglyph Point, Hospital Rock, The Stronghold, Gillems Camp, and Thomas-Wright Battlefield **(LABE-C-014)**.

7. Fern Cave is listed on the National Register of Historic Places and is a site with significant cultural resources. The site has 18 panels of prehistoric rock art (pictographs). The cave entrance is gated, with entry permitted only in the presence of a National Park Service employee.

   Access to the cave is through a vertical opening and down a ladder, which rests upon cave breakdown and debris. Over thousands of years, the prehistoric and historic uses of the cave by Native Americans, the accumulation of debris from windblown dust and soils, and the addition of dead animal and plant material have formed an archaeological midden that holds information of utmost scientific value.

   Contemporary uses of the cave for interpretive and spiritual purposes, even though the numbers of visitors are limited, are having a significant impact upon the midden. Foot traffic upon the midden is moving surface debris downslope as well as compacting surface soils along the pathway. The continual compaction of these soils may be impacting irreplaceable artifacts below the surface. The Fern Cave sites need to be evaluated for these potential impacts, and ways to mitigate these impacts need to be explored **(LABE-C-022)**.

Historic Resources Management

Currently the monument manages six sites listed on the National Register of Historic Places. These sites are Captain Jacks Stronghold, Hospital Rock, Thomas-Wright Battlefield, Fern Cave, Petroglyph Point, and all monument lands identified as the "Modoc Lava Beds Archaeological District."

The monument maintains a list of 31 classified structures (LCS). These include The Stronghold, Gillems Camp & Cemetery, Hospital Rock, Schonchin Butte Fire Lookout, Garage/Shop, Pump House, Service Station, Superintendent's Residence #40, and 18 picnic tables. Lava Beds National Monument has identified 22 specific cultural themes (see page 33).

Needs: The monument has identified several other projects that need funding to properly manage the historic resources:

1. Lava Beds National Monument needs a comprehensive historic overview of the region. A Cultural Resources Scoping Session conducted in 1992 identified this need as critical. All agencies within the area should be consulted and be an active participant in this project **(LABE-C-002)**.

2. The monument needs preservation guides prepared for the 31 historic structures identified within the park **(LABE-C-016)**.

4. Historic base maps of Captain Jacks Stronghold and Gillems Camp have been prepared. However, base maps need to be prepared for Hospital Rock and Thomas-Wright Battlefield **(LABE-C-024)**.

5. One of the most significant historic events at Lava Beds National Monument was the Modoc War (1872-1873). Many of the fourth-generation descendants of the participants of this event are aging and expiring. Much of the knowledge of this historic event is unwritten and held within the minds of direct descendants of the war. It is important for Lava Beds to obtain the oral histories from these descendants before their historical perspectives are lost.

   A research study is needed to collect information from approximately 25 descendants. Oral research would include local on-site interviews and, for participants beyond a 300-mile radius, telephonic interviews **(LABE-C-006)**.

6. From July 13, 1933 through June 30, 1942, a Civilian Conservation Corps camp was located within the monument. From 1933 to 1935 the camp was located at Bearpaw, however in 1935 it was moved to the Gillems Camp area. A reunion of past CCC participants took place on August 3, 1990, to recognize the outstanding work that these people have done for the park.

   In an effort to capture information on the CCC period, several oral histories were obtained from the participants. These tapes still need to be transcribed.

   It is also important to obtain as many oral histories as is possible before the living knowledge is lost due to the passage of time. A Civilian Conservation Corps Study needs to be undertaken to gather and collate the current records and interview, tape, and transcribe information from living participants **(LABE-C-007)**.

7. Modoc National Forest has a series of historic black and white photographs taken in the monument from 1905-1945. These photographs need to be reviewed and copies made of the ones providing valuable documentation of the resources of the park **(LABE-C-018)**.

