Lava Beds National Monument

U.S. Department of the Interior
National Park Service









Draft General Management Plan and Environmental Assessment

September 2010


© Michael Thompson

United States Department of the Interior
NATIONAL PARK SERVICE
Lava Beds National Monument
P.O. Box 1240
Tulelake, California 96134

IN REPLY REFER TO:
D18

September 2010

Dear Friends of Lava Beds National Monument:

It is with great pleasure that we submit to you *the Draft General Management Plan and Environmental Assessment for Lava Beds National Monument* (GMP/EA). When completed, this plan will guide our management of the monument over the next 15- to 20-years. However, before the GMP/EA can be completed, it is important that we receive comments on this draft. Please take the time to review this draft and provide us with any comments you may have.

The *Draft General Management Plan* offers three alternative approaches to public use and enjoyment of the monument, protection of natural and cultural resources, and the overall management of this unique unit of the National Park System. The environmental consequences section of the document provides an understanding of the effects each alternative would have on the environment.

This plan represents your involvement and input into the planning process. The preferred alternative addresses concepts that many of you proposed or supported including more opportunities to learn about monument resources through new interpretive and educational opportunities, enhanced protection of resources through research and restoration efforts, and improved facilities at Petroglyph Point. Your input to this plan is important and will make it a better guide for the future of the monument. You are invited to attend public meetings where you can meet with the planning team to ask questions, discuss, and provide public comments. These meetings will be held in October 2010. Dates, times and locations of these meetings will be published in a newsletter sent to all on our mailing list, in local newspapers, and on our webpage at www.nps.gov/labe. You may submit comments or receive updates on the GMP/EA online through the NPS Planning, Environment and Public Comment System (PEPC) at http://parkplanning.nps.gov/labe. An electronic public comment form is provided through this website. The public comment period for this draft GMP/EA will extend through November 30, 2010. If you prefer you may also send us written comments via US Mail to the address below:

Lava Beds National Monument
Attn: General Management Plan Team
P.O. Box 1240
Tulelake, CA 96134

Our planning effort has benefited from your participation and involvement. We thank you for taking the time to make this the best plan possible for such a special place.

Sincerely,

David F. Kruse, Superintendent
Lava Beds National Monument



Lava Beds National Monument
Draft General Management Plan and Environmental Assessment

Lava Beds National Monument
P.O. Box 1240
Tulelake, CA 96134

Contact: Dave Kruse, Superintendent
Phone: (530) 667-8101

Prepared by:
National Park Service
Pacific West Regional Office
Park Planning and Environmental Compliance
1111 Jackson Street, Suite 700
Oakland, CA 94607



Draft General Management Plan / Environmental Assessment

The National Park Service (NPS) planning team identified three alternatives for managing Lava Beds National Monument for the next 15 to 20 years. These alternatives respond to National Park Service planning requirements, and the issues identified during public scoping. The alternatives establish desired future conditions for administration and management, cultural and natural resource protection, research, education, and opportunities for visitor enjoyment. The alternatives also respond to comments received through public scoping and the ongoing involvement of public agencies, tribes, local communities, organizations, and individuals. Alternative B is the preferred alternative of the NPS to guide future management of Lava Beds National Monument.

Alternative A, Continue Current Management, constitutes the "No Action" alternative and assumes that existing programs, facilities, staffing, and funding would generally continue at their current levels.

Alternative B (Preferred), Expanding Learning and Resource Preservation through Collaboration, is the preferred alternative. Under this alternative Lava Beds National Monument becomes a model for promoting and strengthening resource protection and restoration through stewardship, research, education, and inter-agency cooperation. Visitor opportunities would be expanded through improvements in existing facilities, establishment of new trails, increased interpretive efforts, and expanded educational programming. Sustainability of monument operations would be enhanced.

Alternative C, Diversified Recreation Opportunities, emphasizes an expanded range of visitor programs and recreation opportunities. The National Park Service would strive to meet both current and changing visitor needs by expanding and adding facilities to provide more recreational opportunities. Expanded outreach efforts would develop a more visible identity for the monument. These actions would enhance appreciation for the unique resources protected at Lava Beds and improve understanding of the monument's role in its regional setting.

The environmental consequences of the alternatives are examined in the Environmental Assessment. Results of public involvement, consultation, and coordination conducted throughout the planning process are included in Chapter 6: Consultation and Coordination.

How to Comment on this Document

This Draft General Management Plan / Environmental Assessment has been distributed to other agencies and interested organizations and individuals for their review and comment. The public comment period for this document will last for approximately 60 days. Please submit comments by November 30, 2010.

This document is available online at the NPS Planning and Public Comment System website at http://parkplanning.nps.gov/labe. An online public comment form is provided at this website.

Comments may also be made in person at one of the public workshops that will be conducted during the public review period. The specific dates and times for these workshops will be announced in local newspapers, in the Draft General Management Plan newsletter, and online at the above site.

For further information or to send written letters or comment forms on this draft plan, contact or write:

Dave Kruse, Superintendent
Lava Beds National Monument
Attn: General Management Plan Team
P.O. Box 1240
Tulelake, CA 96134

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that the NPS practice is to make comments, including the names and addresses of respondents, available for public review. Individual respondents may request that their address be withheld from the planning record, which will be honored to the extent allowable by law. There also may be circumstances in which a respondent's identity would be withheld from the record, as allowable by law. To have your name and/or address withheld, state this prominently at the beginning of the comment.

A Guide to This Document

This *Draft General Management Plan / Environmental Assessment* is organized in accordance with the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act, the National Park Service's "*Park Planning Program Standards*," and Director's Order 12 and Handbook, "*Conservation Planning, Environmental Analysis, and Decision Making.*"

Chapter 1: Introduction sets the framework for the entire document. It provides an overview of the monument, describes why the plan is being prepared and what needs it must address. This chapter also details the planning opportunities and issues that were raised during internal and public scoping meetings. The alternatives in Chapter 3 address these issues and concerns. Next is a statement of the scope of the environmental assessment—specifically what impact topics are or are not analyzed in detail. This chapter concludes with a list of servicewide laws and policies that are applicable to all of the alternatives presented in this plan and an overview of other related planning efforts are documented.

Chapter 2: Foundation for Planning and Management provides guidance for the management alternatives that are being considered. This guidance is based on the national monument's establishing legislation or proclamation, its purpose, the significance of its resources, fundamental resources and values, special mandates, and administrative commitments.

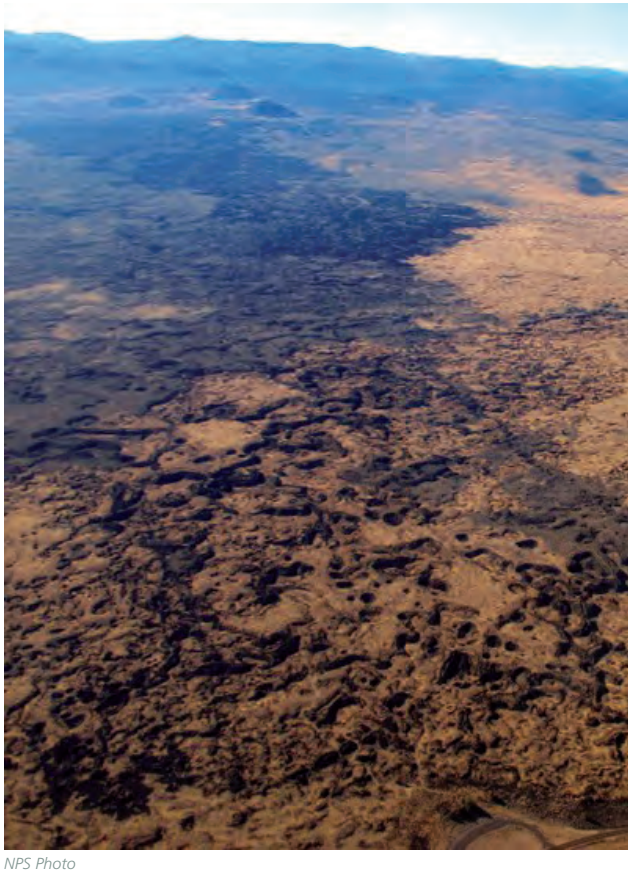
Chapter 3: Alternatives begins with an overview of the individual components included in the General Management Plan alternatives. This section defines management zones that would be used to manage the national monument in the future and specific actions that are common to all three alternatives. Next is the full description of the three alternatives. It includes the continuation of current management practices and trends in the national monument (alternative A – no action). Two alternatives for managing the monument, the preferred alternative (alternative B) and alternative C are also presented. The description of the alternatives concludes with summary tables of the alternatives and their anticipated costs. This section is followed by a summary of the environmental consequences of implementing those alternatives. Next is a discussion of user capacity indicators and standards. The chapter concludes with mitigation measures proposed to minimize or eliminate the impacts of some proposed actions in the alternatives and identification of the environmentally preferred alternative.

Chapter 4: The Affected Environment describes those areas and resources that would be affected by implementing the actions contained in the alternatives.

Chapter 5: Environmental Consequences analyzes the impacts of implementing the alternatives on topics described in the "Affected Environment" chapter. Methods that were used for assessing the impacts in terms of the intensity, type, and duration of impacts are outlined for each impact topic.

Chapter 6: Consultation and Coordination describes the history of public and agency coordination during the planning effort, including Native American consultations, and any future compliance requirements. It also lists agencies and organizations that will be receiving copies of the document. A list of preparers and planning team functions for this plan is included at the end of this chapter.

Appendices, Glossary, Acronyms, and Selected References are found at the end of the document.



NPS Photo

Table of Contents

How to Comment on this Document iii
A Guide to This Document iv
Table of Contents v
Executive Summary ix

Chapter One: Introduction 3

Background on Lava Beds National Monument 3
Purpose and Need for the General Management Plan 6
Planning Issues and Concerns 7
Relationship of Other Planning Efforts to This General Management Plan 11
Impact Topics Considered in the Plan 13
Servicewide Laws and Policies 16

Chapter Two: Foundation for Planning 31

Introduction 31
Foundation Statement Components 31

Chapter Three: Alternatives 37

Introduction 37
Formulation of the Alternatives 37
Identification of the Preferred Alternative 39
Potential for Boundary Adjustments 40
Overview of Management Zones 40
Description of the Alternatives 47
Alternative A: The No Action Alternative 50
Alternative B: Expanding Learning and Resource Preservation through Collaboration (Preferred Alternative) 56
Alternative C: Diversified Recreation 71
User Capacity 95
Mitigation Measures for the Action Alternatives 103
Environmentally Preferred Alternative 108
Actions/Alternatives Considered But Eliminated From Detailed Consideration 109
Implementation of the General Management Plan 110

Chapter Four: Affected Environment 111

Air Quality 113
Soundscape 114
Night Sky 114
Viewsheds 115
Geological Resources 116
Hydrologic Resources 121
Soils 123
Vegetation 123
Wildlife 124
Wilderness 127
Fire 128
Climate Change 132
Prehistory 135
Historic Overview 135
Contemporary Tribal Interests 135
Archeological Resources 136
Ethnographic Sites 137
Historic Structures 137
Cultural Landscapes 137
Museum Collections 140
Access and Circulation 140
Accessibility and Special Populations 143
Monument Visitation 145
Fee Collection 147
Education 147
Interpretation 149
Recreational Opportunities 152
Park Infrastructure and Facilities 154
Asset Management 154
Park Divisions and Staffing 155
Carbon Footprint 156
Regional Socioeconomics 157

Chapter Five: Environmental Consequences 165

Introduction 165
Cumulative Impacts 166
Impairment of Resources 168
Methods and Assumptions 169
Air Quality 169
Soundscape 172
Dark Night Skies 174
Viewsheds/Visual Resources 177
Cave Resources 180
Geologic Resources 184
Soils 188
Vegetation 191
Wildlife and Wildlife Habitat 194
Special Status Species 199
Archeology 202
Cultural Landscapes, Historic Buildings, and Structures 206
Ethnographic Resources 210
Museum Collections 213
Wilderness 217
Visitor Experience 219
Interpretation and Education 224
Access and Transportation 229
Monument Operations 231
Carbon Footprint (Energy Conservation) 233
Socioeconomics 235

Chapter Six: Consultation and Coordination 243

Introduction 243
Public Scoping 243
Preliminary Alternatives/Management Concepts 244
Consultation with Other Agencies, Officials, and Organizations (To Date) 245
Future Compliance Requirements 246
Public Officials, Agencies, Organizations, and Individuals Receiving a Copy of This Document 247
List of Preparers 249

Appendices 251

Appendix A: Presidential Proclamation Establishing Lava Beds National Monument 253
Appendix B: Consultation Letters 254
Glossary 260
Acronyms and Abbreviations 267
Selected References 268



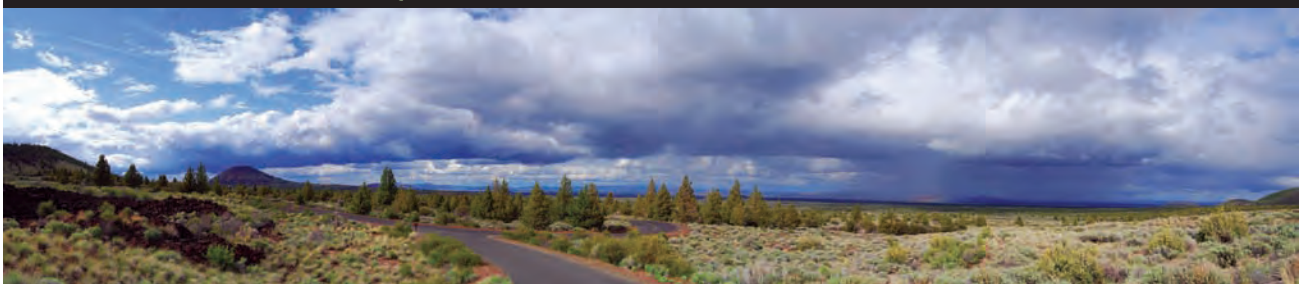
MAPS

MAP 1: REGIONAL CONTEXT 3
MAP 2: MONUMENT MAP 5
MAP 3: ALTERNATIVE B - INDIAN WELL HEADQUARTERS AND VISITOR CENTER 58
MAP 4: ALTERNATIVE B ZONING - MAIN MONUMENT 59
MAP 5: ALTERNATIVE B - PETROGLYPH POINT 60
MAP 6: ALTERNATIVE B - CAVE LOOP 60
MAP 7: ALTERNATIVE B - CAMPGROUND LOOP 60
MAP 8: ALTERNATIVE C - INDIAN WELL HEADQUARTERS AND VISITOR CENTER 72
MAP 9: ALTERNATIVE C ZONING - MAIN MONUMENT 73
MAP 10: ALTERNATIVE C - PETROGLYPH POINT 74
MAP 11: ALTERNATIVE C - CAVE LOOP 74
MAP 12: ALTERNATIVE C - CAMPGROUND LOOP 74
MAP 13: SURFACE GEOLOGY AND ABANDONED CINDER MINES 118
MAP 14: LAVA FLOWS 120
MAP 15: VEGETATION TYPES 122
MAP 16: FIRE HISTORY 129
MAP 16: HISTORIC STRUCTURES 138
MAP 17: ROADS AND TRAILS 141

TABLES AND FIGURES

TABLE 1: SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS 17
TABLE 2: MANAGEMENT ZONES 41
TABLE 3: ACTIONS COMMON TO ALL ALTERNATIVES 47
TABLE 4: MANAGEMENT ACTIONS FOR ALTERNATIVE A 52
TABLE 5: SUMMARY OF COSTS FOR ALTERNATIVE A 55
TABLE 6: MANAGEMENT ACTIONS FOR ALTERNATIVE B 61
TABLE 7: SUMMARY OF COSTS FOR ALTERNATIVE B 70
TABLE 8: MANAGEMENT ACTIONS FOR ALTERNATIVE C 75
TABLE 9: SUMMARY OF COSTS FOR ALTERNATIVE C 80
TABLE 10: SUMMARY OF ALTERNATIVES 81
TABLE 11: SUMMARY OF IMPACTS 84
TABLE 12: USER CAPACITY INDICATORS AND STANDARDS 98
TABLE 13: RARE AND SENSITIVE SPECIES 126
TABLE 14: PREDICTED CHANGES 132
FIGURE 1: ANNUAL VISITATION (RECREATION VISITS) 144
FIGURE 2: CAMPGROUND USE 146
TABLE 15: MONUMENT FUNDING 155
TABLE 16: POPULATION 157
TABLE 17: POPULATION PROJECTIONS 158
TABLE 18: PER CAPITA PERSONAL INCOME 158
TABLE 19: UNEMPLOYMENT RATES 159
TABLE 20: PERCENT OF PEOPLE LIVING IN POVERTY 159
TABLE 21: REGIONAL TOURISM 160
TABLE 22: FUTURE COMPLIANCE REQUIRED FOR IMPLEMENTATION 247

Executive Summary



Introduction

Located in northern California, Lava Beds National Monument encompasses 46,560 acres at the junction of the Sierra-Klamath, Cascade, and Great Basin geologic provinces. President Calvin Coolidge established Lava Beds National Monument by presidential proclamation on November 21, 1925 (No.1755, 44 Stat. 2591). The monument protects and interprets volcanic and natural features of scientific interest, and evidence of prehistoric and historic human settlement, use, and conflict.

The last general management plan (GMP) was completed in 1996 and much has happened since then. Additional land has been added at Petroglyph Point, visitation patterns have changed, and monument staff and researchers have learned more about the significance of the monument's geologic features and historic sites. Each of these changes has implications for how visitors access and use the monument, the facilities needed to support these uses, how resources are managed, and how the National Park Service (NPS) manages its operations.



Subway Cave, *CalLibrary Photo, 1932*

This draft GMP was developed in consultation with NPS staff and program managers, local communities, government agencies, the Klamath Tribes, and other stakeholder groups. It establishes and articulates a management philosophy and framework for decision making and problem solving in the monument that would be implemented over the next 15-20 years. The new GMP will:

- clearly define resource conditions and visitor experiences to be achieved in the monument
- provide a framework for NPS managers to use when making decisions about how to best protect national park unit resources
- determine how to provide a diverse range of visitor experience opportunities
- determine how to manage visitor use
- determine what kinds of facilities, if any, are needed
- ensure that the foundation for decision making has been developed in consultation with interested stakeholders and adopted by the NPS leadership after an adequate analysis of the benefits, impacts, and economic costs of alternative courses of action

The GMP is based on an analysis of existing and predicted natural and cultural resource conditions, visitor experiences, environmental impacts, and costs. It primarily provides a framework for administration and management and a vision to be realized through future actions. This document also includes an environmental assessment (EA), which considers at a general qualitative level the impacts that each of the alternatives could have on the monument environment. The EA sets the framework for future compliance with the National Environmental Policy Act (NEPA) and the National Historical Preservation Act (NHPA) for the monument. It also assists decision makers and the public in assessing the relative merits and effects of any one alternative from the others.

Alternatives

Three alternatives are presented for the future management of Lava Beds National Monument. The alternatives, which are consistent with the monument's purpose, significance, and special mandates, present different ways to manage resources and visitor use and improve facilities and infrastructure at the monument. The three alternatives include, Alternative A: the No Action Alternative (continuation of current management) and two action alternatives, Alternative B: Expanding Learning and Resource Preservation through Collaboration (Preferred Alternative), and Alternative C: Diversified Recreation Opportunities.



Northern end of the monument, *NPS Photo*

Several other actions and alternatives were also considered, but were eventually dismissed from further analysis. These actions and alternatives, along with the rationale for their dismissal, are described near the end of Chapter 3, "Alternatives." The implementation of the proposed action will depend on future funding, NPS priorities, and partnership efforts. The approval of a GMP does not guarantee that funding and staffing needed to implement the plan will be forthcoming. Full implementation of the GMP could be many years into the future.

ALTERNATIVE A: NO ACTION

Alternative A consists of a continuation of existing management and trends and provides a baseline for comparison in evaluating the changes and impacts of the other alternatives. No major new construction would be authorized. The natural resource program would continue to focus on inventorying and monitoring, resource protection, preservation, mitigation, and applied research efforts. The cultural resource program would continue to focus on protecting archeological resources, museum collections, historic buildings and structures, and cultural landscapes. Recreational opportunities would continue to be focused on hiking, cave exploration, camping, wilderness experiences, exploration of historic sites, and viewing wildlife. Limited education programs would be provided for school groups and visitors. The existing monument boundary and designated wilderness boundaries would be maintained. The monument would continue current coordination with universities and researchers, the Klamath Tribes, the U.S. Forest Service, and the U.S. Fish and Wildlife Service, which is primarily for resource stewardship, interpretive, and administrative purposes. The Petroglyph Point unit would remain in its current condition with limited facilities and interpretive programs.

ALTERNATIVE B: EXPANDING LEARNING AND RESOURCE PRESERVATION THROUGH COLLABORATION (PREFERRED)

Alternative B emphasizes research and learning, while providing a wider range of visitor opportunities at Lava Beds National Monument. The monument would promote and strengthen resource protection and restoration through increased stewardship, research, educational opportunities, and inter-agency cooperation. These actions would engage a broader diversity of visitors.

Resource Management

The monument would work with adjoining land management agencies towards actively restoring native ecological communities. This may include restoring threatened, endangered species and extirpated species (e.g. greater sage-grouse). The geologic research program would be expanded to function as a center for research and technical assistance for lava tube caves, emphasizing monitoring, restoration of impacted geologic features and caves, and providing assistance to other volcanic parks and sister agencies through planning, surveying, research, and information sharing.

The cultural resources program would emphasize research and learning. The monument would expand research to address a range of regional cultural resources related to the Klamath Basin. Use of the research center for cultural resource research and

workshops would occur in coordination with the education program. A wider range of cultural and historical educational programming and interpretive materials would be developed. For example, new research and battle forensics would enhance interpretation and knowledge of the Modoc War sites.

Visitor Experience

The visitor experience at the monument would be focused on interpretation for a greater diversity of visitors. The monument would reach out to new audiences by expanding interpretive, educational, and recreational opportunities. Information and programs on new topics based on findings from expanded research programs would be offered and existing topics would be expanded. The monument would employ new technologies for interpretation and education (e.g. virtual cave tours, podcasts for audio tours) and more collections would be put on display at the visitor center.



Gillems Bluff, *Photo by David Hays*

Alternative B would place greater emphasis on enhancing and promoting the enjoyment of wilderness as one of the recreational experiences visitors enjoy at the monument. This would include the enjoyment of solitude, dark night skies, natural soundscapes, wilderness hiking, or backcountry camping. New opportunities to experience wilderness areas would be provided through additional outreach and education programs, new trail opportunities, and designated primitive backcountry camping sites.

Partnerships with schools, tribes, gateway communities, and others would be fostered to provide new opportunities for education. School groups and volunteers would have opportunities to participate in monument research programs. Workshops and interpretive programs about monument resources would be offered both within and outside of the monument at sites related to park significance (Modoc War battlefields, lava tubes, and portions of the Medicine Lake shield volcano).

Expanded recreational opportunities at Lava Beds would include new hiking opportunities and improved day use areas. New hiking trails would primarily include short interpretive loop trails. The monument would collaborate with the U.S. Forest Service to develop longer trail connections and provide opportunities for appropriate winter sports activities such as cross-country skiing or snowshoeing. More accessible trails would be provided to accommodate users of varying abilities.

Facilities

A limited number of new facilities would be provided to accommodate expanded educational programs, recreational opportunities, and research efforts while ensuring that Lava Beds National Monument retains its relatively undeveloped and rustic character. To better accommodate new educational and research programs, the monument would construct an addition to the current visitor center to provide classrooms, several offices, and more collections space. The monument would also explore expanding the research center laboratory area to accommodate new research opportunities. Several day use areas would be redesigned to better accommodate families and larger groups.

The northern entrance roads would be the primary access routes to the monument. If the southeast entrance road remains in poor condition, the NPS would encourage visitors to enter and exit the monument from the more heavily traveled and paved northern routes. Maintenance of the unpaved Medicine Lake Road within the monument would be enhanced to reduce summer season wash boarding. The monument would encourage bicycle use on roads and bicycle storage facilities would be provided at appropriate locations.

The monument would minimize the intrusion of existing buildings on monument views through visual screening, applying muted paint colors, installing less

reflective roofing materials, and minimizing lighting requirements. The NPS would place overhead utility lines underground and where possible, duplicative and unneeded facilities would be removed and revegetated to reduce the overall facility footprint on the monument and to reduce long-term maintenance obligations. For example, the rarely used wildlife overlook roads and parking areas would be removed and restored. A portion of the West Wildlife Overlook road would be retained for special events.



Cave skylight, *NPS Photo*

A new visitor day use area with an educational focus would be constructed at Petroglyph Point. The current road would be realigned southward around the petroglyphs, and the existing chain link fence would be replaced with a more aesthetically pleasing barrier that protects the petroglyphs and allows for wildlife movement and photography. A new wildlife (raptor) viewing area, parking areas, a seasonally staffed ranger contact station, a small picnic area, and an outdoor education space would be provided. Accessible trails would connect the new facilities with the petroglyphs.

The monument would provide more interpretive media for Cave Loop caves to improve the visitor experience (e.g. individual cave guide brochures for trails on the loop), promote responsible caving practices, and increase awareness about the preservation needs of cave resources. Vault toilets would be installed on the loop to reduce human waste issues in caves.

While maintaining its rustic character, the monument would explore various ways to improve the visitor experience in the campground for all types of campers (tent, recreational vehicle (RV) users, and large groups). RV hook-ups would continue to be provided outside of the monument at local RV campgrounds. To encourage longer stays, coin operated and limited time showers would be considered for the campground.

Monument Operations

To minimize its carbon footprint, the monument would make a comprehensive effort to reduce the current amount of energy used to operate the monument. This would be accomplished through changes in monument operations, the use of new sustainable technologies for electricity, heating, and motor vehicle fuel consumption and generating energy on-site from alternative sources such as photovoltaic panels. The NPS would work to reduce visitor reliance on automobiles once they have arrived at the monument by providing additional trail linkages between visitor sites and by encouraging bicycling on monument roads.

ALTERNATIVE C: DIVERSIFIED RECREATION

The monument would expand outreach efforts, visitor programs, and recreational opportunities in an effort to meet both current and changing visitor needs. These actions would enhance appreciation for the unique resources protected at Lava Beds National Monument and improve understanding of the monument's role in a regional setting.

Resource Management

Natural and cultural resource management would remain largely the same as in alternative A. However, additional monitoring and assessment of sensitive resources would occur in high use visitor areas.

Visitor Experience

The NPS would expand outreach to the travel and tourism industry to maintain or increase visitation and in turn raise the regional profile of Lava Beds National Monument. Diversified recreational opportunities would be provided throughout the monument including new opportunities for bicycling and snowshoeing. The monument would offer a diversity of world-class lava tube caving experiences including caving seminars and specialized tours.

The monument would identify new opportunities for visitors to learn about historic resources and monument collections. Examples of new opportunities could include an overnight experience at the Schonchin Butte fire lookout or guided tours to other historic sites. New research and battle forensics would enhance interpretation and knowledge of Modoc War sites.

Facilities

New facilities would be provided to accommodate the diversified recreational opportunities. The NPS would provide more opportunities for trails that are accessible to a wide range of user needs and abilities, including wheelchair accessibility. Diversified recreation trails would also be provided. For example, the monument would explore appropriate trail opportunities for bicycles, horses, cross-country skiing and snowshoeing. The monument would collaborate with the U.S. Forest Service on new regional recreational trail opportunities and would establish additional medium distance (1-3 mile) loop trails within the monument. Improvements to the campground would include expansion to better accommodate groups and RVs.

The northern entrance roads would be the primary access points to the monument. If the southeast entrance road remains in poor condition, the NPS would encourage visitors to enter and exit the monument from the more heavily traveled and paved northern routes. The Medicine Lake Road would be realigned and paved within the monument improving access from the southwest. To allow for more informal, dispersed exploration and recreation, the NPS would construct more 1- to 2-car pullouts along the main monument road. Bicycle use on monument roads would be encouraged and bicycle storage facilities would be provided at appropriate locations.

New day-use facilities with additional recreational opportunities such as wildlife viewing would be available at Petroglyph Point. The new day-use facilities would include a small parking lot, vault toilets, a picnic area, and shade structures. The current road would be realigned southward around the petroglyphs and paved. The existing chain link fence would be replaced with a more aesthetically pleasing barrier that protects the petroglyphs and allows for wildlife movement and photography.

The Cave Loop area would feature a cave docent program to assist visitors with cave exploration. In addition, more rangers would be available during peak visitation. New facilities would include vault toilets and a foot trail around the Cave Loop to allow visitors to leave vehicles at the visitor center or campground. Areas along the Cave Loop impacted by social trails would be restored.

The campground would be improved to better accommodate large vehicles by adding a new RV loop and reducing several campsites in the existing campground loops (with no net loss or gain in the total number of campsites). No hookups would be provided for the RV sites. To encourage longer stays, coin operated and limited time showers would be considered for the campground.

Monument Operations

To minimize its carbon footprint, the monument would reduce electrical energy use for monument operations through use of new technologies and/or changes in monument operations to reduce need. As in alternative B, pedestrian and bicycle visitor circulation would be encouraged throughout the monument.

Environmentally Preferred Alternative

The environmentally preferred alternative is "the alternative that will promote the national environmental policy expressed in the National Environmental Policy Act (NEPA) (Sec. 101(b))." After the environmental consequences of the alternatives were analyzed, each alternative was evaluated to see how well the goals from NEPA section 101(b) are met. Taken as a whole, alternative B is the environmentally preferred alternative because it would best meet all six goals stated in NEPA.

The implementation of the plan (no matter which alternative is selected) will depend on future funding, NPS priorities, and partnership funds, time, and effort. The approval of the GMP does not guarantee that funding and staffing needed to implement the plan will be forthcoming. Full implementation of the GMP could be many years into the future.

Chapter One: Introduction



Previous page: Catacombs Cave

Chapter One: Introduction

An introduction to the purpose, scope, and issues of the plan.

Background on Lava Beds National Monument

President Calvin Coolidge established Lava Beds National Monument by Presidential Proclamation on November 21, 1925 (No.1755, November 21, 1925, 44 Stat. 2591) (See Appendix A, Lava Bed National Monument Presidential Proclamation). Initially managed as part of Modoc National Forest, the National Park Service assumed responsibility for management of the monument in 1933. A second Presidential Proclamation in 1951 transferred lands at Petroglyph Point to Lava Beds National Monument from the Bureau of Land Management. This detached unit is approximately two miles east of the main body of the monument.



LOCATION AND ACCESS

The 46,560 acre monument is located in northeastern California, approximately 155 miles northeast of Redding, California, and 45 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 4th Congressional District. The monument boundary is bordered by Modoc National Forest, Klamath National Forest, Lower Klamath Basin National Wildlife Refuges, Bureau of Reclamation and Bureau of Land Management land, 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 (See Regional Context and Lava Beds National Monument Maps).

Primary access to Lava Beds National Monument is from the north, over paved Siskiyou and Modoc County roads which connect with California State Highways 161 and 139. Both roads are open year round. From the south, access is over two Modoc National Forest (MNF) roads that, in turn, connect to the state highway system. Of these two roads, the Medicine Lake Road is partly paved and is closed from late fall to late spring due to heavy winter snow. The other MNF road (Forest Service Route 10) is paved but in very poor condition and may also be closed during heavy winter snows.

OVERVIEW OF MONUMENT RESOURCES AND HISTORY

The region in and around the monument is a unique and diverse area. It lies at the junction of the Sierra-Klamath, Cascade, and Great Basin geologic provinces and reflects those influences in its landscapes and ecosystems. The monument incorporates a portion of the Medicine Lake shield volcano, a 900-square-mile highland associated with the Cascades mountain range. Over the last half-million years, volcanic eruptions of this volcano have created a rugged landscape dotted with diverse volcanic features.

MAP 1: REGIONAL CONTEXT



Numerous lava tube caves, Native American rock art sites, historic battlefields and campsites, and a high desert wilderness experience are the main attractions at Lava Beds. Volcanic phenomena are the major interpretive features in the monument. Lava tube caves, in particular, draw many visitors and substantial efforts are made by the monument's staff to facilitate the safe and non-destructive exploration of these caves and other volcanic features by visitors. The northern margin of the monument is generally defined by the limits of recent lava flows and the corresponding historic shoreline of Tule Lake. A critical stop on the Pacific Flyway for migratory birds, Tule Lake's environment has been significantly altered by water resources development activities, initiated in 1905, that reclaimed the lake area for agricultural use.

The monument contains a range of Great Basin vegetation communities, including ponderosa pine forest, mountain mahogany/juniper woodland, Great Basin sagebrush/bunchgrass steppe, and the Tule Lake wetland margin. These areas provide habitat for a wide range of animal species including mammals, birds, amphibians, insects, reptiles, crustaceans, and both above-ground and cave invertebrates. The lava tube caves in the monument provide habitat for at least 15 bat species, including the rare and threatened Townsend's big-eared bat. Although the bat's population is declining in most areas, its numbers remain stable in the monument.

Human occupation of the Klamath and Tule Lake basins is estimated to extend back over 11,500 years. The Tule Lake shoreline and nearby areas provided permanent village and seasonal encampment sites for the Modoc tribe and their ancestors, whose subsistence was dependent on hunting and gathering of both lacustrine and montane animal and plant species.

By the early 1870s, as European settlement moved westward, conflicts between cultures culminated locally in the Modoc Indian War of 1872-1873. Native Americans, clinging to their homeland, took refuge within what is now called "Captain Jacks Stronghold." The rugged lava flows provided protection in the forms of rock outcroppings that were effective rifle pits, connecting trenches, cover from mortar fire, and small residential shelters from U.S. Army assaults. After their eventual defeat in the Modoc War, some of the Modoc were relocated to Oklahoma, but most remained in northern California and southern Oregon among tribal neighbors such as the Klamath and northern Paiute. Descendants of the Modoc are now members of the multicultural, federally recognized Klamath Tribes which have tribal offices in Chiloquin, Oregon.

More than 700 lava tube caves, Native American rock art sites, historic battlefields and campsites, and a Great Basin wilderness experience are main attractions at Lava Beds National Monument.

A host of colorful characters populate the early modern history of Lava Beds, including J.D. Howard, a cave explorer who led the effort to obtain federal protection of the lava beds, homesteading families that ran sheep and an underground ice skating business, and moonshiners who set up stills in the remote caves during Prohibition. Like most National Park Service sites operating during the Depression, the newly established Lava Beds National Monument benefited from the work of a Civilian Conservation Corps (CCC) crew. Between 1935 and 1942, hundreds of "CCC boys" constructed the original infrastructure of the monument, some of which visitors can still enjoy today. In the late 1950s and through the 1960s the infrastructure of Lava Beds was further improved and expanded during the National Park Service's Mission 66 initiative. This modern construction program paved the roads of the monument and built the majority of the infrastructure used by visitors and staff today.

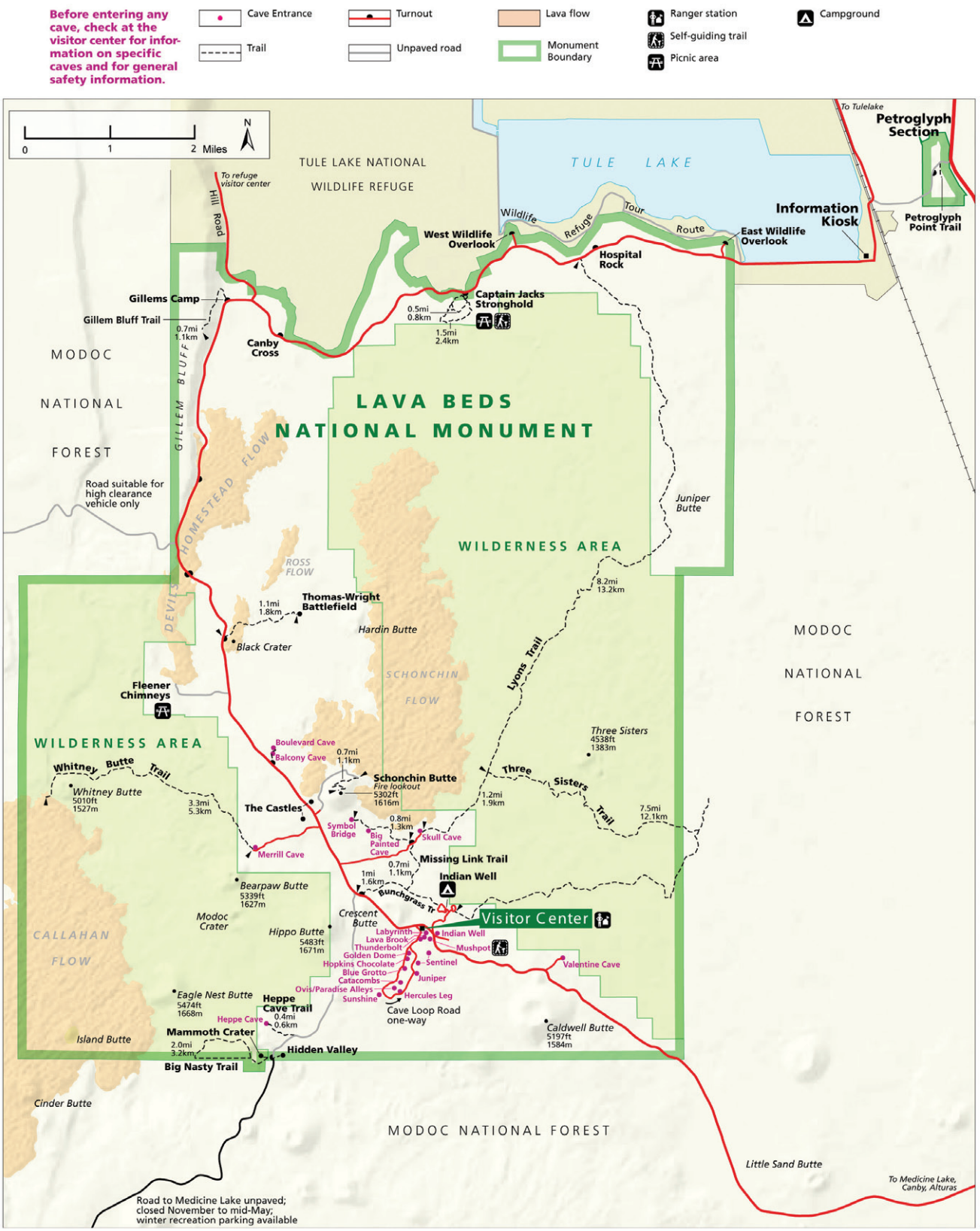
On October 13, 1972, the Schonchin and Black Lava Flow wilderness units, totaling 28,460 acres, were designated in the monument under public law 92-493. The resulting Lava Beds Wilderness Area currently represents 61 percent of the monument's total land area. The next closest wilderness area is Mountain Lakes Wilderness, 45 miles to the northwest. The sense of solitude, natural quiet, and dark night skies associated with the wilderness areas are highly valued by visitors.



View from the visitor center, *NPS Photo*

MAP 2: MONUMENT MAP

Lava Beds National Monument



Purpose and Need for the General Management Plan

GENERAL MANAGEMENT PLANS AND THE NATIONAL PARK SYSTEM

The National Parks and Recreation Act of 1978 requires each unit of the National Park Service (NPS) to have a general management plan (GMP); and NPS Management Policies 2006 (§2.3.1) states "The National Park Service will maintain a general management plan for each unit of the national park system."

The purpose of a GMP is to ensure that a national park system unit (park unit) has a clearly defined direction for resource preservation and visitor use that will best achieve the NPS mandate to preserve resources unimpaired for the enjoyment of future generations.

The ultimate outcome of general management planning for park units is an agreement among the National Park Service, its partners, and the public on why each area is managed as part of the national park system, what resource conditions and visitor experience should exist, and how those conditions can best be achieved and maintained over time. General management plans are intended to be long-term documents that establish and articulate a management philosophy and framework for decision making and problem solving in the parks.

The purpose of a general management plan is to ensure that a National Park System unit has a clearly defined direction for resource preservation and visitor use that will best achieve the NPS mandate to preserve resources unimpaired for the enjoyment of future generations.

PURPOSE OF THE PLAN

The approved general management plan will be the foundational document for managing Lava Beds National Monument for the next 15 to 20 years. The purposes of this general management plan are as follows:

- confirm the purpose, significance, and special mandates of Lava Beds National Monument
- clearly define resource conditions and visitor uses and experiences to be achieved in the monument
- provide a framework for managers to use when making decisions about how to best protect the monument's resources, how to provide quality visitor uses and experiences, how to manage visitor use, and what kinds of facilities, if any, to develop in the monument
- ensure that this foundation for decision making has been developed in consultation with interested stakeholders and adopted by the NPS leadership after an analysis of the benefits, impacts, and economic costs of alternative courses of action

Legislation establishing the National Park Service as an agency and governing its management provides the fundamental direction for the administration of Lava Beds National Monument (and other units and programs of the national park system). This general management plan builds on these laws and the legislation that established Lava Beds National Monument to provide a vision for the monument's future.

This *Draft General Management Plan and Environmental Assessment* presents and analyzes three alternative future directions for the management and use of Lava Beds National Monument. Alternative B is the National Park Service's preferred alternative (see Chapter 3, "Alternatives"). The potential environmental impacts of all alternatives have been identified and assessed (see Chapter 5, "Environmental Consequences").

Actions directed by general management plans or in subsequent implementation plans are accomplished over time. Budget restrictions, requirements for additional data or regulatory compliance, and competing priorities may delay implementation of many actions. Major or especially costly actions could be implemented 10 or more years into the future.

The general management plan does not describe how particular programs or projects should be prioritized or implemented.



Northern Pygmy Owl, *NPS Photo*

Those decisions will be addressed in future, more detailed planning efforts. All future plans should be consistent with the approved general management plan.

NEED FOR THE PLAN

The last general management plan for Lava Beds National Monument was completed in 1996. Since then land has been added at Petroglyph Point, visitation patterns have changed, and monument staff and researchers have learned more about the significance of the monument's geologic features and historic sites. Many of the facility improvements proposed in the 1996 plan are now complete, including the monument's new visitor center, research center, new interpretive exhibits, improved roadways and parking areas, and cave visitation infrastructure.

This general management plan is also needed to meet the requirements of the National Parks and Recreation Act of 1978 and NPS policy, which mandate development of a general management plan for each unit in the National Park System.

> The implementation of the approved plan will depend on future funding. Full implementation of the actions in the approved General Management Plan could be many years in the future.

THE NEXT STEPS

After the distribution of the *Draft General Management Plan and Environmental Assessment* there will be a 60-day public review and comment period, after which the NPS planning team will evaluate comments from other federal agencies, tribes, organizations, businesses, and individuals regarding the draft plan. If no significant environmental impacts are identified and no major changes are made in the alternatives, then a Finding of No Significant Impact (FONSI) can be made and approved by the Pacific West Regional Director. Following a 30-day waiting period, the plan can then be implemented.

IMPLEMENTATION OF THE PLAN

Implementation of the approved plan will depend on future funding. The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the actions in the approved General Management Plan could be many years in the future. The implementation of the approved plan could also be affected by other factors, such as changes in NPS staffing, visitor use patterns, and unanticipated environmental changes.

Once the General Management Plan has been approved, additional feasibility studies and more detailed planning, environmental documentation, and consultations would be completed, as appropriate, before certain preferred alternative actions can be carried out. For example:

- additional environmental documentation may need to be completed
- appropriate permits may need to be obtained before implementing actions
- appropriate federal and state agencies would need to be consulted concerning actions that could affect threatened and endangered species
- Native American tribes and the State Historic Preservation Officer would need to be consulted, as appropriate, on actions that could affect cultural resources

Future program and implementation plans, describing specific actions that managers intend to undertake and accomplish in the monument, will be guided by the desired conditions and long-term goals set forth in this general management plan.

Planning Issues and Concerns

INTRODUCTION

The following topics describe some of the preliminary needs and challenges the general management plan (GMP) must address for the monument to preserve resources while providing for public use and enjoyment. The general public, NPS staff, and representatives from county, state, tribal and federal agencies, and various organizations identified issues and concerns about monument management during the scoping phase (early information gathering) for this general management plan. An issue is defined as an opportunity, conflict, or problem regarding the use or management of public lands. Comments were solicited at public meetings, through planning newsletters, and at meetings with agencies and community stakeholders

(see Chapter 6, "Consultation and Coordination" for more information about the scoping efforts).

Comments received during scoping demonstrated that the public is generally pleased with current management and resources at Lava Beds National Monument. The public values the monument's diverse resources, viewsheds, solitude, visitor opportunities, and facilities. Issues and concerns raised during public scoping generally involved suggestions for the types and levels of services and activities offered at the monument (particularly interpretive and educational programs and exhibits) while ensuring a high degree of protection of the monument's sensitive resources. The general management plan alternatives provide strategies for addressing these issues within the context of the monument's purpose, significance, and special mandates presented in Chapter 2, "Foundation for Planning and Management."

The general management plan alternatives provide strategies for addressing issues within the context of the monument's purpose, significance, and special mandates.

ISSUES

Access and Transportation

Public scoping comments raised concerns about poor road conditions for visitors arriving via southern access routes. Although most visitors (approximately 75% percent) enter the monument from the north, improving the condition of Forest Service Route 10, leading up to the monument's southeast entrance, was of particular concern to some visitors. Forest Service Route 10 was formerly the main road to the monument prior to the paving of the northern access routes in the late 1980s and mid 1990s. Because this road is owned and maintained by the U.S. Forest Service, the NPS would need to coordinate closely with them to provide a long-term solution for improvement and maintenance of this road. Comments also requested improved maintenance on the unpaved Medicine Lake Road to mitigate its rough and dusty surface conditions.



Monument road, *NPS Photo*

Climate Change and Sustainability

Since the monument began measuring surface temperatures in 1946, a 1.5 degree Fahrenheit increase in the average summer high temperature has been documented. This temperature data correlates with a broader trend observed in many locations throughout the western United States. Observed and anticipated increases in atmospheric carbon have the potential to impact sensitive cave ecosystems and contribute to western juniper expansion into formerly treeless communities of the monument. The GMP will address mechanisms to address climate change through interpretation and education, ongoing monitoring, and instituting energy conservation practices.

Cultural Resources

Preservation and protection of sensitive cultural and historical resources was an important concern identified during public scoping, particularly at Petroglyph Point, a site not contiguous with the main unit of the monument. The GMP will define priorities and management direction for cultural resources protection, research, and monitoring throughout the monument. This includes appropriate visitor use, protection of sensitive sites, and opportunities to coordinate with neighboring land managers and tribal representatives to protect cultural landscapes and address surrounding landowner and tribal concerns. Given the concerns about protecting the sensitive rock art at Petroglyph Point, the GMP will explore comprehensive approaches to resource management, facilities, and interpretation at Petroglyph Point.

Education and Interpretation

Visitor surveys and public scoping efforts indicate that visitors and stakeholders value Lava Beds National Monument as an ideal place for learning about geology, nature, history, and pre-history. The majority of comments received during scoping called for increased visitor education programs and opportunities for interpretation. The GMP will explore new educational opportunities within the monument and with partner agencies, schools, and gateway communities.

Opportunities for enhanced interpretation of significant resources through exhibits, programs, interpretive trails, and new media will also be addressed in the GMP.

Facilities

Monument visitors appreciate the perceived undeveloped character of Lava Beds. The roads and parking areas lay lightly on the land, and major facilities are concentrated in one area and tend to be inconspicuous. The monument has recently made numerous facility improvements in implementing the 1996 General Management Plan. Major facilities completed include a new visitor center (2004), research center (2005), and entrance station (2006). Suggestions for additional facilities included campground improvements, more restrooms, expanding employee housing, and improved facilities at Petroglyph Point. The GMP will explore what improvements may be appropriate. The monument also has a small number of visitor and administrative facilities that are either infrequently used or are redundant and unneeded. Opportunities to reduce the amount of infrastructure that requires long term maintenance and rehabilitation or reconstruction will be explored.



Prescribed burn, *NPS Photo*

Visitor Services and Use

Although the monument experiences relatively low levels of visitation compared with many other National Park units, current visitor patterns reflect changing demographics and expectations including:

- increasing number of requests for camping facilities that better accommodate large recreational vehicles
- a greater proportion of older visitors with a need for more accessible trails and facilities
- increasing numbers of bus tours bringing visitors who spend a limited time in the monument
- increasing visitation from non-English speakers
- changing demographics of the local area with an increase in the Latino population
- increasing requests for facilities that can accommodate large group gatherings

The monument provides many non-personal interpretive services such as bulletin boards, wayside displays, and trail guides throughout the monument. However, some visitors commented about the lack of personal services in the field, particularly in the northern portion of the monument in the off-season when the entrance station is not staffed. Visitors also found current staffing levels insufficient to provide interpretive contacts, including resource protection messages to self-guiding cave visitors in the summer.

Another primary concern was access to services such as food and lodging, given the monument's remote location. Opportunities for food services will be explored in the GMP.

The GMP will address changing patterns in visitor use trends and demographics and identify appropriate visitor access and experiences, opportunities for interpretation and education, and desired conditions for visitor safety. Scoping comments about visitor services included suggestions for new visitor contact facilities, campground and trail improvements, improving access for visitors with disabilities, and providing appropriate information to visitors before they enter the monument.

Monument Boundary/Adjacent Lands

General management plans are required to include an assessment of boundaries. Boundary adjustments may be proposed to protect significant resources and values, enhance public enjoyment of monument resources, or to address operation and management issues. Many resources related to the significance of the Lava Beds are located outside of the monument boundary. For example, the monument includes only 10 percent of the Medicine Lake shield volcano, which formed the striking geologic features and caves in the monument. The U.S. Forest Service administers the rest of the volcano and its wealth of other volcanic and natural resources. In addition, important Modoc War battlefield sites are located outside of the monument. The GMP will address whether additional lands are needed to protect monument resources or to improve monument management, and will explore different

approaches for protecting resources near monument boundaries.

Museum Collections

The monument manages almost 200,000 cultural and natural items in its museum collection. Some collections materials are stored off-site at partner facilities. The 2002 Museum Management Plan identified a backlog of items to be added from other collections. Scoping comments indicated a desire to see more of the monument collections on display. The GMP will explore new opportunities for storing and displaying museum collections.



Modoc War fortification, *NPS Photo*

Natural Resources

Lava Beds National Monument contains a variety of sensitive natural resources. The monument is dominated by hundreds of caves and geologic surface features that include lava flows and cinder cones. These geologic resources are made of igneous rock formed from volcanic eruptions and lava flows that occurred hundreds to thousands of years ago. Many of these features are delicate and fragile, and can be easily shattered or broken by foot traffic or even a caver's shoulder or helmet bumping the ceiling of a cave. When there is breakage of cave features or erosion of cinder cones, the result is permanent change. Only new volcanic eruptions can create new geologic resources. Thus the geologic formations and features within caves and on the surface are considered to be non-renewable resources. If lost they are unlikely to be replenished or replaced by natural processes in any of our lifetimes. These fragile and non-renewable resources are the main attraction for monument visitors.

Other natural resource issues specific to the monument include protection of native plants and wildlife, and the use of fire to manage plant communities and wildlife habitat. The GMP will define priorities and management direction for natural resource protection, restoration, research, and monitoring, and address the balance between visitor use and enjoyment and the protection of natural resources. Desired future conditions, management zoning, and indicators and standards for user capacity will also be established.

Regional Cooperation and Partnerships

Cooperation and partnerships with local and regional organizations are important for studying and managing significant resources, as well as educating and informing visitors, local residents, researchers, and students about the monument's significance. Public comments encouraged Lava Beds to explore regional partnerships with local communities, tribes, organizations, and agencies to protect resources, provide visitor information and services, and to interpret regional themes. The GMP will seek new ways in which the monument could coordinate efforts with federal, state, tribal, and local agencies including the U.S. Fish and Wildlife Service, the U.S. Forest Service, the Klamath Tribes, the Bureau of Land Management, and the California Department of Fish and Game.

Tribal Use

Lava Beds National Monument is significant for its tribal history and culture. The GMP will explore opportunities for more tribal involvement with the monument, greater educational outreach about the monument's environmental and cultural history, and enhanced protection of sensitive cultural resources important to tribal members.

Wilderness

Approximately 61 percent of the monument is designated wilderness. Comments concerning wilderness expressed appreciation of the wilderness qualities in the Lava Beds and provided suggestions for expanding the wilderness experience. The GMP will identify desired conditions for wilderness areas that consider appropriate levels of visitor use and external impacts, such as development and population growth in adjacent lands, gateway communities, and the region.

ISSUES AND CONCERNS NOT ADDRESSED

Not all of the issues or concerns raised by the public will be addressed in this GMP. Some issues raised by the public were not considered because they are already prescribed by law, regulation, or policy; would be in violation of laws, regulations, or policies; or were at a level that was too detailed for a GMP and are more appropriately addressed in subsequent planning

documents. For example, during public scoping, some commenters provided detailed suggestions for interpretive exhibits. While the GMP does not address this level of detail, such comments can be considered by the monument in implementing the GMP.

Relationship of Other Planning Efforts to This General Management Plan

Nearly all of the lands surrounding the monument are publically owned by the U.S. Forest Service or the U.S. Fish and Wildlife Service, although there are privately owned timberlands to the south as well as agricultural and residential lands to the northeast. Nearly all of the lands surrounding Petroglyph Point are privately owned agricultural lands. Although monument land is closely associated with the Klamath and Modoc Tribes, there are no tribal-owned lands near the monument.



Petroglyph Point, *NPS Photo*

Several plans have influenced or would be influenced by the approved general management plan for Lava Beds National Monument. These plans have been prepared (or are being prepared) by the National Park Service, the U.S. Forest Service, regional organizations, and local counties. Some of these plans are described briefly here, along with their relationship to this general management plan.

NATIONAL PARK SERVICE PLANS AND STUDIES

Lava Beds National Monument Visitor Survey for Spring/Summer 2007 (2008)

This study describes the activities, expenditures, and attitudes of people who visited the monument during the spring and summer of 2007. The survey provides important data and insights into visitor preferences that were used in the development of alternatives for the general management plan.

Superintendent's Compendium (2009)

The Superintendent's Compendium is an annually updated list of designations, closures, permit requirements, and use restrictions promulgated under the discretionary authority of the superintendent. The compendium covers visitor hours; public use limits; closures and area designations for specific uses or activities; a list of activities that require a NPS permit; regulations regarding preservation of natural, cultural and archeological resources; and general regulations regarding wildlife protection, camping, picnicking and pets among other topics. The compendium would be modified as necessary to reflect any changes resulting from implementation of this general management plan.

General Management Plan for the World War II Valor in the Pacific National Monument, Tule Lake Unit

In December 2008, President George W. Bush signed a presidential proclamation establishing the World War II Valor in the Pacific National Monument. The monument is comprised of discontinuous units in the Aleutian Islands of Alaska and at sites around Pearl Harbor in Hawaii. In California, the new monument includes sites near the monument in the Tule Lake Basin associated with the Tule Lake Segregation Center (more commonly known as the Japanese American Internment Camp). Initially, the Tule Lake portions of the new monument will be managed by staff from Lava Beds National Monument and Tule Lake National Wildlife Refuge. In 2010, the National Park Service and the U.S. Fish and Wildlife Service began work on a separate GMP for this new monument.

Long Range Interpretive Plan

Lava Beds' interpretive staff completed the monument's first comprehensive interpretive plan in 2010. The planning process required by this general management plan contains many of the elements that were also included in the interpretive plan, and many of the proposed actions in the GMP relate to interpretation and education. Therefore the monument's GMP process informed much of the interpretive plan, which guides interpretive products and services in more detail.

Fire Management Plan (2007)

The 2007 Fire Management Plan is an operational guide for managing the monument's wildland and prescribed fire program. It defines levels of protection needed to ensure personnel and public safety, protect facilities and resources, and restore and perpetuate natural processes. It is a detailed program of action to carry out fire management policies and objectives. This plan would be modified as necessary to reflect any changes resulting from implementation of this general management plan.

Cultural Landscapes Inventory (CLI): Modoc War Historic District (2005)

The CLI is an evaluated inventory that contains information associated with historically significant landscape features located within the Modoc War Historic District. The CLI assists the NPS in its efforts to fulfill the identification and management requirements associated with Section 110(a)(1) of the *National Historic Preservation Act, National Park Service Management Policies (2006),* and *Director's Order #28: Cultural Resources Management.*

Wilderness Stewardship Plan (2006)

The 2006 Wilderness Stewardship Plan prescribes the minimum requirements for the management and protection of the monument's designated wilderness. These minimum requirements are standards that provide a baseline level of what is acceptable for the preservation of wilderness at Lava Beds National Monument. These standards in turn determine the minimum tool that can be used for a given action.

Resources Management Plan (1999)

This plan documented natural and cultural resource management efforts and deficiencies, and outlined objectives for future resource management and tasks for accomplishing those objectives. The long-range plan lays out a course of work and funding needs for 10 or more years. Although resource management plans are no longer being prepared by the National Park Service, information from the existing resources management plan was used in preparing this general management plan. A resources stewardship strategy, begun in 2010, will provide future direction for resource management and will incorporates the management directions presented in this document.



Lavasicles inside a lava tube cave, *NPS Photo*

This general management plan builds on the existing 1996 GMP by updating management direction and identifying new actions for the next 15 to 20 years.

General Management Plan for Lava Beds National Monument (1996)

The *1996 General Management Plan* provided management direction for facilities development and visitor use, monument-wide development concepts, and proposed an expansion of monument boundaries at the Petroglyph Point unit. This *Draft General Management Plan* builds on the 1996 plan by updating management direction and identifying new actions for the next 15 to 20 years.

Cave Management Plan (1990)

The monument has an approved cave management plan, which provides direction for preservation and management of visitor use at these important resources. An updated cave management plan is currently underway and is scheduled for completion in late 2010. This will establish guidelines that provide long term management strategies and set resource condition goals for the monument's caves. The plan will identify opportunities for visitors to experience the caves in the Lava Beds while working to protect the natural and cultural resources within. These management strategies will reflect the management direction recommended in this general management plan.

U.S. FOREST SERVICE PLANS

Modoc National Forest Land and Resource Management Plan (1991)

This document guides multiple use management on forest lands adjacent to much of the monument's boundary. In 2009, the U.S. Forest Service initiated the process to update this plan.

LOCAL AND REGIONAL PLANS

Modoc County General Plan (1988)

This plan is designed to provide long-range guidance on growth and development in Modoc County. Portions of this plan most relevant to the general management plan include policies related to agriculturally zoned lands. There appear to be no conflicts with any of the alternatives outlined in the general management plan.

Siskyou County General Plan (1980)

Lands within Siskiyou County that surround the monument are all in federal ownership. These lands are managed by the U.S. Forest Service and U.S. Fish and Wildlife Service. There are no known conflicts with any of the alternatives outlined in the general management plan.

The Modoc Volcanic Scenic Byway Plan

The Modoc Volcanic Scenic Byway traverses an area which includes Tule Lake National Wildlife Refuge, Lava Beds National Monument, and portions of the Klamath, Shasta-Trinity, and Modoc national forests. This plan calls for consistently signing and publicizing a system of rural roads through a wide range of volcanic features on lands administered by several different agencies. The byway plan does not impose any management requirements or road standards on the cooperating agencies.

Impact Topics Considered in the Plan

INTRODUCTION

The consequences of implementing each alternative evaluated in the general management plan are listed and compared using specific impact topics. These impact topics were identified based on federal laws and other legal requirements, the Council on Environmental Quality's guidelines for implementing the *National Environmental Policy Act, NPS Management Policies (2006),* subject-matter expertise and knowledge of limited or easily impacted resources, and issues and concerns expressed by other agencies or members of the public during scoping. Impact topics were developed to focus environmental analysis and to ensure that alternatives were evaluated against relevant topics. Rationale for the selection of the impact topics that will be analyzed in the environmental consequences chapter is given below, as well as a more detailed justification for dismissing any topics from further consideration.

IMPACT TOPICS TO BE CONSIDERED

The following impact topics will be retained for analysis due to the potential of management alternatives to affect these resources and values, either beneficially or adversely. Current conditions for each of these topics are described in **Chapter 4, Affected Environment**:

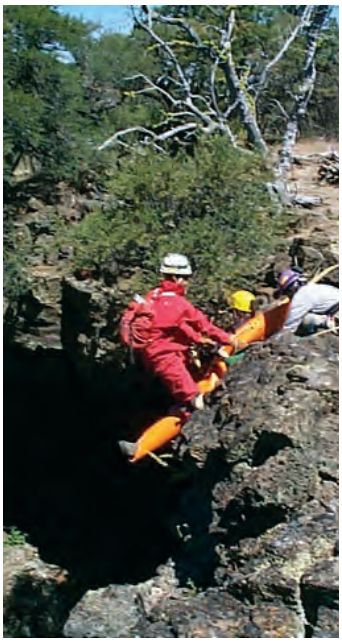
- natural resources
  - air quality
  - natural soundscapes
  - night skies
  - viewsheds/visual resources
  - cave resources
  - geological resources and processes, including soils
  - vegetation
  - wildlife and wildlife habitat
  - special status species
- cultural resources
  - cultural landscapes, historic buildings and structures
  - archeological resources
  - ethnographic resources
  - museum collections
- wilderness character
- visitor opportunities
  - recreation opportunities
  - visitor services
  - visitor facilities
  - interpretation and education opportunities
- access and transportation
- socioeconomic environment
- management and operations
- carbon footprint

IMPACT TOPICS DISMISSED FROM FURTHER CONSIDERATION

The following impact topics were considered and determined not relevant to the development of this general management plan because either they would have no effect or a negligible effect on the topic or resource, or the resource does not occur in the monument. These topics dismissed from further analysis are as follows.

Water Resources

The dry climate and porous soils of the monument result in a lack of surface water. Furthermore, there are no sole drinking water aquifers in the monument; groundwater provides domestic water. There is no known water pollution occurring from any activities in the monument and no significant point sources of pollution are known to threaten any water resource in the monument. None of the alternatives propose any changes that would be expected to increase the potential for water pollution within the monument, and any potential impacts that might accrue would be negligible. Therefore, this topic has been dismissed from further analysis in the general management plan.



Cave rescue training, *NPS Photo*

Wetlands and Floodplains

The National Park Service protects natural floodplains and takes appropriate action to avoid safety risks to visitors and employees as required by Executive Order 11988 and NPS Director's Order 77-2: *Floodplain Management*. Similarly, all wetlands in national park units are protected and managed in accordance with Executive Order 11990, "Protection of Wetlands," and NPS Director's Order 77-1: *Wetland Protection* and *NPS Management Policies 2006*. It is NPS policy to avoid affecting wetlands and to minimize impacts when they are avoidable. There are no floodplains or wetlands within the monument. Therefore, this impact topic has been dismissed from further analysis in the plan.

Energy Requirements and Conservation Potential

Alternatives in the general management plan, including the preferred alternative, could result in new facilities with inherent energy needs. In the proposed alternatives, new facilities would be designed with long-term sustainability in mind. The National Park Service has adopted the concept of sustainable design as a guiding principle of facility planning and development. The objectives of sustainability are to design facilities to minimize adverse effects on natural and cultural values, to reflect their environmental setting, and to require the least amount of nonrenewable fuels/energy.

The action alternatives could result in an increased energy need, but this need is expected to be negligible when seen in a regional context. Additionally, alternatives B and C significantly reduce the consumption of non-renewable energy. Thus, this topic is dismissed from further analysis

Environmental Justice

The Environmental Protection Agency's Office of Environmental Justice defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. The goal of this "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts.

On February 11, 1994, President William J. Clinton signed Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This order requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs/policies on minorities and low-income populations and communities. The Secretary of the Interior established Department of the Interior policy under this order in an August 17, 1994, memorandum. This memorandum directs all bureau and office heads to consider the impacts of their actions and inactions on minority and low-income populations and communities; to consider the equity of the distribution of benefits and risks of those decisions; and to ensure meaningful participation by minority and low-income populations in the department's wide range of activities where health and safety are involved.

In responding to this executive order two questions are asked and answered as the major part of the analysis:

1. Does the potentially affected community include minority and/or low-income populations?

2. Are the environmental impacts likely to fall disproportionately on minority and/or low-income members of the community and/or tribal resources?

Siskiyou, Klamath, and Modoc counties contain both minority and low-income populations; however, environmental justice is dismissed as an impact topic for the following reasons:

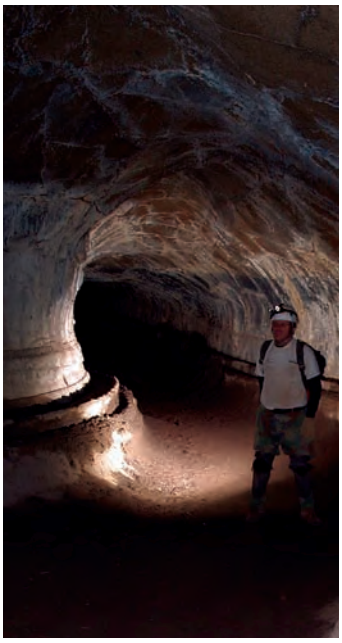
- NPS staff and the planning team actively solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.

- Implementation of the proposed alternative would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse effects on any minority or low-income population.

- The impacts associated with the preferred alternative would not result in any identified effects that would be specific to any minority or low-income population community.

- NPS staff and the planning team have consulted and worked with the affected Native American tribes and will continue to do so in cooperative efforts to resolve any problems that may occur. In addition, the planning team did not identify and negative or adverse effects that would disproportionately and adversely affect the tribes.

Based on the above information and the requirements of Executive Order 12898, environmental justice was ruled out as an impact topic to be further evaluated in this document.



Lava tube, *NPS Photo*

Indian Trust Lands

The National Park Service does not manage or administer Indian trust assets. The overriding mandate for the National Park Service is to manage the park units in the National Park System consistent with park laws and regulations. No lands comprising Lava Beds National Monument are held in trust by the Secretary of the Interior solely for the benefit of American Indians. Therefore, this topic was dismissed from further analysis.

Natural or Depletable Resources Requirements and Conservation Potential

Resources that will be permanently and continually consumed by implementation of the GMP include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Alternatives B and C would result in benefits as they each reduce the use of fossil fuels.

Construction activities related to implementation of the alternatives would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline construction equipment. With respect to operational activities, compliance with all applicable building codes, as well as project mitigation measures, would ensure that all natural resources are conserved or recycled to the maximum extent feasible.

Consideration of these topics is required by 40 *Code of Federal Regulations* (CFR) 1502.16. The National Park Service has adopted the concept of sustainable design as a guiding principle of facility planning and development (NPS *Management Policies* 9.1.1.7). Through sustainable design concepts and other resource management principles, the alternatives analyzed in this document would attempt to conserve natural or depletable resources. Therefore, this topic has been dismissed from further analysis.

Prime or Unique Farmlands

In 1980 the Council on Environmental Quality directed federal agencies to assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resource Conservation Service as prime or unique. Prime farmland is defined as soil

that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland soils produce specialty crops such as specific fruits, vegetables, and nuts.

According to the National Resource Conservation Service there are no unique farmlands in Lava Beds National Monument. Private agriculture does not exist within the monument, so this type of land use would not be affected by this plan. Therefore, there would be no impacts on prime or unique farmlands and the topic is being dismissed from further analysis in the plan.

Urban Quality and Design of the Built Environment

Consideration of this topic is required by the *Code of Federal Regulations* (CFR) 1502.16. The quality of urban areas is not a concern in this planning project. Throughout the monument, vernacular architecture and compatible design would be taken into consideration for new structures built under all of the action alternatives. Emphasis would be placed on designs, materials, and colors that blend in, and do not detract from, the natural and built environment. Therefore adverse impacts are anticipated to be negligible and no further consideration of this topic is necessary.

Conformity with Local Land Use Plans

The basic land use of the monument as a recreation and resource management area is in conformance with local land use plans. The creation of additional recreation and visitor service opportunities in the monument, as proposed in the alternatives, would be consistent with the existing land uses in the monument or local (non-NPS) land use plans. Therefore this topic is dismissed from further consideration.

Public Health and Safety

Actions and developments proposed in the alternatives would not result in any identifiable adverse impacts to human health or safety. Therefore this topic is dismissed from further consideration.

Servicewide Laws and Policies

To truly understand the implications of an alternative in this *General Management Plan and Environmental Assessment*, it is important to combine the servicewide laws and policies with the management actions described in an alternative. Many monument management directives are specified in laws and policies guiding the National Park Service and therefore are not subject to alternative approaches. A general management plan is not needed to decide, for instance, that it is appropriate to protect endangered species, control nonnative species, protect archeological sites, conserve artifacts, or provide for universal access — laws and policies already require the National Park Service to fulfill these mandates. The National Park Service would continue to strive to implement these requirements with or without a new general management plan.

Table 1 shows some of the most pertinent servicewide laws and policy topics related to managing Lava Beds National Monument. For each topic there are a series of desired conditions required by law and policy that the NPS staff would strive to achieve for that topic under all of the alternatives presented in this *General Management Plan and Environmental Assessment*. The alternatives address the desired future conditions that are not mandated by law and policy and must be determined through a planning process. The table cites the law or policy behind these desired conditions, and gives examples of the types of strategies/actions being pursued by NPS staff.



Schonchin Butte, *NPS Photo*

TABLE 1: SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS	
GEOLOGIC PROCESSES AND FEATURES	

POLICY GUIDANCE/ SOURCES
 	
NPS Management Policies 2006; NPS-77, "Natural Resources Management Guidelines"
	DESIRED CONDITIONS
	The national monument's geologic resources are preserved and protected as integral components of the natural systems. Natural geological processes proceed unimpeded.
	
	MANAGEMENT DIRECTION/STRATEGIES
	• Assess the impacts of natural processes and human-related events on geologic resources.
	• Integrate geologic resource management into NPS operations and planning to maintain and restore the integrity of existing geologic resources.
	• Develop a plan to address geologic research, inventory, and monitoring.
	• Collect baseline information on surface geology and partner with the U.S. Geological Survey and others to identify, address, and monitor geologic hazards.
	• Update the geologic map of the Lava Beds National Monument in digital format that can be used in the geographic information system.
	• Update the geologic history of the national monument using modern theory and techniques.
	• Interpret geologic resources for visitors.
	  • Update geologic interpretations of localities that are the subject of interpretive stops or displays.
	  • Develop programs to educate visitors about geologic resources.

CAVE PROTECTION	
POLICY GUIDANCE/ SOURCES Federal Cave Resources Protection Act of 1988 (FCRPA) NPS Management Policies 2006; NPS-77, "Natural Resources Management Guidelines"	**DESIRED CONDITIONS** The NPS manages to perpetuate the natural systems associated with the caves and karst such as drainage patterns, air flows, mineral deposition, and plant and animal communities. Wilderness and cultural resource values will also be protected. **MANAGEMENT DIRECTION/STRATEGIES** • No developments or uses, including those that allow for general public entry, (such as pathways, lighting, and elevator shafts) will be allowed in, above, or adjacent to caves until it can be demonstrated that they will not unacceptably impact natural cave conditions, including sub-surface water movements, and that access will not result in unacceptable risks to public safety. • Developments already in place above caves will be removed if they are impairing or threatening to impair natural conditions or resources. • Parks will strive to close caves or portions of caves to public use, or to control such use, when such actions are required for the protection of cave resources or for human safety. • Some caves or portions of caves may be managed exclusively for research, with access limited to permitted research personnel. • "Significant" caves will be identified using criteria established in the 43 CFR Part 37 regulations for the Federal Cave Resources Protection Act of 1988 (FCRPA). • As further established by the FCRPA, specific locations of significant cave entrances may be kept confidential and exempted from Freedom of Information Act requests. • Parks will manage caves in accordance with approved cave management plans to perpetuate the natural systems associated with the caves.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

LIGHTSCAPE MANAGEMENT

POLICY GUIDANCE/ SOURCES

NPS Management Policies 2006

Lava Beds National Monument offers excellent opportunities to observe dark night skies.

DESIRED CONDITION

The monument will preserve, to the greatest extent possible, the natural lightscapes of the monument, which are the natural resources and values that exist in the absence of human-caused light.

MANAGEMENT DIRECTION/STRATEGIES

- The NPS will cooperate with visitors, neighbors, and local government agencies to find ways to prevent or minimize the intrusion of artificial light into the night scene in Lava Beds National Monument.
- In natural areas, artificial outdoor lighting will be limited to basic safety requirements and will be shielded when possible.
- The national monument staff will evaluate the impacts on the night sky caused by facilities. If light sources in the national monument are affecting night skies, the staff will study alternatives such as shielding lights, changing lamp types, or eliminating unnecessary sources.

AIR QUALITY

POLICY GUIDANCE/ SOURCES

Clean Air Act

NPS Management Policies 2006; NPS-77, "Natural Resources Management Guidelines"

Lava Beds National Monument is a Class I air quality area under the Clean Air Act. Class I areas are afforded the highest degree of protection under the Clean Air Act. This designation allows very little additional deterioration of air quality.

DESIRED CONDITIONS

Air quality in the monument meets national ambient air quality standards for specified pollutants. The monument's air quality is maintained or enhanced with no significant deterioration.

MANAGEMENT DIRECTION/STRATEGIES

The National Park Service will take the following kinds of actions to comply with the policies mentioned above:

- Inventory the air quality-related values associated with the national monument.
- Monitor and document the condition of air quality and related values in conjunction with other government agencies.
- Evaluate air pollution impacts and identify causes.
- Minimize air quality pollution emissions associated with national monument operations, including the use of prescribed fire and visitor use activities, in compliance with federal, state, and local air quality regulations.
- Ensure healthful indoor air quality at NPS facilities.
- Participate in federal, regional, and local air pollution control plans and drafting of regulations and review permit applications for major new air pollution sources.
- Maintain constant dialogue with the California Commission on Environmental Quality regarding visibility conditions at the national monument.
- Develop educational programs to inform visitors and regional residents about the threats of air pollution.
- Participate in research on air quality and effects of air pollution. Determine changes in ecosystem function caused by atmospheric deposition and assess the resistance and resilience of native ecosystems in the face of these external perturbations.
- Research effects of atmospheric deposition on plants, soils, and wetlands in the national monument, and determine changes in ecosystem function caused by atmospheric deposition of pollutants.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

ECOLOGICAL COMMUNITIES

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
Endangered Species Act of 1973, as amended; National Invasive Species Act; Lacey Act, as amended; Federal Noxious Weed Act of 1974, as amended; Executive Order on Invasive Species, #13112 NPS Management Policies 2006, Natural Resources Management Guidelines, NPS 77	• The NPS maintains all native plants and animals as parts of the monument's natural ecosystems. • Natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations are preserved and restored. • Populations of native plant and animal species function in as natural condition as possible except where special considerations are warranted. • Native species populations that have been severely reduced in or extirpated from the monument are restored where feasible and sustainable. • Potential threats to the monument's native plants and wildlife are identified early and proactively addressed through inventory and monitoring. • Sources of air, water, and noise pollution and visitor uses adversely affecting plants and animals are limited to the greatest degree possible. • Visitors and staff recognize and understand the value of the monument's native plants and wildlife. • NPS staff uses the best available scientific information and technology to manage these resources. • Federal and state- listed threatened and endangered species and their habitats are protected and sustained. NPS staff prevents the introduction of nonnative species and provides for their control to minimize the economic, ecological, and human health impacts that these species cause. • Naturally ignited fire, including the smoke it produces, is part of the natural systems being sustained at the monument. **MANAGEMENT DIRECTION/STRATEGIES:** • The management of populations of exotic plant and animal species, up to and including eradication, is undertaken when control is prudent and feasible. • NPS staff uses the best available scientific information and technology to manage these resources. • The NPS works with other land managers, including the states of California and Oregon, tribal governments, the U. S. Fish and Wildlife Service, and the U.S. Forest Service, to encourage the conservation of populations and habitats of species that share common areas or migrate into and out of the monument whenever possible. • Inventories and monitoring of the plants and animals in the monument will continue. Collected data will be used as a baseline against which to regularly monitor the distribution and condition of selected species, including indicators of ecosystem condition and diversity, rare or protected species, and nonnative species. Management plans will be modified to be more effective, based on the results of monitoring. • NPS staff will participate in regional ecosystem efforts to restore native species. • Research will be supported that contributes to management knowledge of native species. • Interpretive and educational programs will continue to be provided on the preservation of native species for visitors and for residents neighboring the monument. • Efforts will be made to avoid, minimize, or otherwise mitigate any potential impacts on state or federally listed species. Should it be determined through informal consultation that an action might adversely affect a federally listed or proposed species, the NPS staff would initiate formal consultation under §7 of the Endangered Species Act. • The NPS will implement its fire management plan, and update when necessary, consistent with federal law and departmental management policies that also address the need for adequate funding and staffing to support the planned fire management program.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

WILDERNESS

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
Wilderness Act of 1964, Public Law 92-493; Wilderness Designation for Lava Beds National Monument (1973) NPS Management Policies 2006; DO 41 "Wilderness Preservation and Management"	The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness. Visitors to the monument will continue to find opportunities for solitude and primitive, unconfined recreation, and signs of people in wilderness areas will remain substantially unnoticeable. **MANAGEMENT DIRECTION/STRATEGIES** • Areas proposed/recommended for wilderness will continue to be managed so as to not diminish their wilderness characteristics until Congress has taken action on the proposal/recommendation. • Uses that are in keeping with the definitions and purpose of wilderness, and do not degrade wilderness resources and character, will be encouraged. Appropriate restrictions may be imposed on any authorized activity to preserve wilderness character and resources, or to ensure public safety. • The national monument will maintain a wilderness management plan or equivalent planning document to guide the preservation, management and use of these resources. • Managers considering the use of aircraft or other motorized equipment or mechanical transportation within wilderness must consider impacts to the character, aesthetics, and traditions of wilderness before considering the costs and efficiency of the equipment. • All management decisions affecting wilderness must be consistent with the minimum tool requirement concept: a proposed management action must be appropriate or necessary for administration of the area as wilderness and not pose a significant impact to wilderness resources and character, and the management method (tools) used must cause the least amount of impact to the wilderness resources and character. Administrative use of motorized equipment or mechanical transport will be authorized only if the superintendent determines it is the minimum requirement needed to achieve the purposes of the area as wilderness, or it is needed in an emergency situation involving the health or safety of persons actually within the area. • In evaluating environmental impacts, the monument will take into account wilderness characteristics and values, including the primeval character and influence of the wilderness; the preservation of wilderness conditions. • Managers will be expected to appropriately address cultural resources management considerations in the development and review of environmental compliance documents for actions that might impact wilderness resources. • Scientific activities will be encouraged and permitted when consistent with NPS responsibilities to preserve and manage wilderness. • Wilderness education/interpretive programs will be used to inform visitors about wilderness ethics and how to minimize their impacts on wilderness, leave-no-trace practices will be emphasized. • All fire management activities in wilderness will conform to the basic purposes of wilderness.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

SOUNDSCAPE MANAGEMENT

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
NPS Management Policies 2006; DO 47, "Sound Preservation and Noise Management" Executive memorandum signed by President Clinton on April 22, 1996	An important part of the NPS mission is to preserve or restore the natural soundscapes associated with National Park System units. The sounds of nature are among the intrinsic elements that combine to form the environment of our park units and monuments. The NPS preserves the natural ambient soundscapes, restores degraded soundscapes to the natural ambient condition wherever possible, and protects natural soundscapes from degradation due to human-caused noise. Disruptions from recreational uses are managed to provide a high-quality visitor experience and protect biological resources and processes that rely on sound (i.e., intra-species communication, courtship, predation and predator avoidance, and effective use of habitat). **MANAGEMENT DIRECTION/STRATEGIES** • Actions will be taken to monitor and to prevent or minimize unnatural sounds that adversely affect Lava Beds National Monument resources or values, or visitors' enjoyment of them. • The monument staff continues to require tour bus companies to comply with regulations designed to reduce noise levels. • Noise generated by NPS management activities will be minimized by strictly regulating administrative functions such as the use of motorized equipment. Noise will be a consideration in the procurement and use of equipment by the national monument staff. • The monument will encourage visitors to avoid unnecessary noise, such as through the use of RV generators and observing quiet hours in the campground. • Activities or actions producing excessive noise in cave environments may be managed when they risk impacting cave soundscapes or other cave resources.

ARCHEOLOGICAL RESOURCES

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
National Historic Preservation Act; Archaeological Resources Protection Act The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (1995) NPS Management Policies 2006, DO 28 "Cultural Resource Management Guidelines;" DO 28A "Archeology;" Nationwide Programmatic Agreement for Section 106 of the Historic Preservation Act	• Archeological sites are identified and inventoried and their significance is determined and documented. • Archeological sites are protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable. **MANAGEMENT DIRECTION/STRATEGIES** • When disturbance or deterioration is unavoidable, the site is professionally documented and excavated and the resulting artifacts, materials, and records are curated and conserved in consultation with the state historic preservation offices (and American Indian tribes if applicable). • Survey and inventory archeological sites monument wide, determine and document their significance. The most critical area for study is monument land where development or visitor activity is planned. • Determine which archeological sites should be added to the Archeological Sites Management Information System (ASMIS) and the National Register of Historic Places. • Educate visitors on regulations governing archeological resources and the importance of protecting sites in situ. • Archeological sites will be monitored. • Treat all archeological resources as eligible for listing on the National Register of Historic Places pending a formal determination by the National Park Service, the state historic preservation offices, and associated Indian tribes as to their significance. • Protect all archeological resources eligible for listing or listed on the National Register; if disturbance to such resources is unavoidable, conduct formal consultation with the Advisory Council on Historic Preservation, as appropriate, and the California state historic preservation office and Indian tribes in accordance with the National Historic Preservation Act and implementing regulations.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

ETHNOGRAPHIC RESOURCES AND SACRED SITES

POLICY GUIDANCE/ SOURCES

National Historic Preservation Act; American Indian Religious Freedom Act; Archaeological Resources Protection Act; National Environmental Policy Act; Executive Order 13007 (Indian Sacred Sites)

NPS Management Policies 2006; DO 28 "Cultural Resource Management Guidelines;" Nationwide Programmatic Agreement for Section 106 of the Historic Preservation Act

Ethnographic resources are the cultural and natural features of a park unit that are of significance to traditionally associated peoples.

DESIRED CONDITIONS

- The National Park Service acknowledges that American Indian tribes, including native Alaskans, treat specific places containing certain natural and cultural resources as sacred places having established religious meaning, and as locales of private ceremonial activities.
- Consistent with the requirements of the policy guidance cited, the NPS will strive to allow American Indians and other traditionally associated peoples access to, and use of, ethnographic resources.

MANAGEMENT DIRECTION/STRATEGIES

- Continued access to and use of ethnographic resources is often essential to the survival of family, community, or regional cultural systems, including patterns of belief and sociocultural and religious life. However, the NPS may not allow access and use if it would violate the visitor use criteria listed in section 8.2 of NPS management policies.
- Park superintendents may reasonably control the times when, and the places where, specific groups may have exclusive access to particular areas of a park.
- With regard to consumptive use of park resources, current NPS policy is reflected in regulations published at 36 CFR 2.1. These regulations allow superintendents to designate certain fruits, berries, nuts, or unoccupied seashells which may be gathered by hand for personal use or consumption if it will not adversely affect park wildlife or the reproductive potential of a plant species, or otherwise adversely affect park resources. The regulations do not authorize the taking, use, or possession of fish, wildlife, or plants for ceremonial or religious purposes, except where specifically authorized by Federal statute or treaty rights, or where hunting, trapping, or fishing are otherwise allowed. These regulations are currently under review, and NPS policy is evolving.
- The NPS will protect sacred resources to the extent practicable, consistent with the goals of the traditionally associated Native American tribe or group when authorized under NHPA.
- The location and character of sacred sites will be withheld from public disclosure, if disclosure will cause significant invasion of privacy, risk harm to the historic resource, or impede the use of a traditional religious site by practitioners.
- Members of Native American tribes or groups may enter park units for traditional non-recreational activities without paying an entrance fee.
- In consultation with the appropriate groups, the NPS will develop a record about such places, and identify any treatments preferred by the groups. This information will alert superintendents and planners to the potential presence of sensitive areas, and will be kept confidential to the extent permitted by law.
- The NPS will collaborate with affected groups to prepare mutually agreeable strategies for providing access to ordinarily gated or otherwise- inaccessible locales, and for enhancing the likelihood of privacy during religious ceremonies. Any strategies that are developed must comply with constitutional and other legal requirements.
- Accommodations will also be made for access to, and the use of, sacred places when interest is expressed by other traditionally associated peoples, especially native Hawaiians and other Pacific islanders, and by American Indian peoples and others who often have a long- standing connection and identity with a particular park or resource.
- Various ethnic groups, local groups with recently developed ties to resources in neighboring parks, and visitors to family and national cemeteries and national memorials also might use park resources for traditional or individual religious ceremonies. Mutually acceptable agreements may be negotiated with these groups to provide access to, and the use of, such places, consistent with constitutional and other legal constraints.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

MUSEUM RESOURCES

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
National Historic Preservation Act; Archeological and Historic Preservation Act; Archeological Resources Protection Act; Native American Graves Protection and Repatriation Act; 36 CFR 79; Management of Museum Properties Act NPS Management Policies 2006; DO 28 "Cultural Resource Management Guidelines;" DO-24 "NPS Museum Collections Management;" NPS Museum Handbook; Nationwide Programmatic Agreement for Section 106 of the Historic Preservation Act	The NPS will collect, protect, preserve, provide access to, and use objects, specimens, and archival, and manuscript collections. These collections may contribute to advancing knowledge in the humanities and sciences, including the disciplines of archeology, ethnography, history, biology, geology, and paleontology, and will aid in improving the understanding of these subjects among park visitors. **MANAGEMENT DIRECTION/STRATEGIES** The National Park Service will take the following kinds of actions to meet legal and policy requirements related to museum resources: • Continue to ensure adequate conditions for the climate control of collections and means for fire detection and suppression, integrated pest management, and research and interpretation access are maintained. • Inventory and catalog all monument museum collections in accordance with standards in the NPS Museum Handbook. • Develop and implement a collection management program according to NPS standards to guide the protection, conservation, and use of museum objects. • Develop documentation for all specimens in the natural and cultural resource collections. • Ensure that the qualities that contribute to the significance of collections are protected and preserved in accordance with established NPS museum curation and storage standards.

CULTURAL LANDSCAPES

POLICY GUIDANCE/ SOURCES	
National Historic Preservation Act, NPS Management Policies 2006; DO 28 "Cultural Resources Management" Secretary of Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes; Nationwide Programmatic Agreement for Section 106 of the Historic Preservation Act	Cultural landscapes at Lava Beds National Monument include the Modoc War Historic District (2005), as well as Public Works Administration, Civilian Conservation Corps, and Mission 66-era infrastructure and facilities associated with the monument. **DESIRED CONDITIONS** Cultural landscapes are preserved with their attendant significant physical attributes, biotic systems, and uses (when those uses contribute to historical significance). **MANAGEMENT DIRECTION/STRATEGIES** • Treatment decisions will be based on a cultural landscape's historical significance over time, existing conditions, and use. • Treatment decisions will consider both the natural and built characteristics and features of a landscape, the dynamics inherent in natural processes and continued use, and the concerns of traditionally associated peoples. • The treatment implemented will be based on sound preservation practices to enable long-term preservation of a resource's historic features, qualities, and materials. • The preservation, rehabilitation, restoration, or reconstruction of cultural landscapes would be undertaken in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guideline's for the Treatment of Cultural Landscapes*.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

HISTORIC STRUCTURES

POLICY GUIDANCE/ SOURCES

National Historic Preservation Act; Archeological and Historic Preservation Act; The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Secretary of the Interior's Standards for the Treatment of Historic Properties; Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (1995);

NPS Management Policies 2006, DO 28 "Cultural Resource Management Guideline;" ; Nationwide Programmatic Agreement for Section 106 of the Historic Preservation Act

DESIRED CONDITIONS

- Historic structures are inventoried and their significance and integrity are evaluated under National Register of Historic Places criteria.
- The qualities that contribute to the listing or eligibility for listing of historic structures on the national register are protected in accordance with the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (unless it is determined through a formal process that disturbance or natural deterioration is unavoidable).

MANAGEMENT DIRECTION/STRATEGIES

The monument will take the following kinds of actions to meet legal and policy requirements related to historic structures:

- Update and certify the list of classified structures (LCS) and determine the appropriate level of preservation for each historic structure formally determined to be eligible for listing or listed on the National Register of Historic Places (subject to the Secretary of the Interior's Standards).
- Analyze the design elements (e.g., materials, colors, shape, massing, scale, architectural details, and site details) of historic structures in the monument (e.g., intersections, curbing, signs, and roads and trails) to guide the rehabilitation and maintenance of sites and structures.
- Prepare historic preservation plans as necessary to guide maintenance.
- Document history through oral histories of individuals, groups, and others who have ties to the monument.
- Before modifying any historic structure listed on the National Register of Historic Places or any historic structure potentially eligible for the national register, the NPS will consult with the state historic preservation officer and the Advisory Council for Historic Preservation, as appropriate.
- Survey, inventory, and evaluate historic properties.
- Submit the inventory and evaluation results to the state historic preservation officer for review and comment. Forward the final nomination to the Keeper of the national register with recommendations for eligibility to the national register.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

PALEONTOLOGICAL RESOURCES

POLICY GUIDANCE/ SOURCES	DESIRED CONDITIONS
1979 Archaeological Resources Protection Act; 2005 Paleontological Resources Preservation Act (Pending, Senate Bill S.263), USC Title 9, Chapter 79, § 5937.	Paleontological resources, including both organic and mineralized remains in body or trace form, are protected and preserved for public education, interpretation, and scientific research. **MANAGEMENT DIRECTION/STRATEGIES** • Confidentiality of information: "Information concerning the nature and specific location of a National Park System resource which is … of mineral or paleontological objects within units of the National Park System… may be withheld from the public in response to a request under section 552 of title 5… • The monument will establish a program to inventory paleontological resources and systematically monitor for newly exposed fossils, especially in areas of rapid erosion. • Scientifically significant resources will be protected by collection or by on- site protection and stabilization. • The NPS will encourage and help the academic community to conduct paleontological field research in accordance with the terms of a scientific research and collecting permit. • Fossil localities and associated geologic data will be adequately documented when specimens are collected. • Paleontological resources found in an archeological context are also subject to the policies for archeological resources. • Paleontological specimens that are to be retained permanently are subject to the policies for museum objects. • The NPS will take appropriate action to prevent damage to, and unauthorized collection of fossils. To protect paleontological resources from harm, theft, or destruction, the NPS will ensure, where necessary, that information about the nature and specific location of these resources remains confidential, in accordance with the National Parks Omnibus Management Act of 1998. Park units will exchange fossil specimens only with other museums and public institutions dedicated to the preservation and interpretation of natural heritage and qualified to manage museum collections. Fossils to be deaccessioned in an exchange must fall outside of the monument's scope of collection statement. Exchanges must follow deaccessioning procedures in the Museum Handbook, Part II, and chapter 6. • All NPS construction projects in areas with potential paleontological resources must be preceded by a preconstruction surface assessment prior to disturbance.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

VISITOR EXPERIENCE

POLICY GUIDANCE/ SOURCES:

NPS Organic Act, Americans with Disabilities Act, P.L. 101-336, 104 Stat. 327, 42 USC §12101

NPS Management Policies 2006; NPS-42, "Accessibility for Visitors with Disabilities," DO 6, "Interpretation and Education."

The NPS Organic Act, NPS General Authorities Act, and NPS Management Policies 2006 (§1.4, 8.1) all address the importance of national park units being available to all Americans to enjoy and experience. Current laws, regulations, and policies leave considerable room for judgment about the best mix of types and levels of visitor use activities, programs, and facilities. For this reason, most decisions related to visitor experience and uses are addressed in the alternatives. However, all visitor use of the national park system must be consistent with the following guidelines.

DESIRED CONDITIONS:

- Monument resources are conserved "unimpaired" for the enjoyment of future generations. Visitors have opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the monument; opportunities continue to be provided for visitors to understand, appreciate, and enjoy Lava Beds National Monument.
- Visitors have opportunities to understand and appreciate the significance of the monument and its resources, and to develop a personal stewardship ethic. Interpretive and educational programs can build public understanding of, and support for, such decisions and initiatives, and for National Park Service mission in general.
- To the extent feasible, all programs, services, and facilities in the monument are accessible to and usable by all people, including those with disabilities.

MANAGEMENT DIRECTION/STRATEGIES:

- The monument interpretive and educational program includes:
    - information and orientation programs that provide visitors with easy access to the information they need to have a safe and enjoyable experience;
    - interpretive programs that provide both on- and off –site presentations and are designed to encourage visitors to form their own intellectual or emotional connections with the resource. Interpretive programs facilitate a connection between the interests of visitors and the meanings of the monument;
    - curriculum-based educational programs that link monument themes to national standards and state curricula and involve educators in planning and development. These programs include previsit and post visit materials, address different learning styles, include an evaluation mechanism, and provide learning experiences that are linked directly to clear objectives. Programs develop a thorough understanding of a monument's resources in individual, regional, national, and global contexts and of the monument's place within the national park system; and
    - interpretive media that provide visitors with relevant monument information and facilitate more in depth understanding of—and personal connection with—monument stories and resources. This media will be continually maintained for both quality of content and condition based upon established standards.
- The monument will integrate resource issues and initiatives of local and national importance into the interpretive and educational programs.
- Outreach services are an active part of a balanced visitor services program.
- To the extent possible, modifications for access will benefit the greatest number of visitors, staff, and the public, and be integrated with, or in proximity to, the primary path of travel for building entrances and from parking areas.
- Access to wilderness areas should balance the intent of access and wilderness laws and find a way of providing the highest level of protection to wilderness resources.
- To the highest extent possible, people with disabilities should be able to participate in the same programs and activities available to everyone else.
- In choosing methods for providing accessibility, higher priority will be given to those methods that offer programs and activities in the most integrated setting appropriate.
- Special, separate, or alternative facilities, programs, or services will be provided only when existing ones cannot reasonably be made accessible.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

SUSTAINABLE FACILITY DESIGN

POLICY GUIDANCE/ SOURCES:	DESIRED CONDITIONS:
Executive Order 12873, Executive Order 12902 NPS Management Policies 2006	• Administrative and visitor facilities are harmonious with monument resources, compatible with natural processes, aesthetically pleasing, functional, as accessible as possible to all segments of the population, energy efficient, and cost-effective. • All decisions regarding operations, facilities management, and development in the monument—from the initial concept through design and construction—reflect principles of resource preservation. Thus, all monument developments and operations are sustainable to the maximum degree possible and practical. • New developments and existing facilities are located, built, and modified according to the Guiding Principles of Sustainable Design or other similar guidelines. • Biodegradable, nontoxic, and durable materials are used in the monument whenever possible. • The reduction, use, and recycling of materials is promoted, while materials that are nondurable, environmentally detrimental, or that require transportation from great distances are avoided as much as possible. **MANAGEMENT DIRECTION/STRATEGIES:** • Whenever possible and authorized, major facilities - especially those that can be shared with other agencies - should be developed outside of monument boundaries. • When structures and facilities are no longer functional in their present locations or are determined to be inappropriately placed in important resource areas they will be removed subject to appropriate compliance. • The NPS will design, construct, and operate all buildings and facilities so they are accessible and useable by persons with disabilities to the greatest extent reasonable. • When plans for meeting transportation needs are updated, a determination must be made as to whether the road system should be maintained as is, reduced, expanded, reoriented, eliminated, or supplemented by other means of travel. • NPS staff will strive to make Lava Beds National Monument's facilities and programs sustainable. • NPS staff will have a comprehensive understanding of their relationship to environmental leadership and sustainability. • NPS staff will support and encourage the service of suppliers and contractors that follow sustainable practices. • Energy usage will be monitored, and energy efficient practices and renewable energy sources would be promoted wherever possible. • Interpretive programs will mention sustainable and nonsustainable practices. Visitors will be educated on the principles of environmental leadership and sustainability through exhibits and other interpretive media. • Monument managers will perform value analysis and value engineering, including life cycle analysis, to examine the energy, environmental, and economic implications of proposed developments. • NPS managers will measure and track environmental compliance and performance. Audits will ensure environmental compliance, emphasize best management practices, and educate employees at all levels about environmental management responsibilities.

SERVICEWIDE LAWS, POLICIES AND DESIRED CONDITIONS

PUBLIC HEALTH AND SAFETY

POLICY GUIDANCE/ SOURCES:	DESIRED CONDITIONS:
NPS Management Policies 2006, Director's Order 51 and RM-51 "Emergency Medical Services;" Director's Order 30 and RM-30 "Hazard and Solid Waste Management; and OSHA 29CFR.	• While recognizing that there are limitations on its capability to totally eliminate all hazards, the National Park Service and its partners, contractors, and cooperators work cooperatively to provide a safe and healthful environment for visitors and employees while applying nationally accepted standards. • Consistent with mandates and nonimpairment, the NPS staff reduces or removes known hazards or applies appropriate mitigating measures, such as closures, guarding, gating, education, and other actions. **MANAGEMENT DIRECTION/STRATEGIES:** • A documented safety program would be maintained in the monument to address health and safety concerns and identify appropriate levels of action and activities. • Maintenance efforts would continue to ensure that all potable water systems and waste water systems in the monument would continue to meet state and federal requirements. • Interpretive signs and materials would be provided as appropriate to notify visitors of potential safety concerns, hazards and procedures to help provide for a safe visit to the monument and to ensure visitors are aware of the possible risks of certain activities. • NPS staff would continue to work with local emergency and public health officials to make reasonable efforts to assist lost persons and rescue sick, injured or stranded persons. • NPS staff would make reasonable efforts to provide appropriate emergency medical services for persons who become ill or injured.

Chapter Two: Foundation for Planning



Previous page: Preparing to cave, *NPS Photo*

Chapter Two: Foundation for Planning

The monument's purpose - a foundation for planning and management

Introduction

Each unit of the National Park Service needs a formal statement of its core purpose to provide a basis for all decisions to be made about a park unit – a foundation for planning and management. The foundation statement records the shared understanding of the monument's purpose, significance, resources and values, primary interpretive themes, special mandates, and the legal and policy requirements.

The foundation for planning and management, called a foundation statement, is generally developed early in the general management planning process, as part of agency scoping and data collection for a GMP.

The foundation statement for Lava Beds National Monument was initiated during a planning team workshop held in the summer of 2005. It has been further refined throughout the GMP process. The foundation statement can be used in all aspects of management to ensure that the most important objectives are accomplished before turning to items that are also important but not directly critical to achieving the park purpose and maintaining its significance. A full copy of the foundation statement is available at the monument.

The purpose of Lava Beds National Monument is to protect and interpret volcanic and natural features of scientific interest, and evidence of prehistoric and historic human settlement, use, and conflict.

Foundation Statement Components

PARK PURPOSE

The park purpose is a statement of why Congress and/or the president established the park as a unit of the national park system. The purpose statement provides the most fundamental criteria against which the appropriateness of all planning recommendations, operational decisions, and actions are tested. The purpose of the monument is based upon its enabling legislation, establishment by presidential proclamation, and legislative history.

