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Department of
Agriculture

Forest Service

Pacific
Northwest
Region

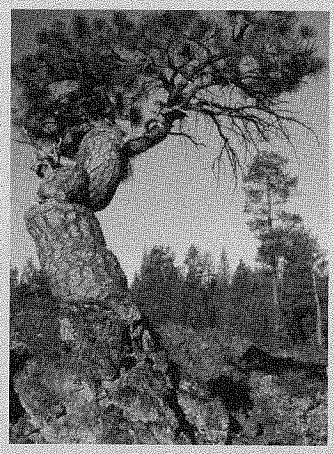
**Deschutes
National Forest**

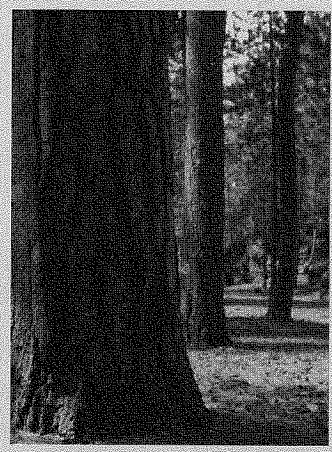
August 1994

Newberry National Volcanic Monument Comprehensive Management Plan

Final Environmental Impact Statement

Deschutes National Forest





NOTE OF APPRECIATION

The Forest Service would like to recognize the help given by the Newberry National Volcanic Monument Advisory Council. This group was created by the Monument legislation. They have given many hours of their time to help the Forest Service develop a Plan that is responsive to the needs and issues of the public. They have represented various interests, and have spoken for many Oregonians; indeed, many United States citizens, in lending their voices to the planning process.

The Advisory Council has studied the role of fire in the Monument's ecosystem. They have learned about insects, disease, and healthy forests. The have experienced both winter and summer recreation in the Monument to better understand the needs of visitors to this special place, now designated a national treasure. In addition, they have spent much time on their own learning about the Monument, and talking to people about what is important for this area's future. We appreciate their time, effort, and dedication.

• Brad Chalfant	Deschutes County
• Greg Custer	Tourism
• John Dotson	Environmental
• Stu Garrett	Governor's Representative
• John Hofferd	Fish and Wildlife
• Wayne Ludeman	Timber
• Dave McClain	Geothermal
• Dave Sherrod	Scientific
• Peggy Spieger	Recreation
• Sally Collins	USDA Forest Service (ex officio)
• Jim Hancock	Bureau of Land Management (ex officio)

Thank You

ENVIRONMENTAL IMPACT STATEMENT
FOR
NEWBERRY NATIONAL VOLCANIC MONUMENT
MANAGEMENT PLAN

Deschutes National Forest
Deschutes County, Oregon
August 1994

Lead Agency: USDA Forest Service
Responsible Official:
John Lowe, Regional Forester
USDA Forest Service
333 SW 1st Street
Portland, OR 97204

For More Information, Contact:
Carolyn Wisdom, Special Projects
Fort Rock Ranger District
1230 NE Third, Suite A262
Bend, OR 97701 (503) 383-4702

Abstract

This final environmental impact statement describes five alternatives for managing the Newberry National Volcanic Monument and adjacent special areas south of Bend, Oregon. Each alternative responds differently to the major issues and concerns identified in the planning process. The final EIS and management plan for the Monument will be incorporated into the Deschutes National Forest Land and Resource Management Plan at the next regularly scheduled revision.

Alternative A protects the special values of Newberry Monument, while emphasizing developed recreation and maximum access. It provides for the highest number of visitors and has the most roads, trails, and facilities.

Alternative B emphasizes solitude, dispersed recreation, wildlife enhancement, and resource protection. It accommodates the fewest number of visitors, and has the fewest roads, trails, and facilities.

Alternative C focuses on interpretation, education, and ecosystems. Principal interpretive topics are the unique archaeology and geology of the Newberry area. Prescribed fire is a major management tool to restore open, park-like stands of old-growth ponderosa pine historically present in Central Oregon. Recreational development is moderate, with an increased emphasis on day-use opportunities.

Alternative C-Modified was developed in response to public comments after the publication of the Draft EIS. It has the same emphasis on education, interpretation, and ecosystems as Alternative C. However, it proposes less vegetation management and includes the Monument trail. Alternative C-Modified is the Forest Service preferred alternative.

Alternative D is the No Action Alternative.

HOW TO USE THIS DOCUMENT

Chapter I gives an overview of the reasons why we need a plan for Newberry National Volcanic Monument. It presents the key issues the Forest Service must address in the management plan. It outlines the decisions to be made in adopting this plan, and discusses its relationship to other plans and agencies that also have an interest in Newberry National Volcanic Monument.

Chapter II discusses the alternatives for managing this area. The Forest Service is required to consider a range of reasonable alternatives before embarking on a course of action. There is a section on how the alternatives were developed, and what all the alternatives have in common. There is a description of each alternative, and then some comparison charts.

Chapter III describes the existing condition in Newberry National Volcanic Monument. In the areas of recreation, vegetation, fish and wildlife, and other environmental components, this chapter tells what is happening now.

Chapter IV assesses the effects the various alternatives would have on the Monument's environment.

We hope this document is useful to you. Some parts of it are long and complex. Federal law requires the Forest Service to conduct a thorough analysis of the area, the alternatives, and what their effects would be. If you have a particular interest, please check the index. That will key you to the pages that are particularly relevant. There is also a list of acronyms on the inside back cover. We hope you learn some new things in reading through this document! Thanks for taking the time to care about the National Forests, and Newberry National Volcanic Monument in particular.

CHANGES BETWEEN DRAFT AND FINAL

We received over 150 letters with formal comments on the draft EIS published in January 1994. We have incorporated many of your suggestion and ideas into this Final EIS. Many changes and improvement have been made. They include:

- We added a new alternative, C-Modified, to the range of alternatives as a direct response to public comment. This new alternative is summarized in Chapter II and analyzed in Chapter IV. Vegetation treatment is significantly reduced and the Monument Trail is added to Alternative C-Modified.
- Appendix B of this document contains a summary of the comments we received - and how we responded to them.
- The Management Plan accompanying this FEIS has been streamlined and improved. It includes standards and guidelines, a monitoring program, criteria for science and research, and other features.
- We developed a new map and accompanying text "Areas of Concern and

Opportunities." This resource synthesis map is included in the map packet. It responds to requests for more specificity in the management plan. This map and test shows the location of key resources such as old-growth ponderosa pine, wildlife corridors, fragile soils and geologic land forms.

- The index has been revised.
- The language in the FEIS has been corrected, clarified, and improved to make reading and understanding easier.

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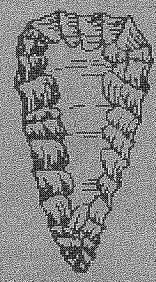


CHAPTER ONE

PURPOSE OF AND NEED FOR ACTION

Introduction

The United States Congress, recognizing the remarkable qualities of the Newberry Volcano area south of Bend, Oregon, created Newberry National Volcanic Monument on November 5, 1990. The first section of the legislation establishing the Monument sets out the purpose for designating this area a national treasure:

> **"There is hereby established the Newberry National Volcanic Monument in the State of Oregon as a component of the National Forest system in order to preserve and protect for present and future generations Newberry's remarkable geologic landforms -- and to provide for the conservation, protection, interpretation, and enhancement of its ecological, botanical, scientific, scenic, recreational, cultural, and fish and wildlife resources."**
> (Public Law 101-522)

The initiative for a national monument grew out of local concerns about the possibility of geothermal development in and around Newberry Crater. In the late 1980's a small group of Central Oregon citizens came to the Forest Service with a proposal to make the area a national monument. Recognizing the many interests at stake, the group invited to the table anglers, campers, hikers, geothermal interests, timber companies, environmentalists, community leaders, skiers and snowmobilers, local government representatives, mountain bikers, and horseback riders. This expanded group became known as the Monument Citizens' Committee.

After extensive collaborative negotiations, all interests on the Committee came to agreement on a proposal for a 50,000-acre national monument, to be managed by the Deschutes National Forest. This proposal also recognized the high potential for geothermal resources and the interests of geothermal leaseholders. The proposal specified a geothermal lease exchange process as a means of compensating leaseholders for the loss of their lease rights within Monument boundaries. It also established four other "special areas" adjacent to the Monument where geothermal exploration and development would be allowed, subject to certain restrictions. These areas are called the Newberry Special Management Area, the Transferal Area, the Transferal Area Adjacent, and the Transferal Corridor. They are described in more detail later in this chapter.

With the support and encouragement of the Oregon Congressional delegation, the group took their proposal to Washington, D.C., where they eventually convinced both Congress and the President of the special qualities of this national treasure. The result was the designation of the area shown on Map I-1 as a national monument, as well as establishment of the Newberry Special Management Area, the Transferal Area, the Transferal Area Adjacent, and the Transferal Corridor. A complete copy of the Monument legislation can be found in the Management Plan.

Deschutes National Forest and Newberry National Volcanic Monument

Figure 1-1

Location and General Description

Newberry National Volcanic Monument (NNVM) occupies some 50,000 acres of cinder cones, lava flows, and predominantly pine forests, in Deschutes County, between the communities of La Pine and Bend in Central Oregon. The Monument is about 25 miles long and varies in width between two and ten miles. Two mountain lakes full of trout and land-locked salmon (kokanee) are nestled in the caldera of massive Newberry Volcano. The caldera is also a wildlife refuge, home to bald eagles, bear, deer and elk. The highest point on the rim of the caldera is 7,985-foot Paulina Peak, offering spectacular views of the Oregon Cascades and across the high desert. The Big Obsidian Flow includes large chunks of black obsidian glass, and is easily accessible by car and trail. Scientists from all over the world come to study the features and learn about the forces that have shaped the landscape here, and to discover the legacy of more than half a million years of volcanic eruptions.

Outside the caldera, much of the rest of the Monument is a mosaic of tall trees and lava flows. The area is rich in cultural history; archaeologists have found human camps in the caldera dating back about 10,000 years, making Newberry one of the oldest known archaeological sites in the Pacific Northwest. The Monument also includes Lava River Cave and Lava Cast Forest, unique features created by past volcanic action. The northwest part of the Monument borders the Deschutes River, a National Wild and Scenic River.

The interpretive hub of the Monument is Lava Lands Visitor Information Center, located just off Highway 97, eleven miles south of Bend. Lava Butte, an ancient cinder cone, rises 500 feet above the visitor center. A lookout tower at the top of the butte is open to the public. Visitors can enjoy the view and learn about the tools that fire lookouts use to scan the horizon for puffs of smoke.

The Monument lies in the middle of a booming recreational area. The clear sky, invigorating climate, and rugged scenery of the Central Oregon high desert draws visitors from all over the country. People come to ski at nearby Mt. Bachelor, canoe the high Cascades lakes, test their skills at over a dozen golf courses, or relax at first-class destination resorts. The area's popularity as a recreation destination has translated into a boom in resident population growth, with Deschutes County growing at a rate almost twice that of the State of Oregon in the past five years.

Proposed Action

Section 6 of the Monument legislation mandated the preparation of a management plan to provide direction for Newberry National Volcanic Monument, as well as for the other special areas designated in Section 1 (The Newberry Special Management Area, the Transferal Area, the Transferal Area Adjacent, and the Transferal Corridor):

"...the Secretary shall develop a management plan which shall address the lands established in Section 1..." (Public Law 101-522, Section 6)

The Forest Service is the lead agency for preparation of this management plan. The Monument legislation identified certain issues that must be considered in the management plan:

RECREATION — Including consideration of a full range of existing and appropriate new facilities and programs for year-round recreation.

VEGETATION — Including consideration of a full range of management options, and a program to re-establish old-growth ponderosa pine ecosystems.

ROADS AND FACILITIES — Including consideration of general location, design, construction and maintenance criteria.

FIRE AND FUEL MANAGEMENT — Including consideration of a full range of management options for fuel hazard reduction and prescribed fire and fire control strategies.

WILDLIFE MANAGEMENT — Including general prescriptions for wildlife habitat improvements.

RESEARCH — Including identification and prioritization of research opportunities.

MONITORING — For air, water, wildlife, soil and other resources. Includes a research and monitoring program for geothermal resources to identify and assess any impacts from geothermal development on Monument and Special Management Area values.

CONFLICTS — Consideration of potential conflicts among uses and resources.

This final environmental impact statement (FEIS) has been prepared to respond to the mandate in the Monument legislation to develop a management plan. The action proposed by the Forest Service is to adopt a comprehensive management plan for Newberry National Volcanic Monument and the adjacent special areas, based on one of the alternatives analyzed in this FEIS. The plan will address (at a minimum) the eight issues identified in the Monument legislation.

The Regional Forester of the USDA Forest Service Pacific Northwest Region is the decisionmaker for this action. Deschutes National Forest staff prepared this FEIS to present the decisionmaker, the public, and other agencies with alternative ways to manage the land and resources of the Monument and the adjacent special areas. The FEIS discloses the environmental consequences of the alternatives and provides the decisionmaker with the information needed to choose the management plan.

This plan is a programmatic document, analogous to the zoning plans typically used by cities and counties. It establishes standards and guideline for managing the Monument, and defines "zones" or management areas where different uses are permitted or prohibited, in keeping with legislative intent to conserve, protect, and enhance the Monument values. This document will serve to guide and constrain proposals for specific actions to be taken at particular sites. Site-specific proposals would include such projects as campgrounds, picnic areas, trail locations, vegetation treatments, or construction of new facilities. Any such proposals will require a more detailed, site-specific environmental analysis before they can be implemented.

Purpose and Need

The **purpose** of the proposed action is to meet the requirement of the Monument legislation to develop a management plan for the Monument and adjacent special areas. The underlying **need** for the proposed action is to give the Forest Service clear direction on how to fulfill its mandate to "conserve, protect, interpret, and enhance" this special place, while providing enjoyment and learning opportunities for many thousands of visitors. By designating the Newberry area a national treasure, Congress intended to guarantee that future generations would be able to enjoy the recreational, scenic and other values of this remarkable landscape. In addition, both Congress and Central Oregon citizens felt that strong protection for the land would ensure that the unique geology, ecology, and cultural heritage of the area would be preserved. The legislation (and the management plan) is a promise to the people of Central Oregon and the nation that this national treasure will receive the care, attention, and respect it deserves.

Decisions to be Made

The Monument Plan will provide the following direction for Newberry National Volcanic Monument and the adjacent special areas (Newberry Special Management Area, Transferal Area, Transferal Area Adjacent, Transferal Corridor):*

► Broad management goals and objectives for the Monument

► Management areas or "zones" with associated objectives, and standards and guidelines for the zones, and for the Monument as a whole. Standards and guidelines will address:

- Recreation developments, settings, and uses
- Vegetation, including a program to re-establish old-growth ponderosa pine ecosystems
- Fish and wildlife habitats
- Federally threatened or endangered wildlife species or candidates for such listing
- Architectural design of facilities and signs
- Plants on the Regional Forester's "sensitive" list
- Roads and traffic management
- Scenic quality
- Protection of cultural or heritage resources
- Special uses and special events
- Interpretive programs
- Protection of geologic features
- Air quality
- Water quality
- Soil productivity
- Strategies for fire management
- Science and research opportunities
- Law enforcement

► A monitoring program. One objective of the monitoring program is to establish a carrying capacity for the Monument, with provisions to ensure that the carrying capacity is not exceeded.

► A Desired Future Condition (DFC) for the Monument. This is a "snapshot" of the future, and a projection of ecological processes and environmental conditions we want to restore or maintain under the management plan.

► Principal interpretive topics for the Monument.

► Whether to continue grazing allotments inside the Monument.

► An estimated activity schedule for intended management activities (each project requires site-specific analysis and approval).

► Recommendations regarding the Mokst Butte Research Natural Area and Lava River Cave Special Interest Area (both proposed under the 1990 Deschutes National Forest Land and Resource Management Plan). These areas lie within the boundaries of Newberry National Volcanic Monument.

* NOTE: All decisions and management for the adjacent special areas are subject to valid geothermal lease rights.

Other Special Areas Addressed in this Plan

The Monument legislation was proposed as a way to protect the geologic landforms and other resource values of this popular recreation area, and still allow for the possibility of geothermal development. To protect the values for which the Monument was created while addressing the interests of geothermal leaseholders (who participated in developing the legislative proposal), the legislation designates four different "special areas."

These areas, adjacent to the Monument proper, allow geothermal exploration and development, subject to varying restrictions. Geothermal leases have been issued on most of the lands within the special designations. Some of these leases were held prior to establishment of the Monument, and some were issued to compensate those who lost their leases when the Monument was created. Some of the lands are yet to be leased and could be offered for lease by the Bureau of Land Management.

The legislation requires the management plan for the Monument to address these special designations. The following list provides a summary of the designations and their relationship to the Monument proper. Map I-2 displays the designations and their geographic proximity to the Monument (for further detail, readers may wish to consult the Management Plan, which contains the legislation).

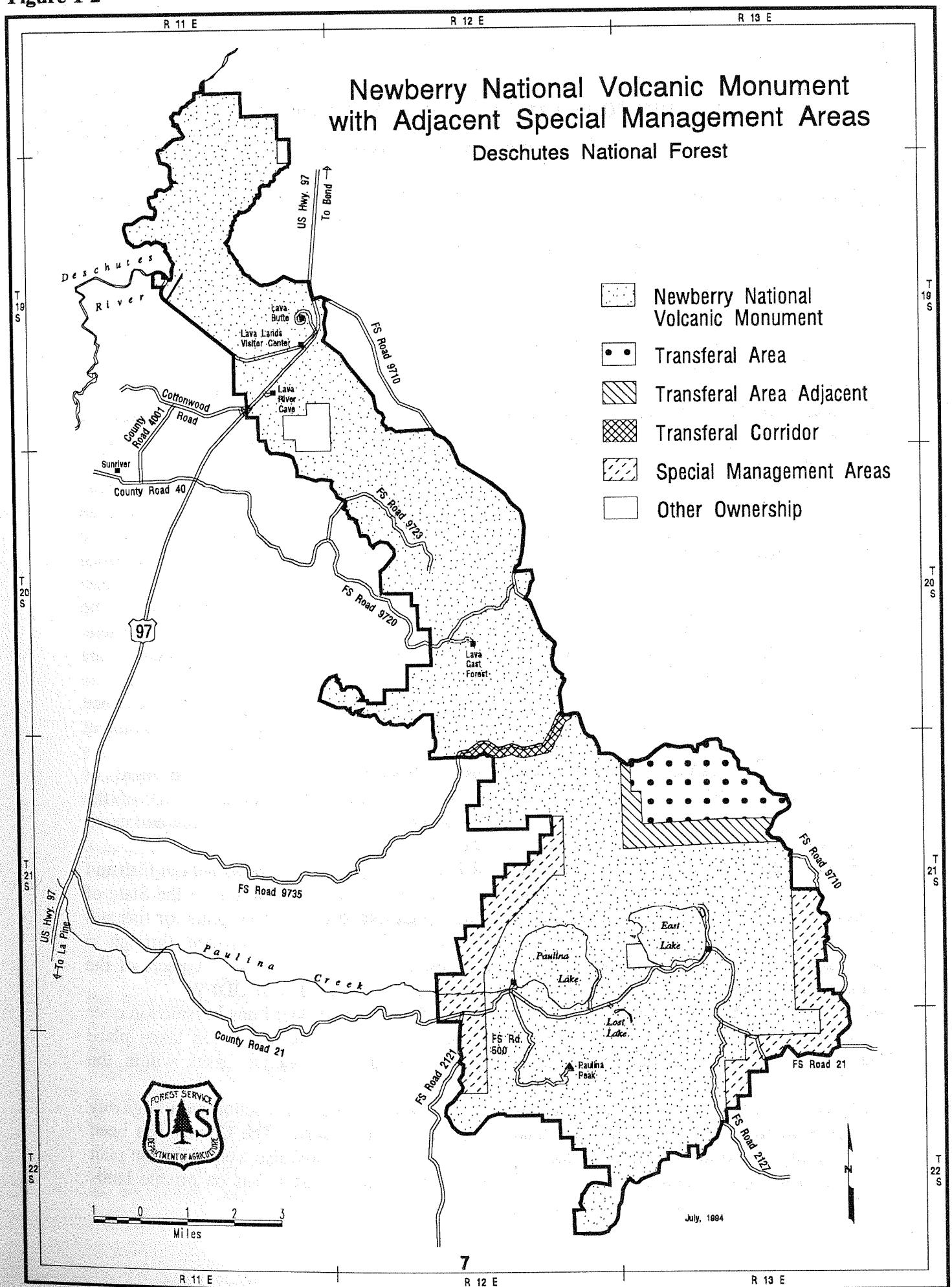
Newberry Special Management Area -- Located adjacent to the Monument along its eastern and western boundaries. Geothermal leases lie within the Special Management Area (SMA), but any exploration or development within the SMA is subject to a "No Surface Occupancy" restriction. This means no surface drilling, roads, or structures related to geothermal activity are allowed. Directional or slant drilling underneath the ground, but from outside the SMA boundaries, is permitted. If no commercial quantities of geothermal resources are developed within 30 years, the SMA becomes part of the Monument. Meanwhile, the SMA is to be managed as part of the Monument, subject to valid existing rights.

Transferal Area Adjacent -- Lies along part of the eastern boundary of the Monument, generally northeast of Newberry Crater, and is subject to a "No Surface Occupancy" restriction. Directly to the north of the Transferal Area Adjacent lies the Transferal Area, described below. Directional drilling under the Transferal Area Adjacent can occur only if commercial quantities of geothermal steam are "proved" in the Transferal Area. In terms of its surface management, the Transferal Area Adjacent is to be considered part of the Newberry Special Management Area.

Transferal Area -- Located just north of the Transferal Area Adjacent. Exploration for and development of geothermal resources within existing leases is permitted including surface developments, such as roads, well pads, and power plants. To the extent practicable given geothermal lease rights, the Transferal Area is to be managed in a way that preserves the natural values of the area. If no commercial quantities of geothermal resources are found and when leases are relinquished, canceled, or terminated, the Transferal Area will become part of the Monument. If commercial quantities are discovered, the area will no longer be considered or managed as part of the Monument.

Transferal Corridor -- This area lies along the part of Road 9735 (about five miles) that crosses the Monument in an east-west direction. It extends approximately 150 feet north of the road, and 1,000 feet south of the road. It is intended to provide a location for transmission lines to cross the Monument in the event of geothermal development in the Transferal Area. There are currently no leaseholdings within the Transferal Corridor.

Figure 1-2


Newberry National Volcanic Monument
with Adjacent Special Management Areas
Deschutes National Forest
Newberry National Volcanic Monument
Transferal Area
Transferal Area Adjacent
Transferal Corridor
Special Management Areas
Other Ownership
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
Deschutes River
Lava Butte
Lava Lands Visitor Center
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
FS Road 9710
FS Road 9723
FS Road 9720
Lava Cast Forest
97
FS Road 9735
US Hwy. 97
To La Pine
Paulina Creek
County Road 21
East Lake
Paulina Lake
Lost Lake
FS Rd. 500
Paulina Peak
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
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DEPARTMENT OF AGRICULTURE
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July, 1994

Relationship to Other Agencies' Plans and Authorities

FOREST PLAN FOR DESCHUTES NATIONAL FOREST: The Regional Forester approved a Forest Plan for the Deschutes National Forest in October 1990, shortly before the Monument proposal was signed into law. The Record of Decision for the Forest Plan recognized the possibility that the Monument legislation would be established. It directed that the lands under consideration for Monument status be managed in a way that would protect the values important to Monument legislation.

The Newberry National Volcanic Monument, as specified in the legislation, is to be managed in accordance with the laws, rules, and regulations pertaining to the National Forest System and the Deschutes National Forest, to the extent that such laws and regulations are consistent with the Monument legislation. The National Forest Management Act required the preparation of Forest Plans to direct management of each National Forest. The Monument legislation, which was passed after the 1990 Forest Plan was adopted, supersedes any Forest Plan direction that is inconsistent with the purposes for which the Monument was established.

The Monument legislation requires the preparation of a comprehensive management plan specifically for Newberry National Volcanic Monument. It also specifically exempts the Monument Plan from the need to amend the Forest Plan until the next regularly scheduled Forest Plan revision. Because the Monument legislation supersedes the Forest Plan, the direction provided in this Monument Plan will take precedence over the Forest Plan. The only time Forest Plan direction will apply to the Monument is when the Monument Plan does not speak to a particular issue and Forest Plan direction on that issue is consistent with the intent of the Monument legislation. During the next regularly scheduled Forest Plan revision, the Comprehensive Management Plan adopted for the Monument will be incorporated into the Forest Plan. The next regular Forest Plan revision is not expected to occur until after the Monument Plan has been adopted.

OREGON DEPARTMENT OF TRANSPORTATION: The Oregon Department of Transportation (ODOT) manages Highway 97 which crosses the northwest "neck" of the Monument. Transportation issues involving this segment of Highway 97 have been addressed in the Monument Plan in consultation with ODOT.

OREGON DEPARTMENT OF FISH AND WILDLIFE: The Oregon Department of Fish and Wildlife (ODFW) has responsibility for managing fish and wildlife populations in the State of Oregon. The Monument Plan will manage wildlife habitat to address ODFW goals for fish and wildlife species. The wildlife refuge in Newberry Crater was established through a memorandum of agreement between ODFW and Deschutes National Forest. Aspects of the Monument Plan alternatives involving wildlife have been coordinated with ODFW.

OREGON STATE MARINE BOARD: The Oregon State Marine Board has jurisdiction over recreational water bodies in Oregon. Coordination with the Marine Board has taken place regarding recreational management and objectives for East and Paulina Lakes within the Monument.

DESCHUTES COUNTY: The County manages Highway 21 from its junction with Highway 97 to its junction with Forest Service Road 21 at East Lake Resort. The County has been consulted on transportation issues related to Highway 21. The County also has a land use plan entitled "Deschutes County Comprehensive Plan." This plan regulates uses on private lands within the county, but not on federal lands.

WILD AND SCENIC RIVERS: The northwest boundary of the Monument is bordered by the nationally designated Wild and Scenic Deschutes River. A Wild and Scenic River Plan is currently being developed for that stretch of the Deschutes River that borders the Monument. Direction in the Wild and Scenic River Plan will be reviewed to ensure its consistency with Newberry National Volcanic Monument (NNVM) legislation and with the alternative selected as the Monument Plan.

All alternatives in this FEIS maintain the unique scenic values of Paulina Creek, which has been determined to be eligible for inclusion in the National Wild and Scenic Rivers System as a recreational river. Part of Paulina Creek lies within the Monument. The Deschutes National Forest will be undertaking a suitability study for this creek. In the interim, its outstandingly remarkable values will be protected under the alternative selected as the Monument plan.

THE NATIONAL REGISTRY OF NATURAL LANDMARKS: The National Registry of Natural Landmarks is maintained by the Department of the Interior and includes nationally significant geological and ecological features. Newberry Crater was designated as a National Natural Landmark in January 1976 and represents one of the largest Quaternary volcanoes in the contiguous United States.

TRIBES' INVOLVEMENT: This FEIS has been prepared in consultation with the Confederated Tribes of the Warm Springs Reservation of Oregon, in Warm Springs, Oregon; the Klamath Tribes headquartered in Chiloquin, Oregon; and the Burns Paiute Tribe in Burns, Oregon.

VEGETATION ENVIRONMENTAL IMPACT STATEMENT (EIS) DOCUMENTS: Alternatives in this FEIS analyze vegetation treatments to re-establish old-growth ponderosa pine ecosystem and to reduce high fuel loads. The legislation calls for allowing natural ecological succession of vegetation to the maximum extent practical, while preventing serious threats from insects, disease, or fire to areas outside the Monument. For guidelines in considering management of competing or unwanted vegetation, we have relied on these environmental documents: the Final Environmental Impact Statement (FEIS) for Western Oregon for Program Management of Competing Vegetation (August 1992), the FEIS for Managing Competing and Unwanted Vegetation for the Pacific Northwest (1988), Region 6 Interim Old Growth Definition (June 1993), and Forest Ecosystem Management, An Ecological, Economic, and Social Assessment (July, 1993). Any site-specific proposals for managing vegetation under this plan would comply with the mediated agreement for managing competing and unwanted vegetation.

Public Involvement

Shortly after the Monument was created, Forest Service planners met several times with the Monument Citizens Committee, which had spearheaded the drive for its creation. These meetings involved 20-30 people from various interest groups, and served as the starting point for identifying the issues and concerns that needed to be addressed in the plan.

NEWBERRY NATIONAL VOLCANIC MONUMENT ADVISORY COUNCIL: The legislation establishing Newberry National Volcanic Monument also called for the creation of an Advisory Council to "advise the Secretary of Agriculture on the preparation of the initial management plan" for the Monument. The Council was appointed by the Secretary of Agriculture in June 1992, and is made up of 11 members who represent various interests, such as recreation, environmental, tourism, timber, scientific, fish and wildlife, geothermal,

Deschutes County, and the State of Oregon, as well as two ex officio, "non-voting" representatives from the Forest Service and the Bureau of Land Management. The Council has met periodically for the past two years. After studying the issues associated with the Monument and reviewing the draft alternatives, the Council gave the Forest Service some specific recommendations about what they would like to see in the preferred alternative. Chapter II discusses the specific advice provided by the Advisory Council and how it has been addressed in the preferred alternative.

The Forest Service also held an internal "Vision Session" in the summer of 1992, bringing together a cross-section of creative and interested employees. The purpose of the retreat was to brainstorm ideas and issues for innovative land stewardship of this national treasure now entrusted to the Forest Service.

The Forest Service held a series of public meetings in the fall of 1992 in La Pine, Sunriver, Bend and Salem, to invite public comment on issues and the scope of the project. Participants saw a slide show on Newberry Monument and were invited to draw or write their ideas and concerns on a Vision Map. Vision Maps were also distributed to public places, schools and businesses throughout Central Oregon, and were mailed to over 1,000 people. Forest Service staff visited four high schools in Central Oregon to make brief presentations on the Monument and solicit students' comments. About 200 students contributed their ideas and opinions. Asking for the thoughts of "future generations" added spice and new information to planning efforts for the Monument. Overall, public comment centered around three main themes:

1) **People wanted recreational access.** They wanted to be able to hike, snowmobile, cross-country ski, ride horses, mountain bike, fish, explore, picnic, and camp as they had in the past. They were adamant about maintaining their access and ability to recreate in this special place. Alternative A responds most strongly to this theme by emphasizing developed recreation and increased access.

2) **In the hundreds of comments received, people spoke loudly and clearly that they did not want to see the Monument overdeveloped.** Many people expressed fears and concerns that the Monument would be commercialized or overcrowded. They urged the Forest Service to institute safeguards to ensure that the rustic, low-key atmosphere of Newberry Monument be maintained. People wanted opportunities for solitude, for discovering things on their own, for seeing wildlife, for getting out of their cars and out into nature on foot, by bike, or on horseback. Alternative B responds to this theme, by focusing on dispersed recreation, solitude, and wildlife habitat enhancement.

3) **People wanted more and better interpretation.** Visitors wanted more information about the unique features of Newberry Monument. They asked where to hike, which trails were good for kids, what caused volcanoes, how obsidian is made, and a hundred other questions. They wanted well-marked trails, and interpretive opportunities for all ages and interests. Alternative C was designed to address these needs, by providing a rich educational and interpretive focus for the Monument.

All alternatives to varying degrees respond to these main themes, as well as to the other key issues.

Following the publication of the Draft EIS in January 1994, the Forest Service held another series of open houses in Central Oregon to discuss the draft plan and answer question. These open houses were held in February 1994 in Bend, La Pine, and Sunriver. They included a slide show on the Monument's features, displays on the alternatives, and the opportunity to comment on the plan and ask question directly to Forest Service personnel.

Throughout the planning process, the Forest Service has also printed and mailed Newberry Update, a newsletter designed to keep people informed about the issues and progress of the Management Plan.

In response to public comments received between the draft and final EIS, the Forest Service developed a new alternative, C-Modified. This alternative is similar to C in the draft, with its emphasis on education, interpretation, and ecosystems --but proposes a scaled-back approach to vegetation management, and includes the Monument Trail. This new alternative is presented in Chapter 2, and its effects are analyzed in Chapter 4.

Appendix A of this volume has more information on public involvement. Appendix B includes a summary of the public comments we received, and how the Forest Service responds to them.

Issues Summary

The issues addressed in this environmental analysis and draft management plan came from a variety of sources. Public Law 101-522 establishing the Monument directed the Forest Service to consider a number of issues (Section 6b). They are all included here. Public comments and concerns led the agency to consider a number of other issues. Internal review further emphasized the need for protection of heritage (archaeological) resources and a sound interpretive program.

The following list of issues are addressed in this plan:

Recreation* (key)	Monitoring*
Roads and Facilities* (key)	Air Quality
Vegetation* (key)	Water Quality
Fire and Fuels* (key)	Scenic Quality
Fish and Wildlife* (key)	Law Enforcement*
Interpretation (key)	Local Communities
Heritage/Geology	American Indian Tribes
Science and Research*	Special Uses

*** Specific issue mandated by the Monument legislation**

The **key** issues are the issues that come up most frequently in public comment and over which there were the widely differing opinions. The alternatives were designed to respond in different ways to these issues. The other issues are also important, but did not drive differences in the design of the alternatives. They are addressed by provisions that would be applied in each of the alternatives.

Associated with the issues are "indicators of responsiveness." These are quantitative measures that reflect the issue, and indicate how the alternatives respond to the issue. For example, the miles of trail provided under a particular alternative is one indicator of how that alternative would respond to the recreation issue. The indicators of responsiveness are used in Chapters II and IV as ways of comparing the different alternatives and their environmental effects. The following pages discuss in more detail the issues considered in this analysis.

ISSUE 1 – Recreation (key)

More people commented on this issue than on any other. (We received a tremendous number of interesting ideas and suggestions, some of which are more specific than can be decided in this Plan.) The key facets of the recreation issue are summarized as follows.

What types and mix of recreation opportunities should the Monument provide? Some people want to be able to continue recreational activities they have traditionally enjoyed within the Monument, such as fishing and snowmobiling. Others feel that some of the recreational activities now taking place in the Monument (such as snowmobiling, horseback riding, mountain biking, special competitive events) unduly interfere with other recreational pursuits such as nordic skiing or hiking.

Some people want a wider range of opportunities, including activities not presently occurring (water skiing, waterslides, bungee jumping, parachuting, summer all-terrain vehicle trail use) inside the Monument. Other people want to be sure we maintain opportunities for solitude, discovery, and exploration. A number of commentors asked us to prohibit any all-terrain vehicles other than snowmobiles.

We also received suggestions to deal with recreational use conflicts by creating additional and/or separate trail systems or use areas, or by dispersing activities more widely throughout the Monument.

How can the quality of recreation experiences within the Monument be maintained? Many people expressed concern about the potential for over-advertising and overdeveloping the Monument -- "Don't create Disneyland," was an expression we often heard at our meetings. Some people feel present levels of use will soon begin to degrade the special qualities of the Monument they now enjoy. They express specific worries about campground overcrowding, erosion from overuse of existing trails, decreases in water quality of the lakes and hot springs, and impacts to fish, wildlife and fragile plant species. Others feel a "carrying capacity" should be defined for the Monument, in terms of the number of visitors it can accommodate without damage to its physical or biological features or to the quality of recreation experiences.

What kind and extent of recreation access should be provided to and within the Monument? Some people felt that the different areas and special features of the Monument (such as Lava Lands, Lava Cast Forest, Newberry Crater) as well as other Forest features outside the Monument (Cascade Lakes Scenic Highway, other trail systems, other sno-parks and snow play areas) should be connected with more extensive road or trail systems. Others wanted trails and roads to stay as they are; still others wanted more trails for specific activities such as horseback riding or mountain biking. Some thought a good way to lessen impacts from recreational use would be to provide facilities such as recreational vehicle (RV) parks adjacent to the Monument, and encourage the use of shuttles or tour buses inside high-use areas like the Crater, as an alternative to private vehicles. Some want to see access to the Monument improved for people with special physical challenges.

Indicators of Responsiveness:

- **Recreation Visitor Days (RVD's) for developed sites**
- **Trail and road miles**
- **Acres in different Recreational Opportunity Spectrum (ROS) types**
- **Capacity of facilities in Persons At One Time (PAOT's)**

ISSUE 2 — Roads and Facilities (key)

Peoples' concerns about roads and facilities involved car, RV, and trailer access to parts of the Monument, and the types, location, and extent of roads they might use. Some were concerned that adding roads and increasing access would diminish Monument values, such as solitude and wildlife habitat. People also had ideas and concerns about the types and sizes of facilities in the Monument, including campgrounds and interpretive centers, and how they would be maintained. How roads and facilities would be integrated with uses adjacent to the Monument (such as geothermal development) was also a concern. Key facets:

What road access should be provided? People differed on how much access they wanted and what type of roads they preferred. Some wanted more and improved roads into the Monument; some wanted roads to stay more or less the same; and some wanted fewer roads. Some people did not want to see any major new loop roads through the Monument. Others wanted to see more roads kept open during winter. Other ideas included closing old logging roads and converting some roads to trails.

Some people wanted improvements to specific roads only, such as Paulina Peak Road, Lava Cast Forest Road, or Road 21 into the caldera. Others wanted to avoid more paved surfaces or widening of the present roads. They felt such changes would bring in too many cars and people, and create congestion and safety problems.

What kinds of facilities should we provide? Again, there was a mix of ideas and opinions. Some people wanted improved and expanded interpretive facilities; others preferred the status quo. Some saw opportunities to expand the functions of facilities to include winter parking or recreation staging areas for snowmobiling and nordic skiing. For research facilities, comments generally favored allowing some small-scale development, if it did not detract from the other values for which the Monument was created. Geology and archaeology were mentioned as meriting special consideration for study and research.

Most who commented on campgrounds did not want to see new ones inside the Monument, especially in the caldera. Some people advocated expanding or improving existing campgrounds, others thought primitive campgrounds at Paulina Lake should be eliminated to protect resources. Others suggested adding campgrounds near (but outside) the Monument. Other suggestions included improving opportunities for dispersed camping, better facilities for RV's, and separate campgrounds for walk-in tent camping.

How should facilities be managed? The main concern here was that the Forest Service keep its campgrounds, buildings and roads in good condition. Specifically, people asked for clean restrooms, adequate sewage and refuse disposal, safe drinking water, attractive campsites, and well-designed and maintained trails.

How many and what kind of resorts should be available? People generally agreed the present number of private resorts and their rustic style is appropriate for the Monument. Some felt the resorts and associated services (store, restaurants) should be expanded and upgraded; others wanted to leave them about as they are. But people didn't want to see more resorts, or condos, or "Disneyland" accommodations.

Indicators of Responsiveness:

- **Miles of road closed or obliterated**
- **Facility and campground PAOT's (See Issue 1)**
- **Miles of road and trail by type and zone location**
- **Road density**

ISSUE 3 — Vegetation (key)

Concerns about vegetation inside the Monument center on how it looks, how healthy it is, how it can contribute to maintaining and increasing biodiversity, and how it should be managed to meet the values for which the Monument was established. Key facets of this issue are described below.

How should old-growth ponderosa pine ecosystems be restored? This question involves not only the methods used to restore old growth, but what kind of old-growth ponderosa pine ecosystems we should try to achieve, and how fast.

The legislation specifically requires us to consider a program to re-establish old-growth ponderosa pine ecosystems. The "historic" old-growth ponderosa pine ecosystems were the result of an average eight-to-twelve-year cycle of wildfire occurrence (as evidenced by fire scarring, and thought to be prevalent before European settlers arrived). They look quite different from the ponderosa pine ecosystems of today, where fire has been systematically excluded (in the last 90 years). On a local scale, the less "natural" ponderosa pine ecosystem of today also offers more biodiversity because it includes more kinds of trees, trees of different sizes, and a more abundant, diverse shrub understory. (The Regional definition of "ecological" old growth would apply to this ecosystem - please see Chapter III for a more detailed discussion.) At the landscape scale and above, the open, park-like stands of large old-growth ponderosa pine associated with frequent fires are very scarce. Thus, they contribute more to biodiversity in a landscape and regional sense.

Leaving large stands of fire-excluded ponderosa pine increases the likelihood of wildfires and insect infestations from mountain pine beetle and western pine beetle that are more extensive and severe than in times past. The thick shrub understory in these stands increases the risk that wildfires will start, will burn across large areas, and will burn "hot." Hot wildfires can destroy entire stands of large ponderosa pine as well as sterilize the soil, making restoration of vegetation slow and difficult. Today's "ecological" ponderosa pine ecosystem cannot be maintained over the long term without constant fire suppression efforts and frequent vegetation treatments. (For a more detailed discussion of ponderosa pine ecosystems see Chapter III.)

Relying extensively on prescribed fire to move young stands of ponderosa pine toward an old-growth state would likely mean slower progress in restoring ponderosa pine old growth and decreases in air quality. Mechanical thinning treatments would be likely to move stands toward the "historic" old-growth condition more quickly, but can have some impacts to soil productivity or visual quality. There are ways to avoid or correct these effects but the methods used (such as horse or helicopter removal of thinned trees, or scarifying compacted soil) are often much more expensive per acre of treatment.

Some people prefer the open, park-like look of the old-growth ponderosa pine ecosystems that originally evolved in conjunction with an eight-to-twelve-year wildfire cycle. Others feel there's a place for the brushier, more diverse old-growth ponderosa pine ecosystems that have resulted from fire exclusion, believing that they contribute more to biodiversity.

How should biodiversity and healthy ecosystems be maintained? The legislation directs us to consider "a full range of management options" when addressing the issue of vegetation management. It also mandates that land management activities shall allow natural ecological succession of vegetation to continue to the maximum extent practical. Some people feel no trees should be cut within Monument boundaries, and some specifically oppose any use of clearcutting. Others have asked how we plan to manage the spread of insects, disease, and wildfire. Some think a full range of management options should be available, but the emphasis

should be on prescribed fire as the primary management tool. Still others are concerned that without some level of tree-cutting or thinning, it will take longer to restore old-growth stands. In this dry climate, use of prescribed fire is limited to the relatively short periods when ground moisture and weather conditions are sufficient to prevent the fire from escaping control.

People are also concerned about other kinds of vegetation. Some are worried about the spread of noxious weeds that compete with native plants. Others want to ensure the protection and enhancement of riparian vegetation; some feel riparian areas are suffering from overuse by recreationists. Protection of sensitive plant species and/or the presence of grazing allotments within the Monument is also of concern to some people.

What is appropriate for the North and South Paulina Roadless Areas? These two areas, to the north and south of Newberry Crater, encompass some 35,000 acres. They are essentially roadless in character, but do have a few recreational trails going through them. Human impact on these areas in the last 50 years or so has been limited to suppressing fires, so the areas have continued to provide solitude for wildlife and people. Because fire has been excluded for so long, some of the forests in these areas have become denser, with more trees of a uniform age, and more dead wood than would have been there historically if fires had been allowed to burn. Some of the questions surrounding these areas are: Should we continue our approach of fire suppression and no management of vegetation? This would mean increasing potential for larger and more severe fires, more difficult to control and more likely to produce large burned areas, with changes in wildlife habitat, scenery, and recreational opportunities. Should we reduce the hazardous fuel loads now present in some areas which could threaten habitat? This could have effects on scenic quality and the undisturbed character of the roadless areas. If anything is done, should we emphasize mechanical treatments or prescribed fire? More information on the roadless areas in contained in the vegetation section of Chapter III.

How can we allow "Natural ecological succession of vegetation to continue to the maximum extent practical?" What is the best thing to do in areas that have high fuels loads? Doing nothing is one option, but one that risks larger and more severe wildfires, because fires have been excluded for so long that fuels have built up to dangerous levels. Treating some stands with mechanical thinning or prescribed fire is another option, but these approaches also have impacts such as soil compaction, scenery effects, air quality issues, and social concerns about cutting trees in a National Monument. These issues are discussed more fully in the Vegetation and Fire and Fuels sections of Chapters 3 and 4.

Indicators of responsiveness:

- **Acres managed for "historic" fire-based old-growth ponderosa pine ecosystems**
- **Acres managed for "ecological" fire-exclusion old-growth ponderosa pine ecosystems**
- **Acres treated for fuel reduction or insect/disease concerns**
- **Acres in grazing allotments**

ISSUE 4 — Fire and Fuels (key)

People were concerned about safety issues with respect to wildfire, and about what role fire should play in the ecological cycles of the Monument.

What should be our policy about fire safety in the Monument? People wanted to know what preventive measures we would take (such as restricting smoking or campfires) to reduce human-caused wildfires. Another important concern is providing for public safety in the

event of a catastrophic incident, such as a large wildfire. Other facets of this issue include what vegetation treatments we should use (and how extensively) to reduce fire hazard, and whether we should allow temporary or permanent roads for fighting wildfires.

How should we use fire to promote healthy ecosystems? Some wondered to what extent we could or should use prescribed fire as a way of recreating more natural ecosystems in the Monument (particularly in old-growth ponderosa pine ecosystems). The three key questions associated with this issue are:

1. What fuel levels are acceptable in terms of wildfire risk, ecosystem health, air pollution from smoke and habitat diversity?
2. How frequently or extensively should we use prescribed fire as a tool for achieving desired vegetation conditions?
3. Where in the Monument should we use this tool?

Indicators of Responsiveness:

- **Projected acres treated with prescribed fire by vegetative type**
- **Acres burned per year by type of fire (prescribed or wild)**

ISSUE 5 — Fish and Wildlife (key)

People wanted to be sure that wildlife abundance and diversity in the Monument continued, and where possible, improved. They wondered what programs we might institute to enhance fish and wildlife populations and to increase viewing opportunities.

What changes (if any) should we make in our present wildlife management approach? Could we be doing more to enhance wildlife habitat? If so, what? Some people suggested introducing additional species, such as peregrine falcon or mountain goats. Some suggested restricting hunting, others wanted hunting opportunities to continue. Others wondered whether specific habitat components (old-growth conifers, caves, or snags, for example) could be increased. Some people suggested creating additional wildlife refuges, while others wanted wildlife refuges limited to the one currently designated within Newberry Crater. Others wanted to be sure that threatened, endangered, or sensitive species would be protected.

How should we minimize conflicts between recreational visitors and wildlife? One facet of this concern involved conflicts between humans and bears in the Crater, and suggestions for managing the bear population and bear/human interactions there. Other commentors expressed concern about potential disturbance to wildlife from motorized vehicles, developments in deer and elk migration corridors, and increases in visitor use in sensitive habitat areas for species such as bats.

How should we manage for high-quality fishing? Suggestions here focused on protecting the fish from over-fishing and maintaining the quality of both the lakes and the anglers' experience. Some people asked that the speed limit on the lakes be maintained at 10 mph; others questioned whether commercial or special uses related to fish or wildlife were appropriate.

Indicators of Responsiveness:

- **Acres of wildlife habitat for selected species**
- **Projected population trends for selected species**
- **Projected change in fishing pressure (number of anglers)**

ISSUE 6 — Interpretation (key)

People were very interested in learning more about the archaeology, geology, and ecology of the Monument. Commentors in general appreciated the present interpretive program but wanted more extensive programs, a greater variety of programs, and better facilities to support the programs.

What type and level of interpretation will be provided, and where? This was the driving question behind a number of comments. People wanted more interpretive trails, more signs, and better marked trails. They liked the personal contact with roving interpreters and campground hosts. They enjoyed guided tours and asked for more education and interpretive programs, year-round if possible. People commented that the Monument receives different kinds of visitors with different needs. Some are just passing through on Highway 97 and want a quick taste of what the Monument is about. Others have the time and inclination to explore on their own the more remote "treasures" of the area. And still others prefer the interaction and learning they gain from a guided experience. Some people pointed out the importance of providing a strong, effective link between interpretation and scientific research in the Monument area.

What subject matter should be interpreted? Archaeology, geology, wildlife, ecosystems, ecology, the role of fire, the history of the area, and winter recreation were all suggested as topics. Some people were interested in learning more about the Monument in the context of its local, regional, and even global setting with respect to geology, archaeology, and ecology. Others suggested interpretive programs be used to promote environmental education and visitors' responsibilities in helping to protect the many special features of the Monument.

Indicators of Responsiveness:

- **Number of miles of interpretive trails**
- **Total capacity of interpretive facilities (including trails) in Persons At One Time (PAOT's)**

ISSUE 7 — Heritage/Geology

The main concerns people expressed were how to protect the unique features present in the Monument, while still providing for recreational opportunities and education.

How should we protect heritage (cultural) resources and sensitive geologic features? People who commented on this topic were unanimous in their desire to see heritage (cultural) resources protected. They wanted to be sure trails, roads and campgrounds did not disturb these sites and expressed concerns about the potential for looting. Other people expressed similar concerns about protecting the quality and beauty of the many geologic features found in the Monument. Some felt increasing access to more remote parts of the Monument could increase the risk of damage to these features. Other comments called for systematic evaluation of geologic and archaeologic sites to help address issues of protection and interpretation. Educating the public about the significance of heritage and geological resources was also suggested as something that could help reduce damage to these resources.

Indicators of Responsiveness:

- **Acres of vegetation treated (potential for disturbance)**
- **Percent change in Recreation Visitor Days (RVD's) at developed sites**
- **Percent change in trail miles**
- **Miles of road**

ISSUE 8 — Science and Research

What are the opportunities that we might want to develop for scientific research and exploration? Comments centered mainly on geology and archaeology, and what we can learn from the rich volcanic and human record the Monument holds. People were also interested in research related to the ecology of the Monument and to ecosystem management generally.

What research should be allowed in the Monument, and how should it be prioritized? The Monument legislation requires us to identify what research opportunities exist within the Monument, which opportunities are appropriate, and what the research priorities should be. This will allow us a basis to evaluate any requests or proposals we receive. We also need standards and guidelines as a framework so we can manage research projects in a way that protects the values of the Monument.

Some people want to see a wide range of geophysical and geological research allowed; others feel that research projects may need to be restricted to be consistent with the values for which the Monument was established. Some comments supported the establishment of small field stations or housing quarters within the Monument to facilitate research.

ISSUE 9 — Monitoring

Numerous commentors mentioned the need to monitor various features and environmental conditions in the Monument. They wanted to make sure these features and conditions continue to be protected, in the face of increasing visitation and use.

What should be monitored? The Monument legislation requires us to address monitoring needs for "air, water, wildlife, soil, and other resources." Additionally, it directs that the Secretary of Agriculture "in cooperation with the Secretary of the Interior, shall maintain a research and monitoring program for geothermal resources for the purpose of identifying and assessing the impact that present and proposed geothermal development in the vicinity of the Monument and Special Management Area may have on the values for which such Monument and Special Management Area were established." We also received specific requests to monitor for fish and wildlife, soil productivity, cultural (heritage) resources, geology, fire suppression, and fuels in the Monument.

ISSUE 10 — Air Quality

What measures should be taken to protect air quality? Some people were concerned that we maintain clean air in the Monument. They wanted some standards and monitoring in place to avoid compromising the present air quality.

Indicators of Responsiveness:

- **PM_{10}* and carbon monoxide concentrations in caldera during typical inversion periods**
- **PM_{10} and carbon monoxide concentrations in caldera in worst case inversion conditions**
- **Total tons PM_{10}'s generated by forest fires (prescribed and wild) per year**
- **Number of miles of unpaved roads**

* **PM_{10}'s are particulates in the air with a diameter of 10 microns or less - about 1/50 the size of the period at the end of this sentence.**

ISSUE 11 — Water Quality

What measures should be taken to protect water quality? Some people were concerned that we maintain clean water in the lakes and streams within the Monument. Some expressed concern over the potential for decreases in water quality as a result of camping, hiking, boating and other uses on or near the lakes. Erosion of soils into water bodies as a result of vegetation disturbance was also mentioned as a potential problem. Suggestions were made to develop standards and monitoring to avoid compromising the present water quality. Some also wondered what we would do to assure that Paulina Creek (designated as eligible for inclusion in the National Wild and Scenic Rivers System) receives adequate protection in the interim until Congress decides whether to include it.

Indicator of Responsiveness:

- **Percent change in Recreational Visitor Days (RVD's) for developed sites near water**

ISSUE 12 — Scenic Quality

People wanted to be sure that the scenic beauty they now enjoy would continue to be a key attraction of the Monument.

How will management activities "conserve, protect, and enhance" the scenic qualities of the Monument? Those who commented wanted to keep the relatively natural "feel" and look of the place. Some expressed concern about the impacts geothermal development near the Monument might have on scenic views. Some felt a standardized architectural theme for buildings and signs would help keep the area aesthetically pleasing. A uniform sign plan would also lend continuity to viewers' experience. Others suggested that we enhance views of the lakes, lava flows, and surrounding peaks. Some commentors thought facilities and roads could benefit from additional vegetative screening and maintenance.

Indicators of Responsiveness:

- **Visual sensitivity as measured by visitor numbers by zone**
- **Acres of corridor viewsheds**
- **Number of feature viewpoints**

ISSUE 13 — Law Enforcement

How will the Forest Service maintain an effective presence to minimize conflicts, vandalism, and other potential law enforcement problems in the Monument? Only a few comments were received on this issue. Public compliance with regulations can be encouraged in a number of ways, including education, facility design, and enforcement. The likelihood and risk that some people will violate regulations depends on a number of factors, such as amount and type of access to sensitive features; number of visitors; duration of stays; proximity of facilities to well-traveled routes and/or sensitive features; the frequency with which potentially conflicting uses occur in the same area or on the same trail; and the number of Forest Service personnel available to handle conflicts or enforcement problems.

ISSUE 14 — Local Communities

How will management of Newberry National Volcanic Monument affect loca communities? The Monument is a national treasure belonging to all the people of the Unite States. Yet it is also very important to local residents and communities. Some local people se the Monument primarily as a source of revenue and economic benefit because of the visitors i attracts to the area. Others see it primarily as a contributor to a desirable lifestyle that provide opportunities for high quality outdoor experiences. Still others value both of these aspects an feel that the exclusive pursuit of either would be detrimental to the other.

ISSUE 15 — American Indian Involvement

How can the American Indians' religious freedom be assured at NNVM? Fores Service policy and the American Indian Religious Freedom Act require that the setting an location of sites important for religious purposes be protected from disturbance and be availabl for use by American Indians. Deschutes National Forest personnel will continue to evaluat procedures in consultation with the Klamath Tribes, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Burns Paiute Tribe to cooperate in identifying an maintaining traditional uses of the Monument. If any sites important for Americans Indians religious purposes are identified, their setting and location will be protected from publi disclosure and made available for use by the religious practitioner.

How can the local American Indians' experience at Newberry be accurately presented and what role will present day Tribes play in telling their story? Consultation an coordination regarding cultural interpretive programs will occur between the US Forest Servic and the Klamath Tribes, the Confederated Tribes of the Warm Springs Reservation of Oregon and the Burns Paiute Tribe during planning and implementation. Mutual cooperation i important in order to preserve areas of cultural significance to living Indian people, to provid useful information to educate the public, and to improve understanding and respect fo archaeological resources and the culture they represent.