8. The monument has six sites listed on the National Register of Historic Places. In addition, Gillems Camp/Cemetery and Canbys Cross were nominated, however they were not accepted. Even though greatly impacted, these sites played an integral part in the outcome of the Modoc Indian War. Gillems Camp was the primary staging

area for the military troops assigned to remove the remaining Modoc people from their homeland. Canbys Cross is the site where two drastically different cultures met to negotiate a peaceful settlement of the Modoc War. These lands were impacted by the military, then impacted by the CCC, and they remain impacted. However, their place in history, as part of the cultural scene, is important, but has not been studied. As part of the proposed scene representing the "Modoc Indian War", these sites need to be re-nominated, reflecting their importance as part of the overall cultural scene **(LABE-C-015)**. The Gillems Camp Historic Trail should also be included in this nomination, or at least the trail needs to be placed on the List of Classified Structures.

9. The military involvement in the Modoc Indian War was extensive. With the application of tested military strategies, the uncalculated loss of soldiers was demoralizing. Troop re-enforcements, weapons, and supplies were allocated to the cause. Valuable information about these soldiers, their daily struggles to survive, their injuries, and their heroism is archived in Army service records. The records of the known service men who participated in the Modoc Indian War need to be researched to provide the historical insight on the human element of this war **(LABE-C-024)**.

Collections Management

Lava Beds National Monument has an extensive museum collection with an inventory of 7906 cataloged objects. Historic objects include items from the Modoc War era, Civilian Conservation Corps, and prehistoric Native American occupation. Also included in the collection are natural history specimens (area plants and animals) and monument archives.

Needs: There are several projects that need to be funded to properly management these collections:

1. A new Visitor Center is desperately needed to replace the current building which was constructed to serve as a temporary Visitor Center around 25 years ago. The monument has many irreplaceable artifacts on exhibit within the current visitor center. These artifacts are subject to extreme changes in temperature and humidity because of an inadequate climate control system. The visitor center is currently heated by baseboard space heaters and is cooled by one wall-mounted air conditioner. There is no mechanism to regulate humidity. During periods of high visitation, with exterior doors regularly opening and closing, these units are not capable of maintaining the narrow climatic parameters for proper care of the artifacts. Until such time as a new facility is constructed, funding is needed to install a central heating/cooling/humidity system within the existing visitor center **(LABE-C-003)**.

2. The monument has identified several projects that require written documents to properly manage the collections. They are:

   Prepare Collections Management Plan **(LABE-C-011)**
   Prepare Collections Storage Plan **(LABE-C-019)**

Prepare Collections Condition Survey **(LABE-C-020)**
Update Scope of Collections Statement **(LABE-C-013)** (completed in Sept. 1994)
Update Collections Fire & Security System **(LABE-C-021)**
Conduct Arc./His./Ethn. Collections Overview **(LABE-C-009)**
Conduct Biological Collections Overview **(LABE-C-020)**

4. The collection at Lava Beds National Monument contains paper records in the form of maps, photographs, cards, and books; dead tissue in the form of leather, and animal skins; and wooden objects in the form of harnesses, handles, and weapon butts. To protect and preserve these valued objects, it is important to identify **(LABE-C-020)** and restore any artifacts within the collection that need conservation treatment.

Ethnographic Resources

Overview: Lava Beds National Monument encompasses lands once inhabited and used by Native Americans. The Modoc people have identified a strong spiritual tie to these lands and desire to conduct traditional activities and their forefathers had done. There is quite a bit of written ethnographic data for the Native American groups whose traditional lands included the monument, but more information needs to be obtained concerning contemporary use of the monument.

Needs: Lava Beds National Monument is currently (FY00) entering into a contract to develop an ethnographic overview. It will identify the peoples traditionally associated with monument resources and those ethnographic resources. The overview will provide a summary of the existing ethnographic resources, associated data, and an analysis of the resources. In addition, the research will identify traditional user groups, past uses, activities, and practices, present needs or desired uses, and should identify tribal leaders and elders for future consultation.

APPENDIX I: R-MAP STAFFING PLAN

Resources Management Assessment Program (R-MAP)

NR-MAP and its sister CR-MAP are processes which provide a workload assessment of the base staffing and funding needed to implement a comprehensive natural and cultural resources management program. R-MAP allocates Full Time Equivalents (FTEs) and support funding for natural and cultural resources management. Several programs are contained within this category such as vegetation and wildlife management, environmental planning, archeological resources management and program supervision.