The purpose of Lava Beds National Monument is:

To protect and interpret volcanic and natural features of scientific interest, and evidence of prehistoric and historic human settlement, use, and conflict

PARK SIGNIFICANCE

Park significance statements express why the park's resources and values are important enough to warrant national park designation. Statements of the park's significance describe why the park is important within a global, national, regional, and system-wide context and are directly linked to the purpose of the park. A park's significance statements are substantiated by data or consensus and reflect the most current scientific or scholarly inquiry and cultural perceptions, which may have changed since the park's establishment.

Significance Statements

Lava Beds National Monument:

- Protects and interprets the largest concentration of lava tube caves in the continental U.S., along with unique environments and cave-dependent species.
- Protects and interprets outstanding, diverse, abundant, and well preserved lava flows, cinder cones, spatter cones, Maar volcanoes, and other volcanic features associated with the Medicine Lake shield volcano.
- Protects and interprets objects, sites, and the rugged volcanic setting associated with the 1872-73 Modoc War.

- Contains archeological evidence of human occupation extending back in time to the early Holocene (10,000 years to present), exceptional rock art consisting of regionally-distinctive petroglyphs and pictographs, and a setting of continued significance to Modoc people as a part of their traditional homeland.

- Provides a wilderness experience in the unique volcanic landscape of the Great Basin and Cascade ecosystems.

- Protects and manages native plant and animal species and processes representative of the transition zone for Great Basin and Cascade ecosystems.

Secondary Significance

- Lava Beds contains sites and resources associated with homesteading and ranching, early cave exploration and use, the Civilian Conservation Corps, and park development.

PRIMARY INTERPRETIVE THEMES

Primary interpretive themes are based upon park purpose and significance. They provide the foundation on which the park's educational and interpretive program is based. Primary interpretive themes connect park resources to relevant ideas, meanings, concepts, contexts, beliefs, and values. They support the desired interpretive outcome of increasing visitor understanding and appreciation of the significance of the monument's resources.

- Lava Beds' abundant lava tube caves offer outstanding opportunities for exploration and research in rare habitats.

- Lava Beds contains the majority of the battle sites of the Modoc War of 1872-1873, which tell the story of a conflict between two cultures that endured tragedy in order to defend or acquire land.

- Abundant archeological sites, exceptional petroglyphs and pictographs, and numerous sites of traditional significance provide a link between past residents and modern peoples throughout Lava Beds.



Lava tube cave entrance, *NPS Photo*

- Outstanding, diverse, abundant, and well-preserved volcanic features at Lava Beds illustrate the powerful geologic history of a small portion of the Medicine Lake shield volcano, where activity is likely to occur again.

- Over half of Lava Beds is protected as wilderness, providing a primitive recreation experience in the unique volcanic landscape of the Great Basin and Cascade ecosystems.

- Native plants, animals, and processes are protected at Lava Beds, and provide important scientific and educational opportunities as surrounding landscapes continue to change.

Secondary Interpretive Themes

- In the early 20th century, homesteaders, ranchers, cave explorers, and bootleggers persevered through difficult conditions in the lava beds to fulfill independent visions for their lives.

- Most of Lava Beds' early infrastructure was built, largely by hand, by Civilian Conservation Corps enrollees stationed at Camp Lava Beds from 1935 to 1942, beginning the era of modern visitation and services.

FUNDAMENTAL RESOURCES AND VALUES

Fundamental resources and values are the most important ideas or concepts to be communicated to the public about a park and merit primary consideration during planning and management because they are critical to achieving the monument's purpose and maintaining its significance. They may include systems, processes, features, visitor experiences, stories, scenes, sounds, smells or other resources and values. Fundamental resources and values provide a valuable focus throughout the planning process and the life of the plan. They are the reasons for data collection, planning issues, management prescriptions, impact assessments, and value analyses.

Other important resources and values or secondary significance statements are those that may not be fundamental to the purpose and significance but are nevertheless determined to be particularly important in general management planning.

Fundamental and other important resources and values, which are linked directly to the significance statements, are as follows.

Fundamental Resources and Values of Lava Beds National Monument

- **Cave structures, features, ecosystems and physical processes**. The monument currently has more than 700 documented significant caves, which have formed in the monument's basalt and andesite flows.

- **Volcanic features in the monument.** The volcanic landscape of Lava Beds National Monument contains a diverse assemblage of "textbook" examples of extensive igneous formations.

- **Historic landscape, sites, archeological features, and artifacts associated with the Modoc War.** Lava Beds National Monument contains the natural environment, viewsheds, artifacts, and structures associated with the Modoc War. The rugged volcanic setting of the national monument provides context to all events of the war; pre-war conflicts, battles, living conditions between battles (and therefore troop/Modoc preparedness). The end of the war would not have been the same in another landscape.

- **Archeological features and sites of past human habitation or use.** Lava Beds National Monument contains archeological evidence of human occupation extending back in time to the early Holocene (10,000 years to present), exceptional rock art consisting of regionally-distinctive petroglyphs and pictographs, artifacts, and a setting of continued significance to Modoc people as part of their traditional homeland.

- **Wilderness values, resources and character.** There are few locations in the west where one can experience unimpaired volcanic landscapes in a protected natural setting. Low volumes of visitor use in the national monument's wilderness allows for solitude and natural quiet. The rugged caves and surface terrain create opportunities for adventure and testing wilderness skills

- **Great Basin habitat for native plant and animals.** The Great Basin habitat contains a number of vegetation transitions from grassland to mid-elevation shrub woodland to pine forest. A full array of plant and animal species are found in these habitats.

- **Natural process of fire on the landscape.** Fire contributes to maintaining natural processes, restoration of the landscape, removal of exotic species, and improves habitats for sensitive species. Fire also benefits the monument's historic landscapes by maintaining and in some cases returning these areas back to their original habitats, found during the time of the events.

- **Paleontological resources reflecting the history of flora and fauna, climate change.** While most geologic resources are non-renewable, all paleontological phenomena are scarce, fragile, and extremely scientifically valuable.

- **Monument collections, archives, documents, research and inventories related to significant resources.** The monument maintains a broad body of literature, manuscripts, oral histories, artifacts, and other associated records related to its natural and cultural resources. These collections, archives, and documents provide important insight and information about the monument's significant resources and their scientific and interpretive value.

- **Public understanding, enjoyment and access to significant park features.** Visitors to Lava Beds National Monument have the opportunity to learn about and access rare and sensitive resources such as caves, artifacts, historical landscapes, and rock art. Providing a general understanding and appreciation of these resources within their local and regional setting helps to ensure their long-term conservation.

Other Important Resources and Values

- **Evidence of a built environment and landscape changes across the monument.** Historic use of the monument is associated with several nationally significant themes including Peopling Places (homesteading and ranching), Shaping the Political Landscape (government institutions, CCC, and early park development), and Developing the American Economy (CCC). Other locally (natural history) significant themes include cave exploration and active natural resource management (reintroduction of Big Horn sheep).

SPECIAL MANDATES AND CONSTRAINTS

Often there are special mandates or constraints that direct park planning and management decisions. The special mandates are specific directions or agreements that relate directly to the park. Mandates might be a legislative requirement or signed agreements that add another dimension to a park's purpose and significance. Mandates include the designation of an area in the park as wilderness or as an area that is managed by another entity, or designating something of international significance such as a world heritage area or biosphere reserve. Mandates may also commit park managers to specific actions and limit their ability to modify land use in a park unit, such as long term cooperative agreements, or easements.

The legislative and administrative constraints for Lava Beds National Monument include the following:

Wilderness

On October 13, 1972 legislation (P.L. 92-493) established the designation of 28,460 acres of Lava Bed's National Monument as wilderness. These areas established include the Callahan (Black) and Schonchin lava flows and their surroundings.



Lava flow in snow, *NPS Photo*

More than 28,000 acres of designated wilderness at the monument protect wilderness values, including opportunities for solitude and a primitive and unconfined type of recreation.



Wilderness Area, *NPS Photo*

Chapter Three: Alternatives



Previous page: View from Cave Loop, *NPS Photo*

Chapter Three: Alternatives

Alternatives for the management of Lava Beds National Monument

Introduction

The National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality regulations that implement NEPA require the development of alternatives in a draft general management plan in order to fully explore a range of ideas, methods, and concepts for managing a national park unit. It must be possible to implement all alternatives considered. In addition, regulations require that the draft general management plan identify a "preferred alternative" before the draft plan and environmental assessment is released for public review. The preferred alternative is the alternative that the NPS believes would best accomplish its goals, based on the analyses conducted.

This *Draft General Management Plan and Environmental Assessment* presents three alternatives for future management of Lava Beds National Monument. Alternative A, the No-Action Alternative, presents a continuation of current management direction and is included as a baseline for comparing the consequences of implementing each alternative. The action alternatives are alternative B, Expanding Learning and Resource Preservation through Collaboration (the preferred alternative) and alternative C, Diversified Recreation.

These three alternatives embody the range of what the public and NPS staff want to see accomplished regarding natural resource conditions, cultural resource conditions, visitor use and experience conditions, and management at Lava Beds National Monument.

The three proposed alternatives embody the range of what the public and NPS staff want to see accomplished regarding natural resource conditions, cultural resource conditions, visitor use and experience conditions, and management at Lava Beds National Monument.



Early Visitors at Petroglyph Point, *CalLibrary Photo*

Formulation of the Alternatives

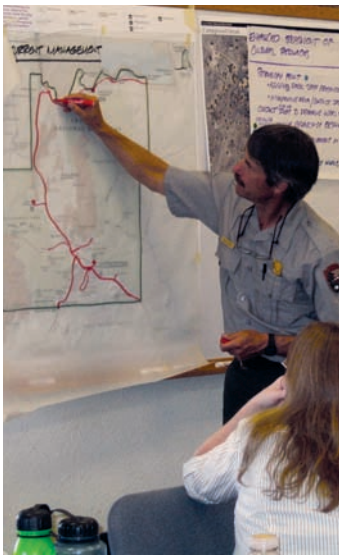
The planning team, comprised of staff from the monument and the NPS Pacific West Region, developed four preliminary management alternatives (including the "no action" alternative) in the summer of 2007. The action alternatives centered on three themes; expanded resource preservation and restoration (preliminary alternative B), providing diversified recreation opportunities (preliminary alternative C), and expanded education and interpretation (preliminary alternative D). Each alternative was evaluated to ensure consistency with the monument's purpose and significance, the desired future conditions, and current laws, regulations, and policies. These preliminary alternatives were presented for public review in winter 2008.

In spring 2008, the planning team incorporated ideas generated from stakeholder meetings and public comment letters submitted to the planning team during the winter of 2008. Overall, GMP actions that the public was most supportive of included preserving the monument's resources and character, and enhancing educational opportunities, interpretive programs, and exhibits. Many of the public comments on the preliminary alternatives that were received indicated a preference for a blending of the themes captured in the alternatives into one or more alternatives that contain a reasonable complement of environmental preservation, research, visitor access, and visitor opportunities.

Alternative Components

Each alternative must meet the program standards for the major elements of a GMP, including:

- An overall **management concept** statement generally describes the guiding philosophy or overall direction for each alternative. The concept highlights the alternative's overall character in terms of emphasis on particular kinds of resource conditions and associated visitor experiences.
- **Management of specific areas.** Area-specific desired conditions are described for various locations throughout the monument, including the desired resource conditions, associated visitor experience opportunities, and the appropriate kinds and levels of management, development, and access. This plan describes area specific desired conditions for the Cave Loop Road area, Petroglyph Point, and the campground.
- **Management zoning** is the method used by the NPS to identify and describe the appropriate variety of resource conditions and visitor experiences to be achieved and maintained in the different areas of a park. Zoning is generally a two-step process: (1) identify a set of potentially appropriate management zones and define what activities or conditions are appropriate for each zone (see table 2: Management Zones), and (2) allocate those zones to geographic locations throughout the park unit. The geographic locations are conveyed on alternative zoning maps. The alternative zoning maps determine where recommended management actions are appropriate (see alternative zoning maps, pp. 58-60 and pp. 72-74). For example, what areas of the monument would be appropriate for new visitor serving facilities such as a picnic area?
- **User capacity** defines the types and levels of visitor and other public use that can be accommodated while sustaining the desired resource conditions, social conditions and visitor experiences that complement the purpose of the monument. The premise behind user capacity management approaches is that with any use on public lands comes some level of impact that must be accepted; therefore it is the responsibility of the public land management gency to decide what level of impact is acceptable and what actions are needed to keep impacts within acceptable limits.
- **Potential Boundary Adjustments.** GMP's are required to take a comprehensive look at concerns at concerns about adjacent land uses, implications for management of lands within the authorized boundary, and potential for boundary adjustments.
- **Management actions** describe the changes in management direction or strategies that the monument would consider to achieve the vision described in the alternative concept. Because some management directions would be implemented regardless of alternative, Table 3 describes those management directions that are "common to all alternatives."
- **Projected Implementation Costs.** NPS policies require general management plans to include estimates of annual recurring costs ("annual operating costs") and of one-time capital costs for facility rehabilitation, new construction, or management projects. Costs of alternatives may vary significantly in recurring needs such as staffing, operations, and maintenance, as well as one-time projects such as facilities, transportation projects, research, and resource rehabilitation.



Alternatives workshop, *NPS Photo*

The Preferred Alternative was chosen by comparing costs against the relative advantages of each alternative to preservation and restoration, research opportunities, and engagement of a broader public through more interpretation, education, and new visitor opportunities.



Public meeting, *NPS Photo*



Mushpot Cave, *NPS Photo*

The preferred alternative proposed includes a blend of the strengths and advantages of themes included in preliminary alternatives B and D. Several actions from alternative C were also incorporated.

The alternatives presented seek to balance resource protection with new visitor opportunities and were developed to be functional and viable. The revised alternative B (the preferred alternative) would maximize resource protection and visitor opportunities by restoring habitat, expanding research opportunities, offering new educational and interpretive opportunities, expanding wilderness opportunities, constructing new trails, and providing a limited number of new visitor service facilities. Alternative C maximizes visitor recreational opportunities by providing more facilities and recreational programs for visitors.

Each alternative has a somewhat different concept, which is primarily defined in terms of different management zones and how they are applied geographically. These differences are displayed on zoning maps for each of the action alternatives. Each alternative also varies in the management prescriptions, or actions, for various resource topics that the monument would initiate in order to achieve the desired conditions. See the opposite page for a detailed description of the alternative components.

The alternatives focus on which resource conditions and what visitor uses and experiences should exist within the monument rather than on details of how these conditions and experiences should be achieved. Thus, the alternatives do not include many details about resource or visitor use management. More detailed plans or studies would be required before most conditions proposed in the alternatives are achieved. The implementation of any alternative also depends on future funding and environmental compliance. This plan does not guarantee that funding will be forthcoming. The plan establishes a vision of the future that would guide day-to-day and year-to-year management of the monument, but full implementation could take many years.

Identification of the Preferred Alternative

The development of a preferred alternative involves evaluating the alternatives with the use of an objective analysis process called "choosing by advantages" or "CBA." Through this process, the planning team identifies and compares the relative advantages of each alternative according to a set of factors. The factors were chosen based on issues and goals identified for the GMP and public comments. The alternatives were evaluated based on the degree to which each alternative accomplishes the following factors:

- Preserves and/or restores significant ecological systems, cultural resources and monument collections
- Provides a range of high quality experiences through interpretive, educational, and recreational opportunities
- Increases scientific knowledge and understanding of monument resources
- Preserves the monument's undeveloped character (unobtrusive and low-profile) and wilderness values
- Improves operational efficiency and sustainability

The planning team evaluated the relationships between the advantages and costs of each alternative according to the factors listed above. This information was used to combine the best attributes of the initial preliminary alternatives into the preferred alternative (alternative B). This alternative gives the National Park Service the greatest overall benefits for each point listed above for the most reasonable cost.

Potential for Boundary Adjustments

The National Park and Recreation Act of 1978 requires general management plans to address whether boundary modifications should be made to park units. Since the 1930s the NPS has looked at a number of different alternatives with respect to expanding Lava Beds National Monument boundaries for the purpose of resource preservation and visitor use. The monument's 1944 Master Plan recommended adding Petroglyph Point and large areas south of the monument including the Black Lava Flow and Big Glass Mountain. In 1951, President Harry Truman issued a presidential proclamation adding Petroglyph Point and Mammoth Crater to the monument. To accommodate a road along the north boundary, Congress authorized the addition of several hundred acres in the October 1974 appropriations bill. The recommended Black Lava Flow and the Big Glass Mountain additions were never implemented. In 2010, additional lands were added to Petroglyph Point.

The action alternatives in this GMP do not propose any boundary adjustments. However, the monument will focus on working primarily with the U.S. Forest Service in the management of significant resources that are associated with the monument, such as lava tube systems that start on U.S. Forest Service lands and cross into the monument. There are also significant holdings of private timberland (approximately 2,500 acres) located along the southern boundary of the monument. Depending on how they are managed, activities on these lands could be detrimental to the resources of the monument. Rather than expanding the monument boundary, efforts would instead be directed to assist the Modoc National Forest in acquiring the timberland.

Overview of Management Zones

Management zones apply to different areas of a park unit and consist of descriptions of the desired conditions for resources and visitor experiences in those different areas. Together, they identify the widest range of potential resource conditions, visitor experiences, and facilities for the park unit that fall within the scope of the park unit's purpose, significance, and special mandates. Four management zones were identified for Lava Beds National Monument: administrative, developed, interpretive backcountry, and backcountry.

In formulating the two action alternatives, the management zones were placed in different locations or configurations on a map of the monument according to the overall concept of each alternative (see alternative zoning maps, pp. 76-78 and pp. 89-91).

The four management zones identified for Lava Beds National Monument are presented in Table 2. Visitor experiences, resource conditions, and appropriate activities and facilities are described for each management zone. Desired conditions that are common to all of the management zones are described below.



COMMON TO ALL ZONES

CAVES

Lava Beds National Monument offers a variety of experiences but the primary recreational activity is cave exploration. The monument recognizes that caves are non-renewable resources, and every effort will be made to provide resources and staff to preserve and protect cave resources in as natural a setting as possible regardless of surface zoning. The monument's cave management plan would outline specific resource management prescriptions for caves.

ETHNOGRAPHIC RESOURCES

In all zones, ethnographic resources are identified. Consultation of the tribes would be undertaken to address issues related to ethnographic resources.

TABLE 2: MANAGEMENT ZONES

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
ZONE CONCEPTS			
The backcountry zone would emphasize the preservation of natural and cultural resources and offer outstanding opportunities for solitude and primitive recreation. Recreational opportunities would be primarily unstructured, with many opportunities for adventure. This zone would include legislated wilderness areas and others areas managed as wilderness.	The interpretive backcountry zone would emphasize the preservation of natural and cultural resources and offer opportunities for solitude and primitive recreation, but the sights and sounds of people would be evident in limited areas. Resources could be modified for essential visitor needs such as trails and interpretive media, as well as operational needs in a way that harmonizes with the natural and cultural environment.	The developed zone would support developed visitor use areas that feature convenient access and support services. Education and interpretive facilities and services would be fully accommodated. This zone would serve as a primary entry into other zones.	The purpose of the administrative zone would be to support the day-to-day management and administration of the monument. These areas would generally be closed to the public.
DESIRED NATURAL RESOURCE CONDITIONS			
Natural resources would be managed with concern for fundamental ecological processes as well as individual species and features. Sage and grassland communities would be maintained in a healthy and stable condition. The Ponderosa pine community would be restored using appropriate management techniques. Nonnative plant management would be focused on eradication. The monument would provide adequate habitat for wildlife, including populations of bats, birds, and sensitive species such as sage grouse. Wildland fire use would be the principal vegetation management tool in this area. Surface geological features would be maintained in their natural condition.	Natural resources would be managed for the same desired conditions as the Backcountry Zone. However, the monument would allow greater visitor access while maintaining and improving the natural and geological setting. Sage and grassland communities would be maintained in a healthy and stable condition. The Ponderosa pine community would be restored using appropriate management techniques. Nonnative plant management would be focused on eradication. The monument would provide adequate habitat for wildlife, including populations of bats, birds, and sensitive species such as sage grouse. Wildland fire use would be emphasized, but managed to accommodate visitor needs and address safety concerns.	Visitor facilities such as structures, trails, parking areas, picnic areas, informational signs, and drinking fountains would be sited in areas that are already disturbed or in areas without sensitive resources. New visitor facilities would be designed to minimize any negative impacts on natural resources. Sage and grassland communities would be maintained in a healthy and stable condition. The Ponderosa pine community is restored using appropriate management techniques. Nonnative plant management would be focused on eradication or containment. The monument would provide adequate habitat for wildlife, including populations of bats, birds, and sensitive species such as sage grouse.	Natural resources would be managed with concern for fundamental ecological processes as well as individual species and features. Monument operations would have a minimal impact on the protection of native vegetation and wildlife New administrative facilities would be sited in areas that are already disturbed or in areas without sensitive resources. Sage and grassland communities would be maintained in a healthy and stable condition. The Ponderosa pine community would be restored using appropriate management techniques. The monument would provide adequate habitat for wildlife, including populations of bats, birds, and sensitive species such as sage grouse.

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
DESIRED NATURAL RESOURCE CONDITIONS (CONTINUED)			
	Surface geological features would be maintained in their natural condition, managed to prevent degradation, or restored where feasible. Area closures to protect sensitive species would be utilized.	Surface geological features would be maintained in their natural condition, managed to prevent degradation, or restored where feasible. Area closures to protect sensitive species would be utilized. Natural resources collections would be housed in this zone.	Surface geological features would be maintained in their natural condition, managed to prevent degradation, or restored where feasible. The visibility of administrative structures and features from other zones would be minimized. Natural resources collections would be housed in this zone.
DESIRED CULTURAL RESOURCE CONDITIONS			
Cultural resources would be recognized as an integral component of the wilderness resource. Historic properties would be managed using the Secretary of the Interior's Standards for documentation, preservation, conservation, and research. Known sites, ruins/structures and features would be fully described for management, research, and interpretation. Past human uses of the land would be researched and understood.	The monument would balance greater visitor use and interpretation with the preservation of sites, buildings, features, and rock art. Historic properties would be managed using the Secretary of the Interior's Standards for documentation, preservation, conservation, and data recovery. Known sites, ruins, structures and features would be fully described for management, research, and interpretation. Past human uses of the land would be researched and understood. Appropriate information concerning human ecology and history would be provided for visitors through formal and self-guided tours.	The monument would actively preserve and maintain resources in this zone to address anticipated visitor impacts. Historic properties would be managed using the Secretary of the Interior's Standards for documentation, preservation, conservation, and data recovery. Known sites, ruins/structures and features would be fully described for management, research, and interpretation. Past human uses of the land would be researched and understood. Historic structures and buildings would be appropriately adapted for continued use. Historic properties are integral to the educational program and would be actively used for interpretation.	Visitor access would not be encouraged or provided. Historic properties would be managed using the Secretary of the Interior's Standards for documentation, preservation, conservation, and data recovery. Known sites, ruins/structures and features would be fully described for management, research, and interpretation. Past human uses of the land would be researched and understood. Historic buildings would be appropriately adapted for continued use. At risk properties would be monitored and threats would be mitigated. Collections would be cared for by providing appropriate environmental controls and by adhering to access and handling protocols.

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
DESIRED CULTURAL RESOURCE CONDITIONS (CONTINUED)			
		Sensitive resources may be documented and salvaged if threatened by use. Archeological sites would be stabilized.	Archives would be fully catalogued and copies would be made available for appropriate research and interpretation.
DESIRED VISITOR OPPORTUNITY RESOURCE CONDITIONS			
Visitors would have the opportunity to experience solitude, adventure, and escape in the monument's unique volcanic landscape. Visitors would experience natural scenery, dark night sky, natural quiet, and the natural qualities of this environment. Visitors would have a self-directed, generally unfacilitated experience involving some level of risk and physical challenge. Interpretive opportunities would be available for pre-planning the visitor experience. Wilderness areas provide an opportunity and obligation for self-sufficiency. Visitor activities within the backcountry zone would require a moderate to extended time commitment. Special programs could be conducted in the backcountry zone.	Visitors would experience the environment with some interpretive features. Visitors would have some opportunities to experience natural scenery, dark night sky, and natural quiet. Visitors would have some ranger guided activities and interpretive opportunities would be provided. Some pre-planning may be required for visitation. Visitor opportunities would require some amount of self-reliance. Visitor activities within the interpretive backcountry zone would require a moderate time commitment. Visitors would have light to moderate contact with other visitors and monument staff.	Visitors would experience a wide variety of both personal and non-personal interpretive opportunities. Aside from caves, most visitor attractions and interpretive features would be accessible to most or all visitor populations. The monument would provide opportunities for more in-depth interpretation. Numerous ranger guided activities would be provided, especially in the summer season. There would be a high potential for contact with other visitors, monument staff, and administrative activities Little or no pre-planning would be required for visitation to most areas. Minimal risk and physical challenge would be required for visitors in the developed zone. Visitor activities within the developed zone would require a short to moderate time commitment. Wheeled conveyances and leashed pets are allowed on roads and designated trails. Monument staff would allow controlled access to collections	Monument staff would allow controlled access to collections and research materials on a case-by-case basis.

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
DESIRED VISITOR OPPORTUNITY RESOURCE CONDITIONS (CONTINUED)			
		and research materials on a case-by-case basis.	
DESIRED FACILITIES RESOURCE CONDITIONS			
Facilities in the backcountry zone could include primitive trails, minimal trail signs, primitive campsites, unobtrusive administrative markers, and temporary resource monitoring equipment. Telecommunications facilities would not be permitted in the backcountry zone.	Only non-motorized transportation would be permitted, with the exception of motorized administrative access where necessary. With the exception of the existing fire lookout facility, no other buildings would be permitted in the interpretive backcountry zone. Development would primarily consist of trails, administrative roads, trail signs (including interpretive signs), and markers. Small scale telecommunications facilities may be allowed for administrative purposes if designed and sited to minimize impacts. Resource monitoring equipment would be permitted.	The developed zone would contain most visitor facilities. Facilities could include paved and unpaved roads, parking areas, buildings, visitor use support structures, utilities, picnic areas, campground area, interpretive media, pullouts, overlooks, and trailheads. Telecommunications facilities may be allowed to support monument operations if designed and sited to minimize impacts. Resource monitoring equipment would be permitted. New development would minimize visitor impacts and emphasize high quality design aesthetics and sustainability.	Facilities in the administrative zone could include employee housing, administrative offices, maintenance shops and storage, roads, parking, signage, utilities, fire and emergency operations centers. Telecommunications facilities may be allowed to support monument operations if designed and sited to impacts. Sustainability and energy efficiency would be a component of facility management. Resource monitoring equipment would be permitted. New development would emphasize high quality design, aesthetics, and sustainability.
DESIRED CAVE RESOURCE CONDITIONS			
The backcountry zone would emphasize cave preservation. Visitor access would not be encouraged. Information would be limited to cave safety and conservation messages (no specific information on cave locations would be provided). Seasonal cave closures may occur to protect sensitive resources.	The interpretive backcountry zone would provide moderate levels of visitor access to selected caves. Cave exploration would require a high degree of self-reliance and responsibility. Caves would be more intensely managed through monitoring of visitor use and restoration efforts.	The developed zone would provide higher levels of visitor access to selected caves. Caves would be more intensely managed through monitoring of visitor use and restoration efforts. More directed interpretation, including designated corridors for accessing caves, and ranger guided tours would be provided for Class 1 caves.	Access to caves would not be encouraged. Caves would be more intensely managed through monitoring of visitor use and restoration efforts. Impacts to caves from administrative facilities and infrastructure would be minimized.

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
DESIRED CAVE RESOURCE CONDITIONS (CONTINUED)			
A high level of self-reliance and responsibility would be required to explore caves in the backcountry zone.	Directed interpretation for Class 1 caves in this zone would be provided.* Seasonal cave closures may occur to protect sensitive resources. Caves would be generally more impacted in this zone and could require intense management.	Seasonal cave closures may occur to protect sensitive resources.	Seasonal cave closures may occur to protect sensitive resources. Caves would be generally more impacted in this zone and require intense management.
DESIRED DARK NIGHT SKY RESOURCE CONDITIONS			
Dark night skies and natural lightscapes would be integral to the visitor experience in this zone. Nocturnal lightscapes would be preserved and restored to the extent possible. No permanent outdoor lighting would be allowed except as needed for emergency response, critical natural resource goals, or emergency communications.	Same as backcountry zone.	Dark night skies and natural lightscapes would enhance the visitor experience in this zone. Some lighting would be appropriate on powered facilities and in heavy use areas where health and safety are of concern. No lighting would be placed in areas that impact the backcountry and interpretive backcountry zones. Lighting developments would preserve the monument's International Dark Night Skies Park status while protecting nocturnal wildlife. New proposed lights would be in compliance with NPS procedures to assure the protection of dark sky resources.	Same as the developed zone. However, no lighting would be permitted in the Crescent storage area.

* Class 1 caves contain developments that make the cave accessible and relatively safe for the average visitor. These developments must include a trail sign that identifies the cave, a nearby parking area, a path to the cave, and trails within the cave that define routes. Normal visitation to class 1 caves must not threaten sensitive or fragile cave resources. Class 1 caves are not located within designated wilderness or backcountry areas.

MANAGEMENT ZONES			
BACKCOUNTRY ZONE	**INTERPRETIVE BACKCOUNTRY ZONE**	**DEVELOPED ZONE**	**ADMINISTRATIVE ZONE**
DESIRED SOUNDSCAPE RESOURCE CONDITIONS			
The major focus of management within this zone would be the complete protection, maintenance, and restoration of the natural soundscape resource in a condition unimpaired by non-natural noise sources. To the fullest extent possible natural soundscapes would be protected as intrinsic elements of this zone to ensure a wilderness/ backcountry experience for visitors and protect natural resources.	The monument would preserve natural soundscapes in a condition unimpaired by inappropriate or excessive noise sources. Vehicle traffic noise along monument roads would be the primary impact in this zone. The monument would take every effort necessary to limit excessive noise from operational activities, such as vehicle and tool use, etc. Natural soundscapes are managed to provide a high-quality visitor experience and protect biological resources and processes that rely on sound (i.e., intra-species communication, courtship, predation and predator avoidance, and effective use of habitat).	Areas developed for visitor use in this zone would maintain natural soundscapes to the highest extent possible. Disruptions from recreational uses are managed to provide a high-quality visitor experience and protect biological resources and processes that rely on sound.	Natural soundscapes would be protected to the fullest extent possible. Sounds associated with powered vehicles and other equipment needed to manage developed and administrative areas would occur in this zone. Disruptions from maintenance activities are managed to minimize impacts to visitor experiences and protect biological resources and processes that rely on sound.

Description of the Alternatives

The following section describes the range of alternatives considered in this general management plan. Before the detailed description of each alternative, an overview of specific general management plan actions that are common to all alternatives are described. For each alternative described, a narrative provides an overall vision for the alternative. This narrative is followed by a table of management actions specific to that alternative and a description of costs.



California Poppies, *NPS Photo*

ACTIONS COMMON TO ALL OF THE ALTERNATIVES

The following table summarizes the management direction, or actions, that would apply to all the alternatives, including alternative A, the no action alternative.

TABLE 3: ACTIONS COMMON TO ALL ALTERNATIVES

ACTIONS COMMON TO ALL ALTERNATIVES	
GEOLOGIC PROCESSES AND FEATURES	• The monument would continue to maintain and restore the integrity of existing geologic resources and assess the impacts of natural processes and human-related events on geologic resources. • The monument would continue to work with the U.S. Geological Survey and other partners to conduct geologic research, inventories and monitoring, and to identify, address, and monitor geologic hazards. • Sensitive caves (such as Fern Cave and Crystal Ice Cave) would be operated in a manner that preserves the resources while allowing for limited visitor use. • The monument would complete a revised cave management plan. The cave management plan would establish guidelines for long term management strategies and set resource condition goals for the monument's caves.
VIEWSHEDS/VISUAL QUALITY	• The monument would continue to work with the California Environmental Protection Agency and other partners, to preserve its Class I air quality within and around its borders. • The monument would continue to monitor air quality to gain a better understanding of ambient air quality conditions and the sensitivity of monument resources to air pollution.
DARK NIGHT SKIES	• The monument would seek recognition as an International Dark Sky Preserve.
ECOLOGICAL COMMUNITIES	• Wildlife is recognized as an integral part of monument wilderness areas and contributes significantly to overall biodiversity. Wilderness areas would continue to function as a key component in maintaining indigenous species. • Habitat would be managed to support a diverse range of native wildlife species and give the public high-quality opportunities for wildlife-based recreation. • Habitat for migratory birds, including forage, water, cover, structure, and security would be available to support healthy populations of resident and migrant species. • The monument would continue to protect cave environments, ecosystems, and habitat.
FIRE MANAGEMENT	• Fire is recognized as one of the most important tools for the maintenance and restoration of plant communities within and outside of the Monument. All operational, planning and implementation steps are taken in a manner to assure the preservation of natural and cultural resources. Fires are managed for resource benefit through multiple means, including wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions). • Desired future conditions are developed within a vegetation management plan (draft 2010), adaptive management is applied in response to non-native plants, and additional research is conducted to understand fire effects on vegetation communities. • Fire on the landscape is a continually developing science and management effort evolving annually with new research information/findings and fire policy.

ACTIONS COMMON TO ALL ALTERNATIVES	
WILDERNESS	• Designated Wilderness would be managed in accordance with the 2006 Wilderness Stewardship Plan and future updates. Lava Beds Wilderness would remain an area characterized by an essentially unmodified natural environment: Interaction between users would be very low; evidence of other users would be minimal; motorized use within the area would not permitted. • No major wilderness expansion legislation would be pursued. Legislation has been proposed for minor adjustments to the wilderness boundary as outlined in the 2006 Wilderness Stewardship Plan. The proposed adjustments would correct errors from the original legislation by drawing the wilderness boundary around features that are incompatible with wilderness values (e.g. road segments, a portion of the campground amphitheater). Such changes are minor and would not add or remove acres from the 28,460 acres of legislated wilderness designated for the monument in PL 92-493. • Cultural and historic sites are recognized as an integral component of the wilderness resource. Past human uses of the land are understood. Values of cultural resource sites are preserved. • Lava Beds provides opportunities for public use, enjoyment, and understanding of the wilderness, through experiences that depend upon a wilderness setting. The monument would continue to provide outstanding opportunities for solitude or a primitive and unconfined setting. Wilderness dependent research would be encouraged. • The Schonchin Lava Tubes Research Natural Area, a 134 acre plot of land set aside for research would continue to be maintained by allowing natural physical and biological processes to prevail without human intervention.
CULTURAL RESOURCES	• The monument would continue efforts to document cultural resources and consider additional nominations to the National Register of Historic Places for historic buildings and structures, cultural landscapes, and archeological sites. • The monument would complete a survey of all monument lands for cultural resources.
ARCHEOLOGY	• The Modoc Lava Beds Archeological District would be managed for preservation, interpretation, and research. • With the recent addition of a cultural resource position to the monument staff, the monument would continue to improve management of archeological resources through day to day coordination with interested parties. • The identification and interpretation of archeological sites would be conducted so as to not compromise the security of the resources.
ETHNOGRAPHIC RESOURCES	• The monument would continue to preserve and maintain contact with The Klamath Tribes, organizers of the annual Modoc Gathering, and with individual Modocs regarding traditional cultural interests. • The monument would formalize use of ethnographic resources. For example, an agreement or special permit with tribes for collection and use. • The monument would compile baseline information on ethnographic resources.
HISTORIC STRUCTURES	• The monument would continue to preserve and maintain its historic structures.
CULTURAL LANDSCAPES	• The monument would continue preservation of the Modoc War Historic District cultural landscape. Prescribed burns and other treatments would continue to be used to restore the historic landscape and control the spread of invasive species. • Preservation and maintenance of buildings, structures, and landscape features associated with the Public Works Administration and Civilian Conservation Corps development would continue. • Mission 66 era infrastructure would be evaluated for national register eligibility.

ACTIONS COMMON TO ALL ALTERNATIVES	
MUSEUM COLLECTIONS	• Monument staff would continue to locate and document museum collections housed at other facilities and identify, process, document, and duplicate monument records and archives, and make these available for staff and public use. • Within the monument, environmental controls for current collections space would be improved. • The monument would develop documentation for all specimens in the natural and cultural resource collections. Specific efforts to preserve historic management/administrative records would be implemented, specifically the preservation of records that cover the period of park management (1925-current). Specific steps to continue the protection of administrative records would be implemented through continued collection management efforts.
INTERPRETATION AND EDUCATION	• The monument would complete a long range interpretive plan that would provide specific guidance for defining interpretive themes and desired visitor experience opportunities. The plan would define the interpretive, outreach, and educational services that would meet the needs and preferences of the widest variety of visitors, students, and community members while preserving resources. • Coordination with new cultural resources staff would improve cultural resource interpretation. • Monument interpretive staff would continue to meet the curriculum goals of a wide range of students in both Oregon and California. • Monument interpretive staff would remain engaged in community events, and recruit employees from local communities and colleges to further enhance ties to local and regional communities. • An emphasis placed on interpreting specific prescient topics such as climate change and utilizing new technologies in interpretation would continue as they evolve at a national level.
ROADS, TRAILS, AND TRAILHEADS	• If the condition of Forest Service Route 10 is not improved and remains in poor condition, visitors would be directed to access the monument from the more heavily traveled and paved northern routes. • The suitability of potential new trail locations would be evaluated through a trail management plan.
FACILITIES (MAIN PARK UNIT)	• Facilities would be managed to protect dark night skies, soundscapes, viewsheds, and wildlife preservation, and to prevent nonnative plant dispersal. • New facilities would not be built over or degrade geologic features and cave resources. • Best available technologies would be used to reduce impacts on wildlife species. For example, the replacement of windows in current facilities with new non-collision technology would be incorporated as the science develops to prevent birds from colliding with structures. • New alternative/solar energy conversion efforts on facilities would be implemented in a manner to protect the monument's natural and cultural resources. • The research center would continue to be used for research and educational purposes by the monument and its partners.
BOUNDARY ADJUSTMENTS	• The monument would focus on working with partners and sister agencies to manage significant resources that extend beyond the monument boundaries, primarily lava tube systems that cross onto National Forest lands.

RESEARCH	• A resource stewardship strategy would be completed for Lava Beds.
	• The monument would identify and prioritize scientific research needs. The following are examples of some of these needs:
	  ◦ Caves – impacts of visitors on cave formations and cave fauna/flora.
	  ◦ Fire –nonnative plant response to fire regimes on large inter-agency landscape level.
	  ◦ Archeology –Modoc War, obsidian sites, and other topics that provide further insight into human occupation on the landscape.
	  ◦ Wildlife – avian use in northern monument lands and mammal presence within low elevation sagebrush communities.
	  ◦ Vegetation –conducting long-term research on low elevation plant communities to understand all parameters of juniper establishment, etc.

ACTIONS COMMON TO ALL ALTERNATIVES	
PARK OPERATIONS	• The monument would continue to practice environmental stewardship and implement best management practices. • The monument would seek ways to reduce its carbon footprint and apply best ecological practices.
PETROGLYPH POINT	• The monument would conduct a conservation assessment/site plan of Petroglyph Point that would include collecting baseline data on birds, mammals, rare species, and cultural resources. • The monument would study/research causes of petroglyph erosion and develop a suitable plan for implementing protection measures.
CAVE LOOP	• The monument would continue to implement seasonal closures of Cave Loop caves to protect resources. • The monument would complete a cave management plan that further describes the management of cave resources.

Alternative A: The No Action Alternative

The "no action" alternative provides a baseline for evaluating changes and impacts in the other alternatives. In the no action alternative, the National Park Service would continue to manage Lava Beds National Monument as described in the 1996 General Management Plan. There would be no major change in the management of the monument.

The key components of alternative A are as follows:

- Existing facilities would be maintained.
- The natural resource program would continue to focus on inventorying and monitoring, resource protection, preservation, mitigation, and applied research efforts.
- The cultural resource program would continue to focus on protecting archeological resources, historic buildings and structures, and cultural landscapes. Cultural resources would be protected unless it is determined through formal processes that disturbance or natural deterioration is unavoidable. The monument would continue to work with regional and other park cultural resource professionals to manage archeological and museum collection resources. Monitoring of cultural resources would continue through cooperative efforts with the fire program and regional archeological program.
- Limited education programs would be provided for school groups and visitors.
- The existing monument boundary and designated wilderness boundaries would be maintained.
- The monument would continue current coordination with the U.S. Forest Service, the U.S. Fish and Wildlife Service, the Klamath Tribes, universities and researchers, primarily for resource stewardship, interpretive, and administrative purposes.

MANAGEMENT OF SPECIFIC AREAS

Petroglyph Point Unit

The Petroglyph Point Unit would remain in its current condition. The visitor experience at this unit is not of high quality. The chain-link fence erected in front of the west-side rock art would continue to obstruct visibility of the petroglyphs and make photography difficult. The proximity of the unpaved road would continue to cloud the site with dust from passing traffic and the absence of shade on the site would continue to make even brief visits during the summer uncomfortable. Although there is a vault toilet, no potable water is available. While an orientation bulletin board, several wayside exhibits, and a trail guide enhance visitor understanding, personal contact with a ranger would be rare. The petroglyphs would remain vulnerable to vandalism because of the "abandoned" appearance of the area and the distance from monument headquarters.

Cave Loop Road

Cave exploration would continue to be the dominant attraction for visitors at Lava Beds National Monument. Most cave exploration takes place along the "Cave Loop Road" located near the visitor center. The Cave Loop Road provides vehicle and trail access to a number of caves with different configurations and resource attractions. Primary access to caves would be via existing vehicle pull-outs along the loop road. Although some ranger guided tours and contact with roving volunteers would exist in summer, most visitors' caving experience would remain self guided.

Campground

Indian Well campground would continue to provide visitors the opportunity to camp within the monument year round. The monument would maintain the campground in its current condition with flush toilets and sink facilities, but without hookups or additional accommodations for recreational vehicles (RVs).

In the no-action alternative, there would be no major change in the management of the monument.



Miner's Lettuce, *NPS Photo*

MANAGEMENT ZONING

In alternative A, NPS managers would continue to follow the management zoning scheme described in the 1996 general management plan. Most of the monument would remain within an overlapping natural/historic zone, with substantial portions further overlapped by a wilderness subzone (which includes designated wilderness areas) and an eagle habitat management subzone. Major visitor facilities such as the existing visitor center, trailheads, overlooks, campgrounds, picnic areas, and parking lots would be in the developed zone.

USER CAPACITY

In this alternative NPS managers would continue to manage visitation as they have in the past, relying on approved plans. The monument staff would continue to respond to user capacity issues on a case by case basis, with facility capacity largely setting the monument's user capacity. No major new initiatives would be pursued to manage visitors and a monument-wide user capacity approach (i.e., monitoring indicators and standards) would not be established.

BOUNDARY ADJUSTMENTS

No new boundary adjustments would be pursued in alternative A.



Skull Cave entrance, *Photo by Adrian Fernandez*

TABLE 4: MANAGEMENT ACTIONS FOR ALTERNATIVE A

MANAGEMENT ACTIONS FOR ALTERNATIVE A	
NATURAL RESOURCES	
GEOLOGIC PROCESSES AND FEATURES	The management of caves would continue based on the classification system identified in the Cave Management Plan.
VIEWSHEDS/VISUAL QUALITY	See *Actions Common to all Alternatives*
DARK NIGHT SKIES	See *Actions Common to all Alternatives*
ECOLOGICAL COMMUNITIES	The monument's primary vegetation management objectives would be to: (1) maintain or re-establish native communities and; (2) eradicate exotic species which are interfering with native species propagation. Special status species (those listed by U.S. Fish and Wildlife Service and/or the California Department of Fish and Game) would remain at viable population levels. Native restoration would continue to be inhibited by nonnative species that have become entrenched in the monument's native plant communities. Habitat for two of 14 sensitive bat species would be protected to maintain sustainable population levels.
FIRE MANAGEMENT	The Lava Beds fire management program would continue to include the use of suppression, prescribed fire (planned ignitions), and wildfire (unplanned ignitions). Prescribed fire (planned ignitions) would be used to manage the ecosystem, maintain fire as a natural process in the biotic communities of the monument, create or maintain a variety of fuel breaks to prevent the spread of wildfire or prescribed fire, and to maintain the historic scene in historical areas of the monument. On a landscape level, the gradual re-introduction of fire into the ecosystem has been accomplished. There are still small areas of the monument that would need the first application of fire (initial entry) to be accomplished. Wildfire (unplanned ignitions) use would continue to be an integral component of the fire management program. In 2005, over 33,000 acres were identified for wildfire use. The monument would continue to expand this acreage through coordination with sister agencies and as plant communities return to a natural cycle of fire use, allowing for broader wildfire use across the landscape. This would be accomplished through continued implementation of the fire management plan and through improved coordination with partners and sister agencies that border the monument.
WILDERNESS	See *Actions Common to all Alternatives*
CULTURAL RESOURCES	
ARCHEOLOGY	See *Actions Common to all Alternatives*
ETHNOGRAPHIC RESOURCES	See *Actions Common to all Alternatives*
HISTORIC STRUCTURES	The monument would continue to work on the establishment of baseline inventories for historic structures and cultural landscapes (national register or national register eligible). Properties listed on the National Register of Historic Places associated with the Modoc War Historic District would continue to be preserved and primarily used for interpretation. Civilian Conservation Corps facilities within the monument would continue to be used for visitor and/or administrative uses.

MANAGEMENT ACTIONS FOR ALTERNATIVE A	
CULTURAL LANDSCAPES	The monument would continue preservation and maintenance of the Modoc War Historic District cultural landscape. Prescribed burns and other treatments would continue to be used to restore the historic landscape to 19th century battle conditions and to control the spread of invasive species. The cultural landscape inventory and determination of eligibility of Civilian Conservation Corps and Mission 66 structures, buildings, and landscape features for the National Register of Historic Places would be completed.
MUSEUM COLLECTIONS	Cultural resource collections would continue to be housed at the visitor center while natural collections would continue to be housed in a storage building at monument headquarters. Curatorial duties would continue to be a collateral duty position of the Chief of Resources. The Crater Lake National Park curator would continue to provide assistance to the monument. A new monument cultural resource specialist would take on collections duties. Continued efforts to preserve collections would focus on upgrading the cooling/heating system in the visitor center and maintaining the natural collections storage building.
VISITOR EXPERIENCE	
RECREATION	Visitors are directed to other locations for experiences and facilities not provided at the monument such as, mountain biking trails, RV camping with hookups, activities for pets, firewood collection, showers, motels, and food services. The monument would make incremental improvements to improve visitor accessibility (ADA compliance) as facilities and interpretive media are renovated and replaced.
INTERPRETATION	The monument would continue to provide a variety of high-quality non-personal services such as museum exhibits, wayside exhibits, website content, maps, brochures, and a monument introductory film. Interpretive staff coordination between the monument, the U.S. Fish and Wildlife Service, and the U.S. Forest Service would continue at current levels. The education program at the monument would continue to provide limited, curriculum-based education programs both in the monument and in surrounding classrooms during the school year for mid-level grades only.
EDUCATION AND OUTREACH	The monument would continue to provide high-quality personal services. Demand for more formal interpretive programming on weekends and during peak visitation periods would sometimes remain unmet.
FACILITIES AND OPERATIONS	
VISITOR CENTER	The existing visitor center facilities would remain and continue to be maintained.
RESEARCH CENTER	The existing research center facilities would remain and continue to be maintained.
ROADS	The monument would maintain its paved roads and improve adjacent sidewalks and parking areas to fully meet federal and state accessibility standards. Although a project to realign and pave the portion of Medicine Lake Road (Forest Service Road 49) within the monument has been partially designed, design work would continue to be postponed due to a National Park Service policy prohibiting adding additional paved road infrastructure. The U.S. Forest Service plan to pave and improve the currently unpaved segments of the Medicine Lake Road would also continue to be postponed due to a lack of funding. Unpaved administrative roads would continue to be maintained in their current conditions.

MANAGEMENT ACTIONS FOR ALTERNATIVE A	
TRAILS AND TRAILHEADS	The monument would continue to maintain its current hiking trails. The monument would continue to manage trails according to the classification system in the 2006 Wilderness Stewardship Plan according to designated use levels. The monument would realign and adjust trails as necessary to reduce impacts where needed.
BOUNDARY ADJUSTMENTS	See *Actions Common to all Alternatives*
PARTNERSHIPS AND REGIONAL COOPERATION	Monument staff would continue to engage in a limited amount of in-monument and community outreach activities including attending local meetings and special events. The monument would continue to coordinate fire management and law enforcement activities with local and federal agencies. The monument would continue to coordinate with tribes on interpretive efforts, ethnographic uses, and compliance issues.
RESEARCH	Existing cooperative efforts with partners and universities would continue. Cooperative bat research with the Bureau of Land Management would continue. The monument would continue current fire research.
COMMERCIAL SERVICES	The Lava Beds Natural History Association would continue to function as a cooperating association for the monument. The monument would continue to authorize the concession contract for visitor convenience items which is currently held by the Lava Beds Natural History Association. The monument would continue to provide authorizations to a few small scale tour operators.
PARK OPERATIONS AND SUSTAINABILITY	The monument would make incremental improvements in energy conservation and sustainability by implementing energy conservation and alternate energy generation efforts. The monument would continue to implement the existing Environmental Stewardship Plan.
SAFETY AND LAW ENFORCEMENT	Law enforcement would continue with current levels of staffing. Monument staff would continue to depend on electronic systems to protect sensitive resources.
STAFFING	Staffing would be expected to remain at current levels.
AREA-SPECIFIC ACTIONS	
PETROGLYPH POINT	Facilities at Petroglyph Point would be limited to the existing restroom, waysides, parking pull-outs and trails. The existing unpaved road would continue to provide access to and traverse the site. A small parking pull-out would remain to view the Coppock Flag on the eastern end of the site.
CAVE LOOP ROAD	The Cave Loop Road and cave access trails would remain. Occasional seasonal closures of individual caves to protect sensitive resources (e.g. bat colonies) would occur. Cave Loop Road would remain closed to motor vehicles after dark.
CAMPGROUND	The campground would continue to provide opportunities for tent and RV camping and for large groups at one group site. Restoration of vegetation in the campground would continue. The monument would continue to plant trees to replace the loss/mortality of the juniper/pine woodlands and establish vegetation islands between campsites to improve camper privacy.

ESTIMATED COSTS

Cost estimates for alternative A are identified below in Table 5. The costs shown here are not for budgetary purposes; they are only intended to show a very general relative comparison of costs between the alternatives. A discussion of the development of the costs and a comparison between the alternatives is included after the description of the alternatives.

The implementation of the approved plan will depend on future funding. The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the actions in the approved general management plan could be many years in the future.

Annual Operating Costs

The monument's annual operating budget for fiscal year 2008 (FY 2008) was $1,701,000.

Staffing

Alternative A assumes that current staffing levels would be maintained at 22.3 full-time positions (one full time equivalent (FTE) is one person working 40 hours per week for one year, or the equivalent). In addition to the 22.3 FTE, the fire program has six positions that are not funded out of the monument's base operating budget. The FTE number indicates base-funded staff only, not volunteer positions or positions funded by partners. FTE salaries and benefits are included in the annual operating costs.

One-Time Capital Costs

Alternative A would continue the current level of facilities. No major capital improvement projects would be planned under alternative A. Improvements to monument facilities would include deferred maintenance and rehabilitation projects.

TABLE 5: SUMMARY OF COSTS FOR ALTERNATIVE A

SUMMARY OF COSTS FOR ALTERNATIVE A	
ANNUAL OPERATING COSTS	
Monument Operations	$1,701,000
Total Annual Operating Costs	**$1,701,000**



Recreational cave exploration, *NPS Photo*

Alternative B: Expanding Learning and Resource Preservation through Collaboration (Preferred Alternative)

MANAGEMENT CONCEPT

Under this alternative Lava Beds National Monument would promote and strengthen resource protection and restoration through stewardship, research, education, and inter-agency cooperation. The monument would strive to engage a broader public through more interpretation, education, and new visitor facilities.

VISITOR EXPERIENCE

The visitor experience at Lava Beds National Monument would be focused on interpretation for a greater diversity of visitors. The monument would reach out to new audiences by expanding interpretive, educational, and recreational opportunities at the monument. Information and programs on new interpretive topics (e.g., new resource management programs) would be offered. More extensive interpretation on existing topics would also be offered.The monument would employ new technologies for interpretation and education (e.g. virtual cave tours, podcasts for audio tours). More collections would be put on display at the visitor center.



Petroglyph, *NPS Photo*

Partnerships with schools, tribes, gateway communities and others would be fostered to provide new opportunities for education. School groups and volunteers would have opportunities to participate in monument research programs. Workshops and interpretive programs about monument resources would be offered both within and outside of the monument at sites related to park significance (Modoc War battlefields, lava tubes, and portions of the Medicine Lake Volcano).

Expanded recreational opportunities at Lava Beds would include new hiking opportunities and improved day use areas. New hiking trails would primarily include short interpretive loop trails. The NPS would collaborate with the U.S. Forest Service to develop longer trail connections and provide opportunities for appropriate winter sports activities such as cross-country skiing or snowshoeing. More accessible trails would be provided to accommodate users of varying abilities. Several day use areas would be redesigned to better accommodate families and larger groups.

FACILITIES

A limited number of new facilities would be provided to accommodate expanded educational programs, recreational opportunities and research efforts while ensuring that Lava Beds National Monument retains its relatively undeveloped and rustic character. The monument would minimize the intrusion of its existing buildings on monument views through visual screening, applying muted paint colors, installing less reflective roofing materials and minimizing lighting requirements.

Where possible, duplicative and unneeded facilities would be removed and revegetated to reduce the overall facility footprint on the monument and to reduce long-term maintenance obligations.

To better accommodate new educational and research programs, the monument would construct a small addition to the current visitor center to provide classrooms, several offices, and more collections space. The monument would also explore expanding the research center laboratory area to accommodate new research opportunities.

The monument would explore additional office space as efficiently as possible through consideration of leasing in local communities, and co-locating with other agencies before considering new construction or enlarging existing buildings.

NATURAL RESOURCES

Habitat Restoration

The NPS would work towards actively restoring native ecological communities throughout the monument. This may include restoring threatened, endangered, and extirpated species (e.g. sage grouse, desert bighorn sheep). To achieve these goals, the monument would actively work with adjoining land management agencies towards restoration.

Research and Technical Assistance for Lava Tube Caves

The monument would expand the geologic research program to function as a center for research and technical assistance focused on lava tube caves. The program would emphasize monitoring, restoration of impacted geologic features and caves and providing assistance to other volcanic parks and sister agencies through planning, surveying, research and information sharing.



Caving tour guide, *NPS Photo*

CULTURAL RESOURCES

Lava Beds National Monument would function as a center for cultural resource research and learning. The monument would expand research to address a range of regional cultural resources related to the Klamath Basin, including increased efforts to collect local oral histories. Use of the Research Center for cultural resource research and workshops would occur in coordination with the education program. New research and battle forensics would enhance interpretation and knowledge of the Modoc War sites. A wider range of cultural and historical educational programming and interpretive materials would be developed.

SUSTAINABLE PARK OPERATIONS

The monument would make a comprehensive effort to reduce the total energy used to operate the monument. This would be accomplished through changes in monument operations and the use of new sustainable technologies for electricity, heating and motor vehicle fuel consumption. The monument would also strive to generate enough electrical energy on-site through alternative means such as photovoltaic panels or windmills to supply the monument's electrical consumption. The NPS would work to reduce visitor reliance on automobiles within the monument by providing additional trail linkages and encouraging bicycling on roads.

MANAGEMENT OF SPECIFIC AREAS

Petroglyph Point Unit

A new visitor day use area with an educational focus would be constructed at Petroglyph Point. The current road would be realigned southward around the petroglyphs and the existing chain link fence would be replaced with a more attractive barrier that protects the petroglyphs and allows for wildlife movement and photography. A new wildlife (raptor) viewing area, parking areas, seasonally staffed ranger contact station, small picnic area and outdoor education area would be provided as well as accessible trails connecting the new facilities with the petroglyphs.

Cave Loop Road

The monument would provide more interpretive media for Cave Loop caves to improve the visitor experience (e.g. individual cave guide brochures for trails on the loop), promote responsible caving practices, and increase awareness about the preservation needs of cave resources. Increased monitoring of cave resources would occur to preserve non-renewable features. To encourage visitors to use other modes of travel other than their cars, the monument would provide a separate pedestrian trail between the visitor center and the caves, and encourage bicycle use through amenities such as bike racks. One or two vault toilets would be installed on the loop to reduce human waste issues in caves.

Campground

The monument would explore various ways to improve the visitor experience in the campground for all types of campers (tent, RV users, and large groups). The campground would retain its current character without providing RV hook-ups. Such services would continue to be provided outside of the monument at local RV campgrounds. To encourage longer stays coin operated and limited time shower buildings would be considered for the campground.

MANAGEMENT ZONING

The zoning maps on pp. 58-60 show how Lava Beds National Monument would be zoned in alternative B. (The management zones are described near the end of the "Introduction to the Alternatives" section.) In alternative B, the majority of the monument would be included in the backcountry and interpretive backcountry zones. Existing circulation patterns in the monument would be maintained; therefore, all primary roads are included in the developed zone. The developed zone would also include existing visitor facilities such as overlooks, pullouts, the visitor center, the campground, and new facilities at Petroglyph Point. The administrative zone would include the monument headquarters and housing area at Indian Well, and the maintenance area near Crescent Butte.

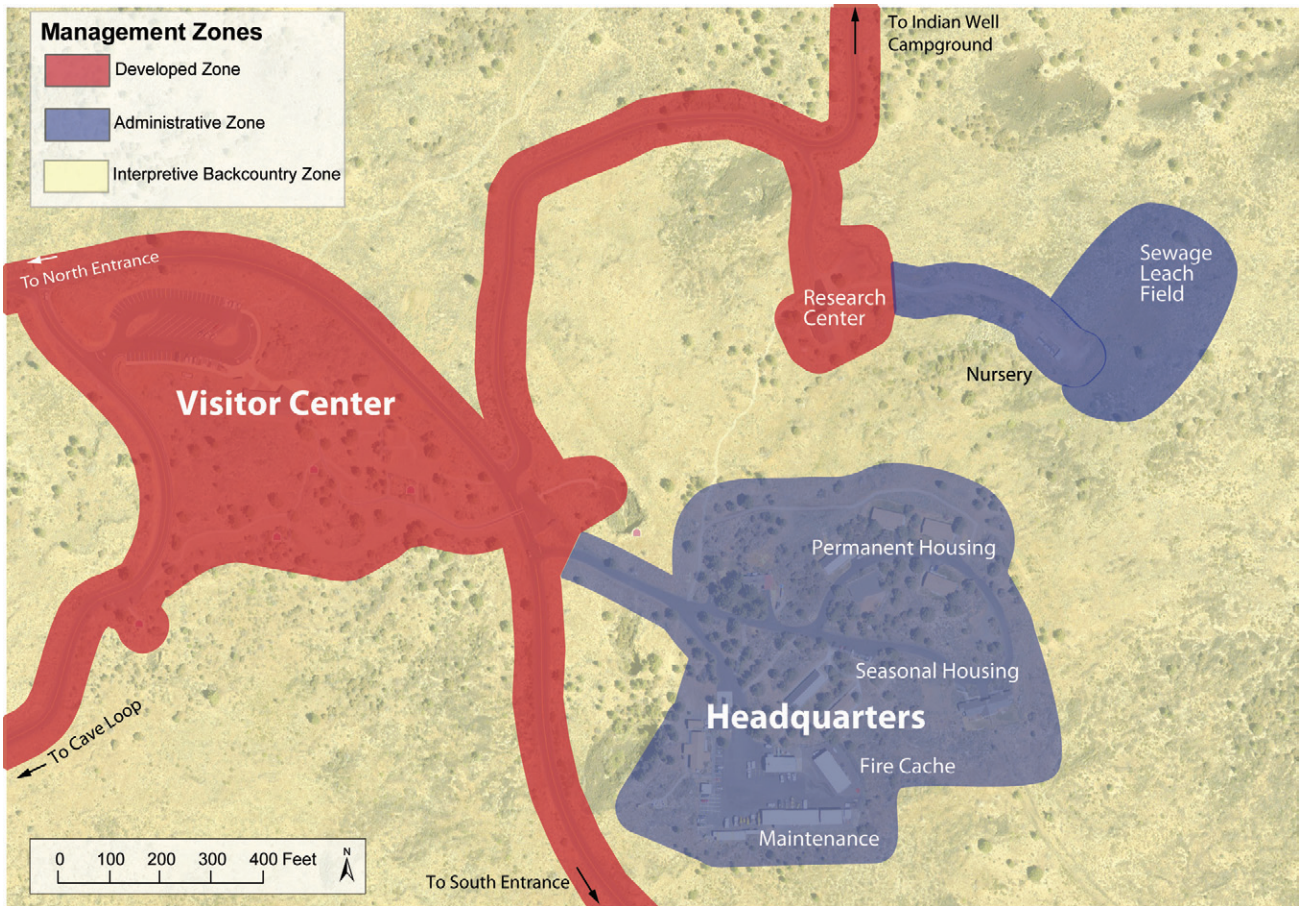
USER CAPACITY

As described in the user capacity section later in this chapter, monument staff would monitor social and resource indicators, evaluate current conditions against standards, and take appropriate steps to ensure the monument's user capacity is not exceeded (See table 12 for the user capacity indicators, standards, and management and monitoring strategies that would be followed under this alternative).

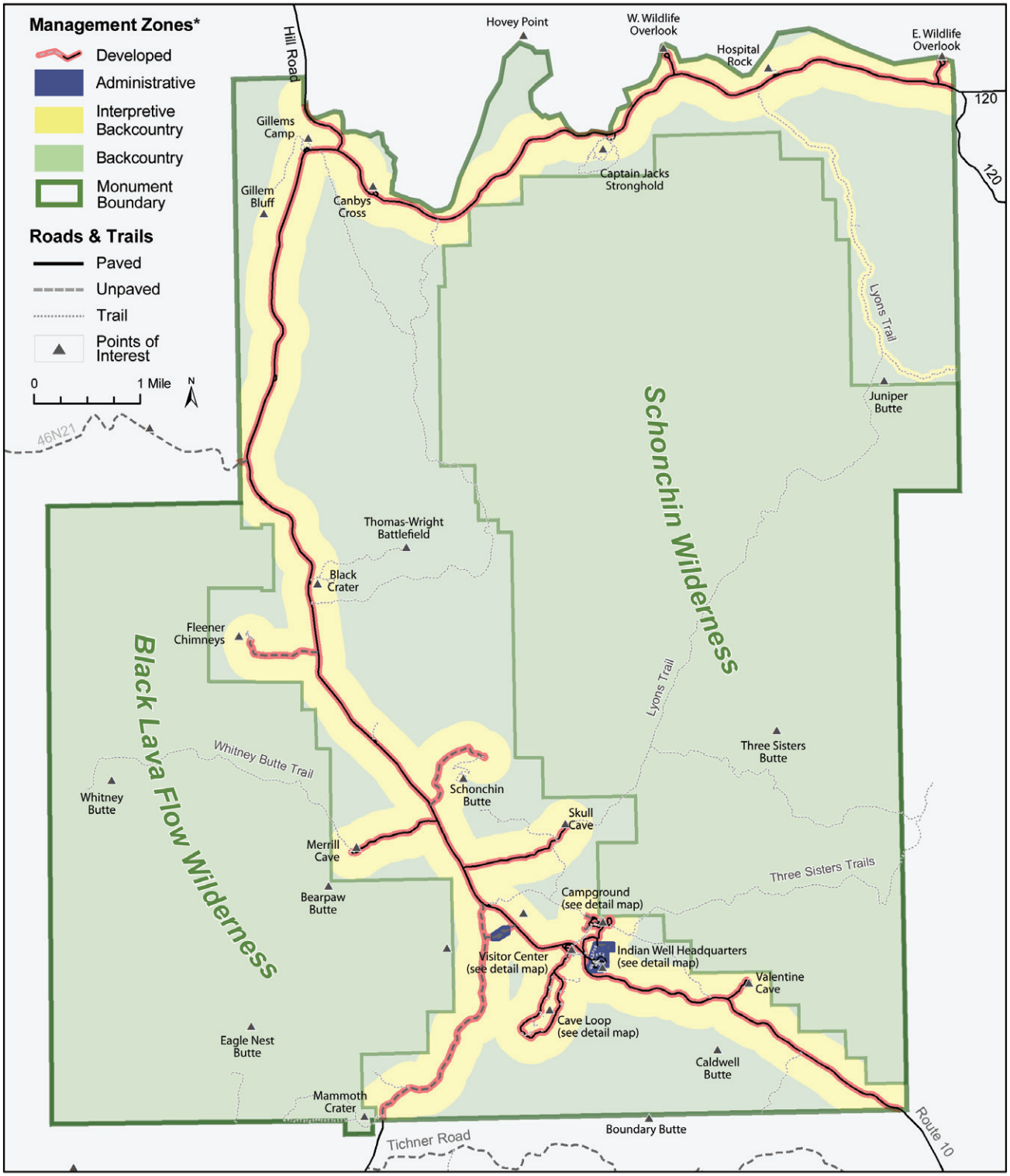
BOUNDARY ADJUSTMENTS

The monument would focus on working primarily with the U.S. Forest Service in the management of significant resources that are associated with the monument, such as lava tubes that start on Modoc National Forest lands and cross into the monument. There are also significant holdings of private timberland (approximately 2,500 acres) along the southern boundary of the monument which depending upon how the lands are managed could be detrimental to the resources of the monument. Rather than expanding the monument boundary, efforts would instead be directed to assist the Modoc National Forest in acquiring the timberland.

MAP 3: ALTERNATIVE B - INDIAN WELL HEADQUARTERS AND VISITOR CENTER

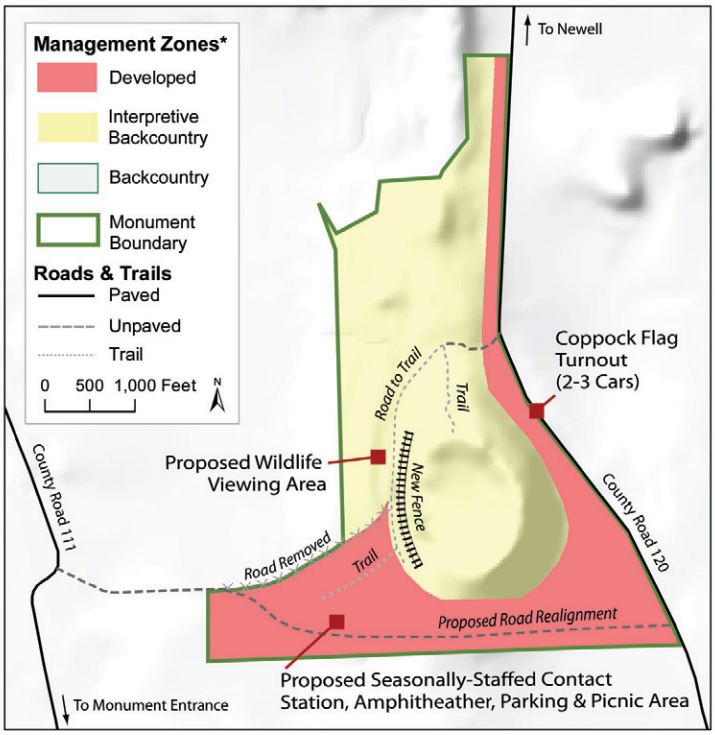


MAP 4: ALTERNATIVE B ZONING - MAIN MONUMENT



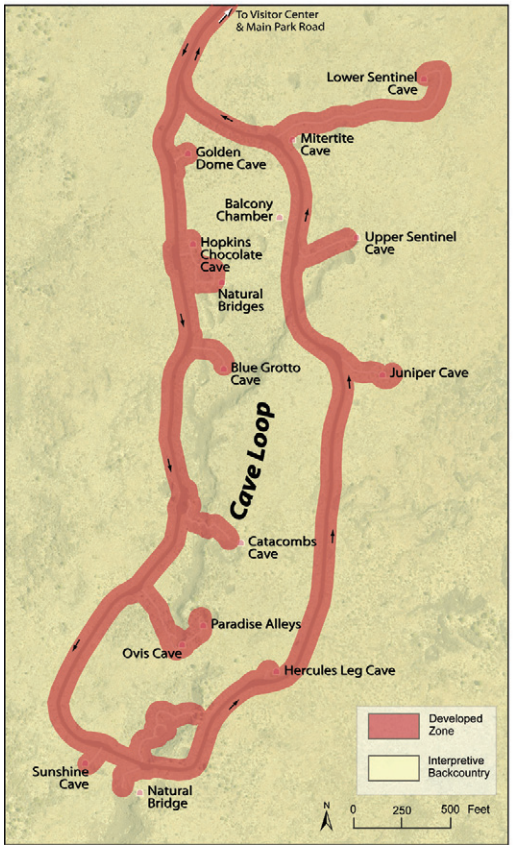
*See management zones table for a description of the conditions and activities that are appropriate to each mangement zone.

MAP 5: ALTERNATIVE B - PETROGLYPH POINT



*See management zones table for a description of the conditions and activities that are appropriate to each mangement zone.

MAP 6: ALTERNATIVE B - CAVE LOOP



MAP 7: ALTERNATIVE B - CAMPGROUND LOOP

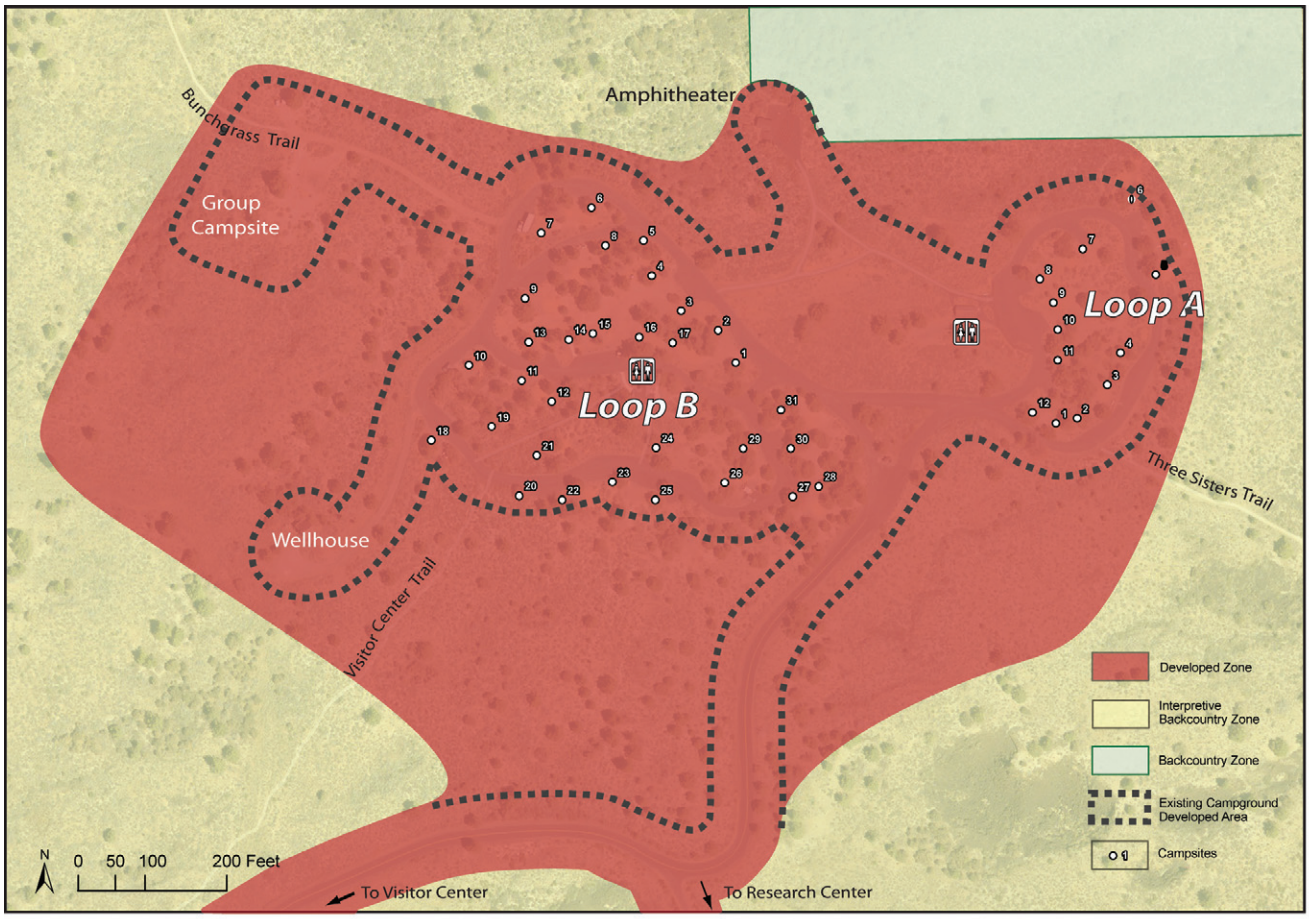


TABLE 6: MANAGEMENT ACTIONS FOR ALTERNATIVE B

MANAGEMENT ACTIONS FOR ALTERNATIVE B	
NATURAL RESOURCES	
GEOLOGIC PROCESSES AND FEATURES	An expanded geologic research program would make Lava Beds National Monument a center for research and technical assistance focused on lava tube caves. Program components would include: • Restoration of impacted geologic features and caves. • Assistance to other volcanic and cave parks through management planning, cave surveys, research, and information sharing. • Establishment of a comprehensive monitoring program for geologic resources throughout the monument. • Working with sister parks, partners, and agencies toward the regional preservation of volcanic and cave resources. Coordinated regional management of volcanic resources would focus on developing research projects, acquiring funding for preservation of resources, analyzing visitor use on a regional scale and taking steps to mitigate impacts across land management agency boundaries. Caves would receive a higher level of management through monitoring, restoration, and management plans.
VIEWSHEDS/VISUAL QUALITY	The intrusion of existing buildings on views throughout the monument would be reduced through screening, muted paint colors, less reflective roofing materials, and minimizing lighting. The monument would work to maintain high quality viewsheds within the monument. The monument would place overhead utility lines underground at Petroglyph Point and cooperate with the Fish and Wildlife Service to place overhead utility lines north of the monument underground.
DARK NIGHT SKIES	Greater emphasis would be placed on community outreach to preserve and restore dark night skies. Efforts would be taken to reduce light impacts on the wilderness areas of the monument, primarily from Klamath Falls and the Tule Lake Basin.
ECOLOGICAL COMMUNITIES	The monument would expand comprehensive restoration efforts for native vegetation and habitat. The monument would increase inter-agency coordination for restoration of native habitat along the monument boundaries and coordinate with adjacent land and wildlife management agencies to restore threatened and endangered species such as the sage grouse and bighorn sheep. Habitat for all 14 sensitive bat species would be protected to maintain sustainable population levels. The monument would take steps to monitor and mitigate, where possible, the pressures of climate change on native vegetation, wildlife, cave resources, and habitat.

MANAGEMENT ACTIONS FOR ALTERNATIVE B	
FIRE MANAGEMENT	The monument would continue to implement the current fire management program including the use of suppression, wildfire (unplanned ignitions) and prescribed fire (planned ignitions). The monument would take steps to monitor the effects of climate change and adapt fire management. Fire research would emphasize coordination with local agency managers to begin to understand large landscape level nonnative plant impacts. Research would become the most important means to understand how fire can be used on the landscape while limiting the current spread of nonnative species with the goal of ecosystem maintenance and restoration. Special efforts would be taken to acquire research funding to focus on controlling the spread of nonnative plants across agency boundary lines. The monument would coordinate with the U.S. Fish and Wildlife Service, the U.S. Forest Service, and private landowners to promote fire ecology/research and the use of wildfire (unplanned ignitions) across property lines. Efforts would be taken to coordinate across political boundaries when looking at fire on the landscape. The practice of aggressively fighting fires along borders would be coordinated and assessed for benefits.
WILDERNESS	New opportunities to experience wilderness areas would be provided through additional outreach and education programs. The monument would explore additional trail opportunities in wilderness areas.
CULTURAL RESOURCES	
ARCHEOLOGY	The monument would establish the cultural context of its archeological sites through analysis of existing archeological collections, research on site distribution of types, and documentation of newly discovered sites. The monument would expand public interpretation of archeology in collaboration with tribes, universities, and cultural resource professionals and identify selected sites that are appropriate for expanded visitor interpretation.
ETHNOGRAPHIC RESOURCES	Modoc War fortification preservation and rehabilitation would be facilitated by conservation studies. The monument would expand research of cultural landscapes for treatment and public interpretation. Opportunities for interpretation of additional Modoc War and Civilian Conservation Corps sites inside and outside of the monument would be developed.
HISTORIC STRUCTURES	Additional interpretive and educational programming and materials would be developed about the 20th century historic structures and human history within the monument.
CULTURAL LANDSCAPES	Modoc War fortification preservation and rehabilitation would be facilitated by conservation studies. The monument would expand research of cultural landscapes for treatment and public interpretation. Opportunities for interpretation of additional Modoc War and Civilian Conservation Corps sites inside and outside of the monument would be developed.

MANAGEMENT ACTIONS FOR ALTERNATIVE B	
MUSEUM COLLECTIONS	Research on current collections would be conducted. A broader understanding of cultural collections would be pursued to promote further understanding of the thousands of items within the collections. Photo documentation of all collections, or a percentage of the collections, would be completed to provide for electronic access by researchers. Images would be posted in a manner to provide understanding while still protecting this non-renewable resource. (e.g. electronic museum tours or new/rotating displays in the visitor center). The monument would replicate objects and photos for hands-on educational use and programming. The monument would implement additional collections management through increased staffing, coordination, and research. Collections storage facilities would be improved and expanded where feasible. The research center would be assessed for potential laboratory space enhancement. The monument would explore new collections management opportunities with nearby parks in the Klamath network.
VISITOR EXPERIENCE	
RECREATION	The NPS would collaborate with the U.S. Forest Service on new recreational opportunities such as trail connections and cross-country skiing near the monument's southern boundary. An improved virtual cave experience would be provided. Several day use areas for large groups would be considered at various monument sites. The site of the former West Wildlife Overlook would be used as an educational area (within or less than the existing developed footprint). Primitive backcountry campsites would be developed. The monument would work to reduce reliance on automobiles by providing additional trail linkages and encouraging bicycling on roads.



Crystal Cave tour, *NPS Photo*

MANAGEMENT ACTIONS FOR ALTERNATIVE B

INTERPRETATION AND EDUCATION	The visitor experience would primarily be focused on learning and education for a wide diversity of monument visitors. **INTERPRETATION:** The monument would significantly increase the use of new technologies and media to improve the connection of visitors to monument resources. The monument would display more collections through rotating exhibits. New exhibits would be provided at the visitor center. The monument would expand use of its oral history collection for historical interpretation and education. The monument would provide an increased number of guided cave tours. The monument would explore expanded interpretation both within and outside the monument on topics related to park purpose and significance such as: • Archeology • Astronomy/dark night skies • Cave ecology • Natural and cultural resources research and management initiatives, including fire ecology and management, restoration ecology, and non-native species Collaborative efforts to expand interpretation would include: • working with The Klamath Tribes to interpret history and pre-history, • coordination between resource management and interpretive staff to provide opportunities for visitors to learn about park research, • collaborating with the U.S. Fish and Wildlife Service to expand the interpretation of refuges and provide tours, and • identifying opportunities for the interpretation of additional Modoc War and Civilian Conservation Corps sites outside of the monument. **EDUCATION AND OUTREACH:** More in-depth visitor education opportunities would be provided (such as guided tours, workshops and educational programs) throughout the monument and at related sites throughout the region. The monument would expand formalized relationships with local and regional schools and collaborate with regional parks on expanded outreach and education. The visitor center would be expanded to accommodate educational programs and provide more opportunities for teachers, students, and the general public. The research center would be expanded to include more laboratory space to provide more opportunities for researchers, students, and the general public to participate in research activities at the monument. Opportunities would be provided for public involvement in research and restoration activities. For example: • The monument would develop a program for high school and university level students to participate/assist in monument research. • Public archeology programs and archeology workshops would be conducted.

MANAGEMENT ACTIONS FOR ALTERNATIVE B

FACILITIES AND OPERATIONS

VISITOR CENTER	The visitor center would be expanded to accommodate educational programs and provide more opportunities for teachers, students, and the general public.
RESEARCH CENTER	The research center would be expanded to include more laboratory space to provide more opportunities for researchers, students, and the general public to participate in research activities at the monument.
ROADS	If Forest Service Route 10 continues to receive inadequate or no funding for project work and remains in poor condition, the NPS would encourage visitors to enter and exit the monument via Medicine Lake Road and the paved and better maintained northern routes. The 1.8 mile segment of Lyons Trail between the main road gate and Fern Cave trailhead would be maintained as a primitive two track road limited to official vehicles. The 2.0 mile segment between the trailhead and the east boundary would also be maintained for official vehicle use, primarily for the treatment of wildland fire fuels. Natural processes would reclaim the remainder of Lyons and Powerline roadbeds. The monument would improve maintenance of the unpaved Medicine Lake Road, within the monument, to reduce summer season wash boarding. The East and West Wildlife Overlooks and roads are removed and revegetated restoring ecological communities on the monument's northern border. A portion of the West Wildlife Overlook road would be retained as an unpaved road and maintained for special events. The monument would encourage bicycle use on roads. Bicycle facilities would be provided at appropriate locations.
TRAILS AND TRAILHEADS	The monument would explore making accessibility improvements to Captain Jacks Stronghold, Gillems Camp, Hospital Rock, and Petroglyph Point trails so that they are accessible to all visitors. The monument would provide more trail opportunities with an emphasis on traditional interpretive methods (such as printed trail guides) or new technologies (such as podcasts). For example, a geology interpretive trail would be constructed at one of three sites in the northern portion of the monument (Gillems Bluff, Thomas Wright Battlefield, or Fleener Chimneys). Additional trail opportunities would be provided in wilderness areas. The monument would explore providing trail loops/connections to national forest lands and refuges, including Gillems Bluff. The monument would create better trail/pedestrian connections between visitor areas. This action could include connecting Schonchin Butte to Symbol Bridge trail, and connecting the campground to Valentine Cave. The monument would remove unnecessary established and social trails. This action would require coordination with other agencies and organizations.
BOUNDARY ADJUSTMENTS	The current boundary would be maintained. The monument would work with the U.S. Forest Service protect resources outside of the monument related to park purpose and significance, and to acquire or trade private timberlands along monument boundary.

MANAGEMENT ACTIONS FOR ALTERNATIVE B	
PARTNERSHIPS AND REGIONAL COOPERATION	The monument would initiate increased interagency cooperation for resource protection and restoration including: • cooperation with U.S. Fish and Wildlife Service efforts to establish wetlands on lands along northern edge of the monument and provide coordinated interpretation such as guided tours along the wildlife tour route, and • cooperation with the U.S. Forest Service on land management in areas south and east of the monument. Increased tribal involvement would be emphasized (e.g. NPS employment, and interpretation and education programs). Partners would have a greater role in research, restoration, education, and monitoring. The monument would expand relationships with gateway communities to provide signage and interpretation. The monument would participate in a larger number of community events. Community outreach programs would increase (e.g. dark night skies program). For sites outside the monument that are related to park purpose and significance, new partnerships/agreements with schools, affiliated tribes, surrounding agencies, and gateway communities would be developed to provide new educational and interpretive opportunities.
RESEARCH	Research activity would remain the primary use of the research center. The research center would be expanded for greater use by researchers, teachers, and the general public. The monument would involve high school and college students in science and research projects. The monument would establish formal relationships with colleges and universities to encourage more research in the monument. Informal opportunities would be provided for visitors to learn about various monument research and management activities. The monument would initiate a citizen-scientist program, possibly in partnership with other agencies (e.g. citizen science program to monitor pika populations). The monument would become a center for cultural resource research and learning. Research publications would be provided and the monument would enter into new research partnerships. Research efforts to address a range of regional cultural resource issues related to the Klamath Basin would be expanded. Through research, the monument would investigate the impacts of climate change on cultural resources, as well as past human responses to climate change. The monument would increase efforts to collect local oral histories. Use of the research center for cultural resource research and workshops would occur in coordination with the education program. The monument would conduct additional research to better understand the full context of all topics related to the Modoc War. This could include surveys, fortification studies, and battlefield reviews.

MANAGEMENT ACTIONS FOR ALTERNATIVE B	
COMMERCIAL SERVICES	The Lava Beds Natural History Association would continue to function as a cooperating association for the monument. Limited seasonal food and drink service in the vicinity of the visitor center would be assessed for commercial feasibility. The monument would consider allowing commercial interpretive tours consistent with the general management plan and NPS service-wide policies. The monument would continue to authorize the concession contract for visitor convenience items which is currently held by the Lava Beds Natural History Association.
PARK OPERATIONS AND SUSTAINABILITY	The monument would strive to reduce as much energy use as possible, including offsetting total electrical use, by generating electricity using alternative sources such as installing grid tied photovoltaic panels and bird/bat safe wind turbines. The monument would also explore using the best available, energy saving vehicle technology for monument operations (e.g. plug in hybrids). The monument would consider leasing or co-locating with other agencies outside the monument before considering new construction or modification of existing buildings inside of the monument for new office space. The monument would retrofit facilities with sustainable materials/building methods where appropriate. Pedestrian trail linkages between visitor areas would be provided in order to encourage visitors to not use their automobiles for short trips within the monument. The monument would pursue an NPS "climate-friendly park" designation.
SAFETY AND LAW ENFORCEMENT	More safety and preparedness information would be provided for visitors.
STAFFING *Terms used **Permanent Staff:** An appointment or hire to a federal position that has no time limit established with it **Term Staff:** Nonpermanent appointment expected to last longer than one year, but less than four years	Additional staffing would include: • 1 Shared/Partner: (Science Advisor that could be located at partner university) • 5 Permanent* Staff: (1 education specialist, 1 resource management specialist, 1 law enforcement, 2 maintenance) • 2 Term* Staff: (1 interpreter, 1 physical science tech) • 8 Part-time/Seasonal Staff: (4 interpreters, 4 resource management techs)

MANAGEMENT ACTIONS FOR ALTERNATIVE B

AREA-SPECIFIC ACTIONS

PETROGLYPH POINT	New visitor facilities would include a parking area, wildlife (raptor) viewing area, seasonal visitor contact station, outdoor education area and a visitor day use area that accommodates families and school groups, picnic tables, shade structures, and toilets. Accessible trails would connect these facilities to the petroglyphs. The fence would be replaced with a new protective structure to improve viewing and allow for wildlife movement. The road through Petroglyph Point would be realigned to the south and remain unpaved. The existing road would be removed and revegetated. On-site seasonal staffing would provide expanded educational and interpretative services as well as visitor orientation to the entire monument. The monument would interpret other resources in addition to rock art (e.g. geology, wildlife, vegetation, astronomy, homesteading). The monument would conduct research and monitoring on sensitive species potentially impacted by visitor use. The monument would seek to improve protection efforts at Petroglyph Point by increasing ranger presence, improving facilities, and implementing remote sensing technologies. The monument would replace the existing inadequate parking pullout and improve visitor access to the Coppock flag site.
CAVE LOOP ROAD	Social trails would be removed and restored. More rangers would be present at peak times to educate visitors about minimum impact caving. Increased monitoring of cave resources would occur to preserve non-renewable features. The monument would provide more in-depth information and educational materials for caves on the cave loop (e.g. cave guides). In order to encourage visitors to use modes of travel other than their cars, the monument would provide a separate pedestrian trail between the visitor center and the caves, and encourage bicycle use through installing bike racks. One or two vault toilets would be installed on the loop to reduce human waste issues in caves.
CAMPGROUND	The monument would explore various ways to improve the visitor experience in the campground for all types of campers (tent, recreational vehicle (RV) users, and large groups), using techniques such as separation and screening. The campground would retain its current character without providing RV hook-ups. Such services would continue to be provided outside of the monument at local RV campgrounds. To encourage longer visitor stays, one or two new shower buildings would be evaluated for addition to the campground.

ESTIMATED COSTS

Cost estimates for alternative B are identified below in Table 7. The cost estimates, in 2008 dollars, are not for budgetary purposes; they are only intended to show a very general relative comparison of costs between the alternatives. A discussion of the development of the costs and a comparison between the alternatives is included after the description of the alternatives.

The implementation of the approved plan will depend on future funding. The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the actions in the approved General Management Plan could be many years in the future.

One-Time Capital Costs

Alternative B would consist of the improvements to facilities and structures described previously in the alternative. The estimated one-time capital cost in 2008 dollars is approximately $9,100,000. One-time capital costs include trails, interpretive facilities and services, road improvements, facility improvements, changes to monument operations to reduce energy use, collection of oral histories, and habitat improvements.

Staffing Requirements

Implementation of alternative B would require additional staffing to support new interpretive and educational programming, increased research and restoration efforts, and additional maintenance needs. Three full-time staff and four seasonal staff would be added to the Resource Protection and Visitor Services Division. An education specialist would be needed to provide greater outreach to schools, to implement new educational programs, and to serve as a liaison with the resource management staff to incorporate new research into interpretive materials and programming. A full-time interpreter would be needed to develop programs and materials for new interpretive topics. Four seasonal interpreters would conduct new guided tours and assist in implementing expanded interpretive efforts within the main monument, at Petroglyph Point, and at surrounding sites related to the monument's purpose. One additional visitor protection position would be needed to ensure protection of sensitive resources through increased roving and visitor contacts.

New research programs and increased restoration efforts proposed in alternative B would require two new full-time staff positions, one part-time science advisor position, and four new seasonal positions in the Resource Management Division. A resource management specialist and one physical science tech would assist in the implementation of new restoration projects and research programs. A full performance physical scientist would be required for enhanced cave management and restoration activities. A new science advisor position, which could be a shared with a partner university, would be needed to facilitate proposed new research efforts and partnership activities with local universities. Four new seasonal resource management technicians would be required for implementing specific restoration projects.

The Maintenance Division would require two new full-time positions to maintain the new facilities at Petroglyph Point, new trails, and to oversee and maintain new sustainable technologies that would be installed to achieve the monument's goal for reducing its carbon footprint.

Five Full-time Permanent Staff Positions

- One education specialist
- One resource management specialist
- One visitor protection (law enforcement position)
- Two maintenance positions

Two Term Staff Positions

- One interpreter
- One physical science tech

One Shared/Partner Position

- One science advisor (possibly located at a partner university)

Additional part-time/seasonal staff positions under Alternative B

- Four interpreters
- Four resource management technicians

Annual Operating Costs

This alternative would be implemented with the current staffing levels plus 7.5 full-time equivalent staff (FTEs) for research, resource protection, maintenance, and interpretation (One FTE is one person working 40 hours per week for one year, or the equivalent) and eight seasonal staff for interpretation and resource management. The addition of these positions would add approximately $737,000 to the operating base for Alternative B. Additional administrative costs for potential leasing of new office space would be $18,000.

The monument estimates that it would have additional annual cost savings of $35,000 upon installation of new energy-saving technologies for monument operations. The total annual operating costs for alternative B would be approximately $2,500,000 per year (in 2008 dollars).



Bat Butte, *NPS Photo*

TABLE 7: SUMMARY OF COSTS FOR ALTERNATIVE B

SUMMARY OF COSTS FOR ALTERNATIVE B	
ANNUAL OPERATING COSTS	
Existing Monument Operations	$1,701,000
Additional Staff (7.5) FTE (8) Seasonal/Part-time	$737,000
Oral Histories	$15,000
Habitat Restoration	$60,000
Law Enforcement	$4,200
Medicine Lake Road Maintenance Improvements	$5,000
Annual Savings from On-site Renewable Energy	$-35,000
Leased Office Space	$18,000
Total Annual Operating Costs	**$2,505,200**
ONE-TIME CAPITAL COSTS	
Campground Improvements	$1,400,000
Cave Loop Improvements (Trail and road improvement, vault toilets)	$121,000
Collections Exhibits	$130,000
Day Use Areas	$20,000
Educational and Interpretive Materials	$166,000
Habitat Restoration	$50,000
Modoc War Historic Landscape Restoration	$80,000
Petroglyph Point Improvements • Protective Fence ($72,000) • Trails ($100,000) • Picnic Area with Shade Structures ($100,000 • Parking ($500,000) • Contact Station ($800,000) • Vault Toilets ($80,000) • Outdoor Education Area ($100,000) • Road Realignment//Unpaved ($700,000) • Wildlife Viewing Area ($25,000)	$2,477,000
Research Laboratory Expansion	$60,000
Sustainable Park Operations (new energy systems)	$2,010,000
Trails	$973,000
Underground Utility Lines	$600,000
Visitor Center Expansion (2 classrooms, office space)	$1,012,000
Total One-Time Capital Costs	**$9,099,000**

*All costs in FY08 dollars

Alternative C: Diversified Recreation

MANAGEMENT CONCEPT

Through an expanded range of visitor programs and recreation opportunities, the NPS would strive to meet both current and changing visitor needs. Expanded outreach efforts would develop a more visible identity for the monument. These actions would enhance appreciation for the unique resources protected at Lava Beds and improve understanding of the monument's role in a regional setting.

VISITOR EXPERIENCE

The NPS would expand outreach to the travel and tourism industry to maintain or increase visitation and in turn raise the regional profile of Lava Beds National Monument. Diversified recreational opportunities would be provided throughout the monument (e.g. biking, snowshoeing, caving seminars, annual events, adventure tours). The NPS would collaborate with the U.S. Forest Service on new recreational trail opportunities and would establish additional medium distance (1-3 mile) loop trails within the monument. The monument would offer a diversity of world-class lava tube caving experiences by offering caving seminars and specialized tours.



Devils Homestead Flow, *NPS Photo*

FACILITIES

New facilities would be provided to accommodate the diversified recreational opportunities. The NPS would provide more opportunities for trails that are accessible to a wide range of user needs and abilities, including wheelchair accessibility. Diversified recreation trails would also be provided. For example, the NPS would explore appropriate trail opportunities for bicycles, horses, cross-country skiing, and snowshoeing.

To allow for more informal, dispersed exploration and recreation, the NPS would construct more 1- to 2-car pullouts along the main monument road. The monument would encourage bicycle use on the main monument road by providing bicycle facilities at appropriate locations.

Improvements to the campground would better accommodate groups and RVs (see management of specific areas for a description of proposed changes to the campground under this alternative). Primitive backcountry camping sites would be designated.

The monument would explore additional office space by considering leasing building space in local communities, co-locating with other agencies, constructing new buildings, or modifying existing buildings using sustainable practices.

NATURAL RESOURCES

Natural resource management would remain largely the same as in alternative A. However, additional monitoring and assessment of sensitive resources would occur in high use visitor areas.

CULTURAL RESOURCES

The monument would identify new opportunities for visitors to learn about historic resources and monument collections. Examples of new opportunities could include an overnight experience at the Schonchin Butte fire lookout or guided tours to other historic sites. New research and battle forensics would enhance interpretation and knowledge of Modoc War sites.

SUSTAINABLE PARK OPERATIONS

The monument would reduce electrical energy use for monument operations through use of new technologies and/or changes in monument operations to reduce need. Pedestrian and bicycle visitor circulation would be encouraged throughout the monument.

MANAGEMENT OF SPECIFIC AREAS

Petroglyph Point Unit

A limited day-use facility and additional recreational opportunities such as wildlife viewing would be available at Petroglyph Point. The road through the Petroglyph Point unit would be realigned to the south

and paved. A group day-use facility would be located at Petroglyph Point. Improvements would include a small parking lot, vault toilets, a picnic area, and shade structures. The NPS would create a new loop trail system to access more areas of Petroglyph Point and provide a surfaced, accessible trail to the petroglyphs. A new protective fence that would allow for photography and wildlife passage would be constructed.

Cave Loop Road

The Cave Loop Road area would feature a cave docent program to assist visitors with cave exploration and more rangers would also be available during peak visitation. New facilities would include vault toilets, and a foot trail around the Cave Loop Road to allow visitors to leave vehicles at the visitor center or campground. Areas along the Cave Loop Road impacted by social trails would be restored.

Campground

The campground would be improved to better accommodate large vehicles by adding a new RV loop and reducing several campsites in the existing campground loops (with no net loss or gain in the total number of campsites). No hookups would be provided for the RV sites, but a new seasonal shower facility would be located in the campground.

MANAGEMENT ZONING

The zoning maps on pp. 72-74 show how Lava Beds National Monument would be zoned in alternative C. (The management zones are described near the end of the "Introduction to the Alternatives" section). In alternative C, the majority of the monument would be included in the backcountry and interpretive backcountry zones. However, this alternative would have significantly more areas zoned as interpretive backcountry to provide more opportunities for new interpretive trails. Existing circulation patterns in the monument would be maintained; therefore, all primary roads are included in the developed zone. The developed zone would also include existing roads and visitor facilities such as overlooks, pullouts, the visitor center, the campground and new facilities at Petroglyph Point. The administrative zone would include monument headquarters, the housing area at Indian Well, and the maintenance area near Crescent Butte.

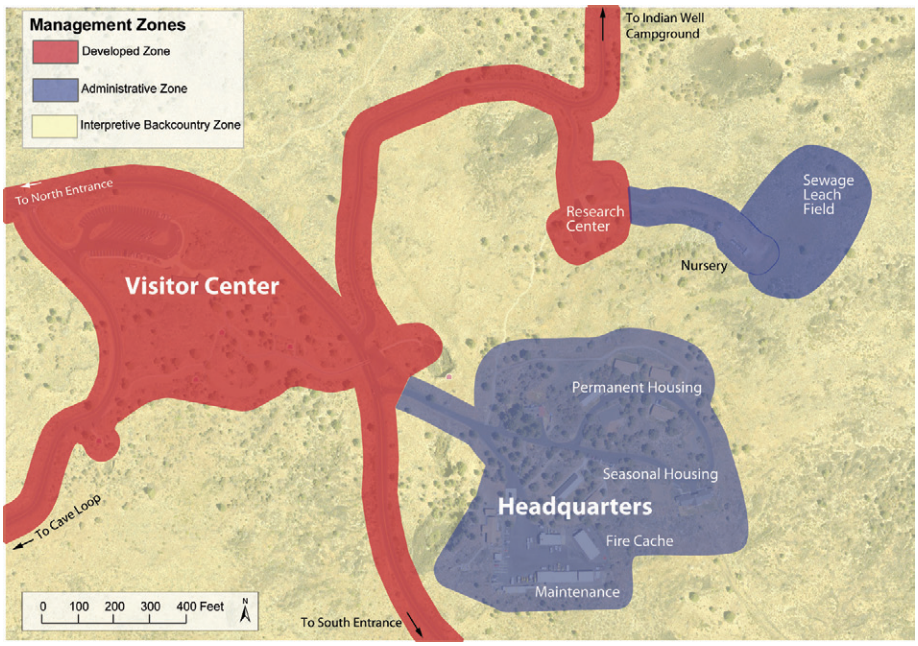
USER CAPACITY

As described in the user capacity section later in this chapter, monument staff would monitor social and resource indicators, evaluate current conditions against standards, and take appropriate steps to ensure the monument's user capacity is not exceeded (see table 12 for the user indicators, standards, and management and monitoring strategies that would be followed under this alternative).