New knowledge about heritage resources is directly proportional to the amount of data recovered, whether through archaeological evaluations or recollections of living American Indians. The National Historic Preservation Act encourages sensitivity to the special concern of American Indians in historic preservation. It also encourages federal agencies to seek ou information from American Indians knowledgeable of historic properties in the area. Programmatic Memorandums of Agreement between the Tribes and the Deschutes Nationa Forest could improve the consultation process. Meetings and maintaining contacts with representatives of the local Tribes should continue to be a major emphasis.

ISSUE 16 — Special Uses

How will summer homes, resorts, and special use permits be managed in the Monument? People wanted to see well-maintained resorts offering quality service in the caldera. Most commentors wanted to see the number of resorts in the Monument remain at two, and they wanted the traditional rustic character of the resorts to continue. Whether to continue, expand, or reduce the presence of summer recreation residences in the Caldera (there are presently six) was also raised as an issue. Some people wondered if special events (Endurance Horse Back Rides, etc.) would continue to be allowed. Others suggested that the overhead powerline in the Crater be buried to eliminate its visual impact.

Planning Records

The complete planning record for this Final Environmental Impact Statement (FEIS) is available at the Fort Rock Ranger District, 1230 N.E. Third Street, Suite A-262, Bend, Oregon 97701. Included in the planning record are such things as reports on Monument resources, baseline data, maps, and all studies used in preparing this Final Environmental Impact Statement. All documents incorporated by reference are also part of the planning record. This planning record is available for public inspection and review.

CHAPTER TWO

ALTERNATIVES

Changes between Draft and Final

A new alternative, C-Modified, has been added to this chapter in response to public comment between draft and final. This alternative keeps the same focus on education, interpretation, and ecosystems as Alternative C, but has some changes. Vegetation management is scaled back in response to comments encouraging us to allow natural ecological succession in large parts of the Monument. The proposed loop road linking Lava Lands Visitor Center with Lava Cast Forest has been modified to make use of existing roads, with no new road construction involved. The Monument trail from Alternative A (Deschutes River to the caldera rim), has been added to C-Modified. More details on Alternative C-Modifed can be found in this chapter.

The Advisory Council advice to the Forest Service has been updated. The Newberry Advisory Council met four times between publication of the draft and the final EIS. Their recent advice, especially regarding vegetation management and ATV issues, is included here.

The comparison charts highlighting differences between the alternatives have also been updated to include Alternative C-Modified.

Introduction

This chapter is the heart of the environmental document. It describes how the alternatives were developed and how they differ in responding to the key issues identified in Chapter I. The alternatives are presented in comparison form, to provide a clear basis for choice for the public and the decision maker. The National Environmental Policy Act (NEPA) directs the Forest Service to consider a range of reasonable alternatives before deciding on a course of action that could significantly affect the environment.

Range of Alternatives

Alternatives Considered But Eliminated From Detailed Study

The Forest Service considered, but did not develop in detail, an alternative that would have severely reduced and restricted the recreational opportunities now available in the Monument. The legislative intent was clear that the Forest Service should provide a wide range of recreational opportunities: "Consider a full range of existing and appropriate new facilities and programs for recreation during all seasons of the year." (Public Law 101-522, Sec. 6b-1).

The Forest Service considered, but did not pursue, a "high development" alternative, that might have included many more roads, facilities and developments. Public scoping indicated broad and deep feeling not to "overdevelop" the Monument. "Don't turn it into Disneyland!" was a comment we heard over and over again.

The Forest Service received a number of site-specific proposals for new trail development -- from equestrian groups, snowmobile and nordic skiing clubs, the mountain biking community, and summer all-terrain vehicle (ATV) users. Since this plan is a programmatic document, we considered general direction and location for recreational programs, trails, and facilities, but avoided getting very site-specific. Some of the specific suggestions were incorporated into opportunities in the zones; some suggestions will be held and considered later when a site-specific environmental analysis is done.

Alternatives Considered in Detail

In the draft environmental impact statement, the Forest Service developed fou alternatives to respond to the requirements of the Monument Legislation, to address public issue about the Monument, and to provide decision-makers and the public with information neede to make a reasoned choice. A modified version of one alternative (C-Modified) was develope in response to public comment and Advisory Council recommendation for the fina environmental impact statement.

Four of these alternatives (A, B, C, and C-Modified) are "action" alternatives. The fift alternative (D) is the "no action" alternative required by NEPA.

Alternative D is the "No Action" Alternative required by the Council on Environmenta Quality (40 CFR 1502.14 (d)) and National Forest Management Act [36 CFR 219.12 (f) (7) regulations. This alternative would continue management of Newberry National Volcani Monument according to direction provided under the 1990 Deschutes National Forest Land an Resource Management Plan (Forest Plan), subject to provisions of the Monument Legislation.

Development of Alternatives

To develop alternatives, the Newberry planning team used a systematic process tha considered the Monument legislation; issues and ideas raised by the public; historic use of th Newberry area; problems and opportunities common to other national parks and monuments advice from our Advisory Council; and our own research into the area's ecosystems (includin human visitors).

The Monument plan is a programmatic document, similar in some respects to mini-Forest Plan. The legislation creating the Monument (Public Law 101-522) establishes th values for which Newberry National Volcanic Monument (NNVM) was designated, and whic the management plan must protect. The planning team performed a landscape scale analysis c Newberry National Volcanic Monument using the Forest Landscape Analysis and Desig methodology developed by Nancy Diaz and Dean Apostol on the Mount Hood National Forest This process was selected because it focuses on the landscape within and surrounding th Monument as a set of ecological systems. It is a method of exploring the relationships betwee the biological, physical and social components that comprise this system. The planning tean was able to apply ecological principles and processes to our current level of understanding.

The landscape analysis process featured a biophysical analysis of the area whil integrating social and political concerns and became the basis for development of th alternatives. The following summary outlines the steps of the process.

The first analysis step included identifying and mapping the landscape **ELEMENTS** those features comprising the structure of the Monument and surrounding area. Some of th

included broad plant communities, various lava flows and pumice flats, rocky outcrops, rivers, streams, lakes, and travel and utility corridors. Elements were considered if they contributed to the above ground structure of the land at a landscape scale.

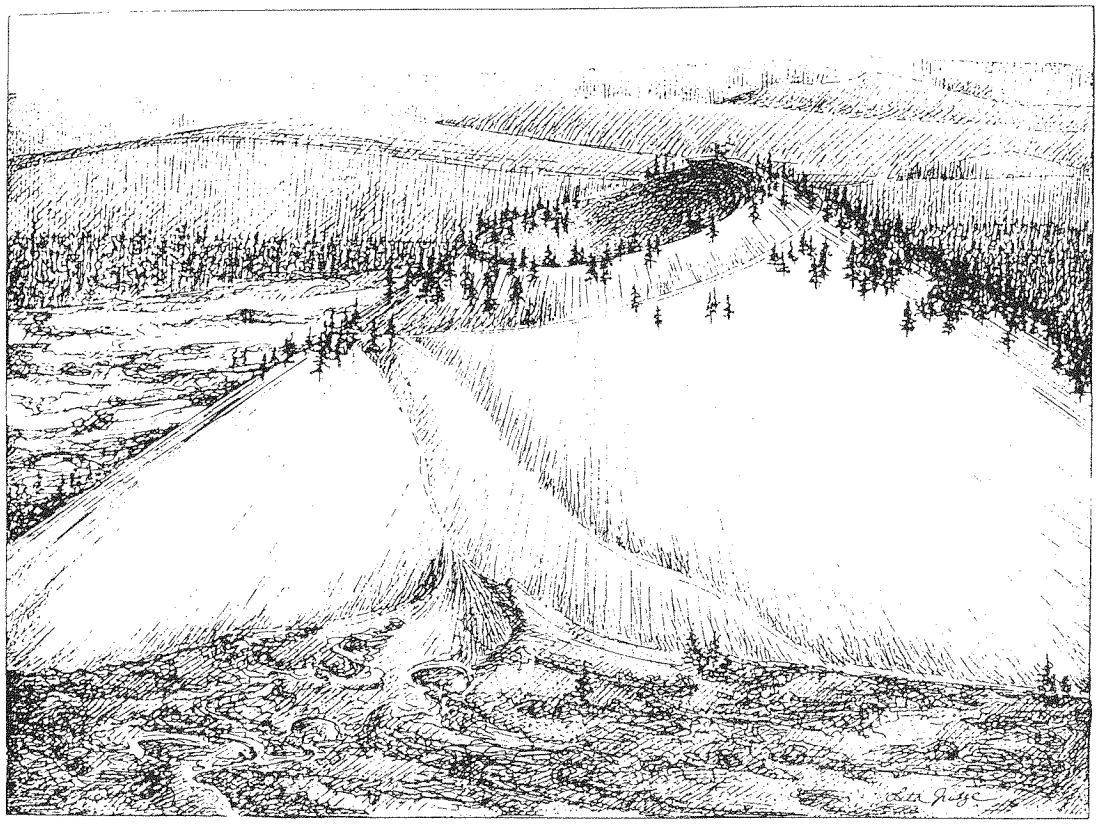
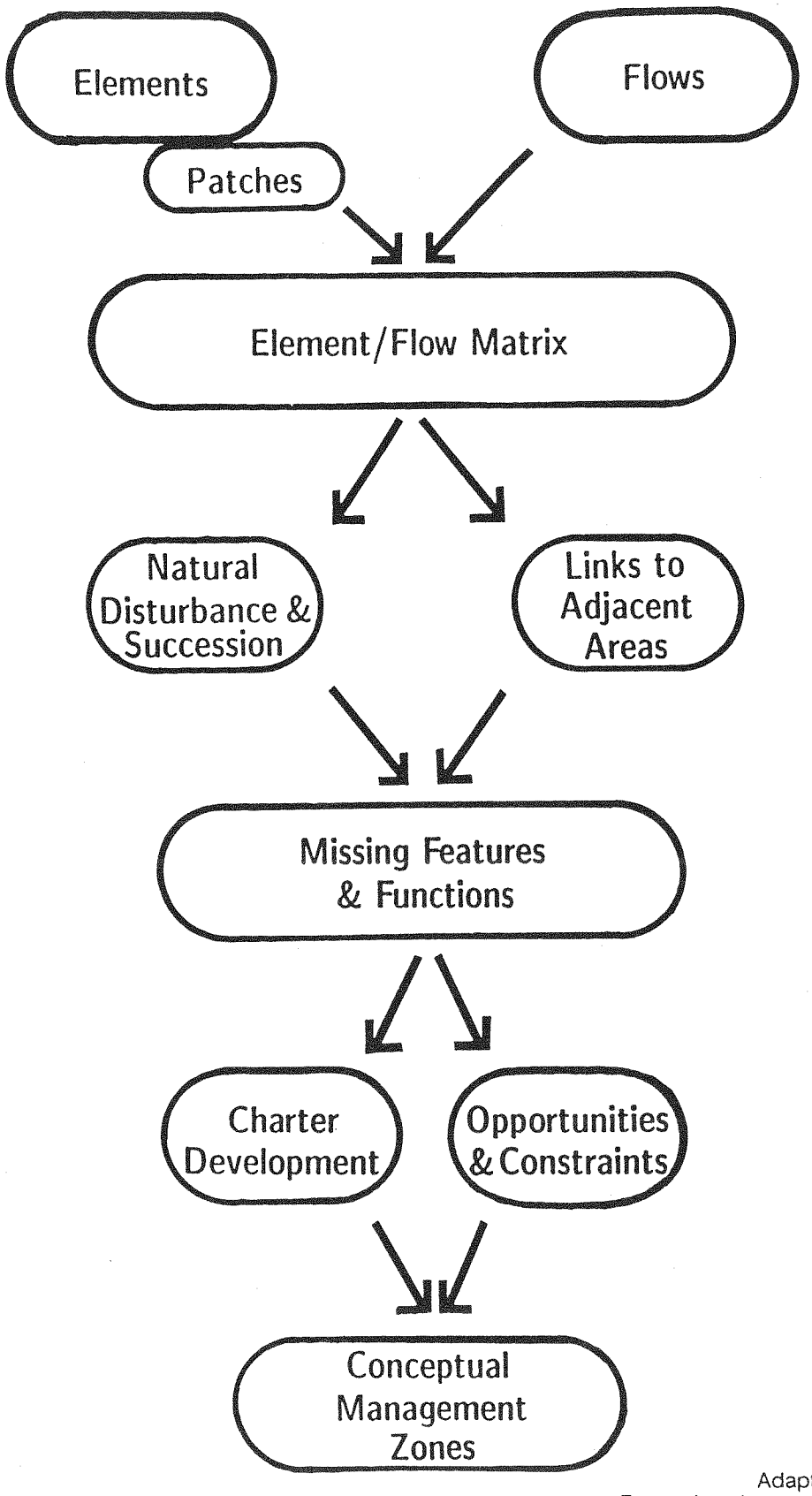


Figure 2-1

LANDSCAPE ANALYSIS PROCESS



Adapted from
Forest Landscape Analysis and
by Dean Apostol and Nancy Diaz

PATCHES were identified next. Patches are relatively distinctive or unique small-scale landscape elements, such as areas with sensitive or threatened and endangered (T&E) plants, heritage sites, critical habitat, or sensitive geologic features. While not displayed on the large-scale maps, these smaller scale features were identified and included as layers in the Geographic Information System (GIS) database.

We then identified and mapped **FLOWS**, those things that move through and interact with the elements or landscape structure. Flows included such things as both modern and prehistoric humans, deer, bats, elk, wind, fire and water. Many of these flows moved via corridors, while others were blocked by corridors.

We combined the elements, flows and patches to create a **MATRIX,** with elements along one axis and flows along the other. The purpose of this step was to document in written form the ecological/functional relationships between the elements and flows in order to identify areas of potential opportunities and/or conflicts.

NATURAL DISTURBANCE AND SUCCESSION were then described for this landscape; specifically how natural systems operate and how this affects landscape patterns. The role of water, fire (or its lack), and insects emerged as key components in disturbance and succession for this area.

LINKS between the Monument and the surrounding landscape (district, Forest, Central Oregon, region, nation, and world) were identified next. Both biophysical and socio-economic links were considered. The range of discussion included international interpretive connections (for example, to the Pacific "Ring of Fire"); the local economy; administrative jurisdictions; adjacent forested lands and geologic features; other national monuments; watersheds; and migratory patterns for birds and other animals.

MISSING FEATURES AND FUNCTIONS that may have formerly been part of the lands now within the Monument or that are potential opportunities for the future were discussed. These included physical, biological, and social features such as fire, quiet, aspen, and peregrine falcons.

Based on all this information, we developed a **CHARTER** that included legislative direction and the other applicable laws that must be considered as part of our planning process. Other special management areas, such as wild and scenic rivers, were included in this step. The charter and the legislation framed the direction of our thinking.

OPPORTUNITIES AND CONSTRAINTS were then brainstormed for the entire Monument. Many of these issues and considerations revolved around human habitats, emphasizing the relationship between people and the environment. In some cases these issues revolved around constraints such as potential resource damage or highway corridors bisecting wildlife migration corridors, while in other cases the issues were opportunities such as increased potential for wildlife viewing and the desire to be near water.

The concluding step in this process was to identify **CONCEPTUAL MANAGEMENT ZONES** that reflected the diverse biophysical areas within the Monument, as well as the opportunities and constraints identified. These zones include the River, Lava Butte, Transition, Flanks, and the Caldera. (See next section for more detail on the zones.) As alternatives for managing the Monument were developed, the boundaries of the conceptual management zones were refined under each alternative to respond to the purposes of that alternative. However, the variations are relatively small. The general size and intent of the management zones remain constant across the alternatives.

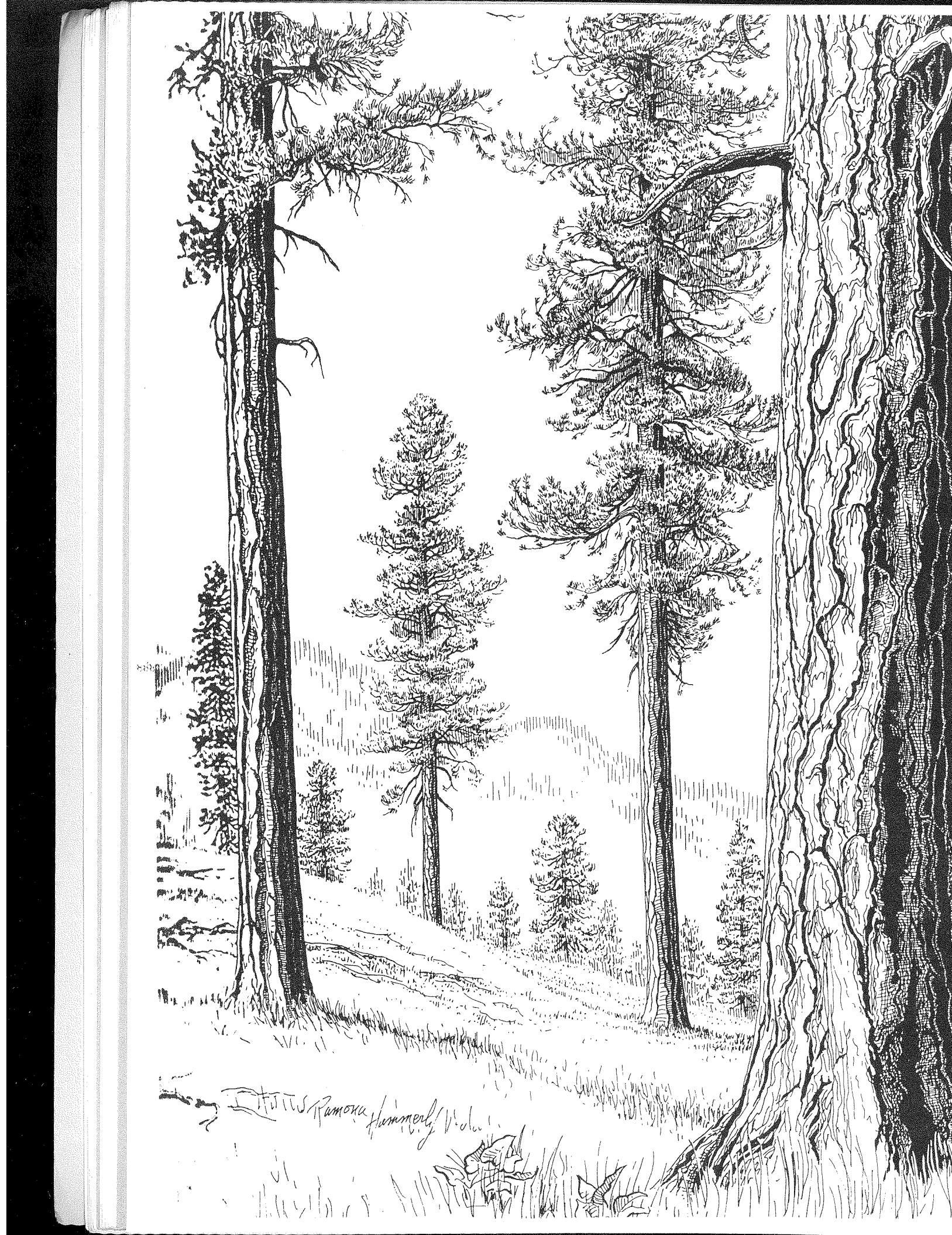
Management Zones

The planning team identified five distinct zones. These are: River Zone, Lava Butte Zone, Transition Zone, Flanks Zone, and Caldera Zone. There is an integrity to each of these areas; they are smaller geographic areas within the Monument that share common plant communities, wildlife species, and types of human use.

The **RIVER ZONE** is the area at the north end of the Monument that borders the Deschutes River. **Under any action alternative, the primary objective of this Zone is to provide wildlife habitat (deer, elk, osprey, waterfowl, others) and opportunities for solitary discovery.** This zone includes the riparian area along the river, and the lava flows from Lava Butte which spilled toward the river about 7,000 years ago. The River Zone is rich in wildlife, and rarely explored by people. It is about 4,000 acres.

The **LAVA BUTTE ZONE** includes the corridor area where Highway 97, one of the busiest roads in Oregon, passes through the Monument. **The emphasis in this zone is education, interpretation and day use.** Lava Lands Visitor Center in this zone welcomes over 100,000 visitors a year during its six or seven month season. We would provide many opportunities for people to get off the highway, learn about the Monument, see displays and exhibits, and perhaps take an interpretive walk. Special features include Benham Falls day-use area, Lava Butte fire lookout, Lava Lands Visitor Center, and Lava River Cave. This zone also includes a highly visible stand of old-growth ponderosa pine along the highway. The Lava Butte Zone encompasses about 6,000 acres.

The **TRANSITION ZONE** stretches from the Lava Butte area south to the caldera. **The objective of this Zone in all alternatives would be to provide a mix of recreation, scenic and interpretive opportunities.** This is an area of lava flows, forested lava islands (kipukas), and many varieties of tree types and plant communities. The Transition Zone provides a fascinating look at how the plant communities and trees change as elevation increases. Ponderosa pine gives way to lodgepole pine and the mixed conifer forest as you begin to ascend the slopes of the giant Newberry volcano. This zone is largely undeveloped, with the exception of Lava Cast Forest. Recreational use is incidental. The southern edge of this management zone includes the transferal corridor, which would allow for electrical transmission lines and commercial traffic to cross the Monument in the event of geothermal development in the transferal area. Total area in the Transition Zone: about 15,000 acres.



The **FLANKS ZONE** is also largely undeveloped, and there are only a handful of roads in this area. **The objective of this Zone would be to provide opportunities for exploring undeveloped country and enjoying solitude.** Vegetation continues to change as you move up the flanks of Newberry Volcano with lodgepole pine forests merging into stands of mountain hemlock and whitebark pine. The special management areas and transferal areas are managed as part of the Flanks Zone (subject to existing geothermal rights), bringing the total acres to about 22,000.

The **CALDERA ZONE** includes the area popularly known as Newberry Crater. **The focus of this zone is developed recreation.** Features and facilities in this zone include: Paulina and East Lake, Paulina Peak, Paulina Falls, the Big Obsidian Flow, Forest Service campgrounds, day-use areas, two resorts, and a network of recreational trails. In summer, there are many people in the caldera fishing, picnicking, camping, hiking, exploring, bicycling, horseback riding, and learning about the outdoors. In the winter, snowmobiling and cross-country skiing are popular activities. This zone is generally defined as the area within the Newberry caldera rim trail, with slight additions. The Caldera Zone is a wildlife refuge, and bears, bald eagles, deer, and elk share this special place with humans. Total area: about 13,000 acres.

Table 2-1

Management Zone Acreages by Alternative

(All figures in acres)

Alternative	River Zone	Lava Butte Zone	Transition Zone	Flanks Zone	Caldera Zone
A	3,479	6,048	14,652	21,813	13,629
B	6,414	2,169	15,596	22,701	12,741
C	3,645	5,883	14,652	22,701	12,741
C-Modified	3,645	5,883	14,652	22,701	12,741
D	N/A - See large map of Alternative D.				

Special Management areas and transferal areas are included in these numbers, mostly in Flanks Zone.

Resource Synthesis

Alternative C-modified was developed between draft and final in an attempt to respond to public comment. Some of those comments asked for more specificity in the management plan. People wanted to know specifically where old growth ponderosa pine stands were; where deer and elk migration corridors were; where vegetation management was planned; how were we identifying and protecting fragile soils and rare plants.

To respond to these comments, the planning team added a resource synthesis section to the draft plan. Within each of the broad management zones (River, Lava Butte, Caldera, etc.), we documented more closely the interactions of resources, plants and animals. We mapped the existing elements and the crucial features in these smaller areas to better portray the existing conditions there.

For example, an area might contain a stand of old growth ponderosa pine, an archaeological site, a key deer migration corridor, three known goshawk nests, and an interpretive trail. These attributes, together with ecological processes, and human uses must all be considered before locating and designing site specific management activities. The resource synthesis, called "Areas of Concern and Opportunity", is part of the Management Plan. It consists of a large map and accompanying text.

As the Forest Service moves toward implementation of this plan, this synthesis will be useful in identifying opportunities to enhance or restore ecosystems. Planning for any project under consideration would begin by consulting this synthesis to determine if the proposed project is a good fit with the concerns and opportunities within the particular area. Projects might include: wildlife habitat improvement, interpretive trails, old-growth ponderosa pine restoration, campground improvements, or others. We have also identified ecosystem components "on the edge," that need immediate attention and care in the first decade of the Plan to ensure their continued sustainability.

Features Common To All Action Alternatives

All action alternatives, in varying ways, meet the intent and purpose of the legislation establishing the Monument. That law states:

> **"There is hereby established the Newberry National Volcanic Monument in the State of Oregon as a component of the National Forest System in order to preserve and protect for present and future generations its remarkable geologic landforms and for the purposes of providing for the conservation, protection, interpretation, and enhancement of its ecological, botanical, scientific, scenic, recreational, cultural, and fish and wildlife resources."**

All the action alternatives (A, B, C, & C-Modified) share the following goals, and desired future conditions. Key opportunities that occur under all alternatives are also listed here.

This section is divided by resources and issues, corresponding to the outline of issues in Chapter 1.

Overall Goals for NNVM

- Manage the Monument so that the values and resources for which it was designated are protected, enhanced, and interpreted.
- Keep the Monument a beautiful place, where people enjoy playing, exploring, and learning about nature.
- Sustain or restore ecosystems and ensure ecosystem resiliency within the Monument and Special Management Area.
- Protect the health and safety of visitors to the Monument.
- Provide for scientific research consistent with the purposes for which the Monument was established.
- Ensure that tree diseases, insect infestations, fire hazards, and fires within the Monument and Special Management Area do not seriously threaten resources outside the Monument and Special Management Area boundaries.
- Manage the surface of Newberry Special Management Area and of the Transferal Area Adjacent as part of the Monument, while allowing appropriate subsurface exploration for, and development of geothermal resources.
- Manage the Transferal Area and Transferal Corridor, to the extent practicable and consistent with the Geothermal Steam Act of 1970 and existing rights under geothermal leases, in a way that preserves the natural values which would qualify this area for designation as a national monument.
- Provide equal opportunity for all people to enjoy the Monument.

Desired Future Condition and Key Opportunities

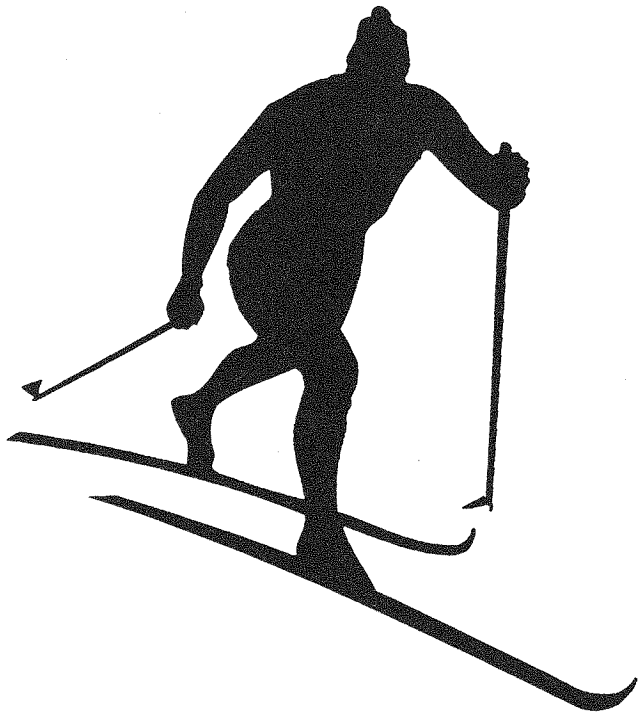
Recreation

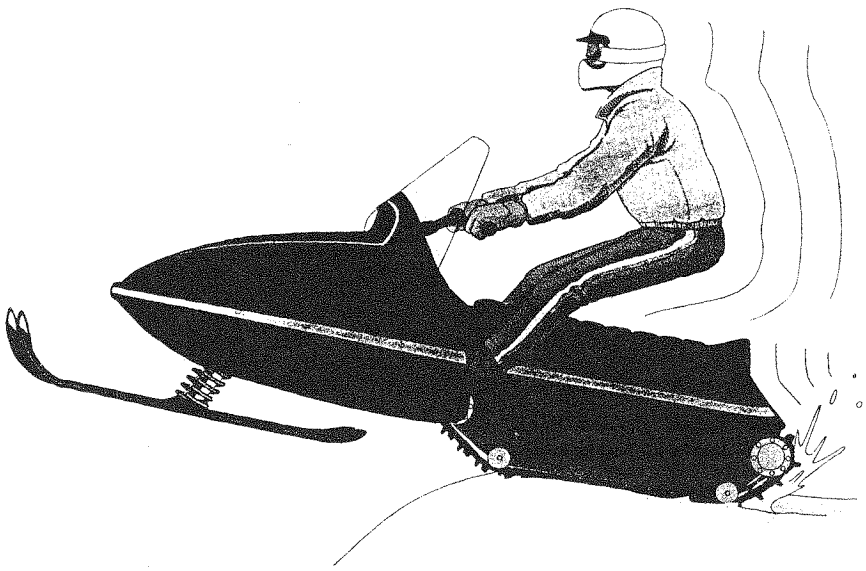
Desired Future Condition

Visitors enjoy many recreational opportunities. Many types of high quality settings provide for developed recreation, dispersed recreation, and opportunities for solitude. People coming to the Monument continue to recreate in "traditional" ways that were taking place at the time of Monument legislation (1990). Among these are: horseback riding, hiking, picnicking, camping, mountain biking, exploring, snowmobiling, cross-country skiing and fishing.

The Monument provides some recreational settings that are peaceful and quiet and others that are busier. Visitors feel that campgrounds, trails and other facilities are well-designed and not over-crowded. The current 10-mph speed limit on East Lake and Paulina Lake is maintained to promote a low-speed, low-key recreation experience, with emphasis on fishing. Campgrounds provide quality overnight experiences. Visitors feel safe, protected and secure in Forest Service campgrounds. Visitors using Monument trails experience minimal conflict with other trail users, and trails are planned and managed to reduce or prevent conflicting uses. Recreational activities

do not disturb sensitive plants, animals' habitats, geologic features or heritage (cultural) resources.





Recreationists in all seasons discover new trails, experiences, and places to explore. Both nordic skiing and snowmobiling opportunities are enhanced by additional trails and warming shelters in the caldera. All people, including mobility and sight-impaired individuals, can find ways to enjoy the Monument and its many features. New facilities comply with regional accessibility standards.

All the alternatives would provide for a range of recreation opportunities and settings. The mix of these opportunities would differ according to the recreation objectives under each alternative, and in each zone.

NOTE: The Recreation Opportunity Spectrum (ROS) is a system used by many federal and state land management agencies to categorize different outdoor recreational settings. A brief description of some classes used in NNVM follows. They are listed from the most "developed" to the least.

Rural generally means that there are facilities for human use in an area (shelters, buildings, roads, campgrounds, parking lots), and you are likely to encounter lots of other visitors. Parts of the landscape have been modified, and the sights and sounds of other people will be readily evident.

Roaded Natural means the landscape appears natural, but roads and trails access the area, and some facilities are present. You can expect less interaction with other people. There is evidence of the human hand on the landscape, but these modifications generally harmonize with the environment.

Semi-primitive motorized means the area is characterized by a predominantly natural appearance, with little evidence of human use or change. Motorized use is permitted. There are very few controls or restrictions, and you would not be likely to encounter many people in these areas.

Semi-primitive non-motorized means the area is predominantly natural. Motorized use is prohibited, and the area remains mostly unaltered by human presence. You would not be likely to encounter many other visitors in these areas.

The mix of these ROS classes varies by alternative. ROS maps appear in the section later in this chapter called "Alternatives At A Glance." See also Chapter IV, Recreation.

Key Opportunities

- Increase the miles of trail, and provide new trails for a variety of users. New trails are proposed in every action alternative that reflect the character and goals of the Alternative.
- Improve signing on trails
- No new trail development in the riparian areas of the River Zone.
- Improve access for the physically challenged with improved surface trails. Offer varying degrees of challenge on trail system (easy - hard).
- Protect the Dome area by modifying or eliminating the Dome Trail.
- Consider new trails from Benham Falls to Lava Lands Visitor Center, and between Paulina and East Lakes.
- Move Benham Falls day use up to the bench above the river.
- Parts of the Monument provide opportunities for solitude.

Roads and Facilities

Desired Future Condition

Roads are safe, efficient, and maintained to a standard appropriate for the setting they traverse. The road system provides access to developed recreation sites and is minimal elsewhere. Unneeded roads are obliterated or closed, as appropriate.

Facilities are attractive, in character with natural surroundings, neat, clean, and meet visitors' needs. They support and enhance experiences in the Monument. Federal, state and county standards for public safety and welfare are met.

Key Opportunities

- Improve Paulina Peak Road to graveled, one-lane road.
- Reroute entrance to Lava Lands, Lava River Cave, and Lava Cast Forest by using Cottonwood Road interchange. This would improve safety and visibility for visitors.
- Replace, renovate, or expand Lava Lands Visitor Center (size would vary by alternatives).
- Build a new greeting/portal center in the vicinity of Road 21 and 2121, near the west entrance to the caldera. The size and function of this facility would vary among the alternatives, but would provide orientation for visitors to the area. In three alternatives (A, C & C-Modified), it would also serve as a winter sno-park.
- Lava River Cave remains open for some use.
- Renovate Lava Butte lookout
- Build warming shelters for winter recreation in the caldera and possibly flanks.
- Upgrade day-use areas

Vegetation, Fire & Fuels

Desired Future Condition

Vegetation restoration activities have served to sustain or enhance ecosystems. Plant communities within the Monument contribute to biological diversity at a landscape and regional scale. Stands of old-growth ponderosa pine are visible in the Monument primarily in the River, Lava Butte, and Transition Zones. These stands include some of the "historic" park-like stands that were present before EuroAmerican settlement; and some fire-excluded ecologically diverse old growth typical of today's forest. This diversity of stands offers scenic views, ecological health and diversity, and wildlife habitat. (See Vegetation section of Chapter 3 for complete definitions of old growth.)

Landscape patterns across some parts of the lodgepole pine forests resemble the "mosaics" of young, mature, and older stands prevalent before EuroAmerican settlement. Unique vegetative communities within NNVM (mountain hemlock, edges of lava flows, *Botrychium pumicola* (pumice grape fern), riparian, etc) are present and healthy. Biodiversity of plant communities is evident in the landscape. Vegetative management has been used only where needed to reestablish fire as an agent in vegetative succession, to improve wildlife habitat, or to reduce serious threats to resources outside the Monument to acceptable levels. Fire is an appropriate part of long-term management, and fire suppression activities continue to some extent. Livestock grazing has been eliminated in the Monument. The Monument's ecosystems are functioning well, and missing elements (such as fire) have been re-incorporated into natural processes. Fire, insects and diseases all play their natural roles as agents of change in vegetation communities, at levels that can be sustained by the ecosystems within the Monument.

Key Opportunities

- Manage vegetation around campgrounds and facilities for scenic quality, privacy, and safety.
- Use thinning, fire, and other silvicultural practices to alter vegetation and improve wildlife habitat and where necessary reduce serious wildfire and insect infestation threats (resources outside the Monument) to acceptable levels.
- Protect all threatened, endangered, and sensitive plants.
- Incorporate the Forest's strategy to preserve *Botrychium pumicola*.
- Make the old-growth ponderosa pine stand on Highway 97 a high priority for re-creating "historic" conditions.
- Protect riparian areas, meadows and unique vegetation communities.
- Reduce population of undesirable exotic plants.
- Keep roadless areas intact as ecological systems.

Fish and Wildlife

Desired Future Condition

Diversity and abundance of wildlife species continues and where feasible, increases. Visitors are able to enjoy wildlife watching opportunities. The Monument provides some relatively scarce habitats (for example, riparian areas and fire-based ponderosa pine old-growth). Deer continue to migrate through the Monument. Where allowed (outside caldera), hunting continues. Threatened, endangered, and sensitive species continue to live within the Monument. Habitats are managed to contribute toward their recovery. Some wildlife habitat improvement

projects have taken place, and conflicts between people and wildlife have been reduced. Wildlife interpretation is part of Monument's educational programs, and people enjoy opportunities to see many kinds of wildlife. The North and South Paulina Roadless Areas within the Monument remain essentially undisturbed by roads and provide solitude for species that are sensitive to human disturbance, as well as a natural appearing landscape.

Fish populations continue to play an important role in the ecosystem (food for eagles, osprey, otters). Non-game fish populations remain at levels that do not compete with game fish.

The primary purpose of the River Zone is to protect wildlife. Osprey, bald eagles, waterfowl, elk, deer, otter, and other species continue to live in this special area relatively undisturbed by people.

Key Opportunities

- Provide at least one Bald Eagle Management Area (the Forest Plan BEMA on East Lake).
- Maintain caldera wildlife refuge.
- Provide a quality fishing experience on East and Paulina Lakes. This includes opportunities to find solitude on the lakes, to catch trout and kokanee, and to enjoy the experience of fishing without undue conflicts or crowding.
- Protect caves to preserve bat habitat; offer interpretive programs on bats.
- Provide habitat to prevent declines of neotropical migratory birds (links and connections to the rest of the Western Hemisphere).
- Increase understanding of wildlife habitats and relationships through interpretation, education, and research.
- Avoid road or facility development in sensitive wildlife habitats.

Interpretation

Desired Future Condition

Effective, engaging, accurate interpretation is provided to inspire visitors' curiosities and encourage resource protection. Strong partnerships between the Forest Service and local, state and national organizations allow for a wide range of experiences, such as: guided walks, demonstrations, interactive media, self-directed discovery, and hands-on participation in research and other projects. Expanded opportunities, especially in the Lava Butte and Transition Zones, support longer visitor stays than at present. Students of all ages come and learn not only about the Monument, but about how it fits within the local, regional, and even global context of geology, ecology, and human history.

Key topics of interpretation are geology, archaeology, ecosystems, and the roles of the Forest Service and natural resource management, and interpretive themes for the Monument are clearly identified.

Interpretive facilities are designed to "facilitate" a visitor's interaction with NNVM's natural and cultural resources, rather than serving as attractions in themselves. They provide information on the Monument's special features, activities, and ideas for exploration of the area. They are clean, functional, accessible, appealing, and designed to be consistent with the Monument's architectural theme.

Visitors enjoy and learn from their visit. They leave with a good impression, and a sense of stewardship for the land. They do not litter, damage NNVM's features, or remove resources.

Key Opportunities

- Highlight the links between Central Oregon and the surrounding area, with respect to volcanology, human history and ecosystems.
- Provide some level of interpretation for all management zones.
- Increase and improve signing on trails, at key features, and in campgrounds.
- Use interpretation as a tool to address resource management concerns (e.g., removal of obsidian).
- Design facilities and programs so that people get out of their cars and experience the Monument up-close.
- Form partnerships with local American Indians for cultural interpretation of NNVM.
- Restore (or adaptively reuse) Paulina Guard Station (CCC Building) in caldera to its historic condition; operate it as a "living museum."
- Develop space for classes, workshops, and research seminars.
- Support field trips and activity programs for all ages.
- Provide guided walks and talks on the Lava Butte flow, in the pine forests, through Lava River Cave, and to interesting features in the caldera.
- Encourage learning independently (self-discovery). "Discovery packs" are available to be checked out at the visitor center. These contain such supplies as topographic maps, wildlife and plant identification guides, compass, and magnifying glass.
- Provide roving interpreters on the trails or in the visitor center.
- Build 24-hour kiosks with orientation maps and interpretive displays.
- Provide books, pamphlets, magazines, etc.
- Participate in or observe living history presentations that make Monument history and stories come alive.
- Develop and environmental education support program in partnership with local schools.

Heritage/Geology

Desired Future Condition

Archaeology and geology are primary interpretive themes for NNVM. Information on geology and archaeology is accurate and up-to-date. Visitors know and respect the unique American heritage and geologic history of Newberry Volcano. Protection of geologic and archaeological resources is enhanced by law enforcement, interpretation, education, inventories, and monitoring.

Caves within the Monument are protected for their historical and ecological significance (bats, etc) and unique geology.

Key Opportunities

- Locate and design all roads and facilities to minimize impacts on important geologic and archaeological features.
- Protect obsidian and other geologic and archaeological resources with a specific strategy and standards & guidelines, especially in high-use areas like the caldera.
- Rehabilitate and restore significant sites and historic properties. Focus on the caldera and the two sites on the National Register of Historic Places.
- Complete archaeological inventory. Prioritize sites for evaluation; evaluate them; then nominate sites to the National Register.
- Interpret, protect, and preserve the Paulina Lake site.
- Develop partnerships with American Indians, scientific and educational organizations,

individuals and corporations to study, protect and interpret resources.
- Evaluate the area between the two lakes before encouraging or discouraging use.
- Develop world class heritage displays. Focus on the Paleo-Indian period and how these people interacted with the environment.
- Complete the analysis of data recovery projects already undertaken.
- Preserve and interpret the Big Obsidian Flow, Newberry caldera, Northwest Rift Zone, Lava Butte, Benham Falls, the lakes, and other special geologic features.
- Develop a strategy to interpret the unique geology of Newberry to the public.
- Complete an inventory and evaluation of the geologic features within the Monument.
- Complete agreement documents for the treatment and management of significant cultu resources.

Science and Research

Desired Future Condition

Appropriate research is encouraged and supported in the Monument, based on standar and guidelines and evaluation criteria. Some of these criteria may include: minim environmental damage, opportunities for public participation, and the availability of resear information to the public.

Research projects are compatible with recreational use, and in general, do not displa recreational activities. (Allow for exceptions: bat research may displace cavers, hot sprin research may displace bathers, etc.).

Science and research projects aid in the public's understanding of the Monument ecosystems and how natural processes work.

Key Opportunities for Science and Research Projects

- Demonstration areas highlighting ecosystems management.
- How people lived 10,000 years ago.
- The effects of nearby geothermal development.
- Underwater archaeology in the caldera lakes.
- How Newberry is connected to the Pacific Ring of Fire.
- The effects of fire on various tree and plant communities.
- Wildlife ecosystems and species interactions.
- Fish dynamics and the best way to promote a healthy fishery in the lakes.
- Bat ecology and bats' role in the ecosystem.
- Radiometric dating of geologic features in NNVM.
- Studies of tephra deposits in the Northwest Rift Zone as geologic time markers.
- Studies of the formation of obsidian flows and volcanic eruptions.
- Paleo-Indian campsites in the Monument.
- Lithic technology and how it has evolved over time.
- Distribution of Newberry obsidian outside the caldera.
- American Indians use of traditional plants from NNVM.
- Distinguishing the different chemical signatures of the caldera flows.
- Complete inventory and evaluation of the area between the two lakes.
- Other opportunities that increase knowledge and are compatible with Monument values.
- Study of fungus flora.
- Cultural chronology and affiliation of prehistoric sites.
- Effects of volcanic activity on biotic productivity.

Monitoring

Desired Future Condition

A monitoring program for key Monument values has been established. The program is accurately determining and evaluating trends in the resiliency of Monument ecosystems, visitor satisfaction, and the effectiveness of management direction in meeting the intent of Monument legislation. Some key resource values to be monitored include: geological, ecological, botanical, scientific, scenic, recreational, cultural, and fish and wildlife. The monitoring program also assesses the impacts of geothermal activities on these values. See the Monument Plan for complete monitoring program.

Key Opportunities

- Monitor the recreational carrying capacity, and have appropriate corrective measures in place if carrying capacity is exceeded.
- Recognize that monitoring will continue with site-specific projects.
- Establish both short-term and long-term monitoring.

Air Quality

Desired Future Condition

Air quality in the Monument remains good or improves. It does not endanger human health. Visitors are satisfied with the air quality, including visibility and odor. Emissions from motor vehicles, wood burning (campfire, woodstove, and forest-fire smoke), and any geothermal or other commercial developments near the Monument do not degrade the special values for which NNVM was created. All federal and state requirements and standards for air quality are met. See the Monument Plan for complete monitoring program.

Key Opportunities

- Monitor weather conditions at several locations with the Monument.
- Collect background air quality data for at least one year prior to the operation of any geothermal power plant(s) on Newberry Volcano.
- Monitor air quality on an on-going basis for fine particulates (PM_{10}) and visibility, as well as other pollutants that may be produced by traffic, fires, or nearby geothermal developments.

Water Quality

Desired Future Condition

Groundwater quality remains excellent in the Monument. All drinking water is safe for human consumption and meets or exceeds state and federal drinking water standards. Public drinking water systems have been upgraded, where needed, to provide reliably uncontaminated (bacteria-free) water. Wastewater treatment and disposal is adequate to protect both ground and surface water from degradation.

Surface water in Paulina Creek, Paulina Lake, and East Lake is of good quality and supports beneficial uses such as fisheries and other aquatic life, aesthetics, and water-contact recreation. Water clarity has been stable or improved since monitoring by the U.S. Geological Survey began in the caldera in 1991. Activities in the Monument do not adversely affect the quality of water entering and leaving NNVM in the ponds along the Deschutes River.

Water sources necessary to meet program objectives have been found and developed. Water conservation programs are in place in the Monument.

The natural fluctuation of hot springs and fumarole activity is well understood and is not adversely affected by human activities.

Key Opportunities

- Replace and upgrade the holding tank for drinking water in the Paulina Lake water system.
- Monitor water quality in wells on an on-going basis for state ground-water standards and primary and secondary drinking- water standards.
- Conduct a thorough investigation and evaluation of the effectiveness of current waste disposal facilities (e.g., septic systems) in the caldera. Change, upgrade, or repair systems as necessary.
- Use "Best Management Practices" (BMP's) to protect water quality, tailoring them for site-specific projects and conditions in NNVM. (See Appendix H of the Deschutes National Forest Land and Resource Management FEIS for a complete discussion of BMP's. Also, see standards and guidelines in the Management Plan for BMP requirements.) See the Management Plan for the monitoring program.

Scenic Quality

Desired Future Condition

Overall, the landscape of the Monument appears scenic and natural to the average visitor. It reflects the diversity, beauty, and ecology of the High Lava Plains of Central Oregon. Outside of developed areas, evidence of human alternations or management is generally not evident to the casual observer or is subordinate to the landscape character. Natural disturbance patterns are part of the landscape structure within the Monument.

Some landscapes have been enhanced by opening views to distant peaks, unique rock forms, unusual vegetation, or other features of interest. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors have been rehabilitated.

Buildings and signs reflect the character of the Monument.

Key opportunities

- Create or enhance vistas and views of interesting landscape features.
- Enhance screening of negative visual elements.
- Provide visual buffers in campgrounds and other recreation areas.
- Shape or grade the land to provide screening or improve vistas.
- Bury powerlines in order to eliminate linear breaks in the forest canopy.
- Upgrade and/or restore recreation facilities to provide high quality recreation settings.
- Provide architectural and signing standards that will result in a long-term transition toward complementary forms, colors, and materials used for structural development in

the Monument (currently being developed).
- Remove stumps in recreation areas.
- Rehabilitate existing vegetative openings that do not complement or blend with the surrounding landscape.
- Highlight viewing in areas of unique vegetative, archaeological, zoological, or geological interest.

Law Enforcement

Desired Future Condition

An effective Forest Service presence reduces vandalism, resource destruction, and disturbances to other visitors.

Key Opportunities

- Consider increasing law enforcement patrols if necessary.
- Stress education and resource protection in interpretive programs to cut down on vandalism. Use roving interpreters to provide a "presence" that is relatively benign, and friendly, but still delivers the message of ethical behavior in the Monument.

Local Communities

Desired Future Condition

Visitation to the Monument contributes to economic diversity in the local communities. The quality of the recreational experience in the Monument draws new and return visitors. The Forest Service and other agencies work together to support a responsible level of tourism and visitation to the Monument.

American Indian Involvement

Desired Future Condition

Local American Indian tribes are involved in developing cultural interpretive programs, identifying continuing religious practices and current traditional uses, and monitoring projects in the Monument. Tribes are consulted concerning projects that have the potential to affect cultural resources. American Indian Tribes are consulted concerning traditional cultural properties, sacred sites, and Tribal religious practices. Effective working relationships with local American Indian Tribes are promoted.

Lands and Special Uses

Desired Future Condition

Appropriate special uses such as railroad and electric power corridor right-of-ways, summer homes, horse endurance rides, and other recreation events support and contribute to the values for which the Monument was created. Two well maintained resorts (East Lake and Paulina Lake Resorts) provide a high quality experience while maintaining their traditional rustic character. The present summer homes on Paulina Lake remain.

The Mokst Butte Research Natural Area (RNA) continues to provide baseline ecological

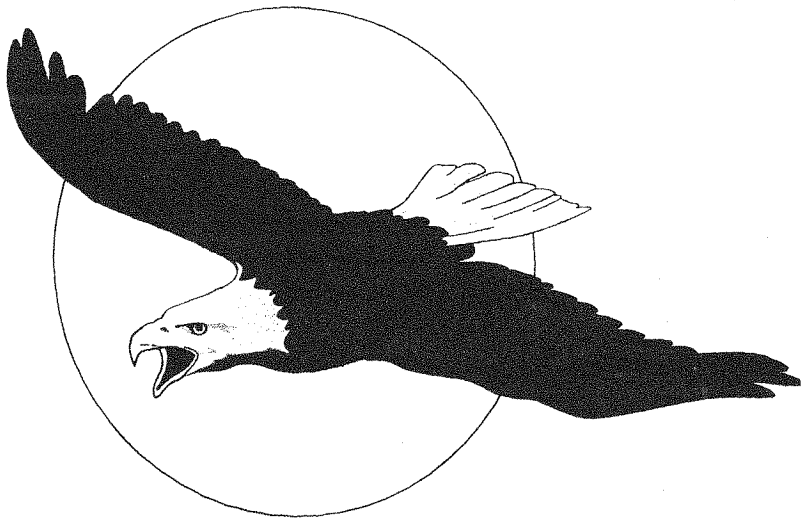
research opportunities as part of the National Research Natural Area Program. Th recommendation made by the Regional Forester in the 1990 Forest Plan was to establish Moks Butte as an RNA. Final establishment would by approved by the Chief of the Forest Service

Special areas outside the Monument designated by Monument legislation are managed t meet the intent of the legislation. Where so designated by the legislation, these areas ar managed as part of the Monument, with their values preserved and protected, subject to vali existing geothermal lease rights.

In the Newberry Special Management Area and the Transferal Area Adjacent, these right involve sub-surface drilling only. No surface occupancy is allowed. In the Transferal Area geothermal rights include opportunities for exploration and development. The Transfera Corridor is land designated to provide a corridor across the Monument in the event o geothermal development.

Key Opportunities

- Evaluate any requests for additional special use permits to determine if they are consistent with Monument legislation and goals.



Alternatives at a Glance

Alternative A — At A Glance

This alternative would protect the special values identified in the Monument legislation, while emphasizing developed recreation opportunities. It would accommodate the highest number of visitors to the Monument. This alternative provides access to many areas within the Monument, and has the most roads, trails, and facilities. Many different kinds of "controls" could be used to direct recreational activities in ways that protect other resources. This is the most people-oriented alternative, designed to provide large numbers of visitors a quality experience in NNVM.

Some of the most popular places in the Monument would be busy, bustling, and humming with life and activity under this alternative. A wide variety of safe, directed activities would guide and inform visitors about unique opportunities.

Interpretation would be state-of-the-art, and often high-tech. For example, at Lava Lands Visitor Center, children and adults might use interactive video displays that show volcanoes erupting or American Indians hunting within the Monument 10,000 years ago. The Monument offers information and activities for people of all ages and interests.

Key Features

A new **Monument Road** would be proposed under this alternative, running the length of the Monument from Benham Falls to Road 21 near the caldera. This new road would provide increased access to areas of NNVM and provide a scenic loop for motorized visitors. The new road would link existing roads as much as possible, but some additional road construction would be required. New roads in selected other areas (Transition Zone, Flanks) would increase access and provide recreational opportunities.

Campground capacity in the caldera would increase by 20-40 percent over present levels to provide for more visitors to NNVM. A new developed campground would be built in the Transition Zone. Up to three additional hike-in campgrounds would also be developed in the Flanks and Caldera.

A new **Monument Trail** would run the length of the Monument, providing access to a series of loop trails, linking the zones together, and providing a high-quality recreational experience for hikers, mountain bikers, and horseback riders. Major new trail developments are also proposed for the Transition Zone and in the caldera from the lakes up to the rim.

ATV access is provided to East Lake Resort, and an ATV "pass-through" corridor would be provided in the Transition Zone. Street legal ATV's may use existing roads in the Monument.

Lava Lands Interpretive Center would be expanded and upgraded to serve a large number of visitors in an efficient and engaging way. Emphasis is on providing the "short stop" visitor with a taste of what the Monument has to offer.

Lava River Cave remains open all year.

One **Bald Eagle Management Area** exists in the caldera.

The focus of **Vegetation Management** is around campgrounds, day-use areas, and other popular facilities. Most of the rest of NNVM is left alone, allowing ecological succession to take place. Where feasible, some areas would be managed for movement toward the old-growth ponderosa pine ecosystem.

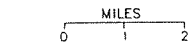
A **New Portal Facility** on Road 21 outside the caldera provides information and orientation. This portal facility also serves as a sno-park in the winter, enhancing snowmobiling and cross-country skiing.