NR-MAP allocates a total of 23.8 FTE to conduct a comprehensive natural resources management program and 10 FTE to manage cultural resources at Lava Beds. An additional 5 FTE are funded through the FIREPRO program for a total of 38.8 FTE. This does not include the resource protection function which is projected by V-RAP (6.0 FTE) . It also does not include the research workload (3.15FTE) which is a function of USGS-BRD.

The FTEs and positions needed to fully fund the Resources Management Program to the R-MAP level will be phased in over a period of time to close the gap between the current resources program of 8.5 FTE (5 of which are FIREPRO funded positions) and the fully funded level of 38.8 FTE. The following sections describe the natural and cultural resource programs identified by R-MAP and strategies for implementing each program.

Division of Resource Management

The purpose of this section is to describe the current and fully funded natural and cultural resources program of the Division of Resources Management and to identify the positions needed to address the natural and cultural resource issues and implement the strategies described in the previous section.

The Natural Resources Management program at Lava Beds National Monument is designed to preserve the natural resources and ecosystem processes within the monument. Natural resources management activities are aggregated into programs, managed by professional natural resource managers who are responsible for implementing the programs and integrating them with cultural programs and other parkwide programs.

Based on the NR-MAP allocations for Lava Beds, a total of 23.8 FTE (plus 5 FTE for the fire operation which is funded by FIREPRO) for a total of 28.8 FTE that are required to manage a comprehensive natural resource program. This does not include the resource protection function which is projected by V-RAP (6.0 FTE). It also does not include the research function which under the DOI's current organization would be met through USGS-BRD (3.2 FTE).

With the current Natural Resources Management program of 7 FTE's, (of which 4.5 FTE are FIREPRO positions) there is a gap of 21.8 FTE's. This plan proposes that the Resources Management Division be organized into one Office and four Branches. NR-MAP program responsibilities and clerical support will be split between the Branches as described in the following table. The organization will develop as funding and positions increase.

Two phases or levels (beyond the current level) will bring the current natural resources management program to the fully funded level of 28.8 FTEs. The positions and phases in which they will be filled are listed below. Highest priority for funding and base increases will be directed toward Vital Signs Inventory & Monitoring programs, programs that impact ecosystems on a large scale and programs that restore altered natural resources to natural conditions.

The FTE will be spread throughout the Branches to ensure the availability of professional level employees qualified to manage each natural resources management program for which FTEs have been allocated. Phase I will add 10.8 FTE to the current 7 FTE and Phase II will add an additional 11 FTE to bring each Branch up to the fully funded NR-MAP staffing level.

The Cultural Resources Management program at Lava Beds National Monument is designed to preserve and protect the nationally significant archeological, historic and ethnographic resources associated with Lava Beds. Cultural resources management activities are grouped into programs, managed by professional cultural resource managers who are responsible for implementing the cultural resources programs and integrating them into the parkwide programs.

Based on the CR-MAP allocations, a total of 10 FTEs are required to implement a comprehensive cultural resource management program. With the current Cultural Resources Management staffing of 1 FTE, there is a gap of 9 FTE to fully staff the program. One of the four Branches proposed in this plan is the Branch of Cultural Resources Management.

As with the Natural Resources Management program, there are two phases or levels (beyond the current level) that will bring the current program to the fully funded level of 10 FTEs. The positions and phases in which they will be filled are listed below.

The FTE will be added in order to ensure the availability of professional level management in each cultural discipline. Phase I will add 3 FTE to the current 1 FTE and Phase II will add an additional 6 FTE to bring the Branch up to the fully funded CR-MAP staffing level.

Resources Management

I. Program Overview

This Office will be responsible for long-range planning, environmental compliance, personnel management, position management, budgeting and the overall supervision of the resources management program. The Division Chief will provide overall program direction, development, long-range planning and position management.

This Office does not exist at this time. Currently there is only the Division Chief. The organization as outlined in this Plan will be developed as funding becomes available

II. Funded FY99 Division of Resources Management Office

Current ONPS Funding: $62,590 1.0 FTE.

The current organization consists of the Division of Resources Management Chief (GS-401-12). The Division Chief is responsible for the management and supervision of all natural and cultural resource management programs including fire management, environmental compliance, planning and budget formulation, execution, review and tracking.