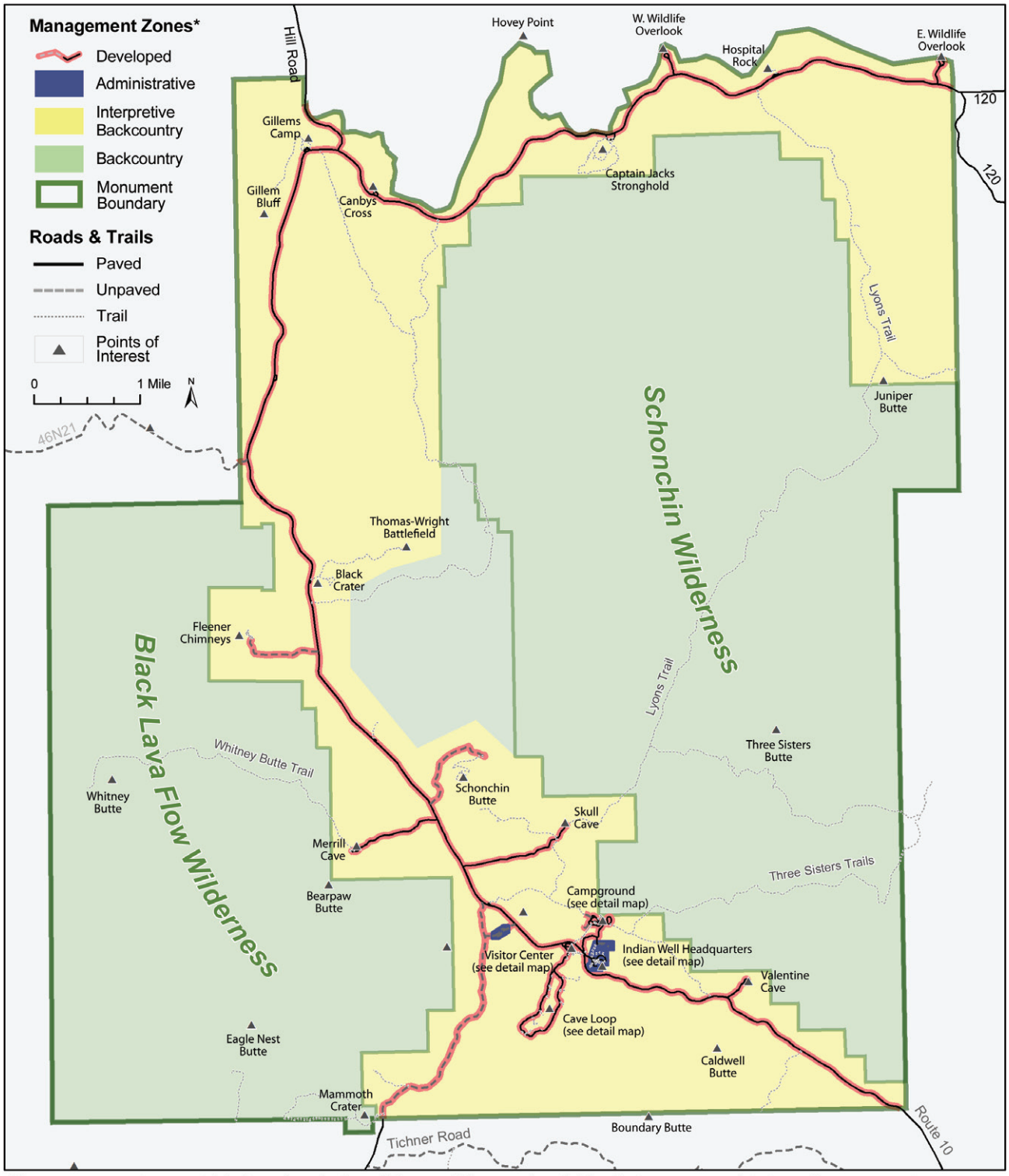
BOUNDARY ADJUSTMENTS

No new boundary adjustments would be pursued in alternative C. The monument would focus on working with partners and sister agencies in managing of significant resources that are associated with the monument, primarily lava tube systems that start on U.S. Forest Service lands and cross into the monument. Many significant caves are found just south of the monument boundary and preservation of these resources would be based on coordination with the primary management agency.

MAP 8: ALTERNATIVE C - INDIAN WELL HEADQUARTERS AND VISITOR CENTER

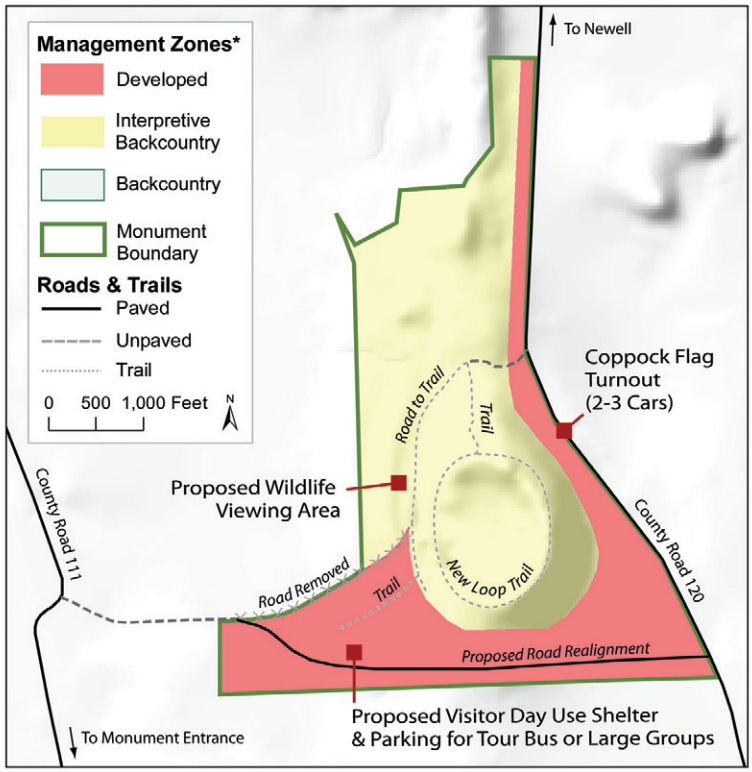


MAP 9: ALTERNATIVE C ZONING - MAIN MONUMENT



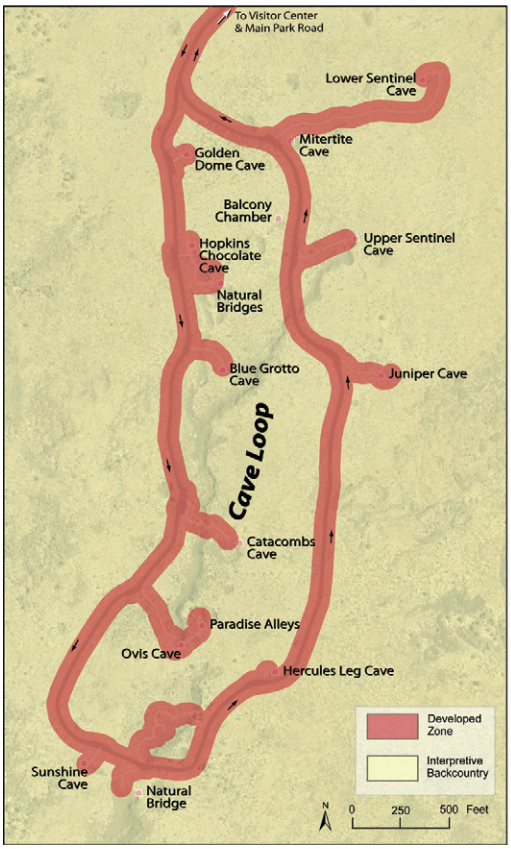
*See management zones table for a description of the conditions and activities that are appropriate to each mangement zone.

MAP 10: ALTERNATIVE C - PETROGLYPH POINT



*See management zones table for a description of the conditions and activities that are appropriate to each mangement zone.

MAP 11: ALTERNATIVE C - CAVE LOOP



MAP 12: ALTERNATIVE C - CAMPGROUND LOOP

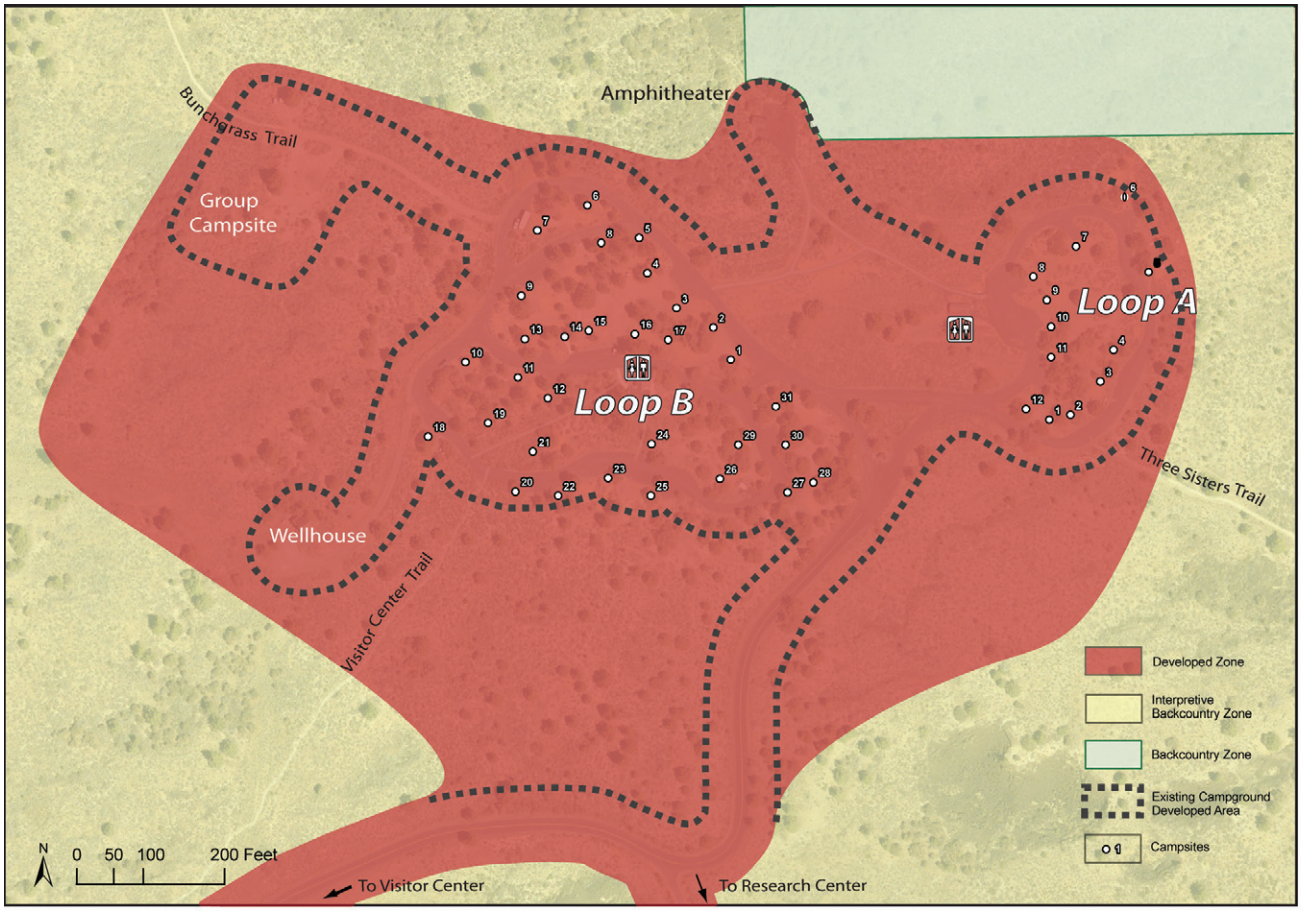


TABLE 8: MANAGEMENT ACTIONS FOR ALTERNATIVE C

MANAGEMENT ACTIONS FOR ALTERNATIVE C	
NATURAL RESOURCES	
GEOLOGIC PROCESSES AND FEATURES	Cave action plans would be developed for caves that may receive increased use on cave loop. The cave management plan would specify classes of caves where such recreation would be appropriate.
VIEWSHEDS/VISUAL QUALITY	Same as Alternative A
DARK NIGHT SKIES	Same as Alternative A
ECOLOGICAL COMMUNITIES	Same as Alternative A
FIRE MANAGEMENT	Same as Alternative A
WILDERNESS	Same as Alternative A
CULTURAL RESOURCES	
ARCHEOLOGY	Same as Alternative A
ETHNOGRAPHIC RESOURCES	Same as Alternative A
HISTORIC STRUCTURES	The monument would identify new opportunities for visitors to access historic structures (e.g. opportunities for an overnight experience at the Schonchin Butte fire lookout, and/or tours to other historic sites while protecting resources). The monument would investigate providing interpretive experiences that allow visitors a broader understanding of the Modoc War (e.g. specialized tours of fortifications, or tours that include sites outside the monument).
CULTURAL LANDSCAPES	The Modoc War cultural landscape would be actively restored to 19th century battlefield conditions. New research and battle forensics would enhance interpretation and knowledge of the Modoc War sites.
MUSEUM COLLECTIONS	Visitors would have greater access and new ways to view monument collections (e.g. electronic museum tours, new/rotating displays in the visitor center).
VISITOR EXPERIENCE	
RECREATION	The monument would increase outreach efforts to encourage more visitation. Diversified recreational opportunities would be provided throughout the monument (e.g. biking, snowshoeing, annual events). More information and resources for recreational users would be provided throughout the monument. The NPS would increase opportunities for a broad variety of adventure and specialized tours. The NPS would collaborate with the U.S. Forest Service on new recreational opportunities (e.g. trail connections, joint management of trails for horses and bicycles, and winter sports such as cross-country skiing, and snowshoeing). The monument would offer a diversity of world-class lava tube caving experiences by offering caving seminars and specialized tours.

MANAGEMENT ACTIONS FOR ALTERNATIVE C

INTERPRETATION AND EDUCATION	**INTERPRETATION:** Interpretive information would be provided about expanded recreation opportunities. Interpretive media would be created for groups and commercial tours. Additional interpretation of Civilian Conservation Corps-era monument features would be provided. The monument would investigate providing interpretive experiences that allow visitors a broader understanding of the Modoc War (e.g. specialized tours of fortifications, or tours that include sites outside the monument). Collaborative efforts to expand interpretation would include: • Collaborating with the U.S. Fish and Wildlife Service to provide guided bird watching tours along Tule Lake. • Collaborating with the U.S. Forest Service to interpret geology and Modoc War sites near Tichnor Road. **EDUCATION AND OUTREACH:** The research center use would be expanded to include recreation seminars (e.g. caving, winter activities). An Artist-in-the-Park program would be established using the Research Center as a base. Public archeology programs and archeology workshops would be held at the monument.
FACILITIES AND OPERATIONS	
VISITOR CENTER	Same as Alternative A
RESEARCH CENTER	Same as Alternative A
ROADS	If Forest Service Route 10 continues to receive inadequate or no funding for project work and remains in poor condition, the NPS would encourage visitors to enter and exit the monument via Medicine Lake Road and the paved and better maintained northern routes. Lyons Trail (outside of backcountry areas) would be maintained for administrative vehicle use, and interpreted as a historic Civilian Conservation Corps-era entrance to the monument. Powerline road would be closed to administrative vehicle use and portions may be used for trails. The Medicine Lake Road would be realigned and paved (within the monument). The NPS would remove and revegetate the West Wildlife Overlook and access road and encourage visitor use of the remaining East Wildlife Overlook. The monument would encourage bicycle use on roads. Bicycle facilities will be provided at appropriate locations. The monument would construct more one to two-car pullouts to allow for informal, dispersed exploration/recreation (approximately every 1-½ mile).

MANAGEMENT ACTIONS FOR ALTERNATIVE C	
TRAILS AND TRAILHEADS	The monument would provide more opportunities for trails that are accessible to a wide range of user needs and abilities, including wheelchair accessibility. Areas with the best potential for ADA accessibility include trails to Hospital Rock, the first quarter-mile of Captain Jacks Stronghold, Gillems Camp, and Petroglyph Point The monument would establish additional medium distance (1-3 mile) loop trails. Areas for potential new trails include Gillems Bluff, Thomas Wright/Black Crater, Whitney Butte, a smaller Three Sisters, and Eagle Nest Butte/Big Nasty/Mammoth Crater. A new foot trail would be constructed around Cave Loop Road to encourage visitors to leave vehicles at the visitor center or campground. The monument would explore new trail opportunities for bicycles, horses, cross-country skiing, and snowshoeing. The monument would complete a trail management plan.
BOUNDARY ADJUSTMENTS	The monument's current boundary would be maintained.
PARTNERSHIPS AND REGIONAL COOPERATION	The monument would expand outreach to the travel and tourism industry to maintain or increase visitation and in turn raise the regional profile of Lava Beds National Monument. The monument would collaborate with the U.S. Forest Service on new recreational opportunities (e.g. trail connections, joint management of trails for horses and bicycles, and winter sports such as cross-country skiing and snowshoeing).
RESEARCH	Same as Alternative A
COMMERCIAL SERVICES	The Lava Beds Natural History Association would continue to function as a cooperating association for the monument. The monument would continue to authorize the concession contract for visitor convenience items which is currently held by the Lava Beds Natural History Association (NHA). The concession contract currently held by the NHA would also focus on providing items that would accommodate recreational users (e.g. trail guides, knee-pads for caving). Limited seasonal food and drink service in the vicinity of the visitor center would be assessed for commercial feasibility. The monument would consider allowing commercial interpretive tours consistent with this general management plan and NPS service-wide policies.
PARK OPERATIONS AND SUSTAINABILITY	The NPS would seek to offset the monument's total electrical use. This offset could be accomplished by installing grid tied alternate electrical generation equipment (e.g. photovoltaic panels and bird/bat safe wind turbines). The monument would consider leasing or co-locating with other agencies outside the monument before considering new construction or modification of existing buildings inside of the monument for new office space
SAFETY AND LAW ENFORCEMENT	The monument would provide more formal ranger presence in the interpretive backcountry/developed zones to address increased visitation and use. More safety and preparedness information would be increased for interpretive backcountry/developed zone visitors.

MANAGEMENT ACTIONS FOR ALTERNATIVE C

STAFFING *Terms used **Permanent Staff:** An appointment or hire to a federal position that has no time limit established with it **Term Staff:** Nonpermanent appointment expected to last longer than one year, but less than four years **GS:** General Schedule payscale	Additional staffing would include: 6 Permanent Staff: (1electrician, 1 resource management specialist, 2 law enforcement, 2 maintenance positions) 2 Term Staff: (1biological science tech, 1 physical science tech) 7 Part-time/Seasonal:(4 interpreters, 3 resource management technicians) Recommended increase in CURRENT permanent GS level for the following: Convert current GS-09 Physical Scientist to full performance GS-11 Physical Scientist.
AREA-SPECIFIC ACTIONS	
PETROGLYPH POINT	A large group day-use facility would be located at Petroglyph Point (including a small parking area, vault toilets, trails, picnic area, and shade structures). The monument would provide a wildlife viewing area for observing raptors and other wildlife. The monument would create a new loop trail system for Petroglyph Point. A surfaced, accessible trail to the petroglyphs would be provided. A new protective fence that would allow for photography and wildlife passage would be constructed at Petroglyph Point. The road through Petroglyph Point would be realigned to the south and paved. The existing road would be removed and revegetated.
CAVE LOOP ROAD	A foot trail would be provided around Cave Loop to encourage visitors to leave vehicles at visitor center or Campground. Areas along the Cave Loop impacted by social trails would be restored. Increased monitoring of cave resources would occur to preserve non-renewable features. This would require additional resource management staff to monitor impacts from current visitor use. More rangers would be present at the cave loop during peak visitation. A cave docent program would be established. Vault toilets would be located along the Cave Loop Road.
CAMPGROUND	The campground would be improved to better accommodate large RVs by adding a new loop for recreational vehicles. The monument would reduce other campsites in the existing campground loops (with no net loss or gain in the total number of campsites). No hookups would be provided for recreational vehicles. The campground would be improved to better accommodate groups. To encourage longer visitor stays, one or two new coin operated and limited time shower buildings would be constructed in the campground.

ESTIMATED COSTS

Cost estimates for alternative C are identified below in Table 9. The cost estimates, in 2008 dollars, shown here are not for budgetary purposes; they are only intended to show a very general relative comparison of costs between the alternatives. A discussion of the development of the costs and a comparison between the alternatives is included after the description of the alternatives.

The implementation of the approved plan will depend on future funding. The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. Full implementation of the actions in the approved General Management Plan could be many years in the future.

One-Time Capital Costs

Alternative C would consist of the improvements to facilities and structures described previously in the alternative. The estimated one-time capital cost in 2008 dollars is approximately $11,200,000. One-time capital costs include trails, interpretive materials, road improvements, facility improvements, changes to monument operations to reduce energy use, and collection of oral histories.

Staffing Requirements

Implementation of alternative C would require additional staffing to support increased monitoring and invasive species control efforts, new recreational programming, and additional maintenance needs at Petroglyph Point. Two full-time staff and four seasonal positions would be added to the Resource Protection and Visitor Services Division. Two full-time visitor protection staff positions would be required to ensure visitor safety and resource protection through increased roving and visitor contacts. The four seasonal interpreters would conduct outreach, guided tours, and expanded interpretive efforts within the monument and at surrounding sites.

Expanded recreational opportunities proposed in alternative C would require three new-full-time and three new part-time positions in the Resource Management Division to ensure that sensitive resources are not harmed. One resource management specialist, a biological science technologist, and a physical scientist technologist would be required for expanded monitoring and restoration efforts. A full performance physical scientist would be required for enhanced cave management and restoration activities. Three seasonal resource management technicians would be required to implement specific monitoring and restoration projects.

The Maintenance Division would require three new full-time positions. Two positions would be needed to maintain the new facilities at Petroglyph Point, new trails, and other day use areas. A third maintenance position would be necessary to oversee and maintain new sustainable technologies that would be installed to achieve the monument's goal for reducing its carbon footprint.

Proposed new staffing includes:

Six Full-time Permanent Staff Positions

- One alternative energy specialist (electrician)
- One resource management specialist
- Two visitor protection (law enforcement position)
- Two maintenance positions

Two Term Staff Positions

- One biological science tech
- One physical science tech

Additional part-time/seasonal staff positions under Alternative C:

- Four interpreters
- Three resource management technicians

Annual Operating Costs

This alternative would be implemented with the current staffing levels plus 8 full-time equivalent staff (FTEs) for law enforcement, restoration and resource management, maintenance and interpretation (One FTE is one person working 40 hours per week for one year, or the equivalent) and 7 seasonal staff for interpretation and resource management. These additional positions would add approximately $839,000 to the operating base for alternative C. Additional administrative costs for potential leasing of new office space would be $14,400. The monument estimates that it would have additional annual cost savings of $35,000 upon installation of new energy-saving technologies for monument electrical use. The total annual operating costs for alternative C would be approximiately $2,500,000 per year (in 2008 dollars).

TABLE 9: SUMMARY OF COSTS FOR ALTERNATIVE C

SUMMARY OF COSTS FOR ALTERNATIVE C	
ANNUAL OPERATING COSTS	
Monument Operations	$1,701,000
Additional Staff (8) FTE (7) Seasonal/Part-time	$839,000
Oral History Collection	$15,000
Law Enforcement	$8,400
Annual Savings from On-site Renewable Energy	$-35,000
Leased Office Space	$14,400
Total Annual Operating Costs	**$2,542,800**
ONE-TIME CAPITAL COSTS	
Campground Improvements	$1,400,000
Cave Loop Improvements (Trail and road improvement, vault toilets)	$121,000
Collections Exhibits	$130,000
Day Use Areas	$20,000
Educational and Interpretive Materials	$30,000
Main Road Improvements (additional pull-outs)	$150,000
Medicine Lake Road Reconstruction and Paving	$3,900,000
Modoc War Historic Landscape Restoration	$80,000
Petroglyph Point Improvements • Protective Fence ($72,000) • Trails ($300,000) • Picnic Area with Shade Structures ($75,000) • Vault Toilet ($50,000) • Road Realignment/Paving ($1,700,000) • Parking ($500,000) • Wildlife Viewing Area ($25,000)	$2,722,000
Sustainable Park Operations (new energy systems)	$1,260,000
Trails	$1,373,000
Total One-Time Capital Costs	**$11,186,000**

*All costs in FY08 dollars



Pictograph, *NPS Photo*

TABLE 10: SUMMARY OF ALTERNATIVES

SUMMARY OF ALTERNATIVES		
Alternative A (No Action)	**Alternative B (Preferred)**	**Alternative C**
CONCEPT		
The no-action alternative provides a baseline for evaluating changes and impacts in other concepts	Lava Beds National Monument would promote and strengthen monument resource protection and restoration through enhanced stewardship, research, education, and inter-agency cooperation.	The monument would provide additional recreational and educational opportunities to meet both current and changing visitor needs and expectations. Outreach efforts would be expanded.
NATURAL RESOURCES		
Natural resource management programs would continue primarily as they are with a focus on inventorying and monitoring, resource protection, preservation, mitigation, and applied research efforts.	An expanded geologic research program would establish Lava Beds National Monument as a center for research and technical assistance focused on lava tube caves. The monument would establish a comprehensive monitoring program on geologic resources throughout the monument. An increased emphasis would be placed on the restoration and protection of sensitive species. The monument would expand comprehensive restoration efforts for native habitat The monument would increase regional coordination and technical assistance opportunities for ecological restoration, viewshed and dark night sky protection, and cave research and management.	Management of natural resources would primarily be the same as alternative A. The monument would conduct additional monitoring and assessment of sensitive resources in high visitor use areas, including development of cave action plans for high-use caves along Cave Loop Road.
CULTURAL RESOURCES		
The monument would document cultural resources and collections. The monument's ability to identify, inventory, conduct research and document significant cultural resources would continue to be limited by staffing constraints.	The monument would expand regional research and outreach programs related to cultural resources. The monument would increase efforts to collect local oral histories. The public would have greater access to library and museum collections. New research would investigate the impacts of climate change on cultural resources. Modoc War conservation studies would facilitate fortification preservation and restoration. Treatment of cultural landscapes would be implemented from additional research results.	The monument would encourage greater public access to historic structures and monument collections. The Modoc War cultural landscape would be actively restored to 19th century battlefield conditions.

SUMMARY OF ALTERNATIVES

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
INTERPRETATION AND EDUCATION		
The monument's education program would continue to provide curriculum-based education programs both on-site and in the classroom throughout the year. The education program would continue to produce education materials for teachers to use on their own in the classroom. The monument would continue to provide personal services such as guided tours, talks, and roving interpreters as staffing permits. The monument would continue to provide a variety of important non-personal services such as waysides, website content, etc.	The monument would expand interpretive topics and new opportunities would be explored both within and outside the monument at sites related to the park purpose and significance, including collaborative opportunities with tribes, regional parks, and schools. The monument would coordinate with the U.S. Fish and Wildlife Service and U.S. Forest Service to provide tours or interpretation on adjoining lands. Opportunities would be provided for public involvement in research and restoration activities. The monument would expand use of the visitor and research centers for teachers, students, researchers, and the public.	The monument would establish an Artist-in-the-Park program. The monument would coordinate with the U.S. Fish and Wildlife Service and U.S. Forest Service to provide tours or interpretation on adjoining lands. Expanded interpretive information would include media for groups and commercial tours.
RECREATION		
The monument would continue to provide programs, maintain its trail system, and to hold annual events. The monument would make incremental improvements to improve visitor accessibility.	Expanded hiking opportunities would be provided. The monument would expand visitor accessibility, including accessible trails and an improved virtual cave experience. New recreational opportunities would be explored such as designated backcountry camping sites, winter recreation, day use areas for large groups, and conversion of the West Wildlife Overlook to an event area. The monument would encourage more opportunities for commercial tours. Bicycling would be encouraged on monument roads.	The monument would increase outreach efforts to encourage more visitation, including raising the regional profile of Lava Beds National Monument within the travel and tourism industry. Expanded hiking opportunities would be provided. The monument would expand visitor accessibility. A greater diversity of recreation opportunities would be provided (e.g. biking, snowshoeing, caving seminars, annual events, and adventure and other specialized tours). The monument would provide increased involvement for commercial tours. The research center would be expanded to accommodate recreation seminars.
MONUMENT OPERATIONS		
Incremental improvements in energy efficiency would be made over time.	The monument would strive to offset its total energy use through changes in monument operations and new technologies, including electricity and motor vehicle fuel use.	The monument would strive to offset its total electricity usage through changes in monument operations and new technologies.

SUMMARY OF ALTERNATIVES

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
FACILITIES AND ROADS		
Existing facilities and roads would remain and continue to be maintained.	A seasonally staffed contact station, education area, and day-use facilities would be located at Petroglyph Point. The campground would be redesigned to improve the experience for groups, tent campers and RVs. Improvements at Cave Loop Road would include a vault toilet and improved pedestrian/bicycle access. The visitor center would be expanded to provide classroom opportunities and offices. Additional laboratory space at the Research Center. The NPS would explore leasing office space out of the monument for administrative functions. The northern monument entrance roads would serve as the primary access points to the monument. The wildlife overlooks and roads would be removed and revegetated. A portion of the West Wildlife Overlook would be used for events. The road at Petroglyph Point would be realigned and remain unpaved. Official vehicle access on portions of Lyons Trail would be maintained. Natural processes would reclaim portions of Lyons Trail and the Powerline administrative road.	A limited day-use facility would be located at Petroglyph Point. The monument would expand the campground to better accommodate groups and RVs. Improvements at Cave Loop Road would include a vault toilet and pedestrian/bicycle access. The NPS would explore leasing office space out of the monument for administrative functions The northern monument entrance roads would serve as the primary access points to the monument. Medicine Lake Road (within the monument) would be realigned and paved. The West Wildlife Overlook and access road would be removed. The road at Petroglyph Point would be realigned and paved. Lyons Trail would be maintained for administrative use and interpreted as the historic entrance to the monument. Powerline administrative road would be converted to trail use or reclaimed by natural processes.
COST COMPARISON		
ANNUAL OPERATING COSTS		
$1,701,000	**$2,505,200**	**$2,542,800**
STAFF (FULL TIME EQUIVALENT)		
22.3	**29.8**	**30.3**
ONE-TIME CAPITAL COSTS		
$0	**$9,099,000**	**$11,186,000**

TABLE 11: SUMMARY OF IMPACTS

The following discussion summarizes impacts of all alternatives considered, in accordance with the National Environmental Policy Act. The full analysis of impacts is included in Chapter 5, "Environmental Consequences."

SUMMARY OF IMPACTS		
Alternative A (No Action)	**Alternative B (Preferred)**	**Alternative C**
EFFECTS ON NATURAL RESOURCES		
AIR QUALITY		
Minor, short-term, adverse impacts on the monument's air quality from operations and visitor use. Short-term, minor adverse effects on air quality from wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions). Cumulative impacts associated with population growth and energy demands would contribute minor adverse impacts to air quality. No impairment of the monument's resources or values.	Long-term, negligible to minor, beneficial effects on monument air quality from alternative energy generation and increased educational and collaborative efforts between the monument and neighboring communities. As in alternative A, short-term, minor adverse effects on air quality from wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions). Negligible, beneficial cumulative effects on the monument's air quality. No impairment of the monument's resources or values.	Long-term, negligible, beneficial effects on monument air quality from alternative energy. More visitors could lead to increased vehicle use and negligible to minor, adverse impacts on monument air quality. As in alternative A, wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality. Negligible to minor, beneficial cumulative effects on the monument's air quality. No impairment of the monument's resources or values.
SOUNDSCAPES		
Long-term, negligible, adverse impacts on soundscapes from monument operations and visitor use Short-term, minor to moderate, adverse impacts from visitors and vehicles in high use areas. Short-term, minor to moderate, adverse impacts on soundscapes in backcountry areas from outside influences. Minor, adverse cumulative impacts on the area's soundscape from external activities such as overhead airplane traffic, freight transport, agricultural activities, and recreational vehicle noise from national forest lands. No impairment of the monument's resources or values.	Long-term, negligible beneficial effects on soundscape resources from the promotion of bicycle use and walking, and increased visitor education. Short-term, minor to moderate, adverse impacts on soundscapes in localized areas as a result of construction activity for new facility development. Petroglyph Point development would have an overall beneficial impact on soundscapes, primarily from the realignment of the current access road. Minor, adverse cumulative impacts on soundscape resources, although alternative B would add small beneficial and adverse increments in localized areas to the overall cumulative impact. No impairment of the monument's resources or values.	Long-term, negligible beneficial effects on soundscape resources from the promotion of bicycle use and walking. Long-term, minor to moderate, adverse impacts on soundscapes from proposed development at Indian Well campground and along the main road shoulders. Short-term, minor to moderate, adverse impacts on soundscapes in localized areas as a result of construction activity for new facility development. Petroglyph Point development would have an overall beneficial impact on soundscapes, primarily from the realignment and paving of the current access road. Minor, adverse cumulative impacts on soundscape resources, although alternative C would add small beneficial and adverse increments in localized areas to the overall cumulative impact. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
DARK NIGHT SKIES		
Alternative A would have no long-term, adverse impact on the monument's dark night skies from monument operations and visitor use. Minor to moderate, adverse cumulative impacts on dark night skies would result from future growth and development in surrounding communities. No impairment of the monument's resources or values.	Long-term, negligible to minor, adverse impacts on dark night skies from the expansion of facilities. These impacts may be mitigated depending on the outside lighting design, and the types of fixtures used. Collaborative efforts between the monument and neighboring communities could improve the quality of dark night skies having a negligible to moderate, beneficial cumulative effect on dark night skies. No impairment of the monument's resources or values.	Same as Alternative B, except there would be minor to moderate, adverse cumulative impacts from future growth and development in surrounding communities. No impairment of the monument's resources or values.
VIEWSHEDS / VISUAL RESOURCES		
Minor to moderate, long-term, adverse impacts on visual resources from visible infrastructure both inside and outside of the monument. Short-term, negligible to minor, adverse impacts on the monument's viewsheds as result of fires. Minor to moderate, long-term, beneficial effects on the monument's viewsheds from regional cooperation to improve air quality. Minor to moderate, cumulative adverse impacts on visual resources from regional air pollution sources. No impairment of the monument's resources or values.	Moderate, long-term, beneficial effects on visual resources from facility improvements and habitat restoration. New facilities at Petroglyph Point and improvements at the campground would improve the visual quality at these sites. Such development would have an overall, minor, adverse impact on broader monument viewsheds. Minor to moderate, long-term, beneficial effects on viewing experiences within the monument by providing additional opportunities for visitors to experience monument landscapes. Long-term, negligible to minor, adverse impact on monument viewsheds from the addition of sustainable technologies such as photovoltaic panels or small wind turbines. Short-term, minor, adverse impacts from construction activities associated with facilities and habitat restoration. Minor cumulative adverse impacts on visual resources when combined with the beneficial and adverse impacts of alternative B. No impairment of the monument's resources or values.	Minor to moderate, long-term, beneficial effects on the monument's viewsheds from regional cooperation to improve air quality. New facilities at Petroglyph Point and improvements at the campground would improve the visual quality at these sites. Such development would have an overall, minor to moderate, adverse impact on broader monument viewsheds. Moderate, long-term, beneficial effects on viewing experiences within the monument by providing additional opportunities for visitors to experience monument landscapes. Such development would have an overall, minor, adverse impact on broader monument viewsheds. Long-term, negligible to minor, adverse impact on monument viewsheds from the addition of sustainable technologies such as photovoltaic panels or small wind turbines. Short-term, minor, adverse impacts from construction activities. Minor to moderate, cumulative adverse impacts on visual resources from regional air pollution sources. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
CAVE RESOURCES		
Long-term, minor to moderate, adverse impacts on cave resources would occur in local areas due to current visitor use levels and the potential for increased visitor use levels. Long-term, minor, beneficial effects on cave resources from mitigation measures such as education and restoration. Long-term, negligible to moderate, adverse cumulative effects on cave resources, primarily from past disturbance and use. Alternative A's contribution to these impacts would be relatively small. No impairment of the monument's resources or values.	Long-term, negligible to minor, adverse impacts on cave resources as a result of improved access to monument resources either through trail development or increased interpretation and visitor tours. The monument would take appropriate steps to mitigate initial impacts monitor use of backcountry caves. Long-term, minor to moderate, adverse impacts on cave resources from visitor use in localized areas within the developed and interpretive backcountry zones. Management actions such as education and outreach, enhanced protection measures, and improved monitoring and research related to caves would provide beneficial effects. Cumulative impacts would be the same as alternative A. The adverse and beneficial impacts of alternative B's contribution to these impacts would be small. No impairment of the monument's resources or values.	Long-term, minor, adverse impacts on cave resources from improved access through trail development or increased recreational opportunities. The monument would take appropriate steps to mitigate initial impacts and monitor use of backcountry caves. Long-term, minor to moderate, adverse impacts on cave resources from visitor use in localized areas within the developed and interpretive backcountry zones. Cumulative impacts would be the same as alternative A. Alternative C would make a modest contribution to these effects, primarily from new caving opportunities and new visitor facilities. No impairment of the monument's resources or values.
GEOLOGIC RESOURCES		
Long-term, moderate, adverse, impacts on the monument's geologic resources as a result of visitor use in certain visitor use areas. Negligible, adverse impacts on geologic features in the backcountry and wilderness areas. Minor to moderate, adverse cumulative effects on geologic resources, primarily from past management practices and infrastructure developments. Alternative A actions are not expected to contribute to these impacts. No impairment of the monument's resources or values.	Long-term, minor, adverse impacts would occur due to new visitor facilities and increased visitor use in localized areas such as along trails and inside caves. However, a potential increase in backcountry use where features are pristine with relatively few visits could receive localized, moderate to major, adverse impacts. The monument would take appropriate steps to mitigate initial impacts and monitor use. Moderate, long-term, beneficial effects from expanded restoration efforts and through establishing and monitoring user capacity indicators and standards to prevent geologic feature degradation. Minor to moderate, adverse cumulative effects on geologic resources, primarily from past management practices and infrastructure developments. Alternative B actions would add a very small increment to this overall cumulative impact. No impairment of the monument's resources or values.	Long-term, minor, adverse impacts would occur due to new visitor facilities and increased visitor use in localized areas such as along trails and inside caves. However, a potential increase in backcountry use where features are pristine with relatively few visits could receive localized, moderate to major, adverse impacts. The monument would take appropriate steps to mitigate initial impacts and monitor use. Minor to moderate, long-term, beneficial effects through establishing and monitoring user capacity indicators and standards to prevent geologic feature degradation. Minor to moderate, adverse cumulative effects on geologic resources, primarily from past management practices and development. Alternative C actions would add a very small increment to this overall cumulative impact. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
SOILS		
Most of the monument's soils would not be affected by the actions in alternative A. Long-term, minor, adverse impacts on soils from compaction and disturbance due to increased visitor use in localized areas such as along trails and in caves. Impacts could be moderate in some highly used areas. Long-term, minor to moderate, adverse cumulative impacts on area soils from past grazing practices and infrastructure improvements. The actions in alternative A would contribute a very small increment to the overall impact No impairment of the monument's resources or values.	Most of the monument's soils would not be affected by actions in alternative B. Long-term, minor, adverse impacts on soils as result of construction projects and compaction and disturbance associated with increased visitor use in localized areas such as along trails and inside caves. Negligible, long term, beneficial effects from the establishment of monitoring and user capacity indicators and standards. Long-term, minor to moderate, adverse cumulative impact on area soils. Alternative B actions would contribute a very small increment to the overall impact. No impairment of the monument's resources or values.	Impacts are similar to alternative B.
VEGETATION		
Long-term, minor, adverse impacts would occur in local areas due to current visitor use levels and the potential for increased visitor use The spread of nonnative plants would have moderate to major, long-term, adverse impacts on native vegetation in the northern half of the monument. Long-term, moderate, beneficial impact in local areas would occur from continuing efforts to control nonnative species. Minor to moderate, long-term, adverse cumulative impacts on native vegetation, primarily from human activities such as agricultural operations, grazing, construction, and other developments. Alternative A would add moderate beneficial increments to this cumulative impact. No impairment of the monument's resources or values.	Vegetation in most areas of the monument would not be affected by alternative B. Localized minor to moderate, adverse impact on native vegetation from visitor use in alternative B. Long-term, negligible to minor, adverse impacts would occur in local areas due to proposed new developments and continued administrative vehicle access on 3.8 miles of the Lyons Road. The spread of nonnative plants would have minor to moderate, long-term, adverse impacts on native vegetation. Long-term, minor to moderate beneficial effects from efforts to restore grassland sagebrush steppe vegetation, and establish and monitor user capacity indicators and standards Minor to moderate, long-term, adverse cumulative impacts on native vegetation. Alternative B would add both moderate beneficial and small adverse increments to this overall cumulative impact. No impairment of the monument's resources or values.	Long-term, minor to moderate, adverse impacts on native vegetation in localized areas due to proposed new developments and increased visitor presence. The spread of nonnative plants would have minor to moderate, long-term, adverse impacts on native vegetation. Long-term, minor to moderate, beneficial effects from efforts to restore native plant communities, remove administrative vehicle access, and the establishment of user capacity indicators and standards. Minor to moderate, long-term, adverse cumulative impacts on the area's native vegetation. Alternative C would add both small beneficial and moderate adverse increments to this overall cumulative impact. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
WILDLIFE AND WILDLIFE HABITAT		
Most wildlife in the monument would not change as a result of alternative A actions. Long-term, negligible, adverse impacts on wildlife would continue to occur in localized areas due to continuing visitor use of the monument. Minor to moderate, long-term, beneficial impacts on some wildlife populations from continuing efforts to prevent the spread of western juniper and control the spread of nonnative species. Long-term, minor to moderate, adverse cumulative impacts on the area's wildlife populations and habitats, primarily from actions outside the monument such as fire suppression and human activities, such as the draining of Tule Lake, farming, ranching, and road development. Alternative A would contribute only a small beneficial increment and a very small adverse increment to these impacts. No impairment of the monument's resources or values.	Minor to moderate, short-term and long-term effects on the monument's wildlife dependent upon design and placement outside of sensitive habitats, from the construction of new facilities and trails. Proposed developments at Petroglyph Point could have the potential to impact feeding areas for local birds of prey that breed at the point. On the other hand, moving existing road, parking and trailhead from sensitive resources would benefit wildlife. Long-term, negligible, adverse impacts would continue to occur in localized areas due to continuing visitor use of the monument. Long-term, beneficial impacts on some wildlife populations due to expanded vegetation restoration efforts, the addition of lands in Petroglyph Point, and the closure and restoration of Powerline road. Long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. Alternative B would contribute only a small beneficial increment and a very small adverse increment to this impact. No impairment of the monument's resources or values.	Minor to moderate, long-term, adverse impact on the monument's wildlife, dependent upon design and placement outside of sensitive habitats, from the construction of new facilities and trails. Proposed developments at Petroglyph Point could have the potential to impact feeding areas for local birds of prey that breed at the point. On the other hand, moving existing road, parking and trailhead from sensitive resources would benefit wildlife. Long-term, negligible, adverse impacts would continue to occur in localized areas due to continuing visitor use. Moderate adverse impacts on wildlife due to collisions and increased disturbance from Medicine Lake Road improvements. Long-term, beneficial impacts on some wildlife populations due to vegetation restoration efforts, the addition of lands at Petroglyph point, and the closure of Powerline administrative road. Long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. Alternative C would contribute only a small beneficial increment and a very small adverse increment to this impact. No impairment of resources or values.
THREATENED AND ENDANGERED SPECIES		
Alternative A would be expected to have no long-term adverse impacts on the monument's threatened and endangered species from monument operations and visitor use. Long-term, minor to moderate, adverse impacts on special status species from continued administrative access to Fern Cave. Long-term, minor, adverse cumulative impact on the area's rare and sensitive species. No impairment of the monument's resources or values.	Long-term, minor to moderate, adverse impacts on threatened and endangered species, primarily due to potential impacts of new trail systems and visitor access to these habitats. Long-term, minor, adverse cumulative impact on the area's rare and sensitive species from past and future impacts. Alternative B's proposed developments would likely be a small part of the cumulative impacts No impairment of the monument's resources or values.	Long-term, minor to moderate, adverse impact on threatened and endangered species, due to potential impacts of new trail systems and visitor access to these habitats and from improvements to Medicine Lake Road. Long-term, minor, adverse cumulative impact on the area's rare and sensitive species from past and future impacts. Alternative C's proposed developments would likely be a small part of the cumulative impacts No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
EFFECTS ON CULTURAL RESOURCES		
ARCHEOLOGY		
Since no new development is planned, the likelihood of adverse impacts from construction on archeological resources is unlikely. Negligible to moderate cumulative impacts have been incurred from past development, staffing constraints and natural processes. Alternative A would not actively contribute to the adverse cumulative impacts. No impairment of the monument's resources or values.	Alternative B would generally benefit the preservation and interpretation of archeology sites and associated collections despite the increase in new construction. No adverse impacts to archeological resources are anticipated, yet without professional oversight, long-term adverse impacts could be negligible to minor. Cumulative impacts would be negligible to minor, and adverse. However alternative B would not contribute to this adverse impact. No impairment of the monument's resources or values.	The overall impacts on archeological resources from proposed development projects and new visitor experiences would be long-term, minor, and adverse. Cumulative impacts would be negligible to minor and adverse. However, alternative C would not contribute to the adverse cumulative impact. No impairment of the monument's resources or values.
ETHNOGRAPHIC RESOURCES		
No impacts to ethnographic resources are anticipated from actions in alternative A. Minor, adverse cumulative impacts on ethnographic resources, primarily from the loss of these resources over time due to past development and administrative/maintenance operations, increasing visitor use, and a loss of resources from activities outside of the monument. Alternative A would not contribute to the cumulative effects. No impairment of the monument's resources or values.	Overall, alternative B would have beneficial effects on ethnographic resources from the increased emphasis on cultural resource research and preservation. Localized, minor, adverse impacts on ethnographic resources from site construction at places of significance to tribes. Increased in collaboration with the tribes for interpretive programs and anthropological research would ensure that development design is sensitive to resources important to affiliated groups. Minor, adverse cumulative adverse impacts on ethnographic resources. Alternative B would not contribute to the cumulative effects. No impairment of the monument's resources or values.	Localized, minor to moderate, adverse impacts on ethnographic resources from site construction at places of significance to tribes, particularly at Petroglyph Point. Full consultation with tribes would ensure important sites retain integrity and would also improve the quality of ethnographic data available to the monument staff. Minor, adverse cumulative adverse impacts on ethnographic resources. Alternative C's contribution would be small. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
CULTURAL LANDSCAPES, HISTORIC BUILDINGS AND STRUCTURES		
Long-term, negligible to minor adverse effects (no adverse effect) on historic buildings, structures, and cultural landscapes due to staffing constraints that limit the monument's ability to identify, inventory, conduct research, and document cultural resource significance. Long-term, minor to moderate, cumulative adverse effect on the integrity of the Modoc War cultural landscape as result of natural processes and loss associated with past development in the monument. Alternative A would not contribute to the adverse cumulative impact. No impairment of the monument's resources or values.	Long-term, negligible to minor, adverse impacts (no adverse effect) on the historic character and setting of the locale from proposed development such as accessible trails. Long-term, minor to moderate, cumulative adverse effect on the integrity of the Modoc War cultural landscape as result of natural processes and loss associated with past development in the monument. Alternative B would not contribute to the adverse cumulative impact. No impairment of the monument's resources or values.	Long-term, negligible to minor, adverse impacts (no adverse effect) on the historic character and setting of the locale from proposed development such as accessible trails. Long-term, minor to moderate, beneficial effects on historic structures from enhanced awareness by the public of historic preservation and stewardship. Long-term, minor to moderate, cumulative adverse effect on the integrity of the Modoc War cultural landscape as result of natural processes and loss associated with past development in the monument. Alternative C would not contribute to the adverse cumulative impact. No impairment of the monument's resources or values.
MUSEUM COLLECTIONS		
Long-term, minor adverse impacts would result from environmental controls that do not meet current NPS standards for museum collections. Minor, cumulative adverse impacts on museum collections would occur, primarily due to the lack of an on-site professional curator over the course of time could result in processing and data gaps that could hinder future research efforts. Alternative A's contribution to these impacts would be small. No impairment of the monument's resources or values.	Long-term, minor, beneficial effects on museum collections as a result of increased research and educational outreach. Negligible to minor, adverse cumulative impacts on museum collections. Alternative B's beneficial effects would contribute a modest amount to the overall cumulative effects. No impairment of the monument's resources or values.	Long-term, minor to moderate, adverse impacts from increased compliance activity associated with trail and facility development and increased collection use for interpretation. Minor, adverse cumulative impacts on museum collections. Alternative C's contribution to these impacts would be small. No impairment of the monument's resources or values.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
WILDERNESS		
WILDERNESS CHARACTER		
Negligible to minor, long-term, adverse impact on the monument's wilderness resources from monument operations and visitor use. Long-term, negligible to minor, adverse cumulative impacts on certain wilderness values that center on natural quiet from sounds outside of the monument including air traffic, freight trains, and agricultural activities. No impairment of the monument's resources or values.	Beneficial effects of unknown intensity on wilderness resources, due the promotion of bicycle use between monument attractions and reduced visibility of monument facilities from wilderness areas. Long-term, minor to moderate, adverse impacts on the monument's wilderness resources due to the increased potential for noise associated with activities outside of the monument. Long-term, negligible to minor, adverse cumulative impacts on wilderness. Alternative B would add small beneficial and adverse increments to the overall area cumulative impact. No impairment of the monument's resources or values.	Beneficial effects of unknown intensity on wilderness resources, primarily due to the promotion of walking and bicycle use. Long-term, minor adverse impacts on the monument's wilderness resources due to the increased trail developments proposed for the wilderness and the increased potential for noise associated with activities outside of the monument. Long-term, negligible to minor, adverse cumulative impacts on wilderness. Alternative C would add small beneficial and adverse increments to the overall area cumulative impact. No impairment of the monument's resources or values.
EFFECTS ON VISITOR OPPORTUNITIES		
VISITOR USE AND EXPERIENCE		
Long- term, negligible to minor, adverse impacts on the visitor experience due to continued deficiencies in in current visitor facilities such as the trail system. Long-term, moderate, adverse impacts as a result of continued deficiencies in visitor facilities at Petroglyph Point. Directing visitors to use the northern entry routes as the primary entrances to the monument would have a minor to moderate, long term, beneficial effect on the visitor experience. Minor to moderate, adverse cumulative impacts, primarily from deficiencies in visitor facilities, changing visitor needs, and limited staffing. Alternative A's contribution would be relatively small.	Long-term, moderate to major, beneficial effects on the visitor experience from new facilities, enhancing visitor access, and offering new recreational opportunities. Short-term, minor, adverse effects on the visitor experience at Petroglyph Point due to temporary closures and construction activities. Directing visitors to use the northern entry routes as the primary entrances to the monument would have a minor to moderate, long term, beneficial effect on the visitor experience. The beneficial effects of alternative B would contribute moderate benefits to cumulative effects on the visitor experience.	Long-term, moderate to major, beneficial effects on the visitor experience from new facilities, enhancing visitor access, and offering new recreational opportunities. Short-term, minor, adverse effects on the visitor experience at Petroglyph Point due to temporary closures and construction activities. Short term, minor, adverse impacts such as noise and increased conflict between user groups. Directing visitors to use the northern entry routes as the primary entrances to the monument would have a minor to moderate, long term, beneficial effect on the visitor experience. Negligible to moderate, cumulative beneficial effects on the visitor experience.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
INTERPRETATION AND EDUCATION		
Long-term, minor to moderate, adverse impacts on visitor interpretive and educational opportunities as a result of staffing constraints that would limit the amount of interpretive and educational programs provided over time. Long-term, minor, adverse impacts on educational opportunities for school children as a result of staffing constraints. Long-term, negligible to minor, beneficial effects on regional interpretive and educational opportunities. Minor to moderate, adverse cumulative impacts on education and interpretation as a result of staffing and programmatic constraints.	Long-term, moderate to major, beneficial effects on the ability of visitors to learn about and understand monument resources as a result of expanded interpreted topics and visitor facilities that better accommodate educational programming. Long-term, major, beneficial effects on educational opportunities for school groups and researchers. Moderate to major, beneficial cumulative effects on educational and interpretive opportunities as a result of increased coordination of educational programming and interpretive planning with the adjoining land management agencies, schools, and community organizations. Alternative B's contribution would be substantial.	Long-term, minor to moderate, beneficial effects on the ability of visitors to learn about and understand monument resources as a result of expanded interpreted topics and visitor facilities that better accommodate educational programming. Long-term, negligible to minor, beneficial effects on educational opportunities for school groups and researchers. Negligible to moderate, beneficial effects to cumulative effects on educational and interpretive opportunities as a result of the increased coordination with schools, and community organizations. Alternative C's contribution would be substantial.
ACCESS AND TRANSPORTATION		
Minor, long-term benefits on access and circulation within the monument as a result of improvements to monument roads, sidewalks, and parking areas over time. Moderate, cumulative adverse impacts on monument access from the south as a result of deteriorating conditions on Forest Service Route 10.	Long-term, moderate benefits on access and circulation at the monument as a result of improved trail systems, accessibility, and road access. New facilities at Petroglyph Point would improve access, parking, and trail accessibility. On-site seasonal staffing would provide better visitor orientation for visitors arriving from the northeast. Cumulative minor beneficial effects on overall access to the monument as result of the beneficial effects from the actions of alternative B such as improved orientation at Petroglyph Point and improvements to Medicine Lake Road.	Long-term, moderate benefits on access and transportation at the monument as a result of direct actions to improve trail systems, accessibility, and road access to the monument. New facilities at Petroglyph Point would improve access, parking, and trail accessibility at this site. Medicine Lake Road realignment and paving would improve access from the south. Cumulative minor to moderate, beneficial effects on access to the monument as result of the beneficial effects from the actions of alternative C such as such as improved orientation at Petroglyph Point and improvements to Medicine Lake Road.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
EFFECTS ON MONUMENT MANAGEMENT		
MONUMENT OPERATIONS		
Long-term, moderate adverse impacts on monument operations as a result of inadequate funding and staffing. Cumulative minor beneficial impacts over time, primarily from ongoing maintenance and replacement of existing facilities.	Long-term, moderate beneficial effects on monument operations as a result of actions to expand staff, encourage interagency and interdivisional cooperation, improve operations and security at Petroglyph Point, and offset total energy use through the use of new technologies. Cumulative, moderate to major, beneficial effects on monument operations.	Long-term, minor to moderate, beneficial effects on monument operations as a result of actions to expand staff, encourage interagency cooperation, improve operations at Petroglyph Point, and offset electrical energy use through the use of new technologies. Cumulative, minor to moderate, beneficial effects on monument operations.
CARBON FOOTPRINT		
The beneficial effects on the monument's current carbon footprint would likely be minor, as reduction of the carbon footprint would continue to compete with other management priorities. Because the region's goal of operational neutrality requires early and significant action, the incremental and ad hoc action proposed under alternative A would result in an adverse moderate impact by delaying actions adequate to achieve the region's goal. Actions outside of the monument would have a negligible effect on the monument's ability to reduce its carbon footprint.	Long-term, major beneficial effect on the monument's operational carbon footprint as well as the region's stated goal of operational carbon neutrality as a result of mitigation, and offsetting of the monument's operational carbon emissions. Cumulative impacts would be the same as alternative A.	Long-term, major beneficial effect on the monument's operational carbon footprint as well as the region's stated goal of operational carbon neutrality as a result of mitigation, as a result of the elimination of carbon emissions for electricity use. Cumulative impacts would be the same as alternative A.

SUMMARY OF IMPACTS

Alternative A (No Action)	Alternative B (Preferred)	Alternative C
EFFECTS ON SOCIOECONOMICS		
SOCIOECONOMICS		
Long-term, negligible to minor, adverse socioeconomic impacts from the possible reduction in monument visitation from a lack of appropriate facilities or activities available to older or ethnically more diverse potential visitors. When considered in concert with the socioeconomic affects of other recreation and tourism sites in the area, the continuation of current management practices would have little to no cumulative effects.	Long-term, moderate, beneficial effects on local and regional from improvements to visitor services, facilities, and experiences that would make the monument a more desirable destination and improve revenues from the tourism sector of the local and regional economy. Moderate, localized adverse impacts may occur on small businesses in the Tionesta area as a result of directing visitors to access the monument primarily over the paved and better maintained northern entrance roads. Minor to moderate, beneficial cumulative effects on the local and regional economy.	Long-term and negligible to minor beneficial socioeconomic effects as a result of improvements in the visitor experience and correlated visitation totals. Long-term, adverse effect on socioeconomic resources if other land uses such as livestock grazing are impacted by expanded recreational opportunities at the monument. Moderate, localized adverse impacts may occur on small businesses in the Tionesta area as a result of directing visitors to access the monument primarily over the paved and better maintained northern entrance roads. Negligible to minor, beneficial cumulative effects as a result of new recreational activities that would attract some new visitation, including users interested in activities such as equestrian travel and mountain biking.
SECTION 106 SUMMARY		
Section 106 of the National Historic Preservation Act (16 USC 470 e seq.) requires (1) that federal agencies consider the effect of their projects on historic properties (including archeological resources) eligible for the National Register of Historic Places, and (2) that agencies give the Advisory Council on Historic Preservation and the state historic preservation office an opportunity to comment on projects. As required by section 110 of the National Historic Preservation Act, federal land management agencies survey cultural resources on lands under their jurisdiction and evaluate these resources by applying criteria for the National Register of Historic Places. A number of surveys, inventories, and studies have been completed or are ongoing, and further resource evaluation and documentation will continue in the monument. At this time, there is not enough information to make a determination of effect consistent with section 106 of the National Historic Preservation Act for the actions related to ethnographic resources, archeological resources, and museum collections. Actions that have the potential to effect resources eligible for or listed on the National Register of Historic Places will be incorporated into a programmatic agreement that is tied to the general management plan. The programmatic agreement would identify proposed actions for which further section 106 consultation is required, such as any ground disturbing construction activities associated with new trail development, building additions, and proposed facilities at Petroglyph Point. Table 22 in Chapter 6, "Consultation and Coordination" includes a full list of future section 106 compliance required for GMP implementation. In the interim, no historic properties would be inalterably changed without consultation with the state historic preservation office and the Advisory Council on Historic Preservation, as appropriate. Archeological sites will be protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable and when disturbance is unavoidable appropriate treatment would follow in consultation with the California State Historic Preservation Office and the Klamath Tribes. Copies of this GMP/environmental assessment have been distributed to affected/concerned Native American Tribes, the California State Historic Preservation Office, and the Advisory Council on Historic Preservation for review and comment related to compliance with section 106 of the National Historic Preservation Act.		

User Capacity

INTRODUCTION

General management plans for national park system units must address user capacity management. The National Park Service (NPS) defines user capacity as the type and extent of use that can be accommodated while sustaining the quality of a park unit's resources and visitor experiences consistent with the park unit's purpose.

User capacity management involves establishing desired conditions, monitoring, and taking actions to ensure the park unit's values are protected. The premise is that with any visitor use comes some level of impact that must be accepted; therefore, it is the responsibility of the National Park Service to decide what level of impact is acceptable and what management actions are needed to keep impacts within acceptable limits.

Instead of just tracking and controlling the number of visitors, NPS staff manages the levels, types, and patterns of visitor use as needed to preserve the condition of the resources and quality of the visitor experience. The monitoring component of this process helps NPS staff evaluate the effectiveness of management actions and provides a basis for informed adaptive management of visitor use.

The foundation for user capacity decision making is the qualitative descriptions of desired resource conditions, visitor experience opportunities, and general levels of development and management described in the management zones. Based on these desired conditions, indicators and standards are identified. An indicator is a measurable variable that can be used to track changes in resource and social conditions related to human activity, so that existing conditions can be compared to desired conditions. A standard is the minimum acceptable condition for an indicator.

User capacity decision making is a continuous process; decisions are adjusted based on monitoring the indicators and standards. Management actions are taken to minimize impacts when needed. The indicators and standards included in this management plan would generally not change in the future. However, as monitoring of the monument's conditions continues, managers may decide to modify, add, or delete indicators if better ways are found to measure important changes in resource and social conditions. Information on the NPS monitoring efforts, related visitor use management actions, and any changes to the indicators and standards would be available to the public.

This general management plan addresses user capacity in the following ways:

- The management zones described earlier in this chapter provide the basis for managing user capacity. Each zone prescribes desired resource conditions, visitor experiences, and recreational opportunities for different areas of the monument. The zones also prescribe the types and levels of developments necessary to support these conditions, experiences, and opportunities. This element of the framework is the most important to long-term user capacity management because it directs the National Park Service on ways to best protect resources and visitor experiences while offering a diversity of visitor opportunities.

- User capacity provides a description of the monument's most pressing use-related resource and visitor experience concerns, existing and potential, given the monument's purpose, desired conditions, and the vulnerability of specific resources and values. This helps NPS managers focus limited resources on the most significant indicators.

- Indicators and standards are identified that will be monitored in the future to determine if desired conditions are deteriorating due to unacceptable impacts from visitor use.

- Potential monitoring strategies are provided to protect resource conditions from unacceptable impacts.

- Representative examples of management strategies to avoid or minimize unacceptable impacts from visitor use are identified.

PRIORITY INDICATORS AND STANDARDS

Table 12 describes the user capacity indicators, standards, monitoring and management strategies for Lava Beds National Monument. This information was developed after careful consideration of key aspects of desired resource conditions and visitor experiences, public scoping information, relevant research studies, staff management experience and other monument data sources. The planning team considered many

potential issues and related indicators that would identify impacts of concern, but those described below were considered the most salient given the importance and vulnerability of the resource or visitor experience affected by visitor use.

The priority resource indicators selected for Lava Beds National Monument are associated with the disturbance of, and damage to, cave and surface geologic features, sensitive wildlife, and archeological sites. In addition, significant changes in visitor use to the backcountry and wilderness areas of the monument was also identified as a priority resource indicator given the potential for impacts to sensitive resources in areas that currently receive little to no visitor use. The condition of these resources are already being monitored in various forms, but the indicators identified below will help the monument staff track specific impacts due to visitor use.

Disturbance to Geologic Features

Impacts to surface geologic features from off-trail visitor activities include disturbance to fragile cinder and spatter cones, the creation of informal trails to cave entrances and geologic features, and the alteration of natural landscapes by stacking rocks, taking pieces of geologic formations, or otherwise altering natural geologic features. These types of impacts can have significant effects on the integrity of non- renewable geologic resources and reduce the quality of other visitors' experiences. A 2008 condition assessment conducted by the NPS Geologic Resource Division identified existing visitor use related impacts to surface features at Fleener Chimneys, Black Crater and cave entrances/collapses (NPS 2008).

Visible Condition of Cave Features and Floors

Among Lava Beds most cherished resources are the 28 lava tube caves that receive over 80,000 visits each year. The monument provides for a range of visitor opportunities in these unique environments, however, minimal supervision of cave visits has led to resource impacts. Lava tube caves contain primary geologic formations that developed during the formation of the cave. These features are non-renewable resources that cannot be restored or replaced. Past research and monitoring efforts by the monument and other NPS units have demonstrated that impacts to primary cave formations occur due to cave development and ongoing visitor use, particularly off-trail travel and depreciative visitor behaviors, such as vandalism, littering, and graffiti.

There is some question whether the current level of unsupervised cave visitation is sustainable. If visitor use increases, current management practices, such as cleaning, temporary closures, or restoration may be increased.

Research and monitoring has also demonstrated that visitation leads to the buildup of lint and litter inside of caves. Both lint and litter impact the low-energy ecosystems of caves, including rare macro-invertebrates that have adapted to these systems. In 2005, a biological inventory of cave macro-invertebrates in 29 caves identified over a dozen cave adapted macro-invertebrates of which approximately four are endemic to the monument and a single cave (NPS 2005a). Monument staff are currently working with the NPS Inventory and Monitoring Program of the Klamath Network to develop long-term monitoring protocols that will be used to evaluate the extent of lint and litter in caves and the related long-term effect on macro-invertebrates. In addition to lint and litter, human waste, glass and other debris also pose a safety and health threat to visitors.

Change in Sensitive Wildlife Species

Since the 1980s, monument staff have focused efforts on monitoring and protecting vulnerable bat populations. The most sensitive bats include cave dependent species, such as Townsend's big-eared, pallid, and Mexican free-tailed bats. These species rely on caves for hibernation in winter and breeding in summer. Visitor use can disturb bat populations, potentially scaring bats away from favorable roost sites, causing the abandonment of young, or causing early, and potentially deadly, awakening from hibernation. Staff efforts to actively monitor bat populations have led to management strategies focused on maintaining viable bat populations. A single disturbance event has the potential to result in a significant population decline for colonies, and can lead to the extirpation of a species from the monument. New threats such as White Nose Syndrome and other diseases transported through visitor use activities could also result in impacts to bat populations.

Disturbance of Cultural Resources

Visitor use impacts on archeological resources can be inadvertend or purposeful. For example, impacts to archeological sites include trampling, vandalism, and theft. Archeological sites include rock art, artifacts, battlefields, and stacked rock features.

These non-renewable resources represent critical links to Native American tribes and are an irreplaceable part of the monument's history. The monument is required to monitor all identified archeological sites and currently uses photo documentation and site mapping and assessments to assess visitor use impacts. Additionally, impacts to archeological sites can increase after wildland fires remove protective camouflaging vegetation. In response to these events, monument staff implement immediate, temporary protective actions to prevent resource degradation. For example, in 2008, the 5,500 acre Jack Fire led to the increased visibility of archeological sites throughout the monument. In this case, monument staff implemented strategies to protect archeological sites, which included increased monitoring, education, areas of restricted and/or regulated visitor access and enforcement.

Backcountry Use Patterns

Visitor use of the monument's wilderness and backcountry areas is currently low, hence there has been no need for intensive visitor use management in these areas. Visitor use is not expected to significantly increase in the backcountry and wilderness, but an indicator to monitor change is needed. Trail registers, visitor counters and visitor surveys have been used for decades to track visitor use levels in the backcountry and wilderness. Advancements in new visitor counter technology will provide additional insight into use patterns over time. Any increase in visitor use will be used as an analog for a potential increase in backcountry and wilderness cave use, potential expansion of dispersed camping and an increase in the visitation to sensitive cultural, natural, and geologic sites within backcountry and wilderness.

Responsiveness to Educational and Interpretive Requests

Given the sensitivity of resources in the monument and the desire to maintain visitor freedom to the greatest extent possible, education is an important management tool for protecting resources and providing high quality visitor experiences. As such, the monument staff's ability to respond to educational needs and requests was identified as a priority indicator to ensure a long term commitment to providing as many opportunities as possible both within and outside of the monument.

Use Conflicts

Use conflicts, such as noise, crowding and depreciative visitor behaviors, were identified as a priority concern since these problems may affect visitors' ability to have high quality recreational experiences and can potentially also affect visitor health and safety. These concerns are already tracked to some degree through law enforcement incident reporting and the documentation of visitor complaints. The indicator below would increase the degree of systematic monitoring and assessment of this issue.

User Capacity Indicators and Standards

The standards selected for each user capacity indicator listed in Table 12 were based on professional management judgment informed by the general management plan's desired conditions, the monument's baseline conditions for each indicator, relevant monument-specific and national research studies, and NPS guidelines and standards.

The monitoring and management strategies included in table 12 provide a general description of the range of considerations for future monitoring and visitor management related to each indicator. The implementation of any specific management actions that affect visitor use will comply with the National Environmental Policy Act, the National Historic Preservation Act, and other laws, regulations and policies as needed.



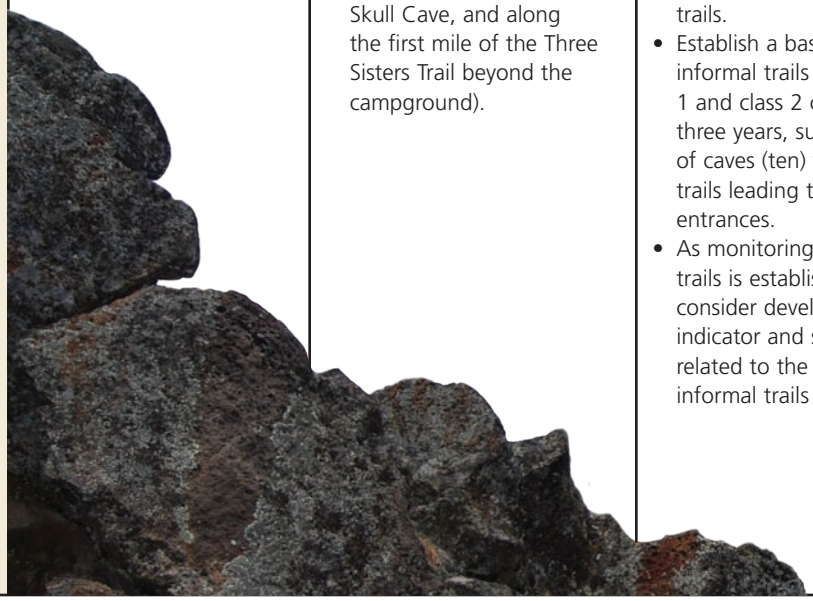
Cave surveying, *NPS Photo*

TABLE 12: USER CAPACITY INDICATORS AND STANDARDS

USER CAPACITY INDICATORS AND STANDARDS

DISTURBANCE TO GEOLOGICAL RESOURCES

	USER CAPACITY INDICATORS	USER CAPACITY STANDARDS	RELATED MONITORING STRATEGIES	POTENTIAL MANAGEMENT STRATEGIES
THROUGHOUT THE MONUMENT	• Number of incidents resulting in a criminal violation and warnings related to geologic resources. • Number of damaged geologic features. • Number of informal trails (trails created by visitors accessing areas off the designated trail system) to primary geologic destination areas and class 1 and 2 cave entrances.	• No incidents resulting in criminal violations, and no more than four warnings annually. • No new damage of geologic features (baseline values established once GMP is implemented). Damage of features includes impacts to lava texture, spatter cones, cinder cones, and basalt fields. • No informal trails into primary geologic destination areas (Black Crater, Fleener Chimneys, Schonchin Butte, Captain Jacks Stronghold). • No more than two informal trails to class 1 and class 2 cave entrances (i.e., 15 caves within the Cave Loop area, within the first mile of the Lyons Trail beyond Skull Cave, and along the first mile of the Three Sisters Trail beyond the campground).	• Continually evaluate law enforcement patrols as trends in incidents are identified. • Weekly notification to management staff on documented violations and warnings (establish inter-divisional database or written record for long-term monitoring purposes). • Every five years, photo survey geologic features (lava texture, basalt fields, spatter cones, cinder cones). Sixteen photo monitoring stations would be established. • Every three years, conduct trail surveys at Black Crater, Fleener Chimneys, Schonchin Butte, Captain Jacks Stronghold to detect establishment of informal trails. • Establish a base map of informal trails to 30 class 1 and class 2 caves. Every three years, survey a subset of caves (ten) for informal trails leading to cave entrances. • As monitoring of informal trails is established, consider developing an indicator and standard related to the density of informal trails per area.	• Increase visitor contacts through roving activities of interpretive staff, natural resources staff, and volunteers. • Increase education about the sensitivity of geologic resources and promote low impact visitor use practices through informal contacts in the visitor center and while roving, in formal interpretive and educational programming, and by other appropriate means. • Increase inventory and monitoring efforts. • Increase restoration and/or rehabilitation efforts. • Increase/modify enforcement patrols and activities. • Change site management techniques (e.g., fences, borders, barriers, sensors and monitoring devices). • Better marking of established trail systems. • Close areas to off-trail travel. • Area or temporal closures to protect impacted sites. • Evaluate realignment of trails to minimize the formation of social trails. • Implement permit systems, group size limitations (including limiting group sizes on tours) or other visitor use access regulation techniques.



USER CAPACITY INDICATORS AND STANDARDS

VISIBLE CONDITION OF CAVE FEATURES AND FLOORS

	USER CAPACITY INDICATORS	USER CAPACITY STANDARDS	RELATED MONITORING STRATEGIES	POTENTIAL MANAGEMENT STRATEGIES
ALL CLASS 1 AND SELECT CLASS 2 CAVES	• Litter and/or lint detected in monitoring plots. • Broken formations detected in monitoring plots.	• No more than 4 pieces of litter and/or lint intercept a line within an established 50 x 50 cm gridded monitoring plot (line every 5cm).** • No more than 50% of plots have 4 or more pieces of litter.** • No formation found broken within 50 x 50 cm monitoring plots.** **Number of pieces of litter within gridded monitoring plots may be increased or decreased with the approval of the Cave Management Plan and I&M Klamath Network cave monitoring protocols – to be established by end of 2011.	• Establish gridded monitoring plots (depending on the size of a given cave) in all Class 1 and select Class 2 caves for the detection of litter. • Use the 2008 Impact Monitoring Assessment of the monument's caves to select random plot locations in high traffic and low traffic areas. • Monitoring plots (depending on size of cave) located in high traffic and low traffic areas will be established in all Class 1 and select Class 2 caves for the detection of broken features. • Every plot will be cyclically revisited within a 3-5 year period. • Monitoring protocol will be assessed and evaluated every 5 years (in a resource summary report), to evaluate the number of plots and acceptable amounts of litter. • A GIS database of restoration efforts, lint removal, formation damage, and general cave conditions will be maintained to monitor long term trends in cave conditions and to correlate with cyclic monitoring plots. • The cycle of monitoring and number of monitoring plots will be established and approved through the cave management plan and the I&M Klamath Network cave monitoring protocols.	• Increase visitor contacts through roving activities of interpretive staff, natural resources staff, and volunteers. • Increase education about the sensitivity of geologic resources and promote low impact visitor use practices through informal contacts in the visitor center and while roving, in formal interpretive and educational programming, and by other appropriate means. • Increase inventory and monitoring efforts. • Increase restoration and/or rehabilitation efforts. • Increase/modify enforcement patrols and activities. • Change site management techniques (e.g., fences, borders, barriers, sensors and monitoring devices). • Better marking of established trail systems. • Close areas to off-trail travel. • Area or temporal closures to protect impacted sites. • Evaluate realignment of trails to minimize the formation of social trails. • Implement permit systems, group size limitations (including limiting group sizes on tours) or other visitor use access regulation techniques.



Cavers on Cave Loop, *NPS Photo*

USER CAPACITY INDICATORS AND STANDARDS

CHANGE IN SENSITIVE WILDLIFE SPECIES POPULATIONS

	USER CAPACITY INDICATORS	USER CAPACITY STANDARDS	RELATED MONITORING STRATEGIES	POTENTIAL MANAGEMENT STRATEGIES
THROUGHOUT THE MONUMENT	• Number of incidents resulting in a criminal violation and warnings per week connected to bat colonies. • The number of individual Townsend's big-eared bats within the resident population. • Changes in observable population numbers, frequency, or location of any wildlife species considered sensitive within the monument (for example, pica, marmots, sage grouse, other bats, and pronghorn).	• No incidents resulting in criminal violations, and no more than one warning per week. • The winter population of Townsends big-eared bats does not fall below a total number of 500 individuals. • Populations of sensitive wildlife species do not incur major change in reduction or location as determined by expert opinion and best available science.	• Weekly notification to management staff of documented violations and warnings. • A total count of Townsend's big-eared bats will be completed once every winter. This schedule will be adjusted to once every two years if climate change effects and/ or other impacts are observed (reducing disturbance from monitoring). • Sensitive wildlife species will be monitored in conjunction with periodic network inventory and monitoring, individual research, and through periodic monitoring conducted by the monument.	• Greater efforts towards increasing education on the sensitivity of bat populations. • Increase in visitor contacts. • Increase in inventory and monitoring efforts with respect to bat use areas. • Increase enforcement patrols and activities. • Change site management techniques (e.g., fences, borders, barriers, sensors, signage, and monitoring devices). • Close areas to off-trail travel. • Area and/or seasonal closures to protect bat populations. • Better marking of cave closures. • Implementation of increased and/or regular monitoring activities if sensitive species experience significant population changes within the monument or surrounding lands.

CHANGES IN BACKCOUNTRY USE PATTERNS

BACKCOUNTRY ZONE	• The number of visitors that travel beyond 0.25 miles from a trailhead.	• A 50 percent increase in the population of backcountry users.	• Use automated counters .25 mile from major trailheads to quantify the number of visitors into the back country. • Monitoring protocol will be assessed and evaluated every five years (produce resource summary report), to evaluate backcountry use and related resource and social conditions. • As baseline use levels are determined, this indicator and standard will be readjusted to establish a maximum use level for the backcountry and wilderness areas, if resource and social conditions dictate the necessity of that management strategy.	• Greater efforts towards increasing education on the sensitivity of back country resources. • Promote low impact visitor use practices (Leave No Trace). • Increase in inventory and monitoring efforts to better evaluate impacts associated with increased visitor use in the backcountry and wilderness areas of the monument (i.e, soundscape, solitude, trail erosion, garbage occurrence, dispersed camping, human waste). • Restoration/ rehabilitation of affected areas. • Increased visitor contacts. • Change site management techniques (e.g., group size, campsites, equipment, sensors and monitoring devices). • Better marking of established trail systems. • Close areas to off-trail travel. • Area and seasonal closures to prevent impacts. • Implement permit systems or other visitor use access regulation techniques. • Update the Wilderness Stewardship Plan to account for an increase in visitor use.

USER CAPACITY INDICATORS AND STANDARDS				
RESPONSIVENESS TO EDUCATIONAL AND INTERPRETIVE REQUESTS				
	USER CAPACITY INDICATORS	**USER CAPACITY STANDARDS**	**RELATED MONITORING STRATEGIES**	**POTENTIAL MANAGEMENT STRATEGIES**
DEVELOPED AND FRONTCOUNTRY ZONES	• Annual ratio of formal interpretive programs offered per visitor center visits.	• One program is provided per every 175 visitor center door counts.	• Continue current tracking of visitor center visits and interpretive program attendance. • Analyze monthly statistics from previous year.	• Improve staff availability. • Formally collect and analyze interpretive program requests. • Improve program scheduling to maximize responsiveness to visitor needs.
RESPONSIVENESS TO EDUCATIONAL AND INTERPRETIVE REQUESTS				
DEVELOPED AND FRONTCOUNTRY ZONES & OFF-SITE	• Annual percentage of requests fulfilled for educational programs and loans of educational materials related to monument interpretive themes.	• At least 80 percent of requests are fulfilled.	• Continue current tracking of requests and loans.	• Formally collect and analyze educational program requests. • Increase staffing and/or volunteer capacity. • Train teachers to provide monument programs. • Provide more materials for teacher-directed programming. • Analyze monthly statistics from previous year and improve program scheduling to maximize responsiveness to school needs and requests.

MONITORING EFFORTS

The monument staff will continue general monitoring of visitor use levels and patterns. In addition, the monument staff will begin monitoring these user capacity indicators. The rigor of monitoring (e.g., frequency of monitoring cycles, amount of geographic area monitored) of the indicators may vary considerably depending on how close existing conditions are to the standards. If the existing conditions are far from exceeding the standard, the rigor of monitoring may be less than if the existing conditions are close to or trending towards the standards.

In addition, the initial phases of monitoring for the indicators/standards defined above will help the monument's staff identify if any revisions are needed. The initial testing of the indicators and standards will determine if the indicators are accurately measuring the conditions of concern and that the standards truly represent the minimally acceptable condition of the indicator. Monument staff may decide to modify the indicators or standards and revise the monitoring program if better ways are found to measure changes caused by visitor use. Most of these types of changes should be made within the first several years of initiating monitoring. After this initial testing period of monitoring indicators and standards, adjustments should not occur unless there is a compelling reason. Finally, if use levels and patterns change appreciably, the monument staff may need to initiate additional monitoring of new indicators to ensure that desired conditions are protected. This iterative learning and refining process is the strength of the NPS user capacity management program, in that it can be adapted and improved as knowledge grows.

USER CAPACITY INDICATORS AND STANDARDS

DISTURBANCE OF CULTURAL RESOURCES

	USER CAPACITY INDICATORS	USER CAPACITY STANDARDS	RELATED MONITORING STRATEGIES	POTENTIAL MANAGEMENT STRATEGIES
THROUGHOUT THE MONUMENT	• Number of incidents resulting in a criminal violation and warnings related to cultural resources. • Number of new damage to archeological sites. • Percent area of rock art (petroglyphs, pictographs, historic graffiti) lost resulting from human actions (not environmental factors) from the existing baselines. • Number of informal trails to primary cultural resource destination areas.	• No incidents resulting in criminal violations, and no more than four warnings per year. • No new damage to archeological sites from 2009 baseline survey. Damage of features include: soil compaction, theft of artifacts, vandalism, ground disturbance, nearby informal trail, rock wall collapse. • No more than a 5% area of rock art lost from the existing baselines resulting from human actions. • No informal trails to primary cultural resource destination areas.	• Law enforcement patrols as needed per trends in visitor impacts. • Weekly notification to management staff of documented violations and warnings. • Every five years, one-third of all known archeological sites and rock art sites are surveyed to detect disturbance. • Every three years, informal trail surveys are conducted at primary cultural resource destination areas.	• Increase visitor contacts through roving activities of interpretive staff, natural resources staff, and volunteers. • Increase education about the sensitivity of cultural resources and promote low impact visitor use practices through informal contacts in the visitor center and while roving, in formal interpretive and educational programming, and by other appropriate means. • Increase in inventory and monitoring efforts. • Increase in restoration and/or rehabilitation efforts. • Increase/modify enforcement patrols and activities. • Change site management techniques (e.g., fences, borders, barriers, sensors and monitoring devices). • Better marking of established trail systems. • Close areas to off-trail travel. • Area closures to protect impacted archeological sites. • Conduct further inventories of archeological sites that are within 0.25-mile of impacted sites. • Implement permit systems, group size limitations (including limiting group sizes on tours) or other visitor access regulation techniques.

USE CONFLICTS

THROUGHOUT THE MONUMENT	• Number of visitor use conflicts recorded in the case incident system.	• Five similar visitor use conflicts within a three month period would trigger management actions beyond those of routine law enforcement. Two similar use conflicts impacting monument resources would trigger management review.	• Track use conflicts with the incident reporting system. • Review each complaint as valid or invalid against established criteria to prevent multiple complaints on a single incident from prematurely triggering management review.	• Increased education regarding low impact practices and monument regulations. • Formal analysis and management of groups or activities (including restrictions on group size or number, conflict studies, site-specific capacity studies – including specific caves). • Contact local user groups. • Avoid conflicts by planning times and locations of ranger-led programs.

Mitigation Measures for the Action Alternatives

Congress charged the National Park Service with managing the lands under its stewardship "…in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (NPS Organic Act, 16 USC 1) As a result, NPS staff routinely evaluates and implements mitigation measures whenever conditions occur that could adversely affect the sustainability of national park system resources.

To ensure that implementation of the action alternatives protects unimpaired natural and cultural resources and the quality of the visitor experience, a consistent set of mitigation measures would be applied to actions proposed in this plan. The National Park Service would prepare appropriate environmental review (i.e., those required by the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), and other relevant legislation) for these future actions.

As part of the environmental review, the National Park Service would avoid, minimize, and mitigate adverse impacts when practicable. The implementation of a compliance-monitoring program would be within the parameters of NEPA and NHPA compliance documents, etc. The compliance-monitoring program would oversee these mitigation measures and would include reporting protocols.



View of Mt. Shasta from Schonchin Butte,
NPS Photo

The following mitigation measures and best management practices would be applied to avoid or minimize potential impacts from implementation of the action alternatives.

MITIGATION MEASURES COMMON TO ALL ALTERNATIVES

Mitigation measures are the practicable and appropriate methods that would be used under any alternative to avoid and/or minimize harm to monument natural and cultural resources, wilderness, visitors, and the visitor experience, and socioeconomic resources. These mitigation measures have been developed by using existing laws and regulations, best management practices, conservation measures, and other known techniques from past and present work in and around Lava Beds National Monument.

The general management plan provides a management framework for the monument. Within this broad context, the alternatives include the following measures that may be used to minimize potential impacts from the implementation of the alternatives. These measures would be applied to all alternatives, subject to funding and staffing levels. Additional mitigation would be identified as part of implementation planning and for individual projects to further minimize resource impacts.

MANAGEMENT AND PROTECTION OF NATURAL RESOURCES

Air Quality

- Implement a dust abatement program. Standard dust abatement measures could include the following elements: water or otherwise stabilize soils, cover haul trucks, employ speed limits on unpaved roads, minimize vegetation clearing, and revegetate with native species.

- Minimize NPS vehicle emissions by using the best available technology whenever possible.

- Encourage the public and commercial tour companies to employ methods that reduce emissions.

- Employ sustainable designs that reduce energy demands, thus reducing pollutant production.

Soundscapes / Natural Quiet

- Implement standard noise abatement measures during monument operations, including: scheduling to minimize impacts in noise-sensitive areas, using the best available noise control techniques wherever feasible, using hydraulically or electrically powered impact tools when feasible, and locating stationary noise sources as far from sensitive uses as possible.

- Site and design facilities to minimize objectionable noise.

- Minimize idling of motors when power tools, equipment, and vehicles are not in use.

- Muffle above ambient noise whenever possible to reduce noise impacts.

Night Skies (Lightscapes)

- In developed and administrative zones, install energy-efficient lights equipped with timers and/or motion detectors so that light would only be provided when it is needed to move safely between locations.

- In developed and administrative zones, use low-impact lighting, such as diffused light bulbs, and techniques such as downlighting to prevent light spill and preserve the natural lightscape.



Western rattlesnake, *NPS Photo*

Soils

- Build new facilities on soils suitable for development. Minimize soil erosion by limiting the time that soil is left exposed and by applying other erosion control measures, such as erosion matting, silt fencing, and sedimentation basins in construction areas to reduce erosion, surface scouring, and discharge to water bodies. Once work is completed, revegetate construction areas with appropriate native plants in a timely period.

Vegetation

- Monitor areas used by visitors (e.g., trails, campsites) for signs of native vegetation disturbance. Use public education, revegetation of disturbed areas with native plants, erosion control measures, and barriers to control potential impacts on plants from erosion or social trails.

- Develop revegetation plans for disturbed areas and require the use of genetically appropriate native species. Revegetation plans should specify species to be used, seed/plant source, seed/plant mixes, site-specific restoration conditions, soil preparation, erosion control, ongoing maintenance and monitoring requirements, etc. Salvaged vegetation should be used to the extent possible.

- Continue to implement and improve the monument's existing program to remove and prevent the spread of nonnative species. Standard measures could include the following elements: use only weed-free materials for road and trail construction, repair, and maintenance; ensure equipment arrives on site free of mud or seed-bearing material; certify all seeds and straw material as weed-free; identify areas of noxious weeds pre-project; treat noxious weeds or noxious weed topsoil before construction (e.g., topsoil segregation, storage, herbicide treatment); when depositing ditch spoils along the roads, limit the movement of material to as close as possible to the excavation site; scrupulously and regularly clean areas that serve as introduction points for invasive plants (campgrounds, staging areas, maintenance areas, and corrals); revegetate with genetically appropriate native species; inspect rock and gravel sources to ensure these areas are free of noxious weed species; and monitor locations of ground-disturbing operations for at least three years following the completion of projects.

Wildlife

- Employ techniques to reduce impacts on wildlife, including visitor education programs, restrictions on visitor and monument activities, and law enforcement patrols.

- Implement a wildlife protection program. Standard measures would include project scheduling (season and/or time of day), project monitoring, erosion and sediment control, fencing or other means to protect sensitive resources adjacent to project areas, disposing of all food-related items or rubbish, salvaging topsoil, and revegetating.

- Monitor wildlife deaths from visitor and/ or management activities (e.g. road kill) and implement appropriate management actions in response.

Special Status Species

Mitigation actions would occur during normal park operations as well as before, during, and after projects to minimize immediate and long-term impacts on rare, threatened, and endangered species. These actions may vary by project area, and additional mitigation measures may be added depending on the action and location. Many of the measures listed for vegetation, wildlife, and water resources would also benefit rare, threatened, and endangered species by helping to preserve habitat.

- Conduct surveys for rare, threatened, and endangered species as warranted.

- Locate and design facilities/actions/ operations to avoid or minimize the removal of rare, threatened, and endangered species habitat. If avoidance is infeasible, minimize and compensate for adverse effects as appropriate and in consultation with the appropriate resource agencies.

- Plan work in areas in or near suitable threatened and endangered bird habitat as late as possible in the summer/fall.

- Conduct work outside of critical periods for the specific species when possible.

- Develop and implement restoration and/ or monitoring plans as warranted. Plans should include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques.

- Implement measures to reduce adverse effects of nonnative plants and wildlife on rare, threatened, and endangered species.

- Carry out surveys and monitoring for special status species.

- Protect and preserve critical habitat features, such as nest trees, whenever possible.

MANAGEMENT AND PROTECTION OF WILDERNESS VALUES

The monument's wilderness management plan provides more specific desired conditions for wilderness resources, visitor experiences, and management protocols. Monitoring would be conducted to ensure that conditions are meeting established standards and to determine if mitigation measures have been successful.

MINIMUM REQUIREMENT PROCESS

The Wilderness Act directs that agencies administer wilderness to preserve the wilderness character. The purpose of the minimum requirement process is to reduce the effects of management on wilderness character and values. It provides a method for developing, evaluating, and selecting the actions that would be the least intrusive on wilderness character and values, while allowing the administration of the wilderness. The concept is applied to all management actions, programs, and activities within the monument that might affect wilderness and potential wilderness.

The minimum requirement concept is applied as a two-step process. The first step determines whether a proposed management action is appropriate and necessary for the administration of the area as wilderness and does not cause a significant impact to wilderness resources and character, in accordance with the Wilderness Act. The second step determines the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized. If the project is found to be appropriate and necessary, then the management method (tool or technique) is selected that would result in the least amount of impact to the wilderness resources and character.

The minimum requirement process provides a formalized method for developing alternative ways to address an issue, and to evaluate each alternative's effects on wilderness character and wilderness resources. The minimum requirement process assists NPS managers in determining the appropriate environmental compliance.

MANAGEMENT AND PROTECTION OF CULTURAL RESOURCES

The protection of the monument's cultural resources is essential for understanding the past, present, and future relationship of people with monument resources and the expressions of our cultural heritage. The monument would pursue strategies to protect its cultural resources, including museum collections and archeological, historic, ethnographic, and archival resources, while encouraging visitors and employees to recognize and understand their value. The strategies would allow the integrity of the monument's cultural resources to be preserved unimpaired. They would also ensure that the monument is recognized and valued as an outstanding example of resource stewardship, conservation education and research, and public use.

Some of the monument's cultural resources are within designated wilderness. The Wilderness Act specifies that the designation of any areas of the park system as wilderness "shall in no manner lower the standards evolved for the use and preservation of" such unit of the park system under the various laws applicable to that unit (16 USC 1133(a)(3)). Thus, the laws pertaining to historic preservation also remain applicable within wilderness but must generally be administered to preserve the area's wilderness character. In accordance with NPS management policies, cultural resources that have been included in wilderness would be protected and maintained according to the pertinent laws and policies governing cultural resources, using management methods that are consistent with the preservation of wilderness character and values (6.3.8). These laws include the National Historic Preservation Act, the Archeological Resources Protection Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, and Executive Order 13007 that addresses government-to-government consultation.

Adverse impacts on properties listed in or determined eligible for listing in the National Register of Historic Places, would be avoided if possible. If adverse impacts could not be avoided, mitigation would be developed through a consultation process with all interested parties. In accordance with NPS management policies, proposed adverse effects would be evaluated to determine whether the proposed actions constitute impairment of significant fundamental park cultural resources.

Archeological Resources

Archeological surveys would precede ground-disturbance required for new construction or removal of eligible historic properties. Known archeological resources would be avoided to the greatest extent possible. If national register-eligible or-listed archeological resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with the state historic preservation officer and associated American Indian tribes.

If unknown archeological resources are discovered during project work, work in the immediate vicinity of the discovery would be halted until the resources could be identified, evaluated, and documented and an appropriate mitigation strategy could be developed, if necessary, in consultation with the state historic preservation office and associated American Indian tribes.

Historic Structures/Buildings

All project work relating to historic structures/buildings would be conducted in accordance with the guidelines and recommendations of the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings. Typical mitigation measures for historic structures/buildings include measures to avoid adverse impacts, such as rehabilitation and adaptive reuse, designing new development to be compatible with surrounding historic properties, and screening new development from surrounding historic resources to minimize impacts on cultural landscapes and ethnographic resources.

Adaptive use is the best strategy to ensure that buildings remain in good condition. When not being adaptively used, the best approach for preserving these structures is regular preservation maintenance, which ensures that roofs and walls as well as supporting structural elements are maintained in a sound, weather-resistant condition. An example of adaptive use is using historic structures to house park operations.

Historic structures would be maintained or stabilized until appropriate maintenance could be undertaken. Benign neglect would not be considered an appropriate management strategy. No national register-listed or –eligible structure would be removed or allowed to decay naturally without prior review by park and region cultural resource specialists, including approval by the NPS regional director and consultation with

the state historic preservation office. Before a national register-listed or –eligible structure is removed, appropriate documentation recording the structure would be prepared in accordance with Section 110(b) of the National Historic Preservation Act, and the documentation would be submitted to the Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) or Historic American Landscape Survey (HALS) program.

Historic structures that have been included within wilderness would be protected and maintained according to the pertinent laws and policies governing cultural resources using management methods that are consistent with the preservation of wilderness character and values. Laws pertaining to historic preservation remain applicable within wilderness but must generally be administered to preserve the area's wilderness character (16 USC 1133 (a)(3)). The responsible decision-maker would include appropriate consideration of the application of the provisions of the Wilderness Act in analyses and decision-making concerning cultural resources.

Cultural Landscapes

All project work relating to cultural landscapes would be conducted in accordance with the guidelines and recommendations of the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes. Typical mitigation measures for cultural landscapes include measures to avoid adverse impacts, such as designing new development to be compatible with surrounding historic properties and screening new development from surrounding cultural landscapes to minimize impacts on those landscapes. Adaptive use is the best strategy to ensure that landscapes remain in good condition.

Ethnographic Resources

The National Park Service will continue to consult with federally recognized Native American tribes with treaty resources in the monument on a government-to-government basis to identify ethnographic resources and develop appropriate strategies to mitigate impacts on these resources. Such strategies could include continuing to provide access to traditional use or spiritual areas and screening new development from traditional use areas to minimize impacts on ethnographic resources. Consultations with American Indians linked by ties of kinship, culture, or history to park lands would address the inadvertent discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony, and all provisions outlined in the Native American Graves Protection and Repatriation Act (25 USC 3001) of 1990 would be followed.

Museum Collections

Mitigation measures related to museum collections consist of conservation of a collection through proper storage, handling, and exhibit of objects as specified in the NPS Museum Handbook and NPS Director's Order No. 24, NPS Museum Collections Management.

SCENIC RESOURCES

Mitigation measures are designed to minimize human-made visual intrusions. These include the following:

- Where appropriate, use facilities such as boardwalks and fences to route people away from sensitive natural and cultural resources while still permitting access to important viewpoints.
- Design, site, and construct facilities to minimize adverse effects on natural and cultural resources and visual intrusion.
- Select colors and textures for built facilities that blend into the visual environment.
- Provide vegetative screening, where appropriate.

SOCIOECONOMIC ENVIRONMENT

During the future planning and implementation of the approved general management plan for Lava Beds National Monument, the National Park Service would pursue partnerships with tribes, local communities, and county governments to further identify potential impacts and mitigating measures that would best serve the interests and concerns of both the National Park Service and the local communities.

SUSTAINABLE DESIGN AND AESTHETICS

Sustainable practices would be used in the selection of building materials and sources and building location and sitting. Design standards specific to the monument would be developed in all repair, rehabilitation, and construction projects.

Projects would use sustainable practices and resources whenever practicable by recycling and reusing materials, by minimizing materials, by minimizing energy consumption during the project, and by minimizing energy consumption throughout the lifespan of the project.

Environmentally Preferred Alternative

The environmentally preferable alternative is defined as "the alternative that will promote national environmental policy as expressed in Section 101 of the National Environmental Policy Act." Section 101 states that it is the continuing responsibility of the federal government to . . .

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2. assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

3. attain the widest range of beneficial uses of the environment without degradation, risk to heath or safety, or other undesirable and unintended consequences;

4. preserve important historic, cultural, and natural aspects of our national heritage; and maintain, wherever possible, an environment which supports diversity, and a variety of individual choices;

5. achieve a balance between population and resource use which would permit high standards of living and a wide sharing of life's amenities; and

6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The Council of Environmental Quality states that the environmentally preferred alternative is "the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources (46 FR 18026 – 46 FR 18038)." According to the NPS NEPA Handbook (DO-12), through identification of the environmentally preferred alternative, the NPS decision-makers and the public are clearly faced with the relative merits of choices and must clearly state through the decision-making process the values and policies used in reaching final decisions.

The environmentally preferable alternative is alternative B, the NPS preferred alternative for Lava Beds National Monument. This alternative best satisfies the national environmental goals—it provides the highest level of protection of natural and cultural resources while concurrently providing for a wide range of neutral and beneficial uses of the environment. The preferred alternative maintains an environment that supports a diversity and variety of individual choices, and it integrates resource protection with an appropriate range of visitor uses and understanding.

The preferred alternative surpasses the other alternatives in realizing the full range of the Section 101 national environmental policy goals. The no-action alternative does not provide as much resource protection or visitor opportunities as the preferred alternative. In addition, the preferred alternative would significantly expand educational opportunities, research, and restoration of resources at the monument resulting in a better understanding of the monument's resources, thus better equipping the monument in fulfilling criteria 3, 4, and 5.

Alternative A, while accurately describing the current management direction and the best efforts of the staff, fails to satisfy the NEPA requirements outlined above when compared to alternatives B and C. A shortage of funding for staff, programs, facilities, and services limits the monument's ffectiveness in achieving criteria 4 and 6.

Alternative C would provide for more visitor use opportunities, but there also would be a higher potential for more impacts to natural resources in comparison with the preferred alternative. For example, while alternative C provides a considerable amount of new visitor opportunities, these opportunities have more potential for increased visitor use in sensitive areas of the monument such as Petroglyph Point and high use visitor caves. Alternative C does not provide nearly as many opportunities to enhance resources through restoration or to provide as many opportunities for improved understanding of resources from expanded research efforts. Thus, alternative C would not satisfy criterion

3 (attain the widest range of beneficial uses of the environment without degradation), criterion 4 (preserve important aspects of our national heritage), or criterion 6 (enhance the quality of renewable resources) as well as the preferred alternative satisfies these criteria.

Actions/Alternatives Considered But Eliminated From Detailed Consideration

The planning team originally developed four preliminary alternatives for public review. These four alternatives were as follows:

- Concept A: Continue Current Management
- Concept B: Expanded Resource Preservation and Restoration
- Concept C: Diversified Recreation Opportunities
- Concept D: Interpretation and Education

The Choosing by Advantages method for identifying the preferred alternative resulted in the combination of alternative actions primarily from Alternatives B and D to create the preferred alternative. These actions best met the goals for the general management plan. Since most components from the former Alternatives B and D were included in the preferred alternative, these alternatives were ultimately dropped from consideration in the draft general management plan and environmental assessment.