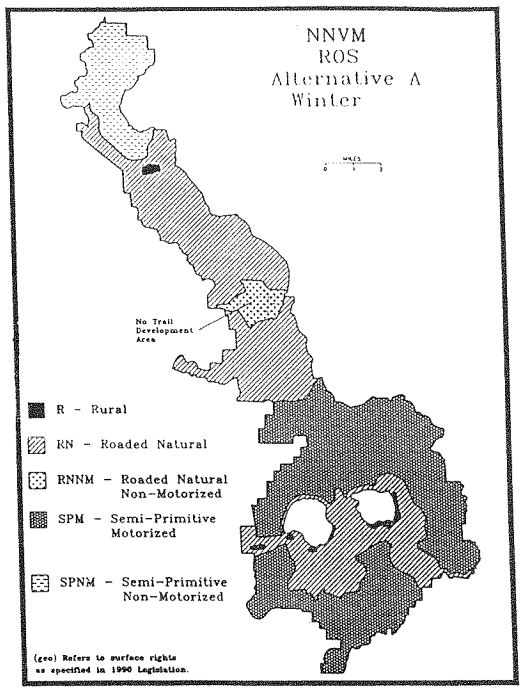
Table 2-2 **Alternative A at a Glance**

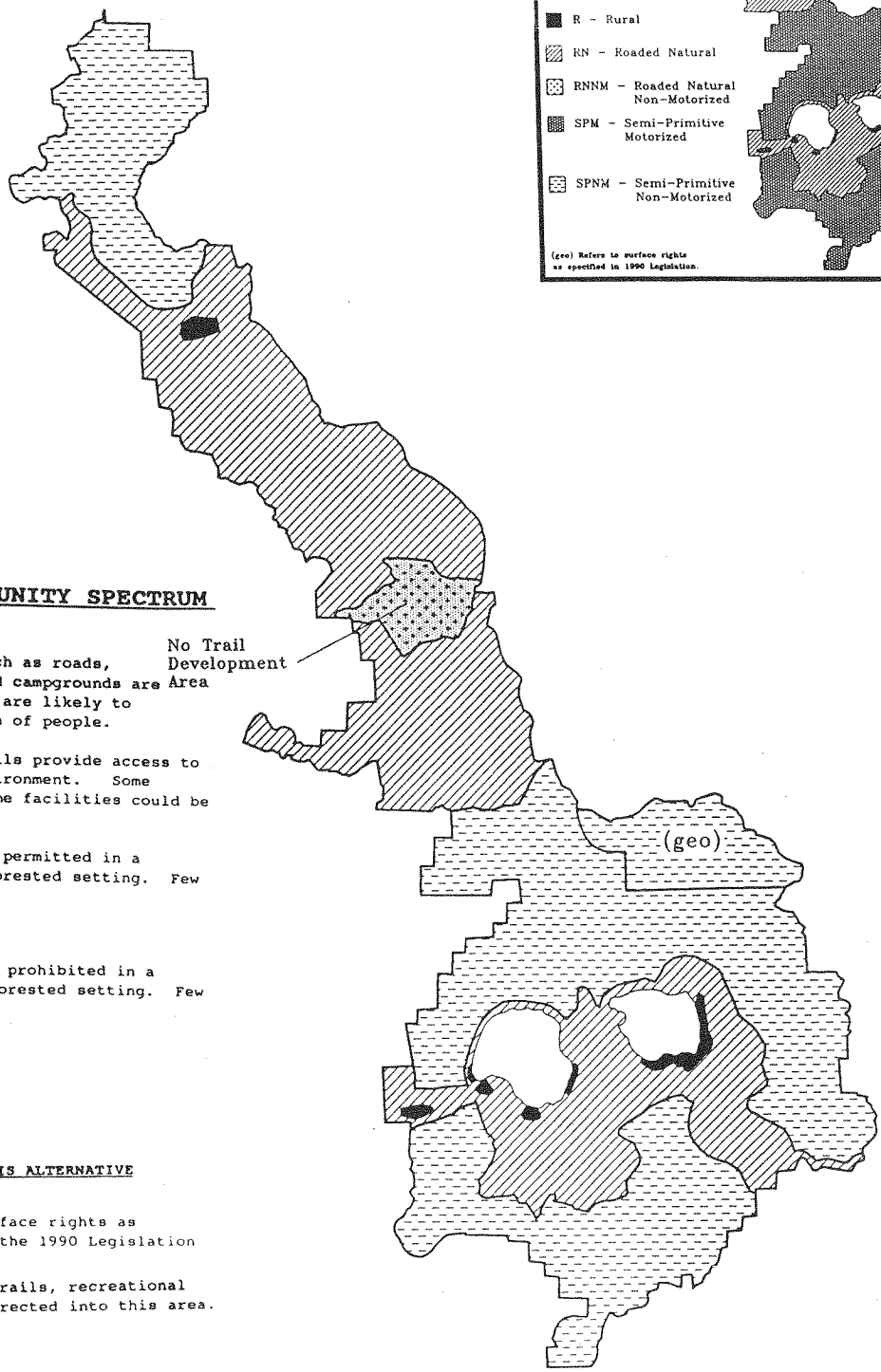
Description	Projected
Change in number of campsites in caldera	+ 20 - 40%
New campgrounds outside the caldera	2 - 4
Change in miles of summer trails	+ 60~70 miles
Miles of interpretive trails	19
Change in capacity of interpretive facilities	+ 120 - 210%
Miles of road	67
Percent of NNVM in semi-primitive ROS classes	53%
Percent of NNVM in roaded natural ROS class	46%
First decade restoration of ecological processes in lodgepole pine (acres)	1,000
First decade restoration of old-growth ponderosa pine (acres)	1,000
Long-term (50+ years) total acres restoration of ecological processes in lodgepole pine	6,200
Long-term (50+ years) total acres restoration of old-growth ponderosa pine	1,000
Number of Bald Eagle Management Areas (BEMA's)	1

Figure 2-2

NNVM ROS Alternative A Summer







RECREATIONAL OPPORTUNITY SPECTRUM

RURAL — R

Facilities such as roads, buildings, and campgrounds are present. You are likely to encounter lots of people.

ROADED NATURAL — RN

Roads and trails provide access to a natural environment. Some people and some facilities could be present.

SEMI-PRIMITIVE MOTORIZED — SPM

Motorized use permitted in a undeveloped forested setting. Few People.

SEMI-PRIMITIVE NON-MOTORIZED — SPNM

Motorized use prohibited in a undeveloped forested setting. Few People.

ADDITIONAL ROS CLASSES IN THIS ALTERNATIVE

(GEO)

Refers to surface rights as specified in the 1990 Legislation

ROADED NATURAL NON-MOTORIZED — RNNM

No roads or trails, recreational use is not directed into this area.

(The key characteristics of the recreational opportunity spectrum classes are found on a table in chapter 3 recreation)

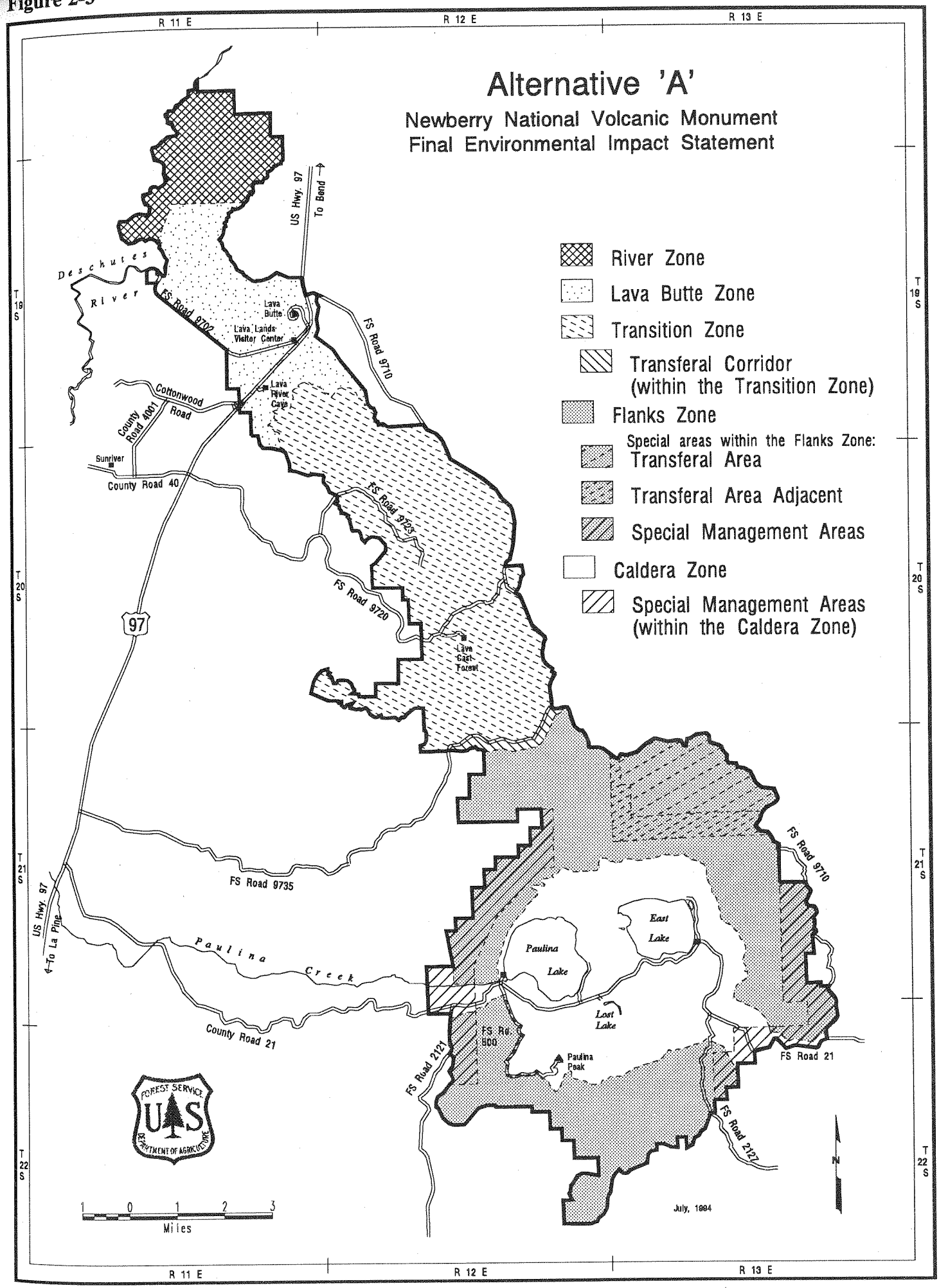
Table 2-3

POINT - COUNTERPOINT

Alternative A

POINT	ISSUE	COUNTERPOINT
Increased access provides opportunities for people to drive, bicycle, hike in new parts of NNVM. Provide for many new visitors; increase campground capacity to accommodate more people; expand day use. Some access provided for ATV (class I and III) users.	RECREATION	More people means more crowding in some areas; less privacy; more possible damage to resources.
Monument Road connects all zones and provides scenic driving experience.	ROADS	Road will cost money to construct; may enter sensitive areas of NNVM. Could reduce opportunities for solitude and wildlife habitat.
Vegetation treatments focus on heavily-used areas; some stands move toward old-growth ponderosa pine.	VEGETATION	Large areas of NNVM left to ecological processes. No management except fire suppression. High risk of more severe wildfire in some areas due to fuel accumulations.
Increased visitation may impact and disturb wildlife populations.	FISH/WILDLIFE	Species that tolerate disturbance do well. "Watchable wildlife" opportunities encouraged.
Lava Lands provides services to many visitors. Shuttles, guided tours, "controls" to manage many visitors.	INTERPRETATION	Many people drawn to Visitor Center. May lose some chances for solitude, quiet.

Figure 2-3


Alternative 'A'
Newberry National Volcanic Monument
Final Environmental Impact Statement
River Zone
Lava Butte Zone
Transition Zone
Transferal Corridor (within the Transition Zone)
Flanks Zone
Special areas within the Flanks Zone:
Transferal Area
Transferal Area Adjacent
Special Management Areas
Caldera Zone
Special Management Areas (within the Caldera Zone)
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
FS Road 9710
Cottonwood Road
County Road 4001
Lava River Cave
Sunriver
County Road 40
FS Road 9725
FS Road 9720
97
Lava Cast Forest
FS Road 9735
US Hwy. 97
To La Pine
Paulina Creek
County Road 21
East Lake
Paulina Lake
Lost Lake
FS Rd. 500
Paulina Peak
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
DEPARTMENT OF AGRICULTURE
1 0 1 2 3
Miles
July, 1994
N

Alternative B — At a Glance

This alternative would increase opportunities for self-guided exploration and discovery of the Monument's many special features. It emphasizes opportunities for solitude, and consequently accommodates the smallest number of visitors. Roads, trails and facilities would be designed to provide for dispersed recreation outside the caldera and developed recreation within the caldera.

This would be a quieter, slower-paced Monument. People have more opportunities to be alone and discover things on their own. There are not as many signs or guidelines. There would be more risk. More measures would be in place to enhance wildlife habitat, and this may limit human access in some areas.

At the Interpretive Center, visitors could check out discovery packs that may include binoculars, field guides, and maps directing them to more remote destinations. More areas of the Monument remain undisturbed. Interpretive programs rely mainly on roving interpreters who offer low-key information, and if needed, aid.

Key Features

No new Monument Road or other road development. Existing roads are maintained as necessary for public safety, fire prevention, or vegetation management.

Campground capacity in the caldera would decrease by 10 - 20 % compared to present levels. Some sites in the caldera would be rehabilitated or removed to enhance the feeling of privacy while camping. The primitive boat-in campgrounds on Paulina Lake would be removed. No new campgrounds would be built.

There is **some new trail development**, especially in the Transition Zone. The focus of trail development would be to provide quality dispersed recreation experiences.

No special **ATV access** is provided. Street legal ATV's may enter NNVM only on existing roads.

Lava Lands Interpretive Center would provide interpretive programs and information. The center would be renovated or if needed, slightly expanded, to provide services and information. Interpretive programs would emphasize self-guided activities and roving interpreters.

Lava River Cave is closed in the winter to enhance bat recovery. In the summer, it is not open to the general public, but guided group tours are offered that feature bat education.

Two additional **Bald Eagle Management Areas** are created in the caldera, bringing the total to two on East Lake and one on Paulina Lake.

Seasonal closures in the River Zone would aid wildlife. These could include closure to protect waterfowl nesting and elk calving at certain times of the year.

The focus of **vegetation management** is to provide more habitat diversity for wildlife species. Mechanical treatments (thinning, cutting, etc.,) would be the primary method for enhancing wildlife habitat.

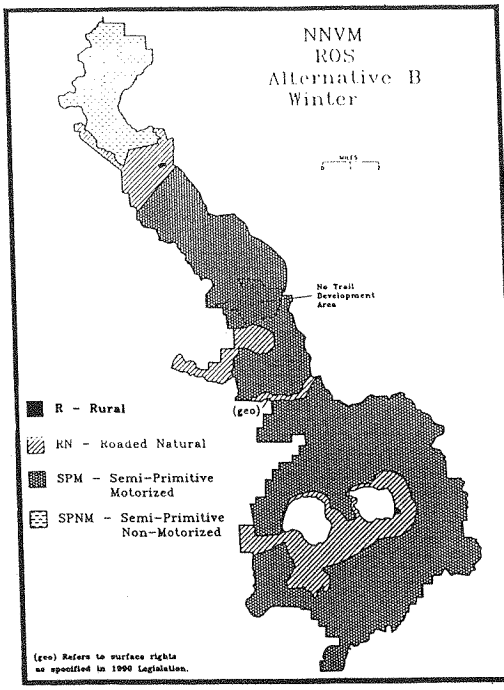
A small **new portal facility** on Road 21 outside the caldera provides information and orientation. In Alternative B, this portal facility would be for summer visitors, and is not expected to serve as a sno-park.

Table 2-4 **Alternative B at a Glance**

Description	Projected
Change in number of campsites in caldera	- 10 - 20%
New campgrounds outside the caldera	0
Change in miles of summer trails	+10-20 miles
Miles of interpretive trails	11
Change in capacity of interpretive facilities	+ 0 - 45%
Miles of road	56
Percent of NNVM in semi-primitive ROS classes	81%
Percent of NNVM in roaded natural ROS class	19%
First decade restoration of ecological processes in lodgepole pine (acres)	1,350
First decade restoration of old-growth ponderosa pine (acres)	1,000
Long-term (50+ years) total acres restoration of ecological processes in lodgepole pine	16,000
Long-term (50+ years) total acres restoration of old-growth ponderosa pine	7,000
Number of Bald Eagle Management Areas (BEMA's)	3

Figure 2-4

NNVM ROS Alternative B Summer



MILES
0 1 2

No Trail Development Area

(geo)

(geo)

RECREATIONAL OPPORTUNITY SPECTRUM

RURAL — R
Facilities such as roads, buildings, and campgrounds are present. You are likely to encounter lots of people.

ROADED NATURAL — RN
Roads and trails provide access to a natural environment. Some people and some facilities could be present.

SEMI-PRIMITIVE MOTORIZED — SPM
Motorized use permitted in a undeveloped forested setting. Few People.

SEMI-PRIMITIVE NON-MOTORIZED — SPNM
Motorized use prohibited in a undeveloped forested setting. Few People.

(GEO) Refers to surface rights as specified in the 1990 Legislation

(The key characteristics of the recreational opportunity spectrum classes are found on a table in chapter 3 recreation)

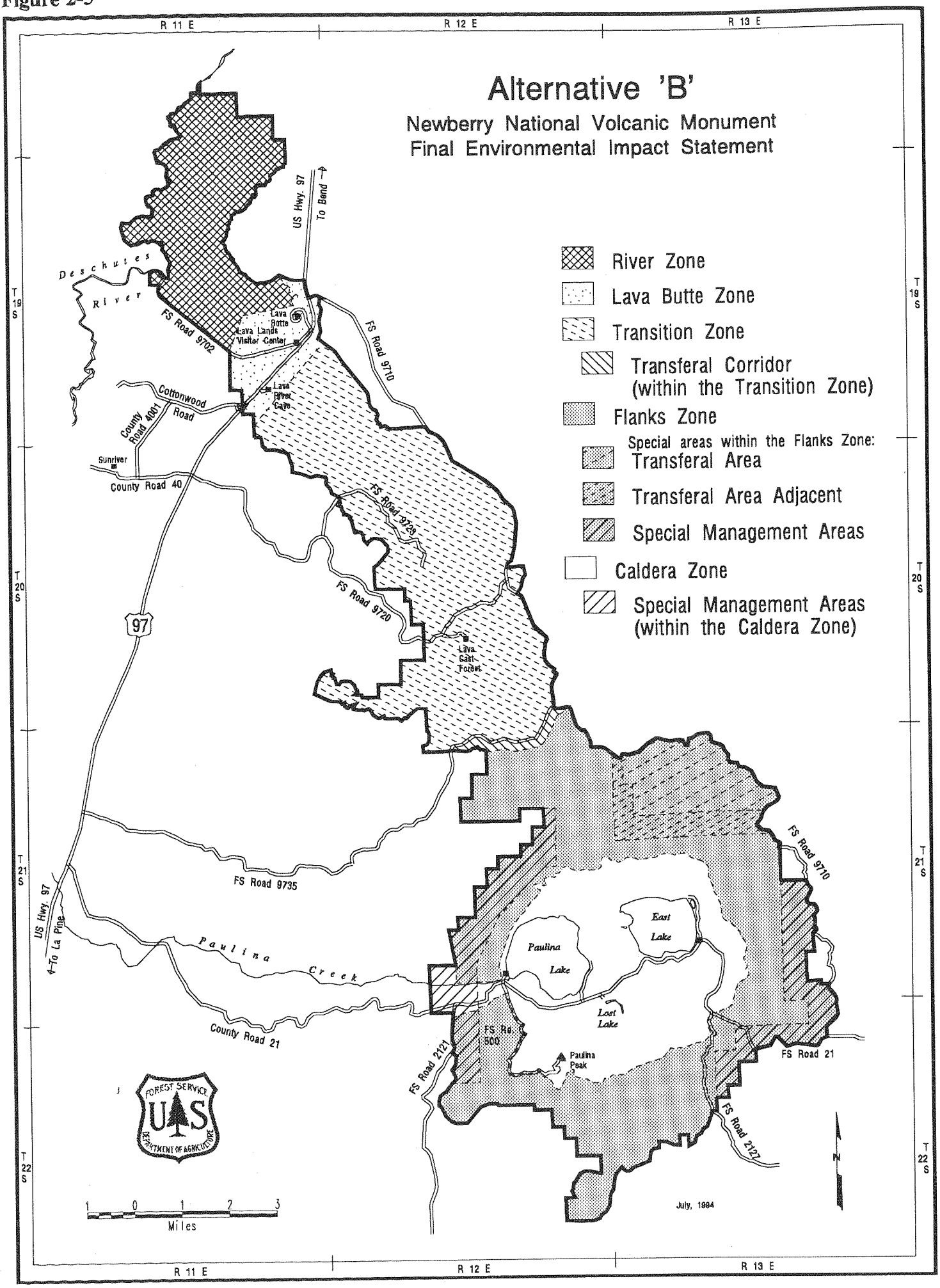
Table 2-5

POINT - COUNTERPOINT

Alternative B

POINT	ISSUE	COUNTERPOINT
Dispersed recreation is featured; limited number of new trails; many areas remain primitive and undiscovered. Lower number of campsites in caldera means increased privacy for campers.	RECREATION	Less access might make it difficult for some people to reach parts of NNVM. Wildlife provisions reduce some recreation (BEMA on Paulina Lake; Lava River Cave closed in winter).
No Monument Road. The "interior" of the Monument remains somewhat inaccessible, providing opportunities for solitude, resource protection.	ROADS	Some roads remain "primitive," limiting access. Some people prefer not to drive to "interior" areas.
Vegetation treatments focus on creating and improving wildlife habitat. More thinning; more biodiversity within stands.	VEGETATION	Fewer stands move toward open park-like stands of ponderosa pine. More understory (bitterbrush, etc.). More mechanical treatment needed to maintain multi-storied stands.
Fish and wildlife enhanced; many wildlife protection measures in place. Active program to manage vegetation for wildlife habitat.	FISH/WILDLIFE	More "wild feeling" Monument. People asked or encouraged to "stay out" of some areas (River Zone, caves, BEMA's).
Relatively small visitor center serves visitors. Emphasis is on roving interpreters, people-to-people interactions instead of facilities.	INTERPRETATION	Some people may miss opportunities for interpretation (fewer, smaller facilities and programs offered).

Figure 2-3


Alternative 'B'
Newberry National Volcanic Monument
Final Environmental Impact Statement
River Zone
Lava Butte Zone
Transition Zone
Transferal Corridor (within the Transition Zone)
Flanks Zone
Special areas within the Flanks Zone:
Transferal Area
Transferal Area Adjacent
Special Management Areas
Caldera Zone
Special Management Areas (within the Caldera Zone)
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
To La Pine
Deschutes River
FS Road 9702
Lava Lands Visitor Center
Lava Butte
Lava River Cave
FS Road 9710
Cottonwood Road
County Road 4001
Sunriver
County Road 40
FS Road 9720
97
Lava Cast Forest
FS Road 9735
Paulina Creek
County Road 21
East Lake
Paulina Lake
Lost Lake
FS Rd. 500
Paulina Peak
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
USDA
DEPARTMENT OF AGRICULTURE
1 0 1 2 3
Miles
July, 1984
N

Alternative C — At a Glance

This alternative would showcase the unique geologic and archaeological resources of Newberry Monument. It would highlight the long and rich history of the earth -- and how people, plants and animals have adapted to living in the shadow of Newberry Volcano. This alternative would emphasize education, interpretation, and ecosystems. Alternative C provides a variety of learning experiences at many levels, including self-guided tours, classes, research opportunities, and hands-on projects designed to engage visitors. Another primary emphasis of the alternative is the use of prescribed fire in the Monument's ecosystem, with the goal of recreating the large, open, park-like stands of ponderosa pine that were present before EuroAmericans arrived in Central Oregon.

Overnight use in the caldera would be moderate, accommodating about the same number of visitors as today. The Monument would provide for more day-use visitors. A visitor center and educational complex in the Lava Butte Zone would be the interpretive hub of the Monument. Visitors could choose from a wide diversity of available experiences, from one hour to one day; from a casual stroll on a lava field to an in-depth, university-sponsored archaeological project.

Key Features

The number of campsites in the caldera would increase slightly in order to spread people out and provide a more pleasant overnight experience. A campground for research or educational groups would be provided in the Transition Zone. The boat-in campgrounds on Paulina Lake would be relocated to reduce damage to sensitive resources.

A series of interpretive trails in the Transition Zone would enhance opportunities for day-use visitors. The focus of any new trail development would be for interpretation. New trails would be built in the Flanks and Caldera Zone as well.

No special **ATV access** is provided. Street legal ATV's would be permitted to enter the Monument on existing roads.

Lava Lands Interpretive Center would provide a comprehensive, theme-driven interpretive program, featuring the geology, archaeology, and ecology of the Central Cascades area and how these resources relate to the larger context around NNVM. An appropriate combination of delivery techniques would be used. Some examples are: guided hikes, displays, interactive media, interpretive brochures, "discovery packs," and interpretive kiosks. The center would be renovated or expanded as needed to support a wide array of interpretive, educational and information services. A key goal would be to integrate interpretation and education as part of any new recreational developments or programs.

Lava River Cave would be closed in the winter, and open for both private individuals and guided tours in the summer. Bats and their role in the ecosystem is a primary interpretive focus of the cave tours.

Two **Bald Eagle Management Area** exist in the caldera, adding an additional BEMA to the one present now.

The focus of **vegetation management** is the re-introduction of fire as an integral part of the ponderosa pine and lodgepole pine ecosystems. This alternative proposes the most extensive use of fire as a vegetation management strategy. Some areas of the Monument (primarily in the Transition Zone) would move toward the open, old-growth ponderosa pine stands that were present before EuroAmerican settlers arrived here. Mechanical treatments would be used in conjunction with fire to achieve reductions in fuel loads and move toward ecological health and biodiversity in the forest.

A **new portal facility** on Road 21 outside the caldera provides information and orientation. This portal facility also serves as a sno-park in the winter, enhancing snowmobiling and cross-country skiing recreation.

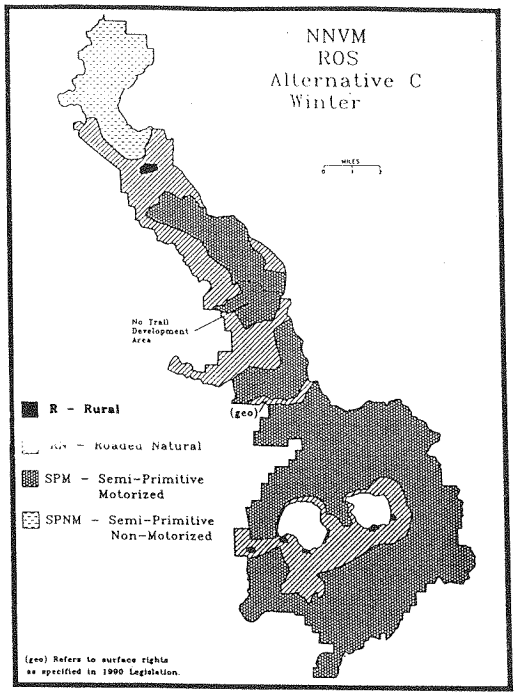
A new **Road** that links Lava Lands Visitor Center with Lava Cast Forest through the Transition Zone is possible under this Alternative, and its effects are analyzed in Chapter 4. The road would be less extensive than the Monument Road in Alternative A, but would provide a short driving loop from Lava Lands. The new road would provide access to a number of interpretive trails and day-use facilities near Lava Cast Forest. This road is a low priority, and unless demand for this kind of use in the Transition Zone increases significantly, it will not be built in the next 10 years.

Table 2-6 **Alternative C at a Glance**

Description	Projected
Change in number of campsites in caldera	+ 5 - 10%
New campgrounds outside the caldera	1
Change in miles of summer trails	+30-40 miles
Miles of interpretive trails	27
Change in capacity of interpretive facilities	+ 135 - 220%
Miles of road	63
Percent of NNVM in semi-primitive ROS classes	72%
Percent of NNVM in roaded natural ROS class	28%
First decade restoration of ecological processes in lodgepole pine (acres)	2,700
First decade restoration of old-growth ponderosa pine (acres)	2,500
Long-term (50+ years) total acres restoration of ecological processes in lodgepole pine	20,000
Long-term (50+ years) total acres restoration of old-growth ponderosa pine	8,000
Number of Bald Eagle Management Areas (BEMA's)	2

Figure 2-6

NNVM ROS Alternative C Summer



MILES
0 1 2

No Trail Development Area

(geo)

(geo)

RECREATIONAL OPPORTUNITY SPECTRUM

RURAL — R
Facilities such as roads, buildings, and campgrounds are present. You are likely to encounter lots of people.

ROADED NATURAL — RN
Roads and trails provide access to a natural environment. Some people and some facilities could be present.

SEMI-PRIMITIVE MOTORIZED — SPM
Motorized use permitted in a undeveloped forested setting. Few People.

SEMI-PRIMITIVE NON-MOTORIZED — SPNM
Motorized use prohibited in a undeveloped forested setting. Few People.

(GEO) Refers to surface rights as specified in the 1990 Legislation

(The key characteristics of the recreational opportunity spectrum classes are found on a table in chapter 3 recreation)

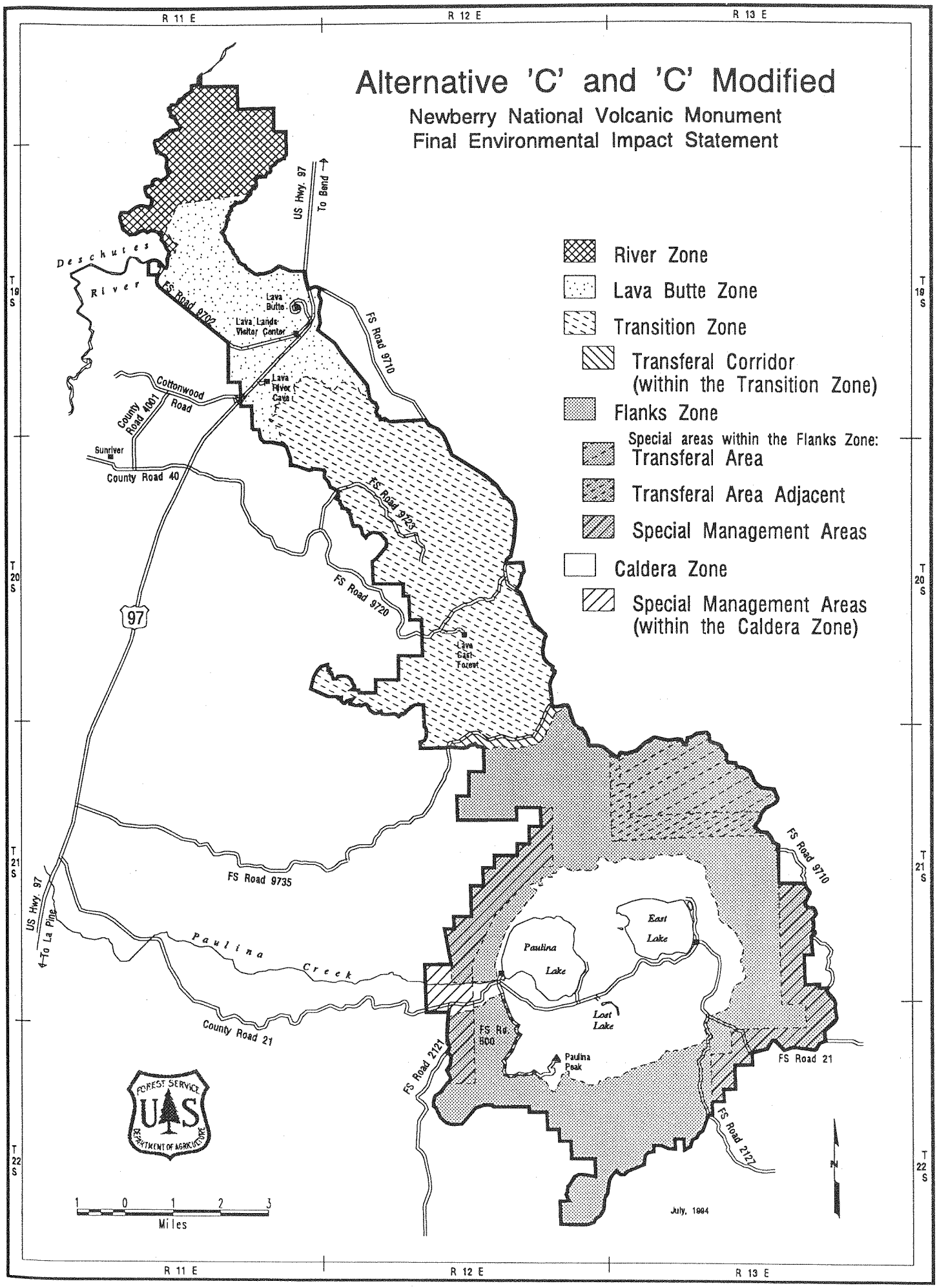
Table 2-7

POINT - COUNTERPOINT

Alternative C

POINT	ISSUE	COUNTERPOINT
New recreation is tied to interpretation. Opportunities for people to learn while they hike, bike, or explore. Increase day-use opportunities and facilities outside the caldera.	RECREATION	Does not provide for large increases in overnight visitors. Limits number of people who can come by facility design. Number of day-use visitors increases.
Roads tied to interpretive themes; allow road from Lava Lands to Lava Cast Forest, if needed, in future.	ROADS	Moderate level of development provides some new access, but emphasizes resource protection and education at same time.
Vegetation treatments focus on re-introducing fire as part of ecosystem. Restore old-growth ponderosa pine stands in many areas. Aggressive approach to vegetation management.	VEGETATION	Extensive use of fire may impact air quality in the short term by putting particulates and smoke into air. Changes in scenic quality may not be acceptable to some. Some change in character of roadless areas.
Increase in visitor day use could increase disturbance to wildlife. Changes in vegetation may benefit some species like flammulated owls.	FISH/WILDLIFE	Education and interpretation help people understand role of wildlife in Monument ecosystem. Open, park-like stands created by fire may offer less biodiversity and narrower habitats for some animals.
Comprehensive, exciting interpretive information program would be major attraction and draw lots of people. Diversity of interpretive activities would make NNVM a lively, exciting place to be.	INTERPRETATION	More staff and facility renovation likely to be needed to support interpretive program.

Figure 2-7


Alternative 'C' and 'C' Modified
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River Zone
Lava Butte Zone
Transition Zone
Transferal Corridor (within the Transition Zone)
Flanks Zone
Special areas within the Flanks Zone:
Transferal Area
Transferal Area Adjacent
Special Management Areas
Caldera Zone
Special Management Areas (within the Caldera Zone)
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
To La Pine
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
FS Road 9710
FS Road 9725
FS Road 9720
97
Lava East Forest
FS Road 9735
Paulina Creek
County Road 21
FS Road 2121
FS Rd 800
Paulina Peak
East Lake
Paulina Lake
Lost Lake
FS Road 21
FS Road 2127
FOREST SERVICE
US DEPARTMENT OF AGRICULTURE
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Miles
July, 1994
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ALTERNATIVE C-Modified -- At A Glance

This alternative was developed after the Draft Environmental Impact Statement (DEIS) was published. Alternative C-modified is an attempt to incorporate and respond to public comment and Advisory Council recommendations. It is similar in many respects to Alternative C, with emphasis on education and interpretation, and moderate recreational development. But there are significant differences between C and C-modified. They are outlined as follows:

Vegetation. Alternative C-modified has a different approach to vegetation management, based on the public comments we heard. This alternative would allow existing ecological succession of vegetation (with less human intervention) to a much greater extent, while still treating some areas to protect and restore existing old growth or to reduce high fire risk. Prescribed fire would be emphasized as a way to re-establish fire as a part of the ecological processes within the Monument. (See Vegetation Section in this chapter for more details).

Monument Trail. The Monument Trail is included in Alternative C-modified, in response to public comments.

Roadless Areas. Vegetation management in the roadless areas would be very limited and would be undertaken only if needed to improve wildlife habitat or to reduce a serious threat from fire, insects, or disease to outside resources. Any treatments would avoid the construction of roads, if at all possible.

Loop Road to Transition Zone. No new loop road from Lava Lands Visitor Center to Lava Cast Forest in the Transition Zone is planned. Existing roads 9720 and 9710, which together already provide a loop drive, would be upgraded with rock surfacing to provide a more comfortable drive.

In many other ways, this alternative is identical to Alternative C.

Alternative C-modified would showcase the unique geologic and archaeological resources of Newberry Monument. It would highlight the long and rich history of the earth -- and how people, plants and animals have adapted to living in the shadow of Newberry Volcano. This alternative would emphasize education, interpretation, and ecosystems. Alternative C-Modified provides a variety of learning experiences at many levels, including self-guided tours, classes, research opportunities, and hands-on projects designed to engage visitors. Another primary emphasis of the alternative is the use of prescribed fire in the Monument's ecosystem, with the goal of re-creating the large, open, park-like stands of ponderosa pine that were present before EuroAmericans arrived in Central Oregon.

Overnight use in the caldera would be moderate, accommodating about the same number of people as today. The Monument would provide for more day-use visitors. A visitor center and educational complex in the Lava Butte Zone would be the interpretive hub of the Monument. Visitors could choose from a wide diversity of available experiences, from one hour to one day; from a casual stroll on a lava field to an in-depth, university-sponsored archaeological project.

Key Features

The number of campsites in the caldera would increase slightly in order to spread people out and provide a more pleasant overnight experience. A campground for research or educational groups could eventually be provided in the Transition Zone, if supported by demand.

The boat-in campgrounds on Paulina Lake could be relocated in the future to reduce damage to sensitive resources, if alternative sites were available and the relocations were needed.

The Monument Trail, linking all five management zones, would eventually be provided. The Monument Trail would be open to non-motorized use. A series of interpretive trails in the Transition Zone would enhance opportunities for day use visitors. The focus of new trail development would be for interpretation. New trails would also be built in the Flanks and Caldera Zone.

ATV access and use would be excluded from the Monument.

Lava Lands Interpretive Center would provide a comprehensive, theme-driven interpretive program, featuring the geology, archaeology, and ecology of the Central Cascades area and how these resources relate to the larger context around NNVM. An appropriate combination of delivery techniques would be used. Some examples are: guided hikes, displays, interactive media, interpretive brochures, "discovery packs," and interpretive kiosks. The center would be renovated or expanded as needed to support a wide array of interpretive, educational and information services. A key goal would be to integrate interpretation and education as part of any new recreational developments or programs.

Lava River Cave would be open by appointment and guided tour in the winter, and open for both private individuals and guided tours in the summer. Bats and their role in the ecosystem is a primary interpretive focus of the cave tours.

Two **Bald Eagle Management Area** would exist in the caldera, adding an additional BEMA to the one present now.

Vegetation management would feature the re-introduction of fire as an integral part of the Monument's ecosystems. The North and South Paulina Roadless Areas surrounding the caldera would remain roadless, with minimal, if any vegetative treatments. Fire suppression and prescribed natural fire (within predetermined parameters established by a fire management action strategy) would be used within the roadless areas. The ponderosa pine communities would move toward the open, park-like stands of old growth trees present before EuroAmerican settlement. Some mechanical treatment (primarily thinning) and prescribed fire would be done in small, selected areas, for the following reasons:

- To protect existing old-growth trees and provide conditions that encourage their reseeding.

- To promote ecological health and biological diversity in the forest communities.

- To enhance the sustainability of the old growth ponderosa pine forests.

- To reduce high fuels loads in areas identified as having a high fire risk.

- To ensure safety in camping, day use, and other developed recreation areas.

- To enhance wildlife habitat.

- To establish small experimental plots to accurately measure the effects of fire, thinning, and other treatments on ecosystem health in various environments.

A **portal facility** on Road 21 outside the caldera would provide information and orientation. This facility could also serve as a sno-park in the winter, enhancing cross-country skiing and snowmobiling recreation.

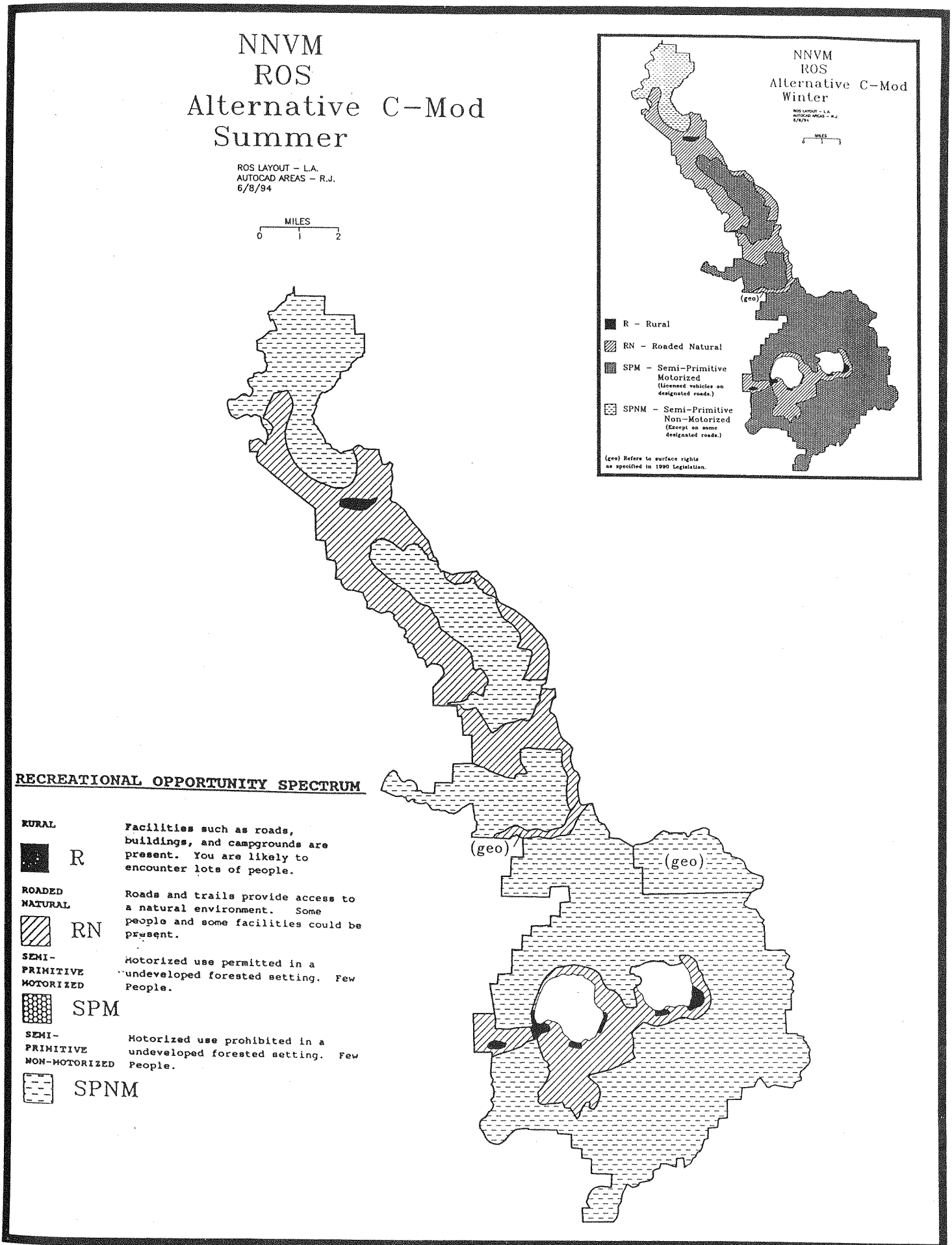
Roads in the Transition Zone (9720 and 9710 to Lava Cast Forest) would be upgraded to improve visitor safety and comfort.

Table 2-8 **Alternative C-Modified at a Glance**

Description	Projected
Change in number of campsites in caldera	+ 5 - 10%
New campgrounds outside the caldera	1
Change in miles of summer trails	+35-45 miles
Miles of interpretive trails	27
Change in capacity of interpretive facilities	+ 135 - 220%
Miles of road	60
Percent of NNVM in semi-primitive ROS classes	74%
Percent of NNVM in roaded natural ROS class	26%
Acres of Roaded Natural recreation	14,860
First decade restoration of ecological processes in lodgepole pine (acres) *	170~760
First decade restoration of old-growth ponderosa pine (acres)*	70~300
Long-term (50+ years) total acres restoration of old-growth lodgepole pine	12,900
Long-term (50+ years) total acres restoration of old-growth ponderosa pine	3,760
Number of Bald Eagle Management Areas (BEMA's)	2

* Vegetation treatments in the first decade of this plan focus on protecting or restoring existing old-growth, reducing fire hazard, safety and scenic improvements around developed sites, and enhancing wildlife habitat. We estimate five to eight projects in the first decade, each ranging from 50 to 200 acres in size. Please see the Vegetation section of Chapter 4 for more details.

Figure 2-8



(The key characteristics of the recreational opportunity spectrum classes are found on a table in chapter 3 recreation)

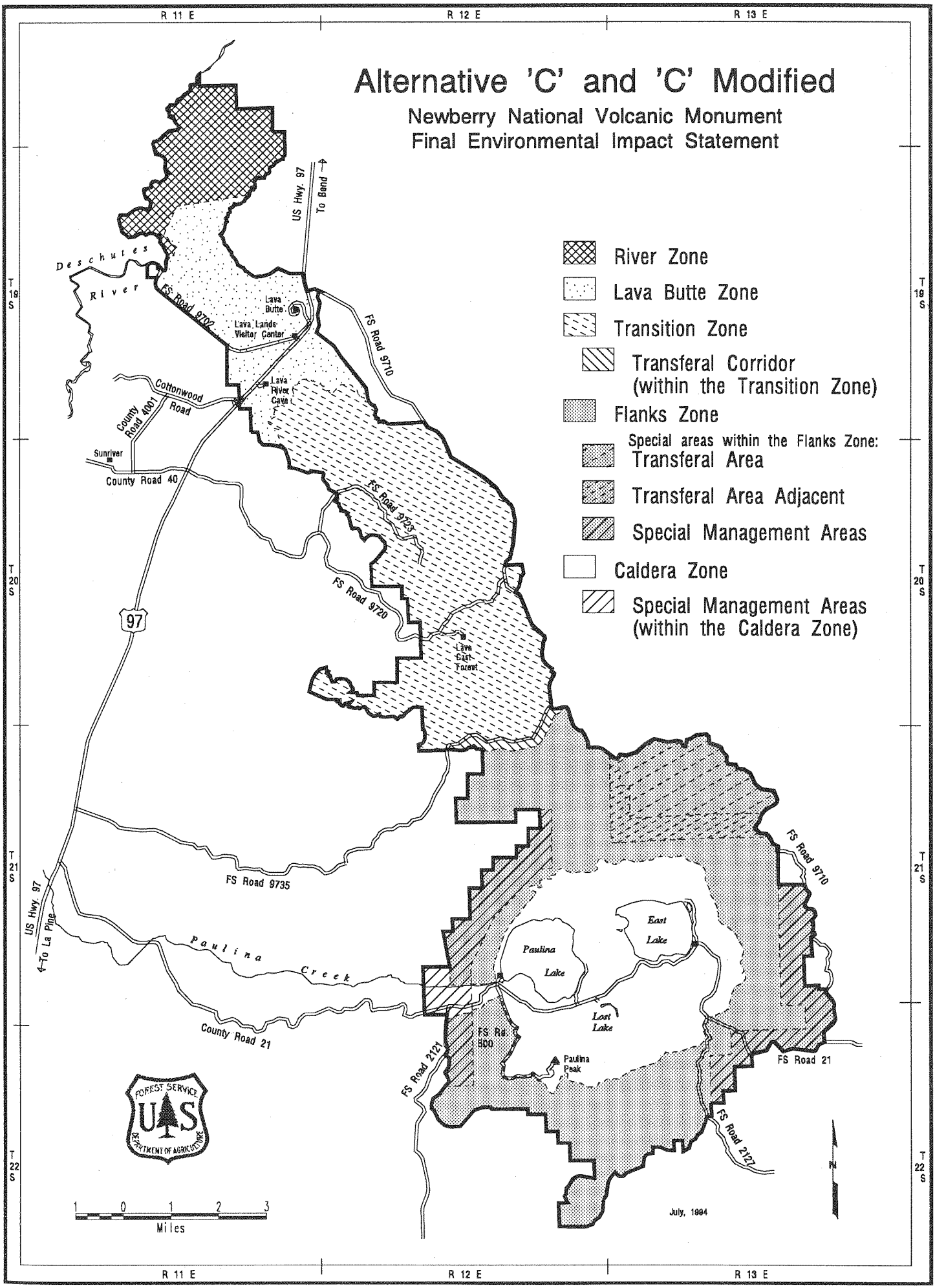
Table 2-9

POINT - COUNTERPOINT

Alternative C-Modified

POINT	ISSUE	COUNTERPOINT
New recreation is tied to interpretation. Opportunities for people to learn while they hike, bike, or explore. Keep current overnight use level in caldera.	RECREATION	Does not provide for large increases in overnight visitors. Limits number of people who can come by facility design. Number of day-use visitors increases.
Roads tied to interpretive themes; close roads where possible. Improve safety of Paulina Peak and Lava Cast Forest roads.	ROADS	Improving surface of Lava Cast Forest Road may draw more visitors. Less roaded access to some areas.
Vegetation treatments focus on re-introducing fire as part of ecosystem. Restore old-growth ponderosa pine stands in some areas. Prescribed natural fire may return some mosaic conditions in lodgepole pine. Roadless areas left unroaded.	VEGETATION	Use of fire may impact air quality by putting particulates and smoke into air. Avoiding treatment in roadless areas may increase size and severity of wild fires, due to high fuel build-ups.
Increase in visitor day use could increase disturbance to wildlife.	FISH/WILDLIFE	Education and interpretation help people understand role of wildlife in Monument ecosystem.
Comprehensive, exciting interpretive program would be major attraction and draw lots of people. Diversity of interpretive activities would make NNVM a lively, exciting place to be.	INTERPRETATION	More staff and more facility renovation would to be needed to support interpretive program.

Figure 2-9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R 11 E
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R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
FS Road 9710
Cottonwood Road
County Road 4001
Lava River Cave
Sunriver
County Road 40
FS Road 9725
FS Road 9720
97
Lava East Forest
FS Road 9735
US Hwy 97
To La Pine
Paulina Creek
County Road 21
East Lake
Paulina Lake
Lost Lake
FS Rd 900
Paulina Peak
FS Road 2121
FS Road 21
FS Road 2127
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Alternative D — At a Glance

This alternative would continue management of Newberry National Volcanic Monument according to direction provided under the 1990 Deschutes National Forest Land and Resource Management Plan (Forest Plan). This is the "No Action" Alternative required by the Council on Environmental Quality [40 CFR 1502.14 (d)] and National Forest Management Act [36 CFR 219.12 (f) (7)] regulations.

Currently, the Forest is managing the Monument to comply with direction in the 1990 Forest Plan (where such direction does not conflict with Monument values). Determining whether or not Forest Plan direction and resulting projects are consistent with Monument legislation is often a complex task. For some activities, such as scheduled timber harvest, the legislation is fairly specific in its direction. (No scheduled timber harvests are allowed, but trees may be removed if needed to achieve the purposes of the Act, and to protect health and safety).

The legislation is much less specific about other activities, such as whether to develop new trails for mountain biking, add new campgrounds, permit new resorts, or allow research on geothermal resources. The need to make such determinations for each individual project, without integrated direction and an overall vision for the Monument, would be time-consuming and fragmented. In addition, this piece-meal approach would require frequent legal counsel, be confusing to the public, and would likely result in conflicts and inconsistencies with both the Forest Plan and the intent of the Monument Legislation.

Some direction in the Forest Plan, such as allowing scheduled timber harvest, conflicts with the Monument legislation (Public Law 101-522). Adopting Alternative D would require either changing the general forest and scenic views allocations within the Monument boundaries to preclude scheduled timber harvests, or changing the Monument legislation to allow scheduled timber harvests. Alternative D would not meet the underlying need (discussed in Chapter 1) to develop a comprehensive management plan for this special area.

In this alternative Monument lands would be allocated into nine different management areas, each of which had its own theme, goals, and objectives. There would be no integrated, overall vision for the Monument. Management emphasis would vary from providing intensive and dispersed recreation opportunities to maximizing production of wood fiber (this emphasis could not be implemented without a change to the Monument legislation).

Under Alternative D, some parts of the Monument would continue to function much as they do today. Newberry Crater would continue to provide intensive and dispersed recreation activities, including day uses and overnight camping. Lava Lands Visitor Center would remain open and continue its current season of use (open about 230 days a year). North and west of the Visitor Center, to the Monument's boundary at the Deschutes River would remain undeveloped and used mostly by wildlife and river recreationists. Some small areas within the Monument would be managed for old growth.

Key Features

General-use **campground capacity** in the caldera would increase by about 37 percent over present levels with the expansion of Cinder Hill and Paulina campgrounds. No new campgrounds would be developed.

No new roads would be developed within the Monument, with the exception of those needed for vegetation management purposes.

Trail systems would remain about the same as present. Some minor reconstruction and rerouting of trails would take place to correct or prevent soil erosion or other resource damage.

Lava Lands Visitor Center would stay the same, with no renovations or expansions planned. Interpretive programs and season of operation also remain the same.

Lava River Cave would be open during the summer and an additional 1/2 mile of interpretive trail inside the cave would be planned.

The **Bald Eagle Management Area** presently along the north edge of East Lake would remain.

Vegetation Management to increase wood fiber production could occur in Management Area 9, general forest allocation (in the area known under other Alternatives as the Transition Zone). Such management would be very limited, however.

Current summer closure orders for **ATV's** on trails inside Newberry Crater would remain in effect. ATV's could use Monument lands outside the Crater as long as they stayed off trail.

Present **interpretive facilities** would remain. No additional interpretive or other facilities would be planned, beyond the reconstruction of the Big Obsidian Flow trailhead and parking lot.

No new snow shelters or additional trails would be developed in the caldera.