The monument's Administrative Division provides administrative support for the Division. The Division currently includes 7 FTE and usually has an additional summer crew of 2 Student Conservation Association research assistants and a 6 person Youth Conservation Corps.

III. Unfunded Division of Resources Management Office

The total R-MAP allocation in the proposed Divisional Office is 4.0 FTE. The existing shortfall is 3.0 FTE. The overall organization of the Office is outlined below. Additional detail can be found in the Project Statement sections of the Plan.

Management/Supervision/Support (2.0 FTE)

The management/supervision function will be the responsibility of the Division Chief. In Phase I, the Chief of Resources Management will be promoted to Chief of Resources Management (GS-401-13). Phase I will create a Secretary (GS-318-05) position to support the work of the Office.

GIS/Environmental Compliance (2.0 FTE)

A GIS Specialist (GS-150-11) will be employed to manage spatial data collection, storage, and interpretation for the monument. Phase I will also create a Resource Management Specialist position (GS-401-11) which will be responsible for environmental compliance and planning as well as serving as the liaison with the Visitor Services Division.

Branch of Biological Sciences

I. Program Overview

The Branch of Biological Sciences will be responsible for planning, compliance, implementing and monitoring of the following: native and exotic plant and animal management; disturbed area restoration; T&E species management; IPM; and the natural history collection. This Branch does not exist at this time.

The Branch of Biological Sciences will be involved in all aspects of vegetation and wildlife issues. The Branch will prepare Environmental Assessments, review and recommend projects, and develop interagency contacts and partners to further the monument's long-range objectives.

Native and Exotic Plant Management

This program involves the inventory and monitoring of native and exotic plant populations, forest pest management, mitigation of disturbed lands, and control of exotic plants. The current

program consists of monitoring exotic plant populations and controlling high priority infestations. Once staffed, this section will maintain a native plant nursery for revegetation projects on trails, road shoulders, constructions sites and other disturbed lands.

Wildlife Management

This program will be responsible for planning, implementing, and managing wildlife programs as well as implementing the IPM program. It will identify needed research, develop and implement management programs, and monitor the effectiveness of programs. This group will be responsible for implementing all aspects of the Endangered Species Act, monitoring and control of exotic wildlife species and together with the plant management shop, manage for the long-term health of Lava Bed's ecosystems. Integrated Pest Management Servicewide guidelines will be implemented by this Branch.

II. FY 99 Funded Biological Sciences Branch Base and Staffing

Current ONPS Funding: $ 78,525 1.75 FTE***

The current organization consists of one Biological Technician (GS-404-09) using .75 FTE, one Term Biological Technician (GS-404-07) funded through 2001 with non-Resource Management Division Park Base funding ($35,000), and one seasonal Biological Technician (GS-404-05).
This Branch provides 18% of the 9.5 FTE required staffing as determined by the R-MAP allocation for this function.

III. Unfunded Biological Sciences Branch Base and Staffing

The total R-MAP allocation for this Branch is 9.5 FTE. The existing shortfall is 7.75 FTE. The overall organization and positions are summarized below. Additional detail can be found in the Project Statements section of the Plan.

Phase I will create a Branch Chief, Biological Sciences (GS-401-11) responsible for the integration of all Vital Signs Monitoring, native plant management, wildlife management and exotic species control.

Vegetation Management

Phase I will create one permanent Botanist (GS-430-11) responsible for exotic plant control and monitoring, disturbed area rehabilitation, and planning/compliance issues related to vegetation. It will also establish Biological Technician (GS-404-07) positions (2.0 FTE) to assist with exotic plant control, disturbed area rehabilitation and T&E species management programs.

Phase II will create a Wildlife Biologist position (GS-486-11) responsible for native animal management and monitoring, T&E species management and compliance issues related to wildlife management. It will establish a Biologist/IPM Specialist (GS-401-09) who will serve as the IPM coordinator, assist with exotic plant control and manage the natural history collection.

Biological Technician (GS-404-07, 2.5 FTE) positions will be created to assist with wildlife related program implementation. A Clerk (GS-326-04) will be hired to support the Division.