BOUNDARY ADJUSTMENTS CONSIDERED

Early in the alternatives development process the planning team explored boundary adjustments as is required by the National Parks and Recreation Act of 1978. One boundary adjustment considered but eliminated from detailed consideration was an expansion of the southern and southwestern boundary along Tichnor Road and Sand Butte. The advantages of this boundary adjustment included having a more 'comprehendible' management boundary along existing roads and providing seamless protection of the area's bald eagle winter roosts and caves resources which traverse both the national forest and the monument. Additionally, this boundary adjustment would have included the Sand Butte Modoc War site which would allow for expanded interpretation of Modoc War history at Lava Beds National Monument. Due to the complexity of ownership of this area (public and private lands) the NPS determined that cooperative resource management with the Forest Service was a superior management option to explore in the general management plan.

CAVE ACCESS FOR PERSONS WITH DISABILITIES

The monument's lava tube caves have steep entries and typically require some physical challenge for entry and exploration. Twenty-five of the monument's caves have ladders, trails, and other features to assist visitor access to caves. While this provides opportunities for most visitors to access a cave, no cave is fully accessible to members of the public with certain disabilities.

Providing access compliant with the Americans with Disabilities Act (ADA) into a monument cave was analyzed for the GMP. All 25 caves with maintained trail facilities were visited by a landscape architect with extensive trail and rock work experience. Each cave was examined for the potential to alter and adapt so as to have accessible trail grades and surfaces. Nearly all of the caves were found to have extremely small openings to the surface with very limited space to accommodate any sort of switchback or ramp structure to drop from the surface to the cave floor level. The only exception was Skull Cave which has a large opening, but where the field of large boulders at the entry would have to be heavily modified to construct a more gradual trail and the impacts of that would be highly intrusive and would have an unacceptable impact on cave resources and conditions. At Mushpot Cave the idea of excavating a vertical shaft to install an elevator was considered. While that could be feasible, the slope of the lava tube (profile) is over 10%. Thus disabled users would encounter grades too steep to go anywhere once they exited an elevator.

In conclusion, it was felt that there is no potential to modify any of the caves with existing developed trails to provide a fully accessible route. The level of development and damage to cave resources necessary to such access would have an unacceptable impact on natural cave resources and conditions. This item was thus rejected from further consideration. The GMP explores other means of providing access to caves for all visitors such as offering improved and expanded virtual cave tours or providing cave exhibits.

SOUTHEAST ENTRANCE ROAD (FOREST SERVICE ROUTE 10)

The NPS reassuming the maintenance responsibilities for the 9.9 mile long Southeast Entrance Road (Forest Service Route 10) outside the monument was also considered, as the majority of traffic on the road is going to or from the monument. The NPS maintained the road between 1965 and 1995 under an agreement with the Modoc National Forest. Given the large backlog of unmet facility maintenance needs within the monument and other national park units, taking on a new facility maintenance burden outside the monument likely would not be approved. Directing visitors to use the existing paved and better maintained northern entrance roads was seen as a more cost effective way of meeting visitor expectations of accessing the monument over reasonably maintained roads.

Implementation of the General Management Plan

Once the general management planning process is completed, the selected alternative would become the new management plan for the monument and would be implemented in phases over 15–20 years. The monument's strategic plan, business plan, and annual work plans would help develop priorities that would determine how best to implement the plan.

Implementation of the actions and developments proposed within the management plan is dependent upon funding available at the time of need. The approval of this General Management Plan does not guarantee that the funding and staffing needed to implement the plan would be forthcoming.

In addition to funding, the implementation of any preferred alternative also could be affected by other factors. More detailed planning and environmental documentation may be completed, as appropriate, before some of the actions would be carried out.

Chapter Four: Affected Environment



Previous page: Approaching a cave, *NPS photo*

Chapter Four: Affected Environment

This chapter describes the existing environment of Lava Beds National Monument and the surrounding region. It is focused on monument resources, uses, facilities, and socioeconomic characteristics that have the potential to be affected by the General Management Plan alternatives.

Natural Resources

Air Quality

Lava Beds National Monument is located within California 's Northeast Plateau air basin, an area of low population and relatively low air pollutant emissions.



Great Purple Hairstreak, *NPS Photo*

The monument's 28,460 acres of wilderness is designated as a Class I airshed and the remaining monument acres are Class II. The Clean Air Act affords Class I areas extra protection against air pollution. NPS management policy protects both Class I and Class II areas equally against air pollution.

In order to fulfill these mandates the monument is committed to obtaining a better understanding of ambient air quality conditions and the sensitivity of monument resources to air pollution.

Presently Lava Beds operates two air quality monitoring stations, an IMPROVE (Interagency Monitoring of Protected Visual Environments) station monitoring aerosols, and a PM10 station (10 micron particulate detector). The PM10 was in use between 1994 and 2009 by the Siskiyou County (038) Air Pollution Control District and monitored concentrations of particulates over 10 microns for regulatory purposes. However, the program was cancelled in 2009 due to State of California budget cuts. During its run, the station detected conditions that exceeded state standards twice (1996 and 2002) and less stringent national standards once (1996). Both the 2002 and the 1996 events were caused by exceptional fire events and not representative of the ambient air quality of the basin. Neither event was recorded as a violation of state or federal regulation.

The IMPROVE monitoring station was installed in 2000 by the University of California, Davis Crocker Nuclear Lab Air Quality Group and monitors for concentrations of particulates of PM10, PM2.5, ammonium sulfate (NHSO), and ammonium nitrate (NHNO). Fine particulates of 2.5 microns or less disperse farther, reduce visibility more, and affect overall air quality more than larger particulates. This unit is not currently part of the 2002 California PM2.5 Monitoring Network nor is it used for regulatory purposes.

The principal pollutants currently affecting the monument are ozone precursors (nitrogen oxides and volatile organic compounds from mobile sources) and particulates from unpaved road dust (e.g. Medicine Lake Road), construction, and agricultural activities. In addition to these local sources, regional sources of air pollution include burning of agricultural fields and the burning of wood for heating.

Emissions from geothermal and combustion energy facilities are a growing concern. Wood-fired industrial boilers in the area emit nitrogen oxides and particulates and more of these combustion energy facilities are planned.

In November 2003, plans were approved for two geothermal power developments in the Medicine Lake Highlands, within approximately 5 miles of the monument. Since that time, the proposals have been subject to legal challenges and remain tied up in the federal courts. Geothermal development in the area could eventually be extensive, resulting in visible steam plumes, as well as significant sulfur dioxide, sulfuric acid mist, and nitrogen oxides emissions.

Soundscape

The soundscape is the total acoustic environment of an area. Both natural and human sounds may be desirable and appropriate in a soundscape, depending on the purposes and values of the park. For example, the sound of reenactment events at Gillems Camp may be appropriate and desirable, but not within Lava Beds National Monument's wilderness areas. The soundscape often varies in its character from day to night and from season to season and can be affected by changes in numbers of visitors who introduce human-caused sound into the environment. The soundscape of Lava Beds, including dripping water, scenery, silent caves, or wildlife, is a valuable resource that can easily be degraded or destroyed by inappropriate sounds or sound levels. As a result, the monument's soundscape requires careful management if it is to remain unimpaired for future generations.

The symphony of natural sounds within Lava Beds is an important natural resource and a critical component of the ecological communities the monument seeks to preserve. Understanding the role of sound and acoustics in a healthy ecosystem is critical to their effective management and protection. Birds, insects, mammals, and amphibians rely on complex communication networks to live and reproduce. In habitats where wildlife vocalizations signify mating calls, danger from predators, or territorial claims, hearing these sounds is important to animal reproduction and survival.

Given its remote location, the monument has relatively few noise intrusions. Activities that affect noise levels at the monument include vehicle traffic (including snowmobiles on the Modoc National Forest), air traffic, and agricultural activities. Traffic volumes at the monument are generally low. Occasionally, loud vehicles, such as motorcycles, disturb the monument's typically quiet setting. Unpaved roads such as Medicine Lake Road and the road through Petroglyph Point tend to generate higher traffic noise than the monument's paved roads.

Commercial air traffic infrequently affects the soundscape as the major north-south flight path for commercial traffic lies west of the monument. A small Air National Guard training base is located 40-miles from the monument. However, Air National Guard flight paths over the monument are rare.

The northern boundary of the monument and Petroglyph Point are more impacted by external noise. This area is sometimes affected by noise from agricultural equipment in the summer and fall. Trains can be heard at Petroglyph Point several times a day and in other areas in the eastern portions of the monument.

These types of issues are examined through research in acoustic ecology which is the study of sound in the relationships between organisms and their environment. Scientists also use bio-acoustics to determine the health of natural habitats. Scientists can discern details about animal populations and behavior by recording sounds in the wild. Such bio-acoustical recordings are used in a variety of ways, including bird censuses and bat echolocation studies.

Future efforts to manage soundscape within the monument include inventorying and monitoring the soundscape and implementing a "Soundscape Preservation and Noise Management Plan." The plan would establish soundscape indicators and standards as well as define impact thresholds on the monument's soundscape.

Currently, the monument has no baseline acoustic data. A preliminary soundscape assessment was completed by Dan Dugan Sound Designs in August of 2005. The assessment took a few sound recordings in the southern portion of the monument in designated wilderness areas and confirmed that the monument maintains a high quality soundscape resource. A much more thorough investigation needs to be completed.

Night Sky

Lava Beds National Monument's dark sky resource is a highly valued asset. The monument recognizes that dark skies are important natural, cultural, and scenic resources. Preserving this critical resource is important for the protection of nocturnal habitat and for the enjoyment of the public.

Visibility at the monument is still superior to that in many other national park units, but degradation by light-scattering pollutants (haze), particularly from agricultural burning and wood stove emissions is common. An analysis of 1990-99 data from Crater Lake NP and Lassen Volcanic NP indicate that visibility within the

area is improving on the clearest days and degrading on the haziest days.

Many nights offer stunning views of the Milky Way and other dim celestial objects. Lava Bed's night sky currently rates as a level 2 on the Bortle scale. The Bortle scale is a qualitative assessment of the degree to which light pollution affects local dark skies. At level 2, airglow, which is a weak emission of light from the earth's atmosphere, is apparent on the horizon, and the Milky Way is highly structured to the naked eye (Bortle, 2001). Light pollution is apparent low along the Northern horizon, with a low light dome visible over Klamath Falls. There is also some light interference from developments along the State Highway 139 corridor. Agricultural facilities adjacent to Petroglyph Point have extensive outdoor lighting that affects dark night skies at this location.

Currently no lighting ordinances to preserve the night sky have been enacted by surrounding communities. Though much of the area surrounding the monument is rural, development is occurring. Eventually, further growth without anticipatory planning will lead to the degradation of dark sky.

Lava Beds National Monument is taking a leadership role in preserving its dark night skies. The monument has replaced all exterior lighting with fixtures that prevent light pollution. The monument is also planning to complete a lighting management plan. This document would restrict lumen output and the types of fixtures that are acceptable. Further assessment of existing lighting will occur, determining whether removal or replacement is possible. Other technologies such as motion detectors and timers may be implemented. South of the monument Pacific Gas and Electric has a natural gas pump station that emits lighting which effects dark night skies. They have recently reduced the intensity of these lights.



Caver on Cave Loop, *NPS Photo*

Periodic monitoring of the nightscape will be necessary to assess the decline or improvement in this resource. Between 2007 and 2009, the NPS Dark Skies Team established a nightsky baseline for the monument. The monument is pursuing designation as an International Dark Sky Preserve pending confirmation in 2010.

Viewsheds and Visual Resources

Lava Beds National Monument's scenic viewsheds include dramatic geologic features such as lava flows and cinder cones and sweeping panoramic views of the surrounding landscape, including views of Mt. Shasta. Many of these panoramic views extend out over the entire Tule Lake Basin where one can see irrigated farmland, lakes and canals, grain elevators, barns and other rural agricultural development. The monument recognizes that its viewshed is an important natural, cultural, and scenic resource, and the preservation of this resource is important for the public's enjoyment.

Along the northern boundary of the monument, views are dominated by Sheepy Ridge and the Peninsula portions of the Tule Lake National Wildlife Refuge. Petroglyph Point and the surrounding agricultural lands are less prominent.

From the monument's main road, views of striking volcanic features such as pahoehoe and a'a lava flows, cinder cones, and enormous lava fields unfold. The shapes and textures of the flows add scenic variety to the landscape. Cinder cones and spatter cones (known locally as "buttes") rise up throughout the entire monument landscape. Schonchin Butte, at 5,300 feet elevation, contains an historic fire lookout that provides a 360 degree panoramic view of the basin. Other notable buttes include Eagle Nest, Whitney, Three Sisters, Juniper, Hardin and Caldwell buttes. Gillems Bluff, flanking the northwestern boundary of

the monument, features exposed formations of volcanic rocks.

Historic views associated with the Modoc War landscape contribute to the significance of the monument. For the past several years the monument has been actively removing encroaching juniper trees from the historic landscape.

The northern half of the monument is primarily an open sage and rabbit brush shrub and grassland. As one moves southward (and higher in elevation) trees and large shrubs become more frequent and increase in size and density. Because of the open nature of the vegetation and sloping landforms, visitors are frequently presented with long panoramic vistas extending for ten to thirty miles. The central monument is characterized by shrub-woodlands with western juniper (*Juniperus occidentalis*) and mountain mahogany (*Cercocarpus ledifolius*) dotting middle elevation slopes. The southern landscape is highest in elevation and dominated by coniferous forest, primarily ponderosa pine. Mammoth and Modoc Craters are giant fissures in the southern portion of the monument. A scenic trail allows visual access to the massive Mammoth Crater.

The developed infrastructure of the monument (roads, trails, buildings, and utilities) for the most part blends in well with the landscape. Exceptions include the shiny metal of cars in the visitor center parking lot, the light colored employee residences, and several buildings with light colored and/or shiny metal roofs. These structures, depending upon the time of day and lighting, can be plainly seen from the far north end of the park and much of the wilderness area.

Geological Resources

SURFACE GEOLOGY

Lava Beds is located on the northern flank of the Medicine Lake shield volcano which began eruptive activity in the Pleistocene, roughly 1 million years ago. Like other Cascades Range volcanoes, it continues to be active with its last eruption dated to around 840 years ago. Within the monument, the most recent eruption formed the Callahan lava flow about 1100 years ago. This and earlier volcanic activity is what dominates both the soils and the bedrock geology of the monument, although some older volcanic rocks are exposed in some locations and a small deposit of volcaniclastic glacial outwash gravel can be found.

The overall topographic setting of the monument is one of a gradual recession of elevation from the south and southwest at around 5700’ to around 4000’ on its northern boundary at the start of the Tule Lake Basin. However, a gravitational anomaly suggests that the sediments of this graben (a tectonically down-dropping, extensional valley associated with normal faulting) may extend up to 1.25 miles, covering over a much larger extent of Medicine Lake lava flows. This long slope is dotted with cinder cones rising 100’ - 500’ above their surroundings. An exception to the gradual north-south elevation trend is Gillem Bluff, the result of both normal and transform faulting and uplift relative to the Tule Lake graben. This faulting follows the same north – south or northwest – southeast trend as other regional faults, and is believed to reach significant depths. It is hypothesized that this faulting, associated with an extensional tectonic regime, provides the conduit through which the Medicine Lake derives its source magma somewhat east of the main Cascade volcanic arc.

The eruptions of the Medicine Lake volcano have been shown to have a clear spatial trend in SiO2 (silica) content, with high SiO2 eruptions of rhyolites and dacites concentrated around vents the central caldera, whereas flank vents (eruptions through the volcano’s slopes) tend towards producing lower SiO2 andesites and basalts. Such is the case with most of the surface geology of the Lava Beds, where lava flows of these less viscous compositions dominate virtually the entire landscape. Nearly 70% of the monument is covered by the basalt of the Mammoth and Modoc Crater vents, located along a major fissure in the southwest corner of the park, and roughly dated to around 30,000 years ago. Other vents, both younger and older, are scattered around the monument with a bias to the south, closer to the volcano’s central caldera. Many of these are cinder cones of various sizes such as Caldwell, Hippo, and Schonchin Buttes, as well as fissure and spatter cone eruptions of the lowest SiO2 basalts, as at Fleeners and Ross Chimneys. Two notable exceptions are Juniper Butte and the Petroglyph Point section, where maar volcanoes formed from the explosive tuff rings of eruptions that mingled with the waters of a more extensive precursor to Tule Lake. Petroglyph Point was subsequently eroded by wave action, exposing sheer cliffs of easily weathered tuff. Lavas of Mammoth Crater also interacted with these waters, forming

pillow basalt and littoral cones along the monument's northern edge.

Three notable exceptions to the surface geology otherwise entirely dominated by Medicine Lake volcanic events can be found in the monument. The first are areas of glacial-outwash gravel transported by melt water that left sand and gravel deposited in thin beds on the bottom of Hidden Valley and near Caldwell Butte. Second, a very small area at the northeast corner of the park preserves lacustrine deposits of the larger ancient Tule Lake. Third, the uplift of Gillems Bluff has exposed formations of volcanic rocks not found elsewhere in the monument, including a rhyodactite tuff that is estimated at 2 million years old, making it the oldest exposed formation in the monument.

The volcanic features and formations found at Lava Beds are significant geologic resources. Textbook examples of a wide variety of formations are found here within an astonishingly small geographical area. Cinder cones, spatter cones, chimneys, and maar volcanoes all represent different kinds of eruption vents. Variously aged and chemically composed lavas form a further diversity of post-eruptive features including both smooth pahoehoe and blocky a'a lava flows, lava tube caves and trenches, ground cracks, hornitos, deflation and inflation depressions and ridges, and pillow lava, tumulus, and littoral cones where the flows encountered standing water. Rarely are so many features preserved and protected in such close proximity and in such pristine condition.

Extrusive volcanic rocks such as those that dominate the landscape at the monument are highly resistant to natural forms of erosion. They are chemically inert, being primarily composed of very small (often microscopic) crystals packed within a sturdy matrix of natural glass. The monument's dry environment precludes water erosion and further delays the slow invasion of plant roots or humic acids associated with decaying vegetation, thereby inhibiting the development of soils. The more massive, blocky lava flows further retard soil development by allowing windborne dust and vegetation to fall deep between their large blocks, effectively lost from the surface and any soil that might form.

Only artificial endeavors can alter most of the monument's surface geological formations. Most delicate are the barren slopes of cinder cones, where a single footfall can loosen a small avalanche of cinders that have rested at the cone's angle of repose for thousands of years, and leave a visible scar that will take just as long to fade.

CAVES

The caves of Lava Beds National Monument are rare geologic features that contain stable-low energy environments. The environment of the caves are a mosaic of interdependent structural, climatic and ecologic relationships that harbor isolated biological communities, unique geologic processes, and important microclimates. The subterranean environment greatly influences surface topography, which in turn, create sharp transitional ecotones that greatly influence terrestrial ecologies within the monument.

Lava tube caves are made of igneous rock formed from volcanic eruptions and lava flows that occurred hundreds to thousands of years ago. Many of these features are delicate and fragile, and can be easily shattered or broken by foot traffic or even a caver's shoulder or helmet bumping the ceiling of a cave. When there is breakage of cave features or erosion of cinder cones, the result is permanent change. Only new volcanic eruptions can create new geologic resources. Thus the geologic formations and features within caves and on the surface are considered to be non-renewable resources. If lost they are unlikely to be replenished or replaced by natural processes in any of our lifetimes.

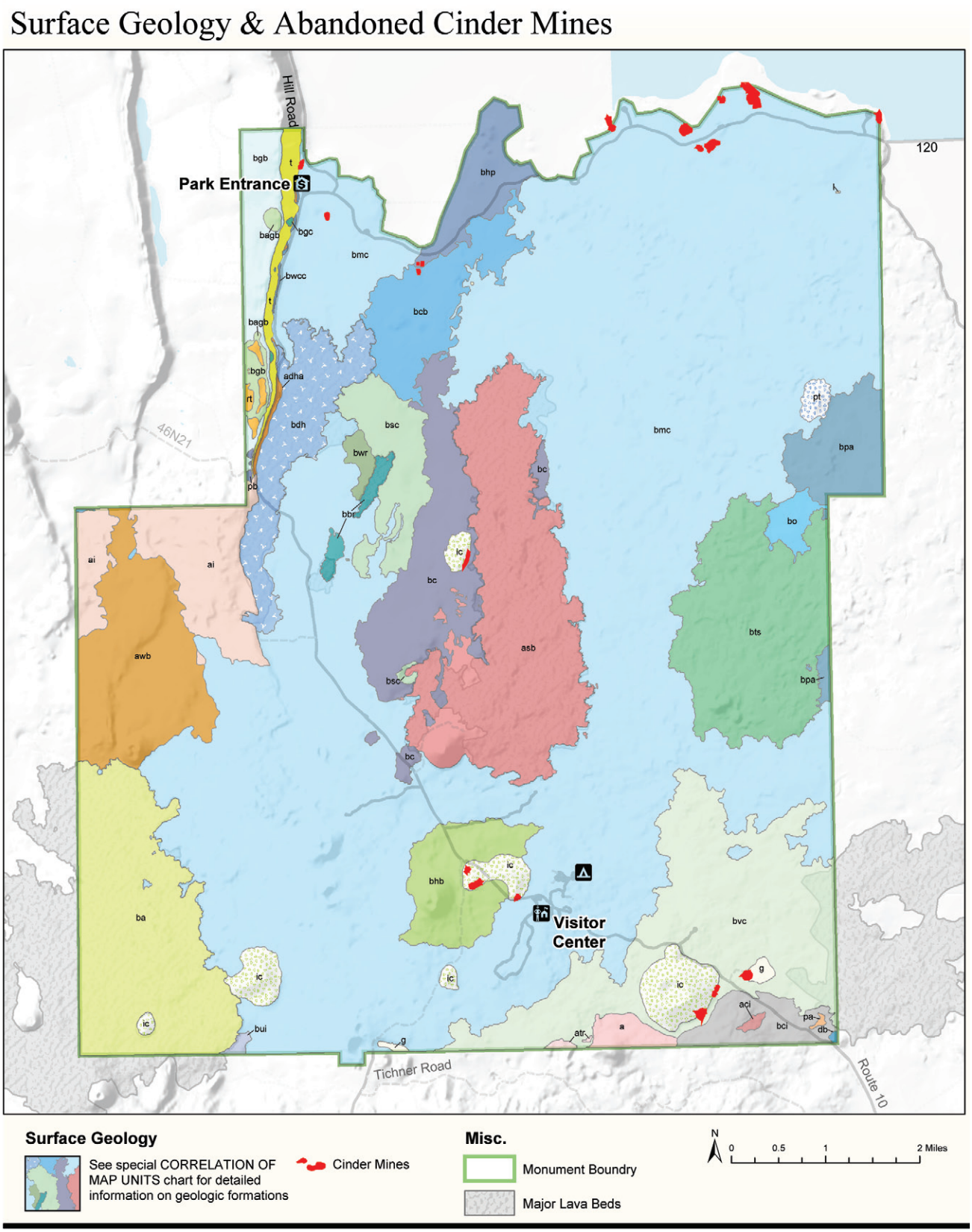
Currently there are 772 caves known within the monument. These caves have a minimum of 1146 known entrances connected to more than 31.7 miles of estimated/surveyed passages beneath the monument. In 2006, 192 previously undocumented caves were discovered within the monument. This represents a signficant expansion to the known cave resources in the monument. The monument expects to discover more caves as it continues to survey lands (NPS 2006a).

The entrance zones and collapsed segments of caves provide habitat for a variety of flora and fauna not found elsewhere in the monument. The humid and cool properties of these environments create islands of unique diversity within the region, including disjunct species of fern and liverworts now up to 150 miles from their closest known populations (Smith 2007).

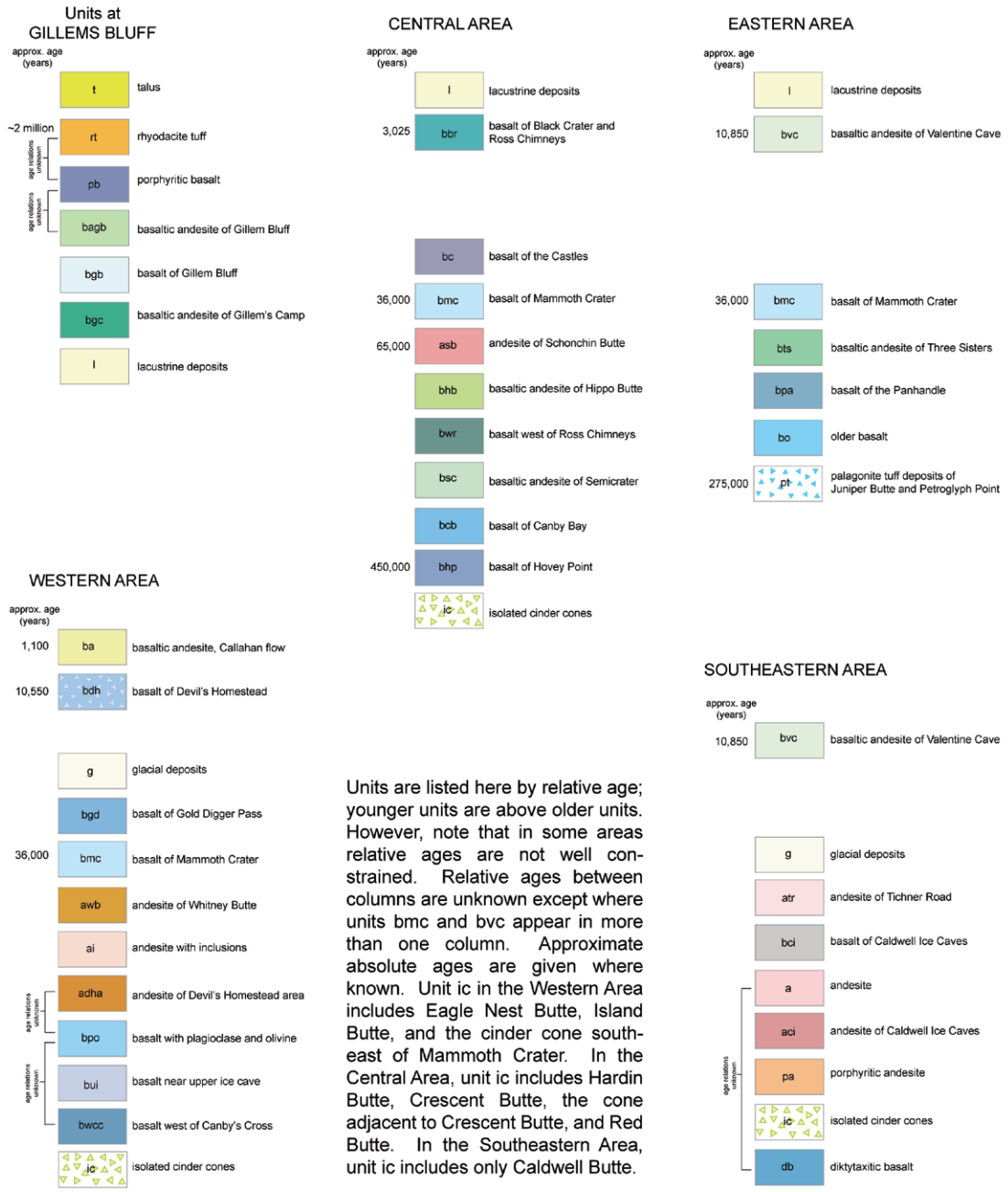
Bird species like purple martins, Say's phoebe, and canyon and rock wrens nest in cave entrance environments. Larger birds like the common raven and barn owls use cave entrances for nesting locations. Amphibians such as the Pacific Tree frog have been documented

MAP 13: SURFACE GEOLOGY AND ABANDONED CINDER MINES

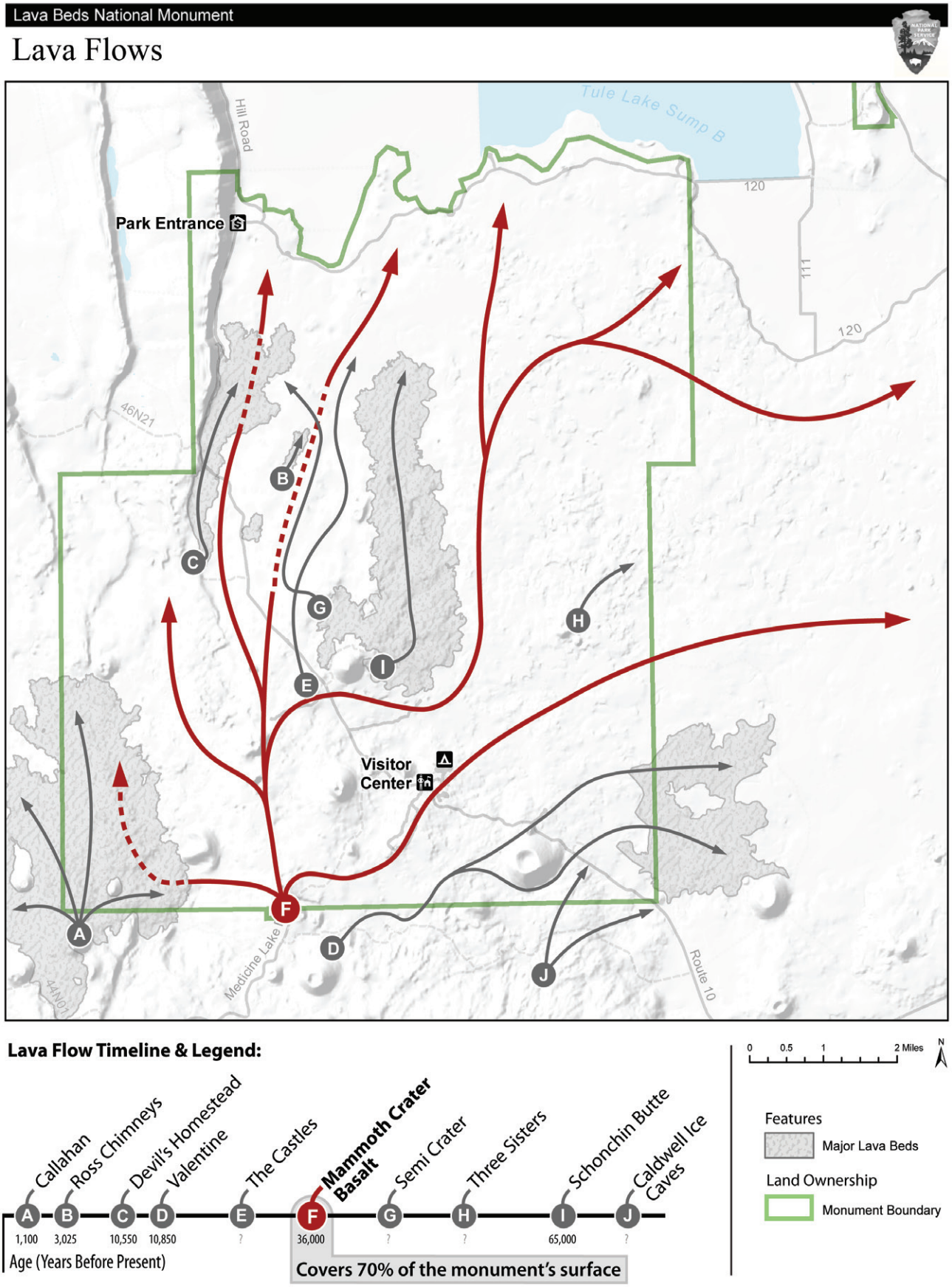
Lava Beds National Monument



CORRELATION OF MAP UNITS



MAP 14: LAVA FLOWS



in entrances along with sensitive mammalian species like pika, pack rats, and bats.

The monument currently protects fourteen documented species of bats. Of these, significant maternal roosts of Townsend's Big-eared bat, Pallid bat, Cave myotis and Brazilian Free-tailed bats have been monitored. Bats along with packrats are critical players in the ecology of caves and the regional landscape. The monument first began documenting bat use in caves in 1962 and initiated intensive monitoring of bat colonies in 1985.

Caves also shelter a rich diversity of macroinvertebrates. In 1989, an initial assessment of macroinvertebrates was completed in ten caves (Crawford 1990). In 2005, an additional 29 cave sites were assessed for macroinvertebrates, resulting in the collection of 1511 specimens. Of particular interest are a dozen or more possible troglobitic (cave obligate) species, two of which (an isopod and pseudoscorpion) may be uniquely endemic to the park (NPS 2005d). Further studies are likely to uncover even greater diversities of macroinvertebrates.

Stable cave environments preserve cultural and geologic materials of scientific interest. It is likely that the first Native American use of caves occurred as early as 11,450 ± 340 BP. Many historical items, remains, and images have been left in situ. Artifacts from early settlement, military conflicts, and the Civilian Conservation Corps are also present in caves.

Besides cultural materials, caves also shelter geologic deposits important to dating and understanding the natural history and volcanic process that have influenced the regional topography. Cave environments protect deposits such as cristobalite, calcite, and sediments, and structural clues that are quickly eroded on the surface. Equally important are biological materials, like paleontological remains, rat middens, and organics that hold important links to climatic and past ecologic communities that once dominated the land.

The cave ice resources found at the monument are of increasing concern. Since 1990, resource management volunteers have monitored ten caves that have historically contained substantial ice resources. As of 2007 the monument has observed the dramatic loss of ice in seven of the ten monitored caves, with the near total loss of ice in four caves. A 0.5 degree rise in the mean monthly low surface temperature and a near 1.5+ degree rise in the mean monthly high surface temperatures seen over the past 60 years is the probable cause for this ice loss.

At present, visitation is monitored in 11 caves by electronic trail counters and 18 other caves by voluntary registers. The counters and registers provide a representative sample of the level of visitor use in front and backcountry caves. Photo monitoring along with speleogen breakage studies are ongoing; however, much more thorough and frequent monitoring is needed.

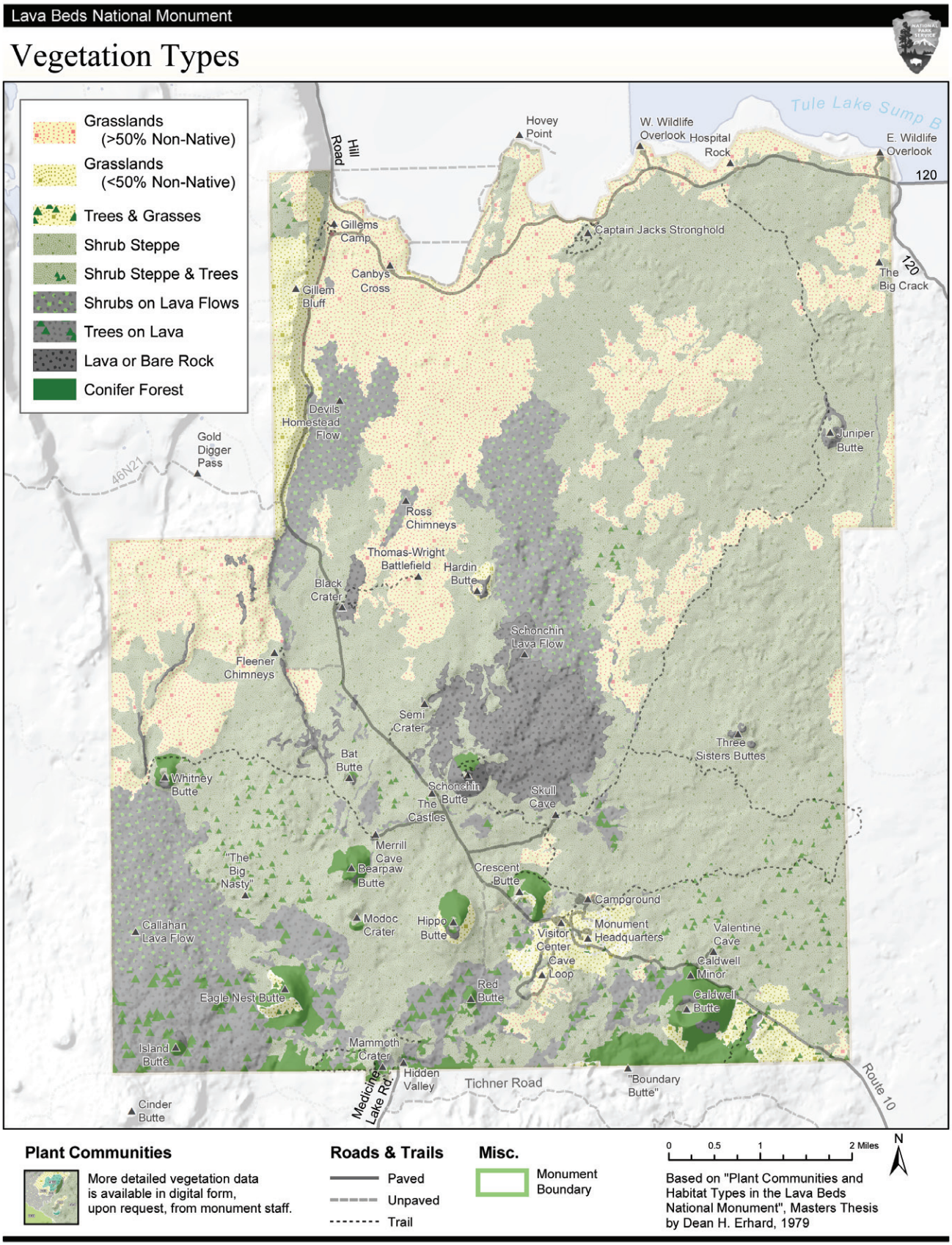
Future efforts will focus on tracking and permitting back country cave use, while limiting visitation within designated protected areas. The development of a new cave management plan along with increased focus on education, restoration efforts, and infrastructure improvements will help reduce future impacts. These actions along with monitoring of cave dependent species, climate, habitat integrity, formation breakage, and other anthropomorphic effects will be critical steps to preserve the monuments caves.

Hydrologic Resources

Lava Beds National Monument has no permanent or ephemeral lakes, streams, or wetlands found within the monument's boundary (USGS 1968; NPS 1999b). Only a few intermittent surface water resources in the form of seeps and ice features are found at the entrances to ice caves, such as Duffy's Well and Upper Ice. Since 1999, two baseline water quality inventories have been completed at Lava Beds. A 1999 analysis looked at eight water quality parameters in 14 ice caves (NPS 1999a). In 2005, the United States Geological Survey (USGS) completed a baseline water quality survey on 12 ice caves, looking at five water quality parameters (USGS 2005). These two surveys provided baseline water quality information showing no negative water quality issues.

Since 1990, the Cave Research Foundation has been monitoring ice levels in nine monument caves. Over this period of time, loss of ice has been documented in seven of the nine caves. In Merrill Cave, the complete loss of the ice floor occurred over a two year period, starting in 1997 (Fuhrmann 2007). Current environmental stressors potentially impacting ice resources include climate change, micro climate within caves, fluctuations in precipitation and increasing surface

MAP 15: VEGETATION TYPES



temperatures. Since 1946, Lava Beds has been monitoring surface temperatures. During that time, a 1.5 degree Fahrenheit increase has been detected for the average summer high temperatures. This temperature data relates to a larger trend identified in many locations throughout the western United States.

Groundwater provides domestic water for the monument. The monument has an active 825' deep well to supply water for the the Indian Well developed area. A second older well located alongside the active well is not currently being used. Since 2001, the USGS has been conducting a ground-water study on water levels in the upper Klamath Basin. Four wells have been monitored at Lava Beds under this project. By the beginning of 2004, one shallow well on the north edge of the monument had gone dry (USGS n.d.). The monument's waters supply wells at Indian Well have remained stable since 2001 (USGS n.d.).

Infiltration of surface water from the Tule Lake sumps and underflow from adjacent volcanic rocks probably are the principal sources of recharge to ground water at Lava Beds (NPS 1968). During the last ten years, geothermal and ground water studies have been implemented on the Medicine Lake Highlands (Mariner, et al. 1998). Groundwater flow sources for Lava Beds originate off of the north slope of the Medicine Lake Highlands. Groundwater north of the caldera rim drain northward to the Tule Lake groundwater subbasin and are within the North Coast Basin ground water system (NPS 2004b; BLM 1999). Lava Beds is found within this system and could be influenced by future developments north of the caldera. Lava Beds is also located close enough to the groundwater recharge areas and far enough from irrigation pumping that the elevation of the water table is not expected to be significantly affected (NPS 2004b).

Soils

The soils of the monument can be characterized by a broad continuum of pumice to silt content, from the higher elevations near the southern boundary to the lower elevation at the northern boundary. The southern soils are, in some places, a single horizon of up to 60" of pumice gravel. This correlates with the proximity of the Glass Mountain flow on the edge of the Medicine Lake caldera, 12 miles south of the park, from which the pumice was explosively ejected during an eruption dating to approximately 840 years ago. As the landscape descends north and away from the source of this pumice, it begins to represent a less significant portion of the soil. At the far north end of the monument, the soil is dominated by aeolian deposition of lacustrine silts. Breaking up the regularity of this pumice-silt continuum are lava flows of various ages and textures, which have more specific influences on the young soils that overlay them.

Most soils in the monument are highly permeable; especially the pumice gravel dominated southern soils. Flowing surface water is non-existent. This has a great influence on floral diversity and distribution.

No survey or mapping has been done on the soils within the monument itself. However, the Modoc National Forest conducted large scale soil surveys between 1978 and 1982, and again in 1985.

Vegetation

NATIVE VEGETATION

Despite the monument's arid environment, with an average annual precipitation of around 15", it is host to approximately 340 plant species, in 38 communities, from three major vegetation associations. These associations are:

1. Great Basin shrub-grasslands dominated by bluebunch wheatgrass (*Pseudoroegneria spicatum*) and basin or mountain big sagebrush (*Artemesia tridentata ssp.*) found at lower elevations. These open expanses on the northern half of the monument include many of the 30 species of grasses in the monument, as well as the ubiquitous rabbitbrush shrubs (*Ericameria sp.* or *Chrysothamnus sp*.) and many exotic weeds.

2. Shrub-woodlands dominated by western juniper (*Juniperus occidentalis*) and mountain mahogany (*Cercocarpus ledifolius*) and a diverse shrub, forb, and grass understory found on the middle-elevation slopes of the monument. The greatest abundance and variety of perennial wildflowers, of great aesthetic importance to visitors, bloom here throughout the spring and summer.

3. Coniferous forest dominated by ponderosa pine (*Pinus ponderosa*) at the southern-most, highest elevation areas of the monument, often with an

understory of bitterbrush (*Purshia tridentate*), snow brush (*Ceanothus velutinus*), or manzanita (*Arctostaphylos patula*). Patches of this association are also found on the north aspects of some large southern cinder cones and on the south wall of Mammoth crater, where some white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) mix in.

Besides precipitation differences due to elevation, distribution of species within these three associations and subsequent communities are strongly influenced by two factors: the park's poor, fast-draining soils and its volcanic topographic features. These soils, coupled with the scarcity of summer and fall precipitation, mean that the majority of plants in the park are either spring annuals that quickly take advantage of winter precipitation, or deep-rooted perennials that can tolerate long arid summers. The notable exception to this rule and source of great floral diversity in the park is the strong influence of the volcanic topography and geologic features. These provide a broad variety of refugium for species not otherwise suited to the area's daily and seasonal temperature fluctuations, rainfall patterns, and poor soils.

The lava tube cave entrances and trench collapse areas provide insulation from temperature changes, shade from baking summer sun, elevated humidity, and more accessible groundwater. Bryophytes and nine species of ferns are the most poignant example, including *Polystichum munitum*, the western sword fern common to coastal redwood forests. Western sword fern is found at the sheltered entrances to several caves that form tiny green oases below the arid landscape. A survey conducted by the Cave Research Foundation in 1993 found significant fern populations at twenty cave entrances.

The somewhat more exposed lava tube collapse trenches, away from cave entrances, still provide shelter to a unique assembly of plants. Desert sweet / fernbush (*Chamaebatiaria millefolium*) is commonly found in these trenches, along with California figwort (*Scrophularia californica*) and purple sage (*Savlia dorrii*). The lava beds themselves, especially blocky flows or ones with deep cracks, provide shade or pockets of groundwater for desert ocean spray (*Holodiscus discolor*) and desert mint (*Monardella odoratissima*).

Small rocky outcrops of lava, common on the rugged landscape of the monument, also provide a haven for a broad diversity of plants benefiting from their shade and collection of rainwater otherwise lost from the surrounding soils. Many flowering forbs, including cinquefoil (*Potentilla sp.*), and six species of penstemon, take advantage of these outcrops.

NONNATIVE VEGETATION

Out of 63 nonnative vegetation species within the monument, 23 are considered invasive. The lands within the monument were heavily grazed by livestock until 1974, which had a significant impact on the native vegetation and fragile soils. Cheatgrass (*Bromus tectorum*) is present throughout the monument and most common in many areas of the lower elevation shrub-grasslands. In addition, because of the monument's location adjacent to active agricultural fields, other aggressive nonnative plant species have been successful in colonizing disturbed areas within the monument. Recent improvements in cooperation with the adjoining Tule Lake National Wildlife Refuge is hoped to help slow infestations entering from refuge lands where weeds are overwhelmingly entrenched.

The monument has identified six primary non-native plants of concern:

- Cheatgrass (*Bromus tectorum*)
- Russian thistle (*Salsola iberica*)
- Bull thistle (*Cirsium vulgare*)
- Canada thistle (*Cirsium arvense*)
- Sweet clover (*Melilotus sp.*)
- Woolly or common mullein (*Verbascum sp.*)

Summer weed control crews currently work to eradicate infestations of all of these species, except the widely established cheatgrass.

Wildlife

Lava Beds National Monument contains a broad array of wildlife that varies from grassland dependent species, such as the pronghorn, yellow-bellied marmot, and western meadowlark to ponderosa pine forest species, such as the Douglas squirrel, pygmy nuthatch, and gray fox.

In addition to the above mentioned species, there are hundreds of others that occupy the varied plant communities and geologic landscapes that make up the Great Basin/Cascade ecosystem of the monument.

It was not until the early 1960s that volunteers, researchers and monument staff began to conduct wildlife studies to determine species presence and geographic distribution. For mammals this began in 1962 when Charles Smith conducted a vector-borne disease survey of rodents, bats, and carnivores. For birds, this began in the early 1960s with volunteers and staff documenting birds observed around the administrative headquarters. For the last fifty years, research and survey projects have provided a foundation for understanding wildlife within Lava Beds National Monument.

Since 1999, the National Park Service has been in the process of operating the Inventory and Monitoring Program. This program is part of the NPS Natural Resources Challenge and has been put into action to inventory 90 percent of all fauna (mammals, reptiles, amphibians, birds, fish) found within parks and to develop monitoring plans for each network of parks. Lava Beds is located within the Klamath Network and has certified species lists for the park, as approved through the Inventory and Monitoring program.



Tree frog, *NPS Photo*

For mammals, the certified park list identifies 67 total species. Of this total, 49 species have been confirmed as present in the monument. Species that are listed as historic, found originally in the area include American bison, gray wolf, river otter, bighorn sheep, and grizzly bear. Unconfirmed species include elk and six small ground dwelling mammals, including voles, mice, and one species of gopher. Elk species have been documented on occasion in the monument. There are five species of mammals that are probably present in the monument which include yellow pine chipmunk, three voles, and one shrew.

For birds, the certified park list identifies 234 total species. Of this total, 223 species have been confirmed present in the monument. Species that are listed as unconfirmed include sage sparrow, wrentit, least bittern, red-necked grebe, yellow-bellied sapsucker, solitary sandpiper, Bohemian waxwing, ruffed grouse, snowy plover, and lesser yellowlegs. One species of bird that has disappeared from Lava Beds since the early 1970s is the greater sage-grouse. This species has not fared well during the last four decades due to road development, fire suppression, and habitat encroachment by exotic plants and western juniper. The nearest population of sage grouse is 15 miles to the east at Clear Lake National Wildlife Refuge. This population is significantly reduced and has been as low as three documented males observed on the breeding grounds (display lek) during the 2003 breeding season. At this time, this bird should be considered extirpated from Lava Beds.

Since 2005, the U.S. Fish and Wildlife Service has been involved in a re-introduction program around Clear Lake. Lava Beds has also been involved in cooperating on a team drafting a Greater Sage-Grouse Recovery Plan for northeastern California. This effort began in 2005 and includes the U.S. Fish and Wildlife Service, State of California, ranchers and the monument. On September 12, 2006, the U.S. Fish and Wildlife Service listed the Greater sage-grouse (*Centrocercus urophasianus*) as a candidate species for the threatened and endangered species list. A candidate species is one which the U.S. Fish and Wildlife Service has sufficient information on biological vulnerability and threats to support proposals to list this species as endangered or threatened. Issuance of a proposed rule for this species is precluded at present by other higher priority listing actions (USFWS 2006).

For reptiles, the monument supports 12 species. The most common species include gopher snake, western rattlesnake, and western fence lizard. For amphibians, there are two species, the Pacific tree frog and the western toad. The pacific tree frog has been confirmed in a full array of habitats ranging from cave openings to the interior of lava flows. The western toad, considered extremely rare, has only been confirmed in the administrative area of the monument. One of the rarest snake species found at Lava Beds is the desert night snake. It has been found twice in the monument since the 1960s.

The lands within the monument provide an array of habitats for many species of wildlife that are considered watchable for tourism. Mule deer is one species visitors are keen to observe. They are found throughout all elevations of the park throughout the year. During the winter season, mule deer densities increase after moving off of the upper elevations of the Medicine Lake volcano.

Pronghorn is another large mammal found in the area of the monument. Between 2003 and 2007 only two pronghorn have been observed within the boundaries of the monument. The encroachment of western juniper into grasslands, land uses outside of the monument, and limited preferred habitat has reduced the occurrence of pronghorn within the monument. Since 2004, prescribed fires and western juniper reduction projects have been implemented in the northern end of the monument. One goal of these activities has been to return the northern end of the monument to a grassland- sagebrush habitat that is preferred by pronghorn. This habitat also benefits yellow-bellied marmots, which are found in limited areas on the northern end of the monument.

The most recent efforts by the monument to document species presence has occurred with the automated wildlife camera project. Since 2003, camera operations have documented rare and elusive species. These have included mountain quail, gray fox, Douglas squirrel, mountain lion, and black bear. Many of these species have only been photographed on one occasion demonstrating their status as rare species within the monument.

RARE AND SENSITIVE SPECIES

Lava Beds National Monument has no federally listed threatened or endangered species. The bald eagle (*Haliaeetus leucocephalus*) was recently removed from the Endangered Species List on June 28, 2007. Although the bald eagle has been removed from the endangered species act protection, it is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Since the 1980s, monument staff have

TABLE 13: RARE AND SENSITIVE SPECIES

RARE AND SENSITIVE SPECIES AT LAVA BEDS NATIONAL MONUMENT

Common Name	Species Name	Status
Loggerhead Shrike	*Lanius ludovicianus*	*,#
Small-footed myotis	*Myotis ciliolabrum*	*
Long-eared myotis	*Myotis evotis*	*
Fringed myotis	*Myotis thysanodes*	*#
Long-legged myotis	*Myotis volans*	*,#
Yuma myotis	*Myotis yumanensis*	*
Townsend's big-eared bat	*Plecotus townsendii*	*,#
Brazilian free-tailed bat	*Tadarida brasiliensis*	*
Northern goshawk	*Accipiter gentilis*	*,#
Burrowing Owl	*Athene cunicularia*	*,#
Swainson's Hawk	*Buteo swainsoni*	*, CA State Threatened
Brewer's Sparrow	*Spizella breweri*	*
American Badger	*Taxidea taxus*	*,#
Pallid Bat	*Antrozous pallidus*	*,#
Cave Myotis	*Myotis velifer*	*,#
Purple Martin	*Progne subis*	*,#
Olive-sided Flycatcher	*Contopus cooperi*	*,#
Short-eared Owl	*Asio flammeus*	*,#
Flammulated Owl	*Otus flammeolus*	*
American Pika	*Ochotona princeps*	*
Troglobitic cave millipede	*Plumatyla humerosa*	* (cave macro-invertebrate)
Cave Collembola springtails	6 families identified	* (cave macro-invertebrate)
Monarch Butterfly	*Danaus plexippus*	*
Northern Rubber Boa	*Charina bottae*	*

* - Lava Beds National Monument identified sensitive species.

- California State Species of Special Concern.

been monitoring the two bald eagle winter roost sites. 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. In 1984, bald eagle use in the Caldwell winter roost site reached 278 birds. This was the largest number of eagles ever documented in Lava Beds. Since that time winter roost occupancy has dropped significantly with the number of eagles averaged 8 per year between 2002 and 2006. The apparent reduction in prey base, ducks and geese wintering farther south into the Sacramento Valley, is one theory for the eagle reduction.

The monument provides particularly important habitat for the Townsend's big-eared bat, which makes use of monument caves both for winter hibernation and for summer maternity roosts. In the 1980s, the Townsend's big-eared bat population in Lava Beds was around 300 individuals. Since that time, additional monitoring effort and protection measures have been put in place to document over 600 individuals in three separate maternity colonies.

One additional sensitive species the monument monitors is the Brazilian free-tailed bat. This species of bat migrates into the monument every spring and forms one large maternity colony. This population of bats is migratory and leaves the monument around early September.

A joint U.S. Forest Service/NPS Bald Eagle Winter Roost Management Plan was approved 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 national forest lands.

Wilderness and Backcountry

On October 13, 1972, two wilderness units (Schonchin and Black Lava Flow) totaling 28,460 acres were designated under public law 92-493 at Lava Beds National Monument. Accordingly, wilderness currently represents 61% of the monument's total land area. In 2006, a *Wilderness Stewardship Plan* (WSP) was completed for Lava Beds that states wilderness and backcountry areas will be managed identically on approximately 45,626 acres (NPS 2006d). The WSP identifies backcountry as ¼ mile off of all paved roads and developments. Facilities and paved roads within the monument account for approximately 934 acres.

The Lava Beds wilderness is an island, the next closest wilderness areas being the Mountain Lakes Wilderness, 65 miles to the northwest, and the South Warner Wilderness, approximately 65 miles to the east. Currently there are 50 miles of trails in the wilderness and backcountry areas of the monument including 38 miles of maintained trails and 12 miles of un-maintained trails (NPS 2006d). Horseback riding and pack animals are currently permitted on three wilderness trails - Lyons, Three Sisters, and Whitney Butte, totaling 29.6 miles. The Powerline administrative road is also open to horse use and totals 6.9 miles.

Over the past decade day hiking, overnight use (backpacking), and caving were the monument's principal wilderness activities. Pack and trail riding stock use accounts for less than 1% of wilderness use. Caving and hiking account for most of the day use activity within the wilderness. Day use far exceeds overnight use. Lack of surface water within the monument discourages most visitors from camping overnight in the backcountry. Backpackers must carry in all the water they will need for overnight trips. Average annual overnight use of the Lava Beds National Monument backcountry is approximately 26 visitor nights. A record 103 visitor nights was recorded in the monument wilderness in 1995 (number of visitors multiplied by the number of nights = visitor nights). The year 1997 was second highest with 32 visitor nights and 1991 third highest use with 28 visitor nights.

Visitor exploration of caves is one of the most popular activities within Lava Beds National Monument. Lava Beds manages its caves within designated wilderness areas as underground "wilderness." In backcountry caves and caves located in wilderness areas where cave registers are used, visitation can vary widely. Between 1995 and 2000, 18 backcountry and wilderness caves contained registers to document use. The range of visitation in these caves fluctuated between a wilderness cave with 15 visitors and a backcountry cave with 4,000 visitors during the five year period (NPS 2006d).

The Wilderness Act restricts activities in designated wilderness areas. No forms of mechanical transport, no permanent roads, and only "minimum tools" are permitted. The Lava Beds wilderness will remain an area characterized by an essentially unmodified natural

environment: interaction between users is very low; opportunities for experiencing solitude are high, especially if one stays overnight; motorized use within the area is not permitted.

There are opportunities for public use, enjoyment, and understanding of the wilderness, through experiences that depend upon a wilderness setting. Outstanding opportunities for solitude or a primitive and unconfined setting exist. However, due to the separation of the two small wilderness units, in some areas visitors can see and hear surrounding developed landscape which includes grain elevators, and freight trains.

Within the Lava Beds wilderness areas, air quality meets federal and state standards. There is no measurable degradation to water resources. The ability of soils to support naturally occurring vegetation communities is not significantly impaired by human activities. Plant communities are affected by natural process and maintain their natural appearances.



Prescribed fire ignition, *NPS Photo*

Wildlife is recognized as an integral part of the wilderness and contributes significantly to overall biodiversity. The Lava Beds wilderness acts as a component to maintain indigenous species.

Cultural and historic sites are recognized as an integral component of the wilderness resource. Past human uses of the land are understood and values of cultural resource sites are preserved

Over the past three years, management steps have been taken to improve the wilderness experience at Lava Beds. Updated wilderness information and boundary signs were placed at trailheads to inform visitors of the boundaries and "leave no trace" guidelines. Old vehicle access gates into monument wilderness areas were removed and replaced with rock structures. A wilderness boundary adjustment proposal was developed and sent to Congress to adjust wilderness boundaries around five developed features (e.g. the main road, campground, amphitheater) that were inadvertently included in the original wilderness boundaries. This boundary adjustment proposal also corrects discrepancies in acreage, adds resources not previously designated as wilderness, and improves boundary management.

In the future, wilderness management challenges will include maintaining desired natural and cultural conditions as outlined in the 2006 W*ilderness Stewardship Plan*, effectively monitoring visitor use in the wilderness and backcountry, and evaluating the use of permits and boundary access issues.

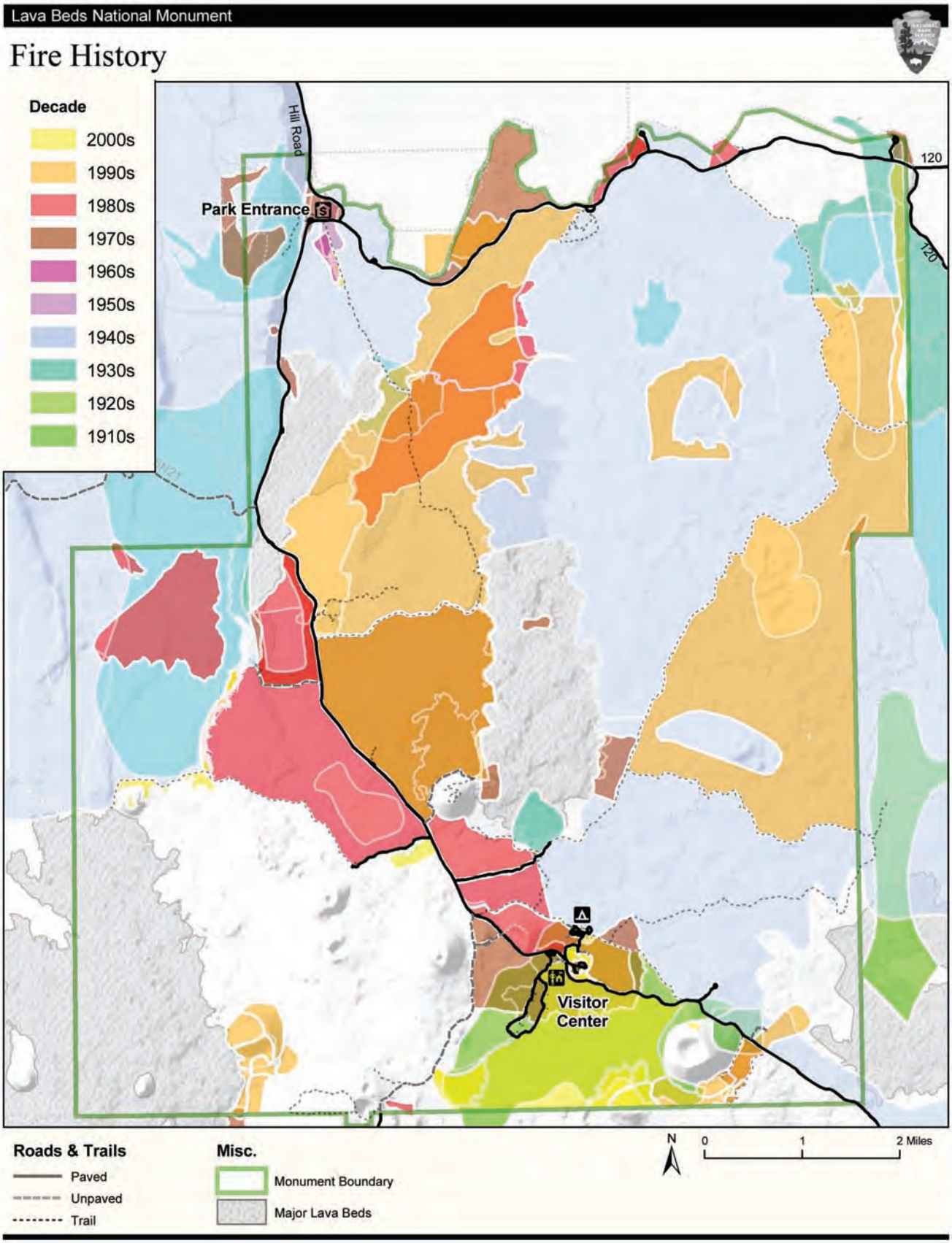
Fire

Since the establishment of the Modoc National Forest in 1904 and the subsequent establishment of Lava Beds National Monument in 1925, fire suppression was the dominant management strategy for the monument and the surrounding shrub-steppe and dry-conifer forest communities (USGS 1966). It wasn't until the mid-1960s that fire was recognized as an important natural process in western ecosystems (Leopold et al. 1963) and institutionalized as U.S. Department of Interior policy in 1968 (Kilgore 1973).

Lava Beds first applied fire in a research context in 1974 (NPS 1982, and Olson et al 1982). From 1974-1979, 56 prescribed fires were conducted using several fire prescriptions. The monument formalized its fire program with a management plan in 1982. Additional fire management activities were assessed and documented in an environmental assessment and management plan in 1992 and 2004. A formal fire monitoring plan was established in 2004. The monument has been systematically collecting fire effects information on prescribed fires since 1989 (NPS 2004a) using up to seven different vegetation categories (monitoring types).

The current *Lava Beds Fire Management Plan* (FMP) was approved in February 2005. Subsequent annual updates through 2009 have been completed on the FMP. The plan contains current policy and guidance that implements a comprehensive fire management program. The FMP serves as the implementation plan to help achieve resource management and fire protection goals defined in a park's general management plan and resource stewardship strategy. The current FMP is reviewed for validity annually, and revised annually as needed to be consistent with current policy, but in

MAP 16: FIRE HISTORY



compliance with the existing and approved environmental analysis (NPS 2005f).

The 1996 *Lava Beds National Monument General Management Plan* reinforced the implementation of a fire management program that included the use of suppression and prescribed fire. The 1996 GMP objectives specified that the monument would maintain the natural role of fire in monument ecosystems to the maximum extent possible through the use of wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions).

While acknowledging that human safety remains the number one goal, the goal of the 2005 FMP is to provide the maximum amount of protection for the important natural and cultural resources of the monument while helping restore natural ecological processes, including native vegetation function and structure. Using wildland fire to achieve the goals of the GMP is an allowed strategy. 'Use of Wildland Fire' is the strategy of using natural ignitions (i.e. lightning) to achieve goals appropriate for the area where the ignition occurred. The FMP identifies over 33,000 acres where using unplanned ignitions is an appropriate management strategy to meet GMP objectives when conditions are conducive. The fire is assessed relative to very specific parameters of topography, weather, fuel types, and resource risk, and if appropriate the fire is allowed to burn in a low intensity manner to achieve resource objectives while being monitored. The application of this strategy is dependent on the natural ignition falling within strict fire behavior parameters.

A prescribed fire program has been in effect at the monument since the mid 1970s. In 28 years, approximately 21,000 acres (approximately 52% of the monument's burnable vegetation) has been treated, or approximately 750 acres per year. Fires burning under natural conditions would burn an average of 1,822 acres per year for a total of approximately 51,000 acres (many areas burning more than once) over the same time period. The net result of the prescribed fire program is that approximately 30,000 acres have not been burned that should have been burned since the inception of the prescribed fire program. In addition, many of the areas that have not been treated with the prescribed fire program have not been burned for a very long time.

Research completed at the monument by Rick Miller and Karl Hopkins at the Eastern Oregon Agricultural Research Center, Oregon State University found evidence that suggest fire has played an active and complex roll in plant communities across the monument. The more arid plant communities, dominated by Thurber and western needlegrass were probably characterized by a relatively long mean fire return interval of 60 to 100 years, which supported a shrub steppe community with few juniper. However on the more arid western needlegrass communities fire return intervals were considerably longer, allowing for the development of old growth juniper woodlands. On some of the recent lava flows and rock outcrops fires were rare or absent allowing juniper trees to exceed ages of 500 (very possibly >1000) years. In contrast, fire return intervals were relatively short (10 to 20 years in the wetter more productive communities dominated by bluebunch wheatgrass and Idaho fescue. These communities would have been dominated by a herbaceous layer with an open scattered stand of shrubs. Western juniper has encroached and/or increased in density in many of these sites since the 1870s resulting from the altered fire regime.

Fire effects monitoring is an important component of the fire management program in the monument. The long-term effects of burning on the composition and structure of vegetation communities are assessed using two primary approaches. First, a systematic prescribed fire monitoring program has been implemented using the nation-wide NPS Fire Effects Handbook (FMH) protocol. A series of standardized plot-level inventory designs are used to quantify vegetation and fuels attributes before and after burning at set time-intervals. Once a sufficient sample size and temporal record is obtained for each monitoring type, long-term succession trends and fuels dynamics can be assessed. Currently, the monument has more than 50 plots in five different monitoring types, but most were established relatively recently (last ten years) and only a small handful of plots have burned more than once. The second major fire monitoring approach utilizes repeat satellite image analysis to map landscape-scale patterns of fire severity and vegetation patch dynamics. Fire severity is classified for any fire >300 acres in size that burns in woody vegetation. In addition to these programs, special monitoring efforts may be conducted on a case by case basis by monument personnel when special issues arise that cannot be addressed through the FMH or satellite analysis.

Future fire management challenges in the monument revolve around the best way to protect resource values and public safety in a changing environment. It is

becoming increasingly clear that "no fire" is not a realistic long-term option given the high flammability of vegetation and local ignition sources in the monument – areas will eventually burn either under wildfire conditions or prescribed fire conditions. Nonnative invasions and fire-exotic interactions will continue to be a key issue. In particular, type conversion from shrub-steppe communities to exotic annual grasslands is a key concern in some areas. Maintaining habitat for rare and sensitive species, such as greater sage-grouse, will also be a challenge, especially as those habitats become increasingly rare due to urbanization, grazing, or large wildfires outside the monument boundary. A proper balance between the positive effects of fire on vegetation communities and fuels and potentially adverse effects in degraded areas must be struck. This challenge will grow more complex in the face of changing climate regimes that favor more severe burning conditions. Public safety due to high fuel loads will also continue to be a growing concern as visitation increases and fuels accumulate in the absence of fire in some areas. Smoke management and the impacts this can cause on visitor experience, air quality, and human health will also be a growing concern.

Another key challenge for fire managers involves the need for comprehensive pre-planning to manage unplanned natural ignitions in a manner that best meets ecological objectives in a cost-efficient manner. A more complete spatial inventory of fuels characteristics and other fire behavior data (weather and terrain) are needed to facilitate fire behavior projections during the fire season. Fire prediction and fire spread simulation modeling need to be tested and calibrated to better represent monument fuels. This will help fire and resource managers make better real-time decisions about the potential for natural ignitions to be safely managed for resource benefit. Fires that pose a low potential for growth and/or that can be confined by natural barriers or existing burn scars can be identified, thereby reducing cost and risks to firefighter safety.

Current and future research activities that enhance our understanding of the key fire management challenges are needed. Some research is already in progress. For example, researchers at Oregon State University are examining the effects of spring and fall burns on cheatgrass and soil dynamics in low elevation shrub-steppe communities. This will help to assess suitable burn prescriptions to promote native species. Other work is being conducted to look at historic fire dynamics in old-growth mahogany woodlands. The Klamath Bird Observatory conducted avian population surveys along point-count routes in the monument to assess fire effects on bird species. As part of the monument's FMH monitoring program, two key long-term "fire management control" units have been established to obtain baseline vegetation trends in the absence of prescribed burning. The first unit contains only wildfires and the second unit contains the only small enclave of unburned (during the 20th century) low elevation shrub-steppe.

Among the additional research needs is an improved understanding of cave-fire interactions. Despite the abundance and importance of caves in the monument, virtually nothing is known about how fire – and particularly altered fire regimes – influences the bio-physical characteristics of cave environments (e.g., flora and fauna, root dynamics, benthic ecology, ph, humidity, temperature).

A better understanding of the effects of fire on special habitats is needed, such as isolated aspen or old-growth shrub relicts like bitterbrush. Experimental treatments that compare and contrast different fuels management and restoration treatments would help refine strategies for maintaining landscape diversity of native species. This would include the use of increasingly utilized manual treatments such as cutting and pile burning to manage species composition and structure (e.g., how does pile burning and exotic response differ between cutting and broadcasting material?). Manual treatment



Cave ice, *NPS Photo*

is the use of handtools or hand operated power tools (chainsaws, weedeaters, etc). Mechanical treatment is the use of heavy equipment (which also generally implies ground disturbance).

Another key knowledge gap relates to the historical and future (projected) fire-vegetation dynamics at the monument's major forest-shrub ecotones. This is particularly pertinent given that ecotones are most sensitive to altered climate and disturbance regimes. Finally, landscape-scale multivariate analyses that examine the influence of land management variables (e.g., fire frequency, fire severity, roads, developments) on vegetation composition in the context of underlying bio-physical gradients would be beneficial from a landscape planning perspective.

Climate Change

Projected shifts in the regional climate, as part of broader anthropogenic global climate change, will affect both natural and cultural resources at Lava Beds National Monument. These impacts may come from both the climate itself (i.e. precipitation or temperature trends, etc) and from related pollutants (i.e. elevated atmospheric CO2 levels). Though it lies within 125 miles of the Pacific Ocean, the higher elevation and physiographic setting of Lava Beds National Monument in the rain shadow of the Klamath Coastal and the Southern Cascade Ranges may reduce the ocean's climate-moderating effects. Regional climate changes will be further influenced by the cyclic Southern Oscillation (El Nino / La Nina) Pacific warming events and longer scale Pacific Decadal Oscillation trends.

Climate projections for the Pacific Northwest, including the Klamath Basin and Southern Oregon, have been developed by the National Center for Conservation Science and Policy (NCCSP) and the Pacific Northwest Research Station's Mapped Atmosphere-Plant-Soil System team. Current projections use the three most popular climate models; the HADCM, CSIRO and MIROC. These models agree on future temperature rises, although they diverge greatly when it comes to precipitation forecasts. According to the NCCSP, the Pacific Northwest region has seen a 1.5 degree Fahrenheit increase, 0.5 degrees higher than the global average. This 1.5 degree assessment concurs with observations taken at Lava Beds from weather data collected from 1946 to present. If carbon emissions are not curbed, projections are that the Klamath Basin may see a total of a +4 to +8 degree Fahrenheit rise by 2080 (NCCSP 2009).

TABLE 14: PREDICTED CHANGES

PREDICTED CHANGES IN ANNUAL MEAN		
	Temperature	**Precipitation**
2020s		
Low	+ 1.1ºF (0.6ºC)	-9%
Average	+ 2.2ºF (1.2ºC)	+1%
High	+ 3.4ºF (1.9ºC)	+12%
2040s		
Low	+ 1.6ºF (0.9ºC)	-11%
Average	+ 3.5ºF (2.0ºC)	+2%
High	+ 5.2ºF (2.9ºC)	+12%
2080s		
Low	+ 2.8ºF (1.6ºC)	-10%
Average	+ 5.9ºF (3.3ºC)	+4%
High	+ 9.7ºF (5.4ºC)	+20%

Model predictions of Pacific Northwest climate change from 20 different climate models. Low, Average and High reflect the range of model predictions and their effects on average annual temperature and precipitation. Source: University of Washington Climate Impacts Group

The regional climate is also expected to become more extreme both in drought severity and duration, winter storm strength, and snowpack levels. Forecasts for the Pacific Northwest (including Oregon) indicate up to a 20% increase in precipitation (See Table 14). By contrast, predictions for California predict a greater increase of between 20% and 50% in average annual precipitation statewide. The future climate of Lava Beds National Monument proper may lie somewhere between these two broad, regional-scale forecasts, but they do point to some specific resources most likely to be negatively impacted.

Among the most obviously climate-sensitive resources are the perennial ice formations in many lava tube caves, and certain ecological components of terrestrial ecosystems such as fire, drought, and invasive species. All of these are directly sensitive to changes in precipitation and temperature changes (e.g. melting, desiccation) and indirectly (increased plant susceptibility to pathogens).

ICE RESOURCES

Cave ice formation, fluctuation, and longevity are subjects of current scientific investigation. This resource is proving to be part of a complex system of interacting variables involving precipitation rates (directly affecting groundwater availability), surface air temperature, cave depth (affecting bedrock and groundwater temperature), and cave morphology (affecting airflow and temperature), as well as interactions of all the aforementioned components. Climate change will affect all but cave depth and morphology. An analogous system may be the glaciers on the slopes of Mt. Shasta, 40 miles to the southwest of the monument. The Mt. Shasta glaciers, the largest glaciers in California, have been growing in recent years. Their growth has been extensively studied. Howat, et. al. (2007) deduce that the glaciers of Mt. Shasta are only able to grow during increasing summer temperatures due to a matching increase in winter snowpack on the mountain. The ratio calculated from past glacial growth and climate data was an additional 20% in winter precipitation for every 1°C in average annual temperature increase to maintain stability in the extent of the glaciers.

Since temperature change is predicted to greatly exceed any possible increase in precipitation, Howat, et. al. also forecast a near total loss of snow from Mt. Shasta by the end of this century. These findings for Mt. Shasta may predict and explain fluctuations that can be expected in cave ice. While some ice formations may persist, or even increase, due to near-term increases in precipitation, long-term climate trends will likely have an overall deleterious effect on ice volume. This change may or may not be as catastrophic as the predictions for Mt. Shasta's glaciers. Further investigation into these ice resources, including determining the age of current ice formations, is key to better understanding how they have reacted to past climate changes, and therefore how they may react to future conditions.

VEGETATION

Typical of other Pacific Northwest areas, winter precipitation provides the overwhelming majority of moisture available to monument vegetation. Research predicts that the greatest loss of snowpack volume in Sierra Nevada, south of the monument, is expected to occur in the 4,300-8,800' elevation range (Knowles and Cayan 2006). These elevations include those of the monument, and with other trends, indicate that summer droughts will be longer and more severe. This will cause changes in plant communities, selecting for more drought tolerant species in areas most prone to desiccation (south aspects, fast draining pumice soils, exposed ridges, etc). Overall shifts in ecotones should be anticipated, with grasslands, sagebrush steppe, and juniper woodland vegetation communities all moving up in elevation. Ponderosa pine currently established in marginal environments would be at the greatest risk of loss, particularly the small patches growing on the north aspects of Hippo and Caldwell Buttes and remnant trees in the Crescent Butte and Indian Wells Areas. Post-fire recruitment of pine seedlings in fire treated areas along the southern boundary of the monument can also be expected to diminish as the juniper woodland / ponderosa pine forest ecotone shifts to the south along the increasing elevational gradient.

Anthropogenic increases is atmospheric CO2 levels will also have a direct effect on the invasiveness of exotic weeds. These non-native plants will benefit more from greater availability of CO2 levels (Patterson 1995), and may change how they grow. These changes may include increased development of storage roots or rhizomes, causing them to be more difficult to control. Laboratory studies have already shown that certain weeds become resistant to common herbicides like glyphosate (Roundup) at elevated CO2 levels (Ziska 1999).

WILDLIFE

Wildlife species that depend on these changing vegetation types will respond by changing their distribution or phenological behavior. Either they will find necessary food or shelter elsewhere, or change the season of year or time of day that they use these resources. Due to the confines of fixed political boundaries, national parks may experience losses of 20% of their species and drastic influxes of new species (Burns et al. 2003). At Lava Beds, the possible loss of the ponderosa pine forest type would result in the reduction or total loss of several species of birds from the park, including the white-headed woodpecker and other large-conifer dependant species. Expected changes to grassland and sagebrush steppe habitats would also affect wildlife, both currently in the park and those species of concern that might be re-introduced. Among these are the pronghorn, bighorn sheep, and sage grouse. Without appropriate vegetation, the change of successful reintroduction is low. Certain sensitive species such as pika and marmot may also be susceptible to climate change effects.

DISTURBANCE

The same projected climate changes that increase drought stress will also affect the frequency, spatial extent and intensity of wildland fires and insect outbreaks, two principal mechanisms of disturbance on the monument landscape. Large wildfire activity increased suddenly and dramatically in the western United States in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons. The greatest increases occurred in mid-elevation, Northern Rockies forests, where land-use histories have relatively little effect on fire risks, and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt. Northern California forests have had substantially increased wildfire activity, with most wildfires occurring in early-snowmelt years (Westerling et al. 2006). Similar increases in average temperatures and reduction in annual precipitation should diminish fire return intervals and make fire a stronger disturbance mechanism for monument landscapes. Climate change could also affect fire frequency and the area burned annually, with most of the scenarios resulting in increased fire (Lenihan 2005). Fire intensity and severity would also increase with drier fuels, causing future fires to have more severe effects than current fires. Fire severity influences vegetative response, and can greatly favor invasive weeds in areas with land use histories that included grazing or other anthropogenic disturbances. Along with wildland fire, mountain or western pine beetle infestation have become increasingly common in western forests, and climate change-driven outbreaks are expected to increase (Ayres 2000). These forest pathogens are opportunistic pests of native pines, and take advantage of drought-stressed trees to infest and kill them. Increases in winter temperatures and longer droughts both favor these insects, and are another reason the monument risks losing its ponderosa pine forest community.

VISITOR EXPERIENCE

Many visitors to Lava Beds place a high value on experiencing the Great Basin environment for activities such as hiking, wildlife viewing, camping, and photography. Potential changes in vegetation regimes and an increase in the frequency and intensity of fire could reduce the diversity and condition of resources visitors currently enjoy. Wildlife viewing and photography opportunities could also decrease, especially concerning birds, pronghorn, elk, pika, and marmot.

In general, hotter summer conditions resulting from climate change could potentially deter visitors from visiting during certain times, spending time enjoying resources above ground, prolonging a visit, or camping.

Ice cave resources are also among the most popular caving experiences for visitors. The loss of ice in Skull Cave (viewed by many thousands of visitors each year) and the loss of ice formations in Crystal Ice Cave (viewed by a few dozen visitors per year, but considered a very high quality resource experience in high demand) would be particularly impacted.

CULTURAL RESOURCES

The cultural landscape of the monument is likely to change as vegetation types react to new temperature and precipitation regimes. However, the grasslands and sagebrush steppe of the Modoc War battle sites is likely to persist, perpetuating the valuable visitor experience in these sites, though they may become more prone to summer wildfires. These fires present issues for resource protection, as artifacts revealed by removal of vegetation leaves them vulnerable to theft until vegetation regrows. Visitor access, and therefore the enjoyment of cultural and historic resources, may need to be restricted more frequently in the future in order to protect sensitive resources. Generally, the effects of unnaturally high intensity fires may have detrimental effects on some kinds of artifacts, hindering research and interpretation of them in turn.

Cultural Resources

Lava Beds National Monument contains numerous, significant cultural resources including archeological sites, rock art, ethnographic sites, historic structures, Modoc War fortifications, cultural landscapes, and objects. Nearly all of the monument's archeological sites and Modoc War fortifications are included in the Modoc Lava Beds Archeological District, listed on the National Register of Historic Places. The boundaries of this district include the entire monument and some U.S. Fish and Wildlife Service refuge lands along the south shore of Tule Lake. In addition, five other monument properties, three associated with the Modoc War and two rock art sites, are also listed on the National Register of Historic Places.

Because of the long history of preservation, the cultural resources of Lava Beds National Monument exhibit an exceptional level of integrity and lack of disturbance.

Prehistory

Eleven and a half thousand years of human occupation throughout the Klamath Basin has provided an extensive array of cultural resources associated with Lava Beds National Monument. The Modocs, their ancestors, and the predecessors of their ancestors were hunters and gatherers, living in semi-permanent villages along the shores of the ancient lake. At sacred sites, they painted pictographs and carved petroglyphs. Their foraging forays and vision quests took them into every part of their territory where their routes are marked today by obsidian chips, projectile points, and various stone tools.



Historic Overview

As European settlement moved westward into the Klamath Basin, conflicts between cultures escalated, culminating in the Modoc Indian War of 1872-1873. During the war, a small band of Modoc Indians successfully held off an Army twenty times their strength because of their detailed knowledge and use of natural fortifications formed by the lava flows just south of Tule Lake. These flows provided rifle pits, connecting trenches, shelters from mortar fire, and finally, a natural escape from encirclement. Occurring only seven years after the end of the Civil War, it was the only Indian war on record in which the army used mortars to assault an Indian stronghold. The war was characterized by embarrassing reversals for the military and it incurred significant costs. It culminated with the only death of a general officer at the hands of Indian warriors.

Before the creation of Modoc National Forest, the area which now encompasses the monument was grazed by large numbers of wild horses, left in the area after the Modoc War of 1872-73. After the Modoc War, cattle raising was the chief industry, and thousands of these animals were grazed in this general vicinity. About 1900, sheep were brought in, and gradually the cattle industry decreased. By 1920, the only grazing within present day boundaries was by sheep. Many sheep grazing allotments remained valid even after the monument management was handed over to the National Park Service in 1933, and grazing continued within the monument to some extent until 1974.

The monument hosted a Civilian Conservation Corps (CCC) camp from 1933 to 1942. Initially located at Bearpaw, the camp was moved in 1935 to the Gillems Camp area. The CCC contributed significantly to the monument during its period of operation, constructing a number of rustic buildings and structures which remain in the monument today, and are included on the List of Classified Structures. Lava Beds also contains significant infrastructure from the NPS's last major infrastructure development initiative, Mission 66. The majority of development used today by visitors and staff date from that era including paved roads and parking areas, much of the campground, employee housing, and maintenance buildings. The monument road system is unusual among national parks in that it was planned, designed and fully constructed during Mission 66. Other park units only had part of their road system constructed.

Contemporary Tribal Interests

Lava Beds National Monument encompasses lands long inhabited and used by Native Americans. The Modoc people retain strong spiritual ties to these lands and continue to visit the area. Descendants of the Modocs are now members of the multicultural, federally recognized The Klamath Tribes. The monument staff maintains regular contact with Modoc interests through The Klamath Tribes, with headquarters in Chiloquin, Oregon. The monument also maintains contact with the organizers of the annual Modoc Gathering, and with individual Modocs regarding traditional interests in the park.

In 1988, Lava Beds National Monument consulted with The Klamath Tribes and repatriated all of the human remains contained in the monument collections. More

recently, since the mid-1990s, monument staff have been working with representatives from The Klamath Tribes to address management issues associated with sensitive resources.

Archeological Resources

ARCHEOLOGICAL SITES

Lava Beds National Monument has a variety of archeological sites that span the Holocene era. Many of these sites, because of the potential to inform us about past people and their adaptations, contribute to the Modoc Lava Beds Archeological District (1990). Sites situated along the historic lakeshore within the monument are particularly significant because they represent a sample of sites in the Tule Lake Basin unaltered by modern agricultural activity.



Rock wall at Captain Jacks Stronghold, *NPS Photo*

The Modoc Lava Beds Archeological District was listed in the National Register of Historic Places in 1991. The District spans the monument and includes 221 significant sites. The assessed material remains represent a sample of pre-contact, historic human occupation sites, and early park development including CCC activities in the monument. The range of site types summarized in the district nomination include fortifications constructed during the Modoc War (1872 - 1873), rock art, occupation sites, production areas and vision quest features. There is also potential for the identification of historical archeological sites related to the CCC and early settlement. Sites are determined to be contributing to the district based on their assessed data potential (Criterion D) or their association with the Modoc War (Criterion A). The district nomination justified the need for enhanced protection of these sites because of the diminished integrity of contemporaneous sites in the basin. Future archeological work should incorporate formal National Register eligibility assessments of sites documented from recent survey efforts. The nomination boundary should also be revisited to better define boundaries associated with the various site types and historic themes represented in the district.

Archeological site types include domestic, trade, subsistence, processing, funerary, religious and defense sites. These cultural resources are significant under a number of National Register of Historic Places themes: in the area of military history and architecture; for their traditional cultural significance to contemporary Modoc; for the association with Captain Jack, the principal Modoc leader during the 1872-1873 War; and for their potential to yield information important to a range of prehistoric, ethnohistoric, and historic research domains.

Three archeologically sensitive environmental zones are identified in the Modoc Lava Beds Archeological District. The most archeologically sensitive zone is the lakeshore zone. Sites are heavily concentrated in this zone and most of the sites represent multi-activity use. The second most sensitive area is the ice cave zone. Since the only sources of water in the monument are Tule Lake and ice caves, these were intensively used by prehistoric peoples. Almost all ice caves have associated prehistoric archeological sites. Last, the least archeologically sensitive area in the monument is the intermediate zone. Archeological sites in this zone are likely to be task-specific sites characterized as lithic scatters.

MODOC WAR ERA FORTIFICATIONS

Many of the Modoc War era fortifications are included in the Modoc Lava Beds Archeological District. In addition, three Modoc War era fortifications/sites, because of their size and importance during the conflict, were previously listed on the National Register of Historic Places. These include Captain Jacks Stronghold, where Modocs took advantage of the rugged topography to hold off a much larger U.S. Army force for several months; Hospital Rock, which served twice as an encampment for U.S. troops attacking the Stronghold; and Thomas-Wright Battlefield, where a surprise attack by Modocs soundly defeated a detachment of U.S. Army troops. Gillems Camp is also included in the Modoc Lava Beds Archeological District. In the future, NPS funding will potentially become available

to complete a survey of all Modoc War era fortifications within Lava Beds.

ROCK ART

Lava Beds National Monument contains exceptional examples of rock art. Petroglyph Point, separated from the contiguous boundary of the unit, is approximately 200 acres in size and contains more than 5,000 petroglyphs. Petroglyph Point was listed on the National Register of Historic Places in 1975. A number of the monument's caves, included in the Modoc Lava Beds Archeological District, also contain extensive rock art or pictographs.

Ethnographic Sites

A number of the cultural resources in Lava Beds National Monument, i.e. archeological and historic sites, hold traditional significance for contemporary Modoc who are now primarily affiliated with the Klamath Tribes of Oregon, the Modoc Tribe of Oklahoma, and the Confederated Modoc and Paiute Tribes. Monument sites serve as one of the tangible links for the Modoc with their ethnic heritage. The significant population decline and cultural disruption after historic contact, coupled with dispersal of the remaining Modoc population after the war of 1872-1873, led to fragmentation and dissipation of knowledge of the Modoc culture. Today there is a revitalized interest among Modoc about their traditional culture, and the Modoc Lava Beds District serves as one of the foci of this interest.

A recent study completed by John Allison (1994), "The Cultural Landscape of the Klamath, Modoc and Yahooskin Peoples: Spirit, Nature, History" and Douglas Deur (2008), "In the Footprints of Gmukamps," confirmed the importance of Lava Beds National Monument to Modoc people.

Historic Structures

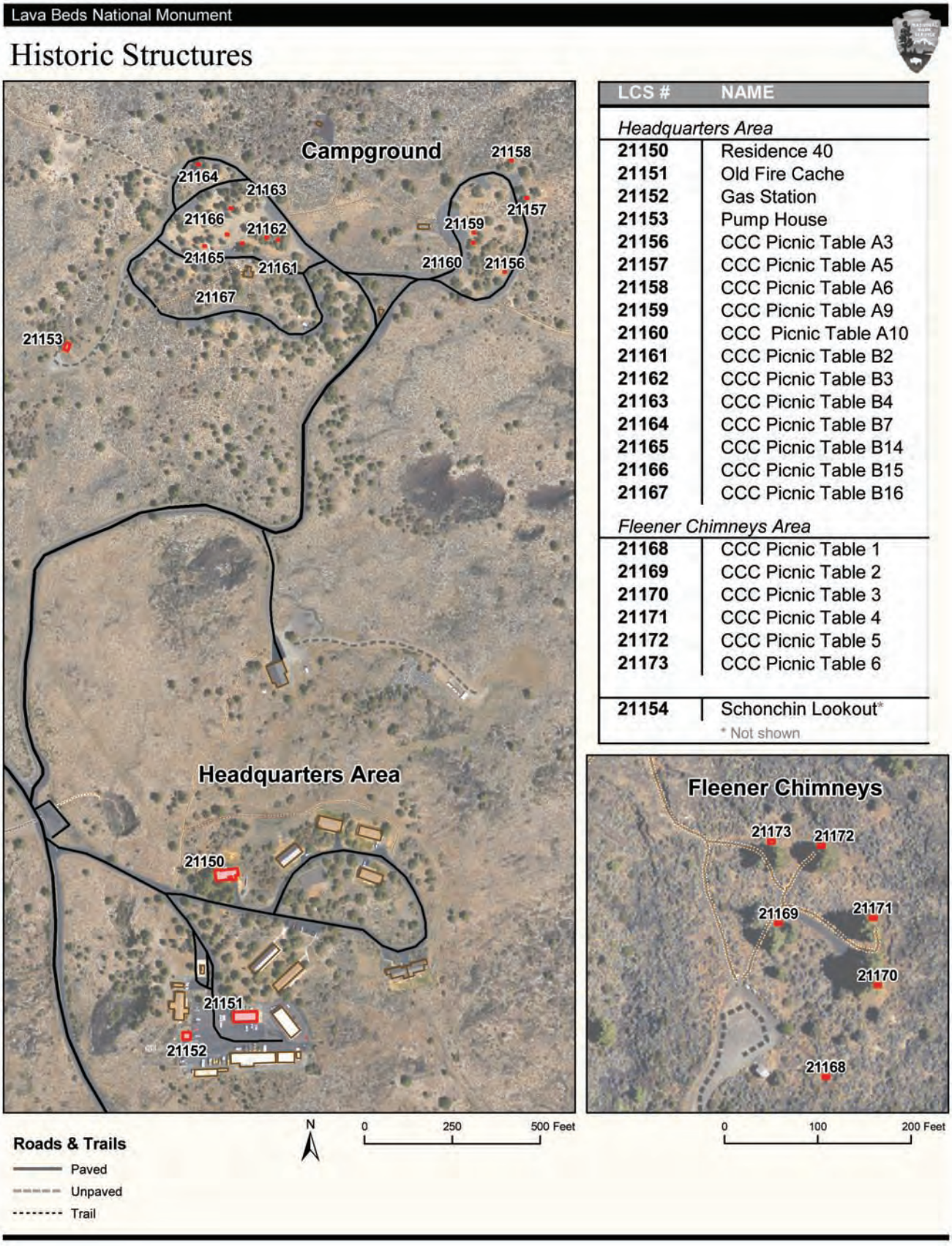
Lava Beds National Monument manages 30 buildings and structures that are on the List of Classified Structures (LCS). These historic features have been evaluated to contain historical and architectural significance. Three structures related with the Modoc War are on the LCS and are individually listed on the National Register of Historic Places. These include Hospital Rock Army Camp site, Captain Jacks Stronghold and Thomas-Wright Battle Site. Gillems Camp, Gillems Camp Rock Circle, and Gillems Camp Cemetery Wall are also on the LCS, although these features are not individually listed on the National Register, rather, they are part of the Modoc Lava Beds Archeological District. In addition to these sites, the Canbys Cross Memorial reconstruction is listed on the LCS. Although it has been determined to be ineligible for the National Register, Canby's Cross is managed as a cultural resource.

The LCS also includes numerous buildings and structures associated with the Public Works Administration (PWA) and Civilian Conservation Corps (CCC) era of development in Lava Beds. These features include the Superintendent's Residence, Service Station (Gas & Oil House), Garage/Shop (Operations Building), Indian Well Pump House, Schonchin Butte Fire Lookout, and 18 Rustic picnic tables. In addition to these buildings and structures, several PWA and CCC-built circulation features may also qualify for inclusion on the LCS, pending the completion of a certified Cultural Landscape Inventory (CLI). In 2007, a CLI was initiated by staff in the National Park Service's Pacific West Region, which evaluated PWA and CCC constructed buildings, structures and circulation features. As of 2010, the CLI is still in progress and, as a result, the National Register eligibility of these buildings and structures has not been determined. In the future, buildings and structures associated with the Mission 66 period of development may also qualify for listing on the LCS and the National Register.

Cultural Landscapes

Lava Beds National Monument contains a number of significant cultural landscape resources. Extant features include rock shelters and stacked rock fortifications associated with the Modoc War as well as roads, trails and several historic buildings and structures associated with Public Works Administration (PWA) and Civilian Conservation Corps (CCC) development. Many of these features have been evaluated and inventoried; however, the documentation, evaluation, and registration of cultural landscapes in the monument is not complete. Currently, the monument has one documented cultural landscape—the Modoc War Historic District. Additionally, PWA and CCC-era infrastructure

MAP 16: HISTORIC STRUCTURES



LCS #	NAME
Headquarters Area	
21150	Residence 40
21151	Old Fire Cache
21152	Gas Station
21153	Pump House
21156	CCC Picnic Table A3
21157	CCC Picnic Table A5
21158	CCC Picnic Table A6
21159	CCC Picnic Table A9
21160	CCC Picnic Table A10
21161	CCC Picnic Table B2
21162	CCC Picnic Table B3
21163	CCC Picnic Table B4
21164	CCC Picnic Table B7
21165	CCC Picnic Table B14
21166	CCC Picnic Table B15
21167	CCC Picnic Table B16
Fleener Chimneys Area	
21168	CCC Picnic Table 1
21169	CCC Picnic Table 2
21170	CCC Picnic Table 3
21171	CCC Picnic Table 4
21172	CCC Picnic Table 5
21173	CCC Picnic Table 6
21154	Schonchin Lookout*

* Not shown

associated with the monument has been identified as a potential cultural landscape. In 2007, a CLI documenting development associated with the PWA and CCC in the monument was initiated, although at the time of this writing, it is still in progress.

In 2005, a Cultural Landscape Inventory (CLI) was completed for the Modoc War Historic District. This inventory identified and documented the landscape's location, physical development, significance, National Register of Historic Places eligibility, and condition of the Modoc War landscape.

The boundaries of the historic district encompass 16,764 acres of land. Located in the northern half of Lava Beds National Monument, the boundary also includes three discontiguous locations within the monument: the Petroglyph Point unit, the Caldwell Ice Caves, and Captain Jacks Ice Cave. The boundaries of the district were drawn to include areas where significant events and battles associated with the 1872-1873 Modoc War occurred. The primary battle sites within the district include the locations of the first and second Battles for Captain Jacks Stronghold and the Thomas-Wright Battlefield. Also included within the boundaries of the district are two important U.S. Army encampments—Gillems Camp/Hospital Rock and the Modoc encampment, referred to as Captain Jacks Stronghold.

According to the CLI, the Modoc War Cultural Landscape is nationally significant under National Register of Historic Places criterion A, B and D for the dates 1872-1873. Under criterion A, the district is associated with the Modoc War, a nationally significant event in the history of Native American-Anglo relationships as well as in the history of journalism in the United States. Furthermore, under criterion B, the district is nationally significant for its association with Captain Jack, the principal Modoc leader during the war. Captain Jack was also a significant figure in American military history and Modoc ethnic heritage. Finally, under criterion D, the archeological sites encompassed by the district have potential to yield information important to the history and documentation of events associated with the Modoc War.

Identified as in "Fair" condition, the Modoc War Historic District landscape shows clear evidence of minor disturbances and deterioration by natural and/or human forces. Some degree of corrective action is needed within three to five years to prevent further harm to its cultural and/or natural values. If no corrective action is taken, the cumulative effect of the deterioration of the landscape characteristics will cause the landscape to degrade to poor condition.

Primary impacts to the landscape are vegetative succession and invasive plants. A secondary impact is visitation. Stabilization measures identified in the CLI include western juniper removal, continued implementation of the fire management program and its goal of restoring the lands to pre-1873 conditions, and the education of visitors to prevent impacts on contributing features/structures. Regardless, it is recommended that the Modoc War Historic District be preserved and maintained.

Since the completion of the CLI in 2005, Lava Beds staff have implemented stabilization measures for the Modoc War Historic District. Between 2006 and 2009, approximately 3,000 acres of land found within the Historic District have been cleared of western juniper. During 2010 to 2012, additional areas of the landscape are scheduled for juniper removal. In 2010, NPS staff will conduct a review of the CLI to determine if the current listed condition of the Modoc War Historic District as "fair" should be adjusted to "good." A landscape in "good" condition shows no clear evidence of major negative disturbance and deterioration by natural and/or human forces.

In 2007, NPS staff initiated field work associated with a CLI, documenting PWA and CCC-era resources within the monument. Many of these resources are associated with the infrastructure of the monument as developed between 1933 and 1942, and include some road segments, trails, the Schonchin Butte fire lookout, the superintendent's residence, as well as several additional buildings and structures. Archeological sites with the potential to yield information about the CCC include features at Gillems Camp, a site near Heppe Cave, the Old Visitor Center SiteThis effort will potentially identify and establish a second cultural landscape within Lava Beds, which will provide valuable information for future management. Currently (2010), the PWA and CCC-era Cultural Landscape Inventory is still in progress and is anticipated to be completed in fiscal year 2010. In the future, a CLI for Mission 66 development at Lava Beds may be initiated to assess the National Register eligibility of buildings, structures, and circulation features associated with this era of development in the monument.

The following contributing structures are located within the Modoc War Historic District

- Captain Jacks Stronghold Fortifications
- Gillems Bluff Trail
- Gillems Camp Cemetery Wall
- Gillems Camp Howitzer Circle
- Gillems Camp Sentry Posts/Fortifications
- Hospital Rock Army Camp Fortifications
- Other Battlefield Stacked-Rock Fortifications
- Thomas-Wright Battle Fortifications

Museum Collections

In 2009, there was a total of 36,744 museum objects managed by Lava Beds National Monument. Total museum collections included the following classifications:

- Archeology - 7,761
- Ethnology - 53
- History -1,535
- Archives -24,172
- Art- 54
- Biology – 3,104
- Paleontology -14
- Geology - 25

Items include historic objects from the Modoc War era, prehistoric objects from Native American occupation, and specimens of the area's plants and animals.

In 2002, a *Museum Management Plan* (MMP) was finalized and approved for Lava Beds National Monument. This plan identified an additional 176,300 items to be added to the collection. Currently, as identified in the 2009 *Collections Management Report*, a total of 1,550 museum objects are in need of cataloging (NPS 2009). Lava Beds is working towards cataloging these items and has received funding to complete this backlog catalogue project.