Table 2-10

Alternative D (NO ACTION) at a Glance

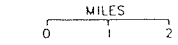
Description	Projected
Change in number of campsites in caldera	+ 34%*
New campgrounds outside the caldera	0
Change in miles of summer trails	0
Miles of interpretive trails	4
Change in capacity of interpretive facilities	0
Miles of road	97
Percent of NNVM in semi-primitive ROS classes	56%
Percent of NNVM in roaded natural ROS class	26%
First decade restoration of ecological processes in lodgepole pine (acres)	minimal
First decade restoration of old-growth ponderosa pine (acres)	minimal
Long-term (50+ years) total acres restoration of old-growth lodgepole pine	minimal
Long-term (50+ years) total acres restoration of old-growth ponderosa pine	minimal
Number of Bald Eagle Management Areas (BEMA's)	1

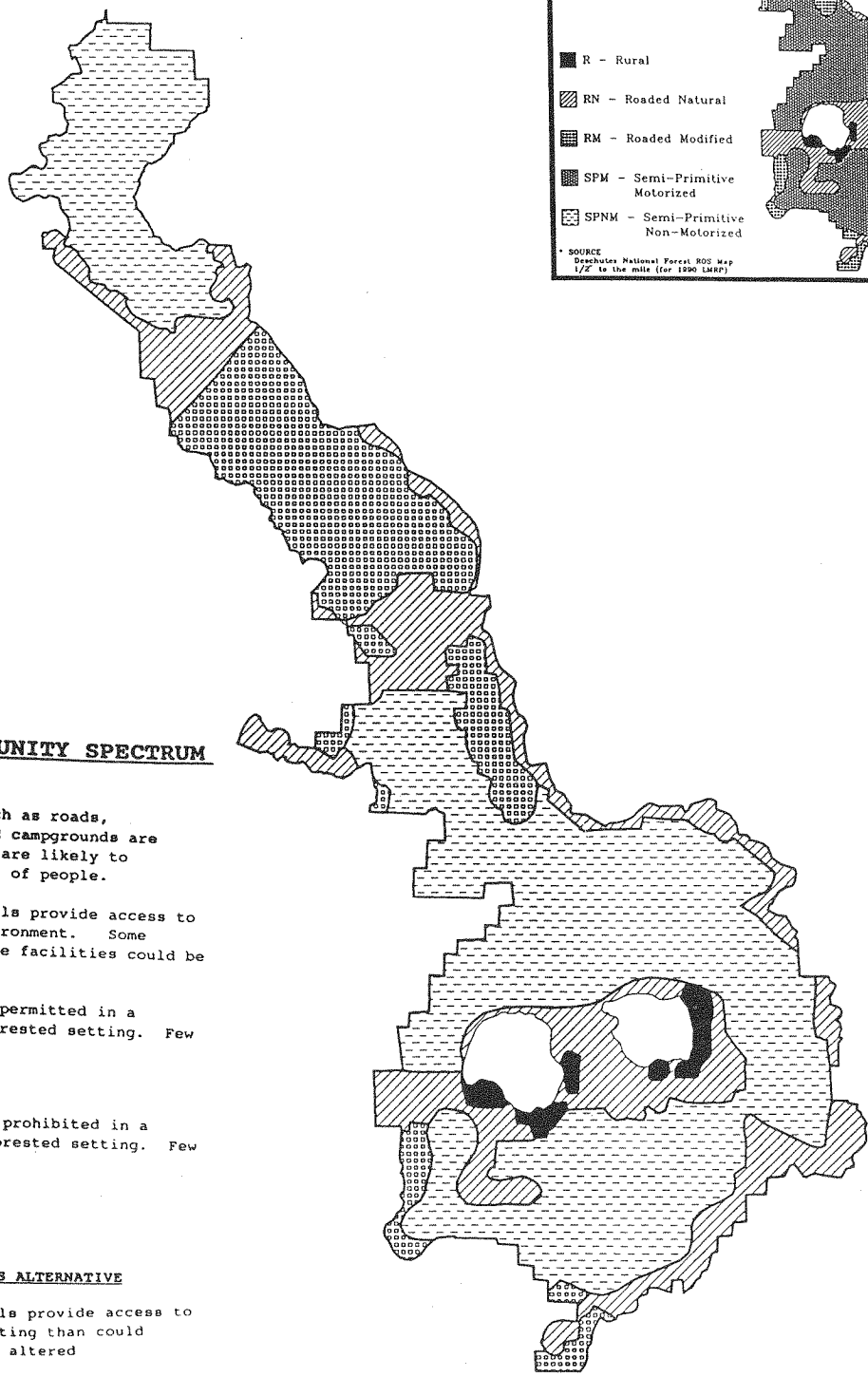
* Current number of campsites in caldera is 328. Under Forest Plan direction, and Capital Investment Project planning, 110 new campsites would be added in the next ten years.

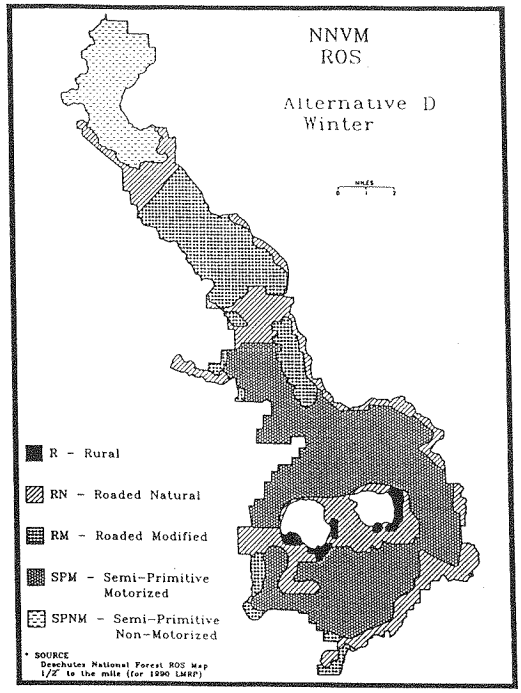
Figure 2-10

NNVM ROS

Alternative D Summer







RECREATIONAL OPPORTUNITY SPECTRUM

RURAL — R
Facilities such as roads, buildings, and campgrounds are present. You are likely to encounter lots of people.

ROADED NATURAL — RN
Roads and trails provide access to a natural environment. Some people and some facilities could be present.

SEMI-PRIMITIVE MOTORIZED — SPM
Motorized use permitted in a undeveloped forested setting. Few People.

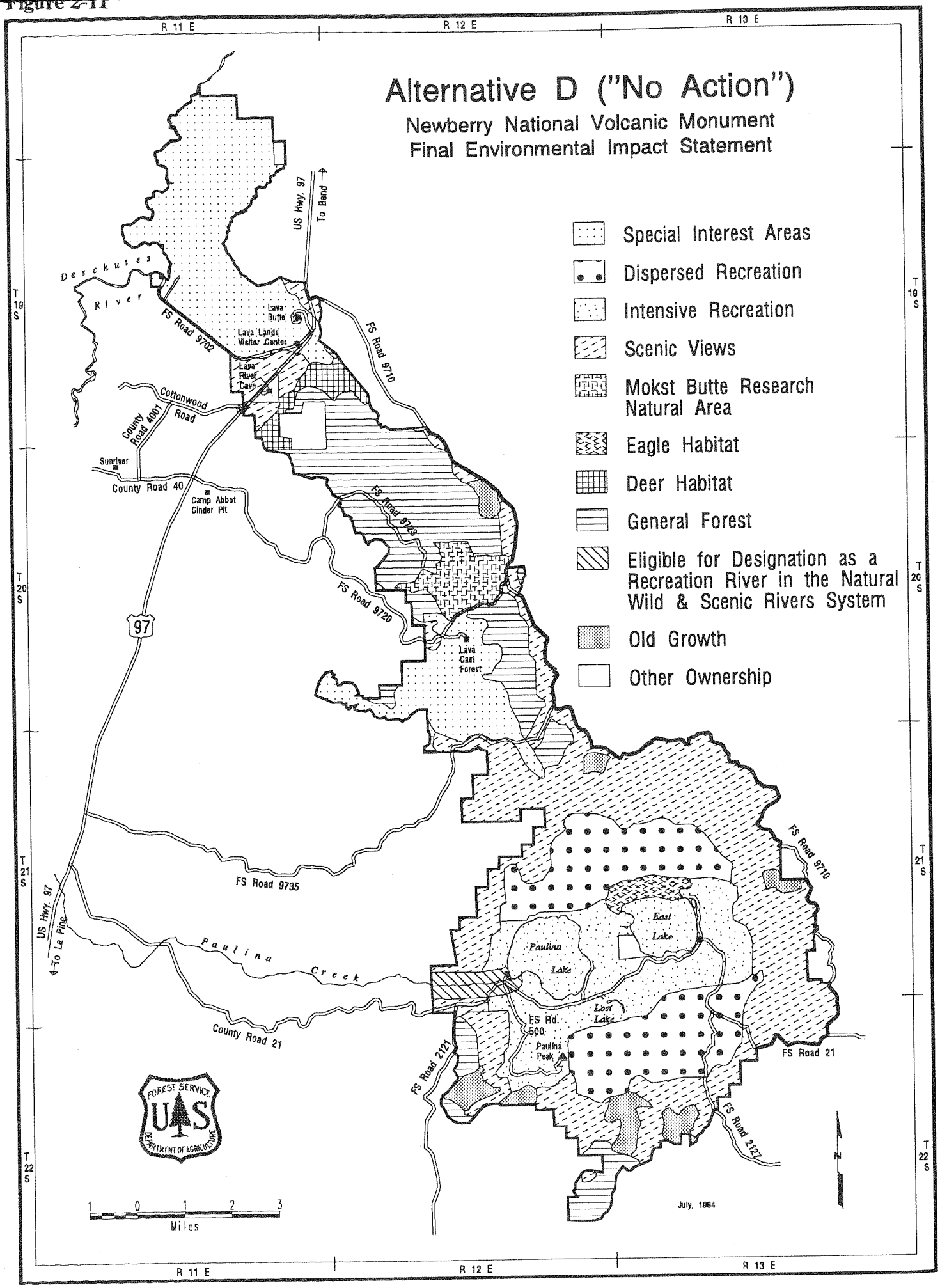
SEMI-PRIMITIVE NON-MOTORIZED — SPNM
Motorized use prohibited in a undeveloped forested setting. Few People.

ADDITIONAL ROS CLASSES IN THIS ALTERNATIVE

ROADED MODIFIED — RM
Roads and trails provide access to a forested setting than could appear heavily altered

(The key characteristics of the recreational opportunity spectrum classes are found on a table in chapter 3 recreation)

Figure 2-11


Alternative D ("No Action")
Newberry National Volcanic Monument
Final Environmental Impact Statement
Special Interest Areas
Dispersed Recreation
Intensive Recreation
Scenic Views
Mokst Butte Research Natural Area
Eagle Habitat
Deer Habitat
General Forest
Eligible for Designation as a Recreation River in the Natural Wild & Scenic Rivers System
Old Growth
Other Ownership
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
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Deschutes River
FS Road 9702
FS Road 9710
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Lava Lands Visitor Center
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
Camp Abbot Cinder Pit
FS Road 9720
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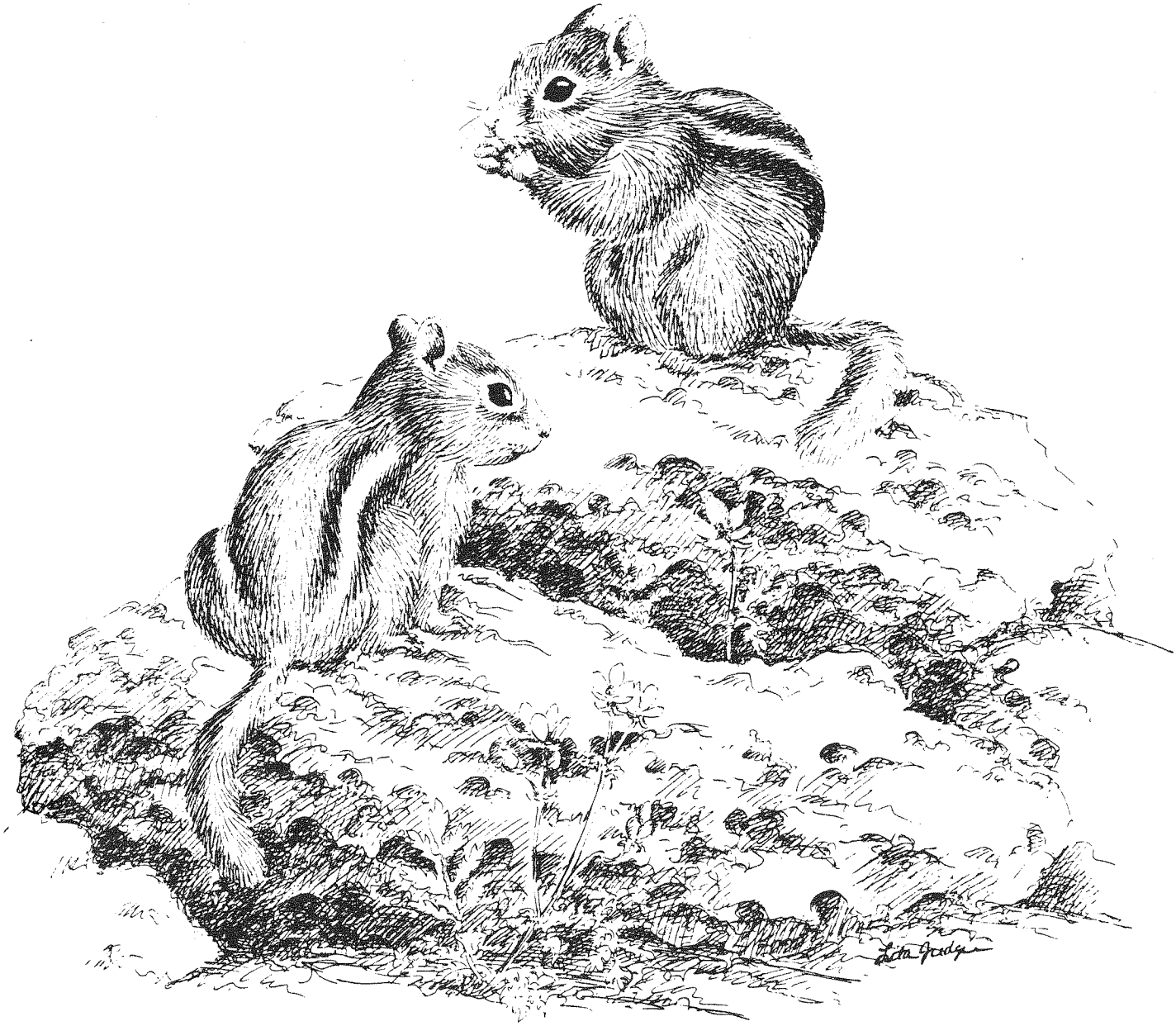


Advisory Council Recommendations

The legislation establishing Newberry National Volcanic Monument called for the creation of an Advisory Council to "advise the Secretary of Agriculture on the preparation of the initial management plan" for the Monument. The Council is made up of 11 members, representing various interests, such as recreation, environmental, tourism, timber, scientific, fish and wildlife, geothermal, Deschutes County, and a Governor's representative. The Council has met periodically for the past two years. After studying the issues associated with the Monument, the Council gave the Forest Service some specific recommendations about what they would like to see in the recommended alternative for the management plan. A summary of their advice, and how the Forest Service has addressed this advice in the preferred alternative (Alternative C-Modified), follows:

Recreation

Advisory Council advice: Develop a wide range of recreational programs, including opportunities for both developed and dispersed recreation. Specific concerns were:

1) Provide for "traditional uses" (snowmobiling, nordic skiing, mountain biking, fishing, hiking, camping, horseback riding) taking place at the time the area became a Monument (1990).

How addressed: 1) Traditional recreational uses taking place at the time of Monument legislation are enhanced or improved in Alternative C-Modified. Alternative C-modified proposes new trails in every zone to improve recreational opportunities. Both interpretive and recreational trails would be built, and the Monument Trail (linking all management zones) is part of the C-modified alternative. C-Modified would improve signing on trails and expand day use areas as well. Opportunities for a broad range of recreation, from developed to dispersed, would be provided.

2) Enhance recreation for all winter users (snowmobilers and cross-country skiers).

How addressed: 2) Alternative C-modified would improve winter recreation by building a portal entrance station to serve in the winter as a sno-park for better winter access. This facility would enhance nordic skiing opportunities and provide more parking for snowmobilers. New trails for nordic skiers and snowmobilers would also be developed. One or two warming shelters planned for the caldera would improve safety and comfort for winter visitors to NNVM.

3) Issues surrounding the use of Class I and III ATVs in the Monument. The Advisory Council recommended that the Forest Service eliminate Class I and III ATV use and access in the Monument in all seasons.

How addressed: 3) The Forest Service has included the Advisory Council's recommendation in Alternative C-modified. (Alternative A proposes to allow OHV access through the Monument and to East Lake; Alternative D (No Action) would continue to allow ATV use inside the Monument, except for the caldera.) Alternative C-modified would eliminate Class I and III ATV use from the Monument in all seasons, as again recommended by the Advisory Council in February, 1994, following release of the draft EIS. The Advisory Council gave a number of reasons for their final recommendation, including: excessive noise,

potential for resource damage, incompatibility with other recreational uses, disturbance to solitude and quiet atmosphere, availability of other ATV trails close to the Monument, and continuation of an existing recreation order (pre-Monument) excluding ATV's from the caldera.

Roads and Facilities

Advisory Council Advice: Re-route the entrance to Lava Lands and Lava River Cave by using the Cottonwood Exit. Deschutes County road planners and engineers also favor this plan.

How addressed: Re-routing the entrance to Lava Lands using the Cottonwood interchange is proposed in Alternative C-modified.

Advisory Council Advice: Do not at this time develop any new major roads. Perhaps consider some kind of loop road in the future but not now. Allow some roads, as needed, for vegetation management.

How addressed: No new road development is planned under Alternative C-modified. Some roads in the Monument, however, have deteriorated from increasing use. The plan allows for some moderate improvements to existing NNVM roads; specifically, resurfacing the road to Paulina Peak for safety and maintenance reasons. The intent is to keep this road as it is, a one-lane road with turnouts, but to ensure visitor safety, improve drainage and provide for easy, year-round maintenance. The road scar from this road would be rehabilitated, if feasible.

No new scenic loop road would be built into the Transition Zone under Alternative C-modified. However, Roads 9720 and 9710, which already provide a loop drive to the Lava Cast Forest area, would be resurfaced to increase visitor comfort and safety.

Advisory Council Advice: Support a larger, expanded visitor center.

How addressed: Alternative C-modified would provide for an expanded, improved and theme-driven interpretation and education program. Interpretive facilities would be designed to support this program. Facility expansion at Lava Lands would occur as needed to meet the interpretive program's needs and public demand.

Vegetation and Fire

Advisory Council advice:

1) Reduce the high fire danger now present in parts of the Monument. Use appropriate means (mechanical thinning, prescribed fire) to accomplish this goal. Target the areas that are truly at high risk.

2) Encourage the creation of the open park-like stands of old growth ponderosa pine (similar to Central Oregon's pre-EuroAmerican forest) in suitable areas of the Monument.

3) Follow the guiding lights of biological diversity, ecological mosaics, and long-term sustainability in vegetation management.

4) Create areas within the Monument that can evolve "naturally."

5) Allow fire to become an integral and natural part of the Monument ecosystem.

6) Keep the North and South Paulina Roadless Areas intact, with a predominantly roadless character.

How addressed: Between the Draft EIS and the Final EIS, the Forest Service designed a new alternative, C-modified, to respond to public comment and more fully incorporate Advisory Council recommendations. Alternative C-modified calls for a scaled-back approach to vegetation management that incorporates many of the Advisory Council's suggestions. This alternative assumes five to eight projects in the first decade of the plan, ranging in size from 50 to 200 acres each. These projects would use prescribed fire, thinning, or a combination of the two to accomplish two main objectives: 1) protect existing large old-growth trees and restore some open, park-like stands of ponderosa pine, and 2) reduce areas of high fire hazard that have built up because of past fire suppression. In some parts of the Monument now, stands are so crowded with young trees and underbrush as a result of fire suppression, that there is a need to intervene to restore natural ecological processes and protect existing large, old trees.

Under Alternative C-modified, the North and South Paulina Roadless Areas would remain unroaded, with little vegetation management. In areas where public safety and protection of Monument values could be assured, prescribed natural fire (lightning-caused) would be allowed. Tn other areas, fire suppression would continue. This is determined through the preparation of specific fire management action strategies that define the parameters of safety, weather, fuel moistures, and other conditions within which a natural ignition would be allowed to continue burning.

Please see also the description of Alternative C-modified in Chapter 2, Alternatives by Resources (Vegetation) in Chapter 2, and the Vegetation section of the Monument Plan for more details.

Long-term sustainability, ecosystem health, biological diversity, and continuation or re-establishment of natural ecological processes are the primary goals for the Monument's vegetation communities.

Wildlife

Advisory Council advice: General: Support the idea that people and wildlife can co-exist in the Monument with biological diversity as a primary driver in providing for wildlife habitats. If large areas of the Deschutes National Forest (outside the Monument) are managed for big game (deer and elk) -- perhaps within the Monument some other habitats could be created, providing counterbalance and increased diversity. Favor an additional Bald Eagle Management Area (BEMA) on East Lake, but do not recommend a third BEMA (on Paulina Lake), because eagles are not nesting there now. The Advisory Council would like the area on Paulina Lake managed so that a BEMA would not be precluded in the future. In other words, if eagles do decide to settle there in the future, they would find it hospitable and not degraded.

How addressed: Alternative C-Modified would allow vegetation management projects to enhance biodiversity and improve habitat for specific species. Some of these species include: bald eagle, American marten, goshawks, and neotropical and migratory birds. Specific species that thrive in old growth ponderosa pine habitats would also benefit (flammulated owls, white-headed woodpeckers). Deer and elk migration corridors would be protected and, where appropriate, enhanced.

Under Alternative C-Modified, the area on the north shore of Paulina Lake would be managed and protected as a "de facto" BEMA. Alternative C-Modified creates an additional BEMA on East Lake, bringing the total to two in the caldera.

This alternative would continue to provide habitat for a wide variety of species, and maintain the current Newberry Crater Wildlife Refuge.

Alternatives by Resource Program

This section compares the alternatives in terms of how their resource management would change in the various zones. It is organized by issues in the same order they appeared in Chapter 1 (Recreation; Roads and Facilities; etc.) In this section, however, Vegetation, and Fire & Fuels are combined. This section of Chapter 2 highlights the **differences** among the alternatives. It is followed by charts that provide another way of comparing the alternatives.

Recreation

The following section describes how recreation management would differ by alternative in each zone. In addition to the following descriptions, readers should also refer to the Recreational Opportunity Spectrum (ROS) maps in the "Alternatives at a Glance" section earlier in this chapter.

River Zone

In all alternatives, the goal is to provide high quality wildlife habitat, and management focuses on wildlife protection and enhancement. The management objective is to keep recreational use in this zone to a minimum. No new trails would be built in the riparian area of the zone. Visitors to areas outside the River Zone would enjoy scenic views looking into this part of the Monument.

Lava Butte Zone

In all alternatives, the goal is to provide education, information, and an interpretive hub for the Monument (Lava Lands Visitor Center). Visitors would be welcomed to the Monument from Highway 97 where a visitor center just off the highway would orient people to the many opportunities in the area. The visitor center would be alive with activities, displays and demonstrations. Short loop trails would originate at the center and take visitors to some of the unique features in this zone.

ALTERNATIVE A: In this alternative, the intent would be to provide high-quality information and education to many people in an efficient way. Many visitors would be invited to see different features in this zone. The visitor center would be expanded, and could serve as a staging area, providing shuttles to other parts of the Monument. An extensive network of trails would connect the special features in this zone. A Monument Trail would run from Lava Lands to the caldera, providing enhanced recreation for hikers, mountain bikers and horseback riders.

ALTERNATIVE B: The focus of Alternative B in this zone would be on low-key self-guided recreation and interpretation. The visitor center would be small -- about its present size. The emphasis of recreation would be on self-discovery, with only a few new trails constructed.

ALTERNATIVE C: The intent of this alternative is to provide a comprehensive, theme-driven interpretive and recreation program that serves many visitors. The visitor center would be moderately expanded to accommodate the growing number of visitors and an enhanced interpretive program. Recreational facilities would be designed to support interpretive services. Expansion of the visitor center (for example, adding a classroom) would depend on the demand for education and interpretation. Shuttles would run to distant parts of the Monument, adding a new experience for visitors. A trail system would connect some of the geologic features and forested islands in the lava (kipukas). New trails would have an interpretive focus to deepen visitors' understanding and enjoyment of the Monument.

ALTERNATIVE C-Modified: Same as Alternative C, with the addition of the Monument Trail, which would connect all five management zones.

ALTERNATIVE D: Present management continues with a small visitor center, and a few trails leading to lava flows and forests. Forest Plan direction guides other recreation.

Transition Zone

In all alternatives the goal would be to provide interpretation of geology, archaeology and ecology. Another objective is to expand recreational and interpretive opportunities. There would be new trails leading to interesting geologic features and old growth forests. Day use visitors would enjoy picnicking, hiking and sightseeing.

ALTERNATIVE A: The intent of this alternative is to provide visitors with increased recreational access and opportunities. A new Monument Road beginning at Lava Lands and continuing through the Transition Zone towards the caldera would offer a scenic driving experience. Visitors could also camp in new campgrounds located in this zone. Loop trails would begin near the new road and lead visitors to unique features of the zone. The Monument Trail running from the Deschutes River to the caldera would continue through this zone also.

ALTERNATIVE B: This alternative would emphasize providing wildlife habitat and dispersed recreation, so no Monument Road or Trail is proposed. Some short loop trails could be built to interesting features. The focus of activities would not expand greatly beyond the Lava Cast Forest area.

ALTERNATIVE C: The intent of this alternative is to enhance recreation and interpretation. Expanded day-use opportunities would make this zone an attractive area for visitors to come and learn, and would take some of the pressure off the caldera. A series of loop trails near the Lava Cast Forest area would provide access to geologic features. A group campground could provide overnight accommodations for researchers or school groups.

ALTERNATIVE C-Modified: Same as Alternative C, except Monument Trail is added, and would pass through Transition Zone.

ALTERNATIVE D: Lava Cast Forest remains the focus of most use under this alternative. The unimproved road to this area limits use and access. The one-mile loop trail continues to provide an interpretive and recreational experience for visitors. Forest Plan direction for recreation continues.

Flanks Zone

The goal is to keep this area remote and undeveloped. All alternatives would emphasize dispersed recreation and maintain existing trail access to parts of this zone. The desired future condition is to keep the flanks area remote and undeveloped, with few facilities except for trails and signs (for example, the Rim Trail around Newberry Caldera). In all alternatives, the Flanks Zone provides opportunities to get away from the sights and sounds of other people, and to explore little-known areas of the Monument.

Caldera Zone

In all alternatives, the goal in this zone is to provide a wide range of developed and dispersed recreational opportunities, and reduce conflicts among different recreation groups. Another goal is to provide wildlife viewing opportunities without harming the wildlife. Many of the Monument's most interesting features would continue to be popular recreation areas. Some of these features include: Paulina and East Lakes, Paulina Falls, The Big Obsidian Flow, Paulina Peak, and various hot springs. The caldera's resorts, campgrounds, day use facilities and trails would be enjoyed by visitors from all over the world.

For management purposes, the Caldera Zone is divided into five recreational units. They are: Portal, Lakeside, Flow, Eagle, and Undeveloped. (See maps on following pages).

Portal: Provides an area to greet and orient visitors to the caldera. A small facility provides interpretation and information.

Lakeside: Provides an overnight camping and resort area in the caldera. Access is provided to the lakes, and there are many facilities such as campgrounds, boat ramps, resorts, picnic and day use areas.

Flow: Provides a focus for interpretation and day use activities.

Eagle: Provides habitat for bald eagles.

Undeveloped: Provides for solitude and challenge in remote areas of the caldera away from the lakes.

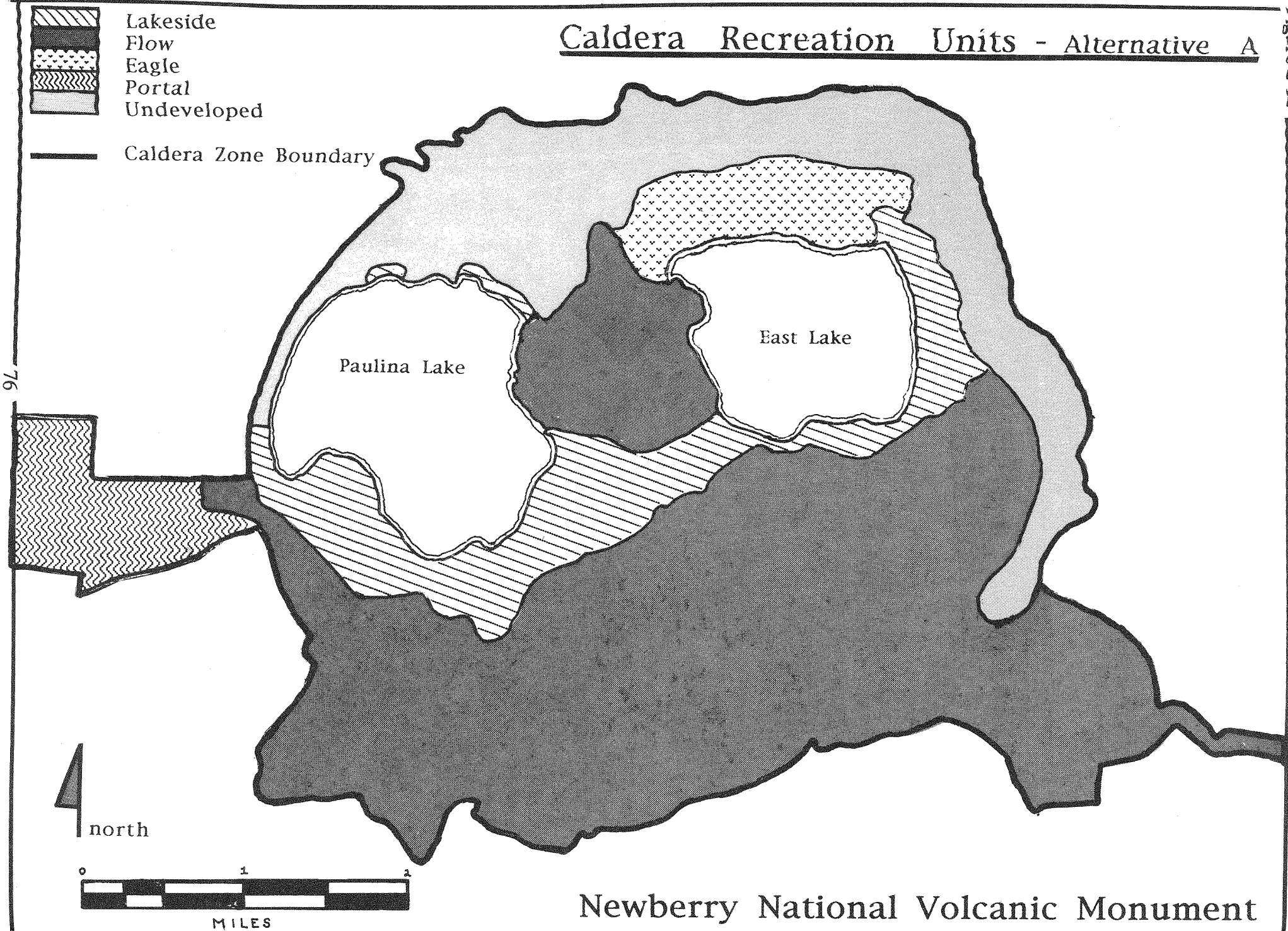
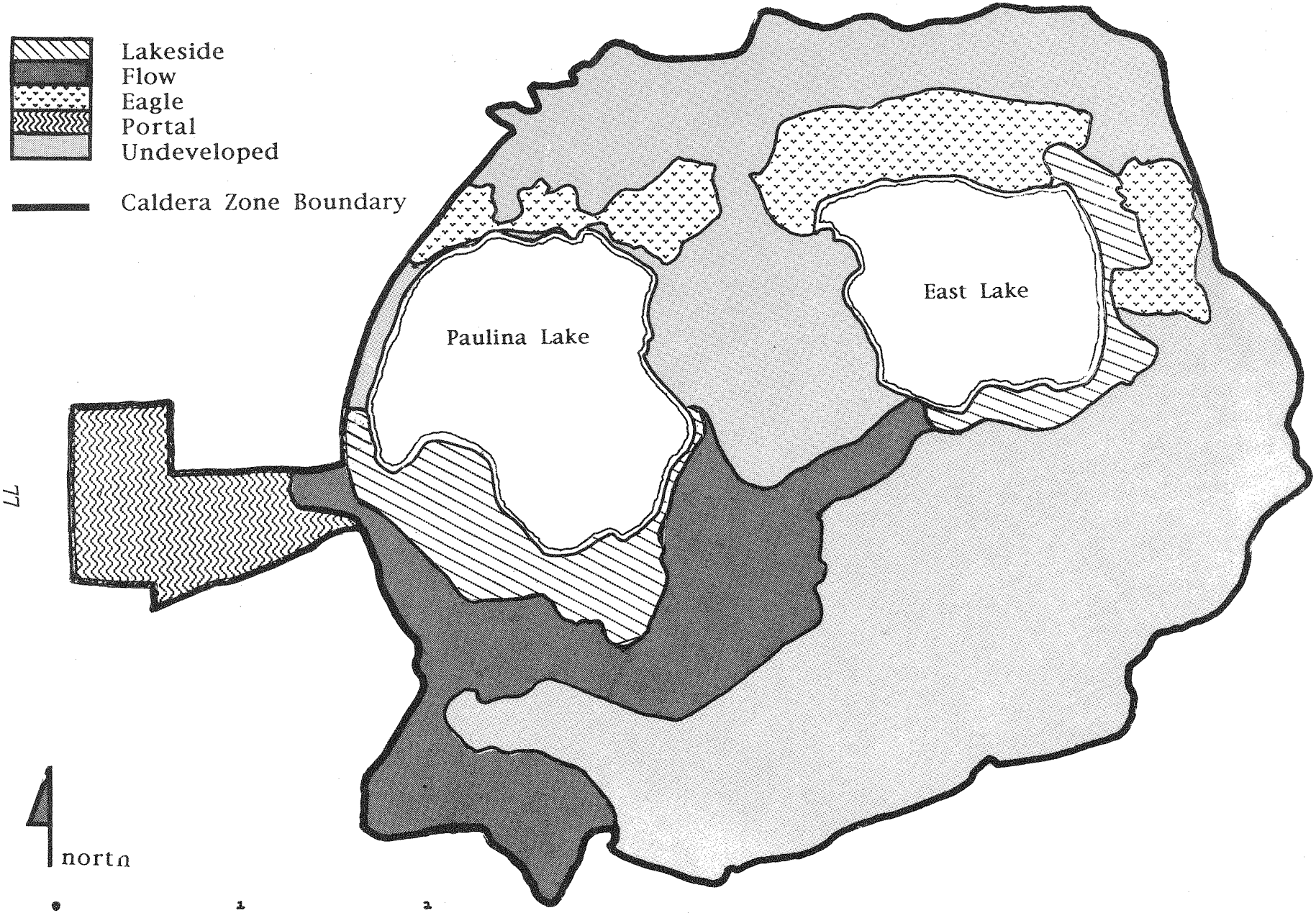

Lakeside
Flow
Eagle
Portal
Undeveloped
Caldera Zone Boundary
Caldera Recreation Units - Alternative A
Paulina Lake
East Lake
north
0
1
2
MILES
Newberry National Volcanic Monument

Figure 2-12

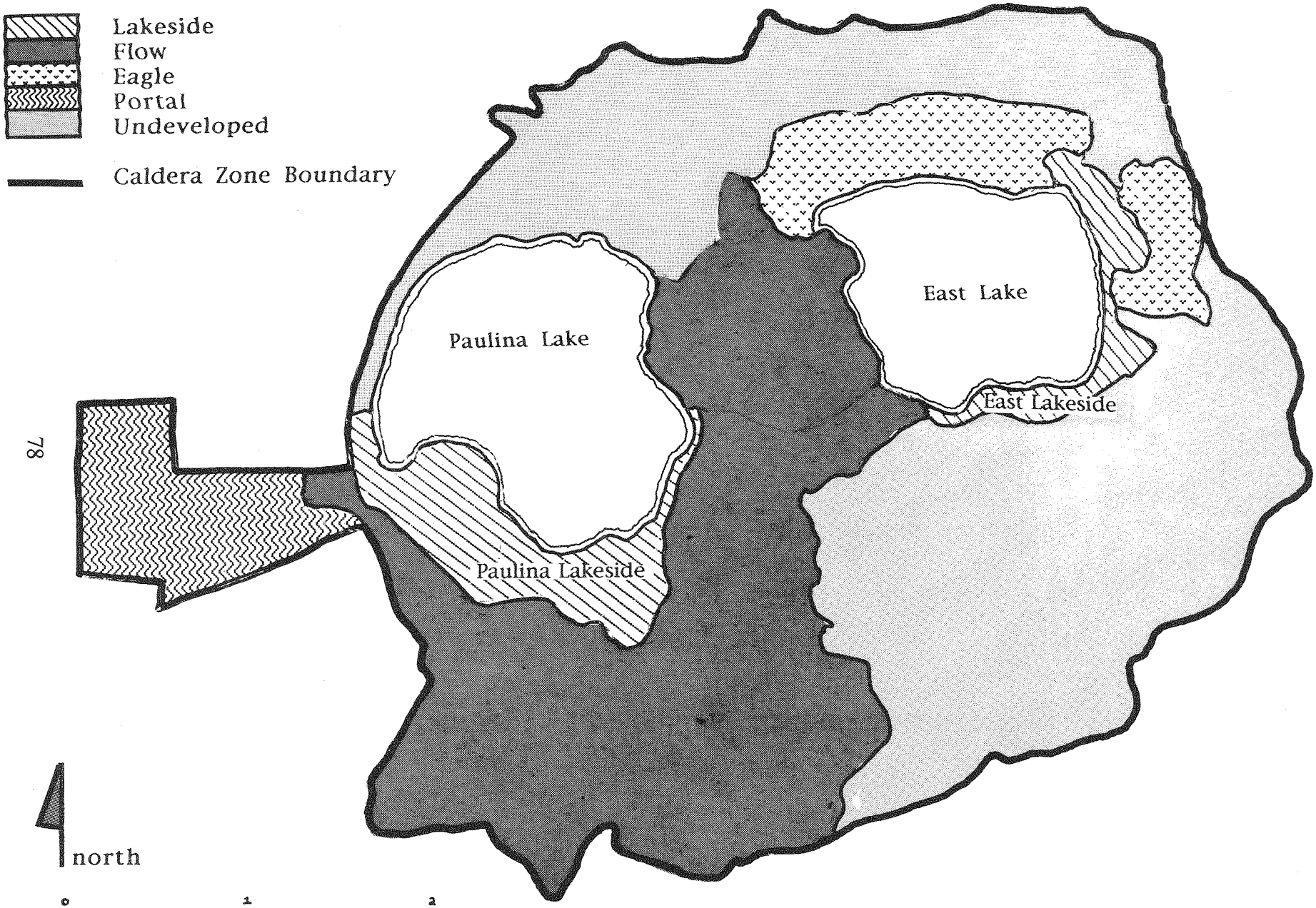
Caldera Recreation Units - Alternative B



Newberry National Volcanic Monument

Figure 2-13

Caldera Recreation Units - Alternative C



Newberry National Volcanic Monument

Figure 2-14

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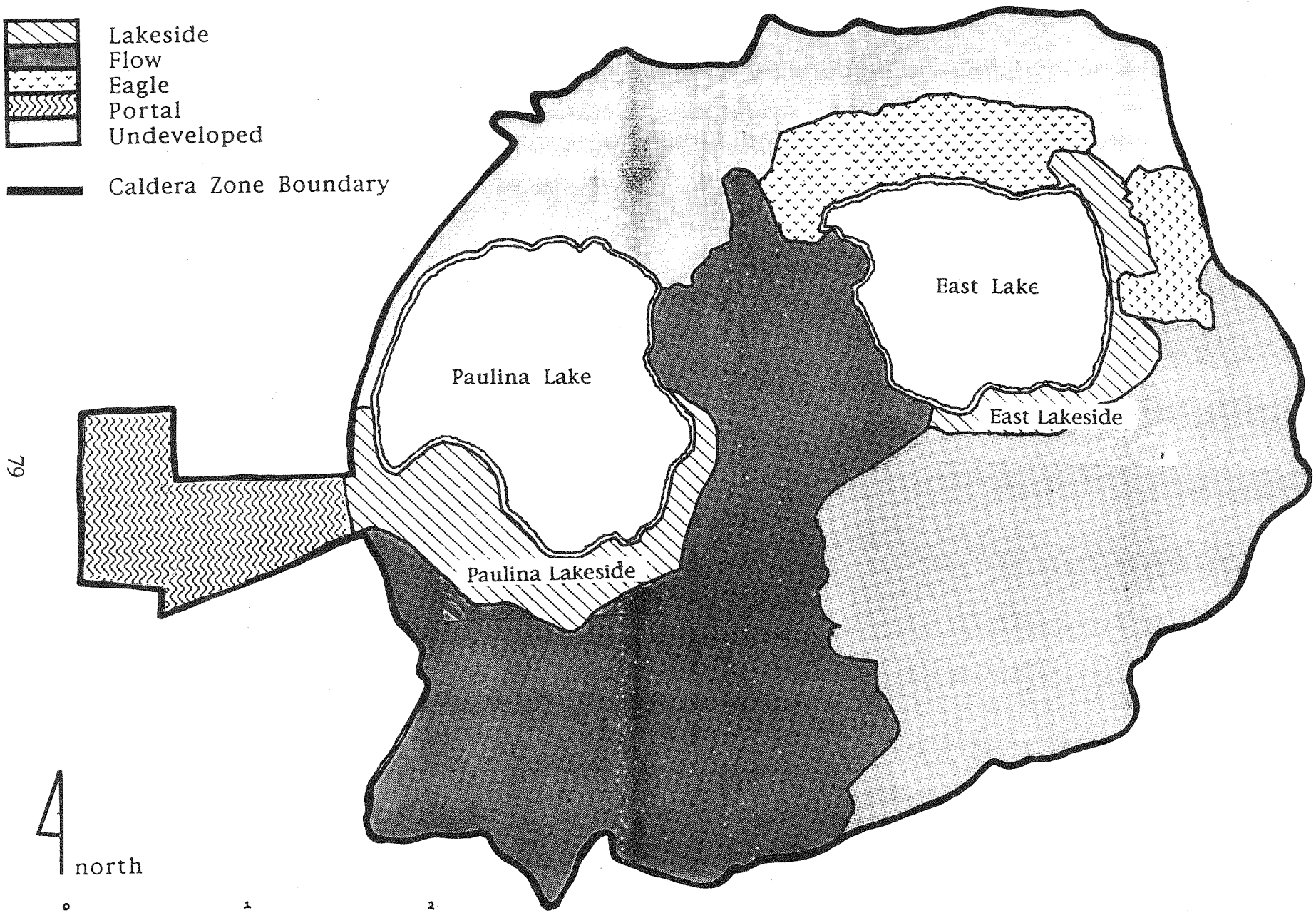
Caldera Recreation Units - Alternative C - Modified



Newberry National Volcanic Monument

ALTERNATIVE A: The caldera area would provide developed and dispersed recreation for many visitors. The portal facility would be large, with room for a parking area and interpretive displays. Personnel would be on hand to assist visitors and provide information. Shuttles could leave from this facility to tour the key features of the caldera and reduce private car traffic. The number of campsites would be increased by up to 30%, and RV hook-ups would be provided. One or two primitive campgrounds could also be added. New trails would be built connecting the floor of the caldera with the Rim Trail. Other trails (Paulina Lake, Paulina Peak) could be improved. All day use areas would be expanded and upgraded to accommodate more visitors.

ALTERNATIVE B: Dispersed and developed recreation would be provided, with an emphasis on wildlife protection and dispersed opportunities. The portal facility would be small with no parking area. The number of campsites in the caldera would be reduced, providing a quality camping experience for fewer people. The boat-in campgrounds on Paulina Lake (North Cove and Warm Springs) would be eliminated. The Paulina Lake day use area would be removed or reduced to provide a more scenic view of caldera. Some new trails would be built, but far fewer than under Alternative A.

ALTERNATIVE C: Recreational facilities under this alternative are tied to interpretation and education. The portal facility would be moderate in size, and would give visitors an orientation to the caldera. Shuttles could leave from this facility, providing a new, guided experience for visitors and reducing private car traffic. A few campsites would be added, and existing sites renovated to provide a better overnight camping experience. The boat-in campgrounds on Paulina Lake would be relocated to reduce damage to sensitive resources. A network of interpretive trails would link the caldera together, providing opportunities to learn about geology, archaeology, wildlife, and lake ecology. A small storage facility and bunkhouse for use by researchers and educational groups would be planned.

Boating and day-use facilities would be modified over time to encourage more low-key, "car-topper" boating activities on East Lake. This would provide a variety of recreational opportunities and choices for visitors.

ALTERNATIVE C-Modified: Same as Alternative C. The Monument Trail coming up the flanks of the volcano from Lava Lands and Lava Cast Forest would connect up with the Rim Trail around the caldera.

ALTERNATIVE D: Present management continues. There is no portal facility. Over the next 10 years, an additional 110 campsites would be built to accommodate more overnight visitors. The boat-in campgrounds on Paulina Lake remain. There are a few trails in the caldera that are enjoyed by a variety of users (Rim Trail, Paulina Lake, Paulina Peak.)

Winter Recreation:

In all alternatives, the goal is to enhance winter recreation opportunities for snowmobilers and cross-country skiers. The desired future condition is that recreationists work together to promote safe and responsible trail use. Many trails are shared between snowmobilers and cross-country skiers. Some trails in some areas encourage one use or another by signing (blue diamond - nordic; orange diamond - snowmobile).

All alternatives would feature building new winter trails and adding some warming shelters in the caldera. Alternative A would build the most trails. Alternative B would feature more nordic trails, in keeping with the theme of dispersed recreation and resource protection. Snowmobile trails would also be improved, but not as extensively as in A. Alternatives C and C-modified would improve and expand trails for both groups of winter recreationists, and add winter interpretive programs. In alternatives A, C, and C-modified, a winter sno-park at the portal facility is planned.

Roads and Facilities

The goal of roads and facilities in NNVM under all alternatives is to provide safe and comfortable access to areas of the Monument, and provide clean, appropriate facilities that enhance peoples' experience while visiting. The desired future condition is that visitors enjoy safe and scenic driving on roads in the Monument. They can choose from an array of driving experiences lasting from half an hour to all day. Interpretive facilities provide accurate information that helps people learn more about the area.

ALTERNATIVE A: This alternative would provide the most access to parts of NNVM, and has the most roads, trails, and facilities. A Monument Road is proposed under Alternative A, beginning at Lava Lands Visitor Center, going through the Transition Zone near Lava Cast Forest, and connecting with Road 21 west of Newberry Crater. This road would be paved, with turnouts, and provide access to campgrounds, trails, geologic features and other opportunities. Some additional short roads could be built (in the Flanks Zone and near Lava Cast Forest) for better recreational access and vegetative treatments. Road 21 east of East Lake would be improved to promote a scenic drive-through experience.

ALTERNATIVE B: Wildlife habitat would be improved under this alternative by closing or obliterating roads not needed for access to recreation sites or vegetation management. Few, if any, new roads would be developed. Existing roads and facilities may be upgraded to provide better safety for visitors.

ALTERNATIVE C: The focus of this alternative is expanded interpretation and education, and any road or facility improvements would be tied to this interpretive theme. Visitors would enjoy safe, comfortable, and educational driving experiences in NNVM. A scenic loop road between Lava Lands Visitor Center and Lava Cast Forest would be consistent with this alternative.

However, it will not be built in the next 10 years unless there is a dramatic increase in use or demand for a driving experience in that area. Day use facilities in most zones would be upgraded to improve interpretation for visitors.

ALTERNATIVE C-Modified: Same as Alternative C, except there are no plans to build a new scenic loop road between Lava Lands Visitor Center and Lava Cast Forest. Upgrading existing roads 9720 and 9710 (which together already provide a loop drive) with a better rock surface for safety and maintenance reasons would be considered, and consistent with this alternative.

ALTERNATIVE D: Continue present management with no new roads. Paulina Peak Road, Lava Cast Forest Road, and Lava Lands entrance remain as they are today. Facilities also remain in their present condition.

For more on facilities, please see the sections on Recreation and Interpretation.

Vegetation, Fire and Fuels

In all alternatives, the goal of vegetation management would be to allow natural ecological succession where practical, and restore old growth ponderosa pine ecosystems in suitable areas. The desired future condition is healthy, ecologically sustainable forests in all the vegetation communities of the Monument. These include: ponderosa pine, lodgepole pine, mixed conifer, mountain hemlock, and riparian areas. Unique plant communities such as willows, aspen, and sensitive plants would also be managed to maintain their presence in the Monument.

ALTERNATIVE A: The general focus of vegetation management in this alternative is to create and maintain high visual quality around popular recreation sites. This alternative would also restore some old growth ponderosa pine stands around popular areas. In the first decade of this plan, we anticipate treating about 1,000 acres of ponderosa pine (100 acres per year). In the lodgepole forests, some stands would be treated to reduce the fuel loads now present. In much of the Monument, vegetation would not be treated . Fires would continue to be suppressed, creating rich biological diversity in some areas.

ALTERNATIVE B: The focus of Alternative B is enhancing wildlife habitat. To meet this objective, large parts of the Monument would be managed for ecological (fire-suppressed) old growth. This creates a variety of habitats and encourages biodiversity. Some stands would also be managed for the open, park-like appearance common before Euro-American settlement. In the first decade we anticipate treating 1,000 acres of ponderosa pine to restore the open, park-like stands (about 100 acres per year would be treated, similar to Alternative A). There would be more treatments in the lodgepole forests, with the goal of enhancing wildlife habitat. Riparian areas would also receive special attention to promote high quality habitat.

ALTERNATIVE C: The focus of Alternative C is re-creating the historic (fire-based) old growth ponderosa pine stands present before EuroAmerican settlement. Prescribed fire would be an important tool in returning stands to this condition. Mechanical treatments such as crushing and thinning would also be used. In the first decade, about 250 acres per year of

ponderosa pine associations would be treated (2500 acres in the first decade), and an aggressive fuels treatment program in the lodgepole pine plant associations would reduce the fire danger in NNVM. Alternative C would be the most aggressive in terms of vegetation management.

ALTERNATIVE C-Modified: In response to public comment, we have added this alternative, with a revised approach to vegetation management. The main difference between Alternative C in the draft, and C-modified in the final EIS is in this area. This alternative would take a conservative approach to the rate of vegetative management activities, anticipating the need for extensive public involvement and understanding before proceeding with any project. **In the first decade, about five to eight projects, ranging in size from 50 to 200 acres each would be planned. The focus and goal of these projects would be to protect and restore the existing old-growth ponderosa pine stands and restore ecological processes in the Monument, primarily through prescribed fire and thinning.** A summary of Alternative C-modified for vegetation follows:

Alternative C-Modified would allow ecological succession of vegetation to continue without human intervention on most of the vegetated acreage in the Monument. Some vegetation management activities would be planned in some parts of the Monument to achieve the goals of:

- protecting and restoring existing large, old-growth stands.
- reestablishing conditions that would allow low-intensity fire (prescribed and prescribed natural) to again become the dominant factor in ecological processes, especially in ponderosa pine.
- reducing serious threats (from wildfires, insects or disease) to resources outside the Monument.
- improving habitat for wildlife or rare plants
- enhancing scenic quality
- protecting public health and safety
- ultimately, reducing or eliminating (where safe and practical) the need for human intervention in ecological succession of vegetation
- becoming more knowledgeable about the short and long-term applications of prescribed fire (alone and in combination with other activities) in ecosystem restoration through small experimental plots.

Alternative C-Modified would avoid vegetation management activities in the North and South Paulina roadless Areas unless needed to restore wildlife habitat or to reduce serious threats to resources outside the Monument. Any proposed activities would emphasize treatment methods that do not require roads. Temporary roads (for the life of the project only) would be considered only as a last resort.

Readers can obtain a sense of where vegetation management activities would be likely to be proposed by reviewing the map "Areas of Concern and Opportunity" and the accompanying text in the Management Plan.

ALTERNATIVE D: Minimal vegetation management occurs. Fires continue to be suppressed. Natural ecological processes continue in most parts of the Monument.

Please see Chapter 4, Vegetation, and Chapter 4 Scenic Quality, for a complete description of the alternatives' effects, and specific acres to be treated. Areas of concern and opportunity, including old growth ponderosa pine stands, are included in the maps accompanying the Management Plan.

Detailed desired future conditions for each vegetation community are in the planning record.

Fish and Wildlife

The goal is to provide and enhance wildlife habitat, and promote a quality fishing experience on Paulina and East Lakes. The desired future condition is to minimize conflicts between people and wildlife. Deer, elk, bears, eagles, fish, otters, bats, waterfowl and other species would all have an important role in the ecosystem of the Monument.

ALTERNATIVE A: The focus of this alternative is providing maximum recreational access to the Monument. Watchable wildlife would be emphasized. Most of the Monument vegetation would be left to natural ecological processes, but fires would be suppressed. These conditions in the forest would favor "late successional species" such as goshawks, martens, and woodpeckers. Fire suppression would also provide abundant hiding cover for big game. Many anglers would be fishing on the caldera lakes.

ALTERNATIVE B: This alternative focuses on enhancing wildlife habitat. Two additional Bald Eagle Management Areas would be added, one on Paulina Lake and one on East Lake. Two boat-in campgrounds in the caldera would be eliminated, reducing disturbance to bald eagles. The caldera wildlife refuge could be slightly expanded to increase wildlife protection in the area. Lava River Cave would be closed in winter to enhance bat recovery; it would be open in summer to guided tours only. A deer underpass or overpass across Highway 97 would reduce deer mortality. Riparian areas would be treated to enhance wildlife habitat. The closing of many roads would protect wildlife in some areas from human disturbance. Vegetation management would improve deer and elk habitat, and snag habitat for late successional species. Fewer people in the caldera would probably mean fewer anglers on the lakes.

ALTERNATIVE C: This alternative focuses on education, interpretation, and ecosystems. One additional BEMA would be added on East Lake, bringing the caldera total to two. Interpretive programs would talk about ecosystems and wildlife, encouraging people to understand the role and importance of all species in Newberry Monument. The extensive use of prescribed fire to clean out understory vegetation and create park-like stands of ponderosa pine would change some wildlife habitats. There would be less hiding cover and browse for deer and elk in these areas. Other species, such as flammulated owls and white-headed woodpeckers, would probably benefit from these habitat changes. Increased day use recreation would mean some additional anglers on the caldera lakes.

ALTERNATIVE C-Modified: Same as Alternative C, except Alternative C-Modified would provide fewer open park-like ponderosa pine stands and more fire-excluded forest, in ponderosa pine, mixed pine, mixed conifer, and lodgepole pine forests.

ALTERNATIVE D: Wildlife management focuses on meeting Forest Plan goals for protecting endangered and threatened species, and providing suitable habitat for other species. Browse and hiding cover for deer and elk is provided with fire suppression, which allows the growth of underbrush beneath big trees. Fishing pressure on the lakes is moderate, peaking on holiday weekends.

Please see Chapter 4, Fish and Wildlife, for a complete description of the alternatives' effects on wildlife. Detailed desired future conditions for wildlife are in the planning record.

Interpretation

The goal of interpretation is to provide a wide range of interpretive services to a diverse audience. The desired future condition is to present accurate, engaging information to visitors from all over the world. People would learn about the unique geology, archaeology and ecosystems of the Monument, and would better understand how the earth's forces have shaped this landscape. They would know how fire played a part in Central Oregon's forests over time, and would appreciate the interdependence of all species in the Monument.

ALTERNATIVE A: Since many more people would be coming into the Monument under this alternative, interpretive programs would feature large group presentations and facility-based services. There would be shuttle buses taking tours through the Monument. An expanded visitor center would be able to accommodate the increased crowds. More facilities would provide information to visitors. Interpreters, displays, exhibits, slide programs, and trail signs all would serve to educate visitors about the Monument's special values.