Branch of Physical Sciences

I. Program Overview

The Branch of Physical Sciences will be responsible for the coordination, implementation and management of the monument's volcanic resources, soil and Class I Airshed. This Branch will administer the Cave Management program, air quality program, and other related earth science initiatives that will enhance long-term ecosystem viability. Additional responsibilities will include the identification of needed research, development, and implementation of management programs directed toward problem mitigation and the restoration and maintenance of natural ecosystem processes. A small component of these duties are currently being managed with available staff, but this Branch does not currently exist under the present Resources Management Divisional organization.

Cave Resources Management

As caves and their associated features are a premiere resource at Lava Beds, an active management program has been in place for many years. It functions almost solely due to the efforts of numerous volunteers dedicated to Lava Bed's cave resources. The future of this program hinges on the ability to build on the past with professional cave specialists and technicians coordinating the program.

Class I Airshed Management

The air quality program will be responsible for managing the Class I Airshed as well as monitoring weather and various components such as PM10, ozone and other critical air quality indicators.

II. FY 99 Funded Physical Sciences Branch Base and Staffing

Current ONPS funding: $ 26,250 0.75 FTE

The current staff allocation to implement the cave management program and other functions of this Division is one Biological Technician (GS-404-07) Term position for 0.75 FTE.

III. Unfunded Physical Sciences Branch Base and Staffing

Physical Science Branch positions in cave management and air quality will be required to fully implement the responsibilities of this branch. The R-MAP allocation for this Branch is 8.0 FTE. The shortfall is 7.25 FTE. The overall organization and required positions is summarized below. Additional detail can be found in the Project Statement section of this Plan.

Phase I will create a Physical Sciences Branch Chief (GS-1301-11) with responsibilities of overseeing the cave management program, volcanic resources management, and planning/compliance issues related to geologic resources management.

Phase I will also establish the following positions: Physical Scientist (GS-1301-11) position responsible for inventory and monitoring cave resources and managing the cave program; Physical Scientist (GS-1301-09) responsible for air quality and assisting with geologic resources management; and a Physical Science Technician (GS-1311-07) to assist with cave management, air quality and the Vital Signs Inventory and Monitoring program.

Phase II will create the following positions: Physical Scientist (GS-1301-09) to assist in the planning and implementation of the cave management and I&M programs; Physical Science Technicians (GS-1311-07, 2.0 FTE) responsible for conducting fieldwork in support of the cave, geologic, air quality and I&M programs; Clerk (GS- 326-04) to support the Physical Sciences Branch.

Branch of Fire Management

I. Program Overview

The Fire Management Branch at Lava Beds National Monument integrates the suppression and presuppression functions with an aggressive prescribed fire management program. Under NPS mandates and directives and due to the fire history at Lava Beds, a comprehensive program funded by FIREPRO has been established which includes funding for a fire crew, administrative support, supplies and equipment.

The Fire Management Branch is responsible for managing all aspects of the fire management program including prevention, presuppression, suppression, prescribed fire, and fire monitoring. The Branch will also work closely with the Biological Sciences and Physical Sciences Branches to promote fire science research projects directed toward maintaining the natural role of fire in the ecosystems at Lava Beds.

The fire management program is fully funded by FIREPRO. R-MAP only allocates staff for the use of prescribed fire management programs designed to enhance ecosystem management. Prescribed fire is currently being used to reduce unnatural accumulations of fuels, to promote native plant health and return the natural role of fire to the land.

II. Funded FY 99 Fire Management Branch Base and Staffing

Current FY 99 FIREPRO funding: $221,455 4.6 FTE

FIREPRO currently funds a Fire Management Officer (GS-401-11); Fire Program Assistant (GS-303-05); Engine Foreman (GS-462-06, 0.5 FTE); Prescribed Fire Technician (GS-462-07, 0.8 FTE); and Forestry Technician seasonal firefighters (GS-462-04, 1.3 FTE).

III. Unfunded Fire Management Branch Base and Staffing

FIREPRO and R-MAP allocations for this Branch total 7.3 FTE. The shortfall is 2.7 FTE. The overall organization and required positions is summarized below.