In 2004, Lava Beds moved the cultural resources collection into the new visitor center. A collections room was developed in the visitor center to house cultural objects, as recommended in the 2002 MMP. Currently, the natural collections are housed in a building that is next to the administration office. The MMP also identified the need to improve professional curatorial oversight. In 2004, Lava Beds National Monument signed an agreement with Crater Lake National Park to receive assistance from their curator. This agreement has improved the professional management of the collections program. Since 2002, storage management within the two locations has included the development of a vertical art rack and installation of storage cabinets.

Future project needs for collections include the development of improved staff access and use, public involvement in partnerships, and location and documentation of collections from the monument which are housed elsewhere. The monument will also identify, process, document, and duplicate monument records and archives, and make these available for staff and public use (NPS 2002). The 2009 *Collections Condition Report* identified 173 applicable management standards for the museum collection. In total, 151 standards were met in 2009 and 22 items were listed as deficient and in need of review.

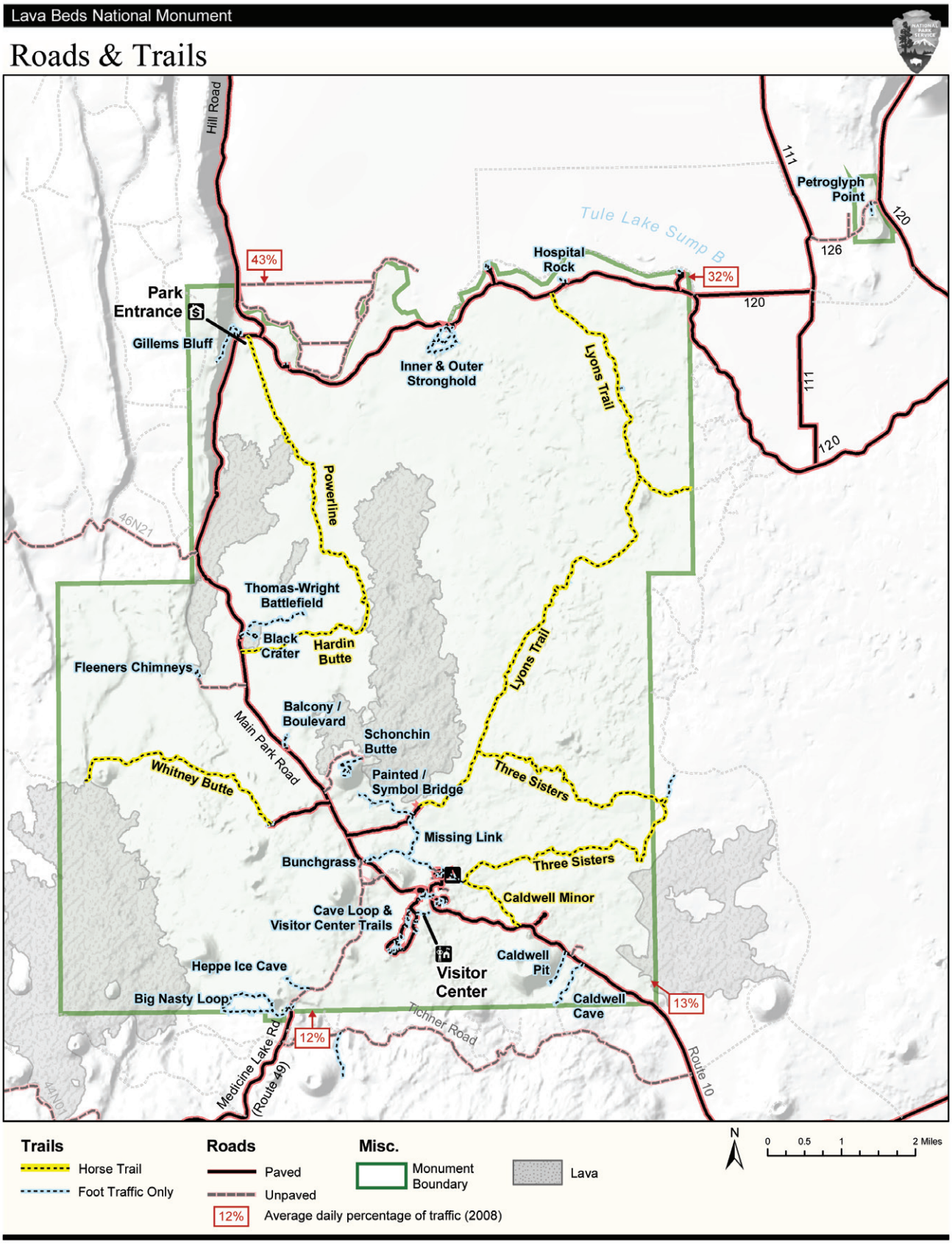
Visitor Use and Opportunities

Access and Circulation

The vast majority of visitors visit Lava Beds National Monument using private or rental automobiles or recreational vehicles (RVs). A smaller percentage of visitors arrive by chartered school or tour bus, and occasionally a rare visitor arrives by touring bicycle. There is no public transit service serving the monument. All of these modes of travel use the monument road system. Lava Bed's road system consists of a north-south trending 20-mile long, paved primary road, with connecting spur roads that lead to various attractions and routes out of the monument. The total mileage of monument roads is approximately 33 miles, of which 28 miles are paved, and all roads are owned and maintained by the National Park Service.

The monument's paved roads are kept open year round. There are four entrances to the monument, two from the north and two from the south. Northern monument entrances are the primary access routes to the monument (75% of visitors). Northeast of the main portion of Lava Beds, the Petroglyph Point section is accessed by the unpaved Modoc County Road 126, which connects with County Road 111 to the west and

MAP 17: ROADS AND TRAILS



County Road 120 to the east. Access from Hill Road from the northwest is the most common access route by monument visitors. Roads that access the northern entrances are paved and in good condition.

The southeastern entrance from Forest Service Route 10 has been deteriorating over time due to a lack of funding for U.S. Forest Service maintenance. On the southwest, the unpaved Medicine Lake Road is kept open during the winter through the monument to the Doorknob Snowmobile Park, which is located approximately 1.5 miles south of the monument boundary. This snow plowing service is paid for by the State of California Off-Highway Vehicle "Green Sticker" program fees. South of that staging area, the Medicine Lake Road (Forest Service Route 49) climbs to over 6,500' in elevation through the Modoc National Forest where it is typically closed by snow between November and late May. The monument trail system generally is not used as a way to access the monument from the outside.

The Lyons Road is maintained as a one lane, primitive "two track" road between the gate on the northern boundary road and 1.8 miles south to the Fern Cave trailhead. A locked gate is maintained at the north end of the road and is closed to general public vehicle traffic. Although the road is passable in a two wheel drive automobile, motor vehicle use is limited to official vehicles and only in the dry seasons as the road can be rutted when wet. Weekly Fern Cave tours drive to the trailhead in a government van from the Hospital Rock parking area during the dry seasons. The remaining two miles of the road leading south connects with a U.S. Forest Service road on the eastern boundary. This section is very rough and passable only for high clearance and short wheel base vehicles. Another locked gate is maintained on the east boundary of Lava Beds. The two mile segment south of the Fern Cave trailhead is used by official vehicles engaged in wildland fire fuels treatment project work on a very infrequent basis (less than once a year). Lyons trail hikers also walk on the road between the Juniper Butte junction and the main gate.

ACCESS HISTORY

Up until the late 1980s the only paved access road leading to the paved internal monument roads was the southeast entrance road (Forest Service Route 10) that connects the monument with Forest Service Route 97 and in turn the community of Tionesta and State Route 139. The 9.9 mile long southeast entrance road between the boundary of Lava Beds and the intersection of Forest Service Route 97 was initially "surfaced" by the NPS in 1965. This surfacing consisted of multiple applications of chip seal surfacing approximately 1-inch thick over a graded base of native soil. Little or no aggregate material was placed under the surfacing to construct a foundation that is typical of a primary paved road. Between 1965 and 1995, the NPS maintained the sections of the road south of the monument under an agreement with the Modoc National Forest. In the 1980s and early 1990s the NPS received inadequate funding to maintain its paved roads, and many roads rapidly deteriorated. Only the most heavily traveled roads or roads with high accident rates received funding for repaving or major maintenance projects. Projects proposed for the southeast entrance road, given it's very low traffic volumes and non-NPS ownership were not funded.

Without funding for proper maintenance treatments, the lack of aggregate foundation, and the thin pavement, the southeast entrance road deteriorated. In 1995, out of concern over the poor conditions of the road pavement, and poor prospects to get future funding, the NPS terminated the agreement with the Modoc National Forest, and turned the responsibility for maintenance back to the U.S. Forest Service. However in the years since 1995, the U.S. Forest Service's financial resources to rehabilitate and maintain roads have proven to be even more inadequate than the NPS' resources. The result is that the road is now in extremely poor condition with large areas of failed and broken up pavement.

Visitor complaints about the road are frequent, and many feel that they should be warned in advance that the road is in such bad condition so that they could choose other routes. The U.S. Forest Service has patched the road on several occasions, and may be able to apply a layer of chip seal surfacing in 2010, but these repairs are stop gaps and will not result in a road surface that will provide a reasonable length of pavement life. The low volume of traffic on the road will always handicap the road when it competes for project funds with other more heavily traveled roads. Modoc County also lacks financial resources to maintain or rehabilitate the road and is not willing to accept ownership or responsibility for the road. The long term prognosis to maintain this road as paved route or to accomplish any major rehabilitation project work is poor.

Around 1989, Modoc County and the NPS paved the Dike Road to provide the first paved access to the northern end of the monument. In 1995, the Siskiyou County road that serves the northwest corner of the monument (Hill Road) was paved. The only remaining unpaved entrance road is the Medicine Lake Road (Forest Service Route 49) that connects the southwest corner of the monument with the Medicine Lake Highlands and in turn, State Route 89 between McCloud and Burney. The majority of Medicine Lake Road between the monument and State Highway 89 is paved.

TRAFFIC VOLUMES

Traffic on the monument's roads is generally light in comparison with other more visited national parks and urban areas. Average Daily Traffic (ADT) on the main monument road can be as low as 25 vehicles on weekdays in the winter months and as high as 350 on summer weekend days. Given these traffic volumes, there are generally no traffic congestion problems. The highest volumes of traffic enter and exit the monument via the Hill Road entrance (48% of total volume) as that is the most direct route to Klamath Falls, followed by the Dike Road entrance on the northeast (25%), followed by the Medicine Lake Road (14% - which is only open as a through route for approximately five months of the year), and lastly by the southeast entrance road (13%). The monument does not keep traffic count data on the Petroglyph Point through road.

ROAD AND PARKING CONDITIONS

The main north-south monument road is generally well designed and constructed with a visually pleasing, smooth alignment and 30- to 50-mph design speeds. The north-south main monument road is 22 to 26-feet in width, thus it is comfortable to drive in all vehicle types. The road also has periodic paved parking areas that allow visitors to pull off and view or visit the monument's attractions. Spur roads are generally narrower (20') and have lower design speed alignments. The parking areas along all of the paved roads are generally separated from the traffic lanes and paved. The capacity of the parking areas is also adequate for the busiest summer months, with the only exception being some of the parking areas on the Cave Loop Road that can fill on busy summer weekends. Most parking areas have pedestrian sidewalks and basic access ramps and or curb cuts for disabled access.

Given the relatively well designed road and low traffic volumes, motor vehicle accidents are rare and when they do occur are, generally, the result of driver error (high speed), inattention, intoxication, or hitting wildlife (primarily deer). In the most recent condition survey of the paved roads of Lava Beds National Monument, the road pavements were found to be in fair and poor condition. This low rating is primarily due to the pavement now being approximately 40 years old, and suffering from rutting in the wheel paths, and extensive thermal (expansion and contraction) cracking of the pavement. Given the age of the pavement, the roads have been well maintained with periodic sealing of the cracks and applications of chip seal surfacing.

FUTURE ROAD IMPROVEMENTS

Sometime during the 20 year life of this general management plan, a project to rehabilitate all of the paved roads and parking areas in the monument by pulverizing the existing pavement and applying new hot mix asphalt pavement over the former roadway will need to occur. The project is designed and awaiting funding.

Another project to realign and pave the Medicine Lake Road within the monument has been partially designed, but design work was halted due to lack of funding and a general National Park Service-wide policy prohibiting adding additional paved road infrastructure. The U.S. Forest Service has long had plans in place to pave and improve the currently unpaved segments of the Medicine Lake Road, but these too have stalled due to the lack of funding.

Accessibility and Special Populations

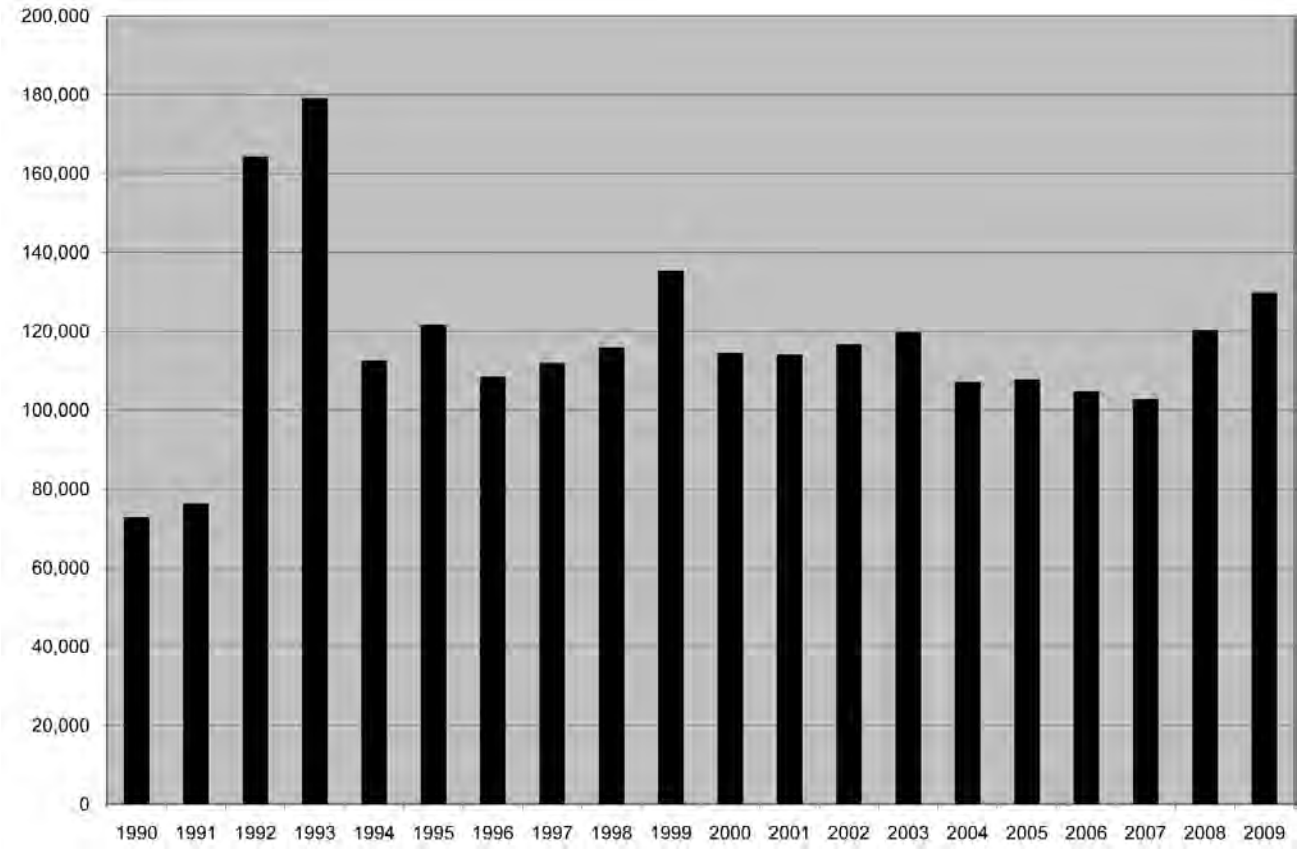
Lava Beds offers limited opportunities for those with impaired hearing, sight, mobility, and cognitive function, as well as people with difficulty understanding English. Some additional accommodations beyond what is currently available at Lava Beds are required. As directed by the standards of the Interpretive Development Program, all interpretive contacts are modified to best meet the physical and cognitive abilities and knowledge base of each visitor to the greatest extent possible.

By the nature of the rugged volcanic terrain, most natural areas of Lava Beds are not easily accessible to visitors with physical impairments, especially cave environments that require steep descents and contain rough lava floors. However, some developed areas offer access to disabled visitors. The visitor center contains exhibits, some bookstore shelving, and a portion of the front desk at wheelchair height. All curbside wayside exhibits and bulletin board displays in the field are located on low-graded pavement with ramps from parking areas. Interpretive programming available to the mobility-impaired includes evening slide programs and porch talks at the visitor center. Some easier caves and relatively level, short hiking trails may be accessible for those with mild mobility impairment, including ranger guided interpretive programs offered in these locations. One self guided trail at Petroglyph Point travels along a level, relatively smooth natural rock surface, which may be accessible to some using wheelchairs. Additional visitor services such as accessible campsites, restrooms, and picnic sites are also available throughout the monument, though all doors must be manually opened.

Although the exhibits in the Lava Beds Visitor Center include many tactile displays and audio stations of benefit to the hearing impaired, there are currently no assistive materials in Braille. Generally, a severely sight-impaired visitor would need assistance from a sighted person to fully experience the exhibits. This is especially true of all non-personal interpretive services outside the visitor center such as wayside exhibits, bulletin boards, and site bulletins, which depend entirely on written material. The 15-minute introductory video, though it includes audio narration, also lacks an audio description track (an additional track which describes the visual content of video programs, typically listened to on a headset). Additionally, the website lacks an audio component to narrate its written content. Generally, a sight-impaired person could independently enjoy the orally-presented portion of a stationary interpretive program such as an evening slide program or porch talk, but may need assistance from another person to attend a guided cave tour or other guided walk of appropriate difficulty.

All written interpretive materials throughout the monument and on the Internet are of benefit to the hearing-impaired that can read. However, NPS standards encourage sites to include assistive listening devices (headsets that narrate audio-visual programming at increased volume) as well as provide interpreters fluent in sign language. Currently, neither of these

FIGURE 1: ANNUAL VISITATION (RECREATION VISITS)



services is available, and personal communication with hearing-impaired visitors occurs either through writing or a companion who can sign.

Lava Beds strives to provide appropriate informal interpretation to cognitively-impaired adults. Sometimes these visitors enjoy participating in the Junior Ranger program. Lava Beds also receives moderate visitation from those who are not fluent in English. Though many visitors speak English as a second language, Lava Beds particularly receives visitors that sometimes struggle with services in English: Spanish speakers from the local area, and Asian-Americans on tour buses from the San Francisco area (typically speaking Cantonese or Mandarin). Recently, monument staff has made an effort to provide interpretation in a number of languages, including Spanish, Chinese, Japanese, German, and French.

Monument Visitation

OVERVIEW

The National Park Service reports visitor use as recreation visits. A recreation visit is one person entering a park for any part of a day for the purpose of recreation. One person may be counted as a "visit" more than once if he/she enters the park at more than one location. Thus we use the term "recreation visit."

VISITATION

During the 1990s the average annual recreation visits to Lava Beds National Monument were approximately 120,000 people. In the 2000s, the average annual recreation visits were slightly lower (6%) at about 112,000. Visitation has remained relatively low for most of the 2000s, ranging from a low of about 102,000 visitors in 2000 to a high of 130,000 visitors in 2009. Figure 1 shows the total annual recreation visits for Lava Beds from 1990-2009. Note that the high visitation spikes in the early 1990s were due to non-recreational traffic associated with a nearby construction project. On a monthly basis most visits occur from June through September with July and August receiving the highest number of visitors.

VISITOR SURVEY PROJECT

In 2007, a Visitor Survey Project was completed for Lava Beds National Monument. The visitor survey provided important information on visitor demographics and patterns and identified visitor concerns and suggestions for future planning. A total of 340 questionnaires were distributed to visitor groups. Of those, 223 questionnaires were returned resulting in a 65.6% response rate. The survey was conducted in May and June, over a holiday weekend, and may not be characterisitic of the rest of the season.

Demographics

United States visitors were from California (47%), Oregon (26%), Washington (8%), and the remaining from 18 other states. International visitors were from 13 countries and comprised 9% of total visitation to the monument during the survey period. Of the international visitors that completed the survey, 25% were from Germany and 15% were from the United Kingdom.

Of the visitors surveyed, the majority were part of a group of two or more. Fifty-one percent of visitors surveyed were in groups of two and 16% were in groups of five or more. The survey indicated that many of the visitors travel together with their family. Of the visitors that described themselves as part of a group, 66% defined their group as family, while 18% described their group as friends.

Seventy-three percent of visitors visited the monument for the first time, while 37% had visited two or more times. Prior to their visit, most groups obtained information about Lava Beds National Monument through maps and brochures (44%), the monument website (41%), and friends/relatives/word of mouth. Nine percent of visitor groups did not obtain any information about the monument prior to their visit.

Length of Stay/Lodging

Of those visitor groups who spent less than 24 hours at the monument, 33% percent stayed up to six hours. Of those that spent more than 24 hours in the monument, 41% stayed for two days. The average length of stay was 14.4 hours. This length of stay is quite long when compared to the length of stay for visitors to many other national park units. The majority of visitors surveyed (82%) stayed in the monument campground, and 71% stayed in a lodge, hotel, motel, or cabin outside the monument.

Most visitor groups (95%) were able to obtain needed support services from communities in the area (within

60 miles of the monument). Over one-half (60%) obtained services in Klamath Falls. The average group expenditure within and outside the monument was $206 with a median (50% paid more and 50% paid less) of $113. Average total expenditure per person was $71.

Visitor Services

Most visitor groups (93%) rated the overall quality of services, facilities, and recreational opportunities at Lava Beds National Monument as "very good" or "good." Less than 1% of visitor groups rated the overall quality as "very poor" or "poor." The most used services/facilities by survey respondents were the restrooms (91%), the visitor center (91%), and the monument brochure/map (90%). The services/facilities that received the highest combined proportions of "extremely important" and "very important" ratings included campgrounds (92%) and restrooms (90%). The services/facilities that received the highest combined proportions of "very good" and "good" quality ratings were assistance from monument staff (93%) and the visitor center (93%).

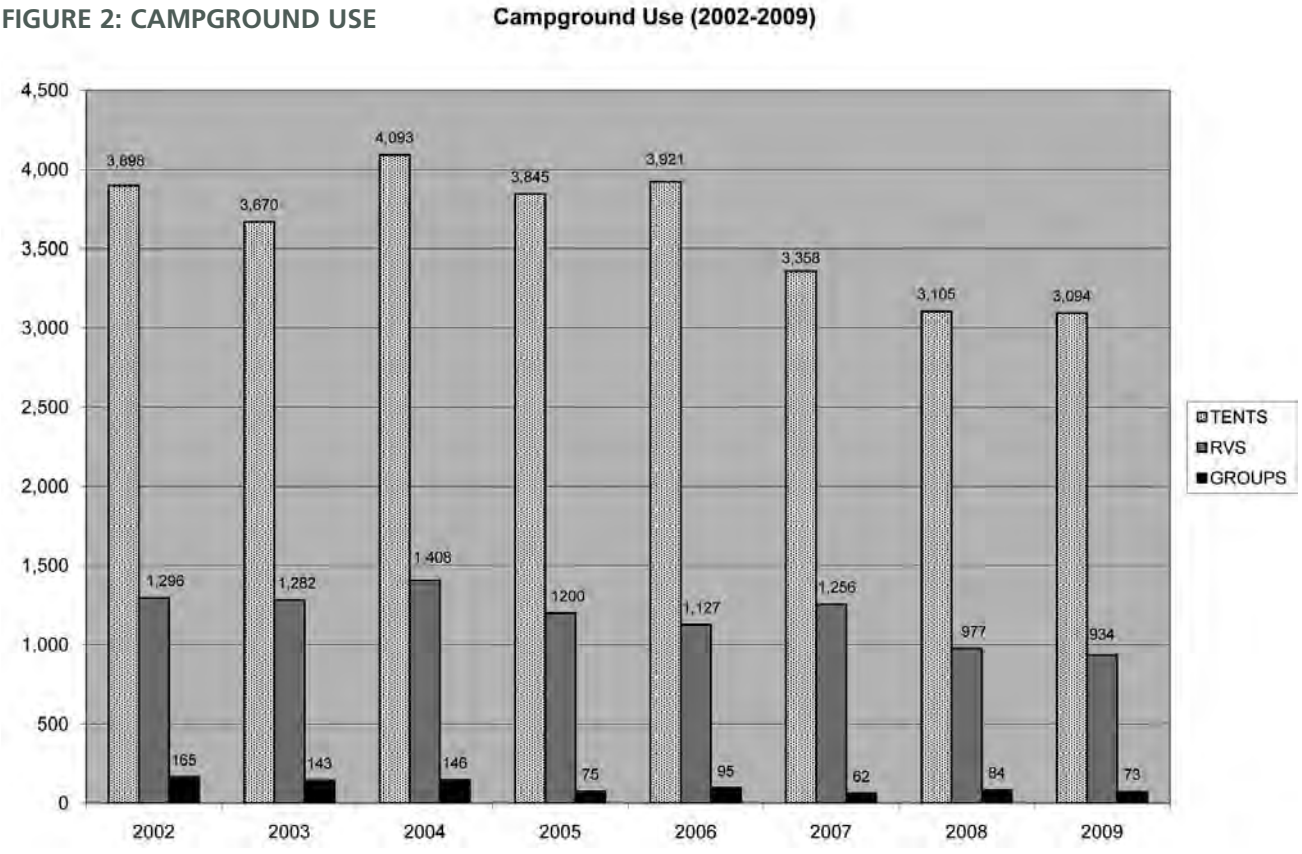
Suggestions for Future Planning

The visitor questionnaire included the question, "If you were planning for the future of Lava Beds National Monument, what would you propose?" The most commonly proposed suggestion was improving regional information for the monument. Visitors desire more directional signage when entering the monument, and many would like more information and advertising about the monument to be available in the region. More overnight accommodations in the area are also desired.

Improvements to southern access roads were suggested by many of the respondents, including repaving the southeastern entry road and paving the Medicine Lake Road. Aside from road improvements, campground improvements and requests for new overnight accommodations were the most common type of facility improvements requested.

Survey respondents would like to see more information/interpretation about the monument resources. This includes more information on history, geology, Modoc culture, Japanese internment camps, and viewing night skies. Better guides and information for caving activities were also common requests.

FIGURE 2: CAMPGROUND USE



While many suggestions for changes were provided by the survey respondents, a number of the respondents would rather see the monument stay the same. Visitors like that the monument is undeveloped -"not like Yosemite." These visitors appreciate solitude and the un-crowded conditions. They do not want to see more development or new facilities.

OVERNIGHT STAYS

Visitors that stay overnight at Lava Beds typically stay at the Indian Well campground, a historic campground built by the Civilian Conservation Corps and later expanded under the Mission 66 program. Most overnight stays are tent campers. However, RVs also stay overnight at the Indian Well campground. Since 2002, RV overnight stays have comprised approximately 25% of campground visits. Figure 2 depicts the distribution of overnight stays in the campground from 2002-2009.

A very small number of visitors stay overnight in the monument's backcountry. The monument has seen an average of 26 overnight stays in the backcountry annually over the past decade. This small number is typical for the monument. Often the monument has gone several years without any overnight camping in the backcountry. In 1991, the monument had over 200 overnight stays in the backcountry. This appears to be an anomaly in the overall trends for backcountry overnight stays at Lava Beds.



Student Conservation Association intern leading a cave tour, *NPS Photo*

VISITOR CENTER USAGE

Visitor Center visitation has averaged over 41,000 annually since 1992 (measured by door counts). A downward trend in the 1990s seems to have been reversing since 2003, with FY2006 visits reaching almost 46,000. Visitor center visitation also varies greatly throughout the year. Peak visitation occurs in July and August with an average of 290 visits per day (with approximately double that amount on holiday weekends), and reaches its lowest point in December and January with an average of 16 visits per day. Moderate visitation extends well into the shoulder seasons, from early May into mid-October, especially in years with mild spring and fall weather and when multiple school classes are visiting. The extensive assistance most visitors need in order to cave safely on their own increases the amount of time necessary per visitor contact, and consequently the number of interpreters necessary to adequately staff the visitor center.

FEE COLLECTION

Lava Beds National Monument began collecting entrance fees in 1996 under the Recreational Fee Demonstration legislation (camping fees have been collected for decades). In 2005, this temporary authorizing legislation was replaced by the Federal Lands Recreation Enhancement Act. The current seven-day entry fee to Lava Beds National Monument is $10 per vehicle and the joint Lava Beds / Crater Lake annual pass is $20. Eighty percent of the fees collected at Lava Beds (averaging approximately $108,000 annually) stay within the monument to fund improvements that will directly benefit visitors. The current entrance station, completed in 2006, is located on the main monument road near the northwest entrance. Entrance station staff collect monument fees, sell passes, and provide information and brochures to incoming visitors. The entrance station is open during weekends in spring and fall, and seven days per week from Memorial Day weekend to Labor Day. Fees are collected in honor boxes (pipe safes) near and inside the visitor center in the off season when the entrance station is closed.

EDUCATION

The ability of Lava Beds National Monument to provide curriculum-based services for education groups has fluctuated considerably over the past decade, in correlation with frequent staff turnover and the urgency of other divisional priorities. At current staffing levels, the equivalent of one-third of one full-time position is dedicated to the Education Program each year by an interpretive staff that is also responsible for a wide range of other duties. The materials and programs now offered successfully present some subjects for students in a limited grade

range, but services addressing other significant subjects and geared towards other grades are not available.

The use of loan materials accounts for a significant portion of educational contacts made by Lava Beds National Monument each year. The five traveling education trunks currently available were developed to meet Oregon and California history, earth science, and life science curriculum standards generally for 3rd through 6th grades, and address volcanic geology, cultural history of the area, and the ecology of local birds, bats, and the monument's caves. These kits contain activities, lesson plans, hands-on materials, and audio-visual media to be used by teachers in the classroom. Most teachers use the trunks to prepare for a field trip to the monument, but they are occasionally requested for post-visit activities or by groups that are not able to make an on-site visit. Recent updates have made the trunks more suitable for these multiple uses, as well as aligning them with current curriculum standards and research.

The four on-site ranger-led programs currently available address volcanic geology, cultural history, and fire ecology at 4th-through-6th-grade levels. These programs are intended to continue the learning process begun in the classroom, which ideally has made use of the traveling education trunks. The two available geology programs—a slide show in Mushpot Cave and a tour of Valentine Cave—tell the story of the Medicine Lake shield volcano and lava tube caves from inside a cave, and also introduce caving ethics to ensure safety and resource preservation. A guided walk through Captain Jacks Stronghold addresses the points of view of all participants in the Modoc War, reinforced by traveling through a landscape where two battles actually happened. A new fire ecology program developed in 2010 also introduces students to the ecological effects of a wildfire that occurred in the monument's grasslands in 2008 as well as the challenges of land management to meet multiple natural and human goals. Occasionally teachers and other group leaders request ranger-led programs on other topics and at other sites. With current staffing levels, these program requests cannot always be met and generally with inappropriate ranger-to-visitor numbers. All ranger-led programs contain a stewardship message and encourage awareness of the mission of the National Park Service.

Teachers are involved to a limited degree in the development and update of educational services at Lava Beds. Traveling trunks include feedback forms, and teachers have an opportunity to give feedback after ranger-led programs. Two lightly attended Teacher Workshops held at the monument in fall 2005 and spring 2010 invited teachers to become more familiar with available materials, provide feedback for updates, and comment on future needs. In-classroom programs and the meetings with teachers that precede them have also increased local teacher knowledge of the resources and programs offered at Lava Beds. Despite these attempts, teacher involvement in the Lava Beds Education Program is well below expectations set by Director's Order #6 and the Centennial Renaissance Action Plan. Increasing efforts in this area would greatly benefit teachers, students, and the monument.

While the Lava Beds Education Program provides high-quality services in some areas, further development is needed to bring the program up to National Park Service standards and meet public demand. NPS standards for education programs include a pre-visit lesson, on-site activity, and post-visit reinforcement of learning, all designed to support state curriculum standards; as well as learning based in student inquiry and direct experience as opposed to teacher- or ranger-directed lessons. Although inquiry-based learning is beginning to be incorporated into programs and materials, very few classes complete a pre-visit lesson with a ranger or teacher, attend an on-site program with a ranger, and complete a post-visit lesson with a ranger or teacher. Approximately 45 percent of visiting students are in the age range served by current education services; Lava Beds has the staffing and material resources to provide about half of these students with loan materials or a ranger-led program. In order to reach the three-quarters of visiting students that are not currently served, it is necessary to increase program availability, develop services for other age groups, and expand the range of topics covered. Encouraging more significant teacher involvement and providing more in-school programs would round out the education program, making Lava Beds resources more widely available and creating a larger role for the monument as an education partner in area communities. Increased staffing devoted exclusively to the Education Program is necessary to begin making this transition.

INTERPRETATION

INTERPRETIVE PLANNING

Interpretive staff has worked to plan and achieve several long-range goals over the past 10 years including training, auditing, and encouraging the submission of interpretive products to national Interpretive Development Program standards; expanding and retooling education services based on both Oregon and California curriculum standards; revising site bulletins, bulletin boards, and website content in line with new themes and interpretive writing standards.

VISITOR CENTER/ INFORMAL INTERPRETIVE CONTACTS

The current Lava Beds Visitor Center was constructed in 2004 to replace a much smaller facility. It is open every day except Christmas, with slightly extended hours during the summer season. Though located in the southern part of the monument, most visitors interested in caving make the visitor center one of their first stops in order to obtain the necessary information and equipment. Services offered include: personal assistance at the desk; availability of maps, site bulletins, and information about Lava Beds and surrounding attractions; daily loans of flashlights for self-guided caving; museum exhibits that adequately cover the majority of the monument's primary interpretive themes and are inclusive of audio stations, a computer program, and tactile items; and a 15-minute video covering several interpretive themes and wayfinding information. Most incoming public phone calls as well as inquiries via mail and e-mail are also handled by visitor center staff. In addition, the visitor center houses a small Lava Beds Natural History Association outlet that sells educational items as well as convenience items such as snacks and protective equipment for caving, since there are no concession services available in the monument.



Cave tour *NPS Graphic*

Visitor satisfaction with the new visitor center has averaged a 95 percent rating of "very good" or "good." Visitor satisfaction with assistance from monument employees, the majority of which occurs in the visitor center, has also remained high, averaging a 96 percent rating of "very good" or "good" since 1999. Additional informal interpretive contacts occur daily in summer, and on weekends in spring and fall, at the fee booth in the northwest corner of the monument. Park interpretive staff also performs limited roving interpretation throughout the monument, primarily during summer weekends.

INTERPRETIVE PROGRAMS

In the past few years, permanent staff have striven to train, coach, and audit all formal interpretive programs to the professional standards of the NPS Interpretive Development Program, including encouraging the submission of programs for national certification. This provides greater opportunities for a wider range of visitors to connect both intellectually and emotionally to the meanings of Lava Beds' many and varied resources, in accordance with national standards for interpretation.

Interpretive programming is focused on the summer season. In summer, evening programs are offered in the monument's campground amphitheater. These programs allow a more in-depth look at the monument's diverse interpretive themes, and can greatly enhance the depth of visitor understanding and appreciation. Ranger-guided cave tours are also currently offered to a different developed cave daily in summer, and provide a safer and more interpretive experience of the monument's geology than self-guided tours. These tours vary widely in difficulty level to meet the needs of a variety of visitors, as well as public demand for ranger-guided tours for those not comfortable caving on their own. Additionally, guided walks through natural and historical areas and porch talks on a variety of monument interpretive themes are offered in summer as staffing allows. Though these types of programs are sometimes sparsely attended at sites in the south end of the monument, there is currently not enough flexibility in summer staffing to offer frequent summer walks and talks at popular sites in the north end of the monument, particularly at Petroglyph Point.

In general, evening programs are very well attended by percentage of visitors camping in the campground, and participants could be easily garnered for additional ranger-guided cave tours if staffing levels allowed. There is also demand for ranger-guided programs from non-school based groups (such as Scouts and church groups) visiting the monument throughout the year, and these are able to be occasionally arranged only as staffing permits.

Several special resource cave tours are also offered to caves that are otherwise not accessible to the public. Currently, this includes once weekly tours of Crystal Ice Cave early December through late March, and once-weekly tours of Fern Cave mid-May through late October. Due to the sensitivity of the cave environments, difficult caving, and/or sensitivity of the interpretive material, these tours are only led by permanent interpretive staff. Concerns in Crystal Cave include human impact on a delicate meteorological environment that sustains year-round ice formations, and having a small enough number of tour participants for one ranger to guide and coach them safely through challenging sections. Concerns in Fern Cave include human impact on, and balanced interpretation of, a sensitive cultural environment. The monument has also received numerous formal and individual comments against public ranger-guided tours of Fern Cave from members of the Klamath Tribes due to its cultural significance. However, the monument currently receives far more public demand than it can meet for tours to these two, and/or additional closed special resource caves, since only six participants are permitted per once-weekly tour.

The monument conducts a year-round Junior Ranger program for children between 5 and 13 years of age via a self-conducted Adventure Book that is reviewed with an interpretive ranger for a small award. Additionally, the monument offers a ranger-guided Junior Firefighter program and a Junior Lookout program which can be completed by hiking to the fire lookout and completing a questionnaire about fire and fire management.



Interpretive Display *NPS Graphic*

The number of visitors attending formal interpretive programs at Lava Beds has varied greatly over the last eight years for which there is accurate data. The highest number of participants in formal programming occurred in 1999, with 7002 participants, or approximately 19% of those visiting the visitor center (5.2% of total monument visitation). The lowest participation occurred in 2004, with 2194 visitors attending a formal program, or about 5.5% of those visiting the visitor center (2.1% of total monument visitation). This wide fluctuation can be explained by the small size of permanent interpretive staff and the reliance on volunteer and other labor through internship programs, particularly the Student Conservation Association. The dependence on seasonal staff consumes a significant amount of permanent interpreters' time to train and coach to professional standards, while still being able to complete off-season projects, ensure daily visitor center coverage, and meet in-monument and national collateral duty contributions. Over the past few years, this trend has been somewhat alleviated, however, by the addition of several uniformed seasonal interpretive staff through the NPS Centennial program funding.

NON-PERSONAL SERVICES: EXHIBITS, TRAIL GUIDES, PUBLICATIONS, AND PARK WEBSITE

The wide variety of natural and cultural resources and interpretive themes at Lava Beds dictates a need for a great number and diversity of exhibits, publications, and web pages. Visitors often arrive at the monument unaware of the diversity of resources and visitor experiences offered here.

Lava Beds has approximately 40 wayside exhibits (large interpretive panels with graphics) in addition to smaller interpretive and informational signs in the field. Most are set into a base made of native lava rock, which is a distinctive and attractive style for the Lava Beds landscape. However, many of these wayside bases are now in fair to poor repair. Interpretive content covers mainly geologic features and historic events of the Modoc War, though other panels touch upon pre-war cultural history (such as rock art), monument

wildlife and vegetation communities, air quality, and 20th century history. Smaller signs identify rock and vegetation types outdoors and lava tube features inside Mushpot, the monument's one lighted and interpreted cave.

The last comprehensive wayside exhibit plan was completed in 1981, and until recently, the majority of the monument's waysides were replacement copies of panels designed and installed in 1987. However, significant updates and additions have been made in recent years, such as a complete redo of 16 geologic science panels, and eight panels at Modoc War sites to more interpretively tell the story of both sides. Limiting factors in wayside exhibit replacement include difficulty obtaining project funding for large-scale panel replacements in a competitive funding environment, and ensuring adequate off-season professional staff are available to facilitate panel design.

The monument currently provides three self-guided trails with brochures: Captain Jacks Stronghold, Petroglyph Point, and Gillems Camp (added in 2006). All are at least somewhat interpretive in style, partially fill in the gap created by a scarcity of personal interpretive programming offered in the north end of the monument, and are quite popular.

Lava Beds currently makes 26 site bulletins (specialty brochures providing in-depth interpretation of a subject) available to the visiting and non-visiting public. These range from basic information about self-guided caves and above ground sights to see, to in-depth historic and geologic background information and interpretation. Site bulletins must constantly be updated and added to in order to meet a variety of visitor interests. The range of site bulletins currently available offers additional detailed informational resources, above standard visitor contacts at visitor center or interpretive programs. All printing costs are covered by donations from the Lava Beds Natural History Association.

The Lava Beds website offers visitor information, interpretation, maps, a webcam at the visitor center, and contact information. In recent years, the monument has received up to six times as many "virtual visitors" annually than in-person visits to the visitor center. In-person visits to the monument can be greatly enhanced by a visit to the website.

In general, the monument provides a great variety of important non-personal services. More comprehensive planning, funding, and staffing is needed, however, to fully address all the monument's interpretive themes. Homesteading and other early historical activities in the monument, caving ethics and equipment, and scientific resource study and management remain among the subjects inadequately covered by non-personal services.

SPECIAL EVENTS, INTERPRETIVE PARTNERS, AND COMMUNITY OUTREACH PROGRAMS

Although Lava Beds is not able to meet all community demands for participation in special events, fairs, and community meetings, there is currently significant special in-monument and out-of-monument programming and participation for a monument of relatively small size.

The largest in-monument special event, the Timeline living history event, occurs in May. This two-day event brings historic re-enactors from local groups, monument staff, and tribal representatives together to operate stations throughout the monument where visitors can explore "stops in time" from different eras of Lava Beds' history. Typically one day is open to visiting local school classes, and a second for the general public. This event receives excellent reviews for the ability to experience Lava Beds history first-hand on the landscape where it happened. Lava Beds has also hosted a Junior Ranger Day each summer, with special resource-related craft activities for kids.

The largest out-of-monument special event that garners annual participation from Lava Beds staff is the Tulelake-Butte Valley Fair in September. This includes staffing a very busy booth for four days, with monument-related exhibits, videos, and children's activities. This event promotes enormous knowledge about, and support for, the monument among the local population. Volunteers and staff from other divisions support booth staffing, as well as design and display of a Lava Beds float in the fair's parade. In recent years, Lava Beds National Monument staff has also offered courses both in and out of the monument to participants in the annual Winter Wings Festival, a locally-organized event celebrating the migratory birds of the Klamath Basin. In addition to these annual events, the monument maintains a year-round display inside the historical museum at the fairgrounds. In recent years, Lava Beds has also sent unstaffed displays to several other fair-style community events, such as the Merrill Potato Festival and the Horse Packers' Clinic in Klamath Falls.

Personal contacts at these and other community-based events would certainly increase local support for the monument. Several new bulletin board panels are also maintained in the towns of Merrill, OR and Tulelake, CA to garner local and tourist interest in visiting Lava Beds.

Lava Beds staff also support other requests for outreach presentations and displays as staff is available. These have included a scholarly article and associated slide presentation for the Shaw Historical Library of the Oregon Institute of Technology in Klamath Falls, events for International Migratory Bird Day, the Tulelake Migratory Bird Festival (coordinated by the Klamath Basin National Wildlife Refuges and the Klamath Basin Wildlife Refuge Association), and National Parks Day at the Science Center in Ashland, OR and Fort Vancouver National Historic Site in Vancouver, WA.



Swans at Tule Lake National Wildlife Refuge
Photo by Dave Menke

Lava Beds does participate with local public, private, and non-profit partners. These include attendance at local meetings of Rotary International, the Answer People (a group supporting tourism in the Klamath Basin), and the Volcanic Legacy National Scenic Byway (part of which runs through Lava Beds), as well as liaison to the Lava Beds Natural History Association.

While the Tule Lake National Wildlife Refuge and Modoc National Forest have contiguous ecosystems with Lava Beds on both the north and south boundaries and much potential crossover in interpreting geology and ecology, interpretive staff coordination is limited by the staffing levels, time constraints, and funding potentials within all three agencies. Monument interpretive staff has coordinated seasonal training sessions and participation in the Timeline living history event in recent years with representatives of the Klamath Tribes (of which one Modoc band is a part). However, there is significant opportunity to work with the tribes on a more extensive level in order to present a tribal perspective in interpretive programming and non-personal interpretation. This could also include personal services presented at the monument by tribal members themselves, as NPS staff members and/or at additional special events or programs. Limited coordination has also occurred in the past with the Klamath County Parks on historical special events.

Monument staff participates in a moderate number of in-park and community outreach activities, but there is considerable room to grow to meet demand and increase local support. This important "third foundation" of interpretation (along with visitor and education services) should continue to expand in the future, especially in coordination with neighboring agencies and tribes to bolster a perspective that supports both the ecological and sociological continuity of the Klamath Basin's people and lands.

Recreational Opportunities

Lava Beds provides a variety of visitor recreational opportunities both above and below ground. Main attractions include Modoc War historic sites and lava tube caves. A variety of visitor facilities including a visitor center, surface trails, cave trails, roadside pull-outs and overlooks, and a campground are available to monument visitors. The following section describes the major recreational opportunities.

VISITOR CENTER AREA

Exhibits and audio-visual displays inside the visitor center's museum, as well as personal contact with interpretive staff, provide visitors with the opportunity to plan their visit and learn about regional geology, high desert ecology, Modoc culture, the Modoc War, rock art, lava tube caves, and other topics. Mushpot Cave is located walking distance from the visitor center and provides an introductory caving experience for most visitors. It features lights, a paved trail, and interpretive displays.

CAVE EXPLORATION

Cave exploration is the most popular recreational activity at Lava Beds. Twenty-five lava tube caves contain various levels of development from entrance ladders to cleared trails, while hundreds more are open to exploration in the monument's backcountry. Difficulty levels also vary widely. With the exception of a few seasonal closures to protect sensitive resources and Cave Loop's nightly closure to vehicle access, Lava Beds' caves are open year round for visitors to explore on their own.

HIKING TRAILS

There are 13 hiking trails within Lava Beds. Many trails are relatively short and level and lead to historic sites, geologic features, rock art, or wildlife viewing areas. Three of the monument's trails range from 3.3 to 8.1 miles in length and provide a more immersive experience in a high desert wilderness environment.

WILDERNESS

More than half of the monument is designated wilderness. Lava Beds provides an opportunity to experience the opposite of civilization and progress, and encounter untamed wildlife and rugged landscapes. Backcountry camping is permitted at Lava Beds, as is horse use on longer trails. Overall backcountry usage is quite low, providing a place to experience solitude.

WILDLIFE AND LANDSCAPE VIEWING / PHOTOGRAPHY / SCENIC TOURING

Many visitors come to view and photograph wildlife at Lava Beds, especially birds. A great variety of waterfowl are visible at the north end of the monument which overlooks Tule Lake National Wildlife Refuge. Mule deer, bats, and many other mammals large and small, reptiles, and a variety of upland birds are also visible throughout the monument. Scenic views of Ponderosa pine, juniper woodlands, sagebrush, and grassland habitats, as well as adjacent wetlands, are abundant from overlooks accessible both by vehicle and by relatively short trails. Photography is also popular in and around the monument's caves and other geologic features.

MODOC WAR HISTORIC SITES

The majority of the battle and camp sites associated with the Modoc War of 1872-1873 can be explored at Lava Beds. These historic sites provide a personal experience of how the Modoc Indians used the geologic features of their homeland to their tactical advantage.

INDIAN WELL CAMPGROUND

Lava Beds' 42-site historic campground is used by both tent campers and recreational vehicle users, although no RV hook-ups are provided. A group site is also available. The campground area provides excellent scenic views, and low usage during the off-season affords a relatively solitary camping experience.

REGIONAL RECREATIONAL OPPORTUNITIES

Regional recreational facilities and outdoor opportunities complement or directly relate to the recreational visitor experience of Lava Beds National Monument in terms of education, environment, and enjoyment.

Tule Lake National Wildlife Refuge, part of the Klamath Basin National Wildlife Refuges, encompasses 39,116 acres and borders Lava Beds to the north. This refuge, managed by the Fish and Wildlife Service, provides a variety of recreational opportunities including a 10-mile wildlife observation route, waterfowl hunting, canoe trails, and photography blinds.

The Emigrant Trail Scenic Byway begins in New Pine Creek, OR and ends in Tulelake, CA. This culturally significant route guides visitors past lakes, mountain peaks, deep canyons, lava flows, and wide-open meadows.

The Applegate Immigrant Trail, part of the California Trail, was a major overland route used by farmers to reach homesteading areas in the mid 19th century. It is now a historic driving route with wayside exhibits.

The Modoc Volcanic Scenic Byway leads travelers 120 miles through a volcanic area in Northeastern California unrivaled in North America for its volcanic features. The north end of the Byway sits near the California/Oregon border, travels south through Lava Beds National Monument and ends in McCloud, CA.

The Medicine Lake Highlands, located 17 miles south of the monument in the Modoc National Forest, were formed with the development of a broad shield volcano approximately 20 miles in diameter-the largest in North America. Medicine Lake is a popular camping, sightseeing, exploring, swimming, fishing, water-skiing and photography site. The lake and surrounding areas

continue to have cultural and spiritual significance to people of Modoc descent and others.

Glass Mountain, located 30 miles south of Lava Beds, is a monolith devoid of vegetation reaching to 7,622 feet, the highest elevation of any lava flow in the Medicine Lake Highlands. Formed through the accumulation of three independent lava flows, the area displays a great mass of volcanic extrusion and a wide variety of obsidian, pumice, and minerals. Visitation to the area is generally confined to the exterior because of the rough, rugged lava terrain.

Door Knob Sno-Park is located eight miles south of Lava Beds on Highway 49. The snow-park provides basic accommodations and 31 miles of groomed snowmobile trails.

WWII Valor in the Pacific National Monument, Tule Lake Unit.

Tule Lake became part of a national monument along with other units in Hawaii and Alaska by Presidential Proclamation in December 2008. Tule Lake includes sites in the Tule Lake Basin where Japanese Americans were incarcerated during WWII. An interim visitor center has been established for the new monument at the Tulelake-Butte Valley Fairgrounds Museum. The sites may be visited on guided tours that are offered in the summer season and by request during the off seasons. Planning for the future of the new monument began in 2010.

Facilities and Asset Management

Park Infrastructure and Facilities

The monument's infrastructure is in relatively good condition. In the Indian Well area, the visitor center is newly constructed (2004) and water and sewer systems were both rehabilitated in mid-1990s. The monument electrical system which was placed underground in the mid-1980s is owned by the utility company, PacificCorp and in good condition. Employee housing is also in good condition although the larger family size 3-bedroom houses are poorly suited to current demographics of monument staff, primarily single employees' with no children. The other employee work spaces (headquarters, maintenance shops, and fire cache) are in good condition. All office and work spaces are currently being utilized, so any new employee offices may need to be located outside of the monument.

Asset Management

The Asset Business Plan (ABP) has been developed to help national parks better understand and manage their assets. Using the data on 'industry standard assets' (includes roads, trails, campgrounds, buildings, housing, water systems, and waste water systems) from the Facility Management Software System (FMSS), the ABP is a subsection of the larger Park Asset Management Plan (PAMP). The ABP allows managers to review their inventories, conduct analyses, and document requirements for operating and sustaining their portfolio of assets. This process supports budget formulation and is the first step in determining which resources are required to bring the portfolio of assets up to an acceptable condition and properly sustain it over time.

All of the monument's built assets have been prioritized through the use of the Asset Priority Index (API). API is a key element to improving the management of a large portfolio of assets. Understanding the relative importance of assets enables leadership to make critical budgetary and programmatic decisions, putting often scarce resources to their best use. The NPS API ranks assets on a low-to-high scale ranging from 0 to 100. A lower API indicates the asset's contribution is less significant in relation to accomplishing the mission of the monument. Conversely a high API indicates that the asset contributes significantly to the mission of a national park unit.

The Facility Condition Index (FCI) is a simple measurement of a facility's relative condition at a particular point in time. The FCI uses a numeric rating system to rank assets. Dividing the collective value of all deficiencies (deferred maintenance) by the Current Replacement Value (CRV) provides the FCI. The calculated FCI is recorded within to document an asset's relative condition. Using the API and FCI together, park managers can begin to identify their highest priority

assets that are in the worst condition by plotting the API and FCI.

As of 2006, Lava Beds National Monument has a total of 183 assets, with a total monument Facility Condition Index of 0.193, and with an average Asset Priority Index value of 64.07, indicating that facilities are primarily in good condition.

Park Operations

Park Divisions and Staffing

ADMINISTRATION

The Administration Division manages and provides general oversight for all monument administrative programs including budget, finance, payroll, Government Performance and Results Act, human resources, uniforms, property, travel, safety, communications, contracting, procurement and housing. The Administration Division currently consists of 3.0 full-time equivalent staff (FTEs) including the superintendent.

RESOURCE MANAGEMENT

The Resource Management Division manages the monument's natural, cultural, historical and archeological resources and is responsible for planning and implementing short-term and long-term projects to enhance these resources. Resource Management staff monitor wildlife, nonnative populations, ice levels in caves, and air quality. Provides information technology, geographic information systems, photography and telephone support for the monument.

The Fire Management Program provides overall direction, with scientific and specialized expertise, for the monuments' fire management program, which includes managing both prescribed and wildland fire. Fire management staff develop, plan, integrate and apply fire science methods and practices into the total program, both at the planning and operational levels. Lava Beds National Monument is unusual in that it also hosts a NPS/U.S. Forest Service (Modoc National Forest) interagency wildland fire engine and crew. In addition to the interagency engine, there is a high degree of shared fire staff resources with the U.S. Forest Service, U.S. Fish and Wildlife Service, and other National Park units in Northern California and Southern Oregon.

Currently, the Fire Management Division consists of six FTE including the Fire Management Officer (FMO) which also serves as the FMO for Oregon Caves National Monument. These positions are not funded out of the monument's base budget.

Currently the Resource Management Division consists of 3.85 FTE of which three are permanent employees and the remainder are seasonal, term or student intern/volunteer employees.

FACILITIES MANAGEMENT (MAINTENANCE)

The Facilities Management Division manages the day-to-day maintenance needs of the monument, serving both employee and visitor facilities. This division is responsible for planning, formulating, implementing, and tracking maintenance projects, as well as develop-

TABLE 15: MONUMENT FUNDING

MONUMENT FUNDING	
Fiscal Year (FY)	**Monument Funding (ONPS)**
FY2009	$1,922,000 plus an additional $300,000 for fire program base positions.*
FY2008	$1,701,000
FY2007	$1,578,000
FY2006	$1,505,000
FY2005	$1,450,000
FY2004	$1,120,000
FY2003	$1,117,000
FY2002	$1,122,000
FY2001	$1,085,000
FY2000	$1,048,000
FY1999	$1,021,000
FY1998	$939,000
FY1997	$886,000
FY1996	$682,000
*Does not include project funding which can range from several hundred thousand to several million dollars per year. Source: All figures derived from the SALT table in FFS 2009	

ing long range planning budgets for Cyclic Maintenance Repair/Rehabilitation and Construction Programs.

Currently the Maintenance Division consists of 7.09 FTE, of which three are permanent, full time employees. Three are permanent, less than full time employees. Additional seasonal employees are hired each year with project funds.

RESOURCE PROTECTION AND VISITOR SERVICES

The Resource Protection and Visitor Services Division provide law enforcement services, (including all emergency services such as search and rescue and emergency medicine) education and interpretation, and fee collection. Currently, the division consists of 7.35 FTE, two of which are permanent full time, and another five which are permanent less than full time. The remainder of the staff are filled by term, seasonal, and student intern/volunteer positions. The Resource Protection and Visitor Services Division is responsible for planning, managing and coordinating interpretive programs and other forms of outreach and providing search and rescue operations as needed. The division also plans for long-term interpretive and law enforcement projects, provides for visitor and employee safety, and manages the structural fire prevention program.

SUPERINTENDENT

Provides on-site management, planning, program direction and operation of resource and visitor protection, interpretation, maintenance, cultural and natural resource management. The superintendent oversees the overall operation of the monument by setting goals and priorities and establishing guidelines. One person fills the superintendent's position.

Currently Lava Beds staff are providing staffing for the new WWII Valor in the Pacific National Monument, Tule Lake Unit. A nominal amount of additional funding in FY2009 and 2010 facilitated the hire of one seasonal interpreter. Starting in FY2012, it is hoped that the new monument will have its own base budget of approximately $250,000 and will be able to hire two to three permanent staff. The Lava Beds Superintendent and Division Chiefs likely will continue to co-manage the new monument for the foreseeable (next 5+ years) future.

Carbon Footprint

The monument's carbon emissions were analyzed in 2008, based on 2007 data. The Climate Leadership in Parks (CLIP) tool, software developed jointly by the Environmental Protection Agency and the NPS, was used to calculate the monument's greenhouse gas emissions. Most of the information needed to perform the calculations was taken from 2007 reports and records. These items included the amount of electricity purchased, sewage pumped, waste sent to the landfill, and fuels consumed. Additional motor vehicle data was derived from a combination of 2007 road counter data and visitor use surveys. The findings show that motor vehicle use is the largest contributor to greenhouse gases (68%), with purchased electricity accounting for approximately 22% of total greenhouse gases. In comparison, emissions resulting from solid waste disposal, refrigeration, wastewater, sewage, propane, and heating oil were negligible.

The monument used 2,129 gallons of heating oil and diesel, 1,402 gallons of propane, 249,540 kWh of electricity, and 6,260 gallons of gasoline in 2007. Additionally, 24 tons of solid waste were generated and 10,140 gallons of sewage were pumped. An estimate of visitor vehicle miles was derived from visitor use survey data and road counters, with the conclusion that visitors drove approximately 883,000 miles on monument roads in 2007.

Monument activities, including both operations and visitor use, were found to result in the gross (excluding carbon sinks) emission of 182.4 metric tons of carbon equivalent (MTCE) in 2007. Seventy MTCE were attributed directly to monument operations, with the remainder (113 MTCE) attributable to visitor vehicle use. By contrast, the state of California reported 483.87 million metric tons of carbon dioxide equivalent (MTCO2E) in 2006. Using a conversion ratio of 3.67 MTCO2E to 1 MTCE, Lava Beds National Monument contributes about 0.0001% of California's gross emissions through its operational activities and visitor vehicle use on the 46,560 acre monument (about 0.05% of California). This inventory, however, did not account for emissions resulting from visitor travel outside of the monument's boundaries, a number which would presumably raise the monument's total emissions due to the fact that the majority of visitors travel 100- to 400 miles or more to reach the monument.

Although the monument's share of carbon emissions may be negligible when compared to state and regional emissions, the cumulative nature of countless small carbon sources and the expectation of National Park Service leadership on environmental issues justify significant actions to mitigate emissions from monument activities.

Regional Socioeconomics

Location

Lava Beds National Monument spans two California counties, Modoc County and Siskiyou County. Klamath County, Oregon is approximately 12 miles north of the monument. Local population centers include the small towns of Tulelake, Merrill, and Alturas. The nearest city is Klamath Falls, Oregon. These communities serve as gateways to the monument, providing a variety of goods and services for visitors. Any socioeconomic impacts from the action alternatives would have the most impact on these counties and communities. Such impacts become insignificant in areas farther from the monument.

Much of the land in the Klamath Basin is federal, with national forest lands predominating. Substantial acreages are also administered by the U.S. Fish and Wildlife Service, Bureau of Land Management (BLM), and Bureau of Reclamation (BOR). The monument is largely adjoined by lands administered by these federal agencies. Private lands adjoin the monument on the northeast and south boundaries of the main unit, and on the west and north sides of Petroglyph Point. U.S. Forest Service and BLM-administered lands are managed for multiple uses, including forest products, mineral resources, grazing, and recreation. The U.S. Fish and Wildlife Service manages the Klamath Basin National Wildlife Refuges as an important link in western waterfowl migration routes. Private and leased public lands in the vicinity of the monument are used primarily for irrigated agriculture, with water supplied by the BOR's Klamath Project.

Access to the monument from the north and east is provided by good state highways, and from the south and west via slow speed rural or U.S. Forest Service roads. The Modoc Volcanic Scenic Byway, which incorporates some of these roads, functions as a tourism route through the area. The nearest commercial airport and AMTRAK rail service is in Klamath Falls, Oregon.

Demographics

TABLE 16: POPULATION

POPULATION			
Counties/Cities	**1990**	**2000**	**% change 1990 to 2000**
Modoc County, CA	9,678	9449	-2.4%
Tulelake	1010	1,020	1.0%
Alturas	3231	2,892	-10.5%
Siskiyou County, CA	43,531	44,301	1.8%
Klamath County, OR	57,702	63,775	10.5%
Klamath Falls	17737	19,462	9.7%
Merrill	837	897	7.2%
Three-County Area	110,911	117,525	6.0%
California	29,760,021	33,871,648	13.8%
Oregon	2,842,321	3,421,399	20.4%
Source: United States Census Bureau, 1990;2000			

The three counties in the affected region for socioeconomics are predominantly rural. This three-county area had a combined population of more than 117,000 persons in the year 2000 (see table 16: Population). Local population centers include the small towns of Tulelake, Merrill and Alturas. The largest city is Klamath Falls with a regional population of 19,462 in 2000. The population centers listed in the table account for nearly 21% of the area's residents.

The 2000 Modoc County population was 9,449, while Siskiyou County had a population of 44,301, most of which is located to the west of the monument along the Interstate 5 corridor. Modoc County's population declined 2.4% between 1990 and 2000, while Siskiyou

TABLE 17: POPULATION PROJECTIONS

POPULATION PROJECTIONS					
Counties	**2000**	**2005**	**2010**	**2020**	**% change 2005-2020**
Modoc County, CA	9,449	9,894	9,285	9,285	-6.2%
Siskiyou County, CA	44,301	45789	45611	45,862	0.2%
Klamath County, OR	63,775	65,330	66,968	70,595	8.1%
Three-County Area	117,525	121,013	121,864	125,742	3.9%
California**	33,871,648	36,038,859	38,067,134	42,206,743	17.1%
Oregon**	3,421,399	3,596,083	3,790,996	4,260,393	18.4%
Sources: U.S. Census Bureau, 2000; California Department of Finance, 2006; California Department of Finance, 2004; Klamath County Population Projections, Oregon Office of Economic Analysis, Department of Administrative Services, 2004					

County grew 1.8%. The California counties together grew at a much lower rate than California as a whole during the decade of the 1990s (1% compared to 13.8% for the state of California). Population in Klamath County, Oregon increased 10.5% between 1990 and 2000, largely due to in migration.

In future years, the population of Modoc, Siskiyou, and Klamath Counties is expected to grow at a much lower rate than California and Oregon. Modoc County population is projected to decline 6.2% by the year 2020, one of the only counties in California where a decline in population is expected. Siskiyou County is projected to grow less than 0.5% by the year 2020, a rate much lower than the 17% increase projected for California. Of the three counties, the most growth is projected for Klamath, 8.1% by 2020. However, this rate is still much lower than the overall projection for Oregon, 20.1% by the year 2020.

ETHNICITY

The largest race/ethnic group in the affected area is White (87%). Hispanic or Latino is the second largest race/ethnic group in the affected area (9,403 persons in 2000). These individuals comprise 8% of the area's population compared to 32% for the state of California and 8% for the state of Oregon. Native Americans were the second largest race/ethnic group in the affected area (4,796 persons in 2000). These individuals comprise 4% of the area's population compared to 0.53% for the state of California and 1.17% for the state of Oregon (U.S. Census Bureau 2000).

INCOME

In 2004, California's per capita personal income (PCPI) was $35,248, about 107% of the national average. Modoc County had the lowest per capita personal income, $25,085, at 72% of the state average for California. Klamath County had a PCPI of $24,917, less

TABLE 18: PER CAPITA PERSONAL INCOME

PER CAPITA PERSONAL INCOME				
Area	**1994 $**	**2004 $**	**% of State Average, 2004**	**State Rank, 2004**
Modoc County	$17,919	$25,085	71	44th out of 58
Siskiyou County	$17,731	$25,521	72	45th out of 58
Klamath County	$16,660	$24,917	82	26th out of 36
California	$23,203	$35,278	100	
Oregon	$21,060	$30,823	100	
United States	$22,172	$33,090		
Source: Bureau of Economic Analysis, U.S. Department of Commerce, 2007				

than 82% of the state average for Oregon. The total personal income for the three-county region was more than $36 billion in the year 2000. This figure represents only a small percentage of the total personal income for California and Oregon (U.S. Department of Commerce 2007).

EMPLOYMENT

Major components of the local economy include timber harvest and processing, livestock production, irrigated farming, public land management, and services. Commercial services including gas, groceries, restaurants, motels, and RV parks located in communities near the monument. The affected region had more than 47,000 jobs in 2000. Educational, health and social services, manufacturing, and agriculture were the sectors employing the most workers in the three counties.

Modoc County's primary industries are government, retail trade, and services. Government, the largest industry, accounts for almost 45% of all employment in the county. Wholesale and retail trade employment accounts for 19% of total employment. The share of employment in services is 14%. Agricultural production and agricultural services are also important to the county and account for close to 10% of the total. The top agricultural products and commodities include alfalfa, cattle and calves, pasture and range, potatoes, and hay (California Department of Transportation 2002).

In Modoc County the only industries that experienced growth from 2001 to 2005 were agriculture and government. Agriculture grew 27.6%. The agriculture industry had an estimated value of $71 million dollars in 2004 (California Employment Development Department 2006).

Historically, Siskiyou County jobs were concentrated in the timber industry. In recent years this sector has been subject to significant consolidation. Today the majority of jobs are found in government, services, retail trade, and the farm sector. In 2002, government accounted for the largest share of jobs with over 27% of total employment. The majority of government jobs are in the local government sector. Services contributed 23% of the total, and retail trade made up 24% of all jobs. Within retail trade, most of the jobs are associated with restaurants and food stores (California Department of Transportation 2002).

TABLE 19: UNEMPLOYMENT RATES

UNEMPLOYMENT RATES		
Area	**1996**	**2005**
Modoc County	12.2	7.9
Siskiyou County	13.7	8.9
Klamath County	8.3	7.6
Three-County Area	10.6	8.1
California	7.3	5.4
Oregon	5.6	6.1
National	5.4	5.1
Source: U.S. Deparment of Labor, 2007		

Although construction and government jobs received growth in Siskiyou County from 2001-2005, most other industries recorded job declines during those years. Mining and natural resources experienced no changes, while the accommodation component of the hospitality industry gained 130 jobs over the years 2001-2005 (California Employment Development Department 2007).

Job growth in Klamath County is expected to increase about 14% between 2004 and 2014 due to an employment sector shift from the manufacturing and wood products to services. This increase in job growth is slightly lower than the projected increase for Oregon (Oregon Employment Department 2007).

TABLE 20: PERCENT OF PEOPLE LIVING IN POVERTY

PERCENT OF PEOPLE IN POVERTY		
Area	**1989**	**1999**
Modoc County	15.0	21.5
Siskiyou County	14.0	18.6
Klamath County	16.7	16.8
Three-County Area	15.5	17.8
California	12.5	14.2
Oregon	12.4	11.6
National	13.1	12.4
Source: United States Census Bureau, 1990;2000		

UNEMPLOYMENT

The unemployment rates in the regional counties have been notably higher than both the state and national rates for the selected years (See table 19: Unemployment Rates). However, unemployment rates steadily declined for all three counties over the past ten years. The unemployment rate for the three-county area meant that one out of 13 people in the labor force were unemployed in 1999. Unemployment in Klamath County remains high relative to the rest of the state due to slower population growth and highly seasonal employment for large job sectors such as agriculture and manufacturing (Oregon Employment Department 2007).

POVERTY

The national average for persons living in poverty in 1999 was 12% (see table 20, Percent of People in Poverty). The poverty rates for California and Oregon were slightly lower than the national rate. For 1989 and 1999, the poverty rates in the three counties were all higher than the state rates. Combined, the three counties had a poverty rate of 17.8% in 1999; this figure represented more than 20,000 people living in poverty.

REGIONAL TOURISM

Tourism spending in the three-county area is relatively small compared to total state expenditures for California and Oregon. Total travel spending in Modoc County for 2004 was $19.8 million compared with $82 billion for the State of California. Siskiyou County fared better with total travel spending of $151 million for 2004. In 2004, the combined travel spending for Modoc and Siskiyou counties accounted for less than 1% of the total travel spending for California. Klamath County, the economic hub of the region, received $114 million in travel spending in 2004, approximately 1.6% of the total travel spending in Oregon (Dean Runyan and Associates 2007).

For the region, the tourism industry provides a total of 4,620 jobs. Total direct employment increased 17% from 1992 to 2004 in Siskiyou County, while Modoc County saw an increase of only 3%. Klamath County saw the greatest increase in direct employment from tourism. Between 1992 and 2004 tourism jobs grew by 29% (Dean Runyan and Associates 2007).

The socioeconomic impact of Lava Beds National Monument on local and regional economies is substantial. The National Park Service uses a Money Generation Model to estimate the contribution of visitor and monument payroll spending to gateway communities within a 50 mile radius of a national park unit. A 2007 analysis shows that national parks and other units within the U.S. National Park System generate an average of four dollars for state and local economies in return for every one tax dollar invested in each national park's annual budget. Using this estimate, Lava Beds National Monument generates around $6,200,000 manifest in local and state tax revenue, jobs, and direct purchases by visitors on lodging, food, transportation, souvenirs, etc. in the areas around the monument. In

TABLE 21: REGIONAL TOURISM

REGIONAL TOURISM						
2004	**Destination Spending (Millions)**	**Total Travel Spending (Millions)**	**Employment (Jobs)**	**Earnings (Millions)**	**Tax Receipts (Millions)**	**% of Total Travel Spending for State**
Modoc County	13.3	19.8	300.0	6.2	1.1	0.01%
Siskiyou County	95.8	151.3	2,560.0	53.3	15.1	0.16%
Klamath County	56.2	113.9	1,760.0	32.0	4.3	1.6%
California	45.8	81,900.0	912,000.0	26,500.0	9,300.0	
Oregon	6,290	6,903	87,200	1,727	617	
Source: Dean Runyan and Associates, 2007						

some years this can be substantially more (e.g. 2009) in which funding for projects was up substantially.

KLAMATH BASIN WILDLIFE REFUGES VISITATION

North and east of the monument is the Klamath Basin complex of national wildlife refuges managed by the U.S. Fish and Wildlife Service. The entire complex encompasses 192,322 acres. Tule Lake National Wildlife Refuge, directly adjacent to the northern boundary of the monument, has the highest number of visitors for the six refuges. This area encompasses 39,116 acres. Most recreational use is associated with wildlife observation. The refuge has a 14-mile auto tour, a 2-mile canoe tour, attracts birders, waterfowl hunters, and photographers.

In 1995, The Tule Lake National Wildlife Refuge logged 196,544 visitors. Almost all of the visitors engaged in wildlife observation activities. Visitation is spread out throughout the year, with the highest levels of use in the spring and the fall. Refuge managers estimate that 80% of non-consumptive users (those other than hunters) and 95% of hunters come from outside the local area (more than 30 miles distant).

Lower Klamath National Widlife Refuge recreational visitation totaled 164,000 for the same year. The vast majority of these visitors engaged in wildlife observation, while about 10,200 visitors hunted. For 2008, the visitation count for the Hill Road Visitor Center was 10, 413. For the past 5 years, the numbers range from 10,319 to 11,273. Tule Lake and Lower Klamath National Wildlife Refuges receive approximately 40,000 visitors per year.

Total visitation spending for the Tule Lake National Wildlife Refuge in 1995 was $683,600. This value was generated in the three-county area by refuge visitor spending. The refuge also generated a total of 19 jobs (Laughland and Caudill 1997).

MODOC NATIONAL FOREST VISITATION

Land to the west, south and east of the monument is managed by the Forest Service as part of the Modoc National Forest. The Modoc National Forest consists of 1,979,407 acres of which 1,654,392 acres are administered directly by the U.S. Forest Service. In 2000, the Modoc National Forest received approximately 146,155 visitors. The primary activities of the visitors included fishing, viewing scenery, and driving for pleasure on forest roads. Facilities used the most include developed campgrounds, swimming areas and trails. Use of the scenic byway ranked fourth. Of those surveyed, 6% of Modoc National Forest visitors were visiting the forest as their primary destination. Most were visiting the forest as part of visits to other local destinations (USFS 2001).

WWII VALOR IN THE PACIFIC NATIONAL MONUMENT, TULE LAKE UNIT VISITATION

In its first year of operation, the Tule Lake Unit maintained a temporary visitor center inside the Tulelake - Butte Valley Fairgrounds from Memorial Day through Labor Day. During this time the visitor center received 633 visitors. Tours were offered regularly on the weekend and by request during the week. In total, 51 formal tours where provided for a total of 1,236 visitors. Visitation was limited by the lack of a website, which was not yet activated, and highway signs not being installed until after the summer season. The dedication for the unit was held in conjunction with the Tule Lake Pilgrimage, and had 700 in attendance. Of those in attendance, over 160 had been interned at Tule Lake or one of the other nine centers. In addition, three education programs were provided to 48 students.

Chapter Five: Environmental Consequences



Previous page: Common nighthawk, *U.S. Fish and Wildlife Service Photo*

Chapter Five: Environmental Consequences

INTRODUCTION

The Council on Environmental Quality (CEQ) regulations that implement the National Environmental Policy Act (NEPA) require that federal agencies discuss the impacts on the natural and social environments of proposed federal actions, feasible alternatives to that action, and any adverse environmental effects that cannot be avoided if a proposed action is implemented In this case, the proposed federal action would be the adoption of a general management plan for Lava Beds National Monument. This chapter analyzes the environmental impacts of implementing the three alternatives on natural resources, cultural resources, visitor experience, monument operations, and socioeconomics. The analysis is the basis for comparing the beneficial and adverse effects of implementing the alternatives.

The alternatives in this general management plan provide broad management direction. Thus, this environmental assessment should be considered a programmatic document. If and when specific developments or actions are proposed subsequent to this general management plan for implementation, appropriate detailed environmental and cultural compliance documentation will be prepared in accordance with NEPA and National Historic Preservation Act of 1966 requirements. Those actions that implement guidance provided in the general management plan may tier from this environmental assessment.

This chapter begins with a discussion on terms and definitions used for determining environmental consequences, followed by a discussion on policy related to cumulative impacts, a description of the projects that make up the cumulative impact scenario, and finally a discussion on impairment. The impacts of the alternatives are then analyzed by impact topic in the order they appeared in the methodology section. Each impact topic includes a description of the methods and assumptions used for analyzing each impact topic, a description of the impact of the alternative, a discussion of cumulative effects, and a conclusion. Where data is limited, professional judgment has been used to project environmental impacts. Professional judgment was based, in part, on observation, analysis of conditions, and responses in similar areas.

The impacts of each alternative are also briefly summarized in the "Summary of Impacts" table at the end of the "Alternatives" chapter (Table 11).

TERMS AND DEFINITIONS

The following section defines the terms used for determining the environmental consequences of the actions in the alternatives. The environmental consequences of each impact topic are defined based on impact type, intensity, and duration, and whether the impact would be direct or indirect. Cumulative effects are also identified.

Impact Type

The effects that an alternative would have on an impact topic could be either adverse or beneficial. Adverse impacts involve a change that moves the resource away from a desired condition or detracts from its appearance or condition. Beneficial effects are those that involve a positive change in the condition or appearance of a resource or a change that moves the resource toward a desired condition. In some cases, the action could result in both adverse and beneficial effects for the same impact topic.

Intensity

Defining the intensity or magnitude on an impact is taken directly from Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decisionmaking (NPS 2001). Impact intensity is the magnitude or degree to which a resource would be beneficially or adversely affected. Each impact was identified as negligible, minor, moderate, or major. Because definitions of intensity vary by topic, separate intensity definitions are provided for each impact topic in the methodology section. Due to the broad nature of actions called for in this general management plan, most intensity findings were expressed qualitatively.

Duration

Duration refers to how long an impact would last. The planning horizon for the general management plan is approximately 15 to 20 years. Unless otherwise stated, in this document the following terms are used to describe the duration of the impacts:

Short term: The impact would be temporary in nature, lasting one year or less, such as the impacts associated with construction.

Long term: The impact would last more than one year and could be permanent in nature, such as the loss of soil due to construction of a new facility. Although an impact may only occur for a short duration at one time, if it occurs regularly over a longer period of time the impact may be considered a long-term impact. For example, the noise from a vehicle driving on a road would be heard for a short time and intermittently, but because vehicles would be driving the same road throughout the 20-year life of the plan, the impact on natural soundscape would be considered long term.

Direct versus Indirect Impacts

Direct effects would be caused by an action and would occur at the same time and place as the action. Indirect effects would be caused by the action and would be reasonably foreseeable but would occur later in time, at another place, or to another resource.

CUMULATIVE IMPACTS

Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonable foreseeable future action, regardless of what agency or person undertakes such other action. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Cumulative impacts are considered for all impact topics and alternatives. The NPS assumes the types of use that are occurring now will continue, but there may be new or different future uses. These actions are evaluated in conjunction with the impacts of each alternative to determine if they have any cumulative effects on a particular resource. For most of the impact topics, the geographic area defined for the analysis was the monument. In some cases, the area of consideration was the Tule Lake Basin.

To determine potential cumulative impacts, projects in the area surrounding the monument were identified. Projects included in this analysis were identified by examining other existing plans and by calls to local governments and to state and federal land managers. Projects identified for the purposes of cumulative impact analyses are past actions, plans or actions that are currently being implemented, and reasonable foreseeable plans or actions. These projects were considered regardless of what agency, organization, or person undertakes them. Projects included in the cumulative impact analysis do not affect all resources equally.

ACTIONS AND PROJECTS OUTSIDE LAVA BEDS NATIONAL MONUMENT

Listed below are ongoing and planned actions and projects on adjoining or nearby federal and private lands, and other actions that could affect the Monument, independent of this general management plan.

United States Fish and Wildlife Service Plans and Programs

United States Fish and Wildlife Service (USFWS) lands are adjacent to the north end of the monument's main unit (Tule Lake National Wildlife Refuge). These lands are used primarily for conservation of wildlife with associated agricultural activities that provide an array of habitats for wildlife use. There are two main water bodies on the Tule Lake National Wildlife Refuge, Sump 1A and Sump 1B. Sumps 1A and 1B are located north of the monument and contain associated wildlife viewing blinds and a wildlife tour route road. The USFWS also sprays herbicides on lands adjacent to the monument to control weeds, and conducts prescribed burns. In addition, the USFWS manages a wildlife tour route through the refuge for recreational bird watching and they also administer a waterfowl hunting program. The refuge also has a high concentration of mule deer that attracts a number of visitors for wildlife viewing.

The USFWS initiated a Comprehensive Conservation Plan (CCP) in 2009. There will be an associated environmental impact statement with this planning effort. This plan will provide management direction for the Klamath Basin Refuge Complex for the next 15 years. The CCP planning process is expected to last approximately three years with a completion date expected in 2012. A core team of USFWS employees will lead this effort followed with involvement from sister agency representatives. The plan will cover the management for all five refuge units. While the plan is being developed, between FY2009 and FY2012, the USFWS will continue to manage by their "annual habitat management plans." These plans focus on water, grain production, fire management, water movement, and food sources for waterfowl. A biologist/irrigator was hired in 2008 to manage the movement of water on the refuge. Farming practices will continue to be managed on the

short term as is with burning of stubble and some use of organic farming.

In the 1950s, the Kuchel Act established lease land farming within the refuge. The act states that refuge lands will be managed for farming and optimal wildlife resources. Farming on refuge lands is expected to continue into the future.

The USFWS manages a program titled "Walking Wetlands." This is a cooperative farming effort on the Tule Lake National Wildlife Refuge. These lands are turned into wetlands for three years and then rotated out of wetland use back into farmlands. The USFWS has the main responsibility of building infrastructure for these walking wetlands (dikes, roads, etc.). Walking wetlands are currently planned to occur east of sump 1A and would have no impact on the monument from a visual or habitat standpoint. Over the last ten years, approximately 7,000 acres of lands within the basin have been converted into these wetlands. No walking wetlands would be near the monument boundary.

The USFWS implements a full array of invasive weed control on the refuge and has the Regional Integrated Pest Management (IPM) coordinator located at the refuge office. There will be a continued need to control invasive weeds on the refuge. This area of focus could provide some participation between agencies. Control of nonnative vegetation and trespass grain crops into monument lands are the main topics. This will be a major effort that is continued on both the NPS and USFWS lands.

The USFWS is working on a duck modeling effort that is striving to increase duck and goose populations back to 1970 levels for ducks and 1990 levels for geese. This is an effort especially for the Tule Lake refuge, since numbers have continued to decrease. This would have a positive effect on the monument with visitors having more watchable wildlife to view from the overlooks and in the overall general area. USFWS biologists are leading this effort. The refuge is currently working on completing the assessment of duck numbers and the modeling document should be complete by the end of 2009. This information will be used in the CCP for planning efforts.

Changes to Sump 1A and 1B will be addressed in the CCP process. Every two years the refuge burns Sump 1A and Sump 1B. Over the next few years changes with fire and burning of stubble may include fall burning requirements. On Sump 1A, the staff will be looking into increasing the size of the marsh and reducing open water. Annual/seasonal water reduction in Sump 1B to promote wetland vegetation will continue. During 2009, a new island was developed in Sump 1B to promote the nesting of Caspian terns. This island development will also bring additional opportunities for watching wildlife along the northern boundary of the monument.

The refuge is not planning on any visitor service infrastructure developments. A new signing effort within the refuge will take place to help the visitor learn about the refuge. No placement of structures is expected over the near future. The vehicle tour route on the Tule Lake National Wildlife Refuge will remain the same. The USFWS is open to evaluating a potential ridge trail from refuge headquarters to the monument that follows Sheepy Ridge. This potential trail would be assessed in the CCP process.

Bighorn sheep re-introduction is not a topic that the USFWS is considering. The only suitable habitat is on Sheepy Ridge, which could be used, but is not a topic of high priority.

Proposed Medicine Lake Area Geothermal Developments

The development of geothermal resources to generate electricity has been proposed on national forest lands at two sites near Medicine Lake. Each site would consist of multiple deep drilled wells to bring steam and hot water to the surface. Pipelines on the surface would connect the multiple wells to a generating station where it would be used to turn turbines and generate electricity. Electrical transmission lines would carry the electricity approximately 20- to 25-miles east to existing major electrical transmission lines near the community of Tionesta. Construction and operations vehicle traffic would access these sites also primarily from the east or south over Forest Service roads 97, 49, or 15. Commercial traffic servicing the developments would not be permitted to pass through the monument on the NPS owned roads.

One proposed site is known as Fourmile Hill and is located approximately five miles south of the monument, and two and one-quarter miles north of Medicine Lake on the Klamath National Forest. The other proposed site is known as Telephone Flat, and that is located approximately eight miles south of the monument and one and a half miles east of Medicine Lake on the Modoc National Forest. Both proposals

were analyzed in separate Environmental Impact Statements/Environmental Impact Reports (EIS/EIR's) in the late 1990s, and both projects have remained dormant since that time due to on-going legal actions with no work occurring on the ground beyond the exploratory drilling that occurred in the mid 1990s. If either or both proposed projects are constructed and begin electrical production, there likely would be some changes and impacts to the visual quality of views from the monument to the Medicine Lake highlands. These visual impacts would most likely be caused by the electrical transmission lines running from each site along the north slopes of the Medicine Lake highlands to the east. Steam emissions at each generating plant or wellhead might also be visible from the monument particularly in cold clear weather. The increased development and traffic from these proposals would likely also cause incremental degradation in wildlife habitats, recreation, and cultural resources.

Cumulative impacts would not differ regardless of the alternative selected for the Lava Beds General Management Plan.

Klamath and Modoc National Forests Travel Management Planning Process

All national forests nationwide are currently in the midst of a Motor Vehicle Route Designation and Travel Management planning process. This process includes completing an inventory of all roads, trails, and areas used by motor vehicles; evaluation of the routes in relation to resource conflicts; environmental analysis of alternative route systems; and finally, designation of routes/areas open or closed for motor vehicle use. In alignment with national policy, cross country motorized travel off designated roads and trails would be prohibited. As of late 2009, the Modoc National Forest has completed its plan, and the Klamath National Forest has released its draft environmental impact statements and solicited public comments on its proposed plans. Around the monument, no routes are proposed to be closed or realigned. The only change that would occur would be the end of cross country motorized travel off of designated routes. This U.S. Forest Service policy change would likely reduce the incidents of motor vehicle trespass into Lava Beds from abutting national forest lands.

Cumulative impacts would not differ regardless of the alternative selected for the Lava Beds General Management Plan.

Privately owned timberlands along the southern boundary

Along the southern boundary of the monument, within the boundary of the Modoc National Forest are approximately 2,500 acres of forestland owned by Fruitgrowers Supply, the timber-growing subsidiary of the Sunkist citrus cooperative. The land is forested primarily with second and third growth Ponderosa Pine, a valuable timber species. Fruitgrowers Supply intends to manage the land to continue to produce timber. Depending upon the methods and type of logging used to harvest timber in the future, there could be significant impacts on visual quality and other resources at the monument. Fruitgrowers Supply has expressed a desire to sell or trade these lands for others that are closer to their larger land holdings near the US 97 and I-5 corridors.

IMPAIRMENT OF RESOURCES

In addition to determining the environmental consequences of the alternatives, NPS policies (Interpreting the National Park Service Organic Act, Management Policies 2006) require that potential effects be analyzed to determine whether or not proposed actions would impair the resources or values of the monument. An evaluation of impairment is not required for topics related to visitor use and experience, operations, or the socioeconomic environment.

The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act (as amended) begins with a mandate to conserve resources and values. NPS managers must seek ways to avoid or minimize adverse impacts on the resources and values to the greatest degree practicable. However, laws do give the NPS management discretion to allow impacts on the resources and values when necessary and appropriate to fulfill the purposes of a unit, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS this management discretion, it is limited by the statutory requirement that the NPS must leave the resources and values unimpaired unless a particular law directly and specifically provides otherwise.

Impairment is an impact that in the professional judgment of the NPS manager would harm the integrity of the resources and values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact on any resource

or value may constitute impairment. An impact would be most likely to constitute impairment if it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the monument;
- Key to the natural or cultural integrity of the unit or to opportunities for enjoyment of the unit; or
- Identified as a goal in the general management plan or other relevant NPS planning documents.

Impairment might result from NPS activities in managing a unit, visitor activities, or activities undertaken by concessionaire, contractors, and others operating in the monument. Actions that occur outside monument boundaries could cause impairment, but these actions would not be a violation of the Organic Act unless the NPS was in some way responsible for the action. In this chapter, a determination about impairment is presented in the conclusion section for each required impact topic related to the unit's resources and values. When it is determined that an action(s) would have a moderate to major adverse effect, a justification for non-impairment is made. Impacts of only negligible or minor intensity would by definition not result in impairment.

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

The planning team based the impact analysis and the conclusions in this chapter largely on the review of existing literature and studies, information provided by experts in the NPS and other agencies, and monument staff insights and professional judgment. The team's method of analyzing impacts is further explained below. Impacts have been assessed assuming that mitigation measures, as described in Chapter 3, would be implemented. If mitigation measures were not applied, the potential for resource impacts and the magnitude of those impacts would increase.

The impact analyses for the no action alternative (alternative A) compare resource conditions throughout the life of the plan to existing conditions, based on the continuation of current management. The impact analysis for the action alternatives (alternatives B and C) compare the action alternative to the no-action. In other words, the impacts of the action alternatives describe the difference between no action and implementing the action alternatives. To understand a complete "picture" of the impacts of implementation any of the action alternatives, the reader must also take into consideration that impacts would occur under the no action alternative.

Natural Resources

Analysis of natural resources was based on research, knowledge of monument resources, and the best professional judgment of planners, biologists, geologists, and botanists who have experience with similar types of projects. Information on the monument's natural resources was gathered from several sources, including maps, satellites imagery of vegetation, and assorted resource inventories. As appropriate, additional data sources are identified under each topic heading.

Where possible, mapped locations of sensitive resources were compared with the locations of existing developments and proposed modifications, including management zoning. Predictions about short-term and long-term site impacts were based on previous studies of visitor and facility development impacts on natural resources.

Impacts were predominately assessed qualitatively, given the programmatic nature of this document and consistent with the level of detail provided in the alternatives. However, when possible, impacts were assessed with quantitative data and analysis.

Air Quality

The area of consideration for this impact topic is the monument. Impacts on the monument's air quality would be based on anticipated changes from base data and national standards as measured at authorized stations. The thresholds of change for the intensity of an impact are as follows.

Negligible: There would be no perceptible visibility impacts. The first highest three-year maximum for each pollutant would be less than the national ambient air quality standards (NAAQS).

Minor: There would be slightly perceptible visibility impacts on less than 180 days per year. The first highest three-year maximum for each pollutant would be less than the national standards.

Moderate: There would be moderately perceptible visibility impacts on less than 180 days per year or slightly perceptible visibility impacts on 180 days or more per year. The first highest three-year maximum for each pollutant could be greater than national standards.

Major: There would be highly perceptible visibility impacts on 180 or more days per year. The first highest three-year maximum for each pollutant would be greater than national standards.

AIR QUALITY – IMPACTS FROM ALTERNATIVE A

Analysis

In this alternative, no new developments would occur that would increase the degradation of air quality within Lava Beds. The monument currently has a minimal effect on air quality, with vehicle emissions, monument operations, and the fire management program being primary contributors. Lava Beds is identified as an unimpaired type 1 air shed, though minimal to moderate impacts do occur from outside influences associated with transportation, industry, energy production, and residential heating.

Currently the fire program conducts prescribed burns that range annually from 500 to 2000 acres a year. The 2000-acre mark is the high end of what would naturally burn without human intervention during a season. Under alternative A, this would not change. Before prescribed burns are ignited, the monument coordinates with local air quality boards to burn only when conditions are correct and the effects on air quality are minimized. Wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality (5-10 days per year average fire burn).

Improved maintenance practices to reduce washboarding of road surfaces on Medicine Lake Road (within the monument) would slightly improve vehicle efficiency and thus reduce vehicle emissions, as well as road dust in localized areas. These improvements would result in long-term, minor to moderate, beneficial effects on air quality.

Cumulative Impacts

Most air pollution affecting the monument comes from external sources as a result of population growth, agricultural burns, and energy production. Additional outside influences are associated with transportation, industry, energy production, and residential heating. As a higher demand for energy is met, and communities continue to grow, a minor adverse effect on the monument's air quality is assumed. Actions from alternative A would not contribute to cumulative impacts.

Conclusion

Implementing alternative A is not expected to have any long-term effects on air quality. Alternative A would have minor, short-term, adverse impacts on the monument's air quality from operations and visitor use. Cumulative impacts associated with population growth and energy demands would contribute minor adverse impacts to air quality. The level of impact from alternative A would not be expected to constitute an impairment of the monument's resources or values.

AIR QUALITY – IMPACTS FROM ALTERNATIVE B

Analysis

The new infrastructure prescribed in alternative B includes an expansion of the visitor center and research center, the construction of new facilities at Petroglyph Point and trail expansion. None of these new developments would result in new emissions or in any substantial changes in visitation and thus would have no long-term adverse impact on the monument's air quality. As in alternative A, short-term impacts from wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality. Additional conservation measures to encourage visitors to walk and bicycle between sites once they have arrived at the monument, and additional energy efficiency improvements in NPS vehicles and operations would slightly reduce air pollution emissions having long-term, negligible to minor, beneficial effects on monument air quality.

Realignment of the access road away from Petroglyph Point would have long-term, localized, minor to moderate, beneficial effects by reducing dust generation near the petroglyphs. Redirecting visitors to use the better maintained and paved northern entrance roads rather than the poor condition southeast entrance road (Forest Service Route 10) would slightly increase visitor vehicle miles driven for visitors accessing the

monument from the southeast. Given that Forest Service Route 10 only carries approximately 13% of total monument traffic, and that not all of the traffic would shift to the northern roads, this would constitute a negligible to minor adverse impact on air quality.

Cumulative Impacts

Cumulative impacts to air quality would be same as alternative A. Generating the monument's entire electrical load from alternative sources such as photovoltaic panels and wind would slightly reduce off -site emissions. Increased educational and collaborative efforts between the monument and neighboring communities in alternative B may also increase awareness and reduce some air quality impacts. When the beneficial effects of alternative B are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be negligible, beneficial cumulative effects on the monument's air quality.

Conclusion

Increased educational and collaborative efforts between monument and neighboring communities in alternative B and alternative energy generation would reduce some air quality impacts resulting in negligible to minor, beneficial cumulative effects. As in alternative A, wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality. The level of impact due to alternative B would not be expected to constitute an impairment of the monument's resources or values.

AIR QUALITY – IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, new developments would be limited to Petroglyph Point, trail expansion, and expanded vehicle pullouts along the main monument road. Pullouts along the main road would not increase vehicle miles driven, which drives air quality emissions and impacts. None of the other development proposals would have a long-term, adverse impact on the monument's air quality. As in alternative A, short-term impacts from wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality.

Additional conservation measures to encourage visitors to walk and bicycle between sites could offset impacts from additional recreational and trail opportunities. Improvements in NPS electrical use would slightly reduce air pollution emissions having long-term, negligible to minor, beneficial effects on monument air quality.

Realignment and paving of the road at Petroglyph Point would have long-term, localized, moderate, beneficial effects by reducing dust near the petroglyphs.

Under this alternative, the monument would increase outreach efforts to promote more visitation and would collaborate with the Modoc National Forest on new recreational opportunities. Medicine Lake Road would be improved under alternative C, resulting in long-term, negligible to minor, beneficial effects as a result of improved vehicle efficiency from paving and reduced dust generation.

The monument would also provide additional recreational and interpretive trail opportunities and explore regional trail connections to national forest trails and sites, including shared trail systems. Encouraging visitors to park their cars and walk could offset some of these impacts.

Cumulative Impacts

Cumulative impacts to air quality would be similar to alternative A. Generating the monument's entire electrical load from alternative sources such as photovoltaic panels and wind would slightly reduce off-site emissions. Increased educational and collaborative efforts between the monument and neighboring communities in alternative C may also increase awareness and reduce some air quality impacts. When the beneficial effects of alternative C are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be negligible, beneficial cumulative effects on the monument's air quality.

Conclusion

Conservation measures and alternative energy generation would have long-term, negligible, beneficial effects on air quality. However, more visitors could lead to increased vehicle use and negligible to minor adverse impacts on monument air quality. As in alternative A, wildfire (unplanned ignitions) and the use of prescribed fire (planned ignitions) would have short-term, minor, adverse effects on air quality. The level of impact due to alternative C would not be expected to constitute an impairment of the monument's resources or values.

Soundscape

The area of consideration for this topic is the monument. Context, time, and intensity together determine the level of impact for an action or activity related to soundscapes. Noise for a certain period and intensity would be a greater impact in a highly sensitive context, and a given intensity would be a greater impact if it occurred more often, or for longer duration. For example, in very low-level ambient soundscapes, like the wilderness, noises can be much more audible, thereby having greater impact intensities. It is usually necessary to evaluate all three factors together to determine the level of noise impact.

Negligible: Noise would rarely be greater than natural ambient sound levels, and/or there would usually be lengthy periods each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than a very small increment above the value for natural ambient sounds in the same area. Natural sounds would predominate.

Minor: Noise would be greater than natural ambient sound levels for a small portion of the day, and/or there would often be substantial periods each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than a small increment above the value for natural ambient sounds in the same area.

Moderate: Noise would be greater than natural ambient sound levels for an intermediate portion of the day, and/or there would rarely be more than intermediate periods each day between noise events. Noise in a specific area would rarely result in a value for any noise metric that is more than an intermediate increment above the value for natural ambient sounds in the same area

Major: Noise would be greater than natural ambient sound levels for a large portion of the day, and/or there would rarely be more than short periods each day between noise events. Noise in a specific area would often result in a value for a noise metric that is more than an intermediate increment above the value for natural ambient sounds in the same area.

SOUNDSCAPE – IMPACTS FROM ALTERNATIVE A

Analysis

In this alternative, no new development would occur that could increase long-term impacts on soundscapes within the monument. The monument would continue to maintain existing facilities and roads with their associated short-term sound levels. No new trails would be developed under this alternative, limiting human impacts on wilderness soundscape. In developed zones, soundscapes would have short-term, minor to moderate, adverse levels of impact depending on increases or decreases in visitor use levels. During heavy visitor use periods, frequently used caves can be noisy, causing short-term, moderate, adverse impacts on certain cave soundscapes.

Cumulative Impacts

Soundscape levels associated with human activities outside of the monument vary depending on location within the monument. The main impacts are from the combined potential increases in overhead airplane traffic, agricultural activities on U.S. Fish and Wildlife Service and private lands, and recreational vehicle noise associated with snowmobiles, vehicles and railroads. The backcountry zone is considered one of the most serene areas where visitors can experience natural quiet. However, cars and overflights can be heard in most areas of the monument and outside of the boundary. When the likely effects of continued public use of the monument under this alternative are added to the effects of actions outside the monument, there could be a long-term, minor, adverse cumulative impact on the area soundscape. However, visitor use and monument operations would likely be a relatively small part of the cumulative impacts on the area's soundscape.

Conclusion

Long-term impacts associated with monument operations and visitor use in alternative A would have a negligible, adverse impact on the monument's soundscape. In some specific areas with visitor facilities there would be short-term, minor to moderate, adverse impacts from visitors and vehicles. There would be a long-term, minor, adverse cumulative impact on the area's soundscape. The level of impact due to alternative A would not be expected to constitute an impairment of the monument's resources or values.

SOUNDSCAPE – IMPACTS FROM ALTERNATIVE B

Analysis

Most of the new developments or ground-disturbing activities in alternative B, including expansion of the visitor center and research center, the redesign and construction of new developments at Petroglyph Point, the development of new trails, and the development of backcountry campsites, would have minor to moderate, short-term, adverse impacts on the monument's soundscape during installation.

There would be a permanent change to the soundscape at Petroglyph Point with developments that include a seasonal visitor contact station, a picnic area, road redesign, trail redesign, and an amphitheater. This development would promote a longer stay for visitors in the area. However, visitor activities would not likely cause soundscape impacts when compared to existing external sound impacts from adjacent agricultural activities. Realignment of the road would have a long-term, moderate, beneficial effect on the soundscape at the petroglyphs.

The formalization of new trails would result in minimal soundscape disturbance. The actual construction of trails would be of short-term, negligible, adverse impacts and levels of visitor use in these new trail areas would follow Wilderness Stewardship Plan use level guidelines set to limit impacts on soundscape. Thus, the construction of new facilities and trails in alternative B would be expected to have a negligible, long-term, adverse impact on the monument's soundscape resources.

As in alternative A, in alternative B the soundscape in the backcountry zone would continue to be impacted at low to moderate levels from outside influences associated with agriculture on Tule Lake National Wildlife Refuge and private lands, airplanes, recreational vehicles and railroad noise impacts. The collaborative efforts between monument staff and the Tule Lake National Wildlife Refuge to restore "walking" or rotating wetlands along the northern boundary would have a long-term, moderate, beneficial effect on soundscapes in this area of the monument by reducing noise associated with agricultural activities.

Monument use levels are not expected to increase to levels where soundscapes would be impacted from trail use in frontcountry and backcountry areas of the monument. There is no reason to expect that there would be any significant change in effects on soundscapes associated with visitor use within the monument.