ALTERNATIVE B: This alternative focuses on dispersed recreation and wildlife enhancement. The interpretive program would be more low-key, with an emphasis on roving interpreters and person-to-person contact, instead of a large facility. Lava Lands would be upgraded, but not greatly expanded, and caldera interpretive facilities would also be small. Much of the interpretation would take place on trails, with signs, kiosks, and other "unattended" facilities. Interpretive programs would feature wildlife, in addition to the main themes of geology and archaeology.

ALTERNATIVE C: Interpretation and education take center stage in Alternative C. An expanded visitor center would provide comprehensive, theme-driven interpretive services to a wide range of visitors. Interpretation would take a variety of approaches: facility-based exhibits and displays; roving interpreters; discovery packs; trail signs; and guided walks and tours. An overnight campground in the Transition Zone for educational groups, and some kind of storage facility in the caldera would aid scientists and researchers in their efforts to learn more about the Monument's wonders. Outreach efforts to Central Oregon schools would be expanded. Any new recreational developments would be keyed to interpretive themes, making the Monument truly a place to learn.

ALTERNATIVE C-Modified: Same as Alternative C, except development of the group campground would not take place unless demand could be demonstrated.

ALTERNATIVE D: Present interpretive programs continue. Lava Lands remains open six to seven months a year. During the summer, interpreters give campfire talks in the caldera. Some guided walks and tours are offered on geology, botany and other topics of interest. There is no portal facility near the caldera.

For the following issues, please see the section in Chapter 2: "Features Common to All Action Alternatives."

Heritage/Geology
Science and Research
Monitoring
Air Quality
Water Quality
Scenic Quality
Law Enforcement
Local Communities
Native American Indian Involvement
Lands and Special Uses

The alternatives' effects on all issues and resources can be found in Chapter 4.

Alternative D - Current Direction ("No Action")

This alternative would continue management of Newberry National Volcanic Monument according to management direction provided under the 1990 Deschutes National Forest Land and Resource Management Plan (Forest Plan).

Adopting Alternative D would require either changing the general forest and scenic views allocations within the Monument boundaries to preclude scheduled timber harvests, or changing the Monument legislation to allow scheduled timber harvests.

Prior to passage of P.L. 101-522, the Forest Plan had allocated the lands that subsequently became part of the Monument to nine management areas. These management areas included:

- **Management Area 1, Special Interest Areas**
- **Management Area 2, Research Natural Areas**
- **Management Area 3, Bald Eagle**
- **Management Area 8, General Forest**
- **Management Area 9, Scenic Views**
- **Management Area 11, Intensive Recreation**
- **Management Area 12, Dispersed Recreation**
- **Management Area 15, Old Growth**
- **Management Area 17, Wild & Scenic Rivers**

The goals and objectives of these Management Areas are summarized below. Management activities that would be expected to occur under Alternative D in the next ten years in these management areas are also described. For ease of comparison to the action alternatives, their geographical location is roughly correlated with the management zones used in Alternatives A, B, and C (the River Zone, the Lava Butte Zone, the Transition Zone, the Flanks Zone, and the Caldera Zone). For more detail about the Forest Plan management allocations that would apply to the Monument under Alternative D, readers should consult Chapter 4 of the 1990 Deschutes National Forest Land and Resource Management Plan.

Management Area 1 - Special Interest Areas

This allocation occurs in two places in the Monument: at the north end of the Monument, surrounding Lava Butte; and in the Lava Cast Forest Area (Transition Zone in Alternatives A, B, and C). The Lava Butte Special Interest Area extends from Lava Butte toward the Deschutes River and encompasses most of the lava flows in that area. The Lava Cast Forest Special Interest Area lies roughly in the center of the Monument and also encompasses part of a lava flow. The goal of this allocation is to preserve and provide interpretation of unique geological, biological, and cultural areas for education, scientific, and public enjoyment purposes.

The primary benefiting uses in this management area are developed and dispersed recreation, research, and educational opportunities. Standards and guidelines allow for recreation uses and facilities but prohibit programmed timber harvesting. In areas of facility development, the Recreation Opportunity Spectrum category is defined as either Roaded Natural or Rural. In other parts of the Special Interest Area, lands are managed to provide Roaded Natural or Semiprimitive non-motorized recreation experiences.

Likely Activities and Developments

This area would remain the same as it is at present. Lava Lands Visitor Center would remain open an average of 230 days a year, with no expansion of facilities or programs planned. Benham Falls day-use area would not change. No new roads, trails or campgrounds would be planned in this area. The area would continue to be used by visitors for interpretive activities at the Visitor Center, as well as hiking, picnicking, and fishing along the Deschutes River.

Management Area 2 - Research Natural Areas

This allocation lies just north of the Lava Cast Forest, within what is known as the Transition Zone in Alternatives A, B, C and C-Modified. It consists of the Mokst Butte Natural Research Area (RNA). The goal of RNA's is to preserve examples of naturally occurring ecosystems in unmodified condition for research and education. Any research must be essentially nondestructive in nature.

Standards and guidelines prohibit any form of timber harvesting, programmed or otherwise. No physical improvements or facilities are allowed. Recreation uses are allowed but not encouraged or directed to the area. Roads and trails are generally not allowed, and grazing is also generally prohibited.

Likely Activities and Developments

No new developments of any kind would be planned for this area. Recreation use of this area would remain minimal.

Management Area 3 - Bald Eagle Management Area

This allocation occurs only along the north edge of East Lake, inside Newberry Crater (Caldera Zone in Alternatives A, B, and C). Its primary goal is to protect and enhance habitat for bald eagles. Nesting habitat and foraging areas are protected and enhanced, and old-growth stands with large trees are emphasized. Human disturbance is managed to be minimal during the nesting season.

Standards and guidelines do allow for programmed timber harvests, but such harvesting is only allowed for the purpose of initiating long-term stand management to achieve eagle habitat objectives. Compatible dispersed recreation activities such as hiking and birdwatching are allowed. Developed recreation, including campgrounds, is prohibited. Seasonal restrictions on recreational activities may be implemented on a case-by-case basis.

Likely Activities and Developments

No development activities would be planned in this management area. Some programmed timber harvesting could occur if needed to achieve eagle habitat objectives.

Management Area 8 - General Forest

Within the Monument boundary, this allocation occurs primarily east and south of Highway 97 and north of Lava Cast Forest Special Interest Area and Mokst Butte Research Natural Area (within the Transition Zone in Alternatives A, B, and C). Small patches of the general Forest allocation also occur along the southwestern and southern flanks of Newberry Crater, within what would be the Flanks Zone in Alternatives A, B, and C.

The goal of this management area is to emphasize timber production while providing forage production, visual quality, wildlife habitat and recreational opportunities. A key objective is to convert unmanaged stands of timber to managed stands. Grazing and fencing/water developments for grazing are permitted. Recreation uses and facilities are permitted, but may be discouraged or prohibited in areas where timber harvesting activities are occurring. ATV use is generally allowed off trails and roads. Management for wildlife habitat meets Forest-wide standards and guidelines as a minimum.

Likely Activities and Developments

No recreation development activities would be planned in this management area. Some timber harvesting could occur, but this would be unlikely. The Record of Decision for the 1990 Forest Plan gives direction as follows: ". . . manage the proposed Newberry Volcanoes National (sic) Monument in a way which will protect the values which are important to its establishment. This decision will be reviewed in two years if legislation has not been enacted. For the duration of this decision the allowable sale quantity (ASQ) of the Deschutes National Forest will be two million board feet less, annually, than called for in the Forest Plan." The goal of this management area to emphasize timber production conflicts with the Monument legislation, since timber production is not a purpose of the legislation.

Management Area 9, Scenic Views

This allocation occurs mostly on the outer flanks of Newberry Volcano (the Flanks Zone in Alternatives A, B, and C). Some "strips" also run along the eastern and western edges of the Monument northwest of Newberry Crater (within the Transition Zone in the action alternatives).

The goal of this allocation is to provide visitors with scenery that represents the natural character of Central Oregon. Programmed timber harvest for the purposes of meeting this goal is allowed. Results of activities should be visually subordinate to the landscape, as a minimum. Recreation developments and livestock grazing are permitted where consistent with the desired visual condition. ATV use is generally allowed off trails and roads.

Likely Activities and Developments

Some minor trail relocation or reconstruction would take place to correct conditions contributing to resource damage. Timber harvests would not be planned except where vegetative conditions create an unacceptably high risk of catastrophic fire or epidemic insect/disease to timber resources outside the Monument. No recreation trail or road developments would be planned.

Management Area 11, Intensive Recreation

This allocation is found only within Newberry Crater. It surrounds most of Paulina and East Lakes on the "floor" of the caldera (the Caldera Zone in Alternatives A, B, and C).

The goal of this allocation is to provide a wide variety of outdoor recreation opportunities within a forest environment. Localized settings may be changed to accommodate large numbers of visitors. Extensive recreation facility development is permitted, and high concentration of visitors are likely around these developments. Rural and Roaded Natural opportunities predominate. Both overnight and day-use recreation activities are permitted. Privately provided recreation opportunities, such as concession-operated campgrounds and resorts, are permitted. The standards and guidelines allow for continuation of present resorts, but prohibit new resorts.

Programmed timber harvest in not permitted within this allocation.

Likely Activities and Developments

Expansion of two campgrounds would be planned under Alternative D. Cinder Hill Campground would add 90 sites, and Paulina Campground would add 20 sites, for a total of 410 general use campsites in the caldera.

No additional trails would be planned. Some existing trails (Paulina Falls trail and Paulina Lake Loop trail) would be reconstructed or rerouted to correct or avoid resource damage such as soil erosion. No new roads would be developed; however, Paulina Peak road would be improved and maintained to ensure minimum safety standards are met.

Boat sites on both lakes would be renovated but not expanded. The Big Obsidian Flow trailhead/parking lot would be expanded to accommodate 250 persons at one time (PAOT's). No new day-use areas or interpretive facilities would be developed.

Management Area 12, Dispersed Recreation

This allocation occurs inside the caldera along the relatively steep inner slopes forming the north and south caldera walls.

The goal of this allocation is to provide a range of recreation opportunities in an undeveloped forest environment; although, some recreation development is allowed. The emphasis is on providing a feeling of remoteness in a predominately unmodified setting.

Primitive recreation facilities such as shelters, small camps, and signing are permitted. Designated trails and roads are allowed where market surveys demonstrate a need. No programmed timber harvesting is allowed.

Likely Activities and Developments

No activities or development would be planned in this allocation.

Management Area 15, Old Growth

This allocation occurs in seven or eight patches within the Monument, primarily on the southern and eastern flanks of Newberry Volcano (Caldera Zone). Two patches also occur in the Transition Zone.

The goal of this management area is to provide naturally-evolved old-growth forest for habitat, representations of landscape ecology, and public enjoyment. The old-growth forests in this allocation are to be managed to provide large trees, abundant snags and down dead trees, and multiple canopy layers (except in lodgepole where a single canopy is most common).

Concentrated recreation uses and facilities are not permitted, but dispersed recreation activities are generally acceptable. Incidental use by ATV's is generally permitted. No programmed timber harvest is allowed, but vegetation treatment to achieve old-growth characteristics is permitted. Roads and trails are permitted if they meet the objectives of this allocation. Livestock grazing is not allowed.

Likely Activities and Developments

No activities or development would be planned in this allocation.

Management Area 17, Wild & Scenic Rivers

This allocation occurs in two places within the Monument: along the east bank of the Deschutes River where it delineates the northern boundary of the Monument, and as a corridor encompassing the segment of Paulina Creek found within the Monument (the Caldera Zone). The Deschutes River has been designated as part of the National Wild and Scenic Rivers System. Paulina Creek has been identified as eligible for inclusion in the system, pending a suitability study/recommendation and action by Congress on the recommendation.

The goal of this allocation is to protect and enhance the remarkable values that qualify the stream for inclusion in the System. Standards and Guidelines permit cutting of trees primarily when needed to enhance scenic, recreational, wildlife, fisheries, or hydrologic values. Recreation developments are permitted.

Likely Activities and Developments

Paulina Falls day-use area would be renovated to address public safety and resource damage concerns. This renovation would not entail any expansion in capacity. Parts of the Paulina Falls trail would be relocated and signed. No other activities or developments would be planned.

Table 2-11

COMPARISONS BY ISSUE

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE C-MODIFIED	NO ACTION ALTERNATIVE D
THEME → / ISSUE ↓	Increase recreational opportunities and access. Accommodate highest number of visitors. Many roads, trails and facilities.	Maximize preservation and protection of all resources, especially wildlife. Limits access in some areas. Emphasizes dispersed recreation, self-discovery, opportunities for solitude.	Focus on education, interpretation, science and research. Emphasize unique geology, archaeology and ecosystems of NNVM and re-introduction of fire.	Same as Alternative C.	Follow guidelines in legislation and Forest Plan; No change from present management.
RECREATION					
Camping	Increase capacity; expand caldera campgrounds and add RV hook-ups; add 1 car-accessible campground and a few small hike-in campgrounds in Transition Zone, plus a few semi-primitive camp sites in Flanks Zone.	Decrease capacity. Focus on quality camping experience for fewer people. Eliminate hike-in/boat-in campgrounds on Paulina Lake.	Increase capacity slightly in caldera to better accommodate existing use levels. New group camp for educational groups in Transition Zone. Relocate hike-in/boat-in campgrounds on Paulina Lake.	Same as Alternative C.	Maintain current camp-grounds. Add sites at Paulina Lake and Cinder Hill.
Trails	Build many new trails, including Monument Trail (River to Caldera). Emphasize accommodating a range of uses for general recreation and sightseeing.	Some new trails to improve dispersed recreation opportunities. Most are semi-primitive.	Focus on interpreting unique geology, archaeology and ecosystems. Some existing trails are enhanced for interpretation.	Same as Alternative C, but add Monument Trail.	Keep current trail system
Day Use	Expand and improve current day-use areas. New day-use facilities in Transition, Caldera, and Lava Butte Zones.	Relocate Paulina Lake day use to provide more natural entrance view of caldera. Improve but do not expand other day-use areas in caldera. New semi-primitive day use in Transition Zone.	New day-use areas enhance education opportunities. Expand interpretive day use in Caldera, Transition and Lava Butte Zone.	Same as Alternative C.	Expand some day-use areas slightly.
ATV Use	Provide one corridor through Transition Zone and access to East Lake Resort. No off-trail use allowed.	No ATV access or use provided, except for licensed use on roads open to public.	Same as Alternative B.	Same as Alternative B.	No ATV trails provided.
Winter Recreation	Build two warming shelters in caldera, one in Flanks. Develop new sno-park 2 miles west of caldera at new greeting/portal facility); Design new nordic and snowmobile trails. Provide more snowplay areas.	Enhance non-motorized nordic use while continuing snowmobile use. Build new nordic trails. One warming shelter proposed in caldera.	Enhance winter interpretive opportunities with snowshoe walks, ski and snowmobile tours. Design new nordic and snowmobile trails. Develop new sno-park west of caldera (at new portal facility) for better access.	Same as Alternative C.	Heavy snowmobile use in caldera, some nordic skiing.

Table 2-11

COMPARISONS BY ISSUE (continued)

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE C-MODIFIED	NO ACTION ALTERNATIVE D
ROADS AND FACILITIES	New roads and facilities provide for more visitors. Build new Monument Road using mostly existing routes to link the Lava Butte Zone to the Caldera Zone. Short new road may enter Flanks Zone (NE of caldera) to access geothermal development and new trails. Build new portal (interpretive) facility on Road 21 west of the caldera. Expand or build new visitor center in Lava Butte Zone.	Minimal road and facility development. Obliterate some roads to protect wildlife. Portal/greeting facility near caldera is small -- probably a drive-through kiosk only. No new campgrounds. Improve Lava Cast Forest Road. Keep or improve CCC building in caldera for visitor information and interpretation.	New roads and facilities support interpretive programs. Develop loop road from Lava Butte Zone to Transition Zone (Lava Cast Forest). Field station/campground in Transition Zone provides overnight facilities for school groups and researchers. Build new portal facility on Road 21 west of caldera. Renovate education/visitor facility in Lava Butte Zone.	Same as Alternative C, except no new loop road from Lava Lands to Lava Cast Forest.	Keep all roads and non-recreational facilities as they are. Expand campgrounds in the caldera.
VEGETATION	Focus on scenic views around high use areas. Create some "historic" open, park-like stands of ponderosa pine by a variety of treatments. Most areas left untouched. High accumulations of fuels due to fire exclusion.	Vegetative treatments focus on mechanical means (thinning) with limited use of fire. Goal is wildlife habitat improvement and promoting healthy, diverse ecosystems. Large areas are treated to promote multi-storied "ecological" old-growth conditions, with the exclusion of fire.	Emphasize restoring natural patterns, including the re-introduction of fire as a major part of the Monument ecosystem. Gradual development of "historic" old-growth ponderosa pine stands. Research projects on vegetative treatments and their outcomes.	Reduce number of acres treated. Emphasize natural processes in ponderosa pine and lodgepole pine.	"Allow natural ecological succession to the maximum extent practical." Continue to exclude fire, allowing high fuel accumulations.
FISH AND WILDLIFE	Increased development and access for people may disturb eagles, bats and other species. Lava River Cave remains accessible to people year-round. Provide more wildlife viewing opportunities.	Enhance wildlife habitat through vegetative treatments and restricting human access. Dispersed recreation may disturb some species. Close Lava River Cave in winter and allow only guided tours in summer to protect bats. Create two additional areas for bald eagles in caldera. Protect River Zone by seasonal closures. Highest biodiversity.	Focus on wildlife study and ecosystems interpretation for visitors. Close Lava River Cave in winter to protect bats. Create one new BEMA in caldera. Leave some areas less accessible to humans.	Same as Alternative C.	Protecting endangered plants and animals. Providing habitat for deer, elk and other species. Lava River Cave remains accessible to people year-round, potentially disturbing bat populations.
INTERPRETATION	Expand/Relocate current visitor center, and make Lava Butte Zone the interpretive hub for NNVM. Feature shuttles running to all parts of Monument. Accessible, high-tech interpretation, relying heavily on facilities to serve many people. Many guided tours.	Minor improvements and expansion of current visitor center in Lava Butte Zone. Interpretive focus includes wildlife and habitat management. Roving interpreters offer more person-to-person interactions. De-emphasize facilities & buildings. "Discovery packs" offer opportunities for families to learn on their own.	Renovate current visitor center in Lava Butte Zone to enhance science education and "hands-on" interpretation. Emphasis includes ecosystem dynamics, role of fire, and links NNVM to global context. Wide range of learning opportunities.	Same as Alternative C.	Continue present level of interpretation. Focus at Lava Lands; some programs in caldera and at Lava Cast Forest.

Table 2-12

Key Opportunities That Differ By Alternative By Zone

RIVER ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alternative C-Modified**	**Alternative D**
3,479 acres	**6,414 acres**	**3,645 acres**	**3,645 acres**	**N/A acres**

ALL ALTERNATIVES

- The primary purpose of the River Zone is to provide and enhance wildlife habitat. There are no new facilities for human use. People may visit this area and enjoy exploring on their own, but use is not encouraged.

- Some interpretation of the River Zone takes place from the Deschutes River (recreational rafting) and from the Lava Butte Zone.

Table 2-12 (continued)

Key Opportunities That Differ By Alternative By Zone

LAVA BUTTE ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alt. C-Mod.**	**Alternative D**
6,048 acres	**2,169 acres**	**5,883 acres**	**5,883 acres**	**N/A**
• Expand or construct new visitor center.	• Renovate existing visiter center.	• Renovate/expand Lava Lands to provide interpretive services.	• Same as Alternative C.	• Maintain Lava Lands Visitor Center as is.
• Extensive trail system connects Lava Lands, Benham Falls Kipukas, High Desert Museum. Begin Mon. Trail to caldera	• Short loop trails near visitor center. Emphasize dispersed recreation with few new trails.	• Interpretive trail system connects Lava Lands, Benham Falls, kipukas, High Desert Museum.	• Interpretive trail system like Alt. C. Add Monument trail.	• Maintain current trails.
• Expand Benham Falls Day-Use Area; add well.	• Maintain Benham Falls area.	• Expand Benham Falls Day Use.	• Same as Alternative C.	• Maintain Benham Falls Day-Use Area as is.
• Interpretation is facility-based; often high tech.	• Emphasize roving interpreters instead of facility-based programs.	• Vigorous interpretive program utilizes talks, walks, programs, displays, and discovery packs.	• Same as Alternative C.	• Limited interpretive programs for 6-8 months per year.
• Begin Monument Road through Transition Zone to caldera.	• Close or obliterate unneeded roads. Maintain current facilities.	• Roads or facilities tied to interpretive theme.	• Same as Alternative C.	• Maintain current roads and facilities.
• Focus vegetation management around high-use areas. Where appropriate, restore old-growth ponderosa pine ecosystems. Leave large areas of NNVM to "natural ecological succession."	• Focus vegetation management on creating high-quality wildlife habitat. Emphasize "ecological" (fire-suppressed) old growth to provide range of habitats.	• Focus vegetation management on creating historic (fire-based) old-growth ponderosa pine stands. Actively use fire as a management tool to create open, park-like stands	• Same emphasis as Alt. C, but fewer acres.	• Minimal vegetation treatments. Continue fire suppression as needed.
• Lava River Cave remains accessible all year.	• Restrict Lava River Cave to guided summer tours only for bat protection. Close in winter.	• Lava River Cave: open in summer to all; closed in winter.	• Lava River Cave closed in winter, except for guided tours. Open summer.	• Lava River Cave remains accessible to people all year.

Table 2-12 (continued)

Key Opportunities That Differ By Alternative
By Zone

TRANSITION ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alt. C-Mod.**	**Alternative D**
14,652 acres	**15,596 acres**	**14,652 acres**	**14,652 acres**	**N/A**
• Build new developed campground plus 1-3 dispersed camps.	• No new campgrounds. Emphasize dispersed recreation.	• Provide rustic overnight campground for researchers or educational groups.	•Same as Alternative C.	• No developed campgrounds exist now.
• Monument Trail links all Zones; provides spur trails to features.	• No Monument Trail. Some new trails to features, but minimal development. Emphasize self-discovery and exploration.	• Design new interpretive trails to unique geologic features.	•Same as Alternative C, but add Monument Trail.	• Lava Cast Forest Trail is main attraction.
• Extensive development of day-use areas.	• Improve Lava Cast Forest Day-Use Area.	• Develop new day-use areas with interpretive tours. Provide activities for 1/2 day stay.	•Same as Alternative C.	• Minimal day use in area now. Keep as is.
• Provide ATV access corridor through Monument.	• Licensed ATV's allowed on Forest Service Roads.	• Licensed ATV's allowed on Forest Service roads.	•Same as Alternative C.	• Some ATV use on roads.
• New Monument Road crosses this Zone -provides scenic driving opportunities.	• No Monument Road. Obliterate or close unneeded roads.	• Allow for future scenic loop road if use increases dramatically. Roads or facilities tied to interpretive theme.	•No new loop road.	• Keep existing roads as they are.
• Focus vegetation management around high-use areas. Where appropriate, restore old-growth ponderosa pine ecosystems. Leave large areas of NNVM to "natural ecological succession."	• Emphasize wildlife habitat in vegetation management by creating snags, hiding cover, and more diversity. Limit vegetation treatments in big game migration corridors.	• Aggressively reduce fire hazard and fuel loads by thinning and prescribed fire. Restore old-growth ponderosa pine.	•Same as Alternative C, but fewer acres.	• Minimal vegetation management.

Table 2-12 (Continued)

Key Opportunities That Differ By Alternative By Zone

FLANKS ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alternative C-Modified**	**Alternative D**
21,813 acres	**22,701 acres**	**22,701 acres**	**22,701 acres**	**N/A**

ALL ALTERNATIVES

- This area is undeveloped and undiscovered, with few facilities present, except for trails, signs, and dispersed campsites.
- The Flanks Zone provides opportunities to get away from the sights and sounds of other people, and explore relatively unknown areas of the Monument. A few more recreational and/or self-directed interpretive trails would be provided.
- Allow for a stub road to semi-primitive trailhead.
- Much of the Flanks Zone includes the North and South Paulina Roadless areas. All alternatives propose some vegetation management in this Zone to restore natural processes. Alternative C would have the most; Alternative C-Modified, the least.

Table 2-12 (continued)

Key Opportunities That Differ By Alternative
By Zone

CALDERA ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alternative C-Modified**	**Alternative D**
13,629 acres	**12,741 acres**	**12,741 acres**	**12,741 acres**	**N/A**
• Large new portal facility on Road 21 outside caldera. Serves as winter sno-park.	• Small portal facility; no parking. Not big enough for sno-park.	• Interpretive portal facility greets and orients visitors. Serves as winter sno-park.	• Same as Alternative C.	• No greeting or portal facility.
• Campground capacity increases 20~40%. Provide RV hook-ups.	• Campground capacity decreases 10~20%. Provide minimal RV hook-ups.	• Campground capacity increases 5~10%. Consider some RV hook-ups.	• Same as Alternative C.	• Over next ten years campground capacity increases 34%.
• Keep boat-in campgrounds on Paulina Lake.	• Eliminate boat-in campgrounds on Paulina Lake (protect eagles).	• Relocate boat-in campgrounds.	• Same as Alternative C.	• Keep boat-in campgrounds on Paulina Lake.
• Extensive network of new trails.	• Some new trails enhance dispersed recreation.	• New interpretive trails take visitors to geologic features.	• Same as Alternative C.	• Keep present trail system.
• Provide ATV access to East Lake Resort.	• No special ATV access trails.	• No special ATV access trails.	• Same as Alternative C.	• No special ATV access.
• Build two new warming shelters for winter recreation. Extensive new winter trails.	• Build one new warming shelter. Emphasize new nordic trails while continuing snowmobile use.	• Build one or two new warming shelters. Expand nordic and snowmobile trail systems.	• Same as Alternative C.	• Winter recreation remains as today.
• Upgrade Road 21 east of East Lake to provide drive through access.	• Consider gating Road 21 east of East Lake to reduce traffic.	• Keep Road 21 east of East Lake as it is now.	• Same as Alternative C.	• Road 21 is unpaved east of East Lake Resort.

CALDERA ZONE				
Alternative A	**Alternative B**	**Alternative C**	**Alternative C-Modified**	**Alternative D**
13,629 acres	**12,741 acres**	**12,741 acres**	**12,741 acres**	**N/A**
• Encourage shuttles to Paulina Peak and other caldera features.	• No shuttles encouraged or provided.	• Consider guided shuttle tours with interpretive focus.	• Same as Alternative C.	• No shuttles.
• Upgrade all day use areas.	• Consider removing Paulina Lake Day-Use Area for better view of caldera. Renovate CCC building to become interpretive facility.	• Upgrade all day-use areas.	• Same as Alternative C.	• Facilities remain as they are.
• Focus vegetation management around camp grounds.	• Vegetation management emphasizes wildlife habitat.	• Most aggressive vegetation management in reducing fire hazard and fuel loads.	• Focus vegetation management around developed areas. Some treatments in lodgepole pine stands.	• Minimal vegetation management.
• Maintain present caldera wildlife refuge. Keep one Bald Eagle Management Area.	• Expand wildlife refuge. Create two new Eagle areas, one on each lake.	• Keep present wildlife refuge. Create one new eagle area on East Lake. Feature wildlife and ecology in interpretive programs.	• Same as Alternative C.	• Maintain present caldera wildlife refuge and one BEMA.

Table 2-13

SUMMARY OF QUANTITATIVE PROJECTIONS*

NNVM COMPONENT	ALTERNATIVE				
	A	B	C	C-Modified	D*** No Action
Miles of road**	67	56	62	60	97
Number of campsites	+15~30%	-10~20%	+5~10%	+5~10%	328
Miles of new trail Summer Winter	 +60 mi. +30 mi.	 +15 mi. +20 mi.	 +40 mi. +20 mi.	 +45 mi. +20 mi.	 0 mi. 0 mi.
First decade restoration of ecological processes in lodgepole pine (acres)	1,000	1,350	2,700	170~760	minimal
First decade restoration of old-growth ponderosa pine (acres)	1,000	1,000	2,500	70~400	minimal
Long-term (50+ years) total acres - lodgepole pine restoration of ecological processes	6,200	16,000	20,000	13,000	minimal
Long-term (50+ years) total acres - restoration of old-growth ponderosa pine	1,000	7,000	8,000	3,760	minimal
Size of Lava Lands (square feet)	6~9,000	3~6,000	9~12,000	9~12,000	3,100
Bald Eagle Management Areas	1	3	2	2	1

* The Monument interdisciplinary team made some assumptions to analyze the effects of the alternatives. These assumptions are shown here -- and developed fully in Chapter 4.

** All action alternatives reduce miles of road by closing some roads. All reroute the entrance to Lava Lands and improve Paulina Peak Road.

*** Alternative D, the "No Action" Alternative, represents current management direction as provided in the Forest Plan. The activity schedule for the Forest Plan identifies several campground expansion projects in Newberry caldera. The campsite number shown in this column would be expected to increase by 110 (for a total of 438 sites) in the first decade of the Forest Plan. The other numbers shown in this column would be expected to remain the same.

Table 2-14

Estimated Outputs and Effects

ISSUE	Indicator of Responsiveness	BY	ALT A	ALT B	ALT C	ALT C-Modified	ALT D
RECREATION	Percent change in Potential RVD's for Developed Sites; includes day use and overnight use	over the next 20 years	+46% to +80%	-12% to +30%	+33% to +52%	+33% to +52% (over the next 40 years)	+17%
	Trail & Road Miles	summer trail winter trail road	+60-70 miles +25-35 miles 67 miles	+10-20 miles +15-25 miles 56 miles	+30-40 miles +15-25 miles 62 miles	+35-45 miles +15-25 miles 60 miles	+0 miles +0 miles 97 miles
	Percent of ROS Types	R R RN RNNM RM SPM SPNM	<1% 1% 44% 2% 0% 0% 53%	<1% <1% 19% 0% 0% 14% 67%	<1% <1% 28% 0% 0% 0% 72%	<1% 0% 26% 0% 0% 0% 74%	2% 0% 26% 0% 17% 0% 56%
	Percent Change in Design Capacity of Facilities	day use overnight	+84%-113% +24%-49%	+1%-19% -24%- -13%	+67%-111% +8%-10%	+67%-111% +8%-10%	0% +26%
ROADS AND FACILITIES	Percent Change in Design Capacity of Developed Facilities by Zone	RIVER day use Overnight	 0% 0%	 0% 0%	 0% 0%	 0% 0%	 0% 0%
		LAVA BUTTE day use overnight	 +45%-97% 0%	 1%-49% 0%	 +90%-140% 0%	 +90%-140% 0%	 0% 0%
	* Not calculable; but a significant increase	TRANSITION day use overnight	 +1758% *	 +25%-150% 0%	 +1108% *	 +1108%	 0% 0%
	** Warming shelter for winter safety	FLANKS day use overnight	 ** 0%	 0% 0%	 ** 0%	 ** 0%	 0% 0%
		CALDERA day use overnight	 +55%-103% +17%-33%	 +0%-3% -29%- -13%	 +67%-111% +6%-7%	 +67%-111% +6%-7%	 0% +26%
	Miles of Open Road inside the Monument Boundary by type and Zone	Paved Road River Lava Butte Transition Flanks Caldera	 0 7.2 7.2 0 13.5	 0 6.9 0 0 12.6	 0 6.9 0 0 12.6	 0 6.9 0 0 12.6	Zone boundaries are not applicable to Alternative D.
		Aggregate River Lava Butte Transition Flanks Caldera	 0 3.3 5.4 0 6.3	 0.3 0.6 7.3 0 6.3	 0 3.6 10.2 0 6.3	 0 3.3 9.0 0 6.3	

ISSUE	Indicator of Responsiveness	BY	ALT A	ALT B	ALT C	ALT C-Modified	ALT D
ROADS AND FACILITIES		Native River Lava Butte Transition Flanks Caldera	 0 4.8 9.5 6.1 3.8	 0 4.3 9.2 7.1 1.9	 0 3.5 9.5 7.1 1.9	 0 3.5 9.5 7.1 1.9	
		Total Paved Aggregate Native	 27.9 15 23.8	 19.5 14.5 22.1	 19.5 20.1 22.9	 19.5 18.6 22.0	 17.6 11.5 68.1
		Total Road	67	56	62	60	97
	Percent New Summer Trails by Type and Difficulty Standard * Multiple use LM = Low to moderate standard MH = Medium to high challenge	Hiking LM Hiking MH Hiking LM * Hiking MH * Interpretive LM Interpretive MH	86% 46% 36% 76% 78% 72%	11% 0% 21% 100% 94% 11%	11% 19% 17% 83% 95% 39%	11% 19% 29% 83% 95% 39%	0% 0% 0% 0% 0% 0%
	Road Density in miles per square mile		0.7	0.6	0.7	0.7	1.0
	Miles of Road Closed or Obliterated		42 mi.	41 mi.	41 mi.	41 mi.	0 mi.
	Average Annual Costs Operations & Maintenance	in 1993 dollars	1,853,000	1,274,000	1,821,000	1,746,000	670,000
	Total Capital Investment Costs (through first 10 yrs)	$	17,020,000	8,798,000	14,706,000	14,574,000	7,200,000
	Acres Managed for "Historic" Old-Growth Ponderosa Pine Ecosystems		1,000 acres	1,000 acres	8,000 acres	3,240 acres	minimal
	Acres Managed for "Ecological" Old-Growth Ponderosa Pine Ecosystems		0 acres	6,000 acres	0 acres	520 acres	minimal
	Area (acres) of Restoration Activities Involving Old-Growth, Introduction of Fire in Ecosystems, the Reduction of Fuels to More Natural Levels, and to Meet Other Management Objectives	Ponderosa Pine Lodgepole Pine Mixed Conifer Total Acres	1,000 acres 6,200 acres 0 acres 7,200 acres	7,000 acres 16,100 acres 1,900 acres 25,000 acres	8,000 acres 20,100 acres 2,400 acres 30,500 acres	3,760 acres 12,900 acres 1,300 acres 17,960 acres	0 acres 0 acres 0 acres 0 acres

ISSUE	Indicator of Responsiveness	BY	ALT A	ALT B	ALT C	ALT C-Modified	ALT D
	Acres in Grazing Allotments		0 acres	0 acres	0 acres	0 acres	2,740 acres
VEGETATION	Projected Acres Treated with Prescribed Fire by Vegetative Type (includes acres treated with a combination of mechanical methods and prescribed fire)	Ponderosa Pine Lodgepole Pine Mixed Conifer Total	1,000 acres 2,500 acres 0 acres 3,500 acres	1,000 acres 9,500 acres 1,900 acres 11,500 acres	8,000 acres 12,700 acres 1,900 acres 21,900 acres	3,240 acres 9,800 acres* 1,300 acres 13,740 acres *estimated 7,460 acres of prescribed natural fire	0 acres 0 acres 0 acres 0 acres
FIRE AND FUELS	Acres Burned Annually in the First Ten Years by Type of Fire	High-intensity Wildfire * Prescribed Fire * Maximum acres predicted to burn annually by wildfire.	600-1200 acres 200 acres	500-1000 acres 400 acres	300-400 acres 550 acres	600-1200 30-115 acres	600-1200 acres <5 acres
FISH	Projected Change in Fishing Pressure		+15%	slight increase	+7%	+7%	slight increase
	Projected area of deer hiding cover in winter and transition range	in long term	72%	51%	30%	61%	89%
	Projected area of deer hiding cover in summer range	in long term	67%	72%	67%	68%	64%
	Range of suitable goshawk nesting habitat	in long term	7,800 to 17,100 acres	11,800 to 15,000 acres	2,300 to 4,400 acres	5,200 to 12,600 acres	7,800 to 17,200 acres
	Range of suitable flammulated owl habitat	in long term	4,000 to 6,900 acres	6,000 to 6,900 acres	9,800 to 10,400 acres	6,600 to 8,600 acres	3,200 to 6,400 acres

ISSUE	Indicator of Responsiveness	BY	ALT A	ALT B	ALT C	ALT C-Modified	ALT D
INTERP.	Total Capacity (PAOT) of Interpretive Facilities (includes interpretive trails)		2110-2760	900-1290	2190-2940	2190-2940	900
	Number of Miles of Interpretive Trails		19	11	27	27	4
ARCHAEOLOGY AND GEOLOGY	Acres of Vegetation Restoration	includes prescribed natural fire	7,200	25,000	30,500	17,960	minimal
	Percent Change in Potential RVD's (developed sites)		+54-91%	-12% to +3%	+38-63%	+38-63%	+13%
	Miles of New Trail	Summer Trail Winter Trail	60-70 25-35	10-20 15-25	30-40 15-25	35-45 15-25	0 0
	Miles of Road		67 miles	56 miles	63 miles	60 miles	97 miles
AIR QUALITY	PM_{10} Concentrations in Caldera during a Typical Inversion Period	micrograms per cubic meter	31	23	27	27	29
	PM_{10} Concentrations in Caldera in Worst Case Inversion Conditions	micrograms per cubic meter	82	56	68	68	77
	Total Tons PM_{10}'s Generated by Wildfires and Prescribed Fires Annually during the First Ten Years	Prescribed Fires Wildfires	26 tons 400-790	50 tons 330-660	78 tons 400-790	22 tons 400-790	<2 tons 400-790
	Miles of Unpaved Road (Aggregate and Native)		38.8 miles	36.6 miles	43.0 miles	40.6 miles	79.6 miles
WATER	Change in RVD's for Developed Sites near Water	Paulina Lake & East Lake Deschutes River	+31% +212%	-10% +0%	+9% +110%	+9% +110%	+19% +0%
	Visual Sensitivity as Measured by Potential for Increasing Visitors Numbers	* Monument sensitivity is already high and will only increase	++++	++	+++	+++	+*

ISSUE	Indicator of Responsiveness	BY	ALT A	ALT B	ALT C	ALT C-Modified	ALT D
SCENIC	Percent Increase in Acres of Corridor Viewshed (Foreground)		59%	11%	26%	35%	0%
	Number of New Key Viewpoints		5	0	3	3	0
LOCAL COMM.	Increase in Annual Employment		most	more	more++	more+	least
	Increase in Income		most	more	more++	more+	least
	Payments to Counties		most	more	more++	more+	least

Mitigation — Monitoring

Mitigation

Mitigation measures are included in all alternatives. For specific resource mitigations, please see each section of Chapter IV. Any site-specific projects coming from this plan will also have specific mitigation measures in place.

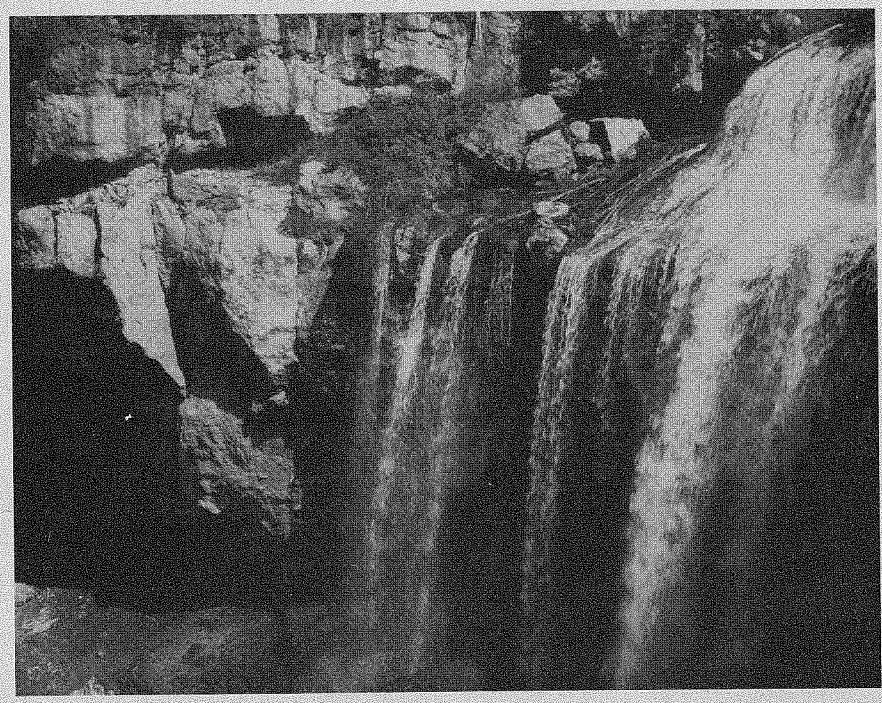
Monitoring

A monitoring program that is effective and efficient is part of this plan. See the section on monitoring in the Monument Plan. The monitoring program will ensure that the Monument's special values will be protected and preserved, as directed by Congressional legislation.

See also "monitoring" section on "Features Common to All Alternatives" in this chapter.

CHAPTER THREE

AFFECTED ENVIRONMENT



Changes between Draft and Final

A new ecological overview introduces this chapter, reflecting the integration of all resources. For consistency, the key issues are addressed in the same order as they appear in Chapters 1 and 2 after this overview. (Recreation, Roads and Non-Recreation Facilities, Vegetation, Fish and Wildlife, etc.).

Each section has been edited for clarity, and where necessary, rewritten to include updated information. The Vegetation section has been revised and improved, with updated definitions of old growth, and fuller explanations of some of the complex relationships in forest communities. The North and South Paulina Roadless Areas are now addressed in more detail in a new section, called "Land Status."

Introduction

This chapter describes the environment which would be affected by implementing a management plan for Newberry National Volcanic Monument. First, there is an ecological overview, divided into three sections:

1) The Physical environment (including soil, water, air, climate).

2) The Biological realm (including fish, plants and animals).

3) The Human dimension (including our beliefs, attitudes, values, behaviors, and recreational patterns).

Following the ecological overview, there are more in-depth sections for each of the different environmental components (Recreation, Roads and Facilities, Vegetation, etc) identified as key issues and concerns by the public.

Ecological Overview

Newberry National Volcanic Monument is a dynamic, interacting system of different plant and animal species, energy exchanges, and "dialogues," all taking place in a landscape carved by volcanic action throughout the past half-million years. It is difficult, but important, to remember that many, many things are happening simultaneously -- people, animals, plants, microbes, fungi, fire, wind and weather all combine to perform a daily symphony, which has been playing, with variations, for centuries. When we focus on just one element of this ecosystem, however, it is like listening to only one component of the symphony, somewhat like hearing only the flutes, or the clarinets. When we talk about one part of this system, we need to keep in mind that all the other parts are also "playing" at the same time.

The Physical Environment

Newberry National Volcanic Monument, located south of Bend, Oregon, is a wonderland of geologic features, mountain lakes, and archaeological treasures. This area is unique, because it is located at the intersection of three broad geographic areas: the Great Basin, the Cascade Mountains, and the Columbia River Plateau. The 50,800-acre Monument, part of the Deschutes National Forest, was created in 1990.

The Monument is bordered on the northwest by the Deschutes River, a nationally-designated wild and scenic river. A major north-south highway, Highway 97, crosses the "neck" of the Monument near the Lava Lands Visitor Center. The Monument then extends south, along the Northwest Rift Zone, climbing in elevation toward Newberry Crater, site of Paulina and East Lakes. The Monument is about 25 miles long, and varies in width between two and 10 miles.

The Monument includes a number of remarkable features. There are extinct cinder cones (such as Lava Butte); a mile-long underground lava tube (Lava River Cave); Lava Cast Forest, featuring molds of trees engulfed by lava flows; and two mountain lakes teeming with trophy-size trout and land-locked salmon. The dominant geologic feature is Newberry Volcano, a broad, shield-shaped volcano that has erupted many times in the past half-million years. Elevation in the Monument ranges from 4,000 feet near the Deschutes River to 7,985 feet at Paulina Peak on the rim of the caldera.

NNVM is located within the high desert terrain of Central Oregon, in the rain shadow of the Cascade Mountains. Temperature variations are more extreme than in western Oregon. Most of the precipitation falls as snow in the winter months.

Because of its high relief and its 40-mile separation from the Cascade range, Newberry Volcano tends to create its own weather patterns. In general, precipitation increases with elevation in the Monument. At the north end of the Monument, between the Deschutes River and Highway 97, elevations are less than 4600 feet, and yearly average precipitation is less than 15 inches (38 cm). In Newberry Caldera, where elevations surpass 6300 feet, yearly precipitation exceeds 30 inches (77 cm).

Temperatures in the Lava Butte area range from an average high of 79°F (26°C) and an average low of 50°F (10°C) in July to an average high of 36°F (2°C) and average low of 16°F (-9°C) in January (USFS weather records 1986-92). Temperature records are not available for the caldera area, but average temperatures there are generally lower due to the higher elevation. Wind conditions in NNVM are variable and greatly affected by topography. Based on data collected at remote, automated Forest Service weather stations in the region, winds tend to blow mostly from the north and northwest in the summer and from the south and southwest in the winter.

The soils in Newberry Monument are almost all volcanic in origin. They are thin, porous soils that include pumice, ash, and finely ground cinders from past eruptions of Oregon volcanoes. Erosion from weathering, and the impacts of human development have altered the conditions of Monument soils in a few locations.

Air and water quality in NNVM are generally good. Paulina and East Lakes are popular recreational fishing lakes; and the human impact on their quality and clarity has been minimal. East Lake has no known outlet. It is fed by snowmelt from the interior walls of the caldera. Paulina Lake drains out through Paulina Creek eventually reaching the Deschutes River.

(See sections in this chapter on geology, and air and water quality for more details on the physical environment.)

The Biological Realm

Vegetation: The principal forest communities within the Monument are mountain hemlock, lodgepole pine, mixed conifer, mixed pine, and "pure" ponderosa pine. Mountain hemlock, lodgepole pine and their associated plant communities dominate the upper elevations in the Monument in the Flanks and Caldera Zones. These tree species give way to ponderosa pine, fir and mixed conifer stands at lower elevations as you descend through Lava Cast Forest down to the Deschutes River. Around the lakes and the Deschutes River, riparian areas include unique plant and tree communities.

Historically, fire was an integral part of the Monument's ecosystem, sweeping through Central Oregon ponderosa pine forests every eight to 12 years on average. These fires cleared out underbrush and created open, park-like stands of large, old-growth trees. In the lodgepole communities, the fires occurred regularly, but at wider intervals (20-100 years) and created ecological mosaics of different age and size trees. In this century, people have actively suppressed fires, thus altering the ecosystem by removing a key element from the system.

Wildlife: The Monument is home to over 100 species of wildlife, including deer, elk, bear, cougar, otter, bald eagle, and osprey. Migrating waterfowl grace the lakes, rare bats nest in caves, American marten slip through the trees in the caldera. Part of the Monument is in the Newberry Crater Wildlife Refuge, established to protect wildlife species and ensure human safety. A number of species are well-established in the Monument, and the present diversity of habitats offers a variety of niches and opportunities for many species.

Fishing on Paulina and East Lakes is generally good. Fish were first introduced to these lakes early this century, and have thrived in the mineral-rich waters of the lakes. Both lakes have become popular fishing spots because of the abundance of fish and the quality of the angling experience. The Oregon record brown trout (27 pounds) was caught in Paulina Lake in 1993.

Interactions: To get a sense of how these biological components interact with each other, let's peek briefly at two locations in the Monument, one in the caldera and one near Lava Cast Forest -- and take an ecological snapshot of a typical summer day in the 1990's. In doing so, we need to remember two things: 1) A snapshot is a picture taken at one particular place, at one particular moment in time. Conditions in nature are always changing and evolving. 2) We can only see a portion of all the ecological interactions, and we understand only a portion of what we see.

On the north shore of Paulina Lake then, bald eagles and osprey would be cruising in the sky, patrolling the air above the Monument in search of fish. If you're lucky, you can see one of these birds dive into the lake to spear a fat trout with its talons. The bird returns to its nest, located high in one of the pine trees surrounding the lakes, to feed its young.

In the lake itself, hundreds of fish dart through the water, exploring the depths of this unique Central Oregon lake. They feed on the aquatic insects and zooplankton living in the lake and nourished by hot springs.

All during this day, plants and trees are quietly and efficiently working their miracle of photosynthesis, converting carbon dioxide into the oxygen needed by terrestrial animals. In the evening, at the edge of the lake, deer, elk, weasels, marten, and the occasional bear and cougar slip down to the water's edge for a drink. They pause briefly, glancing warily at campers'

campfires. Bats circle overhead, guided by their sophisticated internal radar, homing in on mosquitos and gnats, consuming pounds of insects each night. This forest community has evolved over eons of time, and continues to change today. Ten thousand years ago, we know there were oaks, wild sheep and bison in the caldera. Since that time, there have been a half-dozen volcanic eruptions, pushing ash, pumice and obsidian up out of the earth. The climate has become drier, and numerous fires have recreated the landscape. In recent years, a mountain pine beetle epidemic swept through the crater, leaving thousands of dead trees, and abundant food for woodpeckers and other cavity nesters.

A complicated web of life holds all these plants and animals together, each taking its place in the great food chain, each living thing interacting with the elements of life around them.

At another location in the Monument, near Lava Cast Forest in the Transition Zone, the scene and the ecological players are somewhat different. This is a dry, pine-forested area adjacent to a lava flow. Centuries ago, lava flows from Newberry Volcano oozed over this landscape, and in the years since then, grasses, shrubs and trees have slowly been colonizing the fragile soil that formed in pockets among the rocks. Tiny root hairs and mycorrhizae mingle with and enrich the soil, making all other life possible. Fires have swept through this area often in past centuries, and the landscape favors species that have evolved with fire. Trees are large, and widely-spaced. O n the evening of a typical midsummer day, animals begin emerging as the sun goes down and the land cools from the mid-day heat. A porcupine waddles out from his shaded home in a small of overhang of the lava. He shinnies up a tall ponderosa pine, and begins munching on the bark. Nearby, a white-headed woodpecker hammers into a dead snag, seeking out grubs and bugs. In a hollow cavity in another tree, a flammulated owl sleeps peacefully. Below the owl, a herd of deer are bedded down in some grassy tufts among the bitterbrush. Not far away, a pair of badgers begin digging furiously, enlarging their burrowed den with their powerful claws and flinging dirt and dust into the air.

The lack of water limits life in this part of the Monument, at the edge of the High Desert, but many creatures do manage to make a living in these harsh conditions. Again, all creatures participate in the web of life, bound together by the interdependent elements and flows that make up the ecosystem. The plants and animals in the "biological" realm are dependent on the physical elements of the ecosystem (soil, light, water) for their survival. And they are in turn affected by the human influence (roads, trails, hunting, habitat changes).

The ecology of Newberry National Volcanic Monument is taking place all the time at a number of levels, from the minutely cellular to influences on a global scale such as climate and weather. As one thinker about natural processes has expressed it: "Nature is not only more complex that we think, it is more complex than we can think." (Frank Egler). Or as naturalist John Muir once said, "Whenever we try to pick out anything by itself, we find it hitched to everything else in the universe."

At best we understand only a part of this wondrous web of life with its cycles and responsiveness to changing conditions. What we do know is that this ecosystem, and the surrounding communities and elements of life, are the basis for our "home" here on earth.

(See also the Vegetation, Fire, and Fish and Wildlife sections of this chapter for more information on the biological realm..

The Human Dimension

Ancient Times: We know that people have called the Newberry area home for the past 10,000 years. Recent archaeological excavations uncovered a hearth that was used by ancient people, and have radio-carbon dated organic material from that site on Paulina Lake to dates that press back our knowledge of human occupation of the Northwest. Indians from many groups used the caldera for centuries, climbing up the flanks to obsidian deposits where they crafted the shiny black glass into spears, darts, and arrowpoints. In the northern part of the Monument, Indians also camped and hunted along the banks of the Deschutes River.

The first EuroAmerican people to the area came in the mid-1800's. Fur trappers and explorers were the first; they were followed by settlers, loggers, ranchers, and eventually the railroad, which brought many more people into the area at the beginning of the 20th century. The EuroAmerican culture that dominates this area now is a relatively new and recent force on the ecosystem, when you take the long geological and archaeological view.

In recent times, (throughout the 1900's), people have come to the Monument to recreate and enjoy fishing and picnicking by the lakes, or hike among the forests and lava flows. Recreational use has grown steadily, and recent geothermal discoveries spurred Central Oregonians to designate the area a national monument, to be preserved and protected for present and future generations. The following sections outlines some aspects of the human dimension in and around NNVM today.

Area of Influence: Newberry National Volcanic Monument's area of influence is Deschutes County, Oregon. This is the geographic area where the greatest concentration of economic benefits is derived from activities that occur within the Monument, where most of the public concern about management of the Monument is concentrated and where management decisions about the Monument most directly affect the human quality of life. While management decisions may have economic consequences for people outside the area, the local economy feels the largest impact. A portion of Forest Service receipts from camping and other uses is shared with the counties to fund roads and school programs. Local residents also benefit from the close proximity to the recreational opportunities and other amenities provided by the Monument.

Communities in the Area of Influence: Bend is the largest community in Deschutes County with a population of about 28,000 (1994 estimate). It is also the county seat and is located a few miles north of Newberry National Volcanic Monument. Bend has a varied economy with a diversity of manufacturing and non-manufacturing industries, and a growing tourism industry.

The community of Redmond is the second largest city in the county with a population of about 9,000. In the past Redmond has been a center for agriculture and manufacturing, but tourism and service-related industries are growing in importance. The Redmond Airport is the hub of passenger and air cargo service in Central Oregon.

Sisters is the smallest incorporated community in the county with a population of about 800. The community's economy is organized around the tourist industry, along with ranching and farming.

Concentrations of people in the unincorporated part of Deschutes County include areas immediately near Bend such as La Pine, Sunriver, Tumalo, and Cloverdale. The population of unincorporated areas is about 50,000 people. Sunriver and La Pine are the unincorporated communities closest to the Monument. La Pine is located on Highway 97 just south of the Junction of Highway 97 and County Road 21. Road 21 leads to Paulina and East Lakes, two

very popular recreation destinations within the national monument. Sunriver, a recreation-oriented planned development, was built on the site of a former World War II military base, Camp Abbot, and is located west of the Monument.

Population: The Center for Population Research and Census, Portland State University estimates the 1992 population of Oregon as 2,979,000. Oregon's population has grown at an annual rate of just over two percent (2%) since the 1990 U.S. Census. The growth rate is about twice that of the national average and is a continuation of rapid growth experienced in the later part of the 1980's.

Most of Oregon's population (70%) lives along the Interstate 5 corridor in western Oregon. Deschutes County is one of the most populous counties east of the Cascades and has grown at nearly twice the state's rate for the past five years.

Table 3 - 1

1992 Population of Cities in Deschutes County

Area	Population
Bend	24,715
Redmond	8,365
Sisters	760
Unincorporated	48,760
Deschutes County Total	82,600

Source: Center for Population Research and Census, Portland State University, July, 1992.