Phase I will upgrade the Prescribed Fire Technician (GS-462-07, 0.8 FTE) to Prescribed Fire Specialist (GS-401-09, 1 FTE). The Engine Foreman (GS-462-06, 0.5 FTE) will be upgraded to Engine Foreman (GS-462-07, 1FTE). An additional 0.5 FTE will be funded for seasonal Forestry Technicians (GS-462-04) for a total of 1.2 FTE and they will be upgraded to GS-05.

Phase II will involve adding an additional 1.5 FTE for seasonal Forestry Technicians (GS-462-05) for a total of 2.7 FTE of seasonal Forestry Technician firefighters.

Cultural Resources Management Branch

I. Program Overview

Lava Beds National Monument was established, in part, to protect and preserve the nationally significant historic and prehistoric resources found within the monument. The Cultural Resources Management Branch will be responsible for the coordination, implementation and management of the monument's archeological resources, historic resources, ethnographic resources, cultural landscapes, park library and the museum collection and curation programs. Additional responsibilities will include the identification of needed research and mitigation projects directed toward the protection and preservation of the monument's cultural resources. This Branch does not currently exist at Lava Beds National Monument but is instead a collateral duty which diminishes all programs.

Archeology Program

The archeology program will be responsible for inventorying and monitoring archeological sites. The entire monument has been designated an "Archeological District" and therefore all management actions must consider the potential impacts to the District. Additionally, this program will prioritize the monument's lands for archeological survey as well as determine the program's research needs.

Historic Resources Program

The Historic Resources program will be tasked with managing the List of Classified Structure (LCS), National Register of Historic Place sites, Section 106 of the National Historic Preservation Act (NHPA), Inventory and Condition Survey (ICAP), and the survey, treatment and management of other historic sites. Additionally, this program will generate requests and implement projects for Historic Structure Reports, and other research necessary to protect the monument's historic resources.

Ethnographic Resources Program

The Ethnographic Resources program will be responsible for identifying and managing traditional ethnographic sites and resources such as ceremonial locales, structures, objects and landscapes used and assigned cultural significance by traditional users. This program will also be responsible for identifying and seeking funding for Ethnographic Overviews and Assessments, research, traditional use studies, ethnohistory studies, and maintaining a liaison with the Tribes.

Museum Collections Management Program

The Collection Management program is tasked with managing the cultural and natural museum objects, archives, and library materials. This program will ensure that needed research and documentation (accessioning and cataloging) are conducted on and for all objects within the museum collection and that all necessary procedures are implemented to provide appropriate stewardship of the collection. This shop will generate requests for Collection Management Plans, Storage Plan, specific treatments, Condition Survey, upgrading museum storage, museum security surveys, and other projects necessary to manage the program.

II. FY 99 Funded Cultural Resources Management Branch Base and Staffing

Current ONPS Funding: $ 8,000 0.15 FTE***

***This represents Lava Bed's share of a subject to furlough archeologist position stationed at REDW.

III. Unfunded Cultural Resources Management Branch Base and Staffing

R-MAP allocations have determined that 10.0 FTE are needed to adequately manage the Cultural Resources Branch. The shortfall is 9.85 FTE. The overall organization and required positions is summarized below.

Phase I will create a Branch Chief for Cultural Resources (GS-interdisciplinary-12) responsible for the day-to-day management/supervision of the archeology, historic resources, ethnography, cultural landscape, library, and the museum collection/curation programs. An Archeologist (GS-193-11) position will be established to manage the archeological I&M program and coordinate research. Additionally, an Archeological Technician (GS-102-07) position will be created responsible for implementing archeological survey and I&M programs. A Historian (GS-170-11) will be hired to manage the LCS, ICAP and the treatment, restoration, and documentation of other historic resources.

Phase II will create the following positions: 2 additional Archeological Technicians (GS-102-07) to assist in the implementation of the archeological survey and I&M program; a Museum Curator (GS-1016-09) responsible for managing the museum collection and library; an Ethnographer (GS-190-11) to manage ethnographic resources, studies, traditional uses, NAGPRA and consultation; a Cultural Resource Manager (GS-interdisciplinary-11) to coordinate programs with natural resources, manage cultural landscapes, GIS/data management and act as liaison with the Visitor Services Division. Finally, a Clerk (GS-326-04) will be hired to support the Division.