Alternative B would have several beneficial impacts on soundscapes as a result of additional efforts to promote bicycle use along roads, including Cave Loop Road, and improved trail walking access to a number of the main destinations of the monument. Proposed trail improvements would likely result in more people walking in areas that currently have soundscape impacts associated with vehicle use and result in long-term, negligible, beneficial effects on soundscapes.

Cumulative Impacts

Cumulative impacts would be similar to alternative A. When the beneficial impacts of promoting bicycle use, providing more efficient trail route patterns and restoring wetlands on the northern boundary are added to the adverse effects of visitor use and activities outside of the monument, there could be a long-term, minor, adverse cumulative impact on area soundscapes. However, the beneficial and adverse effects of alternative B in the monument would likely be a very small part of the cumulative impacts on the area's soundscape.

Conclusion

Alternative B would have long-term, negligible beneficial effects on soundscape resources, primarily due to the improved trail system that connects primary visitor use destinations, the promotion of bicycle use and walking, and increased visitor education. There would be a long-term, minor adverse cumulative impact on soundscape resources, although alternative B would add small beneficial and adverse increments in localized areas to the overall cumulative impact. Construction activity from new developments would have short-term, minor to moderate, adverse impacts on soundscapes in localized areas. The Petroglyph Point soundscape would change with new uses and facilities. These changes would have an overall beneficial impact on soundscapes, primarily from the realignment of the current access road. The level of impact due to alternative B would not be expected to constitute an impairment of the monument's soundscape resources or values.

SOUNDSCAPE – IMPACTS FROM ALTERNATIVE C

Analysis

In this alternative, new developments would be limited to new facilities at Petroglyph Point, trail expansion, paving and realigning roads, and vehicle pullouts along the main monument road. As in the other alternatives, soundscapes in many areas of the monument would not be affected in alternative C. All of the new facilities and actions in alternative C would be built in previously disturbed areas. The short-term impacts on soundscape associated with construction of the new development would be minor to moderate, and adverse. The proposed development at Indian Well campground and along the main road shoulders would incur long-term, minor to moderate, adverse impacts on soundscapes in these areas of the monument. There would be a permanent beneficial change to the soundscape at Petroglyph Point as realignment and paving of the road would have a long-term, moderate, beneficial effect on the soundscape at the petroglyphs.

Medicine Lake Road would be paved under this alternative, allowing for increased traffic speeds. Paving would reduce noise in areas adjacent to Medicine Lake Road, having a long-term, negligible, beneficial effect on soundscapes in this area of the monument.

As in alternative A, the soundscape in the backcountry zone would continue to be impacted at low to moderate levels from outside influences associated with agriculture on Tule Lake National Wildlife Refuge and private lands, airplanes, recreational vehicles, and railroad noise impacts. The collaborative efforts between monument staff and the Tule Lake National Wildlife Refuge to restore "walking" or rotating wetlands along the northern boundary would have a long-term, moderate, beneficial effect on soundscapes in this area of the monument by reducing noise associated with agricultural activities.

New trails would provide access for visitors, which would directly contribute to changes over time with the natural soundscape. As many as 15 miles of new trails would be developed in the monument with an emphasis on loop trails. With visitor use levels expected to stay constant or increase over the life of this plan, soundscape resources could have negligible to minor, adverse, long-term, localized impacts in the backcountry zone. The development of a trail for hikers would potentially reduce Cave Loop vehicle traffic and improve the soundscape in this heavily used visitor area by limiting reliance on vehicle access to cave locations. This would have a long-term, negligible, beneficial effect on the soundscape in this area.

A larger emphasis on interpretative efforts to educate the public on reducing impacts on soundscape resources would have a long-term, beneficial effect on soundscapes.

Cumulative Impacts

Cumulative impacts on soundscape resources would be the same as alternative B.

Conclusion

The promotion of bicycle use and walking and increased visitor education would have long-term, negligible, beneficial effect on soundscapes in some areas of the monument. The proposed development at Indian Well campground and along the main road shoulders would produce long-term, minor to moderate, adverse impacts on soundscapes in these areas. Construction activity from new development would have short-term, minor to moderate, adverse impacts on soundscapes in localized areas. The Petroglyph Point soundscape would have an overall beneficial impact on soundscapes from the realignment and paving of the current access road. There would be a long-term, minor adverse cumulative impact on soundscape resources. Alternative C would add small beneficial and adverse increments in localized areas to the overall cumulative impact. The level of impact due to alternative C would not be expected to constitute an impairment of the monument's soundscape resources or values.

Dark Night Skies

The area of consideration for this topic is the monument. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows:

Negligible: The effects would be barely detectable and expected to have no discernable effect on dark night sky.

Minor: The effects would be slightly detectable, though not expected to have an overall effect on dark night sky.

Moderate: The effects would be clearly detectable and could have an appreciable effect on dark night sky.

Major: The effects would have substantial, highly noticeable influence and could permanently alter dark night sky.

DARK NIGHT SKIES – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Impacts on dark night skies are associated with unshielded and high output lighting on roads, facilities, and residences. Glare and impacts due to light pollution increase near frontcountry and developed zones of the monument. Remote areas in the backcountry zone currently provide high-quality dark night sky experiences.

In alternative A, no new developments would occur that would increase degradation of dark skies or nocturnal habitats within the monument. Existing facilities have already been retrofitted with reduced output lamps or shields. These fixtures will be retained for their suitable output and reduced glare levels. No new trails or trailheads would be developed under this alternative, limiting access infrastructure impacts on wilderness dark skies. In developed zones, particularly in the campground, low levels of impact may temporarily occur with high visitation levels.

Energy conservation measures under this alternative would reduce nightscape impacts associated with monument operations and management of visitor services. Future technologies, such as lights containing small photovoltaic panels and battery packs, could make it easier to introduce illumination into previously unlit areas. Unplanned use of these new technologies could lead to further degradation of dark skies.

Cumulative Impacts

The largest threat to dark skies in the monument is the visible light dome over Klamath Falls, poorly lit development along the State Highway 139 corridor, and security lighting used around nearby agricultural operations. Visitor use and NPS operations in the monument would likely be a relatively small part of the cumulative impacts on the area's nightscape. As more unshielded/high output lighting is installed in surrounding communities, the cumulative effect could be the degradation of dark night skies in all zones of the monument resulting in minor to moderate, adverse impacts on dark night skies. However, alternative A would not contribute to the cumulative impacts on dark night skies.

Conclusion

Monument operations and visitor use would have no long-term adverse impacts on the monument's dark night skies in alternative A. There would be long-term, minor to moderate, adverse cumulative impacts from future growth and development in surrounding communities. The level of impact due to alternative A would not be expected to constitute an impairment of the monument's resources or values.

DARK NIGHT SKIES – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

New infrastructure developments in alternative B include an expansion of the visitor center and research center, the construction of new facilities at Petroglyph Point, and the development of new trails. All of these developments could have a long-term, negligible, adverse effect on the monument's dark skies depending on the outside lighting design, and the types of fixtures used.

There would be a long-term change to the nightscapes at Petroglyph Point if proposed developments require the addition of nighttime lighting. This new development would introduce nighttime artificial lighting to this area for the first time. Nighttime illumination would have a potential harmful effect on the nocturnal habitat used by bird and bats that roost and forage from the cliffs above having long-term, minor, adverse, impacts on dark night skies at this location. However, relocation of the road at Petroglyph Point would have beneficial impacts by moving vehicle lights further away from the site. To limit effects on dark skies and nocturnal habitats, site-specific surveys and timed-sensored lighting systems would be used to limit impacts on wildlife.

Alternative B also includes an expansion of the visitor center. Lighting on expanded facilities could increase emissions of stray light. However, the monument would follow dark night sky protocols to reduce impacts to dark night sky. The proposed new trails in the frontcountry areas would not have an effect on dark night skies since no new lighting would be installed.

Alternative B would have several beneficial effects on dark night skies. New efforts to implement energy conservation measures under this alternative could reduce nightscape impacts associated with monument operations and management of visitor services. A larger emphasis on interpretative efforts to educate the public would have an effect on reducing impacts to dark night skies. Collaborative efforts between the monument and neighboring communities to shield lights and conserve energy through better light fixtures could reduce dark night sky impacts associated with these developments. The establishment of user capacity indicators and standards would help protect dark night sky resources. Taken together, these actions would have a minor to moderate, long-term, beneficial effect on the nightscape in localized areas.

Cumulative Impacts

Cumulative impacts would be similar to those in alternative A. Alternative B proposes collaborative efforts between the monument and neighboring communities to shield lights and conserve energy through better fixtures to reduce dark sky impacts associated with regional light pollution. When the beneficial effects of alternative B are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be negligible to minor, beneficial cumulative effects on the monument's dark night skies.

Conclusion

The expansion of facilities in alternative B may require additional outdoor lighting resulting in long-term, negligible to minor, adverse impacts on dark night skies. These impacts may be mitigated through sensitive outside lighting design and attention to the types of fixtures used. Collaborative efforts between the monument and neighboring communities could improve the quality of dark skies, having a negligible to moderate, beneficial cumulative effect on dark night skies. The level of impact due to alternative B would not be expected to constitute an impairment of the monument's dark night sky resources or values.

DARK NIGHT SKIES – IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, new developments would be limited to Petroglyph Point improvements, trail expansion, and vehicle pullouts along the main monument road. Very little visitation occurs after dark, thus parking pull-outs along the main monument road would have a short-term, negligible, adverse impact on the monument's dark night skies. As in alternative B, new trails would not have an effect on dark night skies since no new lighting would be installed at trailheads.

As in alternative B, new facilities at Petroglyph Point, and the development of new trails could have long-term, negligible, adverse impacts on the monument's dark night skies depending on the outside lighting design, and the types of fixtures used. However, relocation of the road at Petroglyph Point, would have beneficial effects by moving vehicle lights further away from the site. To limit effects on dark skies and nocturnal habitats, site specific surveys and timed-sensored lighting systems would be used to limit impacts on wildlife.

In alternative C, the monument would increase outreach efforts to promote more visitation and provide additional recreational and interpretive trail opportunities, including shared trail systems. Medicine Lake Road would be improved under this alternative, raising a slim possibility that traffic volumes would increase. The monument would also promote more winter use and additional specialized tour opportunities. There is no reason to expect that there would be a significant increase in negative effects on dark skies associated with these new recreational opportunities.

Alternative C would expand the Indian Well campground to accommodate larger recreational vehicles and visitor use groups. With this expansion, short-term impacts could be incurred with higher visitation levels, depending on lighting sources attached to recreational vehicles.

Cumulative Impacts

Cumulative impacts would be similar to alternative A. The beneficial and adverse effects of alternative C would likely be a very small part of the cumulative impacts on dark night skies.

Conclusion

Alternative C would have a long-term, negligible, adverse impact on the monument's dark night skies from new facilities that may require additional outdoor lighting. These impacts may be mitigated through sensitive outside lighting design and the types of fixtures used. There would be minor to moderate,

adverse cumulative impacts from future growth and development in surrounding communities. The level of impact due to alternative C would not be expected to constitute an impairment of the monument's dark sky resources or values.

Viewsheds/Visual Resources

The area of consideration for this topic is the monument. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows:

Negligible: The effects would be barely detectable and expected to have no discernable effect on scenic/visual resources and viewsheds.

Minor: The effects would be slightly detectable, though not expected to have an overall effect on scenic/visual resources and viewsheds.

Moderate: The effects would be clearly detectable and could have an appreciable effect on scenic/visual resources and viewsheds.

Major: The effects would have substantial, highly noticeable influence and could permanently alter scenic/visual resources and viewsheds.

VIEWSHEDS/VISUAL RESOURCES – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

In alternative A, no new developments are proposed that would impact scenic views within the monument. Existing structures within the monument, visible from backcountry and wilderness areas, would continue to impact viewsheds within the monument. Power lines located in the northern portion of the monument would continue to have a minor, adverse impact on scenic vistas from the monument.

Visibility in the monument can be affected by regional haze, dust from agricultural activities, smoke from wildland fires, and other outside sources of air pollution. Such activities would cause short-term, negligible to moderate, adverse impacts on the monument's viewsheds.

The monument would continue to work regionally with adjacent landowners on viewshed and visibility issues. For example, the monument would continue to work with the California Environmental Protection Agency, and other partners, to preserve its Class I air quality within and around its borders. Cooperating with adjacent landowners to implement air protection measures would also reduce the impact of air pollution on monument visibility and result in minor to moderate, long-term, beneficial effects on the monument's scenic vistas.

Cumulative Impacts

Potential development outside of the monument could have an effect on visual resources by altering scenic landscapes. Visual impacts associated with proposed geothermal facilities on U.S. Forest Service lands would most likely be caused by transmission lines running from each site along the north slopes of the Medicine Lake highlands to the east. In addition, steam emissions at each generating plant or wellhead might also be visible from Lava Beds, particularly in cold, clear weather. Logging activity on the southern border of the monument could cause visual impacts of an unknown magnitude, depending on the harvest method utilized.

Overall, the beneficial and adverse effects from the actions of alternative A, plus the adverse impacts from regional or neighboring sources, would result in minor to moderate, adverse cumulative impacts on the monument's visual resources.

Conclusion

Alternative A would have minor to moderate, long-term, adverse impacts on visual resources, primarily from visible infrastructure both within and outside of the monument. Some activities such as wildland fires would cause short-term, negligible to minor, adverse impacts on the monument's viewsheds. Regional pollution sources would continue to affect the monument, and over time would result in minor to moderate, cumulative adverse impacts on visual resources. Implementation of alternative A would not result in an impairment of monument resources or values.

VIEWSHEDS/VISUAL RESOURCES – IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

In alternative B, the monument would take undertake new efforts to directly improve monument viewsheds through facility improvements. Such improvements would include screening monument buildings, less obtrusive paint colors, less reflective roofing materials, minimal lighting, placing overhead utility lines underground near along Hill Road at the northwest entrance, and Petroglyph Point, and cooperating with the U.S. Fish and Wildlife Service to place north side utility lines underground. These actions would have a long-term, moderate, beneficial effect on viewsheds and visual resources.

Alternative B would emphasize restoration of geologic features and increased monitoring to protect geologic features from damage. Deterring vandalism and other forms of damage to frequently viewed geologic resources, as well as active restoration, would lead to long-term, moderate, beneficial effects.

Alternative B also includes actions to rehabilitate or restore habitat in the northern portions of the monument. These actions would return those vegetated areas to their natural appearance, resulting in a long-term, moderate beneficial effect on viewsheds in the monument.

New visitor facilities proposed in alternative B that could affect viewsheds include new trails, campground renovations, new facilities at Petroglyph Point including relocation of the road and parking area, installation of photovoltaic panels, and small expansions to the visitor center and the research center. These facilities would affect visual experiences at both the site level and broader viewsheds.

Providing additional hiking trails should have a minor to moderate, long-term, beneficial effect on viewing experiences within the monument by providing additional opportunities for visitors to experience monument landscapes. However, some impacts on monument viewsheds would occur from siting new trails. New trails would be carefully sited to minimize such visual impacts.

Screening and separating tent camping and RV uses within the campground would have a long-term, moderate, beneficial effect on the visual experience of campers. Impacts on broader monument viewsheds would depend on whether the campground improvements are visible from elsewhere in the monument. The monument would strive to create minimal intrusions when siting and locating any new facilities at the campground. Campground improvements could have a minor, long-term impact on broader monument viewsheds.

In the long-term, facility improvements at Petroglyph Point would provide moderate beneficial effects on the overall appearance of this site. A new protective fence is intended to provide a more aesthetically pleasing experience for visitors viewing the petroglyphs. Moving the existing road and parking area further away from the petroglyphs will further improve the visual quality of the area. Currently, through traffic creates noise intrusions and dust clouds. As stated in the mitigation measures in Chapter 3, the facilities at Petroglyph Point would be designed, sited, and constructed to minimize the adverse effects on visual intrusions. Within the context of the monument, the addition of the visitor contact station, outdoor education area, and new day use area would have an overall, minor impact on broader monument and Tule Lake Basin viewsheds.

Under alternative B, the monument would add alternate forms of electrical generation to offset monument's electrical energy use. This could require up to 18,000 square feet of photovoltaic panels. While half of the panels could be placed on existing building roofs, the remainder would need to be mounted on about ¼ acre of ground. Sites are available for this in the vicinity of the Indian Well housing area that would be screened from public view and could be connected to the electrical grid. The addition of photovoltaic panels would have a long-term, negligible to minor, adverse impact on monument viewsheds. The monument may also consider wind turbines as an alternative source of energy. Wind turbines are currently manufactured in a variety of shapes and sizes. With careful siting and use of small turbines that can be obscured, the addition of turbines to existing developed areas would likely have a negligible to minor adverse effect on monument viewsheds.

Small additions to the research and visitor centers would likely have little impact on existing monument viewsheds. These small additions would be located in already developed and disturbed areas of the monument. Careful siting and massing, vegetative screening, and choosing appropriate paint colors and roofing materials would greatly minimize visual

impacts. The new additions would a have a long-term, negligible impact on monument viewsheds.

The construction of new trails and facilities would result in short-term, minor, adverse impacts on visual resources. Restoration of native habitats may have similar short-term adverse impacts.

As in alternative A, visibility can be affected by regional haze, dust from agricultural activities, smoke from western wildland fires, and other outside sources of air pollution. These factors would cause short-term negligible to moderate adverse impacts on the monument's viewsheds and night sky.

The monument would continue to work with the state of California Environmental Protection Agency and other partners to preserve its Class I air quality, within and around its borders. Cooperating with adjacent landowners to implement air protection measures would reduce the impact of air pollution on monument visibility and result in long-term, minor to moderate, beneficial effects on the monument's scenic vistas.

Cumulative impacts

The cumulative effects on visibility in the monument would be similar to those described for alternative A. Alternative B would provide beneficial impacts from minimizing the current impact of built structures on the landscape and coordinating with surrounding agencies to prevent and remove visual intrusions on visual resources and viewsheds. When the beneficial and adverse effects from the actions of alternative B are added to the adverse impacts from regional or neighboring sources, the result would be cumulative, minor, adverse impacts on the monument's viewsheds and visual resources.

Conclusion

The effects of facility improvements and habitat restoration proposed in alternative B would have moderate, long-term, benefits on visual resources. New facilities at Petroglyph Point and improvements at the campground would improve the visual quality at these sites. Negative visual impacts would primarily be short-term, during construction and active restoration of native habitat. The monument would minimize adverse cumulative impacts on visual resources through: 1) active management of viewsheds and visual resources within the monument; and 2) by working with adjacent landowners and others to minimize impacts. The beneficial and adverse effects from the actions of alternative B, plus the adverse impacts from regional or neighboring sources, would result in cumulative, minor, adverse impacts on the monument's visual resources. Implementation of alternative B would not result in an impairment of monument resources or values.

VIEWSHEDS/VISUAL RESOURCES – IMPACTS FROM ALTERNATIVE C

Analysis

New visitor facilities proposed in alternative C that could affect viewsheds include new trails, campground renovations, additional road pullouts, paving and reconstructing the Medicine Lake Road, and new facilities at Petroglyph Point. These facilities would affect visual experiences at both the site level and broader viewsheds. Construction of these new trails and facilities would result in short-term, minor, adverse impacts on visual resources.

Alternative C proposes the most new trail opportunities for the monument. Providing additional hiking trails should have a long-term, beneficial impact on viewing experiences within the monument by providing additional opportunities for visitors to experience monument landscapes. A new foot trail on cave loop could improve the visual quality of this area if it allows social trails to be restored. Some impacts on monument viewsheds would occur from altering the landscape to site new trails. However, any new trails would be sited to minimize visual impacts. Overall, new trails proposed under alternative C could have a long-term, minor impact on viewsheds and a long-term, moderate beneficial effect on viewing experiences at the monument.

Under alternative C, the monument would add alternate forms of electrical generation to offset monument's electrical energy use. This could require up to 18,000 square feet of photovoltaic panels and would be screened from public view and could be connected to the electrical grid. The addition of photovoltaic panels would have a long-term, negligible to minor, adverse impact on monument viewsheds. The monument may also consider wind turbines as an alternative source of energy. Wind turbines are currently manufactured in a variety of shapes and sizes. With careful siting and use of small turbines that can be obscured, the addition of turbines to existing developed areas would likely have a negligible to minor adverse effect on monument viewsheds.

Physically separating tent camping and RV camping through a new RV loop would have a long-term, moderate, beneficial effect on the visual experience of campground users. The proposed new RV loop would expand the footprint of the campground and create more of a visual disturbance at both the local site level and possibly on broader monument viewsheds. The monument would take every effort to create minimal intrusions when siting and locating new facilities at the campground. Campground improvements would have a minor to moderate, long-term impact on broader monument viewsheds.

Alternative C proposes to construct new automobile pullouts along the main road to allow for informal, dispersed recreation. This action would have a long term, minor, adverse impact on viewsheds. Additional pullouts would removing native habitat and possibly some geologic features. Additional access through pullouts may also encourage the creation of new social trails, causing long-term, minor, adverse impacts on visual quality.

In the long-term, facility improvements at Petroglyph Point would provide moderate, beneficial effects on the overall appearance of this site. Construction of a new protective fence is intended to provide a more aesthetically pleasing experience for visitors viewing the petroglyphs. Moving the existing road further away from the petroglyphs will further improve the visual quality of the area. Currently, through traffic creates noise intrusions and dust clouds. As stated in the mitigation measures in Chapter 3, the facilities at Petroglyph Point would be designed, sited, and constructed to minimize the adverse effects on visual intrusions. Within the context of the monument, the new day use area would have an overall, minor impact on broader monument viewsheds that include Petroglyph Point.

As in alternatives A and B, visibility in the monument would be affected by regional haze, dust from agricultural activities, smoke from fires, and other outside sources of air pollution. These factors would cause short-term, negligible to moderate, adverse impacts on the monument's viewsheds and visual resources.

As in alternatives A and B, the monument would continue to work with the California Environmental Protection Agency and other partners to preserve its Class I air quality within and around its borders. Cooperating with adjacent landowners to implement air protection measures would reduce the impact of air pollution on monument visibility and result in minor to moderate, long-term, beneficial effects on the monument's scenic vistas.

Cumulative Impacts

The cumulative effects on visibility in the monument would be similar to those described for alternative A. When the beneficial and adverse effects from the actions of alternative C are combined with the adverse cumulative impacts from regional or neighboring sources, the result would be minor to moderate, cumulative adverse impacts on the monument's visual resources. Alternative C's contribution to such impacts would be relatively small.

Conclusion

The effects of proposed actions under alternative C would have both adverse and beneficial effects on visual resources. The monument would continue to minimize impacts on visual resources within the monument and would work with adjacent landowners and others to minimize impacts on scenic resources from cumulative actions outside the monument. Negative visual impacts would primarily be short-term, during construction or renovation of new facilities. Long-term negative effects are primarily associated with new roadside pullouts, paving the Medicine Lake Road, and the creation of new trails. The beneficial and adverse effects from the actions of alternative C, plus the adverse impacts from regional or neighboring sources, would result in minor to moderate, adverse cumulative impacts on the monument's visual resources. Implementation of alternative C would not result in an impairment of monument resources or values.

Cave Resources

Lava Beds National Monument contains some of the most extensive and least impacted lava tube caves in the western United States. Many caves are in remote, isolated areas and are not well known to the general public. The area of consideration for this topic is the monument. Potential impacts from management actions are based on, available information about caves, professional judgment, and experience with similar actions. The thresholds of change for the intensity of an impact are as follows:

Negligible: The impact would be at the lower levels of detection or not measurable.

Minor: A cave feature or environment might suffer some slight alteration that would be noticeable.

Moderate: Cave features or the environment would be obviously altered, or a number of features would show changes.

Major: Impacts on cave features or the environment would result in the permanent loss of an important cave feature or in highly noticeable widespread changes in many cave features or the environment.

CAVE RESOURCES– IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Under alternative A, Lava Beds National Monument would continue to follow current management objectives related to cave resources. Visitors would still be allowed to experience self-guided cave tours. New facility developments would not be built over or degrade cave resources, thus, no impacts to cave resources would occur from construction. Cave resources easily accessible to visitors from trails, roads, picnic areas, and off-trail areas are vulnerable to disturbance, inadvertent damage, and vandalism, particularly if visitor use increases or focuses on specific cave resource areas. Many of the highly visited caves contain trails, which would continue to be used for visitor or administrative uses. These trails need to be maintained to protect caves from potential visitor impacts. Long-term, minor to moderate, deterioration of cave resources would continue to occur and may expand to new cave resources with shifting visitation trends, regular facility and trail maintenance, and field research. Formation of social trails within caves would continue to degrade cave resources. Monument staff would continue efforts to minimize visitor use impacts through education and restoration of some impacted caves, creating a long-term, minor, beneficial effect on cave resources.

The monument's ability to identify, inventory, conduct research and document cave abiotic and biotic resources would continue to be limited by staffing constraints. Long-term monitoring and assessment of cave conditions and cave biota population trends would be minimal, if not inadequate. The lack of inventories and monitoring could lead to unknown deterioration of cave resources. Opportunities for facilitating cooperative research with universities and independent researchers would be limited.

Cumulative Impacts

Most caves in the monument retain their natural character, without alterations. Varying degrees of disturbance from past use has occurred in some caves, particularly in the cave loop area and other primary visitor caves. Past damage includes broken features, trampled invertebrates, compacted soils, sediment transport on clothes, litter, and alteration of airflow and microclimates due to digging. Management provisions to maintain and improve conditions over the long term would continue (e.g., removing litter, cleaning dispersed sediments). No future development of caves is proposed. Most caves would remain unaffected and in good condition, and current restoration efforts would continue.

No regional activities or proposals are expected to have a cumulative impact on cave resources at the monument. Significant regional population growth is not expected and monument visitation would likely remain stable, with modest increases over time. Plans and projects on the adjacent Modoc National Forest and Tule Lake National Wildlife Refuge are not expected to have an effect on caves in the monument.

Overall, the effects of past, present, and reasonably foreseeable future projects have resulted in negligible to moderate, adverse cumulative effects on cave resources. Alternative A's contribution to these impacts would be relatively small.

Conclusion

Alternative A would have both beneficial and adverse impacts on cave resources. Some long-term, minor to moderate, adverse impacts would occur in local areas due to current visitor use levels and the potential for increased visitor use levels. However, continuing efforts to mitigate cave resource damage through education and restoration would likely have a long-term, minor, beneficial effect. The effects of past, present, and reasonably foreseeable future projects have resulted in long-term, negligible to moderate, adverse cumulative effects on cave resources. Alternative A's contribution to these impacts would be relatively small. None of the cave resource impacts that would occur in this alternative would be sufficient to result in an impairment of the monument's resources and values.

CAVE RESOURCES – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

Cave resources at Lava Beds receive the greatest amount of resource damage due to visitation and the development of facilities such as trails within the cave system. Visitation can be a product of recreation, research, and administrative uses. The primary methods in which the monument can prevent cave resource degradation is through limiting access to cave systems and educating visitors on low impact caving techniques. Alternative B proposes several actions that could result in increased access to cave resources.

The provision of new opportunities to experience wilderness areas in alternative B could increase visitation to backcountry cave systems and subsequently introduce adverse impacts to those cave systems. In addition, increased education and outreach on wilderness areas may improve knowledge of sensitive cave locations, leading to increased visitation. On the other hand, increased outreach and education would improve overall visitor knowledge of appropriate caving techniques and ethics, which will help mitigate degradation to cave resources and improve overall visitor experience at the monument.

Wilderness dependent research would continue to be encouraged. The Schonchin Lava Tubes Research Natural Area, a 134-acre plot of land set aside for research, would continue to be maintained by allowing natural physical and biological processes to prevail without human intervention.

The provision for more trail opportunities with an emphasis on traditional interpretive methods or new technologies as appropriate could produce adverse cave resource impacts. The construction of a geology trail could have long-term, negligible to minor, adverse impacts on cave resources. Similarly, the construction of loop trails or trails connecting visitor use areas could lead to impacts on cave resources if these trails require construction over caves or ease access to cave systems.

Overall increases in recreational opportunities, including winter recreation, could lead to adverse impacts from increased use or alternative uses (i.e. climbing). Furthermore, the increase of recreational opportunities on adjacent federal lands may lead to cave impacts within and outside of the monument. An improved virtual cave experience could reduce impacts to cave resources by lowering visitation, minimizing the construction of cave infrastructures, and reducing impacts associated with maintenance of trails within caves.

The proposal for several day use areas for large groups could have both adverse and beneficial impacts to cave resources. Large groups are often associated with inappropriate behaviors in cave systems. The encouragement of more large groups could lead to both cave degradation and reduction of overall visitor experience for those expecting a wilderness experience in the monument's caves. If the group picnic and camp sites are in proximity to known cave resources, it is highly likely those caves will receive increased use and increased adverse impacts. However, providing facilities to accommodate large groups where the monument staff can interact with group leaders and influence the knowledge, behavior, timing, and size of groups could mitigate potentially adverse impacts of large groups.

The reduction of automobiles on cave loop would improve the overall cave experience and the safety of cavers who use the road to travel between cave systems. The creation of trail linkages to reduce automobile use could have both adverse and beneficial impacts on cave systems, dependent upon the proximity of trail linkages to cave resources.

Maintaining approximately 1.8 miles of Lyons Road for administrative vehicle access to Fern Cave should have no new adverse impacts to cave resources. Continued visitation (planned or random) to Fern Cave could have minor long-term impacts on cave resources. Access and parking may be redesigned to better protect resources and should have no impacts to cave resources.

The introduction of more concessionaire services could have long-term, minor to moderate, adverse impacts on cave resources. The allowance of limited, seasonal, retail and food service vendors could increase the amount of litter present in the cave systems, particularly in the cave loop and visitor center area. The introduction of commercial tours would provide more visitor opportunities, but would also increase the potential impact on caves. Group size and behavior would have to be strictly monitored and regulated. Commercial tours could benefit cave resources, if tour operators work in close contact with monument staff and strive for visitor services, safety, and resource protection.

The installation of toilets on Cave Loop would be beneficial for cave resources. The installations could reduce

social trails which promote use of non-primary caves. They would also reduce the frequency of human waste inside caves, dramatically reducing damage to cave ecosystems and improving visitor experiences.

Increased restoration, research, and cave management efforts would have an overall beneficial impact on cave resources at the monument. The establishment of formal relationships with citizens, high schools, colleges, and universities to conduct research should be beneficial towards the protection, restoration, and understanding of cave resources. The advancement of knowledge related to cave resources and management would improve the ability of the monument to manage changing visitation and technologies. There could be a minor, adverse impact if large-scale research begins which involves considerable human presence in backcountry and pristine cave environments.

New facility developments would not be built over or degrade cave resources, thus, impacts to cave resources from infrastructure development are unlikely within this alternative.

Overall, new recreational opportunities proposed in alternative B would have long-term, minor adverse impacts on cave resources. Moderate, adverse impacts would occur in some high visitation areas such as the Cave Loop. Increased education, restoration, monitoring, and research would have beneficial effects, offsetting some of the impact from new recreational opportunities.

Cumulative Impacts

As described under alternative A, varying degrees of disturbance from past use have occurred in some of the more accessible caves. No regional activities or proposals are expected to have a cumulative effect on cave resources in the monument. New visitor opportunities proposed in alternative B could have an impact on cave resources over time. However, alternative B proposes increased cave restoration, improved monitoring, more cave education, and research that would, over time, benefit cave resources.

Overall, the effects of past, present, and reasonably foreseeable future projects would result in adverse, minor to moderate, cumulative effects on cave resources. Alternative B's contribution to these impacts would be relatively small.

Conclusion

Under alternative B, proposed actions that focus on improving access to monument resources, either through trail development or through increased interpretation, could have long-term, negligible to minor adverse impacts on cave resources. The monument would take appropriate steps to mitigate initial impacts and continue monitoring use of caves in the backcountry. Long-term, moderate, adverse impacts on cave resources could occur in localized areas within the developed and interpretive backcountry zones. Alternative B addresses this concern with the proposed implementation of a variety of resource management actions, education and outreach improvements, enhanced protection measures, and improved monitoring and research related to caves. Cumulative impacts would be the same as alternative A. The adverse and beneficial impacts of alternative B's contribution to these impacts would be relatively small. None of the cave resource impacts that would occur in this alternative would be sufficient to result in an impairment of the monument's resources and values.

CAVE RESOURCES – IMPACTS FROM ALTERNATIVE C

Analysis

The expansion of outreach to the travel and tourism industry to maintain or increase visitation, and in turn raise the regional profile of the monument, could impact cave resources. Impacts from new recreational opportunities, increased tours, new food concessions, and proposed new facilities such as day use areas and loop trails would be similar to alternative B and could result in minor to moderate, adverse impacts to cave resources in the Cave Loop area and other primary visitor caves. Such impacts could be mitigated through additional education and interpretation promoting responsible visitation to caves.

The construction of pullouts on the main road to allow for informal, dispersed recreation could have localized, moderate, adverse impacts on cave resources depending on their location. The primary protection method for cave resources is the lack of knowledge of their location. New access points throughout the monument would increase use of caves that currently have had very little to no visitation. It can be expected, using Cave Loop as an example, that the establishment of new access points to visit backcountry caves, and caves within developed and interpretive backcountry zones, would cause long-term, moderate adverse

impacts to some cave resources. In addition, direct impacts could result from the construction of pullouts directly over or adjacent to caves. However, this could be mitigated through careful selection of sites for new pullouts.

The improvement of the campground to better accommodate large vehicles by adding a new RV loop and reducing other campsites should represent minor to no adverse impacts to cave resources. The stipulation that no hookups would be provided for RV sites would also lower the probability of adverse impacts to cave resources. However, depending on the location of proposed campground improvements, there could be some minor to major impacts from site construction and site use on cave resources, if construction occurs adjacent to or over a cave.

Overall increases in recreational opportunities, including winter recreation, could lead to adverse impacts from increased use or alternative types of use (i.e. rock climbing). Furthermore, the promotion or increase of recreation opportunities on adjacent federal lands may lead to cave impacts within the monument.

Additional interpretation of Civilian Conservation Corps-era monument features could provide a method for mitigating cave impacts by fostering appreciation of CCC-built cave trails. Informing visitors should benefit cave resources or, at least, cause no adverse impact.

Cumulative Impacts

As described under alternative A, varying degrees of disturbance from past use have occurred in some of the more visitor accessible caves. No regional activities or proposals are expected to have a cumulative effect on cave resources in the monument. New visitor opportunities such as caving tours and new trail loops could have localized impacts on some cave resources.

Overall, the effects of past, present, and reasonably foreseeable future projects would result in adverse, minor to moderate, cumulative effects on cave resources. Alternative C would make a modest contribution to these effects, primarily from new caving opportunities and new visitor facilities such as trails.

Conclusion

Under alternative C, several proposed actions focus on improving access to monument resources either through trail development or through increased recreational opportunities. The impacts from these actions should have minor impacts on cave resources as long as, appropriate steps are taken to mitigate initial impacts and proper monitoring of backcountry and wilderness caves takes place. If proper mitigation (e.g. trail location, education, protection services) is not employed, long-term, moderate, adverse impacts could occur to non-renewable cave resources. Cumulative impacts would be the same as alternative A. Alternative C would make a modest contribution to these effects, primarily from new caving opportunities and new visitor facilities such as trails. None of the cave resource impacts that would occur in this alternative would be sufficient to result in an impairment of the monument's resources and values.

Geologic Resources

The area of consideration for this topic is the monument. Available information on surface geologic resources and processes, including soils, in the monument was compiled. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows.

Negligible: An action that could result in a change to a geologic feature or process, but the change would be so small that it would not be of any measurable or perceptible consequence.

Minor: An impact that could result in a change to a geologic feature or process, but the change would be so small that it would not be of any measurable or perceptible consequence.

Moderate: An action that would result in a change to a geologic feature or process; the change would be measurable and of consequence.

Major: An action that would result in a noticeable change to a geologic feature or process; the change would be measurable and the level of disturbance would be severe.

GEOLOGIC RESOURCES– IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

The majority of the monument's primary visitor sites are non-renewable geologic features. This includes Fleeners Chimneys, Black Crater, Petroglyph Point, Schonchin Butte, and Captain Jacks Stronghold. The elements of alternative A would have, at a minimum, minor adverse impacts on the monument's geologic resources. The geologic features of Lava Beds would likely continue to be worn, damaged, and/or degraded by visitors activities in localized areas, particularly adjacent to existing trails, near visitor facilities, and wherever social trails exist.

Increases in visitation, or shifting of visitor use toward specific geologic resources, could dramatically increase the extent of geologic resource damage. Monument staff and outside researchers would likely continue to use existing trails and social trails, and would have a minor, adverse impact on adjacent geologic features in the monument, as long as travel is dispersed and infrequent. In some areas, new human-created, social trails may form with increased visitation, particularly in areas with high visitor numbers. Currently, social trails at Black Crater and Fleeners Chimneys are causing long-term, minor to moderate, adverse impacts to geologic resources. Off trail travel on cinder cones represents potential minor, adverse impacts to the geologic resources. For example, sliding down slopes creates noticeable scars on the surface and encourages future reciprocal behaviors. Proposed restoration efforts could have short-term, moderate beneficial impacts on these resources and the establishment of improved low-impact trails around these resources could further mitigate impacts from visitation. Cave geologic features would continue to receive long-term, minor to moderate, adverse impacts in the form of disturbance and compaction from visitors.

Alternative A includes no formal plans for construction of new facilities, thus no geologic features would be altered due to construction. Maintenance of existing facilities would cause minimal degradation of geologic features, resulting in negligible to minor, long-term, adverse impacts in localized areas.

Cumulative Impacts

Geologic features throughout the monument have been altered by past management practices and infrastructure developments. Past developments have resulted in the loss or alteration of some geologic features. However, much of the monument's geologic features remain in their natural character.

No regional activities or proposals are expected to have a cumulative impact on geologic resources at the monument. Increases in visitation will likely continue to be modest and regional population growth is not expected to increase significantly. Plans and projects on the adjacent Modoc National Forest and Tule Lake National Wildlife Refuge are not expected to have an effect on geologic features in the monument.

Overall, the effects of past, present, and reasonably foreseeable future projects and uses have resulted in minor to moderate, adverse cumulative effects on geologic resources. Alternative A actions are not expected to contribute to these impacts.

Conclusion

Most of the monument's geologic features would not be affected by the ongoing use in alternative A. However, some specific geologic features would be worn, damaged, or altered, due to increased visitor use in localized areas such as along trails, in caves, and at major visitor locations. Visitor use of primary frontcountry geologic resources could result in long-term, moderate, adverse impacts on the monument's geologic. Geologic resources in backcountry and wilderness areas would receive little visitation, and thus negligible, long-term, adverse impacts.

The effects of past, present, and reasonably foreseeable future projects have resulted in minor to moderate, adverse cumulative effects on geologic resources. Alternative A actions are not expected to contribute to these impacts. No impairment to the monument's resources and values would result from geologic feature impacts in this alternative.

GEOLOGIC RESOURCES – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

In alternative B, some geologic features would be lost to degradation or substantially altered in local areas where disturbance would occur due to the development of trails, parking areas, campsites, and other facilities. The development of new visitor facilities at Petroglyph Point could have minor to moderate, short-term adverse impacts on local geologic features, particularly

if trails are developed to improve access. Additionally, the expansion of the monument visitor center, the creation of new wilderness trails, and the creation of new areas for large groups, could have moderate, short-term, adverse impacts on geologic features near the site. Mitigation efforts could help reduce the impact on the geologic features in the area. The adverse impact on geologic features would likely be moderate in the specific areas, but the adverse impact on the monument's overall geologic features, due to new developments, would be long-term, minor and adverse.

Several actions would occur in areas that have already been disturbed by people. These actions include alterations to the campground, Petroglyph Point, and expansion of the research center and visitor center. Little additional geologic feature disturbance would be required. Thus, these actions would have a long-term, minor, adverse impact on geologic features in these areas. As in alternative A, maintenance of existing facilities would probably result in some disruption of geologic features, resulting in a negligible to minor, long-term, adverse impact on geologic features in localized areas.

The monument staff and the Cave Research Foundation would likely continue to use existing trails and social trails throughout the monument in order to work in remote caves, creating a long-term, negligible to minor, adverse impact on geologic features by contributing to additional geologic feature wear in the monument. Encouragement of increased research in the monument, could increase the impacts on geologic features, but are considered to be minor, adverse impacts. Future research may also benefit geologic features through increased understanding of the extent, type, and condition of geologic features within the monument.

The creation of a interpretive geology trail could have long-term, minor to moderate, impacts on resources, depending on level of use on the trail and the ability of the monument to promote resource conservation along the trail corridor. Improved interpretation of geologic resources on the trail and in general throughout the monument could have long-term, moderate, beneficial impacts on cave resources. In some areas in the monument, new social trails may be created as visitation increases. The long-term, adverse impacts on geologic features from visitation would likely be moderate and localized in extent.

Expanded recreational opportunities and additional trails could lead to moderate, short-term, adverse impacts on geologic resources. The creation of backcountry campsites, with associated networks of social trails, could create long-term, moderate, adverse impacts to the immediate area and minor long-term impacts radiating outward from the sites. The encouragement of more backcountry trail use could potentially increase adverse impacts to wilderness geologic features. The geologic features in these areas are often pristine and, even with relatively few visits (staff or visitors), can result in long-term, moderate, adverse impacts.

Efforts to remove social trails would help reduce degradation and could result in a long-term, minor to moderate, beneficial effect on geologic features. This should reduce wear, erosion, and degradation compared to the present conditions, and would result in a minor to moderate, long term, beneficial effect. Instituting and monitoring user capacity indicators and standards should help ensure that an unacceptable increase in the number of human-created trails (and resulting increased geologic feature disruption) does not occur in the interpretive backcountry and backcountry zones. Compared to alternative A, this alternative would result in a moderate, long term, beneficial impact.

Cumulative Impacts

As described under alternative A, past management practices and infrastructure improvements have altered geologic features. Overall, the effects of past, present, and reasonably foreseeable future projects have resulted in minor to moderate, adverse cumulative effects. Alternative B's contribution to these impacts would be relatively small.

Conclusion

Most of the monument's geologic features would not be directly affected by the actions in alternative B. However, some geologic features could be disturbed and lost while other features could be altered. This would be due to construction projects and increased visitor use in localized areas, such as along trails and inside caves. Overall, these adverse impacts would likely be minor and long-term in extent.

Establishing and monitoring user capacity indicators and standards and additional restoration efforts should help prevent the establishment of new human-created

trails and resulting geologic feature degradation. This would have a moderate, long term, beneficial effect. When the impacts in alternative B are added to other impacts from past and foreseeable future actions, there would be the potential for a long-term, minor to moderate, adverse cumulative impact on area geologic features, although the actions in alternative B would add a very small increment to this overall cumulative impact. No impairment to the monument's resources and values would result from geologic feature impacts in this alternative.

GEOLOGIC RESOURCES – IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, increases in visitation, or shifting of visitor use toward specific geologic resources could increase the extent of geologic resource damage. Some geologic features would be lost to degradation or substantially altered in local areas where disturbance occurs due to the development of trails, parking areas, campsites, and other facilities. The development of new visitor facilities at Petroglyph Point could have minor to moderate, short-term adverse impacts on local geologic features, particularly if a trail is developed to the top of the point.

The creation of new picnic and camp areas for groups, could have moderate, short-term, adverse impacts on geologic features near the site. Site preparation and landscaping work could disturb geologic features in these areas, and geologic features could be paved over and lost in the footprint of the facilities. Mitigation efforts could help reduce these impacts. The adverse impact on geologic features would likely be moderate at the site level, but adverse impacts on the monument's overall geologic features due to new developments would be minor and long term.

The creation of new loop trails and backcountry campsites, and/or the formalizing of several existing social trails would have long-term, minor, adverse impacts on geologic resources. Increased visitation as a result of the creation of the trail systems could result in long-term, moderate, adverse impacts on geologic resources if they become a planned or unplanned destination (i.e. Ross Chimney near Thomas-Wright Battlefield).

The creation of additional automobile pullouts along the main monument road would create a new opportunities for social trail formation, leading to the possible disturbance of nearby geologic features. This could cause moderate, long-term, adverse impacts to the immediate area and minor, long-term impacts radiating outward from the sites.

The encouragement of more backcountry trail use could potentially increase adverse impacts to wilderness geologic features. The geologic features in these areas are often pristine and even with relatively few visits (staff or visitors), can receive localized, moderate to major levels of adverse impact.

As in alternative A, maintenance of existing facilities would probably result in the minor degradation or alteration of geologic feature properties, resulting in negligible to minor, long-term, adverse impacts in localized areas. Geologic features in the monument would likely continue to be degraded by hikers in local areas, such as along the sides of trails. This causes minor, adverse impacts, which could be exacerbated if, as detailed in alternative B, efforts are made to promote more visitation not only in frontcountry zones, but in backcountry and wilderness zones as well. However, it is likely that the overall impacts from increased visitation will be minor in general, and moderate in specific locations. In some areas, new social trails may form with increased visitation, particularly in areas with high visitor numbers. Efforts to close and revegetate social trails, such as near Cave Loop, would help reduce degradation and would result in a long-term, beneficial impact on geologic features.

Instituting and monitoring user capacity indicators and standards also should help ensure that an unacceptable increase in the creation of human-created trails does not occur. Compared to the alternative A, this would result in a minor to moderate, long-term, beneficial impact.

Cumulative Impacts

As described under alternative A, past management practices and infrastructure improvements have altered geologic features. Overall, the effects of past, present, and reasonably foreseeable future projects have resulted in adverse, minor to moderate cumulative effects. Alternative C's contribution to these impacts would be relatively small.

Conclusion

Most of the monument's geologic features would not be affected by the actions in alternative C. However, some geologic features would be degraded and/or lost and some geologic feature properties would be altered due to new developments and increased visitor use in localized areas such as along trails and in caves. The overall adverse impacts would likely be minor and long-term in extent. A potential increase in backcountry use where features are pristine with relatively few visits could receive localized, moderate to major, levels of adverse impact. However, establishing and monitoring user capacity indicators and standards should help prevent the establishment of new human-created trails and prevent resulting geologic feature degradation.

When the impacts in alternative C are added to impacts from other past and foreseeable future actions, there would be the potential for a long-term, minor to moderate, adverse cumulative impact on area geologic features, although the actions in alternative C would add a very small increment to this overall cumulative impact. No impairment to the monument's resources and values would result from geologic feature impacts in this alternative.

Soils

See "Geologic Resources" for impact thresholds related to soils.

SOILS – IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

Soils will likely continue to be disturbed, compacted, and eroded by visitors in localized areas, particularly along existing trails, near visitor facilities, and near social trails. Monument staff and outside researchers would likely continue to use existing trails and social trails, and thus would have a long-term, negligible to minor, adverse impact on adjacent soils in the monument, as long as travel is dispersed and infrequent. In some areas, new human-created, social trails may form with increased visitation or changes to visitation patterns, particularly in areas with high visitor numbers. These long-term, adverse visitor impacts to soils would likely be minor and limited in extent. Cave soils would continue to receive long-term, minor to moderate, adverse impacts in the form of disturbance and compaction from visitors. Alternative A includes no formal plans for construction of new facilities, thus no soils would be altered due to construction.

Cumulative Impacts

Soils throughout the monument have been altered by past grazing practices and infrastructure developments. The loss and alteration of soils due to past land uses and future management actions would result in a minor to moderate, adverse cumulative impact on area soils. Cumulative impacts to cave soils are unknown, and presumed to be minor to moderate based on visitation levels. The level of adverse impacts could increase with increased visitation to cave systems, particularly backcountry/wilderness caves.

When the potential minor effects from increased visitation in the monument are added to the past and future impacts external to the monument, there would be a long-term, minor to moderate, adverse cumulative impact on area soils. The actions in alternative A would contribute a very small increment to the overall impact.

Conclusion

Most of the monument's soils would not be affected by the actions proposed in alternative A. However, some soils would be compacted and disturbed, and soil properties would be altered due to increased visitor use in localized areas such as along trails and in caves. These adverse impacts would likely be minor, adverse, and long-term in extent. When the impacts in alternative A are concentrated to localized areas, such as social trails and inside caves, impacts may be more moderate and long-term. There would be a long-term, minor to moderate, adverse cumulative impact on area soils from past grazing practices and infrastructure improvements. The actions in alternative A would contribute a very small increment to the overall impact. Overall, no impairment to the monument's resources and values would result from soil impacts in this alternative.

SOILS– IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

As in alternative A, soils would continue to be disturbed, compacted, and eroded by visitors in localized areas, particularly along existing trails, near visitor facilities, and in the vicinity of social trails.

In alternative B, some soils would be lost to degradation, compaction, or disturbance, or substantially altered in local areas due to the development of new trails, parking areas, campsites, and other facilities. The development of new visitor facilities at Petroglyph Point could have minor to moderate, short-term, adverse impacts. The expansion of the visitor center, the creation of new wilderness trails, the creation of new picnic areas for groups, and alteration of the campground could have moderate, short-term, adverse impacts on soils near those sites. Site preparation and landscaping work would disturb soils temporarily, and soils would be modified in the footprint. Construction equipment would also likely disturb and compact soils in the project areas. Mitigation efforts could help reduce the impact on the soils in the area. These actions would have minor, adverse, long-term impacts on soils in those areas.

Expanded recreational opportunities and additional trails could lead to moderate, short-term, adverse impacts on monument soils. Diversification of recreational opportunities could have a minor to moderate, adverse impact on soils along newly designated trails and adjacent areas. The creation of backcountry campsites could create new areas of compacted and disturbed soils, with associated networks of social trails. Moderate, long-term, adverse impacts could occur in the immediate area, with minor, long-term impacts radiating outward from the sites.

Cave soils will continue to receive minor to moderate, adverse impacts from visitors in the form of disturbance and compaction. The soils of highly visited caves with debris cones will continue to incur adverse, minor impacts with continued use. The encouragement of more backcountry trail use could potentially increase adverse impacts to wilderness soils and the use of backcountry caves. The soils in these caves are often pristine, and even with relatively few visits (staff or visitors), can receive moderate levels of adverse impacts.

Efforts to remove social trails would help reduce soil degradation and result in a long-term, beneficial impact on soils. This should reduce compaction and disturbance compared to the present conditions, and would result in a minor to moderate, long term, beneficial effect. Instituting and monitoring user capacity indicators and standards should help ensure that an unacceptable increase in the number of human-created trails (and resulting increased soil disruption) does not occur in the backcountry zones. Compared to the no-action alternative, this alternative would result in a negligible, long term, beneficial effect.

Encouragement of increased research in the monument, could heighten the impact of these activities on soils in the monument. Monument staff and outside researchers would likely continue to use existing trails and social trails throughout the monument in order to work in remote caves, creating a negligible to minor impact on soils by contributing to additional soil compaction and disturbance in the monument. Future research may potentially benefit soils through increased understanding of the extent, type, and condition of soils within the monument. In some areas in the monument, new social trails may be created as visitation patterns change. The long-term, adverse impacts on soils would likely be moderate and localized in extent.

Cumulative Impacts

Cumulative impacts on soils would be the same as alternative A. When the past and future impacts are added to the potential adverse and beneficial effects of alternative B, there would be a long-term, minor to moderate, adverse cumulative impact on area soils. However, the actions in alternative B would contribute a very small increment to the overall impact.

Conclusion

Most of the monument's soils would not be affected by the actions in alternative B. However, some soils would be disturbed, altered, and lost due to construction projects and increased visitor use in localized areas such as along trails and inside caves. Overall, the long-term, adverse impacts would likely be minor. Establishing and monitoring user capacity indicators and standards should help prevent the establishment of new human created trails and prevent resulting soil degradation. This would have a negligible, long term, beneficial effect. When the impacts in alternative B are added to other impacts from past and foreseeable future actions, there would be the potential for a long-term, minor to moderate, adverse cumulative impact on area soils—although the actions in alternative B would add a very small increment to this overall cumulative impact. No impairment to the monument's resources and values would result from soil impacts in this alternative.

SOILS – IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, some soils would be lost to degradation or substantially altered in local areas where ground disturbance occurs due to the development of trails, parking areas, campsites, and other facilities. The development of new visitor facilities at Petroglyph Point could have minor to moderate, short-term, adverse impacts on local soils. Several actions would occur in areas that have already been disturbed. These include improvements and redesigning of picnic areas and Indian Well campground, the creation of new loop trails, backcountry campsites, and the formalizing of several existing social trails. Little additional soil disturbance would be required in these areas, and thus these actions would have minor, long-term, adverse impact on soils. The conversion of the Powerline road to a trail could benefit soils along the portions of the road that would be reclaimed and in surrounding areas through a reduction of off road travel. However, it could have minor to moderate, adverse impacts on surface soils and cave soils if a trail was created and popularized. New social trails would develop to cave resources, and these caves would incur greater visitation, leading to compaction and disturbance of cave soils.

Expanded recreational opportunities and additional trails could lead to moderate adverse impacts on monument lands. Diversification of recreational opportunities could have minor to moderate impacts on soils along the newly designated trails and adjacent areas. The creation of automobile pullouts along the main park road would create a new opportunities for compacted and disturbed soils through the formation of new social trail networks. These would cause moderate, long-term, adverse impacts to the immediate area and minor, long-term impacts radiating outward from the sites.

Cave soils will continue to receive minor to moderate, adverse impacts from visitors in the form of disturbance and compaction. The soils of highly visited caves with debris cones will continue to incur adverse, minor impacts with continued use. The encouragement of more backcountry trail use could potentially increase adverse impacts to wilderness soils and the use of backcountry caves. The soils in these caves are often pristine, and even with relatively few visits (staff or visitors), can receive moderate levels of adverse impacts.

Soils in the monument would likely continue to be compacted and degraded by hikers in local areas, such as along the sides of trails. This causes minor adverse impacts, which could be exacerbated if, as detailed in alternative C, efforts are made to promote more visitation in both the frontcountry and backcountry zones. However, it is likely that the overall impacts from increased visitation would be minor overall, and moderate in specific locations. In some areas, new social trails may form with increased visitation, particularly in areas with high visitor numbers. Efforts to close and revegetate social trails, such as near Cave Loop, would help reduce degradation and would result in a long-term, beneficial effect on soils. The long-term, adverse visitor impacts would likely be minor and limited in extent. Instituting and monitoring user capacity indicators and standards also should help ensure that an unacceptable increase in the creation of human-created trails does not occur in frontcountry and backcountry zones. Compared to the no-action alternative, this would result in a negligible, long-term, beneficial effect.

Cumulative Impacts

Cumulative impacts on soils would be the same as alternative A. When these past and future impacts are added to the potential adverse and beneficial effects of alternative C, there would be a long-term, minor to moderate, adverse cumulative impact on area soils. However, the actions in alternative C would contribute a very small increment to the overall impact.

Conclusion

Most of the monument's soils would not be affected by the actions in alternative C. However, some soils would be degraded and lost and some soil properties would be altered due to new developments and increased visitor use in localized areas, such as along trails and in caves. These adverse impacts would likely be minor and long-term in extent. Establishing and monitoring user capacity indicators and standards should help prevent the establishment of new human-created trails and prevent resulting soil degradation resulting in negligible, long-term, beneficial effects. When the impacts in alternative C are added to impacts from other past and foreseeable future actions, there would be the potential for a long-term, minor to moderate, adverse cumulative impact on area soils—although the actions in alternative C would add a very small increment to this overall cumulative impact. No impairment to the monument's

resources and values would result from soil impacts in this alternative.

Vegetation

The area of consideration for this topic is the monument. Available information on vegetation in the monument was compiled. Potential impacts from management actions are based on professional judgment and experience with similar actions. The thresholds of change for the intensity of an impact are as follows.

Negligible: The impact of vegetation (individuals or communities) would not be measurable. The abundance or distribution of individuals would not be affected or would be slightly affected. Ecological processes and biological productivity would not be affected.

Minor: An action would not necessarily decrease or increase an area's overall biological productivity. An action would affect the abundance or distribution of individuals in a localized area but would not affect the viability of local or regional populations or communities.

Moderate: An action would result in a change in overall biological productivity in a small area. An action would affect a local population sufficiently to cause a change in abundance or distribution, but it would not affect the viability of the regional population or communities. Changes to ecological processes would be of limited extent.

Major: An action would result in a change in overall biological productivity in a relatively large area. An action would affect a regional or local population of a species sufficiently to cause a change in abundance or in distribution to the extent that the population or communities would not be likely to return to its/their formal level (adverse), or would return to a sustainable level (beneficial). Key ecological processes would be altered.

VEGETATION IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

No impacts on vegetation would occur due to new development or improvement of facilities. Visitor use levels in Cave Loop and within 1/4 mile of trailheads would continue to cause moderate, adverse impacts and potentially minor to moderate, adverse impacts in localized areas if use levels increase, change, or continue. Some vegetation may be lost near popular use areas in the monument due to human created social trails. None of these impacts would affect the integrity, distribution, or presence of native plant communities throughout the monument. Overall, visitor use would likely continue to have a long-term, minor, adverse impact on the monument's native vegetation in localized areas.

As noted in the "Affected Environment", the spread of nonnative plants is a problem in the monument. Agricultural use on the Tule Lake National Wildlife Refuge would continue along the northern boundary of the monument. The potential spread of agricultural plants and invasive weeds from these fields into monument lands would continue to have an adverse effect on native vegetation. Vehicles driving through the monument would continue to be a potential source of nonnative plant transport and establishment. Even with education efforts, some nonnative plants could be introduced or spread by visitors in the monument. Continued use of integrated pest management techniques should help contain the spread of some nonnative species. Zones of infestation, depending on the nonnative plant species, would continue to be present during the life of this plan.

Climate change, the resultant spread of cheat grass into higher elevations, and the continued arrival of new invasive weeds into the monument are expected to adversely affect vegetation. Even with continued monitoring and weed control efforts, these adverse impacts would be moderate to major in the northern half of the monument and minor to moderate in the southern half of the monument. Continuing efforts to conduct selective cutting would reduce juniper numbers in the lower elevations of the monument and reinvigorate grasslands. Care in the use of prescribed fire and wildland fire in the lower elevations may limit the continued spread of cheat grass. A mosaic of woodlands, grasslands, and intermediate successional vegetative communities would continue to be promoted in most of the monument with additional treatments

in the southern portions of the monument to support pine forests. These continuing efforts would result in a moderate, long-term, beneficial impact on the monument's vegetation.

Cumulative Impacts

Actions outside the monument would likely continue to affect the area's native vegetation. Over time, most native bunchgrass/sagebrush steppe communities have been affected by human activities such as agricultural operations, grazing, construction, and other developments.

Continued agricultural practices on the Tule Lake National Wildlife Refuge may also promote the spread on nonnative plants, and the subsequent reduction of native plants. Rotating wetlands could have a minor to moderate beneficial effect. Livestock grazing on U.S. Forest Service lands would likely result in the loss of some additional native vegetation and continued spread of nonnative plants. In the area around the monument's two units (main unit and Petroglyph Point), there have been moderate to major, adverse cumulative impacts to native vegetation.

When the adverse and beneficial effects of alternative A are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be a minor to moderate, long-term, adverse cumulative impact on the area's native vegetation. However, other actions in this alternative would add a relatively moderate beneficial increment to this overall impact, given how much change has already occurred in the vegetative communities.

Conclusion

Long-term, minor, adverse impacts would occur in local areas due to current visitor use levels and the potential for increased visitor use levels. Current weed control efforts, selective cutting, and prescribed burning would continue to result in moderate, long-term beneficial effects. When the effects of this alternative are added to the effects of other past, present, and foreseeable future actions, there would be a minor to moderate, long-term, adverse cumulative impact on native vegetation. However, the actions in alternative A would add moderate beneficial increments to this cumulative impact. None of the vegetation impacts that would occur in this alternative would be sufficient to result in an impairment of the monument's resources and values.

VEGETATION – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

The new facilities and other actions in alternative B, including the redesign of Petroglyph Point, trail development, and Indian Well campground footprint expansion would occur in previously undisturbed areas where native vegetation is currently present. Removal of the East and West Wildlife Overlook roads would restore approximately two acres of vegetation. Expansion of the visitor center would occur within disturbed areas where native vegetation already has been substantially altered. Given previous vegetation disturbance and the use of appropriate mitigation measures (e.g., ensuring that equipment stays within project area boundaries, revegetating disturbed areas, and taking steps to avoid the spread of nonnative plants), the long-term, adverse effects on native vegetation from the new developments would be negligible to minor in localized areas.

With current use levels, and if use levels over time in the monument were to increase, more native vegetation might be adversely affected in local areas due to people wandering off of the trails. None of these impacts would affect the overall integrity, distribution, or presence of native plant communities in the monument. Thus, visitor use would likely have long-term, minor to moderate, adverse impacts on the monument's native vegetation in localized areas within the developed and interpretive backcountry zones.

As in alternative A, the spread of nonnative plants would continue to be a problem in the monument in alternative B. Agricultural use on the Tule Lake National Wildlife Refuge would continue along the northern boundary of the monument. The potential spread of agricultural plants and invasive weeds from these fields into monument lands would continue to have an effect on native vegetation. Vehicles driving through the monument would continue to be a potential source of nonnative plant transport and establishment. Administrative vehicle access on 3.8 miles of Lyons Road would potentially continue the spread of nonnative plants into the backcountry. Even with education efforts, some nonnative plants could be introduced or spread by visitors in the monument. Continued use of integrated pest management techniques should help contain the spread of some nonnative species. Zones of infestation, depending on the nonnative plant species, would continue to be present during the life of this plan.

Increased visitor access and use in the monument would intensify the potential for the spread of nonnative species, especially at Petroglyph Point, picnic areas, and new trail installations. Continued use of integrated pest control measures should help contain the spread of some nonnative species in limited areas. But even with these measures and visitor education efforts, some nonnative plants might be introduced or spread by visitors (as well as by wildlife and vehicles) in the monument.

Pockets of nonnative species would continue to be present in the monument during the life of this plan and would potentially spread at new localized developed areas. It is difficult to determine the impact this would have on native species, due to uncertainties about the type of species that might be introduced and the locations and frequencies of such introductions. However, it is expected that even with continuing monitoring and weed control efforts the impacts would be long-term, adverse, and moderate.

Alternative B would have several beneficial effects on vegetation. Expanded efforts to conduct prescribed burns and selective removal of juniper in the northern reaches of the monument would include restoration of the monument's vegetation to a fire-dependent community that is not dominated by juniper in the lower grassland/sage steppe elevations and re-establishes a healthy ponderosa pine forest in the southern reaches of the monument. In addition, the removal of the Powerline administrative road and the East and West Wildlife Overlook spur roads would have long-term, beneficial impacts. A larger emphasis on interpretative efforts to educate the public would have an effect on reducing impacts to vegetation. Finally, the establishment of user capacity indicators and standards would help prevent the spread of additional unofficial trails, and thus prevent the loss and disturbance of native vegetation in the monument. Taken together, these actions would have a minor to moderate, long-term, beneficial effect on native vegetation in localized areas.

Cumulative Impacts

Cumulative impacts would be the same as described under alternative A. When the adverse and beneficial impacts of alternative B are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be a minor to moderate, long-term, adverse cumulative impact on the area's native vegetation. Given how much change has already occurred to the vegetative communities once present, the actions in alternative B would add both moderate beneficial impacts and a minor to moderate adverse increments to this overall landscape impact.

Conclusion

New development and visitor use in alternative B would result in long-term, minor to moderate impacts on native vegetation in localized areas. However, efforts to restore native plant communities, remove administrative vehicle access, and the establishment of user capacity indicators and standards would result in long-term, minor, beneficial effects. When the effects of alternative B are added to the effects of their past, present, and foreseeable future actions there would be a minor to moderate, long-term, adverse cumulative impact on native vegetation. The actions in alternative B would add both small beneficial and small adverse increments to this overall cumulative impact. None of the vegetation impacts that would occur in alternative B would be sufficient to result in an impairment of the monument's resources and values.

VEGETATION – IMPACTS FROM ALTERNATIVE C

Analysis

New facilities and actions in alternative C would be built within relatively undisturbed areas. These actions include pullouts along the main park road, new facilities at Petroglyph Point, a Indian Well campground footprint expansion, and new trails in the backcountry and wilderness portions of the monument. The development of a cave loop trail for hikers would still trample and crush some plants, resulting in the loss of some additional native vegetation and the potential formation of additional social trails. Given previous vegetation disturbance and the use of appropriate mitigation measures (e.g., ensuring that equipment stays within project area boundaries, revegetating disturbed areas, and taking steps to avoid the spread of nonnative plants), the long-term, adverse effects on native vegetation from the new developments would be moderate in localized areas. An effort to limit nonnative plant spread along new trail corridors would be a new mitigation measure implemented by the monument. This would help prevent the spread of nonnative plants into the wilderness areas of the monument.

As in alternatives A and B, most visitors would stay on trails and not affect the monument's native vegetation. None of these impacts would affect the overall integrity, distribution, or presence of native plant communities in

the monument. Thus, visitor use would likely continue to have an overall long-term, negligible to minor, adverse impact on the monument's native vegetation.

The spread of nonnative plants would continue to be a problem in the monument in alternative C. Areas north of the monument with well-established noxious weeds would continue to be a seed source. Vehicles traveling through the monument also would continue to be a potential source of nonnative plant seeds. Increased visitor use in the monument would raise the potential for the spread of nonnative species. Even with education efforts, some nonnative plants could be introduced or spread by visitors (as well as by wind and foot traffic) in the monument. Thus, pockets of nonnative species would continue to be present during the life of this plan. Continued use of integrated pest measures should help contain the spread of some nonnative species in limited areas. However, it is difficult to determine the impact on native species due to the uncertainties about the type of species that might be introduced in the future, and the locations and frequencies of such introductions. It is likely that, even with continuing monitoring and weed control efforts, these long-term, adverse impacts will be minor to moderate.

Alternative C would have several beneficial impacts on vegetation. Continuing efforts to conduct prescribed burns and selective removal of juniper in the northern half of the monument would have minor to moderate, long-term, beneficial impacts. The establishment of user capacity indicators and standards would help prevent the creation of additional unofficial trails, and thus prevent the loss and disturbance of vegetation in the monument. Taken together, these actions would have a minor to moderate, long-term, beneficial impact on the native vegetation in localized areas.

Cumulative Impacts

Cumulative impacts would be the same as described in alternative A. When the adverse and beneficial impacts of alternative C are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be a minor to moderate, long-term, adverse cumulative impact on the area's native vegetation. The actions in alternative C would add both a relatively minor beneficial and moderate adverse increment to this overall impact, given how much change has already occurred to the native vegetative communities.

Conclusion

New development and visitor use in alternative C would result in long-term, minor to moderate impacts on native vegetation in localized areas. However, current weed control efforts, selective cutting, prescribed burning, and the establishment of user capacity indicators and standards would result in long-term, minor to moderate, beneficial effects. When the adverse and beneficial impacts of alternative C are added to actions that have occurred and are likely to occur in the area surrounding the monument, there would be a minor to moderate, long-term, adverse cumulative impact on the area's native vegetation. None of the vegetation impacts that would occur in this alternative would be sufficient to result in an impairment of the monument's resources and values.

Wildlife and Wildlife Habitat

The area of consideration for this topic is the monument. Impacts on wildlife are closely related to the impacts on habitat. The evaluation considered whether actions would be likely to displace some or all individuals of a species in the park or would result in loss or creation of habitat conditions needed for the viability of local or regional populations. Available information on wildlife and wildlife populations was compiled. Predictions about short- and long-term impacts were based on previous studies of impacts to natural resources and recent monitoring data from the park. The thresholds of change for the intensity of an impact are as follows.

Negligible: Effects on wildlife would be at or below the level of detection, would be short term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the species' population.

Minor: Effects on wildlife would be detectable, but localized, small, and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Effects on wildlife would be readily detectable but localized, with consequences at the population level. Mitigating measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Effects on wildlife would be obvious and would result in substantial consequences to the wildlife populations at the regional level. The change would result in a severely adverse or major beneficial impact, and possible permanent consequence on the species. Extensive mitigating measures would be needed to offset any adverse effects and their success would not be guaranteed.

WILDLIFE AND WILDLIFE HABITAT– IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

The human use of the monument is concentrated on roads, in developed areas and caves, and along trails. Animals sensitive to human activities primarily avoid these areas when people are present, with an exception being the Townsend's big-eared bat, which forms breeding maternity colonies within one of the heaviest visitor use areas of the monument; Cave Loop. The bat protection measures implemented by the monument since the early 1990s would continue under all alternatives, which are based primarily on cave closures during seasonal periods. Wildlife that occupy developed areas, such as ground squirrels, jackrabbits, and mule deer, are mostly adapted to the presence of people and would not be noticeably affected by the actions being taken in alternative A.

Peer reviewed literature widely documents that sound plays a critical role in intra-species communication, courtship and mating, predation and predator avoidance, and effective use of habitat. Additionally, similar studies have shown that wildlife can be adversely affected by sounds and sound characteristics that intrude on their habitats. While the severity of the impacts varies depending on the species being studied and other conditions, research strongly supports the fact that wildlife can suffer adverse behavioral and physiological changes from intrusive sounds (noise) and other human disturbances. Documented responses of wildlife to noise include increased heart rate, startle responses, flight, disruption of behavior, and separation of mothers and young (Selye 1956, Clough 1982, National Park Service 1994, U.S. Department of Agriculture 1992, Anderssen et al. 1993).

Where recreational use is high, such as developed zone areas, the presence and noise associated with human activity could displace various wildlife species and cause other conflicts. Some of the most common conflicts between recreation and wildlife would involve noise from motor vehicles and places where high visitor use causes frequent noise and disturbance.

Staff and visitor observations suggest that vehicle traffic along the main monument road produces noise well beyond the road corridor. Motorcycles in particular are often perceived to be very loud, especially when traveling in large groups. Additional soundscape studies would be needed to quantify existing noise and monitor the trends in noise duration, frequency and intensity in relation to visitor use and monument operations.

On occasion, some animals would continue to be injured or killed by motor vehicles on roads. Especially susceptible are snakes that sunbathe on paved roads and rodents (kangaroo rats and ground squirrels) that are attracted to roadside vegetation. Some animals would also continue to be attracted to food being offered by people or to areas where food and trash receptacles are present, although the monument is currently in the process of switching to wildlife proof garbage receptacles. Overall, the impacts of visitor use on wildlife populations in alternative A would be localized and negligible, resulting in no measurable changes to the monument's wildlife populations.

Continued efforts to restore native bunchgrass/sagebrush steppe communities would have both beneficial and adverse impacts on different wildlife populations. In particular, efforts to control the spread of western juniper would benefit species that are found in open areas or an open understory, such as sagebrush lizard, gopher snake, belding ground squirrel, greater sage-grouse, badger, burrowing owl, yellow-bellied marmot, and pronghorn. This would have a moderate to major, long-term, beneficial effect on these species, since a number of these species have become very rare or extirpated from the monument. On the other hand, species commonly found in juniper woodlands, such as great horned owl, mourning dove, townsend's solitaire, and wood rats would likely decline in numbers over time.

Continued administrative vehicle access on 3.8 miles of the Lyons Road would have the potential to cause a minor to moderate, adverse negative impact on greater sage-grouse restoration and other wildlife dependent on open non-disturbed sagebrush steppe habitat. This road would continue to be maintained as an unpaved, two track access, thus limiting vehicle speed and additional maintenance requirements. Long-term studies to determine primary habitat within Lava Beds would

need to be implemented to assess the full scale of impact current roads within the monument have on greater sage-grouse.

Cumulative Impacts

Like vegetation, most wildlife populations surrounding the monument have been substantially altered by human activities, such as the draining of Tule Lake, farming, ranching, and road development, resulting in fewer numbers of some native wildlife species, such as greater sage-grouse and pronghorn. Fire suppression, efforts to control predators, spread of invasive weeds, and hunting also affect wildlife populations in the area. Thus, actions outside the monument have had a moderate to major, adverse impact on native wildlife populations surrounding the monument. One mitigating action is the regional inter-agency recovery strategy for greater sage-grouse and sagebrush ecosystems, in which the monument is a participant. Steps to restore sagebrush habitat through juniper removal and participation with the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the State of California in sage grouse re-establishment will provide direct action steps to restore this species back to its historic range.

When the beneficial and adverse impacts of alternative A are combined with the impacts that have occurred and are likely to occur in the vicinity of the monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, alternative A would contribute a very small adverse increment to this overall cumulative impact, as well as a small beneficial increment by continuing to provide an area where wildlife habitat continues to be managed and protected.

Conclusion

Alternative A would have some adverse and beneficial impacts on the monument's wildlife populations and habitats. Most wildlife in the monument would not change as a result of the actions in this alternative. No actions would affect key migration routes or areas known to be important for breeding, nesting, or foraging. No actions would interfere with feeding, reproduction, or other activities necessary for the survival of wildlife species. Long-term, negligible, adverse impacts would continue to occur in localized areas due to continuing visitor use of the monument. Continuing efforts to prevent the spread of western juniper and control the spread of nonnative species would result in minor to moderate, long-term, beneficial impacts on some wildlife populations. When the beneficial and adverse impacts of alternative A are added to the external impacts that have occurred in the vicinity of the monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, the actions in alternative A would contribute only a small beneficial increment and a very small adverse increment to this impact. None of the wildlife impacts resulting from alternative A would constitute an impairment of the monument's resources and values.

WILDLIFE AND WILDLIFE HABITAT – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

The human use of the monument is concentrated in caves and in developed areas such as picnic areas, the campground, trails, roads, and in the Cave Loop area. Animals sensitive to human activities primarily avoid these areas when people are present, with the exception being the Townsend's big-eared bat, which forms breeding maternity colonies within one of the heaviest visitor use areas of the monument; Cave Loop. Wildlife that occupy developed areas, such as ground squirrels, scrub jays, jackrabbits, and mule deer, are mostly adapted to the presence of people and would not be noticeably affected by the actions being taken in alternative B.

As in alternative A, along the main monument road in particular, noise from vehicles, especially extremely loud vehicles such as motorcycles, would continue to cause disturbance to wildlife, prompting avoidance of road corridors and other behavioral affects such as flushing (such as noise can flush birds from nests). Some animals would continue to occasionally be injured or killed by motor vehicles on the monument's roads. Some animals would also continue to be attracted to food being offered by people or to areas where food and trash receptacles are present, although the monument is currently in the process of switching to wildlife proof garbage receptacles.

New developments or ground-disturbing activities in alternative B, including expansion of the visitor center and research center, the redesign and construction of new developments at Petroglyph Point, the development of new trails in frontcountry and backcountry, and the development of backcountry campsites, would have the potential for minor to moderate, short-term and long-term effects on the monument's wildlife.

There would be a long-term, adverse and beneficial impact to wildlife at Petroglyph Point with developments that include a visitor contact station, picnic area, road relocation, trails, and exhibits. This development would promote a longer stay for visitors in the area, contributing to the potential increase in wildlife disturbance. On the other hand, relocation of the road, parking, and trailhead from sensitive resources would benefit wildlife. NEPA and Endangered Species Act environmental compliance would also occur, including site-specific surveys and design of wildlife friendly infrastructure. New trails in backcountry and frontcountry areas could result in varying levels of impact, depending on location of these trails. The actual construction of trails would be of short-term impact, but long-term visitor use in some areas of the monument could cause wildlife use habits to change. Thus, the construction of new facilities and trails in alternative B would be expected to have a potential minor, long-term, adverse impact on the monument's wildlife, dependent upon design and placement adjacent to sensitive habitats.

The development of a foot trail around the Cave Loop area could have adverse impacts on wildlife due to secondary social trails, resulting in access to more undeveloped caves and disturbance of pika and sensitive bat species. The development of new trails at Petroglyph Point could also affect rare pallid bat populations. Increased visitor use of backcountry and frontcountry caves could pose additional risk to wildlife dependent upon these resources for refuge and breeding habitat.

Continued use of 3.8 miles of the Lyons Road for administrative vehicles could pose long-term adverse impacts to the re-establishment of sage grouse. Removal of the Powerline and wildlife overlook roads would contribute to additional habitat for sensitive wildlife species dependent on unbroken grassland/sagebrush steppe habitat.

Alternative B would have several beneficial effects on wildlife. Under alternative B, monument management would expand restoration efforts, place a larger emphasis on interpretative efforts to educate the public, and efforts to promote bicycle use along main roads and the Cave Loop. Creation of new trails and connecting current trails would likely result in more people walking to destinations instead of using vehicles, slightly reducing wildlife and vehicle collisions. This would result in minor, beneficial effects.

Cumulative Impacts

As described under alternative A, actions outside the monument have had a moderate to major, adverse impact on native wildlife surrounding and migrating into the monument. When the beneficial and adverse impacts of alternative B are added to the impacts that have occurred near the monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, alternative B would contribute a very small adverse increment to this overall cumulative impact, as well as a small beneficial increment by continuing to provide an area where wildlife habitat continues to be managed and protected.

Conclusion

Alternative B would have both adverse and beneficial impacts on the monument's wildlife populations and habitats. The construction of new trails and facilities would result in minor to moderate, short-term and long-term effects on the monument's wildlife dependent upon design and placement outside of sensitive habitats. Expanded vegetation restoration efforts, the addition of lands in Petroglyph Point, and the closure and revegetation of the Powerline administrative and Wildlife Overlook roads would result in long-term, beneficial impacts on some wildlife populations.

When the beneficial and adverse impacts of alternative B are added to the impacts that have occurred near Lava Beds National monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, the actions in alternative B would contribute only a small beneficial increment and a very small adverse increment to this impact. None of the wildlife impacts resulting from alternative B would constitute an impairment of the monument's resources and values.

WILDLIFE AND WILDLIFE HABITAT – IMPACTS FROM ALTERNATIVE C

Analysis

New developments or ground-disturbing activities in alternative C, including the redesign and construction of new developments at Petroglyph Point, and the development of up to 15 miles of new trails in frontcountry and backcountry would have the potential for moderate to major short-term and long-term effects on the monument's wildlife. There would be a long-term

impact to wildlife at Petroglyph Point with the proposed development including a new day use area, road relocation, and an expanded trail system. Paving of the Petroglyph Point road would likely increase wildlife mortality and could constitute a minor to moderate, long-term, adverse impact. Moving facilities away from sensitive resources, however, would also add a beneficial effect. This development would promote a longer stay for visitors in the area, contributing to the potential increase in wildlife disturbance. To limit impacts on wildlife, site-specific surveys and design of wildlife friendly infrastructure would be undertaken before any ground disturbance occurs in areas that could affect wildlife dependent on undisturbed habitats.

New trails in backcountry and frontcountry areas could result in a varying levels of impact, depending on placement of these trails. The actual construction of trails would be of short-term impact, but long-term visitor use in some areas of the monument could cause wildlife use habits to change. Thus, the construction of new facilities and trails in alternative C would be expected to have a minor to moderate, long-term, adverse impact on the monument's wildlife, dependent upon design and placement outside of sensitive habitats.

Under this alternative, the monument would increase outreach efforts to promote more visitation and would collaborate with the Modoc National Forest on new recreational opportunities. Alternative C would also make changes to the Indian Well campground to accommodate larger recreational vehicles and visitor use groups. Medicine Lake road would be paved under this alternative, allowing for increased speeds, which would increase wildlife mortality causing long term, adverse impacts. The monument would also promote more winter use and additional specialized tour opportunities. Additional vehicle pullouts along the main monument road would be developed. All of these proposed actions would have varying levels of impacts to wildlife, depending on design and placement of developments. Noise from vehicles traveling along the main monument road, especially extremely loud vehicles such as motorcycles, would continue to cause disturbance to wildlife, prompting avoidance of certain areas and other behavioral affects such as flushing (such as noise can flush birds from nests). A number of the proposals listed above would occur in previously undisturbed areas. This would also have a direct adverse impact on wildlife in localized areas. Increased noise levels from visitor use and new developments at the Indian Well campground could pose negative impacts upon wildlife. The increased development of visitor use areas at Petroglyph Point would result in the presence of people and equipment for long periods. Some wildlife, such as ground squirrels, jackrabbits and marmots, would be displaced. As a result, there would likely be a negligible to minor, long-term, adverse impact on wildlife populations in this localized area.

The establishment of user capacity indicators and standards would help protect wildlife populations and the removal of the Powerline and West Wildlife Overlook roads would improve wildlife habitat. Taken together, these actions would have a minor to moderate, long-term, beneficial impact on wildlife.

Cumulative Impacts

As described in alternative A, actions outside the monument have had a moderate to major, adverse impact on native wildlife surrounding Lava Beds National Monument.

When the beneficial and adverse impacts of alternative C are added to the impacts that have occurred near Lava Beds National Monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, the actions in alternative C would contribute only a small beneficial increment and a small to moderate adverse increment to this impact.

Conclusion

Alternative C would have both adverse and beneficial impacts on the monument's wildlife populations and habitats. Most wildlife populations and habitats in the monument would not change because of the actions in this alternative. Development actions would have the potential to affect important breeding, nesting, and foraging habitats in localized areas such as Petroglyph Point. Long-term, negligible, adverse impacts would continue to occur in localized areas due to continuing visitor use of the monument. On the other hand, there would be long-term, beneficial impacts on some wildlife populations due to continuing vegetation restoration efforts, the addition of lands at Petroglyph Point, and the closure of the Powerline administrative road. Continued vehicle access out to Fern Cave and effects to wildlife would be mitigated through the continued low vehicle speeds and maintenance of the road as a two-track dirt access route.

When the beneficial and adverse impacts of alternative C are added to the impacts that have occurred near Lava Beds National Monument, there would be a long-term, minor to moderate, adverse cumulative impact on the area's wildlife populations and habitats. However, the actions in alternative C would contribute only a small beneficial increment and a very small adverse increment to this impact. None of the wildlife impacts resulting from alternative C would constitute an impairment of the monument's resources and values.

Special Status Species

The area of consideration for this topic is suitable and known occupied habitat in the monument. Information on threatened, endangered, candidate species, and species of general concern was gathered from responsible agencies, research, and specialists. Known locations of habitat associated with threatened, endangered, candidate species, and species of special concern were compared with locations of development and facilities, and modifications of existing facilities.

In accordance with language used to determine effects on threatened and endangered species under the federal Endangered Species Act (USFWS 1998), potential effects on special status species are categorized as follows:

No effect – The proposed actions would not affect special status species or critical habitat.

May affect / not likely to adversely affect – The effects on special status species would be extremely unlikely to occur and could not be meaningfully measured, detected, or evaluated or they would be completely beneficial.

May affect / likely to adversely affect – Any adverse effect to listed species that might occur as a direct or indirect result of proposed actions, and the effect would not be discountable or would be beneficial.

Is likely to jeopardize proposed species / adversely modify proposed critical habitat – The appropriate conclusion when the National Park Service or the U.S. Fish and Wildlife Service identifies situations in which an action could jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species within or outside park boundaries.

The thresholds of change for the intensity of an impact are defined as follows.

Negligible: The action would have no measurable effect to a listed species, suitable, potential, or critical habitat, resulting in a no effect determination.

Minor: The effects of the alternative would be discountable (extremely unlikely to occur), insignificant (not able to be meaningfully measured, detected, or evaluated), or completely beneficial. Any change would be small and localized and of little consequence, and result in a not likely to adversely affect determination and require informal consultation with the U.S. Fish and Wildlife Service.

Moderate: An action that would result in some change to a population or individuals of a species or designated critical habitat. The change would be measurable and of consequence but would most likely result in a not likely to adversely affect determination and require informal consultation with the U.S. Fish and Wildlife Service.

Major: An action that would result in a noticeable change to a population or individuals of a species or designated critical habitat. Any adverse affect to the species that may occur as a direct or indirect result of the alternative and the effect is not discountable, insignificant, or completely beneficial. Incidental take is anticipated to occur as a result of the action. The change would result in a likely to adversely affect determination and require formal consultation with the U.S. Fish and Wildlife Service.

FEDERALLY LISTED AND STATE LISTED THREATENED AND ENDANGERED SPECIES – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Lava Beds has no federally listed, proposed, or candidate species within the borders of the monument, as of February 2009 (USFWS, Modoc, and Siskiyou county listings). However, the greater sage-grouse (*Centrocercus urphasianus*) was identified as a candidate species for the threatened and endangered species lists for Modoc and Siskiyou counties (U.S. Fish and Wildlife Service 2010). Certain populations of bats and birds could become listed over the lifespan of this plan that would directly affect monument operations. California State listed, proposed, or candidate species within the borders of the monument, as of February 2009, include the bald eagle (state endangered) and the

Swainson's hawk (state threatened). As of 2009, species that are in decline (Species of Concern) are not being maintained/listed by the USFWS or the State of California. Current trends in the greater sage-grouse and a number of bat species may entail inclusion into the threatened and endangered species list over the next 20 years, due to documented declines and current efforts to have certain species listed, i.e., greater sage-grouse.

In this alternative, no new developments would occur that could increase long-term impacts on threatened and endangered species. Existing facilities and roads would continue to be maintained. No new trails would be developed under this alternative. Energy conservation measures would continue to be implemented. Western juniper removal would continue to occur in areas where the species has expanded into grassland/sagebrush steppe habitat. Special precautions to prevent impacts on Swainson's Hawk nesting habitat would be followed. The monument would continue to take steps to assure the conservation of bald eagle winter roost habitat. Expansion of preferred habitat by greater sage-grouse would continue under this alternative. Steps to protect sensitive bat species within the monument from visitor use impacts would also continue.

The continued administrative vehicle use of 3.8 miles of Lyons Road would have the potential to cause a minor to moderate, adverse negative impact on greater sage-grouse restoration and other wildlife dependent on open non-disturbed sagebrush steppe habitat. This road would continue to be maintained as a dirt two-track access to Fern Cave, thus limiting vehicle speeds and minimizing maintenance requirements. Long-term studies to determine primary habitat within Lava Beds would need to be implemented to assess the full scale of impact that current roads within the monument have on greater sage-grouse.

Cumulative Impacts

Adverse impacts to threatened and endangered species over the last 100 years have been significant when looking at landscape changes that have occurred with the draining of Tule Lake, expansion of western juniper, and the establishment of invasive weeds.

Future impacts would primarily be from the continued expansion of invasive weeds, and general human population growth and urban development. However, habitat improvements for greater sage-grouse, Swainson's hawk, and bald eagle on U.S. Fish and Wildlife Service, U.S. Forest Service, and monument lands would likely have a beneficial effect on these species, due to large landscape restoration efforts. When the likely effects of continued monument management of habitats are added to the effects of actions outside the monument, there could be a long-term, minor, adverse cumulative impact on threatened and endangered species.

Conclusion

Alternative A would be expected to have no long-term adverse impacts on the monument's threatened and endangered species from monument operations and visitor use. Continued administrative vehicle use on the Lyons Road could have the potential to cause long-term, minor to moderate, adverse impacts. The level of impact due to alternative A would not be expected to constitute an impairment of the monument's resources or values.

FEDERALLY LISTED AND STATE LISTED THREATENED AND ENDANGERED SPECIES – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

Most of the new developments or ground-disturbing activities in alternative B, including expansion of the visitor center and research center would have no affect on the monument's threatened and endangered species. There would be a permanent change to the habitats at Petroglyph Point with developments that include visitor contact station, picnic area, road relocation, trails, and exhibits. The monument would also provide additional recreational and interpretive trail opportunities and explore regional trail connections to national forest trails. This development would promote a longer stay for visitors in the area, contributing to the potential increase in impacts on rare bat species and birds of prey. To limit impacts on threatened and endangered species, site specific surveys would be undertaken before any ground disturbance occurs in areas that could impact rare species. The formalization of back-country campsites, and new trails in backcountry and frontcountry areas, could pose minor to moderate, long-term, adverse impacts on certain rare species, primarily greater sage-grouse, bats and Swainson's hawk.

Impacts to wildlife near the Lyons Road would be the same as in alternative A. The monument would need

to implement long-term studies to assess the impact of current roads within the monument on greater sage-grouse habitat.

Cumulative Impacts

Cumulative impacts to threatened and endangered species would be same as alternative A. Alternative B's proposed developments within the monument would likely be no more than a small part of the cumulative impacts on the area's threatened and species.

Conclusion

Compared to alternative A, alternative B would be expected to have a long-term, minor to moderate, adverse impact on threatened and endangered species, primarily due to the potential impacts that new trail systems could have on rare species. Cumulative impacts would be the same as in alternative A. The level of impact due to alternative B would not be expected to constitute an impairment of the monument's threatened and endangered species.

FEDERALLY LISTED AND STATE LISTED THREATENED AND ENDANGERED SPECIES – IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, new developments would be limited to Petroglyph Point, trail expansion, and vehicle pullouts along the main monument road. There would be a permanent change to the habitats at Petroglyph Point with developments that include a picnic area, road redesign, and trail redesign. Under this alternative, the monument would increase outreach efforts to promote more visitation and would collaborate with the Modoc National Forest on new recreational opportunities. The monument would also provide additional recreational and interpretive trail opportunities within the monument and explore regional trail connections to national forest trails and sites, including shared trail systems. Alternative C would make changes to the Indian Well campground to accommodate larger recreational vehicles and visitor use groups. Medicine Lake Road would be paved under this alternative, allowing for increased traffic speeds and causing long-term, minor to moderate, adverse impacts on threatened and endangered species. The monument would promote more winter use and additional specialized tour opportunities.

As in alternative B, trail development would occur in a number of areas within the monument. As many as 15 miles of new trails would be developed in the monument, with an emphasis on loop trails. New trails in the backcountry zone would provide greater access for visitors, which would contribute to potential disturbance of rare species such as bats in caves, nesting raptors, and sage-grouse. With visitor use levels expected to stay constant or increase over the life of this plan, threatened and endangered species could incur minor, adverse, long-term impacts, depending on location and habitats affected.

Cumulative Impacts

Cumulative impacts to threatened and endangered species would be same as alternative A. Alternative C's proposed developments within the monument would likely be a small part of the cumulative impacts on the area's threatened and endangered species.

Conclusion

Compared to alternative A, alternative C would be expected to have a long-term, minor to moderate, adverse impact on threatened and endangered species, primarily due to potential impacts of new trails systems and the paving of Medicine Lake Road. Cumulative impacts would be similar to alternative A. The level of impact due to alternative C would not be expected to constitute an impairment of the monument's threatened and endangered species.

Cultural Resources

CULTURAL RESOURCES LISTED, OR ELIGIBLE TO BE LISTED, IN THE NATIONAL REGISTER OF HISTORIC PLACES

Potential impacts to those resources listed or eligible for listing in the National Register of Historic Places were identified and evaluated. The categories considered include archeological resources, cultural landscapes and historic buildings and structures. Evaluation was completed in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800, Protection of Historic Properties). This evaluation was done by (1) determining the area of potential effects; (2) identifying

cultural resources in the area of potential effects that are listed in or eligible for listing in the national register; (3) applying the criteria of adverse effect to affected resources; and (4) considering ways to avoid, minimize or mitigate adverse effects. Information used in this assessment was obtained from relevant literature and documentation, maps, and consultation with cultural resource professionals, as well as from interdisciplinary team meetings, field trips, and site visits.

Under the regulations of the Advisory Council on Historic Preservation, a determination of adverse effect or no adverse effect must be made for affected national register-listed or national register-eligible cultural resources. An adverse effect occurs whenever an action alters, directly or indirectly, any of the characteristics of a cultural resource that qualify it for inclusion in the national register; that is, the action diminishes the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CRF 800.5(a)(1)). A determination of no adverse effect means there is an effect, but the effect would not meet the criteria of adverse effect (36 CFR 800.5(b)).

The thresholds of change for the intensity of an impact are defined as follows.

Negligible: The effects on cultural resources would be at the lowest levels of detection, barely measurable without any perceptible consequences, either beneficial or adverse to cultural landscape resources, historic buildings or structures, or archeological resources. For the purposes of Section 106 and the National Historic Preservation Act, the determination of effect would be no adverse effect.

Minor: The effects on cultural resources would be perceptible or measurable, but would be slight and localized within a relatively small area. The action would not affect the character or diminish the features of a NRHP eligible or listed cultural landscape, historic structure, or archeological site, and it would not have a permanent effect on the integrity of any such resources. For the purposes of Section 106 and the National Historic Preservation Act, the determination of effect would be no adverse effect.

Moderate: The effects would be perceptible and measurable. The action would change one or more character-defining features of a cultural resource, but would not diminish the integrity of the resource to the extent that its NRHP eligibility would be entirely lost. For the purposes of Section 106 and the National Historic Preservation Act, the cultural resources' NRHP eligibility would be threatened and the determination of effect would be adverse effect.

Major: The effects on cultural resources would be substantial, discernible, measurable, and permanent. For NRHP eligible or listed cultural landscapes, historic structures, or archeological sites, the action would change one or more character-defining features, diminishing the integrity of the resource to the extent that it would no longer be eligible for listing in the national register. For purposes of Section 106, national register eligibility would be lost and the determination of effect would be adverse effect.

The relationships between definitions of effects, including beneficial effects, and treatments of cultural resources, are analyzed in the impact analysis for each of the alternatives. Levels of beneficial effect are not directly linked to specific types of treatments; rather they depend on the particular treatment of given cultural resources. All treatments proposed under all of the alternatives would be in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. All treatments proposed under all of the alternatives would have no adverse effect on known cultural resources.

Archeology

ARCHEOLOGY- IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Alternative A does not propose any significant changes to infrastructure or the organization of monument programs. The monument would continue to address shortcomings concerning the documentation of cultural resources and continue to support improvement of the quality of archeology site and associated collection documentation for interpretive and research use.

The monument archeologist and other NPS archeologists would continue to conduct compliance under the National Historic Preservation Act (NHPA) and National Park Service policies and continue to conduct

field research. Both pre-project surveys and monitoring would continue, under existing management, to ensure the preservation of archeology sites. Significant archeological sites would be avoided during expected trail maintenance. Thus, no adverse effects are anticipated concerning archeological resources at the monument. In the unlikely event that direct or indirect impacts to a site could not be avoided, mitigation efforts would be conducted to salvage archeological materials and data. This would be done in consultation with the Klamath Tribes and the California State Historic Preservation Office.

A number of threats, most of them from natural processes, to archeological sites exist within the monument. Recommendations for lessening threats and mitigating damage to sites would be provided to the monument. Damages to sites from visitors and natural forces would continue to be documented by both visiting archeologists and monument staff. While more baseline data is needed to assess the level of impacts, natural processes could have a negligible to moderate, adverse impact on archeological resources.

Cumulative Impacts

The entirety of Lava Beds National Monument has been designated as a National Register of Historic Places Archeological District. The process for this designation identified and documented sites that are likely to yield data relevant to anthropologic and historic themes within the region. These themes include the Modoc War, early settlement, shifts in pre-contact land use, and technological change. Today, archeology sites within the boundary of Lava Beds National Monument reflect a relatively small sample of sites that inform us of pre-contact life ways. Because of the known disturbance to sites outside of the boundary, the need for preservation of site integrity within the monument is high.

Lava Beds National Monument has operated since its establishment without an archaeologist on staff. During 2010, the monument hired a cultural resource manager. Over the years, visitors have caused direct damage to known sites. This is evident at some exposed rock art sites, particularly at Petroglyph Point. Indirect damage by visitors has been difficult to measure but is assumed to affect sites that are adjacent to roads, trails, caves, and picnic areas. Areas like Petroglyph Point, Captain Jacks Stronghold, open and developed caves, and the sites on the north end of the monument have visible surface and aboveground archeological features. Though generally respected by monument visitors, their exposure draws attention that, over time, could result in damage.

Natural processes, including erosion and sediment deposition from neighboring agricultural fields, also have an impact on sites. The rock art images at Petroglyph Point, for instance, could become obscured from the sediment erosion from agricultural fields and the unpaved road. Alternative A does not offer a strategy for addressing documentation of the rock art face or strategic steps for minimizing adverse impacts. In general, Petroglyph Point sites would continue to be at a high risk for direct damage by people and indirect impacts by visitors and natural processes.

Overall adverse cumulative impacts, primarily from natural processes, on archeological sites throughout the monument would be long-term, negligible to minor. Given the remote location and relative lack of NPS presence at Petroglyph Point, this area would continue to experience long-term, minor to moderate, cumulative adverse impacts.

Conclusion

Since no new development is planned in alternative A, adverse impacts on archeological resources from construction activities are unlikely. The continuation of the current management approach to preserve and document archaeological resources is in keeping with NPS responsibilities as they pertain to NHPA. This would ensure no adverse impacts to archeological sites or associated collections. Negligible to moderate cumulative impacts have been incurred from past development, staffing constraints, and natural processes. Alternative A would not actively contribute to the adverse cumulative impact of other past, present, and reasonably foreseeable actions.This alternative does not propose management or infrastructure changes that would impair archeological sites or associated collections.

ARCHEOLOGY - IMPACTS FROM ALTERNATIVE B (PREFFERED)

Analysis

In alternative B, the current focus on the preservation of archeological sites and associated collections would be enhanced by directed actions toward improved documentation for research, interpretive programs, and educational outreach. These improvements include

updated and corrected information concerning site status and location and intensive surveys of areas with only cursory survey coverage. In addition, diverse research approaches would be applied to existing archeological collections to study culture differences across the region, as well as culture changes over time. The outcome of these improvements would benefit the public by providing new assessments and information to the monument's interpretive program. Much of this work would be carried out with greater consultation with the Klamath Tribes. Their input would greatly enhance the quality of information available for education. Alternative B would pursue preservation and educational outreach to increase learning opportunities for both visitors and the community through partnerships with other agencies and organizations.

Alternative B proposes an organizational shift from a relatively loose assembly of monument programs to more integrated programs that share common goals in research and education. New staff positions would enhance the diversity of in-monument expertise. The monument would become a research and learning center for regional cultural topics as well as nationally important history and anthropology themes. Background research would be conducted to ensure the monument accurately portrays the composition of resources within its boundary and new research would help facilitate a more contextualized interpretation of past occupation in the Tule Lake Basin.

A number of construction projects are proposed under alternative B. These include the construction of new facilities and trails at Petroglyph Point, the expansion of existing trails and facilities in the main monument, and changes to accommodate visitors at the campground including the removal/rehabilitation of social trails and plant screening.

The overall effects of alternative B to the monument's archeological resources would be long-term, minor to moderate, and beneficial. The proposed improvements to Petroglyph Point would address the appearance and protection of the site by providing a more distinct National Park Service presence at the unit. Expansion of the collection spaces and the research center laboratory would provide much needed space and equipment to conduct analysis at the monument and near the interpreted resources. The emphasis on data gathering and analysis for regional research questions would result in updated documentation of sites and associated collections that would better serve the monument through interpretive programs and exhibits and would highlight the value of the archeological resource. The proposed construction would be in keeping with sensitive and sustainable development techniques. This approach would minimize the need for extensive subsurface data recovery projects at significant archeology sites and support in-situ preservation.

The potential effect to the monument's archeological resources under alternative B would be driven primarily by increased compliance activity associated with trail and facility development. The proposed development at Petroglyph Point and the campground could result in needed recovery of archeological materials to mitigate the impact of building a day use area and expanding visitor facilities. The construction of new trails, including the proposed accessibility improvements to trails at Hospital Rock, Gillem's Camp, Petroglyph Point, and Captain Jacks Stronghold, would also involve archeological surveys to assess the level of impact and the eligibility of sites in the area to the National Register of Historic Places. Other impacts from increased research, interpretation, and use of archeological materials for educational purposes would depend on the level of staffing provided for oversight and the management of museum collections. Staff would need to remain actively involved in oversight and interpretive planning to prevent the degradation of the collections. Without this oversight, long-term adverse impacts could be negligible to minor.