Economics: Table 3-2 shows the contribution of major economic sectors in Deschutes County to employment and income (in real terms and as a percent of total) for the year 1991.

In 1991, Deschutes County had an average per capita income of $16,946, 97% of the state average and 89% of the national average.

Table 3 - 2

Number of Jobs and Income in Millions of Dollars for 1991.
Deschutes County

Economic Sector	Jobs	% of Total	Income	% of Total
Trade	8,862	26%	129.16	22%
Government	5,040	15%	75.56	13%
Visitor Related	3,275	10%	32.86	6%
Lumber & Wood Products	3,257	10%	74.61	13%
All Other	12,970	39%	273.68	46%
Total	33,404	100%	585.87	100%

In 1991 the economic sectors that contributed the highest number of jobs in the area of influence were trade (26%), government (15%), visitor-related including tourism (10%) and lumber and wood products (10%).

Since 1985 the lumber and wood products and government sectors have declined as a percent of the total labor force. Visitor and trade-related businesses have increased.

A recent market analysis and study (1987) reported that visitors spent $98 million in Deschutes County annually; with $8 million directly spent on recreation. By 1991 visitor expenditures had doubled to $179 million and recreation-related expenditures were almost $14 million.

While declining as a percent of total employment, the number of people employed in the wood products and lumber sector has remained approximately the same, generally going against regional trends. The explanation is that Central Oregon has become a major wood products remanufacturing center, especially in millwork.

Long-term declines are expected to continue in sawmill-related businesses, but they may be offset somewhat by gains in secondary wood processing. As the state and national population continues to grow, tourism and visitor-related business should also increase with these trends. Recent data has shown that while the county's population has grown relatively rapidly, jobs created have generally been at the low end of the wage scale.

Newberry Monument Receipts and Expenditures: In 1991 and 1992, visitation to Newberry National Volcanic Monument amounted to about 300,000 recreation visitor days per year. The figures illustrate the important role the Monument helps to play in attracting visitors to Deschutes County. Forecasts for growth in visitation to the caldera area of the Monument by the year 2000 vary between 28% and 127%, depending on the assumptions used.

Campground fees collected in the Newberry National Volcanic Monument for fiscal year 1991 totaled approximately $115,000. Most fees were collected between May and September. Special use permit receipts (for resorts, recreation residences, outfitters, etc.,) totaled about $16,000 in the same year.

Twenty-five percent of a national forest's annual receipts are distributed to the counties within which the forest's lands lie. Receipts from timber sales, recreation fees, special use permits and other uses are pooled; 25% of the total is then distributed among the counties on the basis of the proportion of the forest's total acreage within each county (the formula has varied recently based on Congressional mandate). Of the $131,000 dollars in camping and special use fees collected by the Monument, approximately $33,000 was distributed to local counties based on the 25% formula.

Adjacent Land Uses: The area surrounding Newberry National Volcanic Monument is varied. Mt. Bachelor, a popular ski area, lies 40 miles west of the Monument, and draws hundreds of thousands of visitors each winter. The high Cascade Lakes near Mt. Bachelor also draw thousands of visitors who come from all over the Northwest during the summer to swim, boat, waterski, picnic, sail, fish and windsurf. To the east of the Monument is the Great Basin stretching away toward eastern Oregon, Idaho, and Nevada.

The communities of Bend, La Pine, and Sunriver are close to the Monument, and local residents share this popular recreation area with visitors from all over the world.

Most of the Deschutes National Forest land around the Monument is in General Forest os Scenic Views Management Areas meaning timber harvest is allowed, if compatible with other values. Some 10 miles to the east of NNVM, a large Off-Highway Vehicle Trail system was created in 1993. This includes over 300 miles of trails that provide recreation for ATV users. Two miles west of the Monument, California Energy, Inc. has proposed siting a 33-megawatt geothermal power plant that would tap energy from the geothermal resources believed to be present under Newberry Volcano. All drilling and exploration, if they occur, would be outside the Monument. The Deschutes River Woods subdivision of Bend borders the River Zone at the north end of the Monument. South of NNVM lies Fort Rock Cave, the oldest archaeological site known in the Pacific Northwest.

Trends: Deschutes County is the fastest growing county in Oregon, and one of the fastest growing in the entire Western U.S. The abundant sunshine, recreational opportunities, clean air and water all attract people to come, settle, work, and play. This growth trend is expected to continue, at least for the foreseeable future. There is an increasing demand for outdoor recreation of all types, and Newberry Monument is viewed as a prime destination for both local residents and tourists. The Deschutes National Forest in recent years has received as many as 10 million visitors in a single year.

(See sections in this chapter on recreation, roads and facilities, interpretation, law enforcement, Indian Tribes, cultural resources, and special uses for more details on the human dimension.)

1. Recreation

Background

Newberry National Volcanic Monument (NNVM) provides recreation for thousands of visitors annually. Newberry Caldera and Lava Lands Visitor Center accommodate many people; however, considerable use also occurs in other parts of the Monument such as Lava River Cave, Lava Butte, Benham Falls, and Lava Cast Forest.

This specially-designated area exists within a larger recreational context. Several designated wilderness areas (Three Sisters, Mt. Jefferson, Waldo Lake, Diamond Peak) lie to the west and northwest in the Cascades. In Oregon, there are two other national monuments, two national recreation areas, one national memorial, and one national park (Crater Lake). The Peter Skene Ogden National Recreation Trail lies partially within the Monument, connecting the Monument with other Forest Service campgrounds (Ogden Group, and McKay). The Trail of the Molten Lands (near Lava Lands visitor center) and the Lava Cast Forest trail (approximately seven miles southeast of Lava Lands) are two other national recreation trails located within the Monument. Paulina Creek, has been determined eligible for inclusion in the National Wild and Scenic River System as a recreational river. The Deschutes Wild and Scenic River, the northwestern boundary of NNVM, is popular for fishing and rafting. Along Highway 97, within the vicinity of the Monument, is the La Pine state-operated Recreation Area and the High Desert Museum.

Recreational activities in the Monument include camping, hiking, biking, sightseeing, horseback riding, horse camping, boating, canoeing, fishing, cross-county skiing, and snowmobiling. Hunting and all-terrain vehicle (ATV) riding also occur; however, these activities are not permitted inside the caldera rim boundary, and ATV's are not allowed on summer trails.

The presence of water in the high desert has historically been a natural attraction for people, and fishing has long been a focus of recreational activity in the caldera. In 1993, a 27-pound brown trout was caught in Paulina Lake, breaking the Oregon state record for brown trout. Currently the Oregon Department of Fish and Wildlife, Oregon State Marine Board, and the Forest Service combine to share management of the caldera lakes. Resort use began at East Lake in the late 1800's. There was a health resort located on the southeast side of East Lake, near the hot springs there. This building burned down in 1923, was rebuilt in 1924, burned in 1941 and was not rebuilt. The current East Lake Resort is located northeast of the historic site. The lodge on Paulina Lake was constructed in 1929, and Paulina Lake campground was built in 1937.

Current Situation

Developed Recreation

Developed recreation within the Monument takes place at four areas: along the Deschutes River, near Highway 97, at Lava Cast Forest, and in Newberry caldera. Opportunities and activities in each of these areas varies according to the distinguishing landscape features. (See also section on Interpretation.)

The northwest boundary of the Monument is the high-water mark on the east bank of the Deschutes River. Facilities in the Monument include the Benham Falls day-use area and an interpretive trail. River activities include rafting, boating, fishing, and scenic viewing.

Lava Lands Visitor Center and Lava River Cave are located adjacent to Highway 97. On the west side of the highway, Lava Lands functions as a staging area for interpretive programs, an information center, and a trailhead for interpretive walks. Shuttle service to the top of Lava Butte (provided by a concessionaire) is also available here. Lava River Cave is a day-use, interpretive area on the east side of the highway, featuring a one-mile-long underground lava tube to explore.

Located eight miles east of Highway 97 along Road 9720 is Lava Cast Forest day-use area and interpretive trail. One mile to the west along an old road is the Hoffman Island trail. Both trails offer scenic walking routes through open lava fields, lightly forested lava and pine woodlands.

A major portion of the recreational activity in the Monument takes place within Newberry caldera. Two lakes, several obsidian flows, rugged peaks, varied topography, outstanding scenic views, and reliable winter snow cover make this a popular destination. Fishing is a primary attraction; however, camping, boating, hiking, biking, snowmobiling, nordic skiing, and horse camping are also established activities. Current facilities include nine boat ramps, six picnic areas, nine campgrounds, one interpretive trail and amphitheater at the Big Obsidian Flow (BOF) and two rustic resorts. Most of these facilities are concentrated around the lakes. There are 328 overnight campsites in the caldera.

Dispersed Recreation

Dispersed recreation takes place throughout the Monument, generally close to roads, trails, and other access points. A significant portion of the land is covered with lava, which acts as a natural barrier or hindrance to travel. Dispersed activities now occurring in the caldera include: car travel, fishing, boating, horseback riding, mountain biking, hiking, snowmobiling, nordic skiing, and viewing scenery. Outside of the caldera some of the dispersed activities include gathering forest products, trailer and car camping, automobile travel, big game hunting, and walking/hiking (RRIS 1992).

Dispersed camping occurs near edges of lava flows, within close proximity to roads and trails, and near water sources. Horse use originates from many points, including the Peter Skene Ogden trailhead, Deschutes River Woods, Sunriver, Inn of the Seventh Mountain, South Rim trail, and Swamp Wells trail. Horse and mountain bike use occur in many of the same places: along Peter Skene Ogden trail (uphill only is permitted for mountain bikes), near the Big Obsidian Flow, and on undesignated loops around Lava Butte and Lava Lands from the Deschutes River Woods subdivision of Bend. Concentrated ATV riding occurs several miles east of the Monument, where a 320-mile ATV trail project was recently approved (1993). Bow and rifle hunting for deer, elk, and black bear occurs during the fall months in areas where this use is permitted (not in Newberry caldera or near developed recreation areas). Hunting issues and effects are covered in the Wildlife sections of this document.

Winter dispersed use near the caldera generally originates at 10-Mile sno-park (outside of the Monument about three miles west of Paulina Lake). Currently, Road 21 is not plowed beyond this sno-park. Blue-diamond (nordic skiing only) and orange-diamond trails (primary use: snowmobiling) originate here. Much of the activity occurs along designated trails. Off-trail recreation tends to be concentrated at winter snow-play areas. Some nordic skiing and snowshoeing also occurs near Lava Lands Visitor Center.

Recreational Accessibility

The term "accessibility" is defined in the Design Guide (draft) for Accessible Outdoor Recreation (USDA Forest Service 1992) as "...a site, building, facility or portion thereof that complies with these standards (The Uniform Federal Accessibility Standards) and that can be approached, entered and used by physically disabled people." Some parts of the Lava Lands complex are accessible; however, the current condition of accessibility within the Monument varies between locations and is typically unclear (no signing). Within the caldera there are three barrier-free toilets (Peak, Newberry Group, East Lake). Trails are not signed according to accessibility. Some of the trails (Trail of the Whispering Pines and Lava Cast Forest trail) are believed to be very close to providing high-standard barrier-free access (easy/moderate). Other trails provide higher levels of challenge. A range of accessibility challenges exists; however, areas are currently not maintained to provide reliable sequences of opportunities. Information concerning the relationship between ROS direction and accessibility can be found in the ROS descriptions in Table 3-3.

ROS Allocations

The Forest Service manages for a variety of recreational opportunities and experiences using the Recreational Opportunity Spectrum (ROS). The ROS system has criteria established for evaluating recreational settings including: access, remoteness, social encounters, visitor management, facilities, visitor impacts, "naturalness" and experience goals. The ROS system is a tool for managing recreational development. The spectrum ranges from urban experiences to primitive wilderness. Within the Monument, current management direction allocates areas to these categories: rural, roaded modified, roaded natural and semi-primitive motorized and non-motorized. The key characteristics of these ROS classification are summarized in Table 3-3. For more information, see these Forest Service documents: ROS Primer and Field Guide (1990), the ROS User's Guide, and the Design Guide for Accessible Outdoor Recreation (draft 1992), and the planning record for this document.

The Deschutes National Forest Management Plan (1990) addresses recreation issues and opportunities in part through direction according to management areas. Additional ROS information and management clarification is found on the Recreational Opportunity Spectrum Map, a supplemental map of the 1990 Lands and Resource Management Plan. This map was used to describe the existing condition and direction for ROS in this document.

Table 3-3 Key Characteristics of Recreational Opportunity Spectrum (ROS) classes

(source: ROS User's Guide; ROS primer and Field Guide; Design Guide for Accessible Outdoor Recreation (draft 1993)

		ACCESS	REMOTENESS	SOCIAL	VISITOR MANAGEMENT	FACILITIES	ACCESSIBILITY	NATURALNESS	EXPERIENCE
Rural	R	full access	of little relevance	moderate to high in developed sites and on roads and trails	on-site controls obvious but harmonize with surrounding environment	designed for user comfort and convenience; some synthetic materials and refinement in design/ facilities in the caldera have rustic qualities	all programs, services, and facilities provided are fully accessible	human alterations may be evident but not dominant; or, may be dominant but blend with and reflect the characteristic landscape. Activities including structural development should borrow line, form, texture, and color from the surrounding landscape	to provide visitors with a high probability of meeting and enjoying others. Convenience in access to and use of sites is important. Challenge, risk, and testing of skills are relatively unimportant except for some specific activities
Roaded Natural	RN	full access, and/or controlled	of little relevance	moderate to high on roads, moderate to low on trails and developed sites	on-site controls noticeable but harmonize with surrounding environment	rustic, provide for some user comfort and convenience; synthetic materials are not evident; some refinement in design	greater challenge (than R) for some persons, longer distance between accessible facilities	human alterations may be not evident; or, evident but not dominant; or may be dominant but blend with and reflect the characteristic landscape. All activities should borrow line, form, texture, and color from the surrounding landscape	to provide visitors with an equal opportunity of meeting and enjoying others, and of being isolated from other people. Visitors have the opportunity to interact with the natural environment, but with little risk and challenge
Roaded Modified	RM	roads and trails for dispersed recreation access	of moderate relevance; areas are usually large	moderate to high on roads and trails, moderate to low at campsites	on-site cantrols not provided except for sanitary and/or safety reasons	simple design, rustic-like materials. Site modifications minimal	greater challenge (than R) for some persons, longer distance between accessible facilities	human alterations may have resulted in a heavily altered appearance; or may be dominant but blend with and reflect the charactertic landscape. All activities should borrow line, form, texture, and color from the surrounding landscape	to provide visitors with an opportutnity to get away from the sights and sounds of other people and to practice self-reliance in an area with easy access. Offers feeling of indendence and freedom, but there is little risk and challenge.
Semi-Primitive Motorized	SPM	primitive roads and motorized trails (winter motorized trails only in Monument)	distant sights and sounds of human activities	encounter 6-15 groups of others/day (typical maximum)	subtle on-site controls and limited information available	not typical, for site protection purposes only. If present, facilities are rustic and rudimentary	low level of accessibility, high level of challenge	human alterations may be evident but not dominant. Activities including structural development should borrow line, form, texture, and color from the surrounding landscape.	to provide visitors with a moderate probability of getting away from the sights and sounds of other people, to be independent, to enjoy nature and to practice outdoor skills. There is also an opportunity to use motorized equipment while in the area.
Semi- Primitive Non-Motorized	SPNM	non-motorized trails	distant sights and sounds of human activities	encounter 6-15 groups of others/day (typical maximum)	subtle on-site controls and limited information available	not typical, for site protection purposes only. If present, facilities are rustic and rudimentary	low level of accessibility, high level of challenge	human alteration are not evident (in the Monument, SPM (winter)/SPNM(summer) areas would be managed as SPM	to provide visitors with a high probability of getting away from the sights and sounds of other people, to be independent, to enjoy nature and to practice outdoor skills.
OTHER ROS VARIATIONS									
Roaded Natural Non-Motorized	RNNM	See Alternative A, area in the Proposed Research Natural Area; the intent is for no roads or trails to be developed in or through this area and recreational use is not to be directed towards this area.							
ROS class followed by (GEO)	(GEO)	'Geo' refers to the surface rights as specified in the 1990 Legislation							

Visitation

Deschutes County is recognized as one of the most important recreation centers in Oregon, with over 90% of all visitation originating from outside the county (ECO Northwest 1989). The number of travelers on Highway 97 through Central Oregon has steadily increased in the past 20 years. Lava Lands Visitor Center has shown a 35% increase in the number of visitors between 1988 and 1992. The High Desert Museum, a grant and donation-funded museum and interpretive facility located along the highway approximately four miles north of Lava Lands, has nearly doubled its visitorship during the same period.

Use levels

Recreation visitor days (RVD's) and occasions (OCC's) are both measures of recreational use in an area. Each RVD is equivalent to 12 hours of use. An occasion (OCC) is a measure of one person taking part in one activity within an area with no regard to duration of stay. For example, if a visitor takes part in three activities over a four-hour period in one area, his/her use is measured as three OCC's and 1/3 of 1 RVD. Permits and receipts for general-use campgrounds in the caldera show a 36% net increase between 1988 and 1992, with a 29% leap between 1990 and 1991. Day use in the caldera shows a net increase of 13% between 1988 and 1992.

At some of the recreation areas within the Monument, visitor numbers are well documented and are listed here. In other places, such as on trails, in dispersed camps, and in many day-use areas, visitor numbers are not directly available (RVD's and OCC's are projected). Day use in the caldera averaged 600 people daily in 1992, during the summer season when the entrance station was open. Use at Lava Lands in 1992 averaged 478 people per day, and at Lava River Cave averaged 143 people per day, during their 7 1/2- and 4-month seasons, respectively. A list and brief description of the developed recreation sites is given on Table 3-5.

Table 3-4

Developed Recreation Physical Capacity

Developed Overnight Recreation
(All located in the Caldera Zone)

Campgrounds	Type	Campsites	Campsite Totals by Type	PAOT*
Paulina Lake	general use	69		345
Little Crater		50		250
East Lake		29		145
Cinder Hill		110	258	550
				1290
Hot Springs	overflow	42	42	**210**
Chief Paulina	horse camp	14	14	**65**
Newberry Group	group	3	3	**160**
Warm Springs	hike-in/walk-in	5		25
North Cove		6		30
			11	**55**
			328	
Resorts				PAOT
Paulina Lake Lodge				80
East Lake Lodge				75
lodging				180
RV camping				
Recreation Residences (See Special Uses)				
Paulina Lake Tract				30
Developed Overnight Totals				**2145**

* PAOT = 'Persons at one time' - Refers to the physical capacity of a site.

Table 3-4, con't.

Developed Day-use Areas

Location	Type	PAOT*
River area		
Benham Falls	Picnic/swimming	42
Highway area		
Lava River Cave	Cave	200
Lava Lands	Visitor Center	350
Lava Butte	Visitor Center	74
Lava Cast Forest area		
Lava Cast Forest	Picnic	40
Caldera Zone		
Paulina Creek Falls	Picnic/swimming	100
Paulina Peak Viewpoint		35
Obsidian Flow		75
Hot Springs		25
Paulina Lake		35
Little Crater		25
Paulina Lake #1	Boating	53
Paulina Lake #2		100
Little Crater #1		35
Little Crater #2		63
Hot Springs Boat Ramp		70
Cinder Hill #1		100
Cinder Hill #2		65
East lake		91
Paulina Lake Lodge	Resort	440
East Lake Resort		95
Paulina Guard Station	Information Center	5
Developed Day-use Total		2118

Developed Recreation PAOT Total for Monument	4263

* PAOT = 'Persons at one time' - Refers to the physical capacity of a site.

Table 3-5

EXISTING DEVELOPED RECREATION AREAS

(Overnight & Day-Use 1992)

Facility Name	Key Features	RVD*	OCC*
NEWBERRY CALDERA			
Paulina Creek Falls	Day-use area, picnicking, trails	2,739	20,130
Paulina Peak Viewpoint	Day-use area, viewpoint	6,109	40,028
Obsidian Flow	Day-use area, interpretive trail, picnicking	14,924	132,202
Paulina Lake	Campground (69 sites) and day-use areas, picnicking, boat ramp/dock	6,109	43,294
Little Crater	Campground (50 sites) and day-use area, picnicking, boat ramp/dock	21,067	32,997
Hot Springs	Campground (overflow 42 sites) and day-use area, picnicking, boat ramp/dock	967	6,099
East Lake	Campground (29 sites) and day-use area, picnicking, boat ramp/dock	14,114	23,345
Cinder Hill	Campground (110 sites) and day-use areas, picnicking, boat ramp/dock.	18,409	28,841
North Cove	Hike-in/Boat-in semi-primitive campgrounds (6 sites)	1,109	1,955
Warm Springs	Hike-in/Boat-in semi-primitive campgrounds (5 sites)	740	1,552
Newberry Group	Group campground (3 large sites), historic cabins	7,692	11,583
Chief Paulina Horse Camp	Horse campground (14 sites), corrals and horse facilities	1,577	2,263
Paulina Lake Lodge	Resort/Cabins, boating facilities, store, restaurant, picnicking	7,019	22,518
East Lake Resort	Resort/Cabins, boating facilities, store, restaurant, picnicking, RV camping, showers, laundry.	5,345	17,079
Subtotal Caldera		107,920	n/a
NON-CALDERA AREAS			
Lava Cast Forest	Day-use area, picnicking, interpretive, trail	11,212	66,832
Lava River Cave	Day-use area, picnicking, interpretive trail (lava tube)	7,104	97,816
Benham Falls	Day-use area, boat ramp, picnicking, interpretive trail	24,293	179,588
Lava Lands Visitor Center	Visitor Center, indoor exhibits and gift shop, picnicking, interpretive trails	37,750	513,541
Lava Butte Visitor Center	Fire Lookout/Panoramic Viewing Building, interpretive trail	48,019	368,388
Total Developed		236,298	n/a

* See definitions chapter III, page 13

Campground Occupancy

Campground occupancy rates for 1992 (based on fees collected) indicate that the general use campgrounds in the caldera (Paulina Lake, Little Crater, East Lake, and Cinder Hill) average 61% occupancy during the peak summer season and 44% occupancy over the entire managed season (generally May or June through October). Both Chief Paulina and Newberry Group camp have much lower use, averaging less than 10% and 4% occupancy, respectively, for the full season.

Dispersed Recreation

Currently, dispersed recreation figures are projected as shown below:

Area	RVD* Dispersed	
Newberry caldera	87,563	
Remaining portion of NNVM (approx.)	13,314	
Total dispersed recreation	100,877	RVD (1992)
Total dispersed & developed rec	337,175	RVD (1992)

* RVD's = Recreational Visitor Days

Source: RRIS database, Deschutes National Forest (1992)

Recreational Trails -- Summer

There are 21 designated summer trails, or portions of trails within NNVM. These trails cover 51.5 miles (Deschutes National Forest Geographic Information System [GIS] database). A majority of these trails are located within or adjacent to the caldera. All but four of these trails have a natural surface. The other four trails are paved and are located at Lava Lands Visitor Center, Lava Butte, and Lava Cast Forest. (See also the section on Interpretation.) Currently, most trails are not specifically designed for wheelchair accessibility; however, in some areas this use could be provided for with only minor modifications. Six of the existing trails have interpretive programs and/or interpretive signs associated with them, three trails have National Recreation Trail status, and one trail is located underground at Lava River Cave. Approximately half of the trails are hiker only and half are multiple use, accommodating hikers, horses and mountain bikes. ATV's are not permitted on any of the summer trails. There is evidence of non-permitted uses on some hiker-only trails.

Recreational Trails -- Winter

There are 23 designated and two non-designated winter trails within and immediately surrounding the Monument, most near the caldera. Many of the winter trails are roads during the summer months. There are 57.5 miles of orange-diamond trails (designed for snowmobiles) and seven miles of blue-diamond (nordic) trails. The main staging area for this trail use is 10-Mile sno-park, outside NNVM.

Trends

Visitation to Newberry caldera is predicted to grow in the near future (ECO Northwest, 1989). A recreational demand study by ECO Northwest identified and evaluated three situations that could affect the rate of growth: 1) major improvements to Road 21, 2) geothermal development, and 3) national monument designation. Two of these changes have already occurred (Monument designation and road improvements), and geothermal development is expected to begin within a year. We expect that growth will increase rapidly for the next five to 10 years, and then return to a more typical annual growth rate of 2-4% (ECO Northwest, 1989).

National

According to the "1993 State of the Industry" report by the Outdoor Recreation Coalition of America (ORCA), 89% of all Americans participate in some type of outdoor recreation. The four largest activity groups are: walking (60% of Americans), wildlife related, non-consumptive (40%), bicycling (36%), and camping in developed sites (20%). The largest age group participating in outdoor recreation is: 25-44 years old. The following four activities have the most people participating: wildlife-related, non-consumptive (76.5 million people), fitness walking (69.6), camping (47.1), and hiking (22.7). Projected trends in outdoor recreation for the years 1989-2000 show the following activities as having the most growth: backpacking (+34%), day-hiking (+31%), bicycling (+25%), and outdoor photography (+23%). For the years 2000-2040, the activities projected to grow the most are: day-hiking (+193%), backpacking (+155%), rafting/tubing (+155%), and bicycling (+122%) (ORCA 1993).

Most outdoor recreation in the U.S. occurs on public lands. Recreational growth on federal lands has increased from 521.8 million recreation visitor days (RVD's) in 1984 to 652.4 million RVD's in 1991. Recreation on public lands include: walking for pleasure (41% of Americans participating), nature study (36%), camping in developed sites (35%), day hiking (24%), and camping in primitive sites (14%) (ORCA 1993).

State of Oregon and Central Oregon

The projected statewide demand for recreational activities identifies growth of the following activities (listed highest to lowest): sightseeing and picnicking, hiking/walking/climbing, nature study/food gathering, non-motorized riding, camping, water activities, fishing, off-road motorized activities, snow activities, and hunting (See Table 3-7). Central Oregon has a relatively high percentage of the statewide totals for snow activities, ATV use, camping, and nature study. State-wide analysis indicates an increasing demand for primitive, semi-primitive, and roaded natural recreational experiences in Central Oregon (Oregon State Parks 1988). The largest projected need in Central Oregon by the year 2000 are for: nature and wildlife observation (145%), on-road bicycle riding (up 114%), hiking trails (up 94%), non-motor lake boating (up 86%), and sailing (up 85%) (Oregon State Parks 1991).

Recreation activities that occur within the Monument can be evaluated as having Low, Moderate, or High growth in the state of Oregon (Oregon State Parks 1988) (Table 3-6), based on a statewide survey of Oregon residents.

Table 3-6 Recreation Growth Rates

LOW	MODERATE	HIGH
Horse camping & riding	Boat Fishing	Day hiking on trails
Sailing	ATV (OHV)	Lake non-motor boating
Snowmobiling	Overnight hiking trails and no trails	Outdoor photography
Group camping, and boat-in camping	Off-road bicycling	Nature study wildlife observation
Hunting upland birds	Picnicking	Visiting interpretive centers
	Cross-country skiing	RV camping
	Tent & car camping	Bicycle day trips
	Hunting big game	

Deschutes County and Local Facilities

Tourism is the third largest industry in Oregon and Deschutes County is one of the most important recreation centers in Oregon. Deschutes County has experienced dramatic and steady growth in population, employment, travel and tourism activity, and per capita income over the past five years. In 1991, 3.5 million visitors came to this area. Their reasons for travel to this area were primarily for pleasure (66%), business (23%) and other (11%) (HILL 1993).

Projected annual visitor numbers for the year 2000 to Lava Lands Visitor Center have been estimated at 273,000 (Runyan 1991). For comparison, the High Desert Museum recorded 141,429 visitors in 1989, and Lava Lands received 83,760 (Runyan 1989).

Seasonal auto traffic on Highway 97 indicates that vehicle numbers peak during the summer months, with the largest concentration in July and August. It can be assumed that a substantial proportion of this is attributable to pleasure travel. Traffic counts on Highway 97 show a steady increase from 1979-1988 (Runyan 1991).

Recent improvements to Road 21 will likely result in an immediate increase in the number of visitors to the Newberry caldera area. The improved road has made access easier for cars with campers, boat trailers, and RV's.

Conclusions

NNVM provides high-quality recreational opportunities and complements the array of activities currently available in Central Oregon. The entire Monument will undoubtedly play a key role in providing for the growing popularity of Central Oregon's many natural features and outdoor activities.

Note that as growth rates continue to increase, potential for problems associated with increased visitation will increase as well. Archaeological, geological, botanical, and zoological resources may be vandalized or destroyed by people. In the Monument, some visitors illegally remove samples of obsidian. Vandalism of some of the unique lava formations has occurred in known locations. Some disruption of animal hibernation cycles has occurred. Heavy use requires mitigation measures to control soil erosion and impacts to some vegetation communities. If not managed appropriately, lots of visitors can also result in social conflicts among people. Interpretation and education will be critical to preserving NNVM's resources and high-quality recreation.

Table 3-7

NNVM RECREATION DEMAND INFORMATION
STATEWIDE RECREATIONAL NEED FOR CENTRAL OREGON AND THE STATE OF OREGON

RECREATIONAL ACTIVITY DEMAND	CENTRAL OREGON PROJECTED INCREASE BY YEAR 2000 (%)	STATE OF OREGON PROJECTED INCREASE BY YEAR 2000 (%)	CENTRAL OREGON ROS PRIMARY EXISTING USE	CENTRAL OREGON ROS HIGHEST PREFERENCE
FISHING				
Fishing: Freshwater - Boat	60	51	RM	RN, RM
Fishing: Freshwater - Bank	34	26	RM	SP
WATER ACTIVITIES				
Swimming: Outdoor - Beach	46	40	R/U	SP, R/U
Sailing	85	21	N/A (STATE RN)	N/A (ST= RN)
Boating: Lake Non-Motor	86	76	RM	(P), SP, RN
Boating: Lake Motorized	19 -	21	–	–
NATURE STUDY				
Nature, Wildlife Observation	145	70	SP	SP, RN
Visits to Interpretive Center	51	53	R/U	(P), SP, R/U
Outdoor Photography	89	73	SP	SP
HIKING				
Day Hiking on Trails	94	89	RM	(P), RM
Overnight Hiking on Trails	63	40	SP (100%)	SP (100%)
Overnight Hiking: No Trails	29	24	SP (100%)	SP (100%)
CAMPING				
Camping: Recreational Vehicle	64	58	RN	RN
Camping: Tent With Motorized Vehicle	33	37	RN, RM	RN
Camping: By Boat	7	14	(P), RM	(P), SP
Camping: Organized Group	14	14	(P), RN, RM	(P), SP, RN
Camping: Horseback With Packstock	12	21	(P), RN, RM	(P), SP
Camping: Horseback Without Packstock	72	11	N/A (STATE RN)	N/A (ST=SP)
SNOW				
Snowmobiling	16	12	RM	RM
Snow: ATV Riding	35	37	SP, RN, RM	SP, RM, R/U
Cross Country Skiing	40	37	SP	SP
OFF-ROAD VEHICLE DRIVING				
Motorcycle: Off-Road	70	45	RM	SP
ATV Driving Off-Road	47	41	RM	RN
Four-Wheel Driving Off-Road	57	38	RM	SP
NON-MOTORIZED RIDING				
Bicycle Riding: On Road	114	91	R/U	R/U, RN
Bicycle Riding: Off-Road	40	32	RN, R/U	RN, R/U
Horseback Riding	19	17	SP	(P), SP
PICNICKING - SIGHTSEEING				
Picnicking	48	35	RN	RN
Sightseeing	44	45	RN	RN
Train, Bus Touring	29	9	SP, RM	SP (100%)

LEGEND

P	=	PRIMITIVE
SP	=	SEMI-PRIMITIVE
RN	=	ROADED NATURAL
RM	=	ROADED MODIFIED
R/U	=	RURAL/URBAN

REFERENCE:
RECREATIONAL NEEDS BULLETIN
OREGON STATE COMPREHENSIVE OUTDOOR RECREATION PLAN, 1991
OREGON STATE PARKS & RECREATION DEPARTMENT

2. Roads and Non-Recreation Facilities

Background & Current Situation

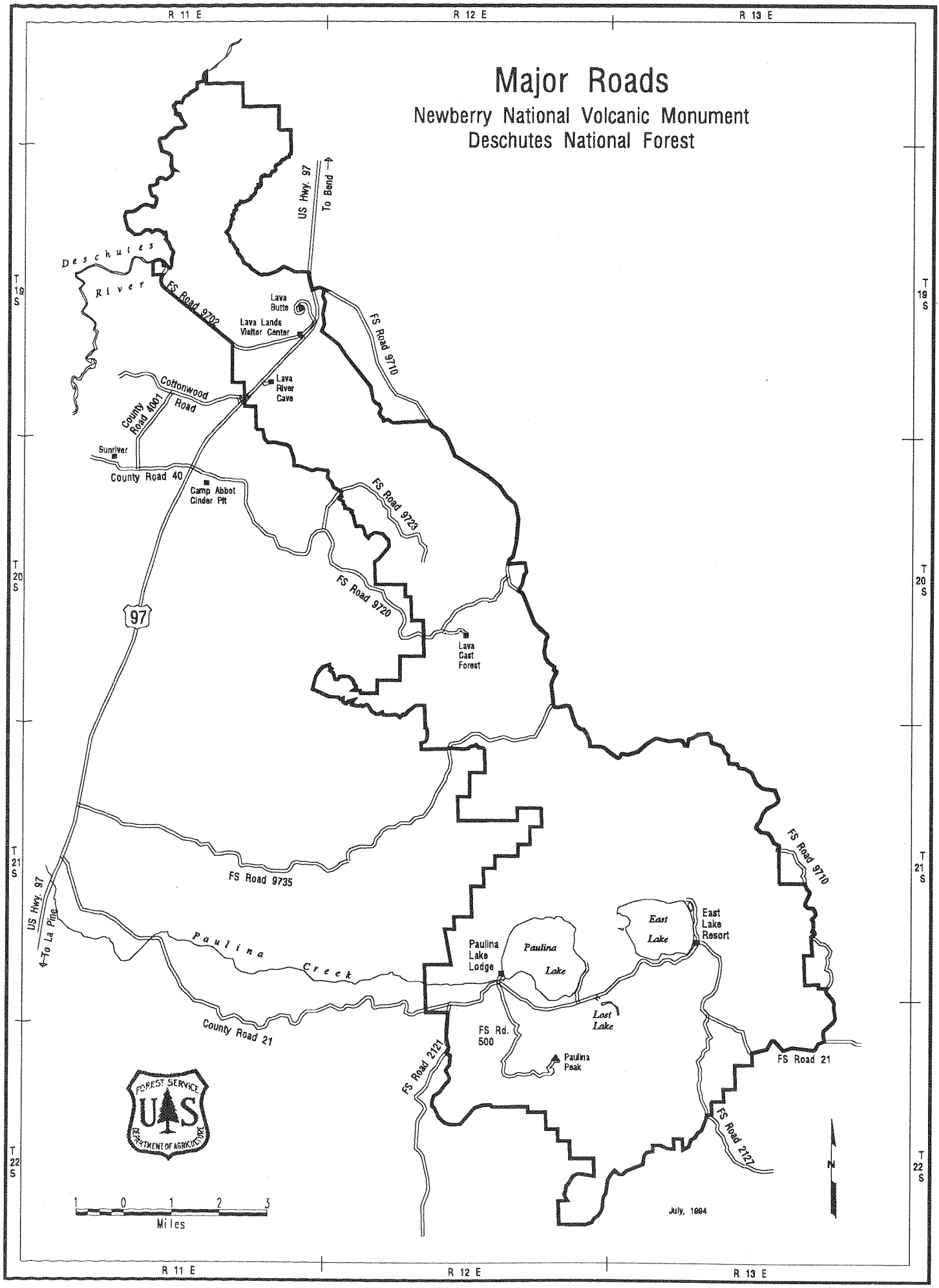
Principal access to the Monument is provided by two routes: US Highway 97 (The Dalles-California Highway) which runs north/south and bisects the northern portion of the Monument area; and, in the southern portion, County Road 21 which runs from Highway 97 east through the caldera. Both routes are double-lane, paved, and meet Highway Safety Act standards for signing and traffic controls. Road 21 has been undergoing staged reconstruction by Deschutes County and the Federal Highway Administration for the last several years. The final stages are currently under contract with completion expected in 1994. The road's junction with Highway 97 has flat grades, excellent sight distance, and there is a left turn lane and a deceleration right turn lane on the highway. The County's jurisdiction ends at East Lake Resort and Road 21 continues east under Forest Service jurisdiction. It is double-lane, cinder surfaced for two miles to the east rim of the caldera. From there, it is a 1 1/2 lane (18-20 foot running surface) road that has a cinder surface for the next three miles, then native-surfaced for about four miles to its terminus with Road 18. (See map on following page.)

Highway 97 is the main north-south corridor on the east side of the Cascades. It has high traffic volumes and high traffic speeds. Between Bend and Sunriver, commuter and recreation traffic is especially heavy and congested. Not only can traffic flow be poor, but weather can be adverse and create hazardous driving conditions. This is especially true for the section between Lava Butte and Sunriver. Major winter storms usually pass to the south of Bend, and stormy conditions with rain or snow along with the increased elevation of this area, make for hazardous driving conditions. This section has been reconstructed and improved over the last several years, and currently has a combination of two, three, and four lanes.

Within this section of Highway 97, there are four junctions that access Monument features: Road 9710 which forms most of the northern and eastern boundaries of the Monument, Road 9702 which accesses Lava Lands Visitor Center and Benham Falls day-use area on the Deschutes River, Road 9700-100 which accesses Lava River Cave, and Road 9720 which provides access to the Lava Cast Forest. Of the four, only Road 9702 fully accommodates turning traffic, but all of them pose potential safety concerns due to the conditions listed above.

The junction of Road 9710 with Highway 97 is located on the Lava Butte grade, and though there is good sight distance, there is no left turn lane and the passing lane for southbound traffic makes left turns hazardous. From the highway, Road 9710 extends southeast as a 1 1/2-lane, cinder surface road for 10 miles to the junction with Road 1810. Here, the road narrows to a 12-foot single lane, cinder surface and continues for two miles to the junction with Road 9735.

Figure 3-1


Major Roads
Newberry National Volcanic Monument
Deschutes National Forest
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
FS Road 9710
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
Camp Abbot Cinder Pit
FS Road 9723
FS Road 9720
97
Lava Cast Forest
FS Road 9735
US Hwy. 97
To La Pine
Paulina Creek
Paulina Lake Lodge
Paulina Lake
East Lake
East Lake Resort
Lost Lake
FS Rd. 500
Paulina Peak
County Road 21
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
DEPARTMENT OF AGRICULTURE
1 0 1 2 3
Miles
July, 1994

For the next 10 miles, the road narrows again to an eight-foot single lane, native surface road with limited turnouts. This section of road has been deliberately left unimproved to provide a primitive driving experience. At the junction with Road 1845, the road again widens to 1 1/2 lane, native surface and continues for two miles to its terminus with Road 21.

Road 9702 joins Highway 97 at the top of the Lava Butte grade where there are four lanes of traffic, a center left turn lane, a deceleration right turn lane, and an acceleration right turn lane. The double-lane paved road forms the entrance to Lava Lands Visitor Center which receives heavy visitation when open during the summer months. Just past the Visitor Center, the road continues with a double-lane gravel surface for about 3.8 miles until it narrows to a single-lane gravel road as it enters the Benham Falls day-use area.

Road 9700-100 is a short, 1/4 mile double-lane paved road that provides access to the Lava River Cave. At its junction, Highway 97 has three lanes of traffic (two northbound and one southbound) and a left turn lane. The two northbound lanes serve as passing lanes and there is merging traffic from the Cottonwood Road interchange. When the cave isn't open, Road 100 is gated about 100 yards off the highway. People still visit this site, however, and cars and buses are often parked haphazardly out to the highway.

Road 9720 is a 1 1/2-lane (18-20 foot travelled way) surfaced road which provides access from Highway 97 to the Lava Cast Forest. Its junction with Highway 97 is located across from the main access to Sunriver. There is heavy traffic, much turning traffic, and the intersection is regulated with a flashing caution/stop light. Sight distance to the south is poor, and there is a refuge lane, but no formal left turn lane. Weather and driving conditions are often poor. From the highway, the road extends about nine miles east to the junction with Road 950 which accesses the Lava Cast Forest. From there, it narrows to a single-lane, native surface road which crosses the midsection of the Monument for two miles before terminating at Road 9710. The road is basically cinder-surfaced which is difficult and costly to maintain due to the high volume of traffic. Over the last few years, the Forest Service has placed a thin 2-inch lift of crushed aggregate on about 50% of the road. This has improved user comfort and reduced maintenance costs, but is only a temporary remedy since the road still has a cinder base.

Another road bisecting the Monument is 9735 which also is a 1 1/2-lane, cinder surface road. It has a good junction with Highway 97 with flat grades and good sight distance. There is a refuge lane, but no formal left turn lane on the highway. The road extends east from Highway 97 about 10 miles to the Monument boundary. For the next three miles, it narrows to a single-lane, cinder surface road that crosses the Lava Cascade lava flow and terminates at Road 9710. An area 150 feet to the north and 1000 feet to the south of this road segment is the Transferal Corridor which would provide a utility corridor through the Monument in the event geothermal power is ever developed on the east side of the Monument.

The Monument is also bisected in the north by the Burlington Northern Railroad with a 100 foot right-of-way, the Pacific Gas Transmission pipeline corridor with an 86 1/2 foot easement, and the Bonneville Power Administration 230 KV powerline with a 125-foot easement. A fourth corridor was occupied by a Pacific Telephone and Telegraph line which had a 50 foot easement. This line is no longer in use; most all of the poles and wire have been removed, and the easement is in the process of reverting back to the Forest Service. In the southern portion of the Monument, Midstate Electric Cooperative has a 14-foot powerline corridor which serves facilities within the Newberry Caldera. All of the utility corridors contain primitive access roads to facilitate inspection and maintenance of the system.

On the southeast side of the Monument, Road 2127 joins Road 21 and continues south for two miles to Road 2125. It is another narrow, native surface road which has been managed to provide a primitive driving experience. Road 2125 has recently received minimal reconstruction, but is also intended to remain a low-standard road.

Within the caldera, Road 2100-500 provides a four-mile scenic access from Road 21 to Paulina Peak. Throughout its length, the road standard varies inconsistently from 1 1/2 lanes to single lane and from cinder surface to native surface. Signing and delineators do not adequately warn users of changes in road width. The grade is steep and there are many sharp curves. Boulders protrude through the subgrade in many areas. Some sections have poor drainage of surface water. All of these factors make maintenance difficult. There are no guardrails, even though some areas drop off several hundred feet. Some cutbanks are unstable so that rocks roll into the road and soil blocks culverts. One of the high cutbanks on the west side is visible from Highway 97 and other major viewpoints. The road is very popular because the top offers a 360-degree panoramic view of Central and Eastern Oregon. There is limited parking and turning area at the top. Trailer traffic is discouraged on this road. Mountain bike use, however, is increasing. The road usually opens in June or July when the snow is gone, and closes again in November.

Within the Monument, Transferal, and Special Management areas, there are about 62 miles of native surface roads, 16 miles of aggregate/cinder surfaced roads, and 17 miles of paved roads (including Highway 97). The number of miles of roads per square mile of area is referred to as the road density, and this figure is used to help assess the impacts of roads on other resources. The overall road density for the entire Monument is 1.0 miles per square mile. By individual area, the road densities are: Monument- 1.1 miles per square mile; Transferal Areas- 0.8 miles per square mile; and Special Management Areas- 0.8 miles per square mile.

A number of roads in the study area have electronic traffic counters to monitor use, although not all counters are monitored every year. If counts are taken for the entire year, the total count is divided by 365 days to yield the Average Daily Traffic (ADT). If counts were taken for only a portion of the year, normally April through September or October, the total vehicle count is divided by the number of days in the counting period to yield the Seasonal Average Daily Traffic (SADT). For comparison purposes, an ADT of at least 200 is normally used as the threshold for considering paving a road. The latest available traffic count data is from 1991. During that year, County Road 21 had an average daily traffic (ADT) of 327 vehicles. This represents a 12% increase from 1990 with 293 ADT and a 45% increase from 1988 with 226 ADT. An unmeasurable part of this increase can be attributed to improvements in the road surface and the designation of the area as a national monument. Road 9710, which flanks the Monument on the northeast side, had a seasonal average daily traffic (SADT) of 33. Road 9720 to the Lava Cast Forest had a SADT of 91. No previous data is available for 9710 or 9720. The latest data for Road 9702, the Benham Falls road, is from 1989 when it had a SADT of 99. This is a 9% increase from 1988 and a 27% increase from 1985. The last recorded data for Road 9735 is 1985 when it had an SADT of 57. This is a 33% increase over the previous year and a 128% increase over 1982. In contrast, the SADT in 1991 for the Paulina Peak road (2,100-500) was 125.

Traffic counts on Road 21 are higher on weekends than weekdays, with Sundays having the highest count. Historically, the highest use in the summer occurs in the second or third week of July. The weather, fishing success, fires or fire closures, and other factors can influence the traffic counts. Individual events, such as the Monument dedication on June 29, 1991, show as significant peaks in the counts. With the exception of the main recreation routes

Table 3-8

NON-RECREATION FACILITIES IN NNVM

Description	Permittee	Location
Dikes	Central Oregon Irrigation	West side of Deschutes
Dam	Inez Kellems	Paulina Lake
Fish Weir	Oregon Dept. of Fish & Wildlife	Paulina Lake
Gauging Station	Oregon State Water Res. Dept.	Benham Falls
Gauging Station	U.S. Geological Survey	
Gauging Station	U.S. Geological Survey	
Gauging Station	U.S. Geological Survey	
Precipitation Gauge	Oregon State Water Res. Dept.	Newberry Crater
Seismograph Station	U.S. Geological Survey	On Red Hill
Weather Station	ODOT	Near Lava Butte
	↓ Permittee/Owner ↓	
Gas Pipeline (buried)	Pacific Gas Transmission	East of Lava Butte
Highway	Deschutes County (Hwy 21)	Newberry Crater
Highway	ODOT (Hwy 97)	East of Lava Butte
Power Line	Midstate Electric	West of Lava Butte
Power Line	Midstate Electric	Newberry Crater
Power Line	Bonneville Power Administration	East of Lava Butte
Railroad	Burlington Northern	West of Lava Butte
Telephone Lines (buried)	U.S. West Communications	East of Lava Butte
Telephone Lines (buried)	U.S. West Communications	Newberry Crater
Telephone Lines (buried)	U.S. West Communications	To Paulina Peak
Fish & Game Cabin	??	East Lake (SW corner)
Compound	Forest Service	Newberry Crater
Fire Lookout	Forest Service	Lava Butte

(Roads 21, 9702, 9720), most roads traditionally receive their most concentrated use during the general deer hunting season in late September-early October.

The latest traffic counts for Highway 97 are from 1991. Mile Post (MP) 143.47, which is just south of Baker Road south of Bend had an ADT of 14,600. MP 153.09, just south of the turnoff to Sunriver and Road 9720, had an ADT of 8,200. MP 161.76, which is just south of the junction with Road 21, had an ADT of 8,100. These figures indicate that there are 6,500 additional vehicles or an 80% increase in traffic on the section of highway between Bend and Sunriver.

In late fall, the snowgate above the 10-Mile sno-park on Road 21 is closed and most main roads in and around the caldera are converted to winter recreation trails. Road 21 is the only road accessing the Monument that is plowed on a dependable basis. Oregon SNO-PARK funds are used to plow the road and the 6-Mile and 10-Mile sno-parks. The 6-Mile sno-park has a capacity of about 15 vehicles, but at an elevation of only 4500 feet, its snowpack is marginal and season of use is either short or non-existent. At 5550 feet, the 10-Mile sno-park is located right at the dependable snowline in a normal winter. It has a capacity of about 75 vehicles, and during the winter of 1992/93, it was full to capacity almost every weekend and overfull on peak weekends and holidays. During low snow years, the snowgate on Road 21 has been opened by mid-winter to allow vehicle access to the snow line, but other than the overlook at the 11-mile marker, there are limited places to get off the road above the sno-park and this has created access and parking problems.

Trends

Nationwide, driving for pleasure is the number one recreational use of the National Forests. As the general population continues to expand and become more mobile, this use would be expected to increase. As the Monument plan is implemented and word of the Monument spreads nationally and perhaps globally, visitation to the area will increase.

Central Oregon is experiencing the largest growth rate in Oregon, so this will also contribute to the increased recreation demand for roads, trails, and facilities. Traffic on Highway 97 is increasing at a 3% annual growth rate. In the State's Six Year Highway Improvement Program, Highway 97 will be widened to four lanes between Bend and Lava Butte and some additional passing lanes will be constructed between Bend and La Pine.

Recreational vehicle traffic has been increasing for several years, and the demand for roads, parking areas, and camping facilities will increase. As the reconstruction of Road 21 into the caldera is completed, there will likely be an increase in the number of RV's or other campers using the caldera as a place just to spend the night before moving on in the morning.

With declining budgets, roads and facilities will have to be brought to a standard that will provide the desired recreation experience while requiring minimal maintenance. Primary recreation roads are gradually being converted from cinder surface to a stabilized gravel surface to increase user comfort and decrease maintenance. Some gravel roads will be converted to pavement to further reduce annual maintenance costs.

Potential geothermal developments would increase commercial traffic on Road 9735 and the standard and surface type of that road would probably be improved to accommodate year-round access.

3. Vegetation

Forest Vegetation Communities

Background & Current Situation

Newberry National Volcanic Monument ranges in elevation from almost 8000 feet on Paulina Peak to about 4000 feet near Bend, Oregon. The transition from alpine to high desert settings provides a range of temperature, precipitation, air movement patterns and other climatic conditions. When combined with a variety of volcanically derived soils and landforms, it produces environmental factors suitable for the establishment and growth of a diverse array of plant and tree species.

The forested portions of the Monument are dominated by the following tree species and communities: mountain hemlock, lodgepole pine, ponderosa pine, and white fir (mixed conifer). The map packet for this document contains a map (Vegetation) of the distribution of forest vegetation within the Monument.

Mountain hemlock is found on cold, snowy subalpine sites within Newberry Caldera and on the flanks of the volcano, particularly northern aspects. Sheltered slopes, northerly exposures and moist, cool sites typically offer the best growing conditions for mountain hemlock. Mountain hemlock grows very slowly, in part due to its short growing season. The species is relatively long-lived, occasionally attaining ages of 800 years.

Mountain hemlock within the Monument often grows in mixed stands. Typical associates are lodgepole pine and whitebark pine. Other species such as western white pine may also be present. With moderate to heavy disturbance such as logging, site preparation for regeneration or wildfire, lodgepole pine will increase in number. Natural and artificial regeneration (planting) of mountain hemlock is difficult. While attempts to plant mountain hemlock have been successful, planting is less effective than natural regeneration.

Lodgepole pine thrives under a wide variety of growing conditions. Lodgepole pine seedlings are resistant to frost injury and can survive in cold air sinks (frost pockets) where other species cannot. Lodgepole also dominates sites with high water tables and extremely poor soils. There are four distinct geographic varieties of lodgepole pine. The local variety is called Sierra lodgepole pine.

In Newberry Caldera lodgepole pine is found in pure stands and mixed with mountain hemlock. Other associated tree species at high elevation include those described for mountain hemlock. Around the flanks of the volcano at mid-elevations it forms extensive pure stands. As one travels lower in elevation it is found in a mixture with ponderosa pine and occasionally true fir, and is finally replaced by pure stands of ponderosa pine at the lowest elevations within the Monument.

Lodgepole pine is a relatively short-lived species. It seldom reaches an age beyond 150 years. Locally, stands of lodgepole begin to break up after 80 to 100 years. Regeneration of lodgepole pine is relatively easy and it is a prolific seed producer. Seedlings, however, do not grow well in shade. Consequently, lodgepole pine thrives in areas of moderate to heavy

disturbance following fires or timber harvest. Reproduction in such stands is often heavy, resulting in even-aged stands where growth has stagnated. Unless humans or insect mortality thin the stands, the trees will never achieve average diameters greater than three or four inches. Present extensive forests of Sierra lodgepole pine are considered by ecologists to be biological anomalies because today's trees have attained larger diameters due to fire suppression.

The mountain pine beetle has played an important historic role in lodgepole pine ecosystems. The historic role, however, was probably less dramatic than recent mountain pine beetle epidemics. Many of the lodgepole pine stands within the Monument incurred heavy mortality from attacks by mountain pine beetle during the 1980's. A 1991 estimate of mortality from aerial photos shows about 5,500 acres of light mortality (11-25%), 5,300 acres of moderate mortality (26-55%), and 3,500 acres of heavy mortality (55% and greater) in lodgepole pine stands within the Monument. The Forest Mortality Map found in the map packet accompanying the FEIS, depicts each of the mortality classes previously mentioned.

Ponderosa pine dominates the lower elevations within the Monument. It occurs in mixed stands with lodgepole pine and other species at middle elevations, and is often the primary species on the well-drained soils of buttes, cinder cones and ridges.

Ponderosa pine does not tolerate shade well, and is not a prolific seed producer. Seedlings depend on years where spring moisture is sufficient for establishment. The infrequent coincidence of enough moisture and a good seed crop results in sporadic regeneration of pine seedlings.

Ponderosa pine develops thick bark at a relatively young age and is therefore fire-resistant. Fire has played an important role in maintaining ponderosa pine stands in the past. With recent fire suppression efforts and the exclusion of fire from ecosystems, some ponderosa pine stands have been invaded by lodgepole pine and shade-tolerant white fir. Historical photos reveal open forests of large ponderosa pine with very little vegetation of any kind in the understory. Monument legislation specifically calls for a program to restore old-growth ponderosa pine, and this could include stands with open park-like characteristics.

Most of the ponderosa pine stands and many of the mixed pine (ponderosa pine and lodgepole pine) forests within and adjacent to the Monument developed following logging in the 1920's and the 1030's. All merchantable (large) trees with the exception of one or two seed trees per acre were harvested during that time period. Following the logging, ponderosa pine seedlings became established naturally from seed produced by the few large trees that remained. The success in establishment of such large numbers of seedlings must have resulted from favorable cone crops and precipitation occurring during the years following logging. In mixed pine stands, the logging practices that removed the large ponderosa pine are believed to have favored an increase in the proportion of lodgepole pine, already on the rise due to fire suppression.

Today's ponderosa pine forests are largely even-aged and between 60 and 70 years of age. The stands of medium-sized trees, called blackbark because of the dark color of their bark, contain trees whose average size varies between about six and ten inches DBH. These stands contain occasional large trees scattered over the landscape that were not cut during previous logging. Small groups of old-growth trees within the Monument can be found adjacent to the Deschutes River, along US Highway 97, on cinder buttes and the flanks of Newberry Volcano.