Staffing Table

Summary of Base Funded FTE Increases Needed to Fully Implement R-MAP

Position (Phase I)	FTE
GIS Specialist (GS-150-11)	1.0
Secretary (GS-318-05)	1.0
Division Chief (GS-401-13)	1.0
Branch Chief, Biological Sciences (GS-401-11)	1.0
Resource Management Specialist (GS-401-11)	1.0
Plant Ecologist (GS-408-11)	1.0
Biological Technician (GS-404-07)	2.0
Branch Chief, Physical Sciences (GS-1301-11)	1.0
Physical Scientist (GS-1301-9/11)	1.0
Physical Scientist (GS-1301-09)	1.0
Physical Science Technician (GS-1311-07)	1.0
Branch Chief, Fire Management, FMO (GS-401-11)	1.0
Fire Program Clerk (GS-303-05)	1.0
Prescribed Fire Specialist (GS-401-09)	1.0
Engine Foreman (GS-462-07)	1.0
Forestry Technician (GS-462-05)	1.8
Branch Chief, Cultural Resources (GS-interdisciplinary-12)	1.0
Archeologist (GS-193-11)	1.0
Archeological Technician (GS-102-07)	1.0

Historian (GS-170-11)	1.0
FTE TOTAL PHASE I =	**21.8**

(Phase II)

Clerk, Physical Science Branch (GS-326-04)	1.0
Clerk, Biological Science Branch (GS-326-04)	1.0
Clerk, Cultural Resources Branch (GS-326-04)	1.0
Wildlife Biologist (GS-482-11)	1.0
Biologist, IPM (GS-401-09)	1.0
Biological Technician (GS-404-07)	2.5
Physical Scientist (GS-1301-09)	1.0
Physical Science Technician (GS-1311-07)	2.0
Forestry Technician (GS-462-05)	1.5
Archeological Technician (GS-102-07)	2.0
Museum Curator (GS-1015-09)	1.0
Ethnographer (GS-190-11)	1.0
Cultural Resource Manager (GS-interdisciplinary-11)	1.0
FTE TOTAL PHASE II =	**17.0**
FTE TOTAL =	**38.8**

LABE COMPREHENSIVE RESOURCES MANAGEMENT PROGRAM

PHASE I STAFFING PLAN
(21.8 FTE)

- **Division Chief, GS-13** (Responsible for management/supervision of all natural/cultural resource programs)
- Secretary: GS-5
- GIS Specialist: GS-11 (Responsible for park GIS, data management, natural resource library)
- Resource Management Specialist: GS 9/11 (Liaison with interpretation; coordinates planning and compliance)

- **Branch Chief, Biological Sciences:** GS-11 (Responsible for integration of all Vital Signs monitoring; native plant management and monitoring)
- Plant Ecologist/Botanist: GS-11 (Responsible for exotic plant control & monitoring; disturbed area rehabilitation; planning & compliance issues related to vegetation management)
- Biological Technicians: 2.0 FTE of GS-07 (may be full-time temporary or permanent employees, seasonals, or some combination – Assist with exotic plant control, disturbed area rehabilitation, plant/animal monitoring, T&E species management)

- **Branch Chief, Physical Sciences:** GS-11 (Responsible for cave management; volcanic resources management; planning and compliance issues related to geologic resources management)
- Physical Scientist: GS-11 (Responsible for inventory and monitoring of cave resources)
- Physical Scientist: GS-09 (Assists with cave management and inventory & monitoring of cave and volcanic resources)
- Physical Science Technician: GS-07 (Assist with cave management, inventory & monitoring, volcanic resources management, air resource monitoring)

- **Branch Chief, Fire Management**: GS-11 (Fire Management Officer)
- Fire Program Clerk: GS-05
- Prescribed Fire Specialist: GS-09
- Engine Foreman: GS-07
- Forestry Technicians: GS-05 (1.8 FTE of seasonal or STF positions- Responsible for implementing prescribed fire and wildland fire program)

- **Branch Chief, Cultural Resources**: GS-12 (Responsible for day to day management/supervision of the archeology, historic resources, ethnography, cultural landscape, and museum curation programs and the library)
- Archeologist, GS-11 (Responsible for archeology inventory, monitoring and management)
- Archeological Technician: GS-07 (Responsible for implementing arch.survey, monitoring)