Cumulative Impacts

As in alternative A, cumulative impacts are primarily from past actions, natural processes, direct and indirect damage from visitors, and disturbance to sites outside of the boundary. The implementation of alternative B would result in no adverse effects to either archeological sites or associated collections. Alternative B, in combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in a negligible to minor adverse cumulative impact.

Conclusion

The actions identified in alternative B would generally benefit the preservation and interpretation of archeology sites and associated collections despite the proposed new construction. No adverse impacts to archeological resources are anticipated. Cumulative impacts would be negligible to minor, and adverse. Alternative B, however, would not contribute to this adverse impact. If impacts

to archeological resources that are documented as significant or identified as contributing to the Archeological District are unavoidable for any of the proposed actions, mitigating efforts would be developed between the State Historic Preservation Office (SHPO) and the Klamath Tribes. The level of impact due to alternative B would not be expected to constitute an impairment of the national monument's archeological resources or values.

ARCHEOLOGY - IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, the monument would continue to follow current management objectives, preserving existing archeology sites and associated collections and documenting newly identified sites. Actions in alternative C would expand the range of visitor programs and recreational opportunities while developing a more visible identity for the monument. Many of the actions identified for this alternative involve increased interpretation of resources. The museum collections would be utilized for archeological information for interpretive and educational programs. The overall intention of alternative C is to create a wider range of visitor experiences through field tours and self-guided trails. Management of the monument's archeological resources would rely on cultural resource staff to orchestrate much of the archeology work through partnerships with other parks, the regional office, and subject matter experts from other organizations.

The potential effect to the monument's archeological resources under alternative C would be driven by compliance requirements associated with trail and facility development. The proposed development at Petroglyph Point and the campground could result in needed recovery of archeological materials to mitigate the impact of building a day use area and expanding visitor facilities. The construction of new trails, including the accessibility improvements to trails at Hospital Rock, Gillem's Camp, Petroglyph Point, and Captain Jacks Stronghold, would also involve archaeological surveys to assess the level of impact.

The overall impacts on archeological resources from proposed development projects and new visitor experiences would be long-term, minor, and adverse. There would be some beneficial effects from visitor education regarding archeological resources. However, there would be more potential for adverse impacts from increased visitation.

Cumulative Impacts

As in alternative A, cumulative impacts are primarily from past actions, natural processes, direct and indirect damage from visitors, and disturbance to sites outside of the boundary. The development proposed at Petroglyph Point would likely draw greater interest by monument visitors and encourage a longer stay at the site. Many of these actions (e.g. increased NPS presence, road realignment, a new protective fence, etc.) would decrease the indirect impacts from natural processes and could be designed to deter visitors from damaging the rock art and other sites in the unit. Open sites (like surface lithic scatters) at Petroglyph Point would continue to be at a moderate risk for direct damage by people and indirect impacts by visitors and natural processes. The implementation of alternative C would result in long-term, minor, adverse effects to archeological resources. This determination, in combination with the adverse impacts of other past, present, and reasonably foreseeable future actions, would result in the potential for negligible to minor, adverse cumulative impacts, particularly at Petroglyph Point. However, actions proposed in alternative C would not contribute to the adverse cumulative impact and may benefit known sites.

Conclusion

Changes to the infrastructure planned under alternative C would require investment in compliance with existing preservation laws and agreements. Since much of the archeology conducted under alternative C would be driven by compliance instead of research, the opportunity to improve general knowledge about past occupants in the Tule Lake Basin through directed analysis of archeological materials could be diminished. The overall impacts on archeological resources from proposed development projects and new visitor experiences would be long-term, minor, and adverse. Cumulative impacts would be negligible to minor and adverse. However, alternative C would not contribute to the adverse cumulative impact. The level of impact due to alternative C would not be expected to constitute an impairment of the national monument's archeological resources or values.

Cultural Landscapes, Historic Buildings, and Structures

CULTURAL LANDSCAPES, HISTORIC BUILDINGS, AND STRUCTURES - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

In alternative A, the monument would continue to follow current management objectives, preserving and maintaining cultural resources associated with the Modoc War Historic District as well as the Public Works Administration (PWA), Civilian Conservation Corps (CCC), and Mission 66 development. To appropriately preserve and protect historic buildings, structures, and cultural landscapes that are listed or eligible for listing on the National Register of Historic Places, all stabilization, preservation, and rehabilitation efforts, as well as daily, cyclical, and seasonal maintenance, would be undertaken in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1995). Stabilization, preservation, and rehabilitation would have no adverse effects upon historic buildings, structures, or cultural landscapes.

Under alternative A, no new construction would be undertaken. The monument would continue to utilize existing buildings and structures for visitor and/or administrative uses, while the National Register listed Modoc War era-structures would continue to be used primarily for interpretation. The monument would continue to develop baseline inventories for historic buildings, structures, and cultural landscapes. The completion of these baseline inventories would directly benefit the public by providing new information to supplement the interpretive program at Lava Beds, resulting in long-term, negligible to minor beneficial effects on historic buildings, structures and cultural landscapes.

Monument managers would continue to follow the general guidance and stabilization measures provided in the 2005 Modoc War Historic District Cultural Landscape Inventory. Prescribed burns and other treatment would continue to be used to restore the historic landscape and control the spread of invasive species. While many of the recommended stabilization measures associated with the removal of vegetation, such as western juniper and the control of invasive species, have been already been implemented to a limited extent, additional restoration efforts are needed to ensure that the stabilization objectives are achieved district-wide.

Cumulative Impacts

Although the Modoc War Historic District cultural landscape continues to reflect many of its character-defining features, the historic district has undergone a number of changes since the period of significance, 1872-1873. As a result of continued use through time, portions of the historic district have been altered by the effects of grazing as well as many other activities. During the 1930s and early 1940s, the PWA and CCC altered the Modoc War cultural landscape with the construction of buildings, roads, and trails at sites such as Gillems Camp and Captain Jacks Stronghold. The NPS also altered the district as a result of Mission 66 construction development of the North Boundary Road and subsequent visitor experience, safety, and operational improvements.

As a result of a fire that burned 5,420 acres within the northern limits of the monument in 2008, archeological features that contribute to the Modoc War Historic District cultural landscape were exposed and are susceptible to the effects of looting and vandalism.

Decades after the Modoc War, the PWA, and CCC established and built the infrastructure of Lava Beds National Monument. During their tenure in the monument, enrollees constructed roads, trails, buildings, and structures. Some of the rustic historic buildings and structures have been lost, while many of the original permanent buildings remain. In addition, the overall alignment of some roads and trails remains similar to that which was constructed by the PWA and CCC, although widespread reconstruction and paving occurred during the Mission-66 program. These past impacts have adversely affected the integrity of PWA and CCC development; however, the landscape, and its associated features, continue to convey its historical significance.

Cumulatively, natural processes, such as fire, as well as past development in the monument have resulted in the disturbance and loss of cultural resources, which have had a minor to moderate, cumulative adverse effect on the integrity of the Modoc War cultural landscape.

As described above, the implementation of alternative A would result in no adverse effects to historic buildings, structures, or cultural landscape features. The no adverse impacts of the alternative A, in combination

with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in an a minor to moderate, adverse cumulative impact. However, alternative A would not contribute to the adverse cumulative impact.

Conclusion

Under alternative A, the monument's ability to identify, inventory, conduct research and document cultural resource significance would continue to be limited by staffing constraints. While significant, these constraints would have long-term, negligible to minor adverse effects (no adverse effect) on historic buildings, structures, and cultural landscapes. No new construction would be undertaken and the monument would continue to utilize existing buildings and structures for visitor and/or monument administrative uses, while National Register listed Modoc War era structures would continue to be used primarily for interpretation. The no adverse impacts alternative A, in combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in a minor to moderate, adverse cumulative impact. However, alternative A would not contribute to the adverse cumulative impact. The level of impact due to alternative A would not be expected to constitute an impairment of the national monument's cultural landscapes, historic buildings, and structures.

CULTURAL LANDSCAPES, HISTORIC BUILDINGS, AND STRUCTURES - IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

In alternative B, the monument would continue to follow current management objectives, preserving and maintaining cultural resources associated with the Modoc War Historic District as well as Public Works Administration (PWA), Civilian Conservation Corps (CCC), and Mission 66 development within the monument. Actions in alternative B would be implemented to increase visitor learning opportunities and resource preservation through collaboration. To appropriately preserve and protect historic structures and cultural landscapes that are listed or eligible for listing on the National Register of Historic Places, all stabilization, preservation, and rehabilitation efforts—as well as daily, cyclical, and seasonal maintenance—would be undertaken in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1995). Stabilization, preservation, and rehabilitation would have no adverse effects upon historic structures or cultural landscapes.

Under alternative B, Lava Beds would serve as a center for cultural resource research and learning (publications, partnerships, research, etc.). Research topics would address a range of cultural resource issues related to the Klamath Basin. Interpretive and educational programming materials would also be developed for 20th century historic structures as well as for CCC sites located both inside and outside of the boundaries of the monument. Moreover, the NPS would increase efforts to collect local oral histories.

The monument would also conduct additional research in order to understand to the full context all topics related to the Modoc War (survey, fortification studies, battlefield reviews, etc.). Additional research would be conducted to understand early human use prior to the Modoc War. Specific research would look at collections and the hundreds of sites found out on the landscape. New research and battle forensics would enhance interpretation and knowledge of the Modoc War sites, inside and outside of the monument, while prescribed burns and other treatment would continue to be used to restore the historic landscape and control the spread of invasive species, thus achieving a multitude of natural and cultural resource objectives. Additional research related to the Modoc War, the Klamath Basin, and the collection of oral histories may serve as a benefit, educating the public about the value of cultural resource stewardship, historic preservation and archeology. Overall, the actions in B would have long-term, minor to moderate, beneficial effects.

Alternative B proposes to minimize the intrusion of existing buildings on monument views by utilizing techniques such as screening, paint colors and less reflective roofing material to conceal the location of buildings and structures. The CCC and Mission 66 houses and structures would not be affected by this action since the asphalt and cedar shingle roofing originally installed on these structures are the most visually compatible. Modifications since this time have adversely affected the landscape.

Removal of the East and West Wildlife Overlooks, which were developed during the Mission 66 period, could have an adverse effect if the overlooks are found to be determined eligible for the National Register of Historic Places as part of the larger Mission 66 circulation system. This could have long-term, minor to

moderate, adverse impacts on the Mission 66 circulation system.

In alternative B, the campground would be redesigned to improve the visitor experience. Initially developed by the CCC and supplemented with later Mission 66-era development, a redesign may negatively affect the historic character of the campground. Additional analysis needs to be performed to assess potential impacts.

The NPS would provide more opportunities for trails that are accessible, especially in locations such as Hospital Rock, the first quarter mile of Captain Jacks Stronghold, Gillems Camp, and Petroglyph Point. All of the aforementioned sites are located within a National Register Archeological District as well as within the Modoc War Historic District cultural landscape. As a result, new trail development may have a long-term, negligible to minor, adverse effect on the historic character and setting of the locale, especially in locations such as Captain Jacks Stronghold where minimal development has occurred.

Despite the aforementioned changes, the selected alternative would have negligible to minor adverse effects (no adverse effect) and minor to moderate beneficial effects on cultural resources. It would not result in the loss or destruction of significant buildings, structures, or cultural landscape features.

Cumulative Impacts

As described under alternative A, natural processes and past infrastructure improvements have altered the monument's historic buildings, structures, and cultural landscape features.

The implementation of alternative B would result in no adverse effects to historic buildings, structures, or cultural landscape features. This determination in combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in minor to moderate, adverse cumulative impacts. However, alternative B would not contribute to the adverse cumulative impact.

Conclusion

The implementation of alternative B would result in no adverse effects to historic buildings, structures, or cultural landscape features. Some long-term, negligible to minor, adverse impacts may occur from the addition of accessible trails to several monument attractions. Alternative B would also contribute no adverse effects to the overall adverse cumulative impact of other past, present, and reasonably foreseeable actions. Any actions would follow approved standards and guidelines and would enhance NPS preservation objectives for the Modoc War Historic District, CCC-era historic buildings and structures, and any other potential cultural landscapes.

In addition, the monument would continue to preserve and maintain its historic structures and cultural landscapes. Any actions would follow the Secretary of the Interior's Standards for the Treatment of Archeology and Historic Preservation, and the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes; this would result in no adverse effects to historic structures and cultural landscapes. The level of impact due to alternative B would not be expected to constitute an impairment of the national monument's cultural landscapes, historic buildings, and structures.

CULTURAL LANDSCAPES, HISTORIC BUILDINGS, AND STRUCTURES - IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, the monument would continue to follow current management objectives, preserving and maintaining cultural resources associated with the Modoc War Historic District cultural landscape as well as Public Works Administration (PWA), Civilian Conservation Corps (CCC), and Mission 66 development within the monument. Actions in alternative C would be implemented to expand the range of visitor programs and recreation opportunities while developing a more visible identity for the monument. To appropriately preserve and protect historic structures and cultural landscapes that are listed or eligible for listing on the National Register of Historic Places, all stabilization, preservation, and rehabilitation efforts—as well as daily, cyclical, and seasonal maintenance—would be undertaken in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1995). Stabilization, preservation, and rehabilitation would have no adverse effects upon historic structures or cultural landscapes.

In alternative C, the monument would analyze means of providing interpretative experiences that allow visitors a broader understanding of the Modoc War. Walking

tours highlighting Modoc War-era fortifications would be considered as long as these actions would not have an adverse effect on the resource. Also, the Modoc War Historic District cultural landscape would be restored to 19th century battlefield conditions and new research and battle forensics would enhance interpretation and knowledge of the Modoc War sites located within the boundaries of the monument. Monument managers would continue to follow the general guidance and stabilization measures provided in the Modoc War Historic District Cultural Landscape Inventory completed in 2005. Prescribed burns and other treatment would continue to be used to restore the historic landscape and control the spread of nonnative species.

The monument would identify new opportunities for visitors to access historic structures (e.g. explore opportunities for an overnight experience at the Schonchin Butte fire lookout, and/or tours to other historic sites). As a result of the potential for increased visitation, the historic buildings and structures could suffer from wear and tear. Unstaffed or minimally staffed structures could be more susceptible to vandalism, but continued ranger patrols and visitor education efforts would discourage vandalism. Few, if any, adverse impacts would be anticipated. Benefits from increased visitation and access to historic structures may include an enhanced awareness by the public of historic preservation and the stewardship of cultural resources. Overall, there would be long-term, minor to moderate, beneficial effects on the historic structures.

Removal of West Wildlife Overlook, which was developed during the Mission 66 period, could have an adverse effect if the overlooks are found to be determined eligible for the National Register of Historic Places as part of the larger Mission 66 circulation system. This could have long-term, minor to moderate, adverse impacts on the Mission 66 circulation system.

As in alternative B, alternative C proposes more opportunities for trails that are accessible, especially in locations such as Hospital Rock, the first quarter mile of Captain Jacks Stronghold, Gillems Camp and Petroglyph Point. All of these aforementioned sites are located within a National Register Archeological District as well as within the Modoc War Historic District cultural landscape. As a result, development may have a long-term, negligible to minor, adverse effect on the historic character and setting of the locale, especially in locations such as Captain Jacks Stronghold where minimal development has occurred.

In alternative C, the campground would be improved to better accommodate large vehicles by adding a new RV loop. Initially developed by the CCC and supplemented with later Mission 66-era development, any redesign or addition may negatively affect the historic character of the campground. Additional analysis will be performed to be able assess potential impacts.

Despite the wear and tear from increased visitation, alternative C would have long-term, negligible to minor, adverse effects (no adverse effect) and moderate beneficial effects on cultural resources. It would not result in the loss or destruction of significant buildings, structures or cultural landscape features.

Cumulative Impacts

As described under alternative A, past management practices and infrastructure improvements have altered the monument's historic buildings, structures, and cultural landscape features.

The implementation of alternative C would result in no adverse effects to historic buildings, structures, or cultural landscapes. This determination, in combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in a minor to moderate, adverse cumulative impact. However, alternative C would not contribute to the adverse cumulative impact.

Conclusion

Implementation of alternative C would result in no adverse effects to historic buildings, structures, and cultural landscapes. However, proposed development may have a long-term, minor to negligible, adverse effect on the historic character and setting of the locale. Increased visitation and access to historic structures may include an enhanced awareness by the public of historic preservation and stewardship resulting in long-term, minor to moderate, beneficial effects on historic structures. Alternative C would not contribute to the adverse cumulative impact of other past, present, and reasonably foreseeable actions.

The monument would continue to preserve and maintain its historic structures and cultural landscapes. Any actions would follow the Secretary of the Interior's Standards for the Treatment of Archeology and Historic

Preservation, and the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes; this would result in no adverse effects to historic structures and cultural landscapes. The level of impact due to alternative C would not be expected to constitute an impairment of the national monument's cultural landscapes, historic buildings, and structures.

Ethnographic Resources

The intensity of potential impacts on ethnographic resources that are not traditional cultural properties is described below:

Negligible: Impact(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs.

Minor: Adverse impact — impact(s) would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs.

Moderate: Adverse impact — impact(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive.

Major: Adverse impact — impact(s) would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized.

Beneficial impact — would allow access to and/or accommodate a group's traditional practices or beliefs.

ETHNOGRAPHIC RESOURCES - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

Since the establishment of the monument, there has been relatively little directed anthropological research that discusses sites and resources viewed as significant to tribes associated with the Lava Beds. Recent research (Deur 2008) concentrated on particular uses of resources within the monument. This was completed primarily through interviews and research on historical records. This research has prompted the need for formal agreements between the monument and associated tribes to balance resource conservation and traditional use.

Alternative A concentrates on minor improvements to the existing management approach for ethnographic resources. It does not propose any significant changes to infrastructure or the organization of monument programs yet would continue to address some of the existing shortcomings concerning the documentation of cultural resources identified over the past several years. For the monument's properties significant to contemporary native tribes (The Klamath Tribes and the Modoc of Oklahoma), this alternative continues to encourage the resource program to improve identification and documentation of ethnographic resources within the monument.

Currently, the monument resource program relies on network or regional anthropology projects to obtain the oral history and significance of sites within the monument to tribes. Under alternative A, the monument would continue an open dialogue concerning the protection of sites and objects that are significant to the Tribes and would follow consultation guidelines outlined in legal documents like NAGPRA, as well, as the NPS Programmatic Agreement (2008). Other informal yet on-going consultation would continue between the monument and tribes to incorporate the tribes' perspective in interpretive programs and ensure their ceremonial activities, like the annual Modoc Gathering, are adequately supported.

Recently, documentation of land use patterns by contemporary Native groups as well as site and resource significance to The Klamath Tribes was published in the book, *In the Footprints of Gmukamps: A Traditional Use Study of Crater Lake National Park and Lava Beds National Monument* (Deur 2008). This publication is helpful in creating a formal agreement between tribes and the monument concerning ethnographic resources. While this study is important for the monument to understand tribal perspectives concerning resources and land use, this type of anthropological study is one of the few published pieces concerning ethnographic resources and the only ethnographic

research completed at Lava Beds within the past few decades.

Based on the actions proposed in alternative A, no impacts to ethnographic resources are anticipated.

Cumulative Impacts

As ethnographic resources on surrounding lands have been lost over time to activities such as grazing, the monument has become more important to tribes. This may result in more collecting from the monument.

Monument development and administrative/maintenance operations, as well as increasing visitor use since its establishment have had and are continuing to have minor cumulative adverse impacts on ethnographic resources.

Alternative A's contribution to these minor impacts would be small. NPS staff would continue consultation with affiliated tribes to address matters of mutual concern.

Conclusion

Progress, though limited, would be made in documenting sites and resources significant to tribes and formalizing agreements between the monument and tribes concerning preservation and use of resources identified through ethnographic research. The documentation would rely on specific project funding. No impacts to ethnographic resources are anticipated from actions in alternative A. Cumulative adverse impacts would be minor. The level of impact due to alternative A would not be expected to constitute an impairment of the national monument's ethnographic resources and values.

ETHNOGRAPHIC RESOURCES - IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

The overarching objectives of alternative B are to provide an array of educational opportunities and interpretive programs to monument visitors and the surrounding community. Collaboration with tribes would be necessary to meet compliance expectations associated with the increase in development in the monument.

The actions proposed for Petroglyph Point would need review by the Tribes Heritage Program to ensure the overall design for the area does not diminish the integrity of the site. Accumulated damage to the rock art at Petroglyph Point has altered the cliff face and obscured some of the images. The majority of the defacement has been caused by gunfire. However, erosion of the rock face may also be responsible for diminished visual clarity of the exposed images. Photo documentation and scaled drawings of the petroglyph panels have been completed but the determination of indirect impacts from wind erosion has been more difficult to record. Efforts in the near future would establish a measurable baseline to assess erosion rates and impacts. The proposed changes at Petroglyph Point may help to reduce incidences of direct and indirect damage to both the rock art and archeology sites in the area.

Alternative B proposes an increase in the number of hiking trails, removal, restoration of under-utilized wildlife overlooks, modification the campground, and small additions to the visitor and research centers. When all of the proposed construction activities are considered, the possibility of degradation to site and resources significant tribes exists. While the proposed changes have a relatively small footprint, several of the actions are adjacent to or in areas identified by tribes as important places. Because of this overlap, alternative B actions would require frequent and direct consultation with the tribes to ensure that no degradation would occur. Overall, new construction could have a long-term, minor, adverse impact on ethnographic resources in localized areas of the monument.

The vision described for the interpretative program in alternative B reflects a desire to expand Tribal representation for educational outreach and interpretation of monument resources. The broadening of educational themes would include the tribes' contemporary identity, views and application of traditional practices. This goal would require greater efforts by monument resource and interpretive staff to implement this type of program. This would have an overall long-term, minor, beneficial effect on ethnographic resources.

Cumulative Impacts

The cumulative impacts are the same as alternative A. Most of the actions proposed in alternative B would not have an adverse effect on known sites or resources deemed significant to the heritage of tribes affiliated with the monument. This is due in large part to the

continued emphasis on cultural resource preservation and natural resource conservation. In addition, the overall the actions needed to meet alternative B objectives for education, interpretation, and research would enrich the cultural resource programs at Lava Beds.

The combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in minor, adverse cumulative impact. However, alternative B would not contribute to the adverse cumulative impact.

Conclusion

Alternative B would have beneficial effects on ethnographic resources from the increased emphasis on cultural resource research and preservation. Since site construction at places of significance to tribes has the potential for diminishing integrity causing localized, minor, adverse impacts, the proposed increase in collaboration with the tribes for interpretive programs and anthropological research would ensure that development design is sensitive to resources important to affiliated groups. Cumulative impacts would be minor and adverse. However, alternative B would not contribute to the adverse cumulative impact. The level of impact due to alternative B would not be expected to constitute an impairment of the national monument's ethnographic resources and values.

ETHNOGRAPHIC RESOURCES - IMPACTS FROM ALTERNATIVE C

Analysis

Alternative C proposes an increase in development to address visitor recreation interests. Alternative C would require greater compliance consultation with tribes. Several of the proposed areas for new construction or improved visitor access are located at key monument areas that are also at or adjacent to sites that are significant to tribes. Petroglyph Point is identified as a place of particular significance to The Klamath Tribes that would undergo significant re-design under alternative C. While the monument would proceed with construction plans that meet visitor needs, there would be a corresponding need for design that is sensitive to preservation of the areas significance identified by The Klamath Tribes.

In alternative C, programming for resource management would continue with the existing approach for documentation and preservation. Many of the improvements to the identification and recordation of sites and items important to tribes traditions would be conducted through minor changes in resource programming or through regional and network assistance. This is particularly important for formalizing agreements between the monument and tribes concerning the collection and use of resources within the monument.

None of the proposed changes in organizational structure or recreation development are likely to have a direct impact on known sites, items, or objects significant to tribes. While potential impacts to ethnographic resources exist under alternative C, particularly at Petroglyph Point, the effects would be diminished through tribal consultation during Section 106 (NHPA) compliance.

Alternative C proposes an increase in the number of hiking trails, removal, restoration of under-utilized wildlife overlooks, and expansion of the campground for RVs. When all of the proposed construction activities are considered, the possibility of degradation to site and resources significant to tribes exists. While the proposed changes have a relatively small footprint, several of the actions are adjacent to or in areas identified by tribes as important places. Because of this overlap, alternative C actions would require frequent and direct consultation with The Tribes. Potential localized adverse impacts at locations such as Petroglyph Point could be minor to moderate and long-term.

Cumulative Impacts

The cumulative impacts are the same as alternative A. Alternative C does not provide a direct avenue for improving knowledge concerning ethnographic resources within the monument. As described in the analysis section, proposed developments, particularly at Petroglyph Point, could be harmful to sites important to tribes. This determination, in combination with both the adverse and no adverse impacts of other past, present, and reasonably foreseeable future actions, would result in a minor to moderate, adverse cumulative impact. The contribution from alternative C would be small for most areas of the monument, but more substantial in the Petroglyph Point area.

Conclusion

Since there is a gap in available information concerning significant sites and resources to monument management and the monument's interpretive staff, all actions

proposed in alternative C should be undertaken in full consultation with tribes. This effort would ensure important sites retain integrity and would also improve the quality of ethnographic data available to the monument staff. Localized impacts from new facilities could cause long-term, minor to moderate impacts, particularly at Petroglyph Point. Cumulative impacts would be minor to moderate and adverse. However, alternative C's contribution would be small. The level of impact due to alternative C would not be expected to constitute an impairment of the national monument's ethnographic resources and values.

Museum Collections

Museum collections (prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens) are generally ineligible for listing in the national register, and are not subject to Section 106 of the National Historic Preservation Act. The intensity of impacts on museum collections is defined as follows:

Negligible: Impact is at the lowest levels of detection, barely measurable with no perceptible consequences, either adverse or beneficial, to museum collections.

Minor: Adverse impact — would affect the integrity of few items in the museum collection but would not degrade the usefulness of the collection for future research and interpretation. Beneficial impact — would stabilize the current condition of the collection or its constituent components to minimize degradation.

Moderate: Adverse impact — would affect the integrity of many items in the museum collection and diminish the usefulness of the collection for future research and interpretation. Beneficial impact — would improve the condition of the collection or protect its constituent parts from the threat of degradation.

Major: Adverse impact — would affect the integrity of most items in the museum collection and destroy the usefulness of the collection for future research and interpretation. Beneficial impact — would secure the condition of the collection as a whole or its constituent components from the threat of further degradation.

MUSEUM COLLECTIONS - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

In alternative A, the monument's museum management program would continue to improve the quality of object documentation for interpretive and research use, incorporating administrative records into the monument's archives (Lava Beds Museum Management Plan 2002), and updating the repository heating and cooling systems to meet facility expectations (Pacific West Region's Curation Facility Strategy 2006). Under this alternative there would continue to be inadequate qualified staff to direct improvements to the various assemblages.

Currently, Lava Beds National Monument relies on the expertise of the curator at Crater Lake National Park to meet annual collection management reporting requirements. This position also provides the monument with identifying needed assemblage improvement projects and reviewing the effectiveness of protocols concerning collection access and use. The existing arrangement between Lava Beds National Monument and Crater Lake National Park would continue to ensure basic coverage for collection care and reporting, but does not provide for direct, in-park oversight of the collection by a professional curator. Lack of an on-site curator could result in long-term, minor, adverse impacts on museum collections.

Although there are no proposed projects for the construction of monument facilities or infrastructure requiring archeological data recovery (projects that would generate large assemblages) for alternative A, there is the likelihood for moderate collection growth. Small-scale compliance projects and other work proposed in resource documents could result in collections that would have to be incorporated into the general collection. Ongoing inventory and monitoring projects for biological and geological resources would also produce reports that should be added to the monument archives. Another potential source for collection growth includes the addition of materials that have been stored at other repositories that can no longer afford to manage the assemblage.

The existing collection storage facilities would continue to be used to house monument archives and objects. Collection use for exhibit and interpretation is possible but would continue to be difficult due to the current status of staff and expertise. Incompliance with environmental control standards could result in long-term,

minor, adverse impacts on museum collections at the monument.

Cumulative Impacts

New and potential additions to the collections offer the chance to improve the social and scientific value of assemblages. The improvements mentioned above, however, would require greater involvement by a curator and a high degree of input from biologists, geologists, archeologists, historians and tribal members. Should management of the collections proceed under the existing arrangement, the NPS mandates and required reporting would be completed but other improvements concerning use and directed collection growth detailed in the Lava Beds Museum Management Plan would be difficult to attain. The lack of an on-site professional curator over the course of time could result in processing and data gaps that could hinder future resource research efforts.

The available space for collection growth is limited. The lack of associated processing and dedicated laboratory space compounds the issue of completing a number of the collection improvement tasks proposed in the Lava Beds Museum Management Plan. This programmatic stasis over the next ten years could lessen the social and scientific value of the overall collection due to lack of information needed to promote research, limited time from a professional curator to oversee collection improvement projects, and continued disuse of the collection for exhibits or other appropriate interpretive programs.

Overall, cumulative impacts on museum collections would be long-term, minor and adverse. Alternative A's contribution to these minor impacts would be small.

Conclusion

Some minor adverse impacts would result from environmental controls that do not meet current NPS standards for museum collections. The monument's ability to focus efforts toward current expectations for documentation, exhibit design, and use for interpretation is limited by both the level of staffing and the available expertise in the monument for addressing many of the issues discussed in the Museum Management Plan having an overall minor, cumulative adverse impact on museum collections. Alternative A's contribution to these impacts would be small. The level of impact due to alternative A would not be expected to constitute an impairment of the national monument's collections and archives.

MUSEUM COLLECTIONS - IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

In alternative B, the monument would emphasize maintaining and preserving objects and specimens accessioned into the museum through directed actions toward improved documentation for research, interpretive programs, and educational outreach. These improvements include object photographs, professional descriptions of artifacts and specimens, and the creation of thematic education kits. Many of the identified efforts associated with the primary goal of alternative B would pursue preservation and educational outreach to increase learning opportunities for both monument visitors and the community through partnerships with other agencies and organizations.

The expected increase in the use of collections for public benefit would include collaboration with appropriate professional cultural resource staff within the NPS. The monument would support appropriate museum training for employees in existing positions while pursuing needed increases in professional cultural resource staffing. Balancing collection use with the conservation of museum objects and research would be accomplished while adhering to NPS servicewide laws and policies.

Alternative B proposes an organizational shift from a relatively loose assembly of monument programs to more integrated programs that share common goals in research and education. The monument would become a research and learning center for regional cultural topics, as well as history and anthropology themes deemed nationally important. An emphasis of the preferred alternative would be the development of educational materials for use at the monument and surrounding communities. Planning for exhibits and developing education kits (either through the use of objects from an interpretive collection or by producing replicas) would require increased collaboration with museum professionals and subject matter experts.

The potential effect to the monument's collections under alternative B would be driven by both increased compliance activity associated with trail and facility development and increased collection use for the interpretation division. The proposed development

at Petroglyph Point and the campground could result in the recovery of archeological materials to mitigate the impact of building. The construction of new trails, including the proposed accessibility improvements at Hospital Rock, Gillem's Camp, Petroglyph Point, and Captain Jacks Stronghold, would also involve cultural and natural resource surveys that could result in additional items added to the collection. Professional oversight is needed to ensure that materials uncovered would be properly assumed into the overall Lava Beds collection. Without this professional oversight, long-term, minor, adverse impacts on museum collections may result from unprocessed and unconsolidated assemblages.

Baseline data would be gathered to address information gaps identified by the different disciplines. These efforts would include analysis of archeological and biological specimens to gain a better understanding of topics associated with the history and ecology of the monument. Background research would be conducted to ensure the monument accurately portrays the composition of resources within its boundary. Resource management staff would also direct efforts toward collecting and transcribing oral histories from living people involved with important national trends (e.g., Civilian Conservation Corps crews, and land-use by affiliated tribes).

Museum repositories would continue to operate as single use facilities as they do now but other in-monument facilities would be assessed for expansion of collection storage if necessary. The research center would also be explored as a viable facility for additional processing and laboratory activities. As noted in alternative A, the needed updates to the visitor center facility would continue to be supported by Lava Beds management. Proposed development, though relatively small, would result in the generation of collections from compliance activities. This type of collection growth is expected to be minor since significant archeological, historical, biological and geological sites would be avoided. Extending collections management to research partners such as Chico State University would provide additional knowledge of collections items and monument history and pre-history.

Cumulative Impacts

Cumulative impacts would be the same as alternative A. As described above, alternative B actions would result in overall beneficial effects on the monument's museum collection. The greatest challenge concerning impacts on the monument's natural and cultural assemblages under alternative B is balancing the increased collection use with the total preservation of objects, specimens, and records that are important monument resources. Without professional oversight from staff with appropriate experience and training in collection care and experience in identifying research potential, alternative B could have adverse impacts to Lava Beds collections over time.

The beneficial impacts of alternative B, in combination with the impacts of other past, present and reasonably foreseeable future actions would result in negligible to minor, adverse cumulative impacts. Alternative B's beneficial effects would contribute a modest amount to the cumulative effects.

Conclusion

Implementation of alternative B could greatly improve the accessibility and use of the monument collections through increased research and educational outreach. However, without proper professional oversight during construction activities, some long-term, minor, adverse impacts may result from unprocessed and unconsolidated assemblages. Other associated improvements may include the inclusion of more appropriate processing and analysis space at the monument. Overall, these actions would result in long-term, minor, beneficial effects on museum collections. The beneficial impacts of alternative B, in combination with the impacts of other past, present and reasonably foreseeable future actions would result in negligible to minor, adverse cumulative impacts.The level of impact due to alternative B would not be expected to constitute an impairment of the national monument's collections and archives.

MUSEUM COLLECTIONS - IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, the National Park Service would continue to follow current management objectives, preserving and maintaining existing museum collections while responsibly managing collection growth. Actions in alternative C would be implemented to expand the range of visitor programs and recreation opportunities while developing a more visible identity for the monument. Many of the actions identified involve increased interpretation of resources. Information from the museum collections would be used for interpretation and educational programs. The overall

intention of alternative C is to create a wider range of visitor experiences through field tours and self-guided trails. Management of the monument would continue to rely on formalized partnerships with other parks for collection care and reporting. Policy standards and NPS mandates would be addressed by subject matter experts regionally.

The potential effect to the monument's collections under alternative C would be driven by both increased compliance activity associated with trail and facility development and increased collection use for interpretation. The proposed development at Petroglyph Point and the campground could result in the recovery of archeological materials to mitigate the impact of building. The construction of new trails, including the accessibility improvements to trails at Hospital Rock, Gillem's Camp, Petroglyph Point, and Captain Jacks Stronghold, would also involve cultural and natural resource surveys that could result in collected items. Professional oversight is needed to ensure that materials uncovered would be properly assumed into the overall Lava Beds collection. Without this professional oversight, long-term, minor to moderate, adverse impacts on museum collections may result from unprocessed and unconsolidated assemblages.

While alternative C would have an impact on the volume and composition of the monument's museum collection, the anticipated effects are minor and no adverse effects are expected if policies and collection care practices are adhered to by monument staff. The potential for collections improvement is possible with the increased use of collection materials for exhibit and educational programs. These uses would require adequate background research, which would fill existing data gaps. Overall, the museum collections would not be adversely affected by alternative C.

Cumulative Impacts

Cumulative impacts would be the same as alternative A. Implementation of alternative C would result in no adverse effects to the integrity of the museum collection. Improvements to the documentation of museum items would continue to be incremental, though adequate oversight for servicewide reporting would be maintained.

Overall adverse cumulative impacts on monument collections would be long-term, minor and adverse. Alternative C's contribution to these impacts would be small.

Conclusion

Actions that detract from planned improvements to the museum program, like unchecked collection growth through compliance efforts, may be balanced by the need for some background research for the use of collection items in exhibits or educational programs. The lack of an on-site professional curator over the course of time could result in processing and data gaps that could hinder future resource research efforts resulting in long-term, minor to moderate, adverse impacts. Adverse cumulative impacts on monument collections would be long-term, minor and adverse. However, alternative C's contribution to these impacts would be small. The level of impact due to alternative C would not be expected to constitute an impairment of the national monument's collections and archives.

Wilderness

Working from definitions included in the Wilderness Act, and included in NPS Management Policies 2006, and the tradition of wilderness preservation and management at the monument, the following wilderness characteristics have been identified for consideration in this analysis:

- The earth and its community of life are untrammeled by humans, where humans area visitors and do not remain.
- The area is undeveloped and retains its primeval character and influence without permanent improvements or human habitation.
- The area generally appears to have been affected primarily by the forces of nature, with the imprint of humans' work substantially unnoticeable.
- The area is protected and managed so as to preserve its natural conditions.
- The area offers outstanding opportunities for solitude or a primitive and unconfined type of recreation.

Impacts on natural and cultural resources, visitor access, soundscape, night sky, and other resources are evaluated elsewhere in the environmental consequences section. The analysis for this topic focuses on wilderness character and wilderness experience, which are integrally related because much of wilderness

character can only be subjectively determined by the visitor's experience (for example, solitude or freedom of movement).

The thresholds of change for the intensity of an impact are as follows:

Negligible: Impacts would not be detectable to most visitors and would have no discernible effect on wilderness character or experience.

Minor: Impacts would be slightly detectable to some visitors but would not be expected to have an overall effect on wilderness character or experience.

Moderate: Impacts would be clearly detectable by many visitors and could have an appreciable effect on wilderness character or experience.

Major: Impacts would have a substantial and noticeable effect for most visitors on wilderness character or experience and could permanently alter various aspects of the visitor experience.

WILDERNESS CHARACTER – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

In this alternative, no new developments would occur within the two legislated wilderness areas of the monument. As discussed in soundscape, the wilderness areas would continue to experience long-term, negligible to minor, adverse impacts from inside and outside influences associated with agriculture on Tule Lake National Wildlife Refuge and private lands, airplane flyovers, visitor use, recreational vehicles, snowmobiles, and railroads. No new trails would be developed under this alternative, limiting human impacts on wilderness. Visitor use levels are not expected to increase significantly in the next 20 years, limiting additional impacts associated with wilderness use.

Cumulative Impacts

Impacts on wilderness resources associated with human activities vary depending on location within the monument. The wilderness is considered one of the most serene areas visitors can experience natural quiet. Impacts increase around the borders of the wilderness and at trailheads.

The main impacts on wilderness are from the combined potential increases in overhead airplane traffic, agricultural activities on Tule Lake National Wildlife Refuge lands and private lands, recreational vehicle noise associated with snowmobiles on national forest lands, and vehicle use in general. Visitor use and park operations in the monument would contribute a relatively small part of the cumulative impacts on the monument's wilderness.

When the likely effects of continued public use of the monument under this alternative are added to the effects of actions outside the monument, there could be a long-term, negligible to minor, adverse cumulative impact on wilderness values (natural quiet, dark skies, solitude, wildlife viewing).

Conclusion

Alternative A would be expected to have a negligible to minor, long-term, adverse impact on the monument's wilderness resources from monument operations and visitor use. There could be a long-term, negligible to minor, adverse cumulative impact on certain wilderness values that center on natural quiet. The level of impact due to alternative A would not be expected to constitute an impairment of the monument's resources or values.

WILDERNESS CHARACTER – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

Under this alternative, the only new developments proposed within legislated wilderness would be the expansion of new trails in the backcountry zone and the development of backcountry campsites. These two proposed developments would have low to moderate short-term impact on natural quiet during installation. Visitor use in these new trail areas would follow use level guidelines set to limit impacts in the wilderness setting. The formalization of permanent new trails in backcountry areas would result in minimal wilderness disturbance. Thus, the construction of new trails and campsites in alternative B would be expected to have a negligible to minor, long-term, adverse impact on the monument's wilderness values.

As in alternative A, in alternative B the wilderness would continue to be impacted at minor to moderate levels from outside influences associated with agriculture on Tule Lake National Wildlife Refuge and private

lands, airplanes, recreational vehicles and railroad impacts. Visitor use levels are not expected to significantly increase to levels where wilderness resources would be impacted from visitor use in the backcountry zone.

Alternative B would have several beneficial impacts on wilderness resources. The establishment of user capacity indicators and standards would help protect wilderness resources. A larger emphasis on interpretative efforts to educate the public would have an effect on reducing impacts to wilderness. The monument would reduce the visibility of monument facilities as seen from wilderness, take additional efforts to promote bicycle use along roads, and trail access would be promoted to a number of the main visitor destinations. The creation of new trails and trail connections would likely result in more people walking in areas that currently have wilderness impacts associated with vehicle noise. Thus, compared to alternative A, reduction in vehicle use due to improved trail systems would have the potential for long-term beneficial impact of unknown magnitude on wilderness resources. The likely result of more hiking in the monument would reduce negative impacts on wilderness and allow visitor more opportunity to experience the wilderness of Lava Beds. Taken together, these actions would have a minor to moderate, long-term, beneficial impact on the wilderness.

Cumulative Impacts

Cumulative impacts on wilderness would be the same as in alternative A. When the likely adverse impacts of public use in alternative B and the beneficial effects of promoting bicycle use and more efficient trail route patterns are added to the effects outside of the monument, there could be a long-term, negligible to minor, adverse cumulative impact on the two wilderness units. However, the beneficial and adverse effects of alternative B in the monument would likely be a very small part of the cumulative impacts on the area's wilderness resources.

Conclusion

Compared to alternative A, alternative B would be expected to have beneficial effects of unknown intensity on wilderness resources, primarily due to the improved trail system that connects primary visitor use destinations, as well as the promotion of bicycle use and reduced visibility of monument facilities. There also would be a long-term, minor to moderate, adverse impact on the monument's wilderness resources due to the increased potential for noise associated with activities outside the monument. There could be a long-term, negligible to minor, adverse cumulative impact on wilderness, although alternative B would add small beneficial and adverse increments to the overall area cumulative impact. The level of impact due to alternative B would not be expected to constitute an impairment of the monument's wilderness resources or values.

WILDERNESS CHARACTER – IMPACTS FROM ALTERNATIVE C

Analysis

Under this alternative, the monument would increase outreach efforts to promote more visitation and would collaborate with the Modoc National Forest on new recreational opportunities. The monument would also explore regional trail connections to national forest trails and sites, including shared trail systems. Alternative C would also make changes to the Indian Well campground to accommodate larger recreational vehicles and visitor use groups. Medicine Lake road would be paved under this alternative, allowing for increased traffic loads and speeds. The Monument would also promote more winter use and additional specialized tour opportunities. Additionally, up to 15 miles of new trail expansion and vehicle pullouts along the main monument road would be constructed under this alternative. The potential impacts from this alternative would center on degradation of wilderness values associated with trail development in the backcountry and facility development in the frontcountry. As in the other alternatives, wilderness in many areas of the monument would not be directly affected in alternative C. The short-term impacts on wilderness associated with the projects listed above would be negligible. The long-term effects from trail expansion on wilderness resources would likely have a minor adverse, long-term, localized impact on the monument's wilderness.

With visitor use levels expected to stay constant or increase over the life of this plan, wilderness resources could have negligible to minor, adverse, long-term, localized impacts in the backcountry zone. New trails in the backcountry zone would provide access for visitors, which would directly contribute to changes over time with wilderness resources (natural quiet, solitude, wildlife viewing).

Alternative C would have several beneficial impacts on wilderness. The establishment of user capacity indicators and standards would help protect wilderness resources. Encouraging bicycle use and the creation of new trails and connecting current trails would likely result in more people walking in areas that currently have wilderness impacts associated with vehicle noise. Taken together, these actions would have a minor, long-term, beneficial impact on the wilderness.

Cumulative Impacts

Cumulative impacts on wilderness would be the same as in alternative A. In alternative C, wilderness is primarily impacted by activities outside of the boundaries of the monument as well as monument administrative activities and visitor use in the frontcountry zones. When the likely effects of monument developments and public use in alternative C and the beneficial impacts more efficient trail route patterns are added to the effects outside the monument, there could be a long-term, negligible to minor, adverse cumulative impact on the area's wilderness resources. However, the beneficial and adverse effects of alternative C in the monument would likely be a very small part of the cumulative impacts on the area's wilderness resources.

Conclusion

Compared to alternative A, alternative C would be expected to have beneficial impacts of unknown intensity on wilderness resources, primarily due to the promotion of walking and bicycle use. There would also be a long-term, minor adverse impact on the monument's wilderness resources due to the increased trail developments proposed for the wilderness and the potential impacts associated with activities outside the monument. There could be a long-term, negligible to minor, adverse cumulative impact, although alternative C would add small beneficial and adverse increments to the overall cumulative impact. The level of impact due to alternative C would not be expected to constitute an impairment of the monument's wilderness resource or values.

Visitor Opportunities

Visitor Experience

The impact analysis evaluates how visitor opportunities might vary between alternatives as a result of applying proposed actions and different management zones in the alternatives. The analysis is qualitative rather than quantitative because of the conceptual nature of the alternatives. Professional judgment was used to reach reasonable conclusions as to the intensity, duration, and type of potential impact. Impacts could be temporary or short-term (for example, delays and inconvenience caused by the construction of facilities).

The following areas have been analyzed in this section:

- Recreation Opportunities: this section analyzes the recreational opportunities for visitors in each alternative, such as hiking, caving, camping, picnicking, and opportunities for solitude.
- Visitor Services: this section analyzes the commercial services available to visitors in each alternative.
- Visitor Facilities: this section analyzes the different facilities available to visitors in each alternative, including visitor centers, campgrounds, trails, and other day use facilities.
- Opportunities for People with Disabilities: this section analyzes opportunities for people with disabilities under each alternative.

The thresholds of change for the intensity of an impact are as follows:

Negligible: Impacts would be barely detectable to the visitor and expected to have no discernable effect related to recreation opportunities, visitor facilities and services.

Minor: Impacts would be slightly detectable to the visitor, though not expected to have an overall effect on the visitor experience related to recreation opportunities, visitor facilities and services.

Moderate: Impacts would be clearly detectable to the visitor and could have an appreciable effect on the visitor experience related to recreation opportunities, visitor facilities and services.

Major: Impacts would be have substantial, highly noticeable influence on the visitor experience and could permanently alter access to and availability of various aspects of the visitor experience related to recreation opportunities, visitor facilities and services.

VISITOR USE AND EXPERIENCE- IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Recreational Opportunities

While some recreational activities would remain the hallmark of a high-quality monument experience, such as the relatively unhampered exploration of developed caves and high desert hiking, other recreational opportunities would continue to be rarely pursued by most visitors. Caving, sightseeing (by car and on foot), camping in the drive-in campground, and short distance hiking or self-guided walks are common recreational activities. However, activities such as equestrian travel, bicycling, and wilderness camping and hiking are not actively promoted nor accommodated by park facilities or programs in a significant manner. Large group day use is also not facilitated by the current park infrastructure that features few optimal sites for group picnicking. Therefore, under the No Action alternative, these recreational opportunities would continue to be underutilized by, or unavailable to, the visiting public. Overall, these deficiencies would have long-term, negligible to minor, adverse impacts on the visitor experience.

Visitor Services

The Lava Beds Natural History Association would continue to supply limited health, safety and educational sales items, as well as concessions items such as pre-packed snacks, souvenirs, and cold drinks at the visitor center. Additional services, such as firewood, prepared food and/or drinks, and wireless internet in the campground would not be available. In the long-term, this could have a negligible to minor impact on the visitor experience.

Visitor Facilities

Alternative A would not address deficiencies that have been identified with the trail system, campground, and the Petroglyph Point facilities. Such deficiencies hinder some aspects of visitor access to, or enjoyment and understanding of, monument resources.

Many monument trails are former roads that are short and frequently used to access caves or points of historic interest. Longer trails are relatively underused by comparison. Only one longer trail loop exists, and at ten miles in length, excludes many visitors. Some visitors may be dissuaded from using non-looping trails if they are reluctant to take hikes that involve retracing their steps. Other longer trails have no specific destinations mapped or designated, and may have little value to visitors unless monument staff specifically direct them to sites or activities along the trail.

The drive-in campground, originally constructed by the Civilian Conservation Corps in the 1930s, and later modified under the Mission-66 program, no longer meets the needs of some modern visitors. The increasing use of RVs has shown that campground roads and parking places are too small to accommodate them. Furthermore, many visitors have requested shower facilities, and several campsites have lost the aesthetic, privacy, and shade value as trees have been killed by pathogens and root damage.

Major deficiencies in the facilities at Petroglyph Point would have a long-term, moderate, adverse impact on the visitor experience. While a restroom was recently constructed, there are no other facilities at this location. Alternative A would not provide any other visitor opportunities in an area that is a significant natural and cultural resource.

As the demographics of the region and monument visitors change, the outdoor recreational needs of an increasingly diverse local ethnic community have shown a growing desire for areas suitable for large group picnicking. Group day-use facilities are limited and are insufficient to meet these needs.

Without addressing current deficiencies in existing visitor facilities, there would be long-term, minor to moderate, adverse impacts on the visitor experience at the monument.

Opportunities for People with Disabilities

Incorporating ADA-compliant access to campsites, the visitor center, scenic overlooks and associated wayside exhibits, and monument restrooms has already been accomplished in some areas. ADA access into the monument's caves would continue to be unavailable as the required modifications would greatly impact cave resources.

Some mitigation in the form of visitor center displays and computer-based virtual cave tours would continue to be available. Access to major Modoc War sites such as Captain Jacks Stronghold would remain unavailable for persons with disabilities. Access is also unavailable or very difficult to the petroglyphs and is further impeded by the existing cyclone fence.

Alternative A would do little to address the existing facility deficiencies and would have a minor to moderate, long-term, adverse impact on the visitor experience.

Cumulative Impacts

Under alternative A, past, future, and ongoing actions in the monument that would affect visitor experiences include the deficiencies described in the above section, which include a lack of high quality visitor facilities at Petroglyph Point, changing needs at the campground, and limited trail opportunities for visitors. Limited staffing would challenge the monument in its ability to meet the changing visitor demographics.

Regional population growth is not expected to significantly increase and visitation to the monument would likely remain stable with modest increases over time. The establishment of the World War II Valor in the Pacific National Monument, Tule Lake Unit, would provide a new visitor opportunity in the region, but is not expected to have a major effect on regional or monument visitation.

Plans and projects on the adjacent Modoc National Forest are not expected to have an effect on visitor experiences in the monument. Several U.S. Fish and Wildlife Service projects on the northern boundary such as increasing the size of the wetlands, and working to increase duck and geese populations could bring additional opportunities for watching wildlife along the northern boundary, providing some benefit to the visitor experience.

The above actions, in combination with the adverse impacts of alternative A as described in the analysis section, would result in minor to moderate adverse cumulative impacts. Alternative A's contribution to these cumulative impacts would be relatively small.

Conclusion

Alternative A would perpetuate some positive aspects of the visitor experience at the monument, but would fail to address deficiencies in current visitor facilities such as the trail system, campground, and Petroglyph Point. Nor would it address changing visitor demographics as needs continue to evolve and change. Increases in visitation at certain locations, or by certain types of visitors such as large groups, RV users, or the disabled, would result in a decrease in the quality of the visitor experience. Overall, alternative A would have a long-term, negligible to minor, adverse impact on the visitor experience. Continued deficiencies in visitor facilities at Petroglyph Point would result in long-term, moderate, adverse impacts. There would be minor to moderate adverse cumulative impacts, primarily from deficiencies in visitor facilities, changing visitor needs, and limited staffing. Alternative A's contribution to these cumulative impacts would be relatively small.

VISITOR USE AND EXPERIENCE- IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

Recreation Opportunities

Alternative B proposes the addition of new hiking trails and the promotion of underutilized recreation activities such as overnight primitive camping in wilderness areas, and winter activities such as snowshoeing and cross-country skiing. The trail system would be improved where needed to provide better routes (primarily loop opportunities) and connections with adjacent U.S. Forest Service lands to the south. These include areas appropriate for non-motorized winter recreation.

Under alternative B, bicycle and foot travel within the monument would be promoted. Trails would be improved or added to ensure pedestrians easily access visitor center and Cave Loop destinations. Additional minor improvements such as trailhead bike racks would make bike use more pleasant.

Monument staff and volunteers would spend more time patrolling the Cave Loop area and educating visitors

about responsible ways to recreate in caves. These visitor contacts could result in more visitor knowledge about their caving recreation options. Self-guided cave tour brochures would improve the quality of visitor caving experiences.

With the addition of new recreational facilities and the promotion of new activities, alternative B would have a long term, minor to moderate, beneficial effect on recreational opportunities at the monument.

Visitor Services

If feasible, alternative B would offer expanded concessions at the visitor center, primarily small food items and/or drinks. Expanded concessions at the visitor center would address some current deficiencies in existing visitor needs, having a long-term, negligible to minor, beneficial effect on visitor services.

Visitor Facilities

Alternative B proposes the construction of comprehensive new visitor facilities at Petroglyph Point including new trails, shade structures, associated group and outdoor educational facilities, and improved vehicle access by relocating the existing access road. Such changes would improve visitor comfort and safety, as well as visitors' ability to view the petroglyphs and wildlife.

The campground would also be redesigned to better accommodate visitors, possibly including new sites for larger RVs. Overall, the campground would be improved to better accommodate the needs of both tent campers (valuing quiet and privacy) and RV users (valuing appropriate ease of access and parking of larger vehicles) while preserving the historic and rustic nature of the facility. The addition of shower facilities would also be considered.

New toilets are proposed in the Cave Loop area under this alternative, correcting a deficiency often noticed too late by many visitors and causing discomfort for all.

The addition of a classroom to the visitor center would expand the visitor experience by providing opportunities for new visitor programs. The classroom would also function as an auditorium.

Removal of the East Wildlife Overlook spur road, which is very lightly used (often zero visitors per day) would have negligible, long-term, adverse impacts on visitor experiences. Removal of the West Wildlife Overlook spur road and parking would have a similar impact. However, the conversion of a portion of the former roadbed into an educational area for use during special events would have long-term, moderate, beneficial effects on the visitor experience.

Overall, visitor facility improvements proposed in alternative B would have long-term, moderate to major, beneficial effects on the visitor experience at the monument.

Opportunities for People with Disabilities

Accessible trails would be provided at the Petroglyph Point area, Hospital Rock, Gillems Camp, and to the edge of Captain Jacks Stronghold enabling all visitors to view and enjoy these sites and attractions. These new opportunities would have a long-term, minor to moderate, beneficial effect on the visitor experience.

Cumulative Impacts

Cumulative impacts are similar to those described in alternative A. Greater cooperation with adjoining public lands is proposed in this alternative, and would improve the visitor's experience and recreational opportunities. These include the integration of roads and trails on adjacent lands into hiking, biking, or winter sports routes, and creating a more seamless visitor experience when travelers transition to or from the monument to adjacent lands. The beneficial effects of alternative B would contribute moderate benefits to cumulative impacts on the visitor experience.

Conclusion

Overall, changes under alternative B would improve the visitor experience at the monument by providing new facilities, enhancing visitor access, and offering new recreational opportunities, resulting in long-term, moderate to major, beneficial effects on the visitor experience. The beneficial effects of alternative B would contribute moderate benefits to cumulative impacts on the visitor experience.

VISITOR USE AND EXPERIENCE- IMPACTS FROM ALTERNATIVE C

Analysis

Recreation Opportunities

Under alternative C, a wider variety of visitors would have the opportunity to learn more about recreational opportunities before and during a visit through expanded outreach efforts to tourism groups and a greater focus on providing recreational information within the monument. New recreational opportunities would provide for a much wider variety of moderately challenging activities.

Like the preferred alternative, alternative C proposes the promotion of winter activities such as snowshoeing and cross-country skiing. In addition, other types of recreational tours (including bicycling, caving seminars, and adventure tours) would be offered by monument staff and/or partners. The addition of designated primitive backcountry campsites could also encourage a larger population of visitors to venture into the monument's backcountry and experience solitude.

The experience of visitors to Cave Loop Road would be diversified with the addition of a formal trail system. Like in alternative B, monument staff and volunteers would spend more time patrolling the Cave Loop Road area educating visitors about responsible ways to recreate in caves. These visitor contacts might result in more visitor knowledge about their caving recreation options. The addition of vault toilets along Cave Loop Road would also meet critical visitor needs.

The trail system would be improved, where needed, to provide better routes and connections with adjacent Forest Service lands to the south. New mid-length loop trails (between one and three miles in length) would also extend hiking as a viable recreational activity to a wider variety of visitors that might not utilize the longer, one-way trails that currently exist. Additional pullouts along the main road would also increase recreational opportunities by allowing for more informal, dispersed recreation and wildlife viewing.

The new recreational opportunities and outreach efforts proposed in alternative C would result in long-term, moderate, beneficial effects on recreational opportunities at the monument.

Visitor Services

Concessions provided by the Lava Beds Natural History Association would be focused on recreational activities and could include limited food service. The monument would encourage more private tour companies to provide additional tour and recreational opportunities. Increasing the amount of tours available would have a long-term, moderate, beneficial effect on visitor services.

Visitor Facilities

Alternative C would improve the visitor experience through the addition of mid-length loop trails and through the development of new facilities at Petroglyph Point, including a picnic area, trails, shade structures, and a group day-use area. These would have a long-term, major, beneficial effect on the visitor experience.

Additional day-use areas large enough to accommodate bigger groups of visitors would begin to address the current deficiency in the monument's ability to meet the needs of increasingly diverse groups seeking those facilities.

Similar to alternative B, the campground would be improved to better accommodate large recreational vehicles, potentially greatly enhancing the visitor experience for this population of visitors. Under this alternative, an additional loop would be added to the campground specifically designed for RVs. The existing campground areas would have larger tent camping sites increasing the quality of the quality of the experience for tent campers. The addition of shower facilities would also be considered.

Overall, visitor facility improvements proposed in alternative C would have long-term, moderate to major, beneficial effects on the visitor experience at the monument. Noise and use conflicts (large day use v. visitors seeking solitude) may occur during peak seasons having a short-term, minor, adverse impact on the visitor experience.

Opportunities for people with disabilities.

The opportunities offered people with disabilities in this alternative are similar to those of alternative B.

Cumulative Impacts

Cumulative impacts are similar to those described in alternative A. When combined with the wider range of

recreational opportunities and the increased coordination with schools, and community organizations in alternative C, there would be cumulative negligible to moderate, beneficial effects on the visitor experience.

Conclusion

The range of new facilities and recreational opportunities offered under alternative C would have long-term, moderate to major, beneficial effects on the visitor experience. In the short term, this alternative may result in minor, adverse impacts such as noise and increased conflict between visitors. There would be cumulative negligible to moderate, beneficial effects on the visitor experience.

Interpretation and Education

This section analyzes two aspects of the visitor experience: interpretation (which includes the elements of visitor information and orientation) and education. These two visitor experience components evaluate opportunities for and the quality of visitor information and orientation, as well as interpretive and educational experiences. Impact analysis was based on whether there would be a change in the access to high quality, diverse media and programs throughout the monument in order to achieve the desired conditions called for by the alternatives.

This assessment focused on the intensity and duration of impacts that would result from the proposed actions in the plan relative to the aspects of the visitor experience related to interpretation and education, and whether those impacts were considered beneficial or adverse. The assessment specifically evaluated whether there were changes in the characteristics or quality of the experience.

The following areas have been analyzed in this section:

- Opportunities for Monument Visitors
- Opportunities for Educational Groups and Members of the Education Community
- Opportunities for Local Communities, Park Partners, and Neighboring Agencies

The thresholds of change for the intensity of an impact are as follows:

Negligible: Impacts would be barely detectable to the visitor and expected to have no discernable effect related to interpretation and education opportunities.

Minor: Impacts would be slightly detectable to the visitor, though not expected to have an overall effect on the visitor experience related to interpretation and education opportunities.

Moderate: Impacts would be clearly detectable to the visitor and could have an appreciable effect on the visitor experience related to interpretation and education opportunities.

Major: Impacts would be have substantial, highly noticeable influence on the visitor experience and could permanently alter access to and availability of various aspects of the visitor experience related to interpretation and education opportunities.

INTERPRETATION AND EDUCATION - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

Opportunities for Monument Visitors.

High-quality interpretive programs would continue to be offered, and all interpretive opportunities for visitors would be comprehensively planned in the long-term. Interpretive topics would expand slightly to include more material about traditional culture and 20th century history of the area. However, since no new employees would be added, monument interpretive staff would not be able to meet visitor demand during the spring and fall seasons and during summer holidays, or on a wider variety of topics. Occasional ranger led programs at Captain Jacks Stronghold and Petroglyph Point would likely continue to be the only personal interpretation available in the northern portion of the monument. The number of guided cave tours offered would likely remain the same (once or twice daily in the summer season), as would evening campfire programs in the campground (four to five nights per week in summer only). Limited Junior Ranger programming would be offered via activities that children complete on their own. Ranger-guided activities such as plant walks and bird watching would be offered sporadically.

An adequate number of non-personal interpretive services would continue to be available to visitors and potential visitors, such as museum exhibits, an introductory monument film, in-depth brochures on many

subjects, an in-depth monument website, and bulletin board displays throughout the monument. Information delivery formats such as podcasts could be introduced on a limited scale. More information media on caves and geologic resources would be beneficial to minimize visitor impacts on the resources, improve safety, and increase visitor appreciate of the resource. Without additional staffing, the replacement of waysides over time would be intermittent, having a negative effect on the ability of the monument to use this medium for interpretive messages. The monument would continue to offer a number of high quality interpretive programs. However, staffing constraints would continue to limit the amount of interpretive and educational programs provided over time having a long-term, minor to moderate, adverse impact on interpretive and educational opportunities.

Opportunities for Educational Groups and Members of the Education Community.

Under this alternative, teachers and students would notice more cultural history education options, as well as the incorporation of information collected from oral history interviews in the local area. These topics would be integrated into new and current education materials and programs. Staff would continue to be limited in their availability to present these programs both on-site and in the classroom on a limited variety of topics. Although the monument currently loans "traveling trunks" of educational materials on many topics, few classes would be able to meet the National Park Service standard for a pre-visit, on-site, and post-visit continuum of learning have overall long-term, minor, adverse impact on educational opportunities for school children.

Opportunities for Local Communities, Park Partners, and Neighboring Agencies.

Community outreach efforts would continue under alternative A. Lava Beds staff would continue to engage in a limited number of community outreach activities including attending local meetings and special events such as the Tulelake-Butte Valley Fair. More cultural history topics could be incorporated into community programs, and the collection of oral histories from the community would enhance community ties to the monument. The popular Timeline living history/ cultural demonstration program would continue to be presented once annually.

Interpretive staff coordination between the National Park Service, U.S. Fish and Wildlife Service, and the U.S. Forest Service would continue to be limited by the staffing levels, time constraints, and funding potentials within all three agencies. Some interpretive programming may be provided at and/or about Modoc War sites outside the monument. Limited coordination with the Klamath Tribes for staff training and special events would continue. Current community outreach efforts would have a long-term, negligible to minor, beneficial effect on regional interpretive and educational opportunities.

Cumulative Impacts

Under alternative A, regional population growth is not expected to significantly increase. However, demand for interpretive and educational services, such as in-classroom programs and participation in the Timeline living history event, would exceed the monument's capacity. Interpretive programming available to off-season visitors would continue to be limited and the monument would have difficulty keeping pace with changing technologies that would allow visitors to receive information and interpretation in new ways.

Outside of the monument there are limited opportunities to obtain interpretive materials through a variety of local, state, federal, and tribal information resources in the region. Visitor surveys indicate that the public desires more information about the monument in the greater region.

Monument staff would continue to work with regional partners to implement projects like the National Scenic Byways program, and to coordinate, assist with, or participate in local events such as the Tulelake-Butte Valley Fair or the Winter Wings Festival. These events provide a regional context to the recreational or educational experience enjoyed by monument visitors. However, there is currently no major coordination of educational or recreational planning with the adjoining Wildlife Refuge or National Forest.

Future plans and projects on the adjacent Modoc National Forest are not expected to have an effect on interpretation and education in the monument. Several Fish and Wildlife Service projects on the northern boundary such as increasing the size of the wetlands and working to increase duck and geese populations could bring additional opportunities for interpretation and education. However, these opportunities would be limited by current staffing constraints.

The above actions, in combination with the adverse and beneficial impacts of alternative A as described in the analysis section, would result in minor to moderate, adverse cumulative impacts on educational and interpretive opportunities. Alternative A's contribution to these cumulative impacts would be relatively small.

Conclusion

Education and interpretive programs under alternative A would provide negligible to minor beneficial effects on the monument visitors, school groups and teachers, local communities, and organizations. However, in the long-term, staffing and programmatic constraints would result in fewer interpretive and educational opportunities resulting in minor to moderate, adverse cumulative impacts on education and interpretation.

INTERPRETATION AND EDUCATION - IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

Opportunities for Monument Visitors.

The monument's interpretive services would expand significantly under this alternative. One full-time and four seasonal interpretive employee positions would be added, allowing additional high-quality interpretive programming and services to be offered at more locations throughout the monument.

A greater number of guided cave tours would also be offered in the spring and summer shoulder seasons, and more than once daily in summer. New media and written materials would be produced for self-guided caving, and a greater ranger and docent presence in the Cave Loop Road area would exist, especially during the summer season. Additional campfire programs and other ranger-guided activities, such as plant walks and bird watching, would be offered.

A new day use area at Petroglyph Point would be staffed seasonally, achieving two goals: visitors entering from the north could pick up brochures, information, and orientation from a staff member; and more interpretive programming would be offered about rock art, traditional culture, birds, and other wildlife, geology, homesteading, and other topics.

Under this alternative, there would be more collaboration between interpreters and monument scientists to accomplish two goals: expanding visitor understanding about scientific research at Lava Beds, and involving the public directly in research and restoration efforts. The expanded visitor center would be utilized as a site for in-depth interpretive programs and workshops. Cultural history topics could include the monument's archeological history and human issues in the area such as the Modoc War, and water resource development.

A more comprehensive replacement of wayside exhibits throughout the monument would occur, as well as an expansion of the Junior Ranger and other children's programs for visiting families. Additional surface trails would facilitate interpretive services such as guided walks, trail guides, and/or wayside exhibits. Replicas of historical artifacts would be made available for interpretive programming, and increased interpretive efforts would enhance visitor understanding of the area's cultural landscape. The visitor center museum would incorporate new exhibits, new classrooms/auditorium space, and a virtual tour of monument caves. New media would also be used to interpret monument resources to visitors without the presence of a ranger, such as podcasts, audio driving tours, or interactive media in the visitor center. These services would be added to the wide variety of non-personal interpretive services currently available, such as museum exhibits, an introductory monument film, in-depth brochures on many subjects, an in-depth monument website, and bulletin board displays throughout the monument.

Expanded interpreted topics and visitor facilities that better accommodate educational programming would have long-term, moderate to major, beneficial effects on the ability of visitors to learn about and understand monument resources.

Opportunities for Educational Groups and Members of the Education Community.

Alternative B proposes a dedicated full-time Education Specialist, expansion of the visitor center to provide classrooms, and possible cooperation with Crater Lake National Park. Teacher workshops would formalize and build upon the monument's relationships with local teachers and schools. Programs and materials would be expanded to serve a wider range of grade levels and subjects. As changes were implemented from comprehensive education planning, teachers and students would have new learning opportunities through an increase in the number of high-quality, curriculum-based programs offered both in the monument and in classrooms, and well as through loan materials such as traveling trunks.

Many more classes would be able to meet National Park Service standard for a continuum of learning. Teachers and students would notice more cultural history education options and the incorporation of information collected from oral history interviews in the local area. High school and college-level students would participate directly in scientific research at the Lava Beds Research Center, and younger students would also study or participate in research. These actions would have long-term, major, beneficial effects on educational opportunities for school groups and researchers.

Opportunities for Local Communities, Park Partners, and Neighboring Agencies.

An expansion of partnerships with regional parks, community groups, neighboring agencies, and tribes would occur under this alternative resulting in long-term, moderate, beneficial effects on communities and partners ability to engage in monument research and education. Monument staff would actively engage in a higher number of community outreach activities, including attending local meetings and a greater number of special events. Community education efforts would take place regarding dark night skies.

A greater number of oral histories would be collected from community members, enhancing personal ties to the monument and establishing a significant repository of knowledge about local history. More cultural history would be incorporated into community programs. The popular Timeline living history/cultural demonstration program would continue to be presented at least once annually, expanding to include a new special event area at the current West Wildlife Overlook location. This area would also be available for other special events, demonstrations, or large group use. Access for persons with disabilities would be improved to sites related to the purposes for which the monument was created (preservation of geologic & Modoc War sites).

Interpretive programming would be provided at and/or about Modoc War and Civilian Conservation Corps sites outside the monument, and collaboration with the Klamath Tribes would increase to better interpret tribal history and pre-history. Increased coordinated interpretive efforts would take place with the Klamath Basin Wildlife Refuges to provide services such as guided birding tours, and the monument would collaborate with the Modoc National Forest to interpret the geology of the larger Medicine Lake volcano. Overall, the expansion of local and regional programs and interpretation of sites outside of the monument related to park purpose, would have a long-term, moderate, beneficial effect on understand and learning about the monument's significance.

Cumulative Impacts

Cumulative impacts are similar to those described in alternative A. The increased coordination of educational programming and interpretive planning with the adjoining land management agencies, schools, and community organizations proposed in alternative B would contribute moderate to major, beneficial cumulative effects on educational and interpretive opportunities.

Conclusion

Alternative B would permanently expand available interpretive opportunities, education opportunities for students at all grade levels, and the scope of relationships with local entities resulting in long-term, moderate to major, beneficial effects on the interpretive and educational opportunities of the monument's visitors, teachers and students, and on local communities and organizations. Alternative B would contribute moderate to major beneficial cumulative effects on educational and interpretive opportunities.

INTERPRETATION AND EDUCATION - IMPACTS FROM ALTERNATIVE C

Analysis

Opportunities for Monument Visitors.

Four seasonal interpretive employee positions would be added, allowing the monument to increase its services to visitors with a focus on expanded recreation opportunities. The current level of high-quality interpretive programming would continue (daily guided cave tours and evening campfire programs in summer). Topics would expand slightly to include more material about traditional culture and 20th century history of the area (including monument infrastructure constructed by the Civilian Conservation Corps). The monument would also investigate providing interpretive experiences to give visitors a broader understanding of the Modoc War (e.g. specialized tours of fortifications, or tours that include sites outside the monument).

Under alternative C, a cave docent program would be expanded to establish a greater staff presence in the Cave Loop area during the summer season. These volunteers would provide wayfinding information and

limited informal interpretation. More guided hikes on the surface would be offered, and winter use and adventure tours would be encouraged. The Lava Beds Research Center would be expanded to accommodate recreational activity seminars (such as caving and winter sports), an Artist-in-Park program, and public archeology programs and workshops. The number of guided cave tours offered could increase, and limited Junior Ranger programming would continue to be offered.

New interpretive products would be created to serve visiting groups and commercial tours. New media would also be used to interpret monument resources to visitors without the presence of a ranger, such as podcasts, audio driving tours, or interactive media in the visitor center. These products would focus on self-guided recreational pursuits. New wayside exhibits could be designed to provide interpretation at new pullouts along monument roads, and new trail guides or waysides could be established on up to 15 miles of new trails. A sufficient number of other non-personal interpretive services would continue to be offered, such as museum exhibits, an introductory monument film, in-depth brochures on many subjects, a detailed monument website, and bulletin board displays throughout the monument.

Overall, alternative C would provide a wider range of interpretive opportunities primarily focused on recreational pursuits, having a long-term, minor to moderate, beneficial impact on visitor interpretive and educational opportunities.

Opportunities for Educational Groups and Members of the Education Community.

As changes are implemented from comprehensive education planning, teachers and students would notice slightly more cultural history education options, as well as the incorporation of information collected from oral history interviews in the local area. These topics would be gradually integrated into new and current education kits and programs. If a new community outreach staff member were located in Tulelake, they might have more direct contact with local teachers. School groups may also have opportunities to attend new archeology programs and workshops, and to participate in new guided bird watching tours along Tule Lake. Additional space available for groups, as well as showers, in the Indian Well Campground may encourage school groups to stay in the monument for multi-day visits.

Staff will continue to provide high quality curriculum-based programs and services, but would be limited in the range of grades and subjects covered by staffing levels. A few additional classes could be expected to meet the NPS standard for a pre-visit, on-site, and post-visit continuum of learning having a long-term, negligible to minor, beneficial effect on educational opportunities for schools.

Opportunities for Local Communities, Park Partners, and Neighboring Agencies.

Participation in community events could increase under alternative C, especially those focused on recreational activities. The popular Timeline living history/ cultural demonstration program would continue to be presented once annually. More cultural history would be incorporated into community programs, and the collection of oral histories from the community would enhance ties to the monument.

A moderate level of collaboration with local agencies and community groups could be expected, especially if a new outreach staff member were located in Tulelake. Interpretive programming would be provided at and/ or about Modoc War sites outside the monument. The monument would collaborate with the Modoc National Forest to interpret significant geological features in and on the forest. Interpretive assistance with the Fish & Wildlife Service would include collaborative bird watching tours along Tule Lake. Coordination with the Klamath Tribes would continue. Collaboration with local agencies and community groups would result in long-term, negligible to minor, beneficial effects on interpretation and education at the monument.

Cumulative Impacts

Cumulative impacts are similar to those described in alternative A. Alternative C would greatly enhance relationships with local communities, recreational groups, and neighboring agencies with a focus on recreational tourism. When the beneficial and adverse impacts of alternative C are added to the impacts of exceeding demand for educational and interpretive programs over time, the increased coordination with schools, and community organizations would contribute negligible to moderate, beneficial effects to cumulative impacts on educational and interpretive opportunities.

Conclusion

Alternative C would have long-term, minor to moderate, beneficial effects on visitor education and interpretation opportunities for visitors, local communities, and organizations. The beneficial effects of alternative C on school groups and teachers would be negligible to minor, and long-term. The monument's increased coordination with schools, and community organizations would contribute negligible to moderate, beneficial effects to cumulative impacts on educational and interpretive opportunities.

Access and Transportation

This impact analysis evaluates how each alternative would change access and visitation and the capacity of roads and facilities in the monument to accommodate that change. Access addresses the distribution of visitors in the monument as well as access points and access options (motorized and non-motorized) to areas in the monument. Beneficial impacts would be associated with an increase in the level of visitor congestion. Adverse impacts would be associated with the actions that reduce access to an area or increase the level of congestion.

The thresholds of change for the intensity of an impact are as follows:

Negligible: The effects would not be detectable and would have no discernable effect on the condition of roads and trails and/or traffic flow.

Minor: The effect would be slightly detectable, but there would not be an overall effect on the condition of roads and trails and/or traffic flow.

Moderate: Impacts would be clearly detectible, and the action could have an appreciable effect on the condition of roads and trails and/or traffic flow.

Major: Impacts would be substantial, with a highly noticeable influence, and the condition of roads and trails and/or traffic flow could be permanently altered.

ACCESS AND TRANSPORTATION - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

In alternative A, no new developments are proposed that would impact roads and trail access within the monument. Most visitors (75%) would continue to access the monument from the northern access roads, with well-maintained pavement, while one quarter of visitors would continue to access the monument from the south. Access from the south is via the partially unpaved Forest Service road 49 (Medicine Lake Road) and Forest Service Route 10, a paved road in poor condition.

The monument would maintain paved monument roads and improve adjacent sidewalks and parking areas to fully meet federal and state accessibility standards. Maintenance and improvement of monument roads, sidewalks, and parking areas would have a long-term, minor, beneficial effect on monument roads and parking areas.

Cumulative Impacts

Over time, lack of funding for U.S. Forest Service maintenance of Forest Service Route 10 and Medicine Lake Roads would result in the deterioration of southern access routes. The lack of long-term funding to improve road maintenance and access outside the monument would result in cumulative, moderate, adverse impacts on monument access from the south.

Conclusion

The effects of proposed actions under alternative A would have minor long-term benefits on access and circulation within the monument. Visitor access from the south may decline over time due to deteriorating road conditions. The beneficial effects from the actions of alternative A, the cumulative adverse impacts from inadequate maintenance on Route 10 would result in long-term, minor to moderate, adverse impacts on access to the monument from the south.

ACCESS AND TRANSPORTATION- IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

In alternative B, the monument would undertake new actions to directly expand trail systems and address access routes to the monument. Access and circulation to Petroglyph Point would also be improved.

The monument would provide more loop trail opportunities with an emphasis on traditional interpretive methods or new technologies as appropriate. Additional trail opportunities would also be provided in wilderness areas. Connections to national forest lands and to the wildlife refuges would also be explored under alternative B. Accessible trails would be provided to the summit of Hospital Rock, portions of Captain Jacks Stronghold, Gillems Camp, and at Petroglyph Point. Expansion of the trail system within the monument to include new interpretive trails and more accessible trails to existing monument sites would result in long-term, moderate, beneficial impacts on trail access within the monument.

Within the main monument unit, the NPS would maintain paved monument roads and improve adjacent sidewalks and parking areas to fully meet federal and state accessibility standards. Visitors would be encouraged to access the monument from the better-maintained and paved roads on the north if Route 10 remains in poor condition. Although this would have a short-term, minor to moderate, impact on some visitors that would arrive from the southeast, in the long-term, visitor access from the north would be greatly improved by the new seasonal contact station at Petroglyph Point. Visitors would have better orientation as they would enter the monument from the north. The segment of the Medicine Lake Road within the monument, would receive improved maintenance and reduced wash boarding improving access from the Modoc National Forest.

Petroglyph Point would have a newly routed access road and new parking areas. The new road would improve the visitor experience by shifting through traffic farther from the visitor use and sensitive resource areas. With a new ADA accessible trail from the parking area to the Petroglyphs, pedestrian access at this site would be considerably improved.

Overall, road and parking improvements recommended under alternative B have a long-term, moderate, beneficial effect on monument access, circulation, and road capacity.

Cumulative Impacts

Cumulative impacts would be the same as in alternative A. However, the beneficial effects of improvements to Medicine Lake Road and the location of a new contact station at Petroglyph Point would improve overall visitor access.

The beneficial effects from the actions of alternative B, plus the impacts from regional roads to the south, would result in, minor, cumulative beneficial effects on overall access to the monument.

Conclusion

The effects of proposed actions under alternative B would have long-term, moderate benefits on access and circulation at the monument. The monument would take direct actions to improve trail systems, accessibility, and road access. New facilities at Petroglyph Point would improve access, parking, and trail accessibility to this site and to the main monument by providing better orientation for visitors arriving from the northeast. The beneficial effects from the actions of alternative B would result in minor cumulative beneficial effects on overall access to the monument.

ACCESS AND TRANSPORTATION- IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, the monument would undertake new actions to directly expand trail systems and improve road access to the monument. Access and circulation to Petroglyph Point would also be improved.

Alternative C provides the greatest amount of new trail opportunities and experiences at the monument. The monument would provide more loop trail opportunities with an emphasis on traditional interpretive methods or new technologies as appropriate. Diversified recreation trails would also be provided (e.g. bike, horse, and cross-country skiing). Connections to Forest Service trails would be explored for the diversified recreation trails. Accessible trails would be provided for access to the summit of Hospital Rock, portions of Captain Jacks Stronghold, Gillems Camp, and at Petroglyph Point. Expansion of the trail system within the monument to include new interpretive trails and more accessible trails to existing monument sites would result in long-term, moderate, beneficial effects on trail access and circulation.

Within the monument, the NPS would maintain paved monument roads and improve adjacent sidewalks and parking areas to fully meet federal and state accessibility

standards. Additionally, the monument would provide more pullouts to provide visitors with more opportunities to experience resources from the main road. As in alternative B, the monument would encourage visitors to enter from the better-maintained, paved northern routes in Route 10 remains in poor condition. This would have an impact on visitors arriving from the southeast by increasing the time it takes to access the monument. Medicine Lake Road would be realigned and paved within the monument, improving visitor access from the southwest.

Alternative C proposes changes to the campground to improve access and circulation. The addition of a new loop to accommodate RVs would improve access for visitors using these vehicles. Petroglyph Point would have a relocated access road and new parking area. The new road would improve the visitor experience by relocating through traffic from visitor use and sensitive resource areas. With a new accessible trail from the parking area to the Petroglyphs, access at this site would be considerably improved.

Road and parking improvements recommended under alternative C would have long-term, moderate, beneficial effects on monument access, circulation, and road conditions.

Cumulative Impacts

Cumulative impacts would be the same as alternative A. Overall, the beneficial effects from the actions of alternative C, plus the impacts from regional access roads, would result in cumulative, minor to moderate, beneficial impacts on access to the monument.

Conclusion

The effects of proposed actions under alternative C would have moderate long-term benefits on access and transportation at the monument. The monument would take direct actions to improve trail systems, accessibility, and road access to the monument. New facilities at Petroglyph Point would improve access, parking, and trail accessibility at this site. Medicine Lake Road realignment and paving would improve access from the south. The beneficial effects from the actions of alternative C, plus the impacts from regional or neighboring sources, would result in cumulative, minor to moderate, beneficial effects on access to the monument.

Monument Management

Monument Operations

Monument operations refers to the current management structure of the park to provide policy direction for the protection, public use, and appreciation of the monument, and the ability of the current staff to adequately protect and preserve vital resources and provide for an effective visitor experience. The discussion of impacts on management, operations, and staffing focuses on the type of management structure, the amount of staff available to ensure public safety, and the ability of the staff to protect and preserve resources given current funding and staffing levels.

Staff knowledgeable about the management of the monument were consulted to evaluate the impacts of implementing each alternative.

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: The effect would be at or below the lower levels of detection, and would not have an appreciable effect on park management and operations.

Minor: The effects would be detectable, but would be of a magnitude that would not have an appreciable adverse or beneficial effect on park management and operations.

Moderate: The effects would be readily apparent and would result in substantial adverse or beneficial change in park management and operations in a manner noticeable to staff and the public.

Major: The effects would be readily apparent and would result in substantial adverse or beneficial change in park management and operations in a manner noticeable to staff and the public, and would be markedly different from existing operation.

MONUMENT OPERATIONS - IMPACTS FROM ALTERNATIVE A (NO-ACTION)

Analysis

In alternative A, the majority of administrative offices would remain in the monument. Some positions would be located outside of the monument. Cooperative efforts with partners and universities would continue on an as-needed basis as staffing and funding allows. The current organizational structure, with limited staffing and operations generally centralized, would continue to function with some deficiencies. Funding for staffing levels would continue to be inadequate to meet public demands for increased interpretation and education as well as meeting the resource management needs of the monument.

The physical separation of the monument's two units poses operational challenges. Monument operations would continue to be based out of Indian Well. The monument headquarters at Indian Well and the Petroglyph Point unit are approximately 15 miles apart. This physical separation of the units results in inefficiencies for management, including staff and equipment mobilization and travel. Lack of apparent NPS presence at Petroglyph Point makes this area vulnerable to vandalism. In addition, without staff presence on site, the monument misses an important opportunity to provide orientation for monument visitors that begin their visit at Petroglyph Point. Approximately twenty-five percent of visitors enter the monument from the Petroglyph Point area.

Overall, the actions proposed in alternative A would have long term, moderate, adverse impacts on monument operations.

Cumulative Impacts

Past and ongoing projects, including road and facility maintenance and repairs, have had long-term, moderate, beneficial effects on monument operations by maintaining the inventory of monument structures. Aging facilities and utilities would continue to be replaced or modified as needed when funds are available.

Eventually, more sustainable and efficient facilities and utility systems would replace existing, less sustainable systems, resulting in minor, cumulative beneficial effects over the long-term.

Conclusion

Alternative A would result in no immediate change to monument infrastructure or operations and would continue a level of inadequate funding and staffing, resulting in long-term, moderate adverse impacts on monument operations. Ongoing maintenance and replacement of existing facilities would result in cumulative minor beneficial impacts over time.

MONUMENT OPERATIONS - IMPACTS FROM ALTERNATIVE B (PREFERRED)

Analysis

Alternative B includes proposals for a number of infrastructure improvements that would add to operational costs, including expansion of the visitor center and research center and redevelopment of the Petroglyph Point unit. Additional space at visitor center and research center would both add maintenance costs and benefit operations by providing facilities that can more appropriately accommodate groups and educational programming. The visitor center expansion would also include space for approximately three-to-five new offices that would accommodate a management education liaison, education specialist, interpreter, and a cultural resource specialist. Co-locating these positions creates an atmosphere that emphasizes incorporating science/research in learning and interpretation.

New office space located off-site, perhaps with partner agencies, would increase interagency cooperation and collaboration. However, the distance from the monument headquarters may cause some inefficiency in coordination with staff working out of Indian Well.

Staffing a seasonal contact station at the Petroglyph Point unit would create an NPS presence on this currently neglected site. Monument staff would be able to provide visitor orientation, educational programming and better security for the fragile petroglyphs.

The monument would actively strive to offset the monument's total electrical energy use. This would be accomplished through changes in monument operations, by use of new technologies, and onsite generation of renewable electricity, resulting in a long-term, major beneficial effect on monument operations.

Removal of the 0.7 miles of East and West Wildlife Overlook spur roads would slightly reduce the amount of road infrastructure to be maintained and eventually

reconstructed. Due to these roads being infrequently used by visitors they also tend to attract undesirable activities thus their removal may slightly reduce law enforcement contacts and issues.

Overall, the actions proposed under alternative B would have a long-term, moderate, beneficial impact on monument operations.

Cumulative Impacts

Cumulative impacts would be the same as alternative A. When the beneficial effects of monument operations in alternative B are combined with the existing beneficial effects of maintenance activities in the monument, there would be a moderate, cumulative beneficial effect over time.

Conclusion

The effects of proposed actions under alternative B would have moderate, long-term beneficial effects on monument operations. The monument would take direct actions to expand staff, provide new offices that encourage interagency cooperation, improve operations and security at Petroglyph Point, and offset electrical energy use through the use of new technologies. The beneficial effects from the actions of alternative B, plus the effects of other past, present, and reasonably foreseeable future actions would result in cumulative, moderate to major, beneficial effects on monument operations.

MONUMENT OPERATIONS - IMPACTS FROM ALTERNATIVE C

Analysis

In alternative C, the monument would use new office space located off-site with partner agencies thereby increasing interagency cooperation and collaboration. However, the distance from the monument headquarters may cause some inefficiency in coordination with staff located at monument headquarters.

More services provided with the new day use area at the Petroglyph Point unit would create an NPS presence on this site. Monument staff would be able to provide visitor orientation and educational programming at this site.

The monument would actively strive to offset the monument's total electrical energy use. This would be accomplished through changes in monument operations, by use of new technologies, and onsite generation of renewable electricity, resulting in a long-term, minor, beneficial effect on monument operations.

Alternative B proposes restoration of the Powerline administrative road and portions of the Lyons Trail which is also used for administrative access. There are few if any visitor activities on either road (Fern Cave is the exception and access to this site is maintained) thus, removal of these roads should not affect visitor protection.

Overall, the actions proposed under alternative C would have a long-term, minor to moderate, beneficial impacts on monument operations.

Cumulative Impacts

Cumulative impacts would be same as alternative A. When the beneficial effects of monument operations in alternative C are combined with the existing beneficial effects of maintenance activities in the monument, there would be a minor to moderate, cumulative beneficial effect over time.

Conclusion

The effects of proposed actions under alternative C would have minor to moderate, long-term beneficial effects on monument operations. The monument would take direct actions to expand staff, provide new offices that encourage interagency cooperation, improve operations at Petroglyph Point, and offset electrical energy use through the use of new technologies. The beneficial effects from the actions of alternative C, plus the effects of other past, present, and reasonably foreseeable future actions, would result in cumulative, minor to moderate, beneficial effects on monument operations.

Carbon Footprint

The area for consideration for this impact topic is the monument. Although the monument's share of carbon emissions may be negligible when compared to state and regional emissions, the cumulative nature of countless small carbon sources and the expectation of National Park Service leadership on environmental issues justify significant actions to mitigate emissions from monument activities. While most topics in this chapter address resources directly or indirectly impacted by the actions within the alternatives, the

unique global nature of this impact requires an examination of the effect of actions on a value. Reducing the park's carbon footprint has been expressed as a value by the public, the monument staff, and the NPS. Accordingly, the threshold criteria are based on potential deviation from the monument's current carbon footprint, as well as the monument's ability to achieve operational carbon neutrality by 2016 – a goal for all parks in the Pacific West Region. Cumulative impacts are analyzed against the public value of global carbon emissions reduction.

The thresholds of change for the intensity of an impact are as follows.

Negligible: The effects on the monument's carbon footprint would be at or below the level of detection.

Minor: The effects on the monument's carbon footprint could result in up to a 10% change from the current carbon footprint.

Moderate: The effects on the monument's carbon footprint would result in between a 10% and 20% change from the current carbon footprint or increase the difficulty of achieving carbon neutrality by 2016.

Major: The effects on the monument's carbon footprint would result in over a 20% change from the current carbon footprint or make carbon neutrality by 2016 unattainable.

CARBON FOOTPRINT – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

Under alternative A, no significant changes to the monument's carbon footprint would be made. Incremental improvements in energy conservation and sustainability would be accomplished as funding became available.

Changes in the carbon footprint resulting from natural resource management activities under alternative A would be negligible to minor, as the management of ecological communities, fire, and air quality would not change significantly.

Existing facilities and roads would be maintained, resulting in negligible to minor impacts. Some impacts could be beneficial, as conservation and alternative energy projects are implemented over time.

Visitor experiences would not change significantly under this alternative, resulting in negligible to minor impacts due to recreation, transportation, and energy use by visitors.

Cumulative Impacts

Past reliance and current dependence on traditional non-renewable sources of energy and the region's minimal renewable energy infrastructure and services make the reduction of carbon emissions difficult, but not unattainable. These cumulative actions, along with the incremental beneficial actions under this alternative, result in a moderate adverse impact.

Conclusion

Under alternative A, the monument would continue to make incremental improvements in energy conservation and sustainability by implementing energy conservation and alternative energy generation projects and programs as funding becomes available. The beneficial effects on the monument's current carbon footprint would likely be minor, as reduction of the carbon footprint would continue to compete with other management priorities. Because the region's goal of operational neutrality requires early and significant action, the incremental and ad hoc action proposed under alternative A would result in an adverse moderate impact by delaying actions adequate to achieve the region's goal.

CARBON FOOTPRINT – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

Under alternative B, the monument would strive to offset its operational carbon emissions due to energy use through changes in park operations and the use of alternative energy generation and fuels. When fully implemented, the monument's operational carbon output would be significantly reduced, resulting in a major beneficial effect on its overall carbon footprint.

Both the visitor center and research center would be expanded in alternative B, and new facilities would be built at Petroglyph Point, but any resulting increased energy use related to expansion of the facilities would be offset by conservation measures in existing facilities and operations, as previously mentioned. Short-term, minor adverse impacts to the monument's current carbon footprint would occur due to construction activities.

A possible increase in visitation due to expanded visitor programs and opportunities could result in negligible to minor, adverse impacts on the monument's overall carbon footprint through increased visitor vehicle use. A small amount of visitor travel would be reduced through additional opportunities for foot and bicycle travel between Cave Loop, the visitor center, and the campground.

Attaining Climate Friendly Park status would lead the monument through an intensive carbon management planning process which would allow them to identify and analyze methods to accomplish the goal of operational carbon neutrality.

Cumulative Impacts

As with the other alternatives, existing energy availability and infrastructure make reduction of the monument's operational carbon footprint difficult. The actions in alternative B, however, will circumvent these barriers by establishing new renewable energy infrastructure and systems, creating a major beneficial effect on the monument's ability to reduce carbon emissions.

Conclusion

Under alternative B, mitigation, and offsetting of the monument's operational carbon emissions would constitute a major beneficial effect on its operational carbon footprint as well as the region's stated goal of operational carbon neutrality.

CARBON FOOTPRINT – IMPACTS FROM ALTERNATIVE C (NO ACTION)

Analysis

Under alternative C, Lava Beds would strive to offset its carbon emissions due to use of electricity through changes in monument operations, including the use of alternative energy technologies and onsite generation of renewable electricity. When fully implemented, the monument's overall carbon output would be significantly reduced (~22%), resulting in a major beneficial impact on its carbon footprint.

The focus on electrical usage may make it more difficult for the monument to reach the region's goal of operational carbon neutrality, resulting in a moderate adverse impact to that value.

Short-term minor adverse impacts to the monument's current carbon footprint would occur due to construction activities related to the Petroglyph Point day use facility, improvements at Cave Loop, and possible construction of office space.

As with alternative B, a possible increase in visitation due to expanded visitor programs and opportunities could result in negligible to minor, adverse impacts on the monument's overall carbon footprint through increased vehicle use.

Cumulative Impacts

Same as alternative B.

Conclusion

Under alternative C, the elimination of carbon emissions due to electricity use would constitute a major beneficial impact on the monument's operational carbon output. The region's goal of operational carbon neutrality would incur a moderate, adverse impact, as carbon emissions from monument vehicles would continue unabated.

Socioeconomics

Economic effects are commonly expressed in terms of the number and types of jobs supported, changes in income, the number of visitors to the recreation area, and the resulting changes in local tourism spending. Less well-defined economic effects include the indirect effects from ongoing NPS operations and the effects on local government fiscal conditions. Examples of social impacts include effects on regional population growth and land use.

Socioeconomic impacts were determined based on applied logic, professional expertise, and professional judgment. The approach to these issues was based on the following factors directly related to implementation of the general management plan:

- estimated costs of building new facilities and infrastructure
- changes in the number of NPS staff and federal spending to operate the recreation area
- changes in the number of visitors to the recreation area

Projected visitor use was generally estimated as increasing or decreasing based on proposed visitor opportunities for each alternative.

This analysis relies on qualitative analysis of the impacts of each alternative, as actual visitor numbers are not estimated, spending values are for comparison only, and influence area data was mainly available at the broad county and regional district level.

Beneficial impacts result in generally recognized improvements to established social and economic environment, or can be recognized as improvements to specific sectors and stated as such. Adverse impacts are those effects that are generally recognized to diminish the established social and economic environment, or diminish the environment for particular sectors and stated as such.

Short-term effects are those that occur during and in response to the planning, design, construction, and major maintenance of buildings, trails, parking lots, and other improvements associated with federal spending. These effects diminish or disappear after the project is completed. "Short-term" may also describe the first or early response in social or economic conditions to more fundamental changes in recreation area management and operations and to changes in visitor use, but which give way to broader changes over time. Generally, "short-term" describes those effects that may last up to 5 years.

Long-term effects are those that last longer than 5 years, including some that may not begin until after completion of direct activities associated with the initial federal government spending or changes in management.

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: No effects occur or the effects on socioeconomic conditions are below or at the level of detection.

Minor: The effects on socioeconomic conditions are small but detectable, and only affect a small number of businesses and/or a small portion of the population. The impact is slight and not detectable outside the affected area.

Moderate: The effects on socioeconomic conditions are readily apparent. Any effects result in changes to socioeconomic conditions on a local scale (e.g. a gateway community) within the affected area.

Major: The effects on socioeconomic conditions are readily apparent. Measurable changes in social or economic conditions at the county or regional level occur. The impact is severely adverse or exceptionally beneficial within the affected area.

SOCIOECONOMICS – IMPACTS FROM ALTERNATIVE A (NO ACTION)

Analysis

The socioeconomic impact of Lava Beds National Monument on local and regional economies is substantial. The National Park Service uses a Money Generation Model (MGM) to estimate the contribution of visitor and park payroll spending to gateway communities within a 50 mile radius of a national park unit. A 2007 analysis shows that national parks and other units within the U.S. National Park System generate an average of four dollars for state and local economies in return for every one tax dollar invested in each of the national park unit's annual budget. Using this estimate, the monument generates around $6,200,000 manifest in local and state tax revenue, jobs, and direct purchases by visitors on lodging, food, transportation, souvenirs, etc. in the areas around the monument.

Under alternative A, no new major changes would be made that would affect the current, short-term local or regional economic impacts of the monument. Road access, recreational opportunities, and facilities would remain relatively unchanged, and would therefore provide a continuation of economic opportunities, tax revenues, and jobs. However, current management plans and existing facilities do not sufficiently take into consideration expected long-term changes in the demographics of monument visitors, which may result in a drop in monument visitation. If monument facilities and visitor services are not managed to anticipate these changes, such as older or ethnically more diverse visitor groups, the monument may become a less desirable destination to these groups. The resulting lower visitation would directly impact socioeconomic factors and may lead to a reduction in local and regional (areas beyond 50 miles from the monument) economic opportunities, revenues, and jobs.

Effects on local economy

Continuation of current management of the monument's section of the Medicine Lake Road would maintain it as an unpaved gravel road with reduced speeds and seasonally variable surface condition. This road condition is perceived as an impediment to further development of the Medicine Lake Area by reducing the accessibility of the area due to the longer drive time and greater discomfort of travelling over the unpaved road. Similarly, no changes to Forest Service Route 10 at the southeast entrance to the monument may also deter visitors from using the services and private lodging or other facilities in the small town of Tionesta, 12 miles east of the monument. This could have long-term, moderate adverse impacts on local business in Tionesta.

Effects on regional economy

Alternative A should not affect the monument's regional status as a destination for travelers on both single and multiple day excursions. It often serves as a stopover for travelers intent on visiting both Lassen Volcanic National Park and Crater Lake National Park, both within about a two or three hours drive of the monument. The monument is also a destination for commercial bus tours, often from as far as the San Francisco area. The economic benefits of these activities are felt both regionally and locally. Regionally, tour bus and rental car companies benefit at the points of departure for these visitors, while travel and tourism related revenues benefit locally.

Cumulative Impacts

When considered in concert with the socioeconomic affects of other recreation and tourism sites in the area, the continuation of current management practices would have little to no cumulative effects. Local attractions, including the Tule Lake National Wildlife Refuge and the Medicine Lake Campground and associated recreation in the Modoc National Forest, are expected to continue attracting tourists and providing activities such as hunting, firewood gathering, timber harvest, and mushroom collection.

Conclusion

The continuation of current management through alternative A would have long-term, negligible to minor adverse impacts on the local and regional socioeconomic impact of the monument. Adverse effects would be generally local in extent, and stem from the possible reduction in monument visitation associated with a lack of appropriate facilities or activities available to older or ethnically more diverse potential visitors. If the monument does not implement changes in facilities and services in anticipation of these expected demographic shifts, it will become a less desirable destination for a greater proportion of possible visitors.

SOCIOECONOMICS – IMPACTS FROM ALTERNATIVE B (PREFERRED ALTERNATIVE)

Analysis

Alternative B stresses resource protection and preservation, research and education and as such would modify the monument's current management of visitor services, the natural environment, interpretive, and recreational activities accordingly. Relevant changes include new visitor facilities at Petroglyph Point, increased natural and cultural resource restoration, interpretation, and new recreational opportunities.

Alternative B provides for new visitor facilities and services at the Petroglyph Point area. These would include a visitor contact station, an outdoor education area, and a visitor day-use area that accommodates families and school groups, picnic tables, shade structures, and toilets. Changes are also planned for the Indian Well campground, where improvements in tent site privacy, shower facilities, and RV use would be considered. Changes in these facilities are planned in consideration of both current deficiencies and expected changes in visitor demographics and use patterns. Facility construction, including those at the Petroglyph Point area, may provide new but temporary employment opportunities.