During the recent mountain pine beetle epidemic that began in lodgepole pine, it was feared that the insects would move into the dense ponderosa pine stands that developed following logging. As a result, some of the area was recently thinned to reduce competition between the trees and to improve their vigor to resist attack by the pine beetle. Larger trees were favored

(smaller trees were removed) during these activities. It is estimated that about 30% of the ponderosa pine stands surrounding the Monument and 15% of the ponderosa pine and 5% of the mixed pine stands within the Monument were recently thinned (within the last 20 years). The remaining clumps of trees were not thinned, primarily to provide security cover and travel corridors for big game. An additional 5% of the ponderosa pine forests within the Monument have undergone regeneration harvest within the same time period.

Mixed Conifer forests are dominated by white fir and occur at mid-elevations. Typical associated species include lodgepole pine and ponderosa pine. White fir prefers moist sites, tolerates shade well and is a species that (where present) increases in number, even under dense canopies of other tree species.

The following table shows the major vegetation types and associated acreages that occur within the Monument. These figures reflect existing vegetation rather than potential or climax vegetation.

Table 3-9

Existing Vegetation Acreages

Existing Vegetation Type	Acreage
Ponderosa Pine	4,729
Lodgepole Pine	23,483
Lodgepole Pine mixed with Ponderosa Pine	4,764
Ponderosa Pine mixed with White Fir	515
Mixed Conifer Associated with White Fir	2,675
Mountain Hemlock	5,739
Water	2,368
Meadows and Sagebrush	295
Lava and other Nonvegetated Areas	14,713

Other Plant Communities: Although the majority of the area occupied by vegetation within the Monument is forested, there are many smaller vegetated areas where shrubs, herbaceous plants, grasses and unique associations of tree species are dominant. These areas are particularly important because of the diversity they afford for wildlife habitat, human study and enjoyment.

Riparian communities are found along the shores of Paulina, East and Lost Lakes, and along Paulina Creek, and the Deschutes River. Springs and seeps provide other areas where small populations of water-loving species occur.

There are several small meadows both within and outside of the caldera. Small portions of the vast lava flows and the edges running along the flows support unique populations of

species that occur rarely within the Monument. Aspen, dry land willows, Douglas-fir, as well as shrubs and other plantlife occurs within these areas.

Plant communities are divided into plant associations which serve as an ecological basis for management-oriented guidelines related to plant establishment, vegetation treatment, successional trends and vegetation mapping. In reality, plant associations often mix together because of environmental gradients created by changes in topography and soils. A list of the most common plant associations in the Monument is available in the planning record.

Trends

For tree species see the discussion that follows under old-growth trends. The understory vegetation in many forested areas will increase in areas killed by the mountain pine beetle. As new tree seedlings occupy these areas, the understory vegetation will be crowded out. Potential stand replacement fires or severe insect infestations could greatly increase the area of open grown shrubs, grasses and other herbaceous plants.

Without further treatment, riparian areas will have gradually increasing areas with woody plants that have died from competition or old age. Areas near recreation sites, damaged by trampling, may continue to deteriorate.

Sensitive Plant Species

Background and Current Situation

The pumice grape-fern, *Botrychium pumicola* is the only confirmed sensitive plant species in Newberry National Volcanic Monument. It is endemic to Central Oregon, and is known only to occur on the Deschutes, Winema, and Fremont National Forests, Bureau of Land Management (BLM) lands, and in Crater Lake National Park. The US Fish and Wildlife Service (USFWS) classifies it as Category 2 (See Glossary). Pumice grape-fern will probably be listed as threatened or endangered within three years.

Pumice grape-fern is a unique, herbaceous plant which grows in pumice soils, generally in frost pockets. Site conditions where it grows are harsh and exposed. There are three locations within the Monument where this plant occurs. One population has been known since the 1920's. The others were found in the 1980's. The populations range in size from a few plants to hundreds. One population of pumice grape-fern occupies a site with two other closely related *Botrychium* species. The occurrence of all three species on one site is considered unique. Clues about the evolution and adaptation of the plants to their environments may be held at the site.

Threats to pumice grape-fern within the Monument are from visitor trampling, collectors and "profiteers," encroaching lodgepole pine (due in part to fire exclusion), effects from construction projects, ATV and snowmobile riding, minor threats from animal predation on the plants, and low probability threat from fire.

A species conservation strategy is being prepared for the pumice grape-fern. It will be completed in 1994. A limited habitat enhancement project has begun to remove lodgepole pine seedlings from one population. The project will be completed in 1994. At least two of the populations are currently being intensively monitored to determine their condition and population size.

Potential habitat for an additional 12 sensitive plant species also occurs within the Monument. Surveys are needed to determine whether or not they occur. Few systematic surveys for sensitive plants have taken place within the Monument. To date, survey efforts have been concentrated on the pumice grape-fern and in areas where there is a potential for disturbance associated with recreation and road development projects. These species, their habitat and status are as follows:

Habitat: Riparian areas

Agoseris elata, tall agoseris - Oregon State Endangered Species.
Artemisia ludoviciana ssp. *estesii*, Estes wormwood - Oregon State Threatened Species, USFWS (Category 2).
Calamagrostis breweii, Brewer's reedgrass - Oregon State Threatened Species.
Gentiana newberryi, Newberry's gentian - Oregon State Threatened Species.
Lobelia dortmanna, water lobelia - Oregon State Sensitive Species.
Lycopodium complanatum, stiff club-moss - Oregon State Threatened Species.

Habitat: Talus scree slopes

Aster gormanii, Gorman's aster - Oregon State Threatened Species, USFWS C2.
Campanula scabrella, rough harebell - Oregon State Sensitive Species.
Draba aureola, alpine draba - Oregon State Sensitive Species.
Cymopterus nivalis, Hayden's cymopterus - Oregon State Threatened Species.

Habitat: Ponderosa pine/bitterbrush plant associations

Castilleja chlorotica, green-tinged paintbrush - Oregon State Threatened Species, USFWS C2.
Mimulus jepsonii, Jepson's monkey-flower - Oregon State Threatened Species.

Trends

Recently *Artemisia ludoviciana* ssp.*estesii* has been "tentatively confirmed" as being present within the Monument. Scheduled chromosome counts have delayed positive identification.

Sensitive plants will continue to be protected, and current monitoring activities will continue. Additional surveys will generally be limited to areas where projects with a potential for disturbance are planned.

Old-Growth Forests

Background & Current Situation

The legislation that created Newberry National Volcanic Monument directed the management plan consider a program to reestablish old-growth ponderosa pine ecosystems. The term "old growth" conjures up different meanings for different people. Common to many definitions are visions of large, old trees, but after that, definitions often diverge. Two broad definitions of old growth are described here. One focuses on historic conditions prior to modern-day fire suppression activities. The other describes conditions found where fire has been suppressed.

"Historic Old growth" -- With fire: Historic or "pre-EuroAmerican" forests can be described in terms of fire regimes, landscape patterns, and stand conditions that were present prior to the settlement of the region by EuroAmericans and prior to fire suppression. Historical photos, observation of fire-scarred trees and analysis of the large woody material in the soil have allowed scientists to piece together a description of historic forest conditions.

Fires, hot enough to scar trees, swept through ponderosa pine forests of the region every eight to 12 years leaving open park-like stands of large trees. There were few snags, an absence of large pieces of dead woody material on the forest floor, and very little woody vegetation (shrubs and small trees) in the understory. Native grasses were the most common understory vegetation.

Historic lodgepole forests were never allowed to grow into "contiguous structured forests" characteristic of those found in Central Oregon today. The historic lodgepole forests were comprised of trees of various ages (between 0 and 100 years) and sizes. Even-aged groups formed mosaics over the landscape. The average diameter of trees in these stands probably ranged from between two and four inches at ground level to scattered trees of six to eight inches in diameter. Lodgepole pine trees did not commonly reach the sizes that they now attain with fire suppression. Each time a fire swept through the lodgepole forest, most trees were killed because of the trees' thin bark. Trees, understory shrubs, and herbs found in these stands did not have the time between fires to develop the structural relationships and canopy levels found today.

Forests comprised of a mixture of species, including pines and true fir, were not as common as today and probably did not contain nearly as many fir trees. The fires that historically burned through these forests at fairly regular intervals probably resulted in the distribution of some large fir trees, well spaced and scattered across the landscape. The thin-barked fir (mainly younger individuals) are more easily killed by fire -- even fire that burns at a low intensity.

Today's forests of mountain hemlock are most likely to resemble historic conditions. Fires burned much less frequently than in other forest communities because of lower temperatures and higher moisture levels that generally prevail at higher elevations where mountain hemlock occurs within the Monument.

"Ecological Old growth" -- Fire-suppressed: Data have been collected from several east side Oregon and Washington Forests to develop definitions for old-growth climax forests. These data were taken from the Ecologist Plot Data Base and represent samples taken over the last 25 years. Because the definitions were developed with the aid of ecology plot data, the definitions have been dubbed "ecological" definitions. To many reviewers the term "ecological" implies something that is natural. In fact, the ecological definitions cover a broad range of stand conditions. When applied to forest communities east of the Cascade Mountain Range they would, for the most part, require fire suppression to create them and would frequently require active vegetation management to sustain them.

The age at which old growth develops and the specific structural attributes that characterize old growth vary widely according to forest type, climate, site conditions, and disturbance regime. The definitions are suitable for use on the Deschutes National Forest and Newberry National Volcanic Monument. The data base was sampled based upon potential vegetation rather than existing vegetation and the old-growth definitions should be applied based on potential vegetation (climatic climax species).

The old-growth definition for each climax vegetation community is based on six factors or attributes. The attributes were extracted from the literature as the best attributes of "old growthness" and have undergone informal validation by natural resource professionals. The attributes are defined on a per acre basis and include:

1. Number of large trees;
2. Number of snags;
3. Amount of down woody material;
4. Number of tree canopy layers;
5. Native shrub/herb component (layers);
6. Amount and size of gaps/openings.

The definition is based on the characteristics of the vegetation only and does not consider other aspects of the old-growth issue (e.g. wildlife habitat characteristics and social considerations).

Present day old-growth areas are often designated based on the above criteria and the "ecological," fire-suppressed definitions. Generally, these areas have more understory vegetation and tree canopy layers, different mixtures of tree species, more dead wood and snags, larger trees in lodgepole pine and more small trees and trees per acre in ponderosa pine than historic forests. Within a given area the forest structure was generally less complex in the past.

The following summarizes the "ecological" definition for old-growth ponderosa pine as described in the "Interim Old-Growth Definitions for National Forest Lands in Eastern Oregon and Washington - Region 6" (as of June, 1993). The definitions are labeled "interim," because they may change as more data becomes available. For a complete explanation of the old-growth definition for the ponderosa pine series, definitions for the lodgepole pine series and the white fir series, as well as a more detailed explanation of how to apply the definitions, consult the Interim Regional Old Growth definitions.

Some attributes are <u>not required</u> to be present to meet the old-growth definition. Basically, the minimum diameter, number of large trees per acre, and age are the only fully required attributes, since in some cases past stand history (fire, salvage, etc.,) could affect other attributes, such as snags or down logs.

Besides the six attributes used to define old-growth ponderosa pine, the definition has been further refined to include two stand conditions and two levels of site productivity. The two classes of site productivity are: 1) low and 2) moderate-high. Productivity is determined by the plant association the area falls within. Most sites within the Monument fall within the moderate-high productivity level. The two stand conditions include mid-late seral and late to very late stand conditions which are defined by the size of dominant trees and reflect the age and degree of stand development.

The first attribute is number and size of large trees. The table following this discussion summarizes the number of trees by size class, condition class and productivity level for old-growth ponderosa pine.

Snag levels (see the following table) can be substituted for, in part, by having 10% of the trees with spire (dead) tops. Fire, lightning, insects and root pathogens are the main causal agents for snags. Snags killed by insects or root pathogens may result in clumps of snags while fire killed trees may be more evenly distributed across the landscape.

Down woody material (see the following table) is measured by the number of pieces of woody material per acre, at least 8 feet in length and 12 inches in diameter at the large end. For example, a down log measuring 24 feet equals 3 pieces. This attribute is a function of site productivity, age, and the relative decadence of each stand. Mid to late seral stands will tend toward the low end of the range for number of pieces, while late to very late seral stands without recent evidence of fire will have large volumes of down material.

There is little data on down woody material in east side forest conditions. Historic records indicate that large woody material was essentially absent in stands of the day (Lieberg 1899; Dodwell et al. 1903; Munger 1917). Evidence today indicates the loss of large woody material with even a low intensity prescribed underburn.

The number of canopy layers in old-growth, fire-suppressed ponderosa pine stands varies from 0 to 2, with a typical range of 1 to 2, and numbers rarely exceeding 2. This figure includes only the number of canopy layers in smaller sized trees (<9"). Commonly ponderosa pine regenerates in "episodes" when conditions are favorable, particularly in high site stands. In low site stands regeneration may occur as scattered individuals rather than as distinguishable clumps or a true layer. Munger (1917) reported both stands that displayed an obvious layer of smaller individuals and stands with just a few scattered trees.

Old-growth ponderosa pine stands will support a layer of native shrubs, grasses, sedges and forbs. Percent canopy cover of this layer ranges from 0 percent, with a typical range of 20 to 40 percent, to 80 percent and above.

The ecological, fire-suppressed definition of old growth recognizes that gaps occur in stands created by fire, insects, disease and windthrow. Gaps would appear as more obvious openings in a contiguous canopy typical of higher productive sites but could be difficult to distinguish in more open, lower productive areas. The definition describes the occurrence of natural gaps of at least 1/2 acre in size. The definition does not describe the extent or total acreage of gaps.

The opinions about stand size and shape necessary to sustain old-growth vegetation processes differ widely, partly due to the condition of the vegetation that surrounds a particular old-growth stand. The definition currently lists the minimum size as 10 acres with a typical range of 40-100 acres and higher acreages are of course possible. Arguments for small acreage suggest that small acreages are enough to provide adequate genetic variability and would protect internal stand integrity against changes in microsite. Arguments for larger acreages include that they provide protection against localized loss from insects, disease and wildfire and that broad open forests may require many acres to encompass the structural variability within the landscape.

According to the definition, the degree and arrangement of various successional stages found within a given old-growth area is of great ecological importance. Identified "stands" within an old-growth area should support vegetation representing mid, late, and very late (decadent) conditions. This mosaic of seral conditions will mimic historic stands, in part, and provide for increased biodiversity in addition to providing the opportunity to maintain old growth for long periods of time. It should not be the intent to always feature only very late or decadent stands, but rather allow for maximum stand diversity reflecting a variety of conditions.

It is important to note that "ecological," fire-suppressed and "historic," fire-based old growth cannot always be cleanly distinguished. In fact, "historic" old-growth characteristics will generally fit within the range of variability of characteristics used to define "ecologic" old growth. The numeric values described for each "ecologic" old-growth attribute reflect those that would be found in climatic climax stands where stand conditions are perpetuated largely by fire suppression. In ponderosa pine, "historic" or pre-EuroAmerican

stands would typically exhibit characteristics found at the low end of the range (not within the typical range for the "ecologic" definition) for canopy layers, development of understory vegetation and presence of downed wood and snags. For lodgepole pine, "historic" stands would not typically exhibit the tree size characteristics found in "ecologic" definitions. The distinction between "ecologic" and "historic" old growth is made here to point to the fact that today's forests (and definitions of old growth), based on decades of fire exclusion, may encompass the "historic" range of variability on any given acre but do not resemble "historic" conditions given the extent of these conditions over the landscape.

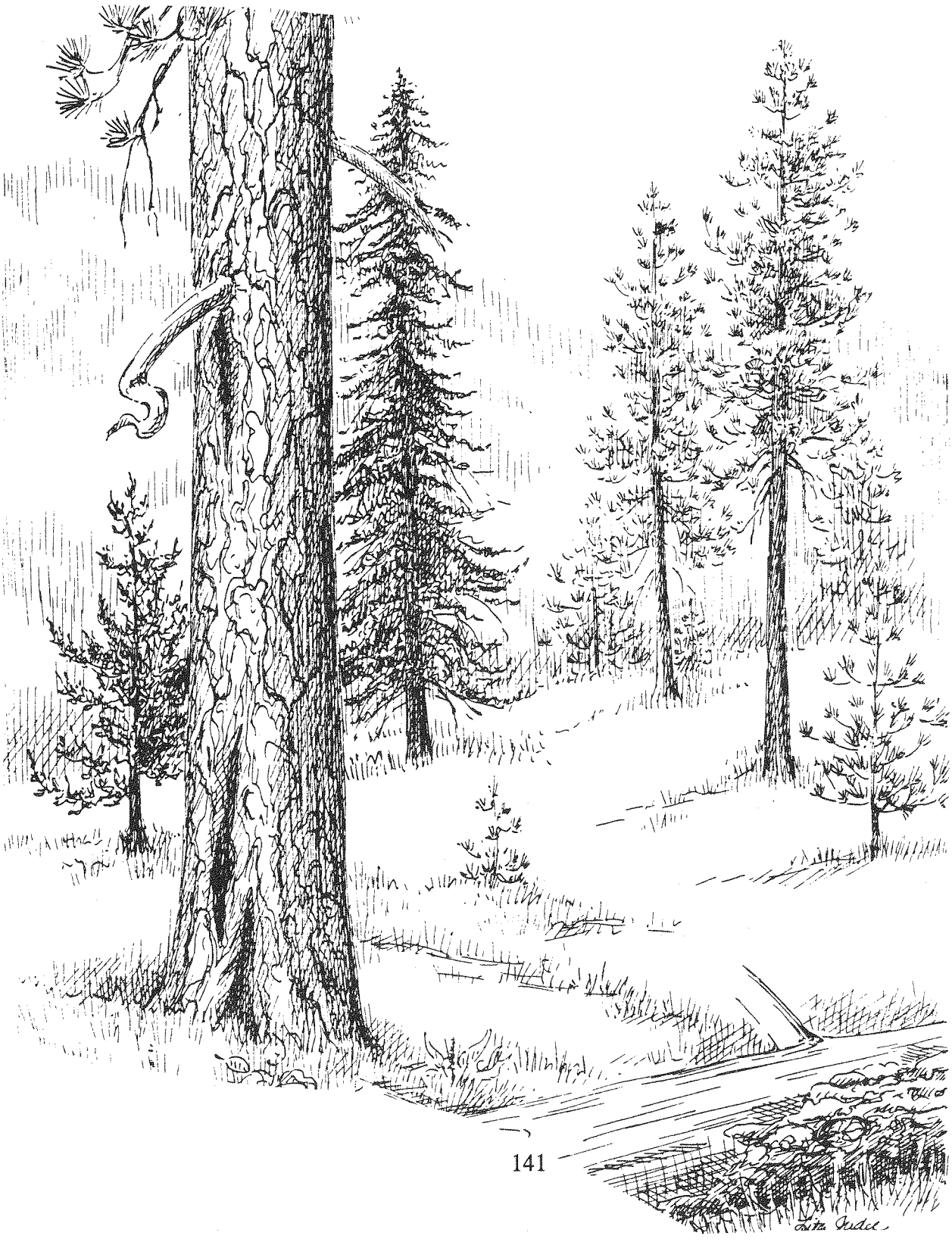


Table 3-10

Region 6 **June, 1993**

Interim Old-Growth Definition Summary Table for Ponderosa Pine

Productivity[1/]	Condition Class[2/]	#[3/]	Old Growth Characteristics						
			Live Trees			Dead Trees			
						Standing		Down	
			DBH	TPA	Age	DBH	TPA	Diameter	Pieces
Ponderosa Pine									
Low	Mid to Late Seral	Min	21"	10	150	14"	3	--	0
		TR		15-25				12	3-6
		High		30+					10
Low	Very Late Seral	Min	31"	2	200	14"	3	--	0
		TR		3-5				12	3-6
		High		6+					10
Moderate-	Mid to Late Seral	Min	21"	13	150	14"	3	--	0
		TR		18-40				12	3-6
		High		45+					10
Moderate-	Very Late Seral	Min	31"	3	200	14"	3	--	0
		TR		5-7				12	3-6
		High		8+					10

1/ Productivity: Low=Low Site Productivity; Moderate-High=Moderate to High Site Productivity.

2/ Condition Class: Mid to Late Seral conditions - where dominant trees are greater than 21" dbh, and at least 150 years age. Late to very late (decadent) Seral conditions - where 21" dbh trees are present and dominant trees are greater than 31" dbh and 200 years in age.

3/ #: Min = Minimum # Required; TR = Typical Range of the Value; High = Highest Value. All characteristics of "ecological" fire-suppressed stands would usually fall within TR. Dead tree characteristics in fire-based stands would usually fall at the lower end of TR.

Trends

Existing old-growth ponderosa pine forests in the Monument most closely meet the definition of "ecological," fire-suppressed old growth. They will continue to develop in this manner in the absence of epidemic insect attacks or stand replacement wildfires. The likelihood for such events will increase as fuels build up from continuing fire suppression. Stands will become more crowded with trees, and susceptible to insect and disease attack because fire has not "naturally" thinned the forest. Human intervention in the form of thinning and treating fuels can perpetuate the "ecological old-growth" stands. The re-introduction of fire could begin to move some of these stands toward "historic" old-growth forests.

Much of the ponderosa pine within the Monument is comprised of even-aged stands of small-to medium-sized trees less than 18 inches in diameter. Over 15% of these forests within the Monument were recently thinned to provide protection from the mountain pine beetle that has devastated the lodgepole pine. Without further thinning by fire or through human intervention, these forests will develop very slowly into conditions resembling the existing "ecological," fire-suppressed old growth, or may never develop into these conditions. The threat of insect epidemics and stand replacement wildfire will pose significant risks over the long-term.

Ponderosa pine in stands mixed with lodgepole pine and other conifers are likely to decline in number, as they are replaced by shade-tolerant species (true fir) or where mixed with lodgepole pine (a prolific seed producer). Ponderosa pine seedlings have little chance to get established under these conditions. Threats from stand replacement wildfire and insect epidemics will also continue to pose significant risks.

Many of the large lodgepole pine trees were killed in the recent mountain pine beetle epidemic. Many of the trees that survived will grow at faster rates and become large trees over time providing new areas of "ecological old growth." Seedlings will fill in unoccupied areas to create large even-aged forests (or two-storied conditions where trees in the original forest have not been killed). The threat of insect epidemics will continue as areas not killed in the recent pine beetle epidemic become increasingly susceptible to attack. Areas that have recently incurred significant mortality harbor increased risks for a stand replacement wildfire.

Ecosystem Health

Background & Current Situation

The July, 1993 "Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl" defines ecological health as: "The state of an ecosystem in which processes and functions are adequate to maintain diversity of biotic communities commensurate with those initially found there." Previously the focus was on forest health. Forest health was usually described in terms of the health and vigor of forest trees as related to levels of insects and disease activity present. Ecosystem health deals with a much broader notion of what constitutes a healthy ecosystem.

Not all of the important indicators of ecosystem health are well understood and many are yet to be discovered. This section of the document attempts to integrate several of the indicators of ecosystem health that can most directly relate to vegetation. Additional indicators of ecosystem health are described in detail in other sections of the document (wildlife, fire, soils, water, etc.).

The current thinking recognizes the gaps in our knowledge about ecosystem structure and function. There is also a recognition that certain key components of ecosystems can be defined and there is some information available about how they function. One of the goals of ecosystem management is to make sure that the components are sustained in some measure across the landscape. Key ecosystem components and functions discussed below include: old-growth, snags and downed logs, soil productivity, undesirable exotic plant species and vegetation health.

The presence of dead wood (snags, downed logs, etc.,) in the forest provides necessary habitat for some wildlife, supports a wide variety of beneficial fungal species, and provides organic inputs for soils. Dead wood is supplied by dead trees or dead parts of trees and other dead woody vegetation. Dead wood is used up through decomposition processes or it can be rapidly consumed by fire or removed for utilization as wood products or fuelwood. Because of past fire suppression there has been a buildup of large woody material in the Monument. Most areas have abundant amounts of dead trees and downed logs. In these areas the amounts are considered in excess of those that occurred historically and the amounts are above the desired level from a fire risk (fuels) perspective. Exceptions include the black bark ponderosa pine stands that occur at the north end of the Monument and small areas of lodgepole pine (just over 400 acres) harvested prior to the establishment of the Monument. These areas do not contain large amounts of dead and down wood and snags. Historically most areas in the Monument probably did not support an accumulation of large dead woody material because fires consumed it. Because down woody material and snags are required by many wildlife species, it may be desirable to have a sustained amount of snags and downed logs over the landscape that may be in excess of historical levels.

There has been no comprehensive survey of old-growth areas within the Monument. Few areas (with the possible exception of mountain hemlock) resemble historical old-growth conditions. This is due to the exclusion of fire by humans. Many areas of the Monument do support forests containing large trees. Much of the Monument was never logged extensively, however, large trees were removed from around the edges of the Monument during the railroad logging days, and the north end of the Monument was heavily logged while it was still privately held land during the first half of this century.

There are probably more lodgepole pine forests with large trees now than there were historically; however, many of these stands have incurred heavy mortality (especially to the large trees) in recent attacks by the mountain pine beetle. Many of the areas that were not severely affected by mountain pine beetle fit the definition of "ecological old growth" as discussed previously. Ponderosa pine has always been valued for the quality of its wood and many of the large trees were logged in the past. Examples of "ecological," fire-suppressed old growth can be found within the Monument. These stands are scattered throughout the Monument and include areas adjacent to the Deschutes River, areas along the Highway 97 corridor and scattered areas around the flanks of Newberry Volcano where lodgepole pine and white fir are invading.

The occurrence of undesirable exotic plant species (weeds) is an increasing problem in isolated areas of the Monument. Examples are knapweed and cheatgrass along the Highway 97 corridor and the invasion of moist meadow areas in the caldera by reed canary grass.

Endemic or moderate to low levels of insect and disease activity are considered natural, even beneficial. For example, several wildlife species depend on and benefit from trees with diseases and trees killed by insects or diseases. A variety of root and stem rots occur in populations of all tree species within the Monument. The overall occurrence of root and stem rots is at low levels. Dwarf mistletoe and western gall rust are probably the most widespread diseases, and they occur most frequently in lodgepole pine. Dwarf mistletoe is also common

in ponderosa pine. Neither of these diseases currently pose serious overall threats. Like all diseases that can kill or weaken trees, however, they may pose hazards to people or property due to falling trees and branches. Many tree and other plant diseases may occur above historical levels due to past fire suppression activities.

Pandora moth is a defoliator of pine trees. The defoliation is often severe and obvious to the forest visitor but trees are rarely killed by the insect. Ponderosa pine and lodgepole pine, especially at the north end of the Monument, have been infested in recent years. The area defoliated by the moth increased in 1992 over that defoliated in 1990. Pandora moth outbreaks are cyclic and the typical outbreak lasts about seven years. The current pandora outbreak should be near its end.

Mountain pine beetle is the most prominent of all local forest insects. (Western pine beetle was also important historically but its occurrence has lessened with a decrease in the number of large ponderosa pine due to logging activity.) Mountain pine beetle occurs in both lodgepole pine and ponderosa pine forests. It also attacks whitebark pine. Lodgepole pine is preferred over ponderosa pine by the mountain pine beetle. Beetle populations are always present but generally remain at low levels until conditions are right for an epidemic outbreak. Optimum conditions for an outbreak include large areas of trees stressed by competition and/or drought and a high percentage of large trees (greater than nine inches diameter breast high [dbh]).

Mountain pine beetle epidemics are known to have occurred historically. There is documentation of an outbreak in the 1920's and more recently a widespread outbreak occurred over much of Central Oregon beginning about 1970. This outbreak peaked in the mid 1980's and beetle populations have declined substantially from those levels.

Some of the medium-sized ponderosa pine that seeded in after logging earlier this century was recently thinned to reduce susceptibility to the mountain pine beetle. It was feared that the mountain pine beetle would move from lodgepole pine into the ponderosa pine. Recent evidence is that the strategy may have been effective with insect activity mainly occurring in unthinned areas. Although mountain pine beetle epidemics have occurred historically, the most recent epidemic may have been more severe than typical epidemics of the past. The hypothesis is that fire suppression has led to large areas of lodgepole pine with a high percentage of large trees that were stressed from competition for limited water availability. The lingering drought in the later part of the 1980's may also have contributed to the length of the epidemic.

Recommendations to reduce the severity of epidemics involve recognizing the risks at both the forest level and at the level of the individual tree. At the forest level the risk of severe epidemics can be reduced by creating a mosaic of tree age and therefore size classes. This will reduce the number of trees that are highly susceptible at any given time. The treatment could approximate the mosaics created by fire in historical lodgepole pine stands. At the stand and individual tree level, resistance to beetle attack can be improved by thinning stands to improve individual tree vigor. Fire probably accomplished this to some degree in the past, especially in ponderosa pine. Thinning by humans using mechanical means can also help achieve management objectives that call for large-sized trees.

Trends

Snags and downed wood are abundant in most areas of the Monument. This situation is expected to continue or increase as vegetation dies. A stand replacement wildfire could significantly reduce this ecosystem component. The risk of such an event is increasing as fuel levels increase.

There are no plans for rehabilitating compacted areas pending completion of the Monument Plan. In the long term many compacted areas will heal if there is no further disturbance. Compaction of soils can heal naturally over long time periods (thousands of years) by processes such as freeze/thaw, burrowing of rodents and the uprooting of trees by the wind. Excavations through ash and cinder deposits from volcanic eruptions have revealed that these processes can effectively mix soils to depths of two to three feet. Dating of these deposits show that not much mixing occurs in the first 1000 years, but by 5000 to 6000 years, they are well mixed.

Areas heavily used by recreationists may incur further damage. If large wildfires occur, there is the possibility of extensive damage to soils through sterilization caused by the heat.

The levels of forest diseases may increase slowly over time in the absence of wildfire. Insect activity will also increase over time as recently thinned ponderosa pine forests are stressed by competition or drought. Densely forested areas may experience higher levels of insect activity even sooner. As the lodgepole pine trees that escaped the recent mountain pine beetle epidemic become larger and competitive stress between the trees increase, a large food base will develop for a future mountain pine beetle epidemic.

Without treatment, the amount of unwanted exotic plant species (noxious weeds and other non-native species) will increase. The rate of spread may accelerate if areas adjacent to the forest (especially areas disturbed by new development) are not treated.

4. Fire and Fuels

Background

Throughout history, particularly before the 1900's, fire, both natural and human, played a significant role in forest ecosystems. The natural role of fire in an ecosystem varies with the characteristics of the natural fire regime under which the ecosystem evolved. A fire regime for a particular land area is a function of frequency of fire occurrence, the fire intensity, and how much of what fuels are consumed (Irving 1971), or as Agee (1981) describes, a function of ignition patterns (lightning, human), growing environment (temperature and moisture patterns) and plant species characteristics (fuel accumulations, adaptations to fire). Three of the regimes will be discussed.

High-severity regimes occur very infrequently (more than 100 years between fires). They typically occur in areas of moist/cool environments under unusual conditions, such as drought with dry hot winds. These fires are high intensity, stand replacement fires of short duration. The forest type in this regime includes mountain hemlock. Fires in this type create ecosystem instability, causing major shifts in forest structure and function. Mountain hemlock is not well adapted to fire. Its relatively thick bark provides some protection, but low-hanging branches, highly flammable foliage and a tendency to grow in dense groups make it very susceptible to fire injury. Fires in mountain hemlock generally occur as infrequent crown fires and result in complete mortality. The estimated pre-logging fire regime in the mountain hemlock of the Pacific Northwest forest types is about 600 years.

Moderate-severity regimes are infrequent (25-100 years), partial stand replacement fires with significant areas of high and low severity. The overall effect is a patchiness over the landscape as a whole. Individual stands will often consist of two or more age classes. These fires occur during long summer dry periods and last weeks to months under variable weather conditions. The local forest type that falls under this regime are the lodgepole pine forests. Smoldering fires are common because understory fuels may be sparse and fire spread to crowns may be difficult. However, lodgepole stands become more flammable as they age because of the dead woody fuels that accumulate on the ground. These fuels result from mountain pine beetle and from other sources of mortality, or from past fires. The lodgepole pine forests of Central Oregon are tied to a disturbance pattern including fire, insects, and disease (Gara et al. 1985). When litter production is limited, the fires usually spread by smoldering logs that are jackstrawed across the forest floor. The down logs are usually a function of mountain pine beetle attacks. These logs burn slowly but conduct enough heat into the ground that the roots are killed or scarred which can kill or stress the tree and set it up for another attack by beetles. The potential for high intensity crown fires is great at two points in the life of a lodgepole stand. The first period is in young stands where crowns are in proximity to dead woody fuels. The second is when stand of overmature or beetle-killed trees break up and are being replaced by shade tolerant species (white fir) that provides a fuel ladder to the crowns. Neither fire nor beetles remove all trees. The role of fire in lodgepole forests perpetuates, encourages, or renews lodgepole pine. Without the periodic disturbance, more shade tolerant species replace lodgepole pine, because it does not regenerate successfully in duff/litter under shaded conditions. Fire interrupts the succession and increases the proportion of lodgepole with each burn. The growing space opened up by death of trees is occupied by new age classes of lodgepole pine.

Low-severity regimes are frequent (1-25 years), low intensity fires with few overstory effects. They are widespread and occur where there is a nearly continuous summer drought. These frequent fires limit the time for fuel to accumulate. Forest types under this regime include ponderosa pine and mixed conifer (white fir). Both species are resistant to fire as mature individuals, but saplings of ponderosa pine are most resistant followed by the white fir. Before fire suppression began in mixed conifer, ponderosa pine dominated the overstory, as large numbers of small shade tolerant, fire sensitive conifers like white fire saplings were killed. Ponderosa pine depends on frequent surface fires to maintain stand health and stability. It develops in small, even-aged groups. After periodic burn intervals, a mosaic forest with many different age groups develops. In mature stands, the overstory limits survival of the understory through competition for light and moisture. Understory trees that survive the first fire are usually destroyed by the next. When the old trees are killed by insects or disease, succeeding fires burn the debris and create openings. In the opening, fuel accumulates more slowly than under the mature trees, so the next fire will burn very lightly or skip the opening. The lack of fuel in openings allows pines to grow large enough that many survive the next fires that pass through the openings (Biswell et al. 1973). Most shrubs in ponderosa pine resprout after burning or have seeds that require heat to germinate. Under this periodic fire regime a diverse shrub community is maintained within the reach of browsing wildlife. The major structural effect of fire is on young trees, favoring the ponderosa pine as a dominant and white fir as a lesser dominate.

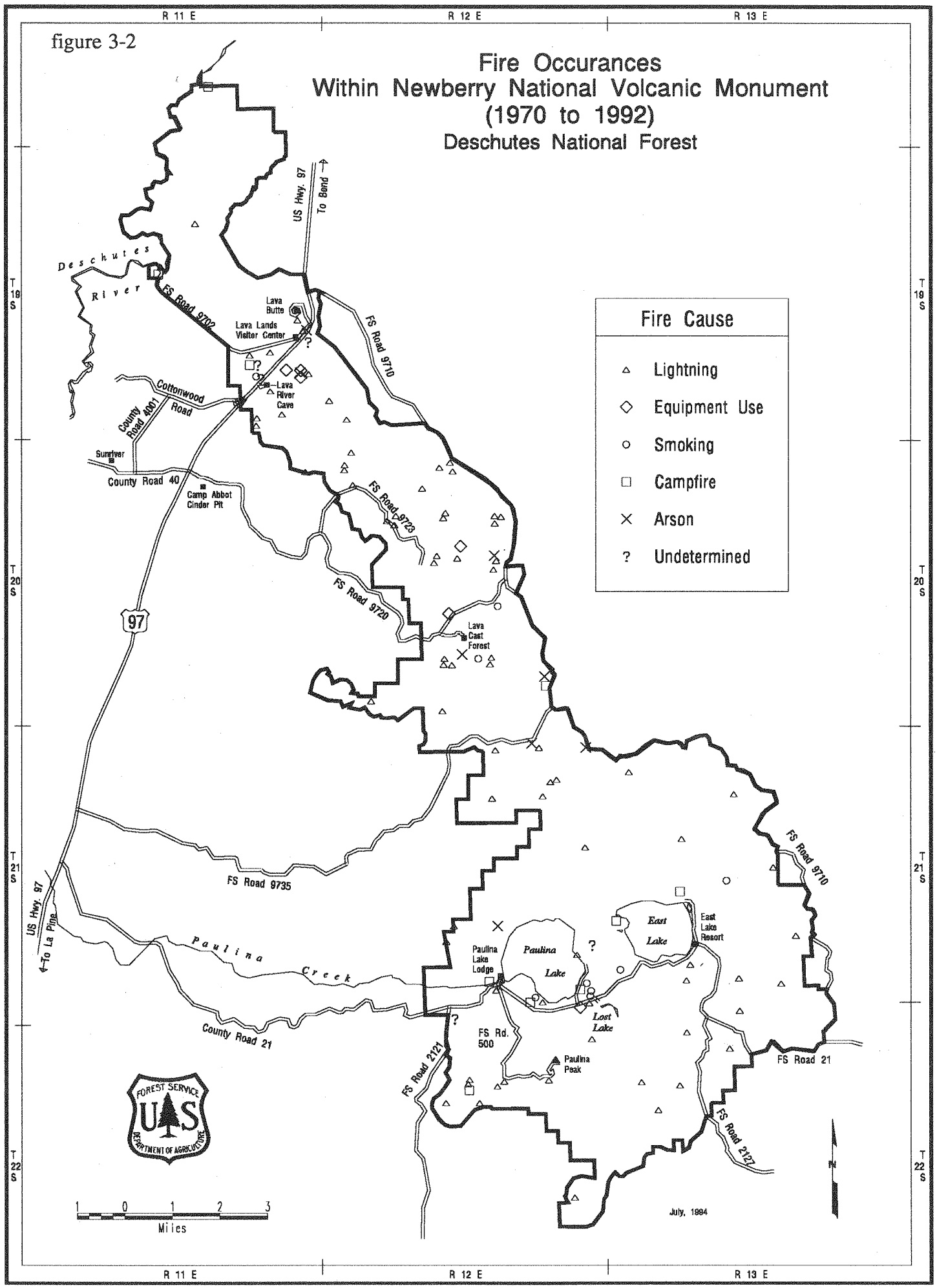
In the absence of fire, seedlings become established under the canopy of mature trees. This high density with no thinning results in stagnated two story stands (Biswell et al 1973). The white fir, more tolerant of the competitive understory, dominates over the ponderosa pine. The abundant white fir forms "dog hair thickets" which provide a fuel ladder, and the resinous needles of ponderosa pine provide an annual source of highly flammable fuel. Yearly accumulations of needles in dense stands exceed 1.5 tons per acre. The current heavy accumulations of fuels on the forest floor and the abundant white fir increases the chances for high intensity crown fires. The occurrence of fire through evolutionary time has caused the ecosystems in this regime to adapt to frequent fire and with the absence of fire these ecosystems have been adversely influenced.

In Central Oregon, fires of low to moderate intensity are believed to have occurred every eight to twelve years. In most cases these figures are thought to be conservative because intervening "light" ground fires may have occurred without scarring trees. The periodic scarring fires scarred the boles of trees, consumed forest litter (ground fuels and understory), and left large fuel gaps between the overstory and the ground. These gaps reduced the probability of crown fires, kept vistas clear and allowed for re-establishment of conifers, shrubs and grasses.

The lower elevations were subject to frequent human-caused fires set by ranchers and farmers who used fire to clear the land and improve forage for livestock. Historically, Indians also used fire as a tool to "move" game out from the brush for better hunting. Fire records are sketchy, but show three large (100+ acre) fires in and near Newberry Monument this century. These are: the Island Fire in 1918, 700 acres, near Lava Cast Forest; the Spencer Fire of 1918, 110 acres, Interlake Flow between Paulina and East Lake; and the Paulina Fire, 1988, 13,000 acres. This most recent fire was human-caused and started within the transferral area of the Monument just off Road 9710, forcing evacuation of Newberry Crater. The majority of this fire burned outside the Monument.

Fire history on the Fort Rock Ranger District (which includes NNVM) is well documented from 1970 through 1992. During this period, 1,257 fires burned on the district,

figure 3-2


Fire Occurances
Within Newberry National Volcanic Monument
(1970 to 1992)
Deschutes National Forest
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
Fire Cause
Lightning
Equipment Use
Smoking
Campfire
Arson
Undetermined
US Hwy. 97
To Bend
To La Pine
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
Camp Abbot Cinder Pit
FS Road 9710
FS Road 9725
FS Road 9720
Lava Cast Forest
97
FS Road 9735
Paulina Creek
Paulina Lake Lodge
Paulina Lake
East Lake
East Lake Resort
Lost Lake
FS Rd. 500
Paulina Peak
County Road 21
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
USDA
DEPARTMENT OF AGRICULTURE
1 0 1 2 3
Miles
July, 1994
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but only 117 of those were within the Monument boundary. Numbers within the Monument range from zero fires per year to 18 per year, with an average of five per year. The causes of these 117 fires vary. They are classified as follows:

Cause	Number
Lightning	78
Equipment Use	6
Smoking	9
Campfires	10
Arson	8
Miscellaneous	6

Virtually all the fires occurring since 1970 inside the Monument have been small; only 14% were larger than 0.1 acres. The largest fire recorded during this time (not counting the Paulina Fire) was a three-acre fire.

The scarcity of continuous fine surface fuels (1/4" diameter or less), the large areas of lava flows, coupled with the rain commonly accompanying thunderstorms in this area -- all these factors effectively limit the spread and severity of fires in NNVM. There are, however, accumulations of natural fuels due to mountain pine beetle attacks, lack of natural fire, and effective fire suppression. Any fire occurring when the environmental conditions are "right" has potential for doing serious damage to the forest within the Monument.

Current Situation

The Deschutes National Forest fire policy emphasizes that all wildfires receive timely and energetic suppression that minimizes costs. Priority is given to fires that threaten life, private property, public and firefighter safety, improvements and resource values.

The appropriate suppression strategies are identified in the Fire Management Action Plan. The strategies are based on objectives designed to minimize both cost and resource damage. The strategies range from immediate control, minimizing acres burned, to indirect control through containment and confinement.

Fire surveillance covering Newberry Monument comes from the Lava Butte Lookout in the north end of the Monument, East Butte Lookout to east, Spring Butte Lookout to the south, and Round Mountain Lookout to the west. During high risk periods, other facilities such as Pine Mountain and Paulina Peak are used, along with fixed-wing aircraft.

Trends

Fire suppression efforts of this century have caused unnatural accumulations of fuels in the forest, allowing fuel build-ups to reach a high probability for catastrophic fire in some areas of the Monument.

In the ponderosa pine stands, there is a lot of encroachment and increasing tree densities. Increase in densities leads to more fuel on the forest floor, and creates ladder fuels. Fires that would typically be low intensity fire on the forest floor are making the transition via ladder fuels to high intensity, stand-replacement fires.

In the lodgepole pine, mountain pine beetle attacks of the 1980's and fire suppression efforts have created very high fuel loads. All the elements exist here for a large, high-intensity

crown fire, which would kill most or all of the overstory and start secondary succession. From a landscape perspective, not all trees in a crown fire die. The richness and diversity of landscape patterns is often a result of random behavior patterns of past fires. The interplay between burn and unburned patches give landscapes composition and structural variability. (Romme and Despain 1989). In Eastern Oregon, vegetation series such as lodgepole pine typically experience crown fires as part of the natural succession cycle. (Agee 1993).

There is a substantial amount of overmature trees and trees damaged by insects, disease and wind in the Monument. Primary areas are in the Transition, Flanks, and Caldera Zones. The forests here are mainly lodgepole pine and ponderosa pine/lodgepole pine mix. Figures from mortality maps used in this planning effort show that there is approximately 3450 acres that fall in the Greater-Than 55% mortality category; 5260 acres of 25-55% mortality; and 5450 acres of 11-25% mortality (See Mortality Map). The ability of large wildfires to burn in these areas and the resource damage that could be caused by them have greatly increased with this build-up of fuels. Fuel loadings now range from 25-40 tons per acre, depending on the age of the bug-killed trees. The fuel loads will increase to 60-100 tons per acre as the blowdown increases over time. With the continued buildup of forest fuels, these areas will become catalysts for more frequent, larger, and more destructive fires in and near the Monument.

Fire is an event controlled by fuels, weather and topography. Regardless of significant variations, fire occurs nearly everywhere fuel is present in sufficient quantities, in flammable condition and when an ignition source is available.

Large fires on the Deschutes must have three of four components present. They are: wind, low relative humidity, heavy fuel accumulations or brush. Most Deschutes fires spread by spotting from wind, either weather-induced or fire-induced. If a fire escapes initial attack on a windy day or on an average day, (85-90 degrees, 15-20% relative humidity, 10-15 mile per hour wind, and a month without rain), this fire has the potential to be a large, stand-replacement fire with substantial threat to life and property.

The Deschutes National Forest is actively using prescribed fire to reduce the hazards of wildfire and benefit the forest ecosystem, and is considering re-introducing prescribed "natural" fire. Prescribed fires are fires intentionally set by management. Prescribed "natural" fires are ignited by natural means, usually lightning.

The effects of prescribed fire can differ remarkably from the effects of wildfire. Wildfires are very likely to kill all or part of the trees, remove most or all of the protective litter and duff layers, leaving soil exposed to erosive forces of wind and water, and have an uncontrollable impact on water and air quality. The intense heat from wildfires severely damages soil. Wildfires also consume large woody debris which is important in maintaining long-term site productivity and providing habitat for wildlife species.

Prescribed fire, however, can benefit areas by opening up stands, reducing fuels, and exposing some soil to seed dispersion. It also stimulates growth of selected forage for wildlife and fire-dependent plant species. A prescribed fire can also be planned to minimize consumption of large woody debris for habitat, start decomposition and nutrient cycling processes, and minimize impacts to water and air quality.

Prescribed fire effects differ from wildfire effects, due to the mitigation measures taken. All prescribed fires must have a written, site-specific burn plan approved in advance. The purpose of a plan is to ensure that resource objectives are clearly defined so the site and environment are not harmed.

A plan must include: the primary reason for the burn; the range of acceptable results expressed in quantifiable terms; the burning prescription which includes weather and fuel

moisture criteria that will produce such results; and parameters for the fire behavior which will enable the burning crew to maintain control. The plan needs to identify the level of complexity of the burn and contingency actions to be taken if the fire exceeds prescription parameters. Provisions for public safety and protection of sensitive features needs must be addressed. Risk of escape and the range of possible consequences are identified. A prescribed burning plan must identify areas that will be protected from smoke, and specifies procedures to protect the environment and the health and interests of the public. The plan specifies exactly how the burning will be done in accordance with all state and local air quality regulations. It lists health and safety hazards and pre-burn coordination efforts, (for example, notification of appropriate individuals). Pre-burn and post-burn monitoring objectives are listed and documentation of burn day conditions, fire behavior, smoke dispersal, fire effects and results is required.

Waiting for suitable weather conditions is a primary constraint on prescribed burning. Both the fuel and atmospheric conditions must be dry enough to support combustion, yet not so dry that escape of the fire is likely. Atmospheric conditions must also be acceptable from an air quality standpoint. If the weather and atmospheric conditions are right, prescribed fire objectives can be met by controlling the amount of fuel consumed and consumption will be more efficient and produce less smoke.

Prescribed fire can be used to achieve many objectives but may not be the tool that should be used on all sites or in all situations. The areas where heavy fuel loads and multi-storied canopies have developed may need to be manually or mechanically treated first. We need mechanical treatments first in high risk stands to reduce the chances of a large fire. We can then use prescribed burning where risks are relatively low, potential payoffs are high, and opportunities for treatment are widest. Proper application of fire, in harmony with other management techniques, may often be the best option for meeting specific objectives while creating the fewest adverse effects.

If we do not do some prescribed burning now, a wildfire may soon do the job for us, in a way that is much more destructive to air quality and the ecosystem of the Monument.

5. Fish and Wildlife

Background & Current Situation

A wide variety of wildlife typical of Central Oregon forests is found within NNVM. A list of species found in the Monument is included in the Plan.

Mule Deer have been part of this area since the last Ice Age. Recent research has found evidence of deer in the caldera 10,000 years ago.

Deer populations have fluctuated through the centuries, however. Early explorers and fur trappers noted a scarcity of deer in Eastern Oregon in the early 1800's. Miners later found more deer in the 1850's, but by 1900 their populations were again low. Numbers increased until the mid-1960's when deer numbers were higher than at present. The fluctuations have been caused by changes in habitat and in hunting patterns.

Deer use a variety of habitats. Variables which influence their use of habitat include: water availability, forage quality (shrubs, forbs, grasses), vegetation and cover for protection from temperature extremes, and security from predators, including human pressure from hunting. Security is related to hiding areas (dense forests) and degree of access by people on foot or vehicle.

Some deer live in the Monument year-round, while an estimated 2,200 migrate through the Monument seasonally. This migration corridor is an important part of deer viability in Central Oregon. The corridors run generally east-west through the Monument and across Highway 97. Each year many deer are killed while crossing Highway 97 in this migration corridor.

Mule deer populations within the Monument are managed by the Oregon Department of Fish and Wildlife (ODFW) as part of the North and South Paulina units. About 7500 people come to Central Oregon to hunt deer or accompany hunters in the Paulina units during the 12-day general buck hunt in the fall. The Paulina Hunt Unit includes the Monument. More than 400 others participate in archery hunts. The total number of hunter days in the Paulina Hunt Unit during the general buck hunt is estimated at about 30,400. Statewide, the numbers of hunters has gradually declined by about 20% between 1955 and 1990. Hunter numbers in Central Oregon have also declined, as regulations have changed to more closely control hunter numbers and distribution.

The caldera is a wildlife refuge, established by ODFW and the Forest Service to protect both people and wildlife. With intensive recreation in the caldera area, land managers felt it was unsafe to have people shooting there. The refuge also offers wildlife viewing opportunities for deer, and black bear. Regular ODFW hunting regulations apply in the rest of the Monument outside the caldera.

Rocky Mountain Elk have lived in the area for 10,000 years, based on archaeological evidence. Their main winter range is southeast of the Monument along the Fort Rock Valley. About 100-200 spend spring, summer, and fall in the Monument. At present, elk numbers are too low to attract many hunters.

Black Bears are common within the caldera during the summer. The population is between six and 10 bears. Their primary food appears to be garbage associated with human habitation (campgrounds, summer residences, and resorts) and food taken from campers. Other foods available within the caldera include ants, other insect grubs, some berries, and kokanee salmon during the fall spawning period. the total number of bears in the Monument, including the caldera, is 25-35.

Cougar have been seen within the past few years, both within the caldera and near Lava River Cave. These big cats range widely and feed on mule deer and smaller mammals throughout the year. Populations of cougar within the Monument are difficult to estimate, but may range between one and five individuals.

American marten live year-round in the dense, old, mixed conifer and lodgepole pine forests on the caldera flanks and interior. They also live northwest of the caldera in more open ponderosa pine forests which include some lodgepole pine or white fir. They feed on small mammals, birds, insects, fruits, and berries. **Otters** live along the Deschutes River and their tracks can also be seen along the shores of Paulina Lake in winter.

Chipmunks and ground squirrels are common throughout most of the Monument. Visitors frequently see them at developed areas such as Lava Lands Visitors Center, Lava River Cave, and the campgrounds. They have lost their fear of humans because many people share their lunches with them. This could become a problem because "human" food is often not suitable for these animals, and occasionally they may bite or carry disease.

Preble's shrew (Category 2 species, see glossary) is a small mammal which eats insects and other invertebrates. In 1947 a Preble's shrew was trapped near the shore of East Lake. There have been no recent surveys to determine if the shrews still live there. Even if no shrews occur within NNVM now, there is potential habitat (riparian openings in ponderosa pine,

shrublands, and high elevation forests). These sites could provide the Monument habitat for the shrew's recovery.

Bats: Several species of bats occur in the Monument. All are insectivorous, consuming a variety of moths, beetles, and ground-dwelling insects. As many as five species may be found in the same area. Habitats for bats vary from shrub/steppe types of open, widely spaced trees, to denser forests with small openings. Some roost in trees, some under loose bark of live or dead trees, some in caves, and some in cracks commonly found in rimrock or lava flows. It is common for bats to roost under bridges over water where they can find a good supply of insects.

Some species of bats hibernate in caves in the winter, and they are particularly vulnerable to human disturbance. When people enter caves in which bats are hibernating, the bats may awaken, take flight, and therefore use up energy they need to survive. Also, species which raise their young in colonies have most of the females and young in a small area. Protection of the colonies is important for the continued survival of the bats.

Townsend's big-eared bats, a category 2 species (see glossary), depend on caves for hibernating and for raising their young. There is one cave within NNVM where a few individuals hibernate while waiting for their insect food to emerge in the spring. During spring, summer, and fall they hunt for moths within several miles of the Monument, so it is likely that they also forage in the Monument. These bats are not known to have a nursery cave within the Monument, but there have been no systematic searches for caves where they may raise their young. Because there are extensive areas of lava flows, it is likely that the bats live within the Monument year-round.

Birds: A wide variety of birds spend part of each year within NNVM. Birds of particular interest to visitors include bald eagles, osprey, tundra swans, and the many songbirds which migrate through and nest in Central Oregon. Many more species are important in their contribution to functioning ecosystems and biodiversity. Migratory birds are part of ecosystems extending far beyond Central Oregon to include wintering grounds in Central and South America. The Monument provides a link in the migration routes which tie together the entire Western hemisphere from Arctic to tropics.

A variety of raptors (hawks and owls) among them **bald eagles, prairie falcons, red-tailed hawks, goshawks, great-horned owls and flammulated owls** are known to nest and forage within the Monument.

Many species of **woodpeckers** are found within NNVM. They depend on trees and snags for mating and nest building, as well as for sources of insect food. They also feed on insects in bark crevices in live and dead trees.

Waterfowl nest and feed in the caldera lakes and the Deschutes River. Some are in the Monument only during spring and fall migration as they move from wintering areas to breeding ranges further north.

Reptiles & Amphibians

Although no rattlesnakes have been observed within the Monument, a variety of other snakes and lizards are found. Amphibians, such as tree frogs, also occur and are closely associated the aquatic and riparian areas.

Habitats and Species Given Detailed Analysis:

Certain wildlife species and their habitats are given a more detailed analysis in Chapter 4. These species and habitats were chosen because 1) the species is protected under the Endangered Species Act; 2) the species has special habitat needs, or uses relatively limited

habitat components that may be influenced differently by management activities proposed in the different alternatives, or 3) are Forest Plan Management Indicator Species. Not all Deschutes National Forest Management Indicator Species were given more detailed analysis in this document because they all do not occur within the Monument, or management under different alternatives would not affect the species or habitat. Detailed analysis of the following is included in Chapter 4: peregrine falcon, bald eagle, goshawk, flammulated owl, marten, Townsend's big-eared bat, mule deer, and snags and fallen log habitat.

Other Species of Interest or Concern:

Two animals are known to occur in the Monument which are protected under the Endangered Species Act: the bald eagle (threatened) and the peregrine falcon (endangered). There are no threatened or endangered plant species.

Bald eagles live in the caldera, and adults have successfully raised 11 young in the past 20 years. Nesting success is below recovery goals. Low nesting success may be related to the high elevation (6,500 feet) of the nest (F. Isaacs personal communication). At this elevation, ice remains on the lakes until May. The eagles are limited to fishing in small ice-free areas at the Paulina Lake outlet, the southeast edge of East Lake, and lakes and rivers located 15-20 miles to the west. Nest failure may also be caused by snow storms during incubation. The Working Implementation Plan for Bald Eagle Recovery in Oregon and Washington (1990) identified other potential nesting areas in the caldera. Eagle occupancy of one of the sites (on Paulina Lake) is an objective for bald eagle recovery.

Peregrine falcon nesting habitat is in the cliffs along portions of the caldera rim. Waterfowl and other birds associated with the lakes would provide a prey base. Peregrines do not currently nest within the Monument; the habitat remains unoccupied. A juvenile was seen flying over Paulina Peak in 1992, perhaps a pioneer investigating possible nesting areas. Although no direct efforts are underway to re-introduce peregrine falcons within the Monument, hope remains that a nesting pair will eventually make the crater their home.

There are other species (plant and animal) which are being reviewed for their possible addition to the list of threatened and endangered species under the Endangered Species Act. These species are on the Forest Service Sensitive species list for the Pacific Northwest Region. More discussion concerning them is in the sections on Vegetation and on Wildlife.

Fish

Background & Current Situation

Fish and Aquatic Wildlife

The four major water bodies which support fisheries in or adjacent to the Monument are the Deschutes River, Paulina Creek, and East and Paulina Lakes. Several small ponds on the east side of the Deschutes River provide some fish habitat. Several small ponds within the caldera do not support fish, but they do provide habitat for other aquatic wildlife, e.g. amphibians and aquatic invertebrates. The Deschutes River itself is not within the Monument; the Monument boundary is the east bank of the river.

Paulina Creek is a first order stream originating at the southwest corner of Paulina Lake. Its flow is regulated by a dam at the lake outlet. Only the uppermost two miles of Paulina Creek are within the Monument and the Special Management Area. The lower portions are outside the Monument.

A survey of habitat conditions was completed in 1989. The creek has very limited fishery value due to many waterfalls which block fish movement up the creek. Over-winter survival is low because of the lack of pools and low flow. Fish cannot move between the creek and the Deschutes River because there is no surface flow linking the two water bodies. Water rights to the creek flow and about the top three surface feet of Paulina Lake are held by private interests. A few fish can be found in the creek; these may be survivors which escaped over the dam at Paulina Lake, or they may be the a small population of resident brook trout. Fishing pressure is very light.

Although some habitat components limit the fishery value, other components are excellent. There is a good supply of food for trout to grow rapidly (stoneflies, mayflies and other small aquatic insect populations are healthy). In the past, ODFW stocked rainbow trout fingerlings. The trout grew well, reaching a length of 12 inches by the following year. They tended to congregate in the larger pools where they were easily caught. ODFW discontinued stocking in the mid-1970's.

There are at least four ponds on the east side of the Deschutes River. The ponds form in oxbows created when the river followed different channels. Water collects in the ponds when river flows are high. Two of the ponds have surface flows connecting them to the river. These ponds provide good rearing habitat for young trout in the river, but when the water level drops in the fall, the young fish become trapped and die. The wide fluctuation in flow levels (related to irrigation needs) is the primary limiting factor on fish in the ponds. Two other ponds do not have surface flows to the river. Fish cannot move into or out of these ponds. Their value is in providing riparian vegetation for wildlife which utilizes this vegetation type.

East and Paulina Lakes are the two large lakes within the caldera. Surface flow into the lakes comes primarily from snowmelt; the watershed is defined by the rim of Newberry Crater. There are no perennial streams into either lake; most of the inflow is from underground sources, including hot springs.

Oregon Department of Fish and Wildlife is responsible for management of the fish populations, and sets fishing regulations. There are no special bait or tackle regulations. ODFW is developing a new management plan for the Upper Deschutes River basin, including the two lakes. Comments from the Deschutes National Forest, other agencies, and the public will be incorporated into the fish management plan which will be completed by 1995. The Forest Service is working with ODFW to coordinate goals and the desired quality of the fishery for the lakes.

Chubs (also called roach) were introduced into the lakes in the 1920's by anglers who used them as live bait. Efforts to control their populations have covered 50 years. As early as 1940 the Oregon Wildlife Commission reduced their numbers in order to increase trout productivity.

The lakes are valuable as a fishery for several reasons, not only from an angling and recreation perspective. The same qualities that support such a productive fishery also support a wide variety of wildlife. Osprey, bald eagles, belted kingfishers, and common mergansers are some of the birds which prey on fish. Mammals in the caldera which eat fish and crawfish include otter, raccoon, mink, and black bear. Additional species depend on some of the same foods that the fish eat; for example, Barrow's goldeneye feed on aquatic invertebrates.

Table 3-11

Fish Species and ODFW Fish Stocking Program

Fish	Paulina Lake		East Lake	
	Occurs	Annual Stocking Program	Occurs	Annual Stocking Program
Rainbow Trout	yes	85,000 fingerlings	yes	115,000 fingerlings
Brown Trout	yes	10,000 fingerlings and year-old fish	yes	10,000 fingerlings and year-old fish
Kokanee	yes	25,000 fingerlings	yes	New program
Brook Trout	no	--	yes	Discontinued
Atlantic Salmon	no	--	yes	Experimental Program
Blue Chub	yes	none	no	--
Tui Chub	yes	--	yes	None

Although neither lake had fish prior to their release in 1912, both lakes are now productive fisheries. Fingerlings stocked by ODFW grow very well, reaching catchable size within six months of their release. The high productivity is related to the concentration of dissolved nutrients which support food for the fish and their prey populations. The dissolved nutrients result from the inflow from springs, including thermal springs, under the lakes' surfaces. Snails, shrimp, insects, plankton, crawfish (in Paulina Lake only), and smaller fish are part of the foods for the fish. The record size brown in Oregon (27 lbs.) was caught in Paulina Lake in 1993.

Spawning habitat for game fish is essentially non-existent. A very few brook and brown trout spawn in East Lake, apparently near the underwater springs in shallow water. Natural reproduction is insufficient to sustain the angling pressure. ODFW stocks both lakes annually.

The thermal springs contribute to the minerals in the lakes (see also Water Quality section). Recent sampling raised concerns that mercury and arsenic levels in the water may pose health risks to people who eat fish from the lakes. After further sampling and analysis, the Oregon Health Division (1994) issued an advisory recommending that people limit their consumption of fish from East Lake. Average mercury level in fish tissue from East Lake was 0.64 parts per million (ppm). This level exceeds the national standard of 0.6 ppm recommended by the U.S. Environmental Protection Agency. The advisory encourages catch-and-release fishing, especially for larger, older fish (A copy of the advisory is on file in the planning record). Tissue of fish collected from Paulina Lake averaged less than 0.05 ppm. Analysis for arsenic content of fish tissues will be completed later this summer.

Paulina Lake provides a valuable source of kokanee eggs for stocking programs in Oregon, Washington, and Idaho. State fishery personnel collect eggs in the fall from fish which gather at the Paulina Lake outlet. The eggs are then taken to hatcheries where they are hatched. The young fish are raised for later release. The concentration of kokanee at the lake outlet is an interesting sight.

Without control, chub populations reach high levels, reducing the quality of fishing experience, and competing with trout and kokanee for food. Unlike trout, which have nearly nonexistent spawning habitat in the lakes, chubs spawn in open water and their reproductive rate is extremely high. Currently, ODFW uses chemical means to keep the chub numbers in check. The department is exploring other methods which could be used in combination with chemical treatments to control chub populations.

An estimated 100,000 angler days of recreation are provided by the lake fisheries, putting an estimated $3 million into the local economy. Recreational crawfishing is popular in Paulina Lake. There is also a commercial permit for crawfish harvest. There are occasional conflicts between the commercial activities and traditional angling when fishing lines become tangled up in crawfish traps. The Forest Service has recommended to ODFW that this permit not be renewed. Commercial extraction of wildlife species is not consistent with the legislation establishing the Monument. There are no crawfish in East Lake.

Anglers who fish in the lakes usually fish from boats, either trolling, still fishing, or drifting. There is a 10 mph speed limit on the lakes, enforced by the Oregon State Marine Board. Because of the low speed limit and sporadic winds, there are virtually no conflicts between anglers and other recreation on the lakes. Wind surfers are rare.

Trends

Human impacts on wildlife populations are hard to predict, and vary with species tolerance for disturbance and population dynamics outside the Monument. At present, deer populations appear stable; elk populations are growing. ODFW manages deer and elk populations by the number of hunting permits issued each year. Forage quality for deer is declining due to long-term fire suppression. Hiding cover is currently excellent, but is at risk from wildfire because of the high fuel loads.

Human disturbance is most likely to affect species such as bald eagles, nesting raptors, or bats. Presently these species do live in the Monument and are occasionally disturbed by human presence. If the number of visitors continues to increase, or if people disrupt these animals' reproductive success, their populations or productivity could decline.

Fish populations are regulated by ODFW through their stocking program and fishing regulations in the lakes. Angling pressure varies by year. Pressure appears to have shifted from high weekend peaks with low mid-week levels to a more even distribution. At present, there doesn't seem to be too much danger of the lakes being "fished-out." Close coordination with ODFW (regarding daily catch limits, stocking program) would continue to assure a quality fishing experience.

The ponds along the Deschutes River provide marginal habitat for some fish. They are gradually filling with silt and becoming shallower, offering less habitat for the fish that live there now.

6. Interpretation

Background

Interpretation in what is now NNVM began in 1962, with a single interpreter stationed on the summit of Lava Butte. A small visitor center beneath the fire look-out tower was completed in the summer of 1962. It served as the interpretive center for the Deschutes National Forest for the next decade.

In 1968, plans were developed for a larger visitor center just south of Lava Butte, to be called Lava Lands Visitor Information Center. The Forest Service also identified satellite interpretive sites on the Fort Rock District at this time. Paved interpretive trails were completed in the pines adjacent to the visitor center (Trail of the Whispering Pines), on the Lava Butte flow (Trail of the Molten Land), and at Lava Cast Forest by 1974. In the latter half of 1974, the Lava Lands center opened, its dioramas and exhibits were installed, and it became the interpretive hub for the Deschutes National Forest.

From 1975 to 1980, the interpretive staff for the Fort Rock District consisted of five employees based at Lava Lands: the Director, two other permanent employees, and two temporary seasonal employees. The visitor center remained open year-round, with annual visitorship ranging between 85,000 and 105,000 people. Interpretive trails were developed around the rim of the Lava Butte crater and at the Big Obsidian Flow in Newberry Caldera. Informational signs were also installed on Paulina Peak. Interpreters were available inside Lava Lands Visitor Center and periodically along the Trail of the Molten Land and on the Lava Cast Forest Trail. In 1980, a paved spur trail and overlook were added to the Trail of the Molten Lands and named after local geologist Phil Brogan.

In the early eighties (1981-1985), the Lava River Cave interpretive site was transferred to the Forest Service from the Oregon State Parks system. The season of operation of the Lava Lands Visitor Center was reduced to 6-7 months (generally May-October) during this period, but visitorship declined only slightly. Scheduled interpretive walks began on the Trail of the Molten Land, while informal interpretation continued on the trail and in the center. Interpreters were sometimes stationed on Lava Butte, as well. A program for volunteer interpreters began in 1982. In the first year, 10-12 volunteers served at the Lava Lands Visitor Center, on the Trail of the Molten Lands, on Lava Butte, and at Lava River Cave. In 1985, interpretive programs began in Newberry Caldera. A full-time volunteer organized and conducted nearly all of the activities, which consisted of interpretive talks, guided walks, and evening campfire programs.

In the late eighties (1986-1989), the Lava Lands center gradually increased its operations to 7 1/2 months a year during this period and welcomed 82,000 - 93,000 visitors annually. The number of volunteer interpreters peaked at 25-30 in 1986-1987. Guided talks and walks occurred more frequently than before, especially in the Lava Lands/Lava Butte area. Informal interpretation continued, and occasionally included sites more remote from Lava Lands, like Benham Falls and Lava Cast Forest. In cooperation with the Seattle-based Northwest Interpretive Association, Forest Service interpreters and resource specialists led two-day field seminars, in the summers of 1988 and 1989. Participants learned first-hand about the natural history of Central Oregon.

Summer interpretive programs in Newberry Crater continued to rely heavily on a single volunteer or Forest Service employee in the late eighties. On-site interpretation and guided walks were offered at the Big Obsidian Flow, Paulina Peak, East Lake, and Paulina Creek and

Falls. Volunteers and Forest Service staff presented evening programs on week-ends at the Big Obsidian Flow amphitheater. In 1987, a small interpretive center was established at the Paulina Lake guard station. This center supplied visitors with displays and information 3-4 days per week, during the summer season. It was staffed primarily by volunteers.

In 1990, the number of visitors to Lava Lands Visitor Center exceeded 100,000; in 1991, it topped 110,000. The number of guided interpretive activities dropped during these years, along with the number of volunteers, while the demand for these programs was increasing. The number of participants in pre-arranged tours led by Forest Service interpreters at the Lava Lands Visitor Center, Lava Butte, Lava River Caves and Newberry Crater doubled between 1988 and 1991 (from approximately 3,000 to 6,000 people). Tour groups included many students from Oregon as well as out of state. Two important changes in 1990 were the initiation of summer shuttle-bus service to the top of Lava Butte and the expansion of operation of the Paulina Visitor Center in the Paulina Lake guard station (CCC building) to seven days per week, 6-7 hours per day, in the summer.

Table 3-12

Interpretive Services
Fort Rock Ranger District

Years	Approximate Number of Employees at Peak Season	Approximate Number of Volunteers	Lava Lands VIC* Yearly Visitorship	Normal Length of Season for VIC* (in days)
1962 - 1974	1 - 5	0	80,000 Lava Butte summit only	180
1975 - 1980	5	0	47,000 - 106,000	365
1981 - 1985	6 - 7	0 - 15	74,000 - 100,000	180
1986 - 1989	6 - 8	4 - 30	82,000 - 93,000	180 - 215
1990 - 1992	7 - 10	4 - 25	104,000 - 114,000	230

* Visitor Information Center

Visitorship to the Lava Lands Visitor Center remained steady in 1992, at approximately 110,000 for the 7-1/2-month season. The Fort Rock interpretive staff grew appreciably to ten employees, including summer seasonals. The ranks of volunteer interpreters swelled to 20-25 individuals, partly due to the first annual volunteer-training workshop held jointly by the Bend and Fort Rock Districts. The frequency and number of locations for guided interpretive events

increased markedly in 1992, especially in Newberry Caldera. Approximately 9,500 visitors took part in interpretive programs offered throughout Newberry National Volcanic Monument between June 24 and September 7, 1992. Most of the activities were held on Fridays, week-ends, or holidays. They are described in the following.

Current Situation

Interpretive programs are normally conducted by Forest Service employees, unless noted otherwise. Scheduled programs are announced weekly by fliers (e.g. at the Central Oregon Welcome Center and other locations) and in the local newspaper. Lava Lands Visitor Center continues to be the major hub for interpretation in NNVM.

Programs take place in rural and roaded natural settings (See Recreation section, Chapter 3 for explanation of the Recreational Opportunity Spectrum, ROS). Rural environments are characterized by frequent contact with interpreters providing guided programs. Interpretive facilities include visitor centers and exhibits made of quite refined, native-like materials. In Roaded natural areas, visitors meet fewer interpreters, and interpretive structures are simpler.

Current programs are listed by location, along with their ROS class, based on the 1992 season:

Lava Lands Visitor Information Center (Rural. Open about 230 days per year.)

- Visitor information, such as maps, books, computerized trail information, and personal attention to visitors. Desk attendants are Forest Service employees and volunteers. Sale items offered through the Northwest Interpretive Association.
- Exhibits and dioramas focused on Central Oregon and world-wide volcanology; Central Oregon prehistory, history, wildlife, botany, and recreation opportunities.
- Two self-guided interpretive loop trails: Trail of the Molten Lands on the Lava Butte Flow, and Trail of the Whispering Pines.
- Interpretive talks and guided walks on pre-arranged basis for groups. On request when staffing permits. (Non-scheduled interpretation normally done by volunteers.)
- Scheduled interpretive talks and walks at peak periods (3-4 talks per day on holiday week-ends).
- Scheduled flintknapping demonstrations (normally one per week-end), or on request when staffing permits.
- Summer shuttle-bus to Lava Butte summit during peak season (offered on a fee basis by a concessionaire).

Lava Butte summit (Roaded natural. Open about 215 days per year. Shuttle bus access in summer.)

- Protected viewing area with painted "mountain finder" in lower level of the tower.
- Self-guided interpretive trail around rim of Lava Butte crater (geology focus).
- Roving interpretation or scheduled talks several hours/day on week-ends.
- At times, visitors may observe and talk with fire look-out in upper level tower.

Lava River Cave (Roaded natural. Open approximately 140 days per year.)

- Concessionaire collects fees/rents lanterns 9 a.m. to 5 p.m., seven days a week.
- Self-guided trail through the cave.
- Occasional roving interpretation by volunteers (a few hours per week at most).
- Pre-arranged interpretive talks or group tours when staffing permits.

Benham Falls (Roaded natural. Open approximately 170 days per year.)

- Self-guided interpretive trail along riparian zone (logging history and vegetation).
- Occasional scheduled nature walks, mainly led by volunteers.

Lava Cast Forest (Roaded natural. Open approximately 170 days per year.)

- Self-guided paved interpretive loop trail (geology focus brochure).
- Interpreter on site (volunteer) five hours per week.

Newberry Caldera area (Programs occur in roaded natural, with the exception East Lake Lodge, which is rural. Open to automobiles approximately 170 days per year.)

- Regularly scheduled interpretive talks and walks at Big Obsidian Flow, normally two guided walks and three to five talks per day, Friday-Sunday and holidays. (Seven interpretive signs are scheduled to be installed on the trail in fall 1993.)
- Interpreter at Paulina Peak during peak hours (normally 10 a.m. - 4 p.m.), Friday-Sunday and holidays.
- Scheduled interpretive walks to Paulina Lake hot springs (one or two per week-end) and the Dome (every Friday morning). These are commonly led by a volunteer.
- Regularly scheduled Saturday evening campfire programs at Big Obsidian Flow Amphitheater, presented by Forest Service employees and volunteers. Mainly natural history topics.
- Visitor information and displays at the Paulina Lake guard station. This small visitor center is open 10 a.m. to 4 p.m., seven days a week, and is staffed by volunteers. Books, maps, t-shirts and other souvenirs available for sale through Northwest Interpretive Association. Slide-tape program available on demand.
- Occasional scheduled flintknapping demonstrations at the Big Obsidian Flow.
- Occasional scheduled children's activities at East Lake Lodge, including puppet shows by volunteers, nature arts and crafts, games, model volcano demonstrations, and interpretive activities for the annual Free Fishing Day in June.
- Pre-arranged interpretive talks, slide shows, guided walks as staffing levels permit.

Trends

The demand for interpretive programs has increased significantly since the Monument's designation in 1990. The numbers of people participating in programs and visiting Lava Lands Visitor Center continue to rise. Available staff can not always meet the growing requests for interpretive services such as guided tours for school classes and other groups. High attendance at evening programs in Newberry Crater commonly causes the small amphitheater there to overflow.

The quality of interpretive programs offered to the public throughout what is now the Monument has varied greatly, depending on the skills and efforts of individual interpreters (whether staff or volunteers), and on the available training, supervision and evaluation programs. In the late 1980's Interpretive Services on the Fort Rock Ranger District began to establish a positive working relationship with the local scientific community, including geologists and other resource specialists in the Forest Service and at Central Oregon Community College in Bend. These ties have improved the scientific accuracy of information that is provided to the public.

The subject matter, locations, and quantity of interpretive programs have also varied considerably, based on the interests, backgrounds, and numbers of active interpreters. Most programs have focused on geology, archaeology, botany and/or wildlife of the Deschutes National Forest. Much of the interpretive activity has been concentrated at Lava Butte and the

Lava Lands Visitor Center area. The number and type of interpretive programs and facilities offered has depended heavily on the available funding and staff.

The public is interested in improving the quality and quantity of interpretation in the Monument. One means of addressing this, in the face of shrinking Forest Service budgets, is through partnerships with other public and private agencies. A cooperative effort with the Oregon State Parks Foundation has already proved successful in bringing a special exhibit to Lava Lands Visitor Center in 1993.

Since interpretive programs in the Monument have generally been developed and/or modified by the individual interpreters who present them, there has been no overall schema or organization relating one interpretive presentation to another. The Forest Service has an opportunity to develop a clear set of interpretive themes, or messages, to be presented in NNVM. Such themes would be carried through interpretive programs all over the Monument, helping to create a Monument identity and reinforcing visitors' memories and appreciation of the important messages they take home with them. Interpretive themes need not apply solely to the Monument. The Lava Butte area, with its proximity to a busy highway, has particular potential as an interpretive hub for the geology, archaeology, and ecology of all of Central Oregon. Interpretive links can also be made to more distant features and processes in the Pacific Northwest and around the globe.

The demand for environmental education programs is increasing rapidly. As school budgets shrink, educators are looking for inexpensive and innovative ways of providing meaningful learning experiences for students -- so they bring students to the Lava Butte area. It is close to Bend and has a variety of features to study. Schools also request activities and presentations that involve students directly with the resources.

Universal access to interpretive facilities and programs in NNVM has not been systematically addressed or instituted by management. Where it exists, access for wheelchairs and physically challenged individuals is typically unmarked. Most facilities at Lava Lands Visitor Center are accessible, but entry to interpretive trails there is inconvenient. Improvements to accessibility in the Monument have been slow and haphazard, but the potential exists to make this a welcoming place for people of all abilities.

Visitor education is key to fostering a stewardship ethic in the public. Through interpretation, the Forest Service has opportunities to influence visitor behavior as it affects all of the natural resources in the Monument. A major problem that Monument interpretation is helping to solve is the unlawful removal of obsidian from Newberry Crater. The approach is twofold: (1) to inform visitors of the federal ordinance (36 CFR 261.9 b) prohibiting rock collection and (2) to foster respect for this resource through education about its formation and significance. In addition to stationing interpreters at the Big Obsidian Flow during peak visitation periods, the Forest Service began distributing an informational flier on the obsidian in 1992. The success of the flier is evidenced by people who now voluntarily return pieces of obsidian at the entrance station when they leave.

7a. Heritage Resources

Background

Cultural or Heritage Resources includes both ancient sites and living traditions. The Monument contains a rich legacy extending back into the last Ice Age when the Fort Rock basin was covered by a large lake. Recent archaeological excavations have revealed that the Newberry area was inhabited 10,000 years ago. Materials from Fort Rock Cave, just south of the Monument, have been dated at 13,000 years old, making this region one of the oldest and most significant in the Northwest.

Newberry Volcano dictated a pattern that native peoples followed for many centuries. This tradition saw native peoples hunting and living along the shores of the twin lakes in the caldera when the volcano was sleeping, using tools crafted from nearby frozen rivers of black obsidian glass. When the volcano awoke, they abandoned their claims to this awe-inspiring land to the next cycle of fire. This complex relationship between a dramatic volcano and native people spanned thousands of years and influenced cultures hundreds of miles away.

The caldera contains at least nine different sources of obsidian dating back to 12,000 years ago. Three other flows are over 12,000 years old. The most recent is the 1300 year-old Big Obsidian Flow, which served as a major quarrying and collection site from the time of its formation until the arrival of Europeans. This quarry site has left rich documentation of several techniques and methods for making stone tools.

In addition to Newberry Volcano, the Deschutes River also shaped the lifestyle of ancient Indian peoples. The Deschutes provided water, food, and a warmer area to camp in the winter for the people who lived on the terraces and in the caves along its banks. There are numerous prehistoric camp sites along the banks of the river, including Lava Island Rockshelter.

There are also numerous archaeological sites throughout the rest of the Monument. Most are small scatters of stone tools and debris, since much of the plant and bone artifacts have long since decayed. Several scientifically excavated sites have yielded spectacular artifacts and important information about the prehistory of Central Oregon.

From archaeological excavations we know that people have lived within Central Oregon for almost 13,000 years. The earliest people, referred to as "Paleo-Indians" or the oldest American Indians, hunted animals that are now extinct, such as mammoths and mastodons, with thrusting spears. The Paleo-Indian occupation occurred in a colder, moister climate associated with the end of the last Ice Age. At least one site dates to this era, with perhaps more yet to be scientifically tested. The end of the last Ice Age marked the beginning of a warmer and drier era. Americans Indians still relied on big game, but they were also adapting to the environment by using plants for food and living materials; artifacts from this time include grinding stones and other implements.

During these recent centuries of climatic change, "Archaic," or ancient American Indians hunted and collected many of the same animals and plants that are present today. They used an "atlatl" or spear thrower to hunt animals and used various stone, bone, and wooden tools to collect and process plant and animal foods. Food might be collected or carried in baskets made of plant fibers. They lived in small shelters made of willow branches that were covered by sagebrush, pine boughs, or woven mats and lined with furs and mats. By 7,000 years ago, the area was becoming much drier, and people migrated seasonally to pursue plant crops and animals. This was also a time of increased volcanic activity, which affected their movements.

Approximately 2,500 years ago, these people began using the bow and arrow, but otherwise their lives changed very little from previous generations. By the time "EuroAmericans" came to Central Oregon in the mid-1800's, many of the native peoples' lives had changed dramatically from the introduction of disease, trade goods (metal, cloth, and glass), and the horse.

The "Archaic" people also left evidence of their camps and travels throughout NNVM. There are over 100 known "Archaic" sites within the Monument, with more yet to be found. These people probably lived along the banks of the Deschutes River during the harsh winter months, then migrated up into the surrounding mountains during the spring, summer and fall. Wherever they lived, they depended on a steady supply of water, game, and other natural resources.

Not only did the geology of the local area affect the "Archaic" people, but geologic occurrences many miles away also shaped their lives. At the edge of Paulina Lake, atlatl dart points and other artifacts have been found beneath a blanket of Mazama ash. The ash fell about 7600 years ago when Crater Lake was formed and covered all of central Oregon with several feet of ash. The people who were hunting and collecting obsidian here were forced to flee from the area, because plant and animal life was devastated, and food was scarce. Not only did the plants and animals disappear, but the major obsidian sources were also buried from view. Soon after the Mazama ash-fall, the caldera began to be used seasonally rather than year round. There seems to be a real difference in the pre-Mazama use of the caldera compared to the post-Mazama times. The eruption of Mt. Mazama marked the end of season-long habitation within the caldera.

Around 1000 years ago there is evidence for expansion of peoples related to the Northern Paiute, from out of the southwestern United States and across the Great Basin toward the Newberry area. Most archaeologists believe that an ethnic identity can be established at this time, based on the linguistic rather than the physical record. These people, the ancestors to the Northern Paiute, either joined or replaced the indigenous Great Basin peoples.

In recent times, many different tribes or bands have used the Monument, specifically, the Klamath, Tenino, Northern Paiute, Mollala, Cayuse, Nez Perce, and Umatilla. Both the Northern Paiute and the Tenino had strong ties to the area, with similar lifeways centered on a seasonal round. The Tenino were more strongly focused on the Columbia River, with hunting forays in the autumn along the Deschutes. The Northern Paiute were more closely associated with other Central Oregon rivers, including the Deschutes. Both bands spent time in the area that is now the Monument, using the high-grade obsidian from volcanic eruptions to craft knives, scrapers, and arrow points.

Most of what we know about these early people has come from the archaeological record and ethnographic research, and there is much more to learn. Much recent research has centered on the Paulina Lake site, which is considered the most systematic excavation of a pre-Mazama site in Oregon. This site has several hearths, and possibly a domestic structure dated about 10,000 radio carbon years ago, making it one of the oldest structures found in the western hemisphere. Of the many hundreds of other sites within the Monument, only a few have been evaluated.

Of the more than 100 sites within the Monument, most have no firm dates. Radio carbon dates have come from only six sites within the caldera. Only seven sites have had obsidian hydration analysis or x-ray fluorescence studies completed on the artifacts. Most of the quarries have been dated through context with an associated obsidian flow. However, those quarries which are associated with the almost 7,000 years old Interlake, Gamehut, and Central Pumice

Cone obsidian flows and the poorly-dated East Lake flows have not been dated in detail. Most other sites can be dated through their association with one of the volcanic tephras. There are still questions, however, about the dating and associations of these tephras which need to be answered. A larger sampling of the sites and their geologic contexts may provide more information to help refine the early history of the Monument.

The Historical Record

The earliest EuroAmerican explorers in the area were Peter Skene Ogden and Nathaniel Wyeth in 1826 and the mid-1830's, respectively. Ogden, while exploring for new trapping grounds, walked through the Monument in 1826. He traveled along the Deschutes and Little Deschutes Rivers and "discovered" Newberry. Wyeth passed through the site of Bend and traveled up the Deschutes River past Dillon, Benham, and Pringle Falls. Neither Ogden nor Wyeth found the area worth trapping and decided not to stay. The John Fremont and Robert Williamson parties were part of US Army expeditions traveling through the area in the mid 1840's and 1850's. Dr. John Strong Newberry was Williamson's geologist, and the volcano is named for him. During the 1840's and 1850's three wagon trains traveled through the Bend area on their way to the Willamette Valley: the Stephen Meek train in 1845, the Thomas Clark train in 1851, and the Elijah Elliot train in 1853.

The EuroAmerican invasion significantly changed the ancient lifeway of the people who had lived here for over 10,000 years. Resource competition, disease, and a series of short-lived Indian wars in southeast Oregon brought most Indians to reservations by the late 1870's.

The original EuroAmerican settlements within the Monument area were located along the Deschutes River near Big Meadows in the late 1800's. A brief expansion of homesteading between 1906 and 1916 occurred. In many cases the claims were abandoned. For the most part, this was due to the extensive lavas and deep ash which made agricultural homesteading impractical. A drought in the early 1900's drove out all but those people who had permanent water sources.

Early transportation in the area was by foot, horse, wagon, car, and railroad. The first of the established roads that existed is near the route of Highway 97. It was called the Huntington Road and was constructed by J.W. Huntington from The Dalles to the Klamath Indian reservation along the Deschutes River. Prior to the turn of the century, subsistence logging was the main use of trees in the area, and parts of the area were cut for timber up until the early 1900's. Much of this timber was used to build the railroad that came through the Bend area.

Many of the structures now within the Monument were built in the 1930's. The original lookout that stood on top of Lava Butte was built in the 1930's, but was later replaced by the lookout you see today. The Paulina Lake Resort was built in the 1920's. The East Lake Hot Springs Resort was built in 1898. It burned to the ground twice, and after the second fire in 1940, the site was abandoned. The present East Lake Resort was built in the early 1930's.

The Paulina Lake Guard Station, located at the west entrance to the caldera, was built in 1938 as a Civilian Conservation Corps (CCC) project. In the Newberry Group Camp are four cabins and a fireplace that were part of a private resort built by the International Order of Odd Fellows in the 1930's. Both the guard station and the cabins are on the National Register of Historic Places.

There are six private residences located at the southern edge of Paulina Lake which are under permit by the Forest Service. The cabins are thought to have been built in the 1920's when most of the other resort facilities were constructed.

Current Situation

From their survey of the caldera, Flenniken and Ozbun (1988) have proposed that instead of a series of discontinuous sites, many of the sites are continuous. These two researchers propose that the entire caldera is interrelated geologically, archaeologically, and technologically, and that the area should be considered a single, integrated archaeological phenomenon known as the Newberry Crater Complex. They point out that due to the numerous tephra producing events, many sites are probably buried and not visible on the surface. After all, people have used the caldera for at least 10,000 years. This chronological record, when combined with the rich history and the rare and unusually clear stratigraphic record, helps make the Monument a living laboratory. We have much more to learn about the pre-history and history of this unique area.

The evaluation, monitoring, and mitigation projects for heritage resources have been small and focused mostly on recreation sites and project activities. The program has grown from a quick walk through a site to more complex sampling designs with professional archaeologists. To date there have been 27 compliance projects that have been reported under the National Historic Preservation Act (Section 106). While many of these projects give us useful information, they haven't always been performed with trained individuals or appropriate methods and may not always give a representative sample. The densest archaeological sites seem to be within the caldera, near obsidian flows or water sources, and on the eastern slope of the volcano. Most of the sites tend to be quarries, lithic workshops, and food processing locations and camps. The Monument contains numerous examples of significant prehistoric cultural resources and examples of how people coped with volcanic hazards and evolved over time. Only two sites have had sufficient information collected and evaluated for their significance and inclusion to the National Register of Historic Places.

Determinations of significance for the historic and prehistoric sites can be accomplished through the use of a screening process applicable to cultural or heritage resources on public lands (36 CFR Part 60.4). Sites are determined significant if they meet one or more of the following criteria: a) associated with historic events; b) associated with historic persons; c) embody distinctive characteristics; and d) yield significant information. In addition, the sites must have integrity and should not be overly redundant with other site types or information.

Trends

The Deschutes National Forest's primary goal has been the protection of these resources for cultural preservation, research and interpretation. The two main emphasis areas have been identification and documentation of the resource so that the information is integrated into land management decisions. Mitigation measures are developed in consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation. The Forest also consults with these two offices on historic preservation laws and regulation.

Recognized American Indian Tribes and groups are consulted also, regarding activities that are deemed significant (see American Indian Religious Freedom Act (AIRFA) and Section 106 (S.106) of the National Historic Preservation Act (NHPA). In addition, special considerations and requirements may be implemented for cultural resources based on consultation with the Confederated Tribes of the Warm Springs Reservation of Oregon, the Burns Paiute Tribe, and the Klamath Tribes in response to the AIRFA, NAGPRA and National Park Service Bulletin 38 which provides guidelines for implementing the "traditional cultural properties" criteria of the National Historic Preservation Act.

Illegal collecting and artifact theft and destruction is a major concern in Newberry Monument. The fragile and non-renewable resource is disappearing at an alarming rate at the hands of recreational collectors, commercial excavators and artifact traffickers and criminals. Several individuals have been convicted of felonies under the Archaeological Resources Protection Act (ARPA). The violations occurred in the Monument.

7b. Geology and Soils

Geology

Background

Newberry Volcano is one of the largest Quaternary volcanoes in the contiguous United States and has a long and varied volcanic history. Its broad shield-like form is distinctly different from the Cascade peaks to the west. Volcanic activity began in the Newberry area at least a million years ago and has continued nearly to the present (1,300 years ago), with continued activity in the future highly probable. The summit caldera has been the location of five eruptive periods during the last 12,000 years.

Newberry Volcano is located at the western end of the High Lava Plains Province, adjacent to the Basin and Range Province, and 60 kilometers (40 miles) east of the crest of the Cascade Range. Newberry Volcano shares many of the geologic characteristics of these adjoining regions. It is well known in the scientific community because of its long and varied history of volcanism, and its wide range of rock types from basalt to rhyolite.

The north and south flanks are distinctly different from the east and west flanks. Large areas of the east and west flanks are covered with deposits resulting from extremely violent silicic eruptions like those at Mount St. Helens in Washington or Mt. Pinatubo in the Philippines. These deposits are related to the eruptions which formed the caldera of Newberry. In contrast, the north and south flanks of the volcano are covered by hundreds of cinder cones and their associated lava flows resulting from relatively gentle mafic eruptions like those at Kilauea in Hawaii. The most recent flank eruptions have occurred on the north and south flanks.

At the summit of Newberry Volcano is a caldera (often referred to as a crater) that is seven kilometers by five kilometers (four miles by three miles). This caldera was formed during at least two major eruptions. The first occurred about 500,000 years ago and the second 300,000 to 200,000 years ago. The deposits from these large silicic eruptions are found on the east and west flanks of the volcano. Other periods of caldera collapse may have occurred, but the deposits of these eruptions are poorly exposed or buried by younger volcanism.

Newberry National Volcanic Monument includes many of the youthful volcanic features which have formed over the last 12,000 years on Newberry Volcano: the Big Obsidian Episode (1,300 years ago); the East Lake Obsidian Episode (3,500 years ago); the Northwest Rift Episode (7,000 years ago); the Interlake Episode (7,300 years ago); the East Rim Episode (11,200 years ago); and the South Obsidian Episode (approximately 12,000 years ago). Another important eruption which affects the Monument is the eruption (7,600 years ago) of Mt. Mazama (Crater Lake) 110 kilometers (70 miles) to the south. Deposits from the Mt. Mazama eruption are common in the Monument.

Associated with these eruptive episodes and older eruptions of Newberry Volcano are numerous geologic features of scientific, interpretive, and scenic interest. A brief list of geologic features found within the monument includes cinder cones, spatter cones, spatter ramparts, craters, a caldera, mafic and silicic lava flows and airfall deposits, ashflows, tuff cones, pumice cones, hot springs, water falls, kipukas, lava cascades, tree molds, and lava tubes (caves).

Within the caldera there are three areas with surface indications of the volcanic heat below the surface. At Paulina Lake, small hot springs occur along the shoreline in the northeast corner of the lake. A shallow water well at the north end of Little Crater Campground produced hot water before it was abandoned. At East Lake, small hot springs occur along the shoreline west of the Hot Springs Boat Ramp. These springs supplied hot water to the East Lake Health Resort from 1915 to 1941. A shallow water well in the Hot Springs Campground also produced hot water until it was abandoned. At Lost Lake, a small fumarole exists near the Big Obsidian Flow.

The youthful volcanism associated with Newberry Volcano is the reason for the existence of a potential geothermal resource adjacent to Newberry National Volcanic Monument. Various geophysical surveys, geologic studies, and borehole temperatures suggest the presence of a small magma body beneath Newberry Volcano at a relatively shallow depth of about three kilometers (two miles). This magma body has been the source of magma to feed the four silicic eruptive periods within the caldera over the last 12,000 years. Newberry will likely be the source of future eruptions.

The above geologic summary is based on information from Fitterman (1988), Jensen (1988), Linneman (1990), MacLeod and Sherrod (1988), and MacLeod and others (In Press).

Current Situation

The current condition of geologic features varies greatly depending on the scale of the feature and its location. In general, large scale geologic features such as cinder cones and lava flows are in good condition with only minor disturbance due to road and trail construction. The condition of small scale geologic features such as tree molds, surface features on lava flows, and features within caves varies greatly depending on their location. At developed sites such as Lava Lands, Lava Cast Forest, Lava River Cave, and the Big Obsidian Flow Trail, many of the small scale features have been heavily impacted by the large numbers of people who visit these sites. Some visitors steal obsidian, deface rocks, leave litter, and otherwise damage geologic resources. At some undeveloped sites, where road access and signing have directed visitors to geologic features, there has also been heavy vandalism, including theft or defacement. In most areas, small scale features are generally in good condition with one important exception, from the late 1920's through the 1930's there was heavy collecting by Bend area residents of tree mold features, even at remote sites near the center of flows.

Trends

Due to the million-year time span involved in the history of Newberry Volcano, it is difficult to establish future geologic trends which are relevant in human time spans. But with the evidence of a magma body beneath the caldera and six eruptions in the last 12,000 years, one event that will occur in the future is another eruption, probably within the caldera and on the scale of the eruption which formed the Big Obsidian Flow. It is only a question of time.

Increasing public interest in the natural world and the environment is reflected in steadily increasing visitor counts at visitor centers and museums throughout the Northwest. The visitor

who want to be entertained is gradually giving way to visitors who want to know and learn more about the world around them. In addition, volcanoes are receiving increasing worldwide interest due to their impacts on the environment (climate, soils, atmosphere, vegetation, human facilities, etc.). With increasing use of all public lands, a major trend affecting geologic resources in the Monument is vandalism and degradation of sensitive features at developed sites where there is only a limited Forest Service presence. This is especially noticeable at the Lava Cast Forest and Lava River Cave.

Geothermal Energy

Background

Geothermal energy is heat from the earth, normally in the form of hot water or steam. Geothermal energy is used throughout the world to produce electricity and heat buildings and greenhouses. "Geo" means earth, and "thermal" means heat.

Beginning in 1970, with the passage of the Geothermal Steam Act, exploration for geothermal energy began at Newberry Volcano. The US Geological Survey (USGS), with new direction to do research on alternative energy sources such as geothermal, began mapping the geology of Newberry Volcano in 1976, and in 1981 they completed a temperature gradient hole in the center of Newberry Crater. The 932 meter (3,058 foot) hole became a point of major interest when the temperature at the bottom was measured at 265 degrees C (509 degrees F). The hole also produced steam for 20 hours during a test. An additional dozen core holes have been drilled by private companies to depths deeper than 610 meters (2,000 feet); the deepest was 1,400 meters (4,550 feet). This drilling has provided the best evidence to date for the high geothermal potential of Newberry. Projections of temperatures beyond the bottom of each hole suggest that temperatures of greater than 205 degrees C (400 degrees F) exist between 1500 and 3,000 meters (5,000 and 10,000 feet) under the volcano's flanks. The most important remaining question is: Are there fluids available (either water or steam) in these hot regions that can be brought to the surface to generate electricity?

In 1988, a major research journal, the Journal of Geophysical Research, devoted a special section to the geology and geophysics of Newberry Volcano. The research articles supported the view that Newberry was a good geothermal prospect. It may indeed hold an active magma chamber which has been responsible for the periodic eruptions which have produced the Big Obsidian Flow and other silicic lava flows within Newberry Crater.

Current Situation

The development of geothermal resources of Newberry Volcano was one of the driving forces in the designation of Newberry National Volcanic Monument and is a major part of the Legislation. The creation of Newberry National Volcanic Monument settled the major issue of where and where not to allow the continued exploration and potential development of geothermal energy. No geothermal drilling is permitted in the Monument. However, geothermal exploration and development is allowed outside Monument boundaries, if the Forest Service and BLM approve the projects.

Trends

Two proposals for geothermal exploration were submitted to the Deschutes National Forest in 1992. Both proposals call for drilling to tap the geothermal resource on the west flanks of Newberry Volcano, outside the Monument. Environmental analysis has been undertaken for both proposals, with a determination of whether or not to proceed expected in 1994. If the larger proposal is approved, it would likely result in the development of 14 geothermal well pads (4-6 acres each), a 33-megawatt power plant, a transmission line corridor running west to Highway 97, and associated pipelines and access roads. All surface development associated with these projects would occur west of the Special Management Area.

Minerals

Background & Current Situation

Minerals are divided into three categories: locatable minerals (under the 1872 Mining Laws), leasable minerals (under 1917, 1920 and 1947 mineral leasing acts and the Geothermal Steam Act of 1970), and saleable materials (Materials Act of 1947).

Locatable Minerals

There are no known commercial deposits of gold or other precious metals, strategic metals or other base metals within or adjacent to Newberry National Volcanic Monument. No part of the Monument is considered to have potential for locatable minerals. No claims presently exist, and the legislation establishing the Monument forbids any entry into the Monument for mining.

Leasable Minerals

There are no oil and gas leases anywhere on the Deschutes National Forest. Numerous geothermal leases have been granted for lands adjacent to the southern part of the Monument. These leases also occur within the Transferral Area and include no surface occupancy within the Special Management Areas adjacent to the Monument. There is currently (1993) a 157-acre inholding in the caldera that is in private hands. Exploration or extraction of minerals on this land is restricted by county zoning ordinance. The Forest Service is attempting to purchase this property (1993).

Saleable Materials

Saleable materials include such things as cinders, gravel, hardrock, building stone, clay, and borrow. The Deschutes National Forest has a very active sales program (primarily cinders), from several large sources. Many pits and quarries occur on the forest and are used mainly for forest projects. Within the Monument and the special management areas there are seven material sources (pits).

Trends

Cinders have long been used as a cheap but poor road building material, with high maintenance costs. There has recently been a shift to higher cost, better quality materials with lower maintenance costs, especially during the past five to 10 years. This shift has reduced the need for cinders.

Soils

Background

Measured in human lifetimes, soil is a basic nonrenewable resource. Soil contains the nutrient elements required by all vegetation. It is the medium in which plant roots can find anchorage, and in which many small life forms important to the health of the ecosystem can thrive. Stable and fertile soils are critical in the production of trees, forage, wildlife habitat and clean water. The ability of soil to remain productive depends largely on the management practices that are allowed. Over a long period of time, the effect of repeated activities has the greatest potential for lowering soil productivity.

Soils (or lack of) within the Newberry National Volcanic Monument are entirely the result of recent volcanic action. Various eruptions have deposited volcanic ash, pumice, cinder, and lava over the entire Monument area within the last 7600 years. Soils within the monument can be subdivided into five groups and are discussed below.

Mazama Pumice Soils (46 % of Monument)

Mazama Pumice soils, which cover the largest area of the Monument, are the result of the eruption of Mt. Mazama (Crater Lake), some 70 to 80 miles to the southwest, 7600 years ago. This eruption deposited from 20 to 30 inches of ash and pumice over the entire Monument, but its deposits have been buried in many areas by younger eruptions. In the northern part of the Monument the Mazama Pumice soils have been mixed with the underlying buried soils.

Barren Flows (25 % of Monument)

Numerous lava flows have little or no soil cover. These barren flows make up about 25% of the Monument area and range in age from 7,300 to 1,250 years ago. The flows buried the Mazama Pumice in large areas of the Monument. Mafic eruptions of the Northwest Rift Episode resulted in the Lava Butte, Gas-Line, Mokst Butte, Forest Road, Lava Cast Forest, Lava Cascade, Hidden, North Summit and Surveyor Lava Flows. Silicic eruptions within Newberry Crater resulted in the Interlake Obsidian Flow, East Lake Obsidian Flows, and Big Obsidian Flow. Vegetation growth on the barren lava flows generally occurs only where wind-blown fine material has accumulated to form small soil pockets.

Caldera Pumice Soils (18 % of Monument)

The Caldera Pumice soils cover the third largest area and includes the thick pumice soils which blanket much of the eastern half of Newberry Crater and the area to the east. These pumice soils result largely from the Big Obsidian Episode, the East Lake Obsidian Episode, and the Interlake Obsidian Episode. In areas of the Caldera Pumice soils where vegetation has not become established, cryptogamic crusts can be found. Cryptogamic crusts are a critical component of soil stabilization, development, and productivity through nitrogen fixation. These crusts, made up of cyanobacteria (formally known as blue-green algae) and lichens, are extremely fragile, especially when dry. Foot and mechanical disturbance destroy the crust and result in lowered productivity of the site.

Mafic Tephra Soils (7% of Monument)

The Mafic Tephra soils cover the fourth largest area and include the cinder cones, spatter cones, and downwind airfall cinder deposits from the eruptions of the Northwest Rift Episode.

These deposits include Lava Butte, Mokst Butte, spatter vents (for Forest Road, Lava Cast Forest, Lava Cascade, Hidden, North Summit, and Surveyor Lava Flows) and airfall cinders related to these vents. These deposits cover areas of Mazama Pumice and small areas of the lava flows of the Northwest Rift Episode.

Eroded Areas (4 % of Monument)

Wind and water has removed most or all of the Mazama Pumice, Caldera Pumice, and other soils in some areas. These areas include the shores of East and Paulina Lake, steep slopes in the caldera such as Paulina Peak, and the tops of many older cinder cones in the Monument.

Current Situation

Condition of Monument Soils

The existing condition of soils within the Monument is good with three important exceptions. The most important and obvious exception occurs within developed recreation sites (resorts, campgrounds and day-use areas) where the soils are in very poor condition due to soil compaction from use of the sites. (This could total 300 acres or more.) Soil compaction is an increase in the soil's bulk density and a decrease in its porosity, resulting from the application of mechanical forces such as weight and vibration. Soil compaction leads to decreased water infiltration, accelerated erosion of topsoils, damage to soil biological systems, and reduced seedling growth which are all evident at most developed recreation sites.

The second exception occurs mainly along the edges of the Monument where timber management activities have occurred in the form of sale units and thinning over the last 20 to 30 years. Soil compaction and soil displacement have occurred as a result of these activities. Soil displacement is the horizontal movement of soil from one place to another, triggered by mechanical force.

The final exception occurs largely in the northern part of the monument where railroad logging of the ponderosa pine occurred in the 1920's and 1930's. Soil compaction along skidding routes has resulted in vegetation patterns that are still evident today.

Trends

Soil compaction is likely to continue in high recreational use areas. Some soil compaction in previously logged areas will gradually ease as the natural healing process takes place, and they remain undisturbed under management guidelines for the Monument.

8. Science and Research

Background

Newberry Volcano has long been of interest to geologists. The first geologic reconnaissance of the area was conducted by Dr. I.C. Russell of the US Geological Survey in 1903. The results of this study was published in 1905 and included the naming of Newberry for Dr. John Strong Newberry of the 1855 Pacific Railroad Survey which passed to the west. It also included the first descriptions of the geology of Lava Butte and features in Newberry Caldera.

From 1919 to 1938, number of geologist looked at features within the Monument area. In 1919, Professor W.O. Crosby (MIT) studied the Benham Falls area and visited Newberry Caldera. In 1921, Ira Williams (State Geologist) studied Lava River Cave. In 1925, Harold Stearns (USGS) looked at the fissure system (NW Rift Zone) which extends from Lava Butte to East Lake. In 1935, Dr. Howell Williams (University of California) published the first detailed study of the geology of Newberry Volcano. In 1938, a group headed by Robert Nichols (Tuffs College) studied the Lava Butte and Lava Cast Forest areas.

During the 1960's there were numerous geologic studies in the area funded by the State of Oregon Department of Geology and Mineral Industries and by N.A.S.A. During this period many of the first dates on the age of various features were obtained. Two major scientific conferences (Lunar Geological Field Conference - 1965 and The Andesite Conference - 1968) were held in the Bend area with field trips to Newberry.

Beginning in the late 1970's, new studies of the geology of Newberry began due to the interest in geothermal energy. During the late 1970's and early 1980's the USGS funded detailed geologic mapping and exploratory drilling. Additional geophysical studies occurred during the 1980's.

Newberry has long been know as a major source of obsidian for pre-historic peoples. Archaeological studies beginning in the 1980's began to reveal just how important the area was.

Current Situation

The rebuilding of Road 21 through the caldera has funded important archaeological study of the area. This research has revealed that pre-historic use of the caldera dates back at least 10,000 years. The type of use has varied through time depending on the volcanic activity and climate of the area.

The rebuilding of Road 21 has also resulted in several significant geologic exposures. Also a full color geologic map of Newberry Volcano is in final review by the USGS and is based on the detailed mapping done in the late 1970's and early 1980's.

Trends

A great many research opportunities exist within the Monument, especially in geology and archaeology. The designation of the Monument may exposes the area to more scientist who will become interested in various research opportunities in the area. Also the need to develop facilities will drive additional research to understand these resources before facilities are located and to preserve and understand resources encountered during construction of facilities.

9. Monitoring

Background

There have been limited attempts to monitor changes and conditions within the caldera through the use of photo points at various locations. Generally the photo points have been established, but periodic reoccupation of the sites has not occurred.

Geodetic monitoring looks for changes in the shape of a volcano which may indicate future volcanic activity. Geodetic monitoring of Newberry began in August 1985, when US Geological Survey staff from the Cascades Volcano Observatory established a trilateration network centered on Paulina Peak. Distances were measured to nine points inside the caldera,

and two additional points on the outer south slope. A leveling traverse was also made across the caldera from Paulina Lake Campground eastward to Cinder Hill Campground. Both of these geodetic monitoring systems were remeasured in 1986 to establish baseline information. Future remeasurement will occur periodically or when seismicity or other conditions indicate the need.

Newberry Caldera lies near the current southern edge of the seismic network operated by the University of Washington and the US Geological Survey from the University campus in Seattle. Local seismicity at Newberry has been monitored since 1987 from one station on its east slope, outside the caldera. The only previous station in the area was operated at Pine Mountain, 28 km northeast of Paulina Peak, from December 1979 through 1981. Due to the sparse, discontinuous station coverage in the region (and apparently low seismicity), few earthquakes have been reliably located in the Central Oregon Cascades.

A meteorological station near Lava Butte has been operated by the Forest Service since 1986.

Current Situation

Limited monitoring is occurring at this time.

- Periodic remeasurement of the geodetic monitoring system.
- For the last two summers the US Geological Survey has been gathering baseline information about the ground water and surface water quality in the caldera and Paulina Creek.
- A baseline monitoring of weather conditions near the caldera is being conducted for the proposed geothermal development west of the monument. Some weather components are also being monitored by the US Geological Survey at the Paulina day-use area.
- A monitoring program has been established for the pumice grape-fern at sites within the caldera. (See Chapter 3's Threatened and Endangered Plant discussion.)
- The drinking water at Lava Lands Visitor Center and the Forest Service operated campgrounds are tested monthly during the use season to check for potential health problems. (See Chapter 3's Ground Water discussion.)
- Data on recreation use is being gathered. (See Chapter 3's Recreation discussion.)

Trends

While some monitoring, especially for air and water quality, is now taking place because of proposed geothermal development near the Monument, more needs to be done. See Monitoring Program in the Plan.

10. Air Quality

Background & Current Situation

The Monument must meet Class II air quality standards. This is the air quality class for the entire state of Oregon, except for wilderness areas and Crater Lake National Park, which are Class I.

Air quality in the Monument now appears to be excellent. No data have been collected inside Monument boundaries, however. The nearest monitoring location is about six miles (10 km) N-NW of the north end of the Monument, in the city of Bend. Here, the Oregon

Department of Environmental Quality monitors for two pollutants regulated under the Clean Air Act: inhalable particulates, with diameters of 10 microns or less (called PM_{10}), and carbon monoxide (CO). For reference, PM_{10} are about one-50th the size of the period at the end of this sentence. In Bend, they are produced mainly by wood smoke. The major human-caused source of CO is automobile exhaust; wood smoke also contributes. Bend has met federal and state standards for PM_{10} and CO since 1988, yet concentrations of these pollutants approach the limits on some winter days, when cold, stagnant air traps motor-vehicle exhaust and smoke from woodstoves near the ground.

Weather conditions are important to air quality in any setting. Wind may transport airborne pollutants from Bend into NNVM; however, when pollution levels are highest in Bend (in the winter), northerly winds are rare. The topography of Newberry caldera tends to allow air pollutants to accumulate there, even in light winds. During the summer camping season, cold, still air commonly settles into the caldera at night. This temporarily traps campfire smoke near the ground and causes smoke to linger over the surfaces of the lakes in early morning. As the air is warmed by the sun and begins to circulate, the smoke rises and dissipates. Rarely, Newberry caldera experiences longer-lived stagnant air conditions that may trap