- Historian: GS-11 (Responsible for LCS, ICAP (Inv. & condition survey), treatment, restoration, mgmt. of other historic structures)

LABE COMPREHENSIVE RESOURCES MANAGEMENT PROGRAM

FINAL (PHASE II) STAFFING PLAN
FULLY STAFFED
(38.8 FTE)

- **Division Chief, GS-13** (Responsible for management/supervision of all natural/cultural resource programs)
- Secretary: GS-5
- GIS Specialist: GS-11 (Responsible for park GIS, data management, natural resource library)
- Resource Management Specialist: GS 9/11 (Liaison with interpretation; coordinates planning and compliance)

- **Branch Chief, Biological Sciences:** GS-11 (Responsible for integration of all Vital Signs monitoring; native plant management and monitoring)
- Clerk: GS-4
- Plant Ecologist/Botanist: GS-11 (Responsible for exotic plant control & monitoring; disturbed area rehabilitation; planning & compliance issues related to vegetation management)
- Wildlife Biologist: GS-11 (Responsible for native animal management and monitoring; T&E management and monitoring; planning and compliance issues related to wildlife management)
- Biologist/IPM Specialist/Curator: GS-09 (Serves as IPM coordinator; assists with exotic plant control and monitoring; responsible for natural history collection)
- Biological Technicians: 4.5 FTE of GS-07 (may be full-time temporary or permanent employees, seasonals, or some combination – Assist with exotic plant control, disturbed area rehabilitation, plant/animal monitoring, T&E species management)

- **Branch Chief, Physical Sciences:** GS-11 (Responsible for cave management; volcanic resources management; planning and compliance issues related to geologic resources management)
- Clerk, GS-4
- Physical Scientist: GS-11 (Responsible for inventory and monitoring of cave resources)
- Physical Scientist: GS-09 (Responsible for air resource management; assists with cave management and inventory)
- Physical Scientist: GS-09 (Assists with cave management and inventory & monitoring of cave and volcanic resources)
- Physical Science Technicians: GS-07 (3.0 FTE, may be full-time temporary or permanent employees, seasonals or some combination –Assist with cave management, inventory & monitoring, volcanic resources management, air resource monitoring)

- **Branch Chief, Fire Management**: GS-11 (Fire Management Officer)
- Fire Program Clerk: GS-05
- Prescribed Fire Specialist: GS-09

- Engine Foreman: GS-07
- Forestry Technicians: GS-05 (3.3 FTE of seasonal or STF positions- Responsible for implementing prescribed fire and wildland fire program)

- **Branch Chief, Cultural Resources**: GS-12 (Responsible for day to day management/supervision of the archeology, historic resources, ethnography, cultural landscape, and museum curation programs and the library)
- Clerk, GS-04
- Archeologist, GS-11 (Responsible for archeology inventory, monitoring and management)
- Archeological Technician: GS-07 (Responsible for implementing arch.survey, monitoring)
- Archeological Technician: GS-07 SAME
- Archeological Technician: GS-07 SAME
- Museum Curator: GS-09 (Responsible for managing museum collection)
- Ethnographer: GS-11 (Responsible for ethnographic resources management, studies, traditional uses, NAGPRA and consultations)
- Historian: GS-11 (Responsible for LCS, ICAP (Inv. & condition survey), treatment, restoration, mgmt. of other historic structures)
- Cultural Resource Manager: GS-11 (Responsible for coordination with natural resources, cultural landscape program, GIS/data management, and liaison with interpretation division)

APPENDIX II: GEOLOGY MAP

APPENDIX III: PROJECT STATEMENTS

APPENDIX IV: UNFUNDED PROJECTS

APPENDIX V: CULTURAL RESOURCE DOCUMENTATION CHECKLIST

APPENDIX VI: LIST OF PREPARERS

Chuck Barat, Chief of Resources Management, Lava Beds National Monument

Craig W. Dorman, Superintendent, Lava Beds National Monument

Terry Harris, Chief of Resource Protection and Visitor Services, Lava Beds National Monument

Corey Preston, Chief of Maintenance, Lava Beds National Monument

Chris Zinda, Chief of Administration, Lava Beds National Monument