Increased interpretive outreach may also attract greater visitation. Anecdotally, visitor center staff report that many visitors come to the monument at the behest of their children, whose interest in the monument is piqued by interpretive rangers that visit their schools. Planned improvements in interpretive media and displays should all serve to increase visitation though providing a more enjoyable experience to visitors interested in the monuments historic and scientific importance.

Proposed changes in management of natural and cultural resources, including more emphasis on resource protection and ecological restoration, should lead to an improved visitor experience. This includes active restoration of habitats crucial to wildlife, protection of historic structures and landscapes, and

perpetuation of wilderness values including the natural soundscape and dark night skies. These goals serve to improve the visitor's experience, possibly leading to longer stays and greater economic contribution.

Under current management, the monument is not a destination for overnight backpacking. Under alternative B, improvements are planned in recreational opportunities including the designation of primitive campsites and an improved trail system with connections to adjacent national forest trails. This should attract a new user group interested in overnight wilderness camping, increasing visitation and use by a more diverse visitor base.

Effects on local economy

Planned management changes in alternative B would affect improvements in the local socioeconomic impacts of the monument. They provide for a better overall visitor experience, anticipate demographic changes in the population of potential visitors, and attract new kinds of visitors though development of new recreational opportunities. Increased visitation leads directly to increased local revenue for tourism-based goods and services, and helps perpetuate jobs provided by the monument. No longer designating Forest Service Route 10 as a primary entrance to the monument may also hamper development of services and private lodging or other facilities in the small town of Tionesta, 12 miles east of the monument. This could have long-term, moderate, adverse impacts on local businesses in Tionesta.

Effects on regional economy

Impacts on the regional socioeconomic impact of the monument should be positive as well. Planned improvements in facilities, services, recreational and interpretive opportunities could draw greater visitation at the regional scale as well, with similar benefits.

Cumulative Impacts

Greater visitation and enjoyment of the monument should increase visitation to neighboring areas such as the Tule Lake National Wildlife Refuge, Modoc National Forest, and Klamath National Forest, as well as other tourist destinations in the Klamath and Tulelake Basins. There would be a minor to moderate, beneficial cumulative effect on the local and regional economy.

Conclusion

Changes proposed by the alternative B would increase visitation and enjoyment of the monument, having a long-term, moderate, beneficial impact on local and regional economies. Some minor to moderate adverse impact on local businesses in Tionesta may occur as visitors are encouraged to access the monument from the north. Overall, improvements to visitor services, facilities, and experiences would make the monument a more desirable destination and improve revenues from the tourism sector of the local and regional economy.

SOCIOECONOMICS – IMPACTS FROM ALTERNATIVE C

Analysis

Alternative C does less to address needed changes in resource protection and education required to improve the visitor experience, and therefore increase monument visitation. While emphasizing recreational opportunities, it does provide for improvements to facilities such as paving the Medicine Lake Road. It also calls for some improvements to the Petroglyph Point area, and expanded use of the Research Center for educational activities open to the public. More diverse recreational activities would be promoted, including mountain biking and equestrian access to some monument and adjoining Forest Service roads and trails. Some new but temporary jobs would be created by the aforementioned facilities improvements.

Effects on local economy

The socioeconomic benefits would be similar to the alternative A, but with some increases in those benefits associated with higher visitation to the Petroglyph Point area when new facilities are constructed. However, these facilities are not planned to be as substantial as those called for in alternative B and would therefore have less of a beneficial effect. Similarly, some visitation may increase if the monument portion of Medicine Lake Road was paved and classes were held in the research center. As in alternative B, no longer designating Forest Service Route 10 as a primary entrance to the monument may also hamper development of services and private lodging or other facilities in the small town of Tionesta, 12 miles east of the monument. This could have long-term, moderate, adverse impacts on local businesses in Tionesta.

Effects on Regional economy

Regional socioeconomic effects would be similar to alternative A, with marginal increases in visitation due to the facility and recreational or educational programs mentioned above. The cumulative beneficial effects to the local and regional economy would be negligible to minor.

Cumulative Impacts

The cumulative impacts of alternative C would be negligible to minor and beneficial. New recreational activities would attract some new visitation, including users interested in activities such as equestrian travel and mountain biking. These activities would also occur on neighboring national forest lands, and possibly increase the environmental impacts of these activities (including increased trail erosion and exotic weed introduction). The deleterious effects of these activities may have a minor, long-term, adverse effect on socioeconomic resources in and around the monument if other land uses such as livestock grazing are impacted.

Conclusion

Overall, the beneficial socioeconomic effect of alternative C would be long-term and negligible to minor. Overall improvements in the visitor experience and correlated visitation totals, and increased spending and job creation for facility improvements, are all of a lesser degree than alternative B.

Chapter Six: Consultation and Coordination



Chapter Six: Consultation and Coordination

Introduction

Public involvement and consultation efforts were ongoing throughout the process of preparing the General Management Plan/Environmental Assessment. Public involvement methods included published Federal Register notices, sending press releases, conducting public meetings and workshops, holding stakeholder meetings, distributing newsletters, and posting to appropriate websites. Public involvement is a necessary and important part of the planning process that provides valuable information. Consultation and coordination among the agencies and the public were vitally important throughout the planning process. The public had three primary avenues for participation in the development of the plan: participate in public meetings, respond to newsletters, and review and comment on the draft plan.

Public Scoping

The Lava Beds National Monument GMP planning team launched the start of the GMP planning process in spring of 2006. In May 2006 the planning team produced and mailed newsletters to 145 organizations and individuals on the park mailing list. In addition, over 1,000 newsletter copies were printed for distribution at the park visitor center, local communities and at public meetings. The purpose of the May 2006 newsletter (Newsletter 1) was to: 1) announce the start of the planning process; 2) inform the public on how they can participate; 3) present and obtain comment on park purpose and significance statements developed through foundation planning; and 4) to solicit comments on issues that the GMP should address. The newsletter also contained information on the date, time and location of public scoping meetings.

The newsletter was published and made available for comment on the National Park Service's Planning, Environment and Public Comment (PEPC) website. September 2, 2006 was established as the close of the public comment period. Comments received after this date were also accepted.

Press releases announcing the GMP were also distributed to local newspapers. Several newspapers carried feature stories on the need for new GMP at Lava Beds National Monument and announced the upcoming public meetings.

On July 10, 2006 a Notice of Intent to prepare a general management plan and environmental impact statement was published in the Federal Register. The notice that the project had received a waiver for preparing an environmental impact assessment and approval to prepare an environmental assessment was published in the Federal Register on October 16, 2008 (Vol. 71, No. 131, pp. 38898-38899).

PUBLIC MEETINGS

In June 2006, the planning team held a series of public scoping meetings in California and Oregon. Included in the agenda was an introduction from the Park Superintendent and a presentation on the GMP process and initial park purpose and park significance statements from the GMP Project Manager. Displays and stations were set up at the start of the meetings so that attendees could have one-on-one conversations with members of the planning team. After the presentation, group discussions were held about park planning issues and planning team members recorded comments on flipcharts.

On June 5, 2006 a public meeting was held in Klamath Falls at the Oregon Institute of Technology College Union. Representatives of the U.S. Forest Service, park staff and one member of the public attended this meeting. On June 7, 2006, a second meeting was held in Tulelake at the Fairgrounds. One member of the public attended this meeting. On June 8, 2006 a meeting was held in Yreka, California at the Community Center. A member of the California Wilderness Coalition and a member of the Volcanic Legacy Scenic Byway Committee attended.

STAKEHOLDER MEETINGS

Throughout the scoping period presentations and meetings with local organizations, agencies and tribes were conducted by the Superintendent and members of the planning team. Organizations and agencies included:

- Klamath, Lake, Modoc, Siskiyou Counties Tourism Board
- Modoc County Commissioners
- Shaw Historical Library
- The Klamath Tribes, Tribal Council
- Klamath County Tourism, 10-15 people
- Tulelake Rotary, 10-15 people
- Klamath Falls Rotary, 75 people
- City of Merrill
- Sunrise Rotary Club
- Tulelake City Council
- Klamath Basin Wildlife Refuge Association
- Tule Lake Committee; NHL plaque dedication with Caltrans
- Town of Tionesta
- Volcanic Scenic Legacy Byway Core Group
- Tulelake Town Council
- Klamath Refuges Friends Group
- Lava Beds Natural History Association
- Volcanic Legacy Scenic Byway Group

COMMENTS RECEIVED

During the scoping period, a total of 30 written comments were received by the planning team. Most of the comments (26) were submitted via the comment form that was distributed through the newsletter, the park visitor center and at various public and stakeholder meetings. Two comments were entered directly into the PEPC site. Comment letters were received from The Klamath Tribes and the California Wilderness Coalition. Most comments received were from organizations and individuals in Oregon and California. These comments were considered and incorporated into the issues for the plan. The NPS distributed a second newsletter in July 2007, describing issues identified during public scoping.

Topics that received the greatest number of comments during public scoping included: new ideas about visitor education programs and suggestions for more interpretation opportunities; support for protection of cultural and natural resources; an emphasis on working with surrounding agencies, tribes, schools and communities; preserving the undeveloped character of the park; greater protection of sensitive resources at Petroglyph Point; preserving the rustic, undeveloped character of the monument; and ideas for improving visitor services such as camping.

In addition to issues to be addressed in the GMP, the planning team received comments on the draft park purpose and significance statements presented in Newsletter 1. The statements captured what most comments value and find most important about Lava Beds National Monument: the caves and other geologic features, the history conveyed (Modoc War, Native American history, settlement), the landscape, the undeveloped character of the park, the wilderness, the plant communities, wildlife, and the rock art. Many of the commenters value opportunities to explore the monument on their own and the educational opportunities that Lava Beds provides.

While the comments were generally in agreement with the draft park purpose and significance statements, one commenter suggested that the stories related to park purpose and significance should be connected to their larger area of interest, e.g. the Great Basin, Medicine Lake Volcano, and the tribal territory of the Modoc.

Preliminary Alternatives/ Management Concepts

The Lava Beds National Monument GMP planning team developed preliminary alternatives for the GMP in Summer/Fall 2007. On January 9, 2008, the GMP team released a newsletter with preliminary management concepts for public review. Almost 200 newsletters were mailed to organizations and individuals on the park mailing list. In addition, nearly 800 newsletter copies were distributed at the park visitor center, to local communities and businesses, and at public and stakeholder meetings.

The purpose of the newsletter was to provide opportunities for the public and stakeholders to comment on the preliminary alternatives to identify strengths, areas for improvements, and preferences. Preliminary management concepts presented to the public included:

- Concept A: Continue Current Management
- Concept B: Expanded Resource Preservation and Restoration
- Concept C: Diversified Recreation Opportunities
- Concept D: Interpretation and Education

A comment form was included in the newsletter so that members of the public could provide feedback to the planning team. Comments on the preliminary management concepts were received through February 28,

2008. Press releases asking for public comments on the preliminary management concepts were distributed to local newspapers. The local newspaper in Klamath Falls, OR (Klamath Falls Herald and News) announced the public meeting and carried two feature stories on the preliminary management concepts.

PUBLIC MEETINGS

A public meeting was held in Klamath Falls, Oregon on January 29, 2008. Included in the agenda of the meeting was a presentation of the preliminary management concepts followed by an opportunity for participants to ask questions and share ideas. One person attended this meeting. Low attendance was due in part to poor winter weather conditions on the night of the meeting.

STAKEHOLDER MEETINGS

Throughout the public comment period presentations and meetings with interested organizations and agencies were conducted by NPS staff. Organizations and agencies included:

- Tulelake Rotary Club, 12-15 attendees
- Lava Beds Natural History Association Board, 3 attendees
- Klamath Basin Audubon Society, 46 attendees
- National Speleological Society Chapters (San Francisco, Diablo and Mother Lode Chapters), over 60 attendees
- Bureau of Land Management
- U.S. Forest Service
- U.S. Fish and Wildlife Service, 3 attendees

TOTAL COMMENTS RECEIVED

The planning team received a total of 24 written comments. One comment was submitted to the monument over the phone (Good Sam Club). Seven transcripts of comments made at stakeholder meetings were recorded and included in the comment analysis. Of the 24 written comments submitted, 18 comments were from individuals. Agencies and organizations that submitted comments through stakeholder meetings or individual letters include the: National Speleological Society (San Francisco, Diablo, Shasta, and Mother Lode Chapters); Cave Research Foundation; Bureau of Land Management; United States Geological Survey; California Wilderness Coalition; United States Fish and Wildlife Service; CHS Speak; Natural History Association; and the United States Forest Service.

Comments on the preliminary management concepts included both preferences for the management concepts and preferences for the desired conditions associated with each of the concepts. Overall, commenters placed a high value on preserving the character of Lava Beds while recognizing that it is an important place to learn about history and science. A strong preference for one management concept did not emerge. Most commenters expressed a preference for a combination. For example, many commenters that expressed a preference for Management Concept D (Interpretation and Education) preferred this concept only in combination with either B (Expanded Resource Preservation and Restoration) or C (Diversified Recreation Opportunities).

Commenters expressed positive support for most of the desired conditions associated with the management concepts. Desired conditions for which commenters had concerns include: restoring the landscape to pre-European conditions, decommissioning roads, wilderness expansion, co-locating some monument staff with other agencies, increased Tribal involvement, closing the cave loop at night, improving the campground to accommodate large vehicles, and providing areas for large groups. Some commenters were concerned about the potential impacts of more tour groups and new recreational activities associated with alternative C, Diversified Recreation.

Consultation with Other Agencies, Officials, and Organizations (To Date)

SECTION 7 CONSULTATION

Consultation with U.S. Fish and Wildlife Service

The Endangered Species Act of 1963, as amended, authorizes federal agencies to enter into early consultation with the U.S. Fish and Wildlife Service (USFWS) to ensure that any federal action would not jeopardize the existence of any listed species or destroy or adversely modify its habitat. During the preparation of this plan, NPS staff initiated consultation with the Klamath Falls U.S. Fish and Wildlife Office in November 2006 documenting a list of threatened and endangered species for Modoc and Siskiyou counties. The letter and accompanying list are included in Appendix B.

SECTION 106 CONSULTATION

Federal agencies that have direct or indirect jurisdiction over historic properties are required by Section 106 of the National Historic Preservation Act (NHPA), as amended (16 USC 270, et seq.), to take into account the effect of their undertakings on properties either listed in or eligible for listing in the National Register of Historic Places.

Consultation with the California State Historic Preservation Office

Under the terms of stipulation VI.E of the 1995 programmatic agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers, the National Park Service, "…in consultation with the SHPO [state historic preservation office], will make a determination about which undertakings are programmatic exclusions under IV.A and B, and for all other undertakings, whether there is sufficient information about resources and potential effects on those resources to seek review and comment under 36 CFR 800.4-6 during the plan review process."

To meet the requirements of the Advisory Council on Historic Preservation implementing Section 106, the National Park Service sent a letter to the California State Historic Preservation Officer on August 17, 2006 inviting the office to participate in the planning process. The letter is included in Appendix B.

Consultation with Native American Tribes

The National Park Service recognizes that indigenous peoples may well have traditional and contemporary interests and ongoing rights in lands now under National Park Service management, as well as concerns and contributions to make for the future via the scoping process for general management plans and other projects. Related to tribal sovereignty, the need for government-to-government Native American consultations stems from the historic power of Congress to make treaties with American Indian tribes as sovereign nations. Consultations with American Indians and other Native Americans, such as Alaska Natives and Native Hawaiians, are required by various federal laws, executive orders, regulations, and policies. For example, such consultations are needed to comply with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended. Implementing regulations of the Council on Environmental Quality (CEQ) for the National Environmental Policy Act of 1969), as amended (NEPA), also call for Native American consultations.

During the public scoping period the Lava Beds National Monument superintendent invited the chairperson of The Klamath Tribes to meet at their convenience, at a tribally selected place. The purpose of the meeting was to discuss the general management planning process underway and any concerns the tribal government, on behalf of the members of the tribe, might have about protecting, preserving, and managing Lava Beds National Monument's cultural and natural resources. The planning team met with the Klamath Tribes Tribal Council on June 6, 2006 at the Klamath Tribes Headquarters in Chiloquin, OR to receive input on issues that should be addressed in the general management plan.

The national monument respects tribal sovereignty and the fact that tribes decide their own priorities and ways of doing business. The national monument has worked well with the tribes in the past when issues of concern have materialized. The rights, privileges, concerns, and interests of the national monument's American Indian neighbors are very important to consider; it is equally important to work out mutually acceptable arrangements on particular issues. The tribes have been kept fully informed throughout the planning process and have been sent all newsletters and copies of the draft general management plan. Although The Klamath Tribes have not initiated further contact, the monument is open now and in the future for consultation on any features of the plan or on any other possible issues that might be of tribal concern.

Future Compliance Requirements

The NPS will conduct additional site-specific compliance as individual projects or actions included in the preferred alternative are implemented. Some of the specific future compliance requirements of the preferred alternative are listed in table 22. Included are the NPS determinations of how those individual requirements relate to the National Environmental Policy Act (NEPA), the Endangered Species Act (Section 7 requirements), and the 2006 programmatic agreement in relation to cultural resources (Section 106 Historic Preservation Act Requirements).

TABLE 22: FUTURE COMPLIANCE REQUIRED FOR IMPLEMENTATION OF SPECIFIC ACTIONS

FUTURE COMPLIANCE REQUIRED	
Action	**Compliance Requirement**
Routinely monitoring and stabilizing archeological sites. Monitoring cultural landscapes and historic structures to protect, preserve, maintain, and research them.	These items are programmatically excluded from future Section 106 review and SHPO consultation in accordance with the 2006 Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers.
New visitor facilities including, trails, the Petroglyph Point Seasonal Contact Station and day use facilities, building additions (visitor and research centers), backcountry campsites, campground improvements, and vault toilets. Road realignment at Petroglyph Point. New sustainable technologies such as solar panels or wind turbines. Access improvements to monument attractions such as Captain Jacks Stronghold. New habitat restoration efforts. Removal of existing facilities including the wildlife overlooks and overhead utilities.	NEPA Compliance – Although some of the listed actions have been generally assessed in the environmental consequences of this document, many details have yet to be identified (e.g. precise location, design, and size of a facility). Appropriate NEPA compliance would be completed for these actions before their implementation. Future Section 7 compliance - Consultation with the U.S. Fish and Wildlife Service) would occur for restoration of monument habitat. Future Section 106 compliance review and SHPO consultation would likely be necessary and required before construction at the project implementation planning or design stages.

Public Officials, Agencies, Organizations, and Individuals Receiving a Copy of This Document

FEDERAL AGENCIES

- Bureau of Land Management
    - Alturas Field Office
    - Lakeview District, Klamath Falls, OR
- Bureau of Reclamation
    - Klamath Basin Area Office
- National Park Service
    - Crater Lake National Park
    - Denver Service Center
    - Klamath Network Inventory and Monitoring Coordinator
    - Lassen Volcanic National Park
    - Oregon Caves National Monument
    - Pacific West Region
    - Park Planning and Special Studies Division
    - Redwood National Park
    - Whiskeytown National Recreation Area
- U.S. Fish and Wildlife Service
    - Klamath Basin National Wildlife Refuges
    - Region 1
- U.S. Forest Service
    - Modoc National Forest
    - Klamath National Forest
    - Shasta-Trinity National Forest
    - Winema National Forest
- U.S. Geological Survey
- US Post Office
    - Dorris CA 96023
    - Klamath Falls, OR 97603
    - Malin, OR 97632
    - Merrill, OR 97633
    - Tulelake, CA 96134

U.S. SENATORS AND REPRESENTATIVES

- Honorable Barbara Boxer, U.S. Senator, CA
- Honorable Dianne Feinstein, U.S. Senator, CA
- Honorable Jeff Markley, U.S. Senator, OR
- Honorable Ron Wyden, U.S. Senator, OR
- Honorable Wally Herger, U.S. Representative, 2nd District, California
- Honorable Tom McClintock, U.S. Representative, 4th District, California

STATE ELECTED OFFICIALS

- California State Senators and Assembly Members
- Senator Sam Aanestad
- Senator Dave Cox
- Assembly Member Jim Nielson

STATE AGENCIES

- California Department of Fish and Game
- California Department of Forestry and Fire Protection
- California Department of Parks & Recreation/ California State Parks
- Cultural Resources Division
- Northern Buttes District
- North Coast Redwoods District
- California Department of Transportation, District 2
- California Flight Standards District Office
- California State Office of Historic Preservation

AMERICAN INDIAN TRIBES AND ORGANIZATIONS

- The Klamath Tribes

LOCAL AND REGIONAL GOVERNMENTS

- Alturas City Hall
- Dorris City Hall
- Klamath County, Oregon, Mayor and City Council
- Klamath Falls City Hall
- Malin City Hall
- Merrill City Hall
- Modoc County, California, Board of Supervisors
- Siskiyou County, California, Board of Supervisors
- City of Tulelake
- Tulelake Irrigation District

COLLEGES, UNIVERSITIES AND SCHOOLS

- California State University, Chico
- College of the Siskiyous
- Humboldt State University
- Klamath Community College
- Oregon Institute of Technology
- Oregon Institute of Technology
- Oregon State University
- Oregon State University
- Phoebe A. Hearst Museum of Anthropology, University of California, Berkeley
- Shasta College
- Southern Oregon University
- Tulelake High School
- University of Nevada

ORGANIZATIONS AND BUSINESSES

- AAA Oregon
- Bravo Tours
- California Wilderness Coalition
- Capt. Jack's Restaurant
- Cascade Civil War Society
- Cave Research Foundation
- Civilian Conservation Corps Alumni
- Cookeville High Chapter, SPEAK
- Dragonfly Adventures
- Eagle's Nest RV Park
- Great Basin Visitor Association
- High Desert Trail Riders
- Jackson Co. Horseman's Association
- Klamath Basin Audubon Society
- Klamath Co. Tourism Bureau
- Klamath County Museum
- Klamath Water Users Association
- Klamath Wing Watchers, Inc.
- Horse & Carriage Society
- Lassen Tours
- LuCena West Tours
- Medicine Lake Homeowners Association
- Modoc County Historical Society
- NACCCA Headquarters
- National Parks Conservation Association
- National Parks Conservation Association
- National Speleological Society
- National Trust for Historic Preservation
- Natural History Association
- Northwest Trail Riders
- Ore-Cal RC&D Area
- Rotary International of Tulelake
- 211HShasta Area Grotto
- Shaw Historical Library
- Sierra Club Chapter - Redding
- Siskiyou County Historical Society
- Spokes, Unlimited
- The Wilderness Society
- Timber Mountain Store
- Tule Lake Preservation Committee
- Tule Lake Reunion Group
- Tulelake Growers Association
- Tulelake Partnership Committee
- Tulelake-Butte Valley Fairgrounds
- Volcanic Legacy Community Partnership
- Volcanic Legacy Scenic Byway
- Volcanic Legacy Scenic Byway
- Native Plant Society of Oregon
- Wilderness Society
- Winema 4H
- Yreka Chamber of Commerce

MEDIA

- Lost River Star
- Jefferson Public Radio
- KLAD Radio
- KOTI TV
- KTVL Radio

INDIVIDUALS

Copies were also mailed to approximately 60 individuals who signed up for mailings at public meetings and events.

List of Preparers

PLANNING TEAM COMPOSITION AND FUNCTIONS

NPS: Pacific West Regional Office

Jean Boscacci, Outdoor Recreation Planner
Pacific West Region, Oakland

- Involved in foundation planning, development of alternatives, and identification of the preferred alternative. Responsible for scoping comment analysis; newsletter editing, design and production; and public involvement efforts.

Barbara Butler, Landscape Architect
Pacific West Region, Oakland

- GMP Project Manager, overall responsibility for preparing the GMP, public involvement, organization of GMP meetings and workshops.

Cortney Cain Gjesfjeld, Historical Landscape Architect
Pacific West Region, Seattle

- Involved in development of alternatives, identification of the preferred alternative, and development of user capacity indicators and standards. Responsible for writing sections related to cultural landscapes and historic resources issues.

Martha Crusius, Senior Planner
Pacific West Region, Oakland

- Involved in foundation planning, development of alternatives, and identification of the preferred alternative. Responsible for project oversight and reviews.

Kirstie Haertel, Archeologist
Pacific West Region, Seattle

- Involved in foundation planning, development of alternatives, and identification of the preferred alternative. Responsible for writing sections related to archaeology and ethnographic issues.

Amanda Kaplan, Environmental Protection Specialist
Pacific West Region, Seattle

- Project environmental compliance coordinator. Involved in public scoping efforts, development of alternatives and identification of the preferred alternative. Responsible for coordinating and writing sections for affected environment and environmental consequences.

Brad Phillips, Outdoor Recreation Planner
Pacific West Region, Oakland

- Involved in identification of the preferred alternatives, development of user capacity indicators and standards and public outreach efforts. Responsible for coordination, editing, design and production of the draft plan, writing sections related to climate change, user capacity and alternatives.

NPS: Lava Beds National Monument

Al Augustine, Fire Management Officer

- Involved in foundation planning and development of alternatives. Responsible for writing sections related to fire management.

Kale Bowling, Lead Interpreter/Park Ranger

- Involved in foundation planning, development of alternatives, identification of the preferred alternative and development of user capacity indicators and standards. Responsible for writing sections related to interpretation and education.

James Deshayes, Former Chief of Maintenance

- Involved in foundation planning and internal scoping for the General Management Plan.

Craig Dorman, Former Superintendent

- Involved in GMP start and orientation, foundation planning, public and internal scoping for the General Management Plan.

Shane Fryer, Cave Technician

- Involved in development of alternatives, identification of the preferred alternative and development of user capacity indicators and standards. Responsible for writing sections related to natural resources.

Terry Harris, Chief Ranger

- Involved in foundation planning, development of alternatives, identification of the preferred alternative and development of user capacity indicators and standards. Responsible for writing sections related to recreation, monument operations and visitor services.

David Hays, Resource Management Specialist
- Involved in foundation planning, development of alternatives, and identification of the preferred alternative. Responsible for GIS mapping and analysis and writing sections related to natural resources, socioeconomic and recreation issues.

Dave Kruse, Superintendent
- Involved in the development of alternatives, public involvement and outreach, identification of the preferred alternative, and development of user capacity indicators and standards. Responsible for writing sections related to park operations, facilities and infrastructure, visitor access and transportation, visual resources, and energy use/sustainability.

David Larson, Chief of Resource Management
- Involved in foundation planning, public involvement and outreach, development of alternatives, identification of the preferred alternative and development of user capacity indicators and standards. Responsible for compliance consultation and coordination, writing sections and coordinating impact topics related to natural and cultural resources.

Jason Mateljak, Resource Management Specialist
- Involved in identification of the preferred alternative and development of user capacity indicators and standards.

Angela Sutton, Education Coordinator and Interpretive Park Ranger
- Involved in identification of the preferred alternative and development of user capacity indicators and standards. Responsible for writing sections related to interpretation and education.

NPS: Crater Lakes National Park

Marsha McCabe, Chief of Interpretation
- Involved in foundation planning and development of alternatives. Provided guidance on topics related to interpretation and education.

Consultants

NPS: Denver Service Center

Sarah Bodo, Community Planner
- Produced cost estimates for the alternatives.

Kerri Cahill, Community Planner
- Facilitated the user capacity workshop. Provided guidance for developing user capacity indicators and standards for the general management plan.

Erin Flanagan, Community Planner
- Coordinated preparation for selecting the preferred alternative and facilitated the Choosing by Advantages Workshop.

Carla McConnell, Community Planner
- Facilitated the Alternatives Development Workshop.

Stephan Nofield, Community Planner
- Facilitated the GMP Foundation Workshop. Wrote initial draft of monument foundation statement.

Appendices



Appendix A: Presidential Proclamation Establishing Lava Beds National Monument

Proclamation No. 1755, November 21, 1925, Establishing Lava Beds National Monument

A Proclamation

Whereas, lands of the United States within the area hereinafter described in the State of California contain objects of such historic and scientific interest as to justify their reservation and protection as a National Monument;

Now, Therefore, I, Calvin Coolidge, President of the United States of America, by virtue of the power in me vested by Section 2 of the Act of Congress approved June 8, 1906 (34 Stat. 225), entitled, "An Act For the preservation of American antiquities," do proclaim that there are hereby reserved from all forms of appropriation under the public land laws, subject to all prior valid adverse claims, and set apart as the Lava Beds National Monument, all tracts of land owned by the United States in the State of California lying within the area described as follows:

Beginning at the quarter section corner on the east side of Section thirteen, Township forty-six North Range three East, Mount Diablo Meridian; thence running due east to the shore line of Tule Lake; thence following the shore line of said Lake in a southerly and easterly direction to its intersection with the east line of Section seven, Township forty-six North, Range five East, thence running southerly along the section line to the southeast corner of Section thirty-one, said Township; thence westerly to the northeast corner of Township forty-five North, Range four East; thence southerly to the southeast corner of said Township; thence westerly to the southwest corner of Section thirty-five, Township forty-five North, Range three East; thence northerly to the northwest corner of Section two, said Township; thence easterly to the southeast corner of Township forty-six North, Range three East; thence northerly to the point of beginning; also Lot three, Section ten, Township forty-six North, Range five East 00 all Mount Diablo Meridian.

The reservation made by this proclamation is not intended to prevent the use of the lands for National Forest purposes under the proclamation establishing the Modoc National Forest, and the two reservations shall both be effective on the land withdrawn but the National Monument hereby established shall be the dominant reservation and any use of the land which interferes with its preservation or protection as a National Monument is hereby forbidden.

Warning is hereby given to all unauthorized persons not to appropriate, injure, deface, remove, or destroy any feature of this National Monument, or to locate or settle on any of the lands reserved by this proclamation.

IN WITNESS WHEREOF I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this 21st day of November, in the year of our Lord one thousand nine hundred and twenty-five, and of the Independence of the United States of America, the one hundred and fiftieth.

By the President: Calvin Coolidge
Frank B. Kellogg, Secretary of State.

Appendix B: Consultation Letters

United States Department of the Interior
NATIONAL PARK SERVICE
Lava Beds National Monument
1 Indian Well Headquarters
Tulelake, California 96134

IN REPLY REFER TO:

D18

August 17, 2006

Milford Wayne Donaldson
State Historic Preservation Officer
1416 9th Street, Room 1442-7
Sacramento, CA 95814

Dear Mr. Donaldson,

In accordance with our responsibilities under the National Historic Preservation Act of 1966 and the amended Programmatic Agreement between the National Park Service, the National Conference of State Historic Preservation Offices, and the Advisory Council on Historic Preservation, this letter is to inform you of the National Park Service's intent to prepare a General Management Plan (GMP) for Lava Beds National Monument.

The GMP will set forth the basic management philosophy for the park and will provide strategies for addressing issues relevant to natural and cultural resources management, visitor use, and interpretation of those resources. We invite your office to attend meetings of the planning team preparing the GMP.

The NPS held public scoping meetings in both California and Oregon during June 2006. The public comment period will come to a close on September 2, 2006. Our team will begin to develop management alternatives in early 2007. Current information relevant to the GMP is available on the National Park Service Planning, Environment and Public Comment (PEPC) website located at http://parkplanning.nps.gov/labe.

We encourage your involvement in this important planning process. If you have any questions please do not hesitate to contact me at 530-667-8101. We look forward to working with you and your staff on this endeavor.

Sincerely,

Craig W. Dorman
Superintendent

United States Department of the Interior

NATIONAL PARK SERVICE

Lava Beds National Monument
1 Indian Well Headquarters
Tulelake, California 96134

IN REPLY REFER TO:
N1621

November 27, 2006

Curt Mullis
Field Supervisor
U.S. Fish and Wildlife Service
Klamath Falls Fish and Wildlife Office
1936 California Ave
Klamath Falls, OR 97601

Dear Mr. Mullis,

In accordance with our responsibilities under section 7 of the Endangered Species Act, this letter is to inform you of the National Park Service's intent to prepare a General Management Plan (GMP) for Lava Beds National Monument (Lava Beds).

A new GMP is scheduled to be completed in 2009 and will set forth the basic management philosophy for the park and will provide strategies for addressing issues relevant to natural and cultural resources management, visitor use, and interpretation of those resources. On June 27, 2006 Lava Beds downloaded an electronic copy of the U.S. Fish and Wildlife Service (USFWS) listed, proposed, and candidate species that may occur in Siskiyou and Modoc counties of California. This list will serve as the official list for the Lava Beds GMP planning process and will be updated on a quarterly basis through the USFWS website. One additional species not found on the USFWS list, but listed for Lava Beds on the National Park Service (NPS) Threatened and Endangered list is the gray wolf (*Canis lupus*). With concurrence from the USFWS, it is identified by the NPS that this species is listed as historic and will not be considered within the current GMP planning process. It is recognized that this species may become a higher management goal in the future due to re-colonization into neighboring areas.

The NPS held public scoping meetings in both California and Oregon during June 2006. The public comment period came to a close on September 2, 2006. Our team will begin to develop management alternatives in early 2007. Current information relevant to the GMP is available on the National Park Service Planning, Environment and Public Comment (PEPC) website located at http://parkplanning.nps.gov/labe.

If you have any questions please do not hesitate to contact David Larson (Chief of Resources) at 530-667-8106. We look forward to working with you and your staff on this endeavor.

Sincerely,

Craig W. Dorman

Enclosures

cc: Barbara Butler, Landscape Architect, PWR

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Klamath Falls Fish and Wildlife Office
6610 Washburn Way
Klamath Falls, Oregon 97603
(541) 885-8481 FAX (541) 885-7837
kfallsfwo@fws.gov

LISTED, PROPOSED, AND CANDIDATE SPECIES THAT MAY OCCUR IN SISKIYOU COUNTY, CALIFORNIA

Status: **Endangered**

Phylum	Common Name	Scientific Name	Critical Habitat
Fish	winter-run chinook salmon	Oncorhynchus tshawytscha	Designated
Fish	Shortnose sucker	Chasmistes brevirostris	Proposed
Fish	Lost River sucker	Deltistes luxatus	Proposed
Invertebrate	Shasta Crayfish	Pacifastacus fortis	
Plant	Yreka phlox	Phlox hirsuta	

Status: **Threatened**

Phylum	Common Name	Scientific Name	Critical Habitat
Amphibian	California red-legged frog	Rana aurora draytonii	Designated
Bird	Northern spotted owl	Strix occidentalis caurina	Designated
Bird	Bald eagle	Haliaeetus leucocephalus	
Fish	S. OR/N. CA coho salmon	Oncorhynchus kisutch	Designated
Fish	Central Valley spring-run chinook salmon	Oncorhynchus tshawytscha	Designated
Fish	CA coastal chinook salmon	Oncorhynchus tshawytscha	Designated
Fish	Sacramento splittail	Pogonichthys macrolepidotus	
Plant	Slender Orcutt grass	Orcuttia tenuis	Proposed

Status: **Candidate**

Phylum	Common Name	Scientific Name	Critical Habitat
Amphibian	Oregon Spotted frog	Rana pretiosa	
Bird	Yellow-billed cuckoo	Coccyzus americanus occidentalis	
Fish	Central Valley fall-run chinook salmon	Oncorhynchus tshawytscha	
Invertebrate	Mardon skipper butterfly	Polites mardon	

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Klamath Falls Fish and Wildlife Office
6610 Washburn Way
Klamath Falls, Oregon 97603
(541) 885-8481 FAX (541) 885-7837
kfallsfwo@fws.gov

LISTED, PROPOSED, AND CANDIDATE SPECIES THAT MAY OCCUR IN MODOC COUNTY, CALIFORNIA

Status: **Candidate**

Phylum	Common Name	Scientific Name	Critical Habitat
Amphibian	Oregon Spotted frog	Rana pretiosa	
Bird	Yellow-billed cuckoo	Coccyzus americanus occidentalis	

Status: **Endangered**

Phylum	Common Name	Scientific Name	Critical Habitat
Invertebrate	Shasta Crayfish	Pacifastacus fortis	
Fish	Modoc sucker	Catostomus microps	
Fish	Lost River sucker	Deltistes luxatus	Proposed
Fish	Shortnose sucker	Chasmistes brevirostris	Proposed

Status: **Proposed Endangered**

Phylum	Common Name	Scientific Name	Critical Habitat
Fish	Cowhead Lake Tui Chub	Gila bicolor vaccaceps	

Status: **Threatened**

Phylum	Common Name	Scientific Name	Critical Habitat
Plant	Slender Orcutt grass	Orcuttia tenuis	Proposed

Bird	Northern spotted owl	Strix occidentalis caurina	Designated
Bird	Bald eagle	Haliaeetus leucocephalus	

Glossary

A'a lava flows: Solidified lava with a rough, clinkery surface.

Accessibility: Occurs when individuals with disabilities are able to reach, use, understand, or appreciate NPS programs, facilities, and services, or to enjoy the same benefits that are available to persons without disabilities. See also, "universal design."

Adaptive management: A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will best ensure that outcomes are met or to re-evaluate the outcomes. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain and is the preferred method of management in these cases.

Archeology: The scientific study, interpretation, and reconstruction of past human cultures from an anthropological perspective based on the investigation of the surviving physical evidence of human activity and the reconstruction of related past environments. Historic archeology uses historic documents as additional sources of information.

Archeological resource: Any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research.

Area-specific desired condition (also called area-specific action): Based on management zones, area-specific guidance about the desired resource conditions, visitor experience opportunities, and appropriate kinds and levels of management, development, and access (modes of transportation) for particular areas of the monument; also the kinds of changes needed to move from the existing to the desired conditions.

Asset: A physical structure or grouping of structures, land features, or other tangible property which has a specific service or function.

Asset management: A systematic process of maintaining, upgrading, and operating assets cost-effectively by combining engineering principles with sound business practices and economic theory.

Backcountry: Primitive, undeveloped portions of park units, some of which may be managed as "wilderness."

Best management practices (BMPs): Practices that apply the most current means and technologies available to not only comply with mandatory environmental regulations, but also maintain a superior level of environmental performance. See also, "sustainable practices/principles."

Carbon Footprint: A measure of the amount of carbon dioxide produced by a person, organization or state in a given time.

Climate Change: refers to any distinct change in measures of climate lasting for a long period of time. In other words, "climate change" means major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from:

- natural factors, such as changes in the Sun's energy or slow changes in the Earth's orbit around the Sun;
- natural processes within the climate system (e.g., changes in ocean circulation);
- human activities that change the atmosphere's make-up (e.g, burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.).

CLIP Tool: Software developed jointly by the Environmental Protection Agency and the NPS, was used to calculate the park's greenhouse gas emissions.

Conserve: To protect from loss or harm; preserve. Historically, the terms conserve, protect, and preserve have come collectively to embody the fundamental purpose of the NPS—preserving, protecting and conserving the national park system.

Consultation (cultural resources): A discussion, conference, or forum in which advice or information is sought or given, or information or ideas are exchanged. Consultation generally takes place on an informal basis; formal consultation requirements for compliance with section 106 of the NHPA are published in 36 CFR Part 800. Consultation with recognized tribes is done on a government-to-government basis.

Cultural Landscape: A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or esthetic values. There are four non-mutually-exclusive types of cultural landscapes: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Cultural Resource: An aspect of a cultural system that is valued by or significantly representative of a culture or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places; and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for NPS management purposes.

Cumulative actions: Actions that, when viewed with other actions in the past, the present, or the reasonably foreseeable future regardless of who has undertaken or will undertake them, have an additive impact on the resource the proposal would affect.

Desired condition (also called management direction and management actions): A park's natural and cultural resource conditions that the National Park Service aspires to achieve and maintain over time, and the conditions necessary for visitors to understand, enjoy, and appreciate those resources.

Developed area: An area managed to provide and maintain facilities (e.g., roads, camp-grounds, housing) serving visitors and park management functions. Includes areas where park development or intensive use may have substantially altered the natural environment or the setting for culturally significant resources.

Ecosystem: A system formed by the interaction of a community of organisms with their physical and biological environment, considered as a unit.

Ecosystem management: A collaborative approach to natural and cultural resource management that integrates scientific knowledge of ecological relationships with resource stewardship practices for the goal of sustainable ecological, cultural, and socio-economic systems.

Enabling legislation: The law(s) that establish a park as a unit within the national park system.

Environmental assessment (EA): A brief NEPA document that is prepared, with public involvement, (a) to help determine whether the impact of a proposed action or its alternatives could be significant; (b) to aid the NPS in compliance with NEPA by evaluating a proposal that will have no significant impacts, but may have measurable adverse impacts; or (c) as an evaluation of a proposal that is either not described on the list of categorically excluded actions, or is on the list, but exceptional circumstances apply.

Environmentally preferred alternative (or environmentally preferable alternative): Of the action alternatives analyzed, the one that would best promote the policies in NEPA section 101. This is usually selected by the planning team members. CEQ encourages agencies to identify an environmentally preferable alternative in the draft EIS or EA.

Ethnographic resource: A site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Existing infrastructure: The systems, services, and facilities currently in a park unit, including buildings, roads, trails, power equipment, water supply, etc.

Finding of No Significant Impact (FONSI): A determination based on an EA and other factors in the public planning record for a proposal that, if implemented, would have no significant impact on the human environment.

Foundation statement: A statement that begins a park unit's planning process and sets the stage for all future planning and decision-making by identifying the park's mission, purpose, significance, special mandates and the broad, park-wide mission goals. Incorporated into a park unit's GMP, but may also be produced as a stand-alone document for a park unit.

Fundamental resources and values: Those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to warrant primary consideration during planning and management because they are critical to achieving the park unit's purpose and maintaining its significance. A fundamental value, unlike a tangible resource, refers to a process, force, story or experience, such as such as an island experience, the ancestral homeland, wilderness values, or oral histories.

Fossil: Any evidence of past life found in a geological context.

Fossiliferous: Containing fossils.

Gateway community: A community that exists in close proximity to a unit of the national park system whose residents and elected officials are often affected by the decisions made in the course of managing the park unit, and whose decisions may effect the resources of the park. Because of this, there are shared interests and concerns regarding decisions. Gateway communities usually offer food, lodging, and other services to park visitors. They also provide opportunities for employee housing, and a convenient location to purchase goods and services essential to park administration.

General management plan (GMP): A plan which clearly defines direction for resource preservation and visitor use in a park, and serves as the basic foundation for decision making. GMPs are developed with broad public involvement.

Geologic period: The period is a basic unit of geological time. Two or more periods comprise a geological era. Most periods are divided into smaller units called epochs.

Geologic resources: Features produced from the physical history of the earth, or processes such as exfoliation, erosion and sedimentation, glaciation, karst or shoreline processes, seismic, and volcanic activities.

Historic district: A geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, landscapes, structures, or objects, united by past events or aesthetically by plan or physical developments.

Human environment: Defined by CEQ as the natural and physical environment, and the relationship of people with that environment. Although the socioeconomic environment receives less emphasis than the physical or natural environment in the CEQ regulations, NPS considers it to be an integral part of the human environment.

Impact: The likely effect of an action or proposed action upon specific natural, cultural or socioeconomic resources. Impacts may be direct, indirect, individual, cumulative, beneficial, or adverse. (Also see Unacceptable impacts.)

Impact topics: Specific natural, cultural, or socioeconomic resources that would be affectedby the proposed action or alternatives (including no action). The magnitude, duration, and timing of the effect to each of these resources is evaluated in the impact section of an EA or an EIS.

Impairment: An impact that, in the professional judgment of a responsible NPS manager, would harm the integrity of park resources or values and violate the 1916 NPS Organic Act's mandate that park resources and values remain unimpaired.

Implementation plan: A plan that focuses on how to implement an activity or project needed to achieve a long-term goal. An implementation plan may direct a specific project or an ongoing activity.

Indicators of user capacity: Specific, measurable physical, ecological, or social variables that can be measured to track changes in conditions caused by public use, so that progress toward attaining the desired conditions can be assessed

Issue: Some point of debate that needs to be decided.

Life cycle costing (analysis): An accounting method that analyzes the total costs of a product or service, including construction, maintenance, manufacturing, marketing, distribution, useful life, salvage, and disposal.

Light Pollution: The illumination of the night sky caused by artificial light sources, decreasing the visibility of stars, and other natural sky phenomena. Also includes other incidental or obtrusive aspects of outdoor lighting such as glare, trespass into areas not needing lighting, alternation of nighttime landscape, and negative impact to ecosystems.

Management concept: A brief, statement of the kind of place the park should be (a "vision" statement)

Management zone: A geographical area for which management directions have been developed to determine what can and cannot occur in terms of resource management, visitor use, access, facilities or development, and park operations. Each zone has a unique combination of resource and social conditions and a consistent management direction. Different actions are taken by the NPS in different zones.

Management zoning: The application of management zones to a park unit. The application of different type of zones and/or size of zones will likely vary in different alternatives.

Management direction (also called desired condition and management prescription): A planning term referring to statements about desired resource conditions and visitor experiences, along with appropriate kinds and levels of management, use, and development for each park area.

Manager: The managerial-level employee who has authority to make decisions or to otherwise take an action that would affect park resources or values. Most often it refers to the park superintendent or regional director, but may at times include, for example, a resource manager, facility manager, or chief ranger to whom authority has been re-delegated.

Mitigation: A modification of a proposal to lessen the intensity of its impact on a particular resource. Actions can be taken to avoid, reduce, or compensate for the effects of environmental damage.

Museum Collection: Assemblage of objects, works of art, historic documents, or natural history specimens collected according to a rational scheme and maintained so they can be preserved, studied, and interpreted for public benefit. Museum collections normally are kept in park museums, although they may also be maintained in archeological and historic preservation centers (NPS DO-28).

Museum object: A material thing possessing functional, aesthetic, cultural, symbolic, and/or scientific value, usually movable by nature or design. Museum objects include prehistoric and historic objects, artifacts, works of art, archival material, and natural history specimens that are part of a museum collection. Structural components may be designated museum objects when removed from their associated structures.

National Park Service Organic Act: The 1916 law (and subsequent amendments) that created the National Park Service and assigned it responsibility to manage the national parks.

National park system: The sum total of the land and water now or hereafter administered by the Secretary of the Interior through the National Park Service for park, monument, historic, parkway, recreational or other purposes.

National Register of Historic Places: The comprehensive federal listing of nationally, regionally, or locally significant districts, sites, buildings, structures, and objects of national, regional, state, and local significance in American history, architecture, archeology, engineering, and culture kept by the National Park Service in authority of the National Historic Preservation Act of 1966.

Native American: Pertaining to American Indian tribes or groups, Eskimos and Aleuts, and Native Hawaiians, Samoans, Chamorros, and Carolinians of the Pacific Islands. Groups recognized by the federal and state governments and named groups with long-term social and political identities who are defined by themselves and others as Indian are included.

NEPA process: The objective analysis of a proposed action to determine the degree of its impact on the natural, physical, and human environment; alternatives and mitigation that reduce that impact; and the full and candid presentation of the analysis to, and involvement of, the interested and affected public –as required of federal agencies by the National Environmental Policy Act of 1969.

Other important resources and values: Those attributes that are determined to be particularly important to park management and planning, although they are not related to the park's purpose and significance

Paleontological / paleoecological resources: Resources such as fossilized plants, animals, or their traces, including both organic and mineralized remains in body or trace form. Paleontological resources are studied and managed in their paleoecological context (that is, the geologic data associated with the fossil that provides information about the ancient environment).

Planning, Environment, and Public Comment (PEPC) System: An online database designed to facilitate the project management process in conservation planning and environmental impact analysis. It assists NPS employees in making informed decisions with regard to a number of compliance issues throughout the planning, design, and construction process.

Potential boundary modifications: The description of areas or resources that meet criteria for boundary adjustments, along with the rationale for an adjustment,

Potential management zone: General guidance about an integrated set of resource conditions and associated visitor experiences that could be applied to various locations throughout a park,

Preferred alternative: The alternative an NPS decision-maker has identified as preferred at the draft EIS stage. It is identified to show the public which alternative is likely to be selected to help focus its comments.

Preserve: To protect from loss or harm; conserve. Historically, the terms preserve, protect and conserve have come collectively to embody the fundamental purpose of the NPS—preserving, protecting and conserving the national park system.

Preservation (cultural resources): The act or process of applying measures to sustain the existing form, integrity, and material of a historic structure, landscape or object. Work may include preliminary measures to protect and stabilize the property, but generally focuses upon the ongoing preservation maintenance and repair of historic materials and features rather than extensive replacement and new work.

Primary interpretive themes: The most important ideas or concepts to be communicated to the public about a park

Professional judgment: A decision or opinion that is shaped by study and analysis and full consideration of all the relevant facts, and that takes into account

- the decision-maker's education, training, and experience
- advice or insights offered by subject matter experts and others who have relevant knowledge and experience
- good science and scholarship; and, whenever appropriate,
- the results of civic engagement and public involvement activities relating to the decision.

Public involvement (also called public par-ticipation): The active involvement of the public in NPS planning and decision-making processes. Public involvement occurs on a continuum that ranges from providing information and building awareness, to partnering in decision making.

Projected implementation costs: A projection of the probable range of recurring annual costs, initial one-time costs, and life-cycle costs of plan implementation.

Purpose: The specific reason(s) for establishing a particular park unit.

Rehabilitation: In reference to cultural resources, the act or process of making possible an efficient compatible use for a historic structure or landscape through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, and architectural values (NPS DO-28).

Research Natural Area (RNA): Research Natural Areas are part of a national network of sites administratively designed to facilitate research and preserve natural features. RNAs are usually established in a typical example of an ecological community type, preferably one having been little disturbed in the past and where natural processes are not unduly impeded. The tract is set aside permanently and is managed exclusively for approved non-manipulative research; i.e., research that measures but does not alter existing conditions. Activities in RNAs are restricted to non-manipulative research, education, and other activities that will not detract from an area's research values. An RNA in a park is designated by the National Park Service.

Restoration: From a cultural resource perspective, (1) The act or process of accurately depicting the form, features, and character of a historic structure, landscape, or object as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period; (2) The resulting structure, landscape, or object.

From a natural resource perspective, restoration refers to the reestablishment/recovery of biological community structure, natural functions and processes in landscapes that have been disturbed or altered by people — actions taken to return disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated.

Landscapes that have been disturbed by natural phenomena, such as floods and hurricanes, generally are allowed to recover naturally in parks unless manipulation is necessary to protect other park resources, developments, or employee and public safety.

Sacred Sites: Certain natural and cultural resources treated by American Indian tribes and Alaska Natives, and Native Hawaiians as sacred places having established religious meaning, and as locales of private ceremonial activities.

Scoping: Includes internal NPS decision-making on issues, alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, lead and cooperating agency roles, available references and guidance, defining purpose and need, and so forth; and external scoping, the early involvement of the interested and affected public.

Section 106: Refers to Section 106 of the National Historic Preservation Act of 1966, which requires federal agencies to take into account the effects of their proposed undertakings on properties included or eligible for inclusion in the National Register of Historic Places and give the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed undertakings.

Significance: Statements of why, within a national, regional, and systemwide context, the park's resources and values are important enough to warrant national park designation.

Social Trail: A trail that is created by humans and is not part of the monument's official designated trail system; also called unofficial and visitor-created trails.

Soil Association: A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Soil Map Units: A unit of description used in soil surveys. It is a locality of soil containing specific characteristics. Soil associations can contain many different soil map units.

Soundscape (natural): The aggregate of all the natural, nonhuman-caused sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials.

State Historic Preservation Officer (SHPO): An official in each state appointed by the governor to administer the state historic preservation program and carry out certain responsibilities relating to federal undertakings in the state (NPS DO-28).

Structure: Structures are constructed works, usually immovable by nature or design, consciously created to serve some human activity. Examples are buildings of various kinds, monuments, dams, roads, railroad tracks, canals, millraces, bridges, tunnels, locomotives, nautical vessels, stockades, forts and associated earthworks, Indian mounds, ruins, fences, and outdoor sculpture. In the national register program "structure" is limited to functional constructions other than buildings (NPS DO-28).

Special mandates: Legal mandates specific to a park unit that expand upon or contradict a park unit's legislated purpose.

Stakeholders: Individuals and organizations that are actively involved in the project, or whose interests may be positively or negatively affected as a result of the project execution /completion. They may also exert influence over the project and its results. For GMP planning purposes, the term stakeholder includes NPS offices/staff as well as public and private sector partners and the public, which may have varying levels of involvement.

Standards: The minimum acceptable condition for an indicator of a desired condition

Stewardship: The cultural and natural resource protection ethic of employing the most effective concepts, techniques, equipment, and technology to prevent, avoid, or mitigate unacceptable impacts.

Strategic plan: A Service-wide, 5-year plan required by GPRA (5 USC 306) in which the NPS states (1) how it plans to accomplish its mission during that time, and (2) the value it expects to produce for the tax dollars ex-pended. Strategic plans serve as "performance agreements" with the American people.

Superintendent: The senior onsite NPS official in a park.

Sustainable design: Design that applies the principles of ecology, economics, and ethics to the business of creating necessary and appropriate places for people to visit, live in, and work. Development that has a sustainable design sits lightly upon the land, demonstrates resource efficiency, and promotes ecological restoration and integrity, thus improving the environment, the economy, and society.

Sustainable practices/principles: Those choices, decisions, actions and ethics that will best achieve ecological/ biological integrity; protect qualities and functions of air, water, soil, and other aspects of the natural environ-ment; and preserve human cultures. Sustain-able practices allow for use and enjoyment by the current generation, while ensuring that future generations will have the same opportunities.

Traditionally associated peoples: Social cultural entities such as tribes, communities, and kinship units exhibiting a continued identity and associated with a specific park unit, area, or resource.

User Capacity: The type and level of use that can be accommodated while sustaining the quality of park resources and visitor opportunities consistent with the purposes of the park unit. It is not necessarily a set of numbers or limits, but rather a process involving establishing desired conditions, monitoring, evaluation, and actions (managing visitor use) to ensure values are protected.

Unacceptable impacts: Impacts that, individually or cumulatively, would

- be inconsistent with a park's purposes or values, or
- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with park programs or activities, or an appropriate use, or
    - the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park, or
    - NPS concessioner or contractor operations or services.

Universal design: The design of products and environments to be usable by all people to the greatest extent possible, without the need for adaptation or specialized design.

Value analysis/value engineering: An organized, multi-disciplined team effort that analyzes the functions of facilities, processes, systems, equipment, services, and supplies for the purpose of achieving essential functions at the lowest lifecycle cost consistent with required performance, reliability, quality, and safety.

Visitor: Anyone who physically visits a park for recreational, educational or scientific purposes, or who otherwise uses a park's interpretive and educational services, regardless of where such use occurs (e.g., via Internet access, library, etc.).

Visitor experience: The perceptions, feelings, and reactions a person has while visiting a park. Examples of visitor experiences include: a sense of being immersed in a natural land-scape; a feeling of being crowded; a feeling of being in an area where the sights and sounds of people and vehicles are predominant; having a sense of challenge and adventure; or a perception of solitude and privacy.

Wilderness (designated): Federal land that has been designated by Congress as a component of the national wilderness preservation system.

Zone: See "management zone."

Acronyms and Abbreviations

ABP	Asset Business Plan
ADA	Americans with Disabilities Act of 1970
APCD	Air Pollution Control District
API	Asset Priority Index
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CBA	Choosing By Advantages
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CLI	Cultural Landscape Inventory
CLIP	Climate Leadership in Parks
CFR	Code of Federal Regulations
C02	Carbon Dioxide
CRV	Current Replacement Value
DO	Director's Order
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCI	Facility Condition Index
FCRPA	Federal Cave Resources Protection Act of 1988
FMH	Fire Effects Handbook
FMSS	Facility Management Software System
FTE	Full time equivalent
FY	Fiscal Year
GIS	Geographic Information Systems
GMP	General Management Plan
I&M	Inventory and Monitoring

IMPROVE	Interagency Monitoring of Protected Visual Environments
LABE	Lava Beds National Monument (also Lava Beds and "the monument")
LCS	List of Classified Structures
MMP	Museum Management Plan
MNF	Modoc National Forest
NAGPRA	Native American Graves Protection and Repatriation Act
NHNO	Ammonium nitrate
NHSO	Ammonium sulfate
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NPS	National Park Service (also Park Service)
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
PAMP	Park Asset Management Plan
PEPC	Planning, Environment, and Public Comment
PL	Public Law
PWA	Public Works Administration
RV	Recreational Vehicle
SI02	Silica
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Selected References

Allison, John

1994 The Cultural Landscape of the Klamath, Modoc and Yahooskin Peoples: Spirit, Nature, History. National Historic Preservation Grants to Indian Tribes and Alaskan Natives, Grant #41-92-NA-411. The Klamath Tribes, Chiloquin, OR.

Anderssen, S.H., Nicolaisen, R.B., and Gabrielsen, G.W.

1993 "Autonomic response to auditory stimulation." *Acta Paediatrica*. 82:913-918.

Bortle, John E.

2001 "The Bortle Dark-Sky Scale; Excellent? Typical? Urban? Use this nine-step scale to rate the sky conditions at any observing site." *Sky & Telescope*. (February 2001): 126-129.

Bureau of Land Management, U.S. Department of Interior,

1999 Environmental Impact Statement, Telephone Flat Geothermal Development Project. California State Clearinghouse Number 97052078. Alturas Resource Area. Alturas, California.

Burns, Catherine E., Kevin M. Johnston, and Oswald J. Schmitz.

2003 Global climate change and mammalian diversity in U.S. national parks. *Proceedings of the National Academy of Sciences* 100:11474-11477.

California Department of Transportation

2002 *County-level Economic Forecast: 2002-2020*. Sacramento, CA : Office of Transportation Economics, Division of Transportation Planning, California Dept. of Transportation.

California Employment Development Department

2007 *County Snapshots: Modoc and Siskiyou Counties*. Accessed February 23, 2007. Available on the Internet at <www.labormarketinfo.edd.ca.gov/cgi/databrowsing/?PageID=4&SubID=147>

Clough, G.

1982 "Environmental Effects on Animals Used in Biomedical Research." *Biological Reviews*. 57:487-523.

Dean Runyan and Associates

2007a California Travel Impacts. Accessed on Feburary 16, 2007. Available on the Internet at <http://www.deanrunyan.com>.

2007b Oregon Travel Impacts. Accessed on Feburary 16, 2007. Available on the Internet at <http://www.deanrunyan.com>.

2007c California Travel Impacts by County. Accessed on Feburary 16, 2007. Available on the Internet at <http://www.deanrunyan.com>.

2007d Oregon Travel Impacts by County. Accessed on Feburary 16, 2007. Available on the Internet at <http://www.deanrunyan.com>.

Deur, Douglas
2008 *In the Footprints of Gmukamps: A Traditional Use Study of Crater Lake National Park and Lava Beds National Monument*. U.S. Government Printing Office. Washington.

Fuhrmann, K.
2007 "Monitoring the Disappearance of a Perennial Ice Deposit in Merril Cave." *The Journal for Cave and Karst Studies*. (68) 3.

Howat, Ian M, et. al.
2007 "A Precipitation-dominated, mid-latitude glacier system: Mount Shasta, California." *Climate Dynamics*." (28)85–98.

International Dark Skies Association.
2008 "Dark-Sky Park Program (Version 1.31)." Available on the Internet at <www.darksky.org>.

Knowles, Noah, Michael Dettinger, and Daniel Cayan.
2006 "Trends in snowfall versus rainfall for the western United States." *Journal of Hydrometeorology*. (In review)

Laughland, A., and J. Caudill
1997 *Banking on nature: The economic benefits to local communities of national wildlife refuge visitation*. Division of Economics, U.S. Fish and Wildlife Service, Washington, D.C. July 1997.

Lenihan, Jim.
2005 Climate change and California: Potential effects on vegetation, carbon, and fire. *PNW Science Findings* (75) 5.

Kilgore, B.M.
1973 "The ecological role of fire in Sierran conifer forests: its application to national park management." *Quaternary Research*. 3496-513.

Leopold, A.S., S.A. Cain, C.M. Cottam, I.N. Gabrielson, and T.L. Kimball.
1963 "Study of wildlife problems in national parks: in national parks and wildlife management in the national parks." *Transactions of the North American Wildlife and Natural Resources Conference*. (28) 28-45.

National Center for Conservation Science and Policy (NCCSP)
2009 "Climatic and Ecological Conditions in the Klamath Basin of Southern Oregon and Northern California: Projections for the Future." Available on the Internet at <http://nccsp.org/files/climate-change/Klamath%20Futures%20Forum_Model%20Results%20Summary_20090724.pdf

National Park Service, U.S. Department of the Interior
2009 Collections Management Report. Lava Beds National Monument. Tulelake, California.

2008 "Lava Beds National Monument 2008 Geologic Condition Assessment." NPS Geologic Resource Division. Internal Document on file at Lava Beds National Monument.

2007 NPS Air Resources Division: Natural Lightscapes. Available online at: <www2.nature.nps.gov/air/lightscapes/>

2006a "Discovery and Documentation of Cave Resources at Lava Beds National Monument," by Fryer, Shane E. and Metaljak, Jason. Internal Document, Lava Beds National Monument.

2006b "Memorandum of Agreement between the National Park Service and the Bureau of Reclamation For Management and Historic Preservation of the Tule Lake Segregation Camp." On file at Lava Beds National Monument, California.

2006c Management Agreement between the California Department of Transportation and the National Park Service for Management and Historic Preservation of the Tule Lake/Newell Maintenance Station Historic District. On file at Lava Beds National Monument, California.

2006d Wilderness Stewardship Plan. Lava Beds National Monument. Tulelake, California.

2006e Collections Management Report. Lava Beds National Monument. Tulelake, California.

2006f Tule Lake Segregation Center National Historic Landmark Nomination. Prepared by Jeffery F. Burton and Mary M. Farrell, Western Archeological and Conservation Center. Tuscon, Arizona.

2005a "Lava Beds National Monument 2005 Cave Macroinvertebrate Survey Project Summary Report." by Pleszewski, Robert. Internal Document on file at Lava Beds National Monument.

2005b "Field Report: 2005 LABE Cave Ice and Water Survey." by Pleszewski, Robert.Internal Document on file at Lava Beds National Monument.

2005c "Acoustic and Soundscape Studies in National Parks." Available online at <www.nature.nps.gov/natural-sounds/publications/acoustics_studies08312005.doc>

2005d "A Biological Assessment of Caves In Lava Beds National Monument." by Taylor, Steven J. Krejca, Jean K. Unpublished Document, Draft.

2005e *Cultural Landscape Inventory: Modoc War Historic District*. Lava Beds National Monument. Tulelake, California.

2005f *Lava Beds National Monument Fire Mangement Plan*. Lava Beds National Monument, Tulelake, California.

2004a March 2. Personal communication with Dana Sandifer, Lead Fire Effects Monitor.

2004b Draft. "Hydrogeologic Conditions and Water Supply Wells at Lava Beds National Monument." Martin, L., Water Resources Division, Fort Collins, Colorado.

2003 "Fire Regimes, Regimes, Pre- and Post- Settlement Vegetation, and Modern Expansion of Western Juniper at Lava Beds National Monument, CA." by Miller R., E. Heyerdahl, and K. Hopkins. On file Lava Beds National Monument. 38p.

2002 Museum Management Plan. Lava Beds National Monument. Tulelake, California

2001 "Assessment of Air Quality and Air Pollutant Impacts in Class I National Parks of California." by Sullivan,T. et al. Available on the Internet at <www2.nature.nps.gov/air/Pubs/pdf/reviews/ca/CAreport.pdf>.

2000 "Directors Order #47: Soundscape Preservation and Noise Management." Available on the Internet at <www.nps.gov/refdesk/dorders/doder47.html 2000>

1999a "Baseline Water Quality Analysis of Lava Beds National Monument Caves, Headquarters Building, and Tule Lake," by A. Cannon. Special Report on file at Lava Beds National Monument.

1999b Baseline Water Quality Data Inventory and Analysis. Lava Beds National Monument. Water Resources Division.Technical Report NPS/NRWRD/NRTR-99/214. U.S. Department of the Interior. Washington, D.C.

1994 Report to Congress, Report on Effects of Aircraft Overflights on the National Park System (September 12, 1994).

1982 "Recommended Program for Fire Management at Lava Beds National Monument, California." by Olson, Craig M. and Robert E. Martin. National Park Service, Western and Pacific Northwest Regions.

1966 "A Resources Management Plan for Lava Beds National Monument." Unpublished manuscript on file at Lava Beds National Monument.

n.d.a "Visibility Monitoring Overview." Available on the Internet at <www2.nature.nps.gov/air/Monitoring/vismon.cfm#locations>.

n.d.b "Lava Beds National Monument- Nature and Science." "NATURE & SCIENCE Air Quality." Available on the Internet at <www.nps.gov/archive/labe/pphtml/subenvironmentalfactors23.html>.

n.d.c Natural Sounds Program. "Acoustic and Soundscape Studies in National Parks." Available on the Internet at <www.nature.nps.gov/naturalsounds/publications/acoustics_studies08312005.doc>.

n.d.d Lava Beds National Monument- Nature and Science. "NATURE & SCIENCE Air Quality." Available on the Internet at <www.nps.gov/archive/labe/pphtml/subenvironmentalfactors23.html>.

Oregon Employment Department

2007 "Regional Profile: Industry Employment in Region 11." Accessed on February 23, 2007. Available online at < www.qualityinfo.org/pubs/indemp/r11.pdf >

2006a "Regional Profile: Labor Force, Employment and Unemployment in Region 11." Accessed on February 23, 2007. Available online at < http://www.qualityinfo.org/pubs/lf/r11.pdf>

2006b "Regional Profile: Occupational Employment in Region 11." Accessed on February 23, 2007. Available online at < http://www.qualityinfo.org/pubs/occemp/r11.pdf>

Oregon Office of Economic Analysis, Department of Administrative Services.

2004 "April Forecasts of Oregon's County Populations and Components of Change, 2000 – 2004." Salem, Oregon.

Patterson, D.L.

1995 "Weeds in a changing climate." *Weed Science*, (43: 4) 685-701.

Selye, H.

1956 *The Stress of Life*. New York: McGraw-Hill.

U.S. Census Bureau

1990a 1990 Summary Tape File 1: Persons. Accessed on February 22, 2007.Available on the Internet at <factfinder.census.gov>.

1990b Table DP-4. Income and Poverty Status in 1989: 1990. Accessed on February 22, 2007. Available on the Internet at <factfinder.census.gov>.

1990c Table DP-1. Profile of General Demographic Characteristics: 1990. Accessed on February 22, 2007. Available on the Internet at <censtats.census.gov/pub/profiles.shtml>

2000a Summary File 3 (SF3), Poverty Status in 1999 of Individuals: 2000. Accessed on February 23, 2007. Available on the Internet at <http://factfinder.census.gov>.

2000b Summary File 1 (SF1), P1. Total Population: 2000. Accessed on February 22, 2007. Available on the Internet at <factfinder.census.gov>.

2000c Summary File 1 (SF1), P3. Race: 2000. Accessed on February 22, 2007. Available on the Internet at <factfinder.census.gov>

2000d Summary File 1 (SF1), P4. Hispanic or Latino and not Hispanic or Latino by Race: 2000. Accessed on February 22, 2007. Available on the Internet at <factfinder.census.gov>.

2000d Summary File 3 (QT-P34). Poverty Status in 1999 of Individuals: 2000. Accessed on February 23, 2007. Available on the Internet at <factfinder.census.gov>.

1990c Table DP-1. Profile of General Demographic Characteristics: 1990. Accessed on February 22, 2007. Available on the Internet at <censtats.census.gov/pub/profiles.shtml>.

2000f Table DP-1. General Population and Housing Characteristics: 1990. Accessed on February 22, 2007. Available on the Internet at <http://factfinder.census.gov>.

U.S. Department of Commerce, Bureau of Economic Analysis

2006 Regional Economic Information System. Bearfacts 1994-2004. Accessed February 22, 2007. Available on the Internet at <http://www.bea.doc.gov/bea/regional/reis>.

U.S. Fish and Wildlife Service, United States Department of the Interior,

2010 Listed, Proposed, and Candidate Species Lists for Modoc and Siskiyou Counties. Available on the Internet at <http://www.fws.gov/klamathfallsfwo/es/es.html>.

2006 Federal Register, September 12. Part II. Department of the Interior. Fish and Wildlife Service. 50 CFR, Part 17. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions.

U.S. Forest Service, United States Department of Agriculture

1992 Report to Congress. Potential Impacts of Aircraft Overflights of National Forest System Wildernesses.

2001 "National Visitor Use Monitoring Results," USDA Forest Service, Region 5, Modoc National Forest. National Visitor Use Monitoring Project.

U.S. Geological Survey, U.S. Department of the Interior

2005 "Level 1 Baseline Water Quality Report for the Klamath Network: Lava Beds National Monument, Lassen Volcanic National Park and Oregon Caves National Monument," by C.R. Currens. Western Ecological Research Center. Arcata, CA.

1968 "A Geologic and Hydrologic Reconnaissance of Lava Beds National Monument and Vicinity." by Smathers, G.A. Water Resources Division. Menlo Park, California.

n.d. Well monitoring at Lava Beds National Monument: 2001 to present. Water Resources Division, Oregon District. Unpublished data.

U.S. Department of Labor, Bureau of Labor Statistics
2007 Local Area Unemployment. Accessed on February 21 and February 23, 2007. http://data.bls.gov.

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam.
2006 "Warming and earlier spring increases western U.S. forest wildfire activity." *Science Express*. (July 6):1-9.

Ziska, L.H. et al.
1999 Future atmospheric carbon dioxide may increase tolerance to glyphosate. *Weed Science* (47:5) 608-615.

Index

A

Accessibility xiii, 26, 53, 65, 71, 77, 82, 92, 204, 205, 215, 216, 217, 230, 231, 237
Acronyms and Abbreviations 267
Administrative zone **41-46**, 58, 72
Air Quality 18, 84, 103, 113, 169, 270, 271
Airshed 113
Alternative A (Continue Current Management; No Action) iii, x, xii, 37, 47, **50-55**, 71, 75-77, 81-94, 108, 169-239, 244-245
Alternative B (Expanding Learning and Resource Preservation through Collaboration; Preferred Alternative) iii, x, xi, xiii, 6, 37, 39, **56-70**, 81-94, 108, 170-239, 244-245
Alternative C (Diversified Recreation Opportunities) iii, x, xi, xii, 37, 39, **71-94**, 108, 171-239, 244-245
American Indian 21, 22, 106, 246, 263, 265
Archeological resources 21, 23, 106, 136
Archeology 21, 24, 48, 49, 52, 62, 64, 75, 89, 140, 202, 208, 209, 260
Asset management 154, 267

B

Backcountry 41-46, 97, 100, 127, 153, 260
Backcountry camping xi, 71, 82
Backcountry zone **41-46**, 172-175, 201, 217, 218
Bats 41, 96, 100, 117, 121, 125, 127, 148, 153, 175, 199, 200, 201
Battlefields xi, 4, 56, 96
Bicycling xi, xii, xiii, 57, 63, 65, 68, 71, 76, 83, 84, 91, 140, 170-174, 197, 218-221, 223, 235
Birds 4, 41, 47, 49, 50, 88, 117, 125, 127, 133, 134, 148, 151, 153, 196, 198-200, 226
  Bald eagle 109, 126, 127, 199, 200
  Greater sage-grouse x, 125, 131, 195, 196, 199, 200, 201
  Swainson's hawk 200
Black Crater 77, 96, 98, 185
Boundary adjustment 109, 128
Bureau of Land Management (BLM) 3, 10, 54, 123, 157, 245, 247, 267, 268
Bureau of Reclamation 3, 157, 247, 267, 270

C

Campground xii, xiii, 9, 21, 38, 44, 48, 51, 54, 57, 58, 65, 68, 71, 72, 77, 78, 83-85, 98, 104, 128, 135, 145-149, 152-154, 161, 174-180, 184, 186, 189-193, 196, 198, 201, 204, 205, 208-224, 231, 235, 237, 245, 247
Camping xi, 9, 11, 53, 54, 71, 82, 97, 100, 127, 134, 147, 149, 150, 153, 178, 180, 219-221, 223, 239, 244
Campsites xiii, 4, 54, 63, 72, 78, 100, 104, 144, 173, 184-187, 189, 190, 196, 200, 217, 220, 221, 223, 238, 247
Captain Jacks Stronghold 4, 65, 77, 98, 136, 137, 139, 140, 150, 185, 203-206, 208, 209, 215, 216, 221, 224, 225, 230, 247
Carbon *emissions* or *footprint* xii, xiii, 8, 13, 50, 69, 79, 93, 132, 156, 233-235, 260, 269, 273
Cascades 3, 116
Cave Loop xii, xiii, 36, 38, 50, 51, 54, 57, 68, 70, 72, 77, 78, 80, 81, 83, 98, 99, 115, 143, 152, 173, 174, 182, 183, 187, 190, 191, 195-197, 221-223, 226, 227, 235
Cave management 12, 17, 40, 47, 50, 69, 75, 79, 99, 121, 183
Cave resources xii, 13, 17, 21, 40, 49, 50, 57, 61, 68, 78, 86, 109, 117, 134, 180-184, 186, 190, 221, 267, 269
Caves x, xii, 4, 9, 10, 12, 17, 31-33, 40, 43, 44, 45, 47, 50-52, 54, 57, 61, 68, 72, 75, 81, 86, 87, 96, 98, 99, 102, 108, 109, 114, **117-121**, 124, 127, 131, 132, 136, 137, 144, 148--153, 155, 172, **180-186**, 188-190, 195-197, 201, 203, 220-226, 244
Caving xii, 51, 57, 68, 71, 75, 76, 77, 82, 86, 127, 134, 146, 148, 149, 151, 152, 182, 184, 219-223, 225, 226, 228
Civilian Conservation Corps (CCC) 4, 23, 32, 33, 48, 52, 53, 62, 64, 76, 121, 135-137, 139, 147, 184, 206-209, 215, 220, 227, 248, 267
Climate change (see also *Carbon*) 8, 33, 49, 61, 62, 66, 81, 100, 121, 132, 133, 134, 249, 260, 268
Commercial services (see also *Concessions*) 158
Compliance i ix, 6, 15, 18, 20, 27, 39, 45, 53, 54, 90, 103, 105, 130, **165**, 197, 203-206, 212-217, 246, 247, 249, 250, 260, 261, 264
Concessions 183, 221, 223
Consultation iii, ix, 6, 19, 21, 22, 89, 105, 106, 199, 202-204, 211-213, 243-247, 250, 260
Contemporary tribal interests 135
Costs (see also *Summary of Costs*) i ix, 6, 20, 38, 39, 47, 55, 69, 70, 79, 80, 135, 151, 233, 236, 262, 264
Cultural landscape(s) x, 8, 13, 23, 48, 50, 52, 53, 62, 75, 81, 90, 106, 107, 134, 137, 139, 201, 202, 206-210, 227, 247, 249, 261, 267, 268, 270
Cultural Resources 8, 12, 23, 48, 52, 57, 62, 71, 75, 81, 89, 96, 102, 134, 201, 248
Cumulative impacts 84-92, 165, **166**, 170, 172, 173, 175-177, 179, 180, 192, 201, 203-205, 208, 212, 214-219, 222, 223, 226, 228, 229, 239

D

Dark Night 45, 47, 52, 61, 75, 85, 174
Day use xi, xii, xiii, 56, 57, 63, 68, 71, 72, 78, 79, 82, 83, 127, 178, 180, 182, 183, 198, 204, 205, 220, 221, 224, 227, 234, 236, 238, 247
Demographics 9, 145, 154, 221, 222, 237, 238
Developed zone **41-46**, 51, 58, 72, 77, 172, 175, 195

E

Ecological ***processes, communities***, and ***restoration*** x, 19, 40-42, 47, 50, 52, 57, 61, 65, 75, 81, 114, 130-132, 152, 191, 192, 235, 238, 261-269
Ecosystem(s) 3, 8, 18, 19, 32, 33, 47, 52, 62, 96, 114, 124, 128, 130, 132, 152, 183, 196, 262

Education iii, x, xi, xii, 8, 9, 11, 13, 20, 25, 28, 37, 38, 39, 50, 53, 56, 57, 62, 64, 66-69, 81, 82, 83, 84, 86, 92, 97-106, 121, 139, 147, 148, 15-155, 161, 173, 174, 178, 181-184, 191-194, 204, 205, 209, 212, 214, 22-229, 232, 237, 238, 244, 249, 250, 264
Educational programs xi, 8, 18, 19, 26, 56, 64, 65, 69, 92, 101, 205, 215, 216, 225, 239
Endangered Species (see also *Special Status Species*) x, 7, 16, 19, 61, 88, 105, **125-127**, 199, 200, 201, 245
Energy 14, 27, 70, 80, 175, 200
Entrance xi, xiii, 8, 9, 22, 32, 40, 51, 76, 83, 94, 110, 117, 142, 143, 147, 152, 170, 178, 237, 238
Environment ix, 4, 13, 16, 21, 28, 33, 41, 43, 48, 107, 108, 109, 113, 114, 117, 123, 128, 130, 134, 149, 150, 152, 153, 168, 181, 236, 237, 249, 260, 261, 262, 263, 266
Environmental Assessment i, i, iii, i 6, 7, 16, 37, 243, 267
Environmental justice 14
Environmentally Preferred Alternative xiii, **108**
Ethnographic resources 13, 22, 40, 48, 54, 89, 106, 107, 134, 210-213, 249, 261

F

Facilities iii-xiii, 6, 8-10, 12-14, 18, 23, 26, 27, 38-41, 44, 45, 49-53, 55-58, 63, 65, 67-69, 71, 72, 76, 79, 83, 85, 86, 88, 91-94, 104-109, 113, 115, 146, 147, 152, 153, 155, 170, 172-193, 197-200, 204, 205, 213, 215, 218-224, 226, 229-232, 234-238, 247, 250, 260, 261, 263, 266
Facility improvements 7, 9, 69, 79, 85, 146, 178, 179, 180, 222, 223, 239
Fees 142, 147
Fire xii, 4, 10, 12, 18, 19, 20, 23, 33, 41, 44, 47, 49, 50, 52, 54, 55, 62, 64, 65, 71, 75, 84, 88, 113, 115, 125, 128, 130-135, 139, 142, 150, 154, 155, 166, 167, 170, 171, 191, 193, 206, 209, 234, 249, 269
Fire management 12, 19, 20, 52, 54, 62, 128, 130, 131, 139, 150, 155, 166, 170, 249
Fleeners Chimneys 65, 96, 98, 116, 185
Foundation statement **31-34**, 250, 262
Fundamental resources and values **32**, 262
Funding iii, x, xiii, 7, 12, 19, 39, 53, 55, 61, 62, 69, 76, 79, 93, 103, 108, 110, 136, 140, 142, 143, 148, 150-154, 156, 160, 211, 225, 229, 231, 232, 234

G

Gateway communities xi, 8, 10, 56, 66, 148, 160, 236
Geologic processes 17, 47, 52, 61, 75
Geologic resources 10, 17, 33, 47, 61, 81, 86, 96, 98, 99, **116-121**, 178, 184-187, 225
Geology 8, 17, 23, 65, 68, 76, 116, 117, 146, 148, 149, 152, 182, 186, 226, 227
Gillems Bluff xi, 65, 77, 115, 117, 140
Gillems Camp 65, 77, 114, 135-137, 139, 140, 151, 206, 208, 209, 222, 230
Great Basin ix, 3, 4, 32, 33, 123, 124, 134, 244, 248

H

Habitat 4, 10, 13, 19, 21, 33, 39, 41, 46, 47, 51, 61, 69, 79, 81, 85, 105, 114, 117, 121, 125-127, 131, 166, 167, 175, 178-180, 194-201, 245, 247
Habitat restoration 85, 179, 247
Habitats 19, 32, 33, 88, 114, 125, 126, 131, 133, 153, 166, 168, 175, 176, 179, 195, 196, 197, 198, 199, 200, 201, 237
Headquarters 50, 53, 58, 72, 125, 135, 154, 167, 232, 233
Hiking xi, 54, 56, 82, 127, 134, 144, 150, 152, 178, 179, 211, 212, 218-223
Historic buildings x, 13, 48, 50, 90, 137, 201, 202, 206-209
Historic District 12, 23, 48, 52, 53, 137, 139, 140, 206-209, 270
Historic overview 135
Historic preservation 7, 12, 21-24, 97, 103, 106, 107, 165, 201-203, 205, 208, 209, 213, 246-248, 263, 265, 267, 268, 270
Historic structures 24, 48, 52, 62, 75, 81, 90, 106, 134, 202, 207-210, 237, 247
Hospital Rock 65, 77, 136, 137, 139, 140, 142, 204, 205, 208, 209, 215, 216, 222, 230
Howard, J. D. 4
Hydrologic resources 121, 272

I

Impairment of resources 168, 169, 262
Indian Well 51, 58, 72, 84, 123, 137, 147, 153, 154, 174, 176, 178, 190, 192, 193, 198, 201, 218, 228, 232, 237
Indicators and standards i 10, 51, 86, 87, 95, 101, 176, 186-190, 193, 194, 198, 218, 219, 249, 250
Interagency cooperation iii, x, 56, 66, 81, 93, 232, 233
Interpretation xi, xii, 8, 9, 11, 13, 23, 25, 37-39, 42-45, 48, 49, 52, 56, 57, 62, 64, 66, 69, 71, 75, 76, 79, 82, 86, 89, 90, 92, 109, 134, 145, 146, 149, 150-152, 155, 156, 183, 184, 186, 204-209, 211-217, 224-229, 232, 237, 244, 249, 250, 260
Interpretive backcountry zone 40, **41-46**, 58, 72, 77, 86, 183, 186, 192
Interpretive media xii, 26, 27, 41, 44, 53, 57, 237
Interpretive programs x, xi, 20, 26, 37, 56, 89, 101, 144, 149, 150, 151, 155, 204, 211, 212, 214, 224-226, 228
Interpretive themes 31, 32, 49, 101, 149-151, 264
Invasive species 48, 53, 79, 132, 206, 207
Issues addressed in this plan 8
Issues not addressed in this plan 10

K

Klamath Falls 3, 61, 115, 143, 146, 151, 156, 157, 175, 243-245, 247, 248
Klamath National Forest (see also *United States Forest Service*) 3, 167, 168, 238, 247
Klamath Tribes, The ix, x, 4, 10, 48, 50, 64, 135-137, 150, 152, 203-205, 211, 213, 226, 228, 229, 244, 246, 248, 268

L

Land use 16, 34, 134, 203, 210, 235
Lava Beds Natural History Association 54, 67, 77, 149, 151, 152, 220, 223, 244, 245
Lava flows 4, 10, 31, 34, 115-117, 123, 125, 130, 135, 153, 154

Lava tube caves (see also *Caves*) x, xii, 4, 12, 31, 32, 40, 48, 49, 57, 61, 71, 72, 75, 81, 96, 109, 117, 124, 132, 151-153, 180, 182
List of Classified Structures (LCS) 24, 135, 137, 267
Lodging 9, 160, 236-238, 262
Long Range Interpretive Plan 49
Lyons Road 87, 142, 182, 192, 195, 197, 200
Lyons Trail 65, 76, 83, 98, 233

M

Maintenance xii, 8, 9, 24, 38, 44, 46-48, 53, 55, 56, 58, 62, 65, 67, 69, 72, 78, 79, 89, 93, 104, 106, 110, 135, 142, 154-156, 170, 181, 182, 186, 187, 196, 199, 200, 203, 206-208, 211, 229-233, 236, 262, 264
Management plans 6, 9, 12, 17, 38, 40, 61, 95, 166, 236, 246
Management zones (see also *Backcountry zone, Interpretive Backcountry zone, Developed zone*, and *Administrative zone*) i, iv, viii, 38, **40-46**, 51, 58, 72, 77, 86, 95, 100, 101, 104, 172, 174, 183, 186, 189, 190, 192, 195, 201, 218, 219, 260, 263, 264
Maps *and mapping* 38, 39, 40, 53, 58, 72, 97, 123, 145, 149, 151, 169, 202, 250
Medicine Lake Road xi, xiii, 3, 8, 53, 65, 70, 76, 80, 83, 88, 92, 113, 114, 142, 143, 146, 170, 171, 174, 176, 179, 180, 201, 229-231, 237, 238
Medicine Lake shield volcano 3, 9, 31, 32, 116
Mission 66 4, 23, 48, 53, 135, 137, 139, 147, 206-209, 220
Mitigation 103, 105, 107, 186, 187, 189, 194, 263
Modoc County 3, 13, 140, 142, 143, 156, 157, 158, 159, 160, 244, 248
Modoc National Forest (see also *United States Forest Service*) 3, 12, 40, 58, 110, 114, 123, 128, 135, 142, 152, 153, 155, 161, 167, 168, 171, 181, 185, 198, 201, 218, 221, 225, 227, 228, 230, 237, 238, 247, 253, 267, 272
Modoc Tribe(s) 4, 11, 137
Modoc War xi, xii, 4, 9, 10, 12, 23, 31-33, 48, 49, 52, 53, 56, 57, 62, 64, 66, 70, 71, 75, 76, 80, 81, 90, 109, 116, 134-137, 139, 140, 150, 152, 153, 203, 206-209, 221, 225-228, 244, 270
Monitoring x, xii, 8, 10, 17, 19, 44, 47, 50, 51, 57, 58, 61, 66, 68, 71, 72, 78, 79, 81, 86, 87, 95-105, 113-115, 121, 125, 127, 128, 130, 131, 178, 181, 183, 184, 186-191, 193, 194, 203, 214, 247, 260, 266, 273
Museum collections 10, 23, 49, 53, 63, 75, 90, 107, 140, 213

N

National Environmental Policy Act (NEPA) ix, xiii, 13, 22, 37, 84, 97, 103, 108, **165**, 197, 246, 261, 263, 267
National Historic Preservation Act (NHPA) 12, 21-24, 97, 103, 106, 107, 165, 202, 203, 212, 246, 260, 263, 265, 267
National Register of Historic Places (NRHP) 21, 24, 48, 52, 53, 106, 134, 136, 137, 139, 201-203, 204, 206-208, 246, 261, 263, 265, 267
Native American (see also *American Indian*) i, 4, 7, 15, 22, 23, 97, 106, 107, 121, 139, 140, 244, 246, 263, 267
Native plants 10, 19, 47, 104, 124, 133, 192
Need for the plan 7
Night sky 18, 43, 81, 115, 174, 175, 176, 179, 216, 262
Nonnative plants 62, 87, 105, 191, 192, 193, 194
NPS Management Policies 6, 13-15, 17-24, 26-28, 216

O

Operations iii, ix, xii, xiii, 13, 14, 17, 18, 27, 38, 41, 44, 57, 67, 69-71, 79, 82, 84, 85, 87-89, 91, 93, 104-106, 126, 155, 156, 165, 167, 168, 170, 172, 175, 176, 192, 195, 200, 210, 217, 231-236, 249, 250, 263, 266
Orientation 26, 50, 68, 92, 224, 226, 230, 232, 233, 249
Outreach 26, 53, 64, 76, 81, 151
Overflights 172

P

Paleontological resources 25, 33, 121
Parking xii, xiii, 7, 9, 26, 41, 44, 51, 53, 54, 57, 68, 72, 78, 88, 92, 116, 135, 142-144, 176, 178, 182, 185, 187, 189, 190, 197, 220, 222, 229-231, 236
Partnerships (or *Partners*) 10, 66, 107, 140, 151, 204, 205, 207, 214, 215, 224, 225, 227, 228
Petroglyph Point ix, x, xii, xiii, 3, 7, 8, 9, 11, 12, 37, 38, 40, 50, 54, 57, 58, 61, 65, 68-72, 77-80, 83-85, 88, 89, 91-93, 108, 114-116, 137, 139, 140, 143, 144, 149, 150, 157, 170, 171, 173-176, 178-180, 185, 186, 187, 189, 190, 192, 193, 196-198, 200, 201, 203-205, 207, 208, 211, 212, 214, 216, 220-224, 226, 230-235, 237, 239, 244, 247
Petroglyphs xii, xiii, 32, 33, 50, 57, 68, 72, 78, 102, 135, 137, 170, 171, 173, 174, 178, 180, 221, 222, 232
Picnic area(s) xii, xiii, 38, 41, 44, 51, 57, 72, 78, 173, 181, 189, 190, 193, 196, 197, 200, 201, 203, 223
Planning issues **7**, 32, 243
Plant communities 10, 47, 49, 52, 87, 124, 130, 133, 191, 192, 193, 244
Policy requirements 23, 24, 31
Population 4, 9, 10, 15, 27, 52, 61, 84, 96, 100, 108, 113, 125, 127, 131, 137, 148, 151, 156, 157, 158, 159, 170, 181, 185, 191, 194, 199, 200, 221, 223, 225, 235, 236, 238
Powerline Road 65, 76, 88, 190
Preferred alternative (see also *Alternative B*) i xiii, 6, 7, 14, 15, 37, 39, **56-70**, 108, 109, 110, 214, 223, 246, 249, 250, 261
Public health and safety 16, 28
Public involvement iii, 64, 82, 140, 249, 250, 261, 262, 264
Public Works Administration 23, 48, 137, 206, 207, 208, 267
Purpose of the monument 31, 38
Purpose of the plan 6

R

Recreation iii, xiii, 13, 16, 20, 32, 34, 37, 41, 44, 47, 71, 75, 76, 82, 94, 145, 157, 168, 180, 182-184, 195, 208, 212, 215, 216, 219-223, 227, 230, 234, 235-237, 249, 250
Recreational opportunities iii, xi, xii, xiii, 39, 56, 63, 71, 75, 77, 79, 82, 86, 91, 94, 95, 146, 152, 153, 171, 176, 182-184, 186, 189, 190, 198, 201, 205, 218-224, 236-239

Recreational vehicles xiii, 51, 71, 78, 83, 140, 147, 212, 220-223, 231
Research iii, x, xi, xii, 7-10, 17, 18, 23, 25, 32, 33, 37-39, 42-44, 47-50, 53, 54, 56, 57, 61-66, 68, 69, 71, 75, 76, 81, 82, 86, 89, 90, 95-97, 100, 106, 108, 114, 125, 128, 131, 134, 136, 148, 169, 170, 173, 175, 178, 181-183, 186, 189, 195, 196, 199, 200, 202-204, 206-208, 210, 211, 213-216, 226, 227, 232, 234, 237, 239, 247, 260, 264
Research Center x, xi, 7, 9, 49, 53, 56, 63, 64-66, 76, 82, 170, 173, 175, 178, 186, 196, 200, 204, 215, 232, 234, 239
Restoration 54, 57, 61, 70, 80, 100, 109, 179, 244, 245, 264
Road pullouts 6, 44, 58, 68, 71, 72, 171, 174, 176, 179, 180, 183, 184, 187, 190, 193, 198, 201, 218, 223, 228, 231
Roads xi, xii, xiii, 3, 4, 9, 13, 24, 43, 44, 46, 53, 57, 58, 63, 65, 72, 76, 82, 83, 92, 94, 103, 104, 109, 110, 114, 116, 127, 132, 135, 137, 140, 142, 143, 146, 154, 156, 157, 161, 167, 168, 170-175, 181, 192, 193, 195-198, 200, 201, 203, 206, 207, 218, 220, 222, 228-234, 239, 245, 261, 265
Rock art 4, 8, 32, 33, 42, 50, 68, 96, 102, 134, 136, 137, 150, 152, 203, 205, 211, 226, 244
Route 10 3, 8, 49, 65, 76, 92, 110, 142, 170, 171, 229-231, 237, 239

S

Sacred sites 22, 265
Sagebrush 4, 49, 87, 123, 126, 133, 134, 153, 192, 195-197, 200
Scenic resources **114-116**, 153, 161, 177, 179, 180, 221
Schonchin Butte xii, 16, 65, 71, 75, 98, 103, 115, 137, 139, 185, 208
Schools *and school groups* xi, 8, 56, 64, 66, 69, 82, 92, 148, 183, 224, 226, 227, 228, 229, 237, 244
Siskiyou County 199
Socioeconomic environment 235
Soils 13, 14, 15, 16, 18, 87, 103, 104, 116, 117, 123, 124, 128, 133, 181, 184, 188-190, 265
Solitude xi, 4, 8, 20, 33, 34, 41, 43, 48, 100, 128, 147, 153, 216, 217, 219, 223, 266
Soundscape 46, 84, 100, 114, 166, 172-174, 195, 216, 217, 239, 266
Southeast Entrance road (see also *Route 10*) 8
Special status species (see also *Endangered Species*) 105, 199
Staffing iii, x, xiii, 7, 9, 19, 38, 54, 55, 63, 67-69, 78, 79, 81, 82, 89-93, 101, 103, 110, 147-149, 151, 152, 156, 181, 203, 204, 207, 214, 221, 225, 226, 228, 231, 232
Stewardship 12, 48, 54, 100, 127, 128, 173, 265, 270
Summary of Costs for Alternative A 55
Summary of Costs For Alternative B 70
Summary of Costs For Alternative C 80
Sustainable facilities *and design* xii, 14, 15, 27, 232, 247, 266

T

Thomas-Wright Battlefield 136, 139, 187
Tourism xii, 71, 77, 82, 94, 126, 151, 157, 160, 183, 223, 228, 235, 237, 239
Tours xi, xii, 9, 42, 44, 51, 56, 63, 64, 66, 67, 69, 71, 75, 76, 77, 79, 82, 86, 98, 99, 102, 109, 142, 149, 150, 153, 161, 181-184, 205, 208, 215, 221, 223, 224, 226-228, 237
Townsend's big-eared bat 4, 96, 100, 121, 126, 127, 195, 196
Traditional use 107, 210
Traffic 10, 46, 50, 84, 91, 99, 110, 114, 117, 142, 143, 145, 167, 168, 171, 172, 174, 176, 178, 180, 194, 195, 201, 217, 218, 229-231
Trail development 44, 86, 183, 184, 192, 201, 207, 218
Trails iii, xi, xii, xiii, 9, 24, 39, 41, 43, 44, 53-57, 65, 68, 69, 71, 72, 75-79, 82, 86-88, 90, 96, 98, 99, 102, 104, 109, 116, 127, 137, 139, 144, 150, 152-154, 161, 168, 171-201, 203-208, 211, 212, 214-223, 226, 228-230, 236, 239, 247, 261, 265
Transportation 13, 20, 27, 38, 44, 92, 160, 170, 231, 234, 236, 250, 260
Tribal use (see also *Traditional use*) 10
Tribes ix, x, 4, 10, 11, 48, 50, 64, 135, 136, 137, 150, 152, 203, 204, 205, 210-212, 225, 227, 228, 244, 246, 248, 268
Tulelake i, iii, 151, 153, 156, 157, 161, 225, 228, 239, 243, 244, 245, 247, 248, 269, 270
Tule Lake 4, 11, 13, 61, 76, 88, 115-117, 123, 124, 134-136, 152, 153, 156, 160, 161, 166, 167, 173, 174, 178, 181, 185, 191, 192, 196, 200, 204, 206, 217, 218, 221, 228, 237, 239, 244, 248, 253, 270
Tule Lake National Wildlife Refuge (see also *United States Fish and Wildlife Service*) 11, 13, 115, 124, 152, 153, 160, 161, 166, 167, 173, 174, 181, 185, 191, 192, 217, 218, 237, 239
Tule Lake Segregation Center (see also *World War II Valor in the Pacific National Monument*) 11, 270

U

United States Fish and Wildlife Service (see also *Tule Lake National Wildlife Refuge*) x, 10, 11, 13, 19, 50, 52, 53, 61, 62, 64, 66, 76, 82, 125, 134, 153, 155, 157, 160, 164, 166, 172, 178, 196, 199, 200, 221, 225, 228, 245, 247, 267, 269, 272
United States Forest Service (see also *Klamath National Forest* or *Modoc National Forest*) x, xi, xiii, 3, 8, 9, 10, 11, 12, 13, 19, 40, 49, 50, 53, 56, 58, 62, 63, 65, 66, 71, 72, 75, 76, 77, 82, 92, 109, 110, 127, 142, 143, 155, 157, 161, 167, 168, 170, 171, 177, 192, 196, 200, 221, 223, 225, 229, 230, 237, 239, 243, 245, 247, 267, 272
User capacity i 10, 38, 51, 58, 72, 86, 87, 95, 97, 101, 176, 186, 187, 188, 189, 190, 193, 194, 198, 218, 219, 249, 250, 262

V

Vegetation 49, 87, 104, 123, 124, 133, 191, 270
Viewsheds 8, 13, 33, 47, 49, 52, 61, 75, 85, 115, 177, 178-180

Visitation ix, xii, xiii, 7, 9, 32, 43, 51, 53, 71, 72, 75, 77, 78, 82, 94, 96, 97, 121, 127, 131, 139, 145, 147, 150, 160, 161, 170, 171, 175, 176, 181-183, 185, 186-190, 198, 201, 205, 208, 209, 218, 221, 229, 235-240, 269
Visitor center xi, xiii, 4, 7, 9, 51, 53, 56-58, 63-65, 67, 68, 72, 75, 77, 78, 83, 98, 99, 101, 102, 116, 140, 144, 146, 147, 149-154, 161, 170, 173, 175, 178, 182, 186, 189, 192, 196, 200, 215, 220-222, 226, 228, 232, 234, 235, 237, 243, 244
Visitor experience ix, xi, xii, 6, 21, 26, 38, 43, 45, 46, 49, 50, 56, 57, 64, 68, 91, 94-96, 103, 131, 134, 153, 165, 182, 206, 207, 217, 219-224, 230, 231, 237-240, 260
Visitor spending 160, 161
Visual resources (see also *Scenic resources* and *Viewsheds*) xi, 13, 56, 85, 107, 116, 144, 148, 152, 167, 168, 177-180, 211, 250
Volunteers xi, 51, 56, 98, 99, 102, 121, 124, 125, 221, 223, 227

W

Website iii, 53, 82, 144, 145, 148, 151, 161, 225, 226, 228, 243
Western juniper 4, 8, 49, 54, 88, 115, 116, 123, 125, 126, 130, 133, 139, 142, 150, 153, 191-196, 200, 206, 278
Wilderness 4, 10, 12, 17, 20, 33, 34, 43, 47, 48, 52, 54, 62, 75, 91, 100, 105-107, 127, 128, 152, 173, 182, 216, 243, 244, 245, 248, 266, 270
Wilderness character 13, 20, 105, 106, 107, 217
Wilderness values 34, 48, 91, 105, 217, 218, 239, 262
Wildlife xii, xiii, 10, 11, 13, 19, 22, 41, 45, 47, 49, 57, 61, 66, 68, 71, 72, 78, 83, 88, 96, 100, 104, 105, 114, 124-126, 133, 134, 143, 150, 152, 153, 155, 160, 166-168, 175, 176, 193-201, 211, 212, 217, 219, 221-223, 226, 230, 237, 244, 247, 261, 269
Wildlife habitat(s) 10, 13, 88, 160, 168, 194-198
World War II Valor in the Pacific National Monument 11, 153, 156, 221

Z

Zones see *Management zones*

The National Park Service cares for the special places saved by the American people so that all may experience our heritage.

Experience Your America

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

147/104059 September 2010


© Selfnouveau | Dreamstime.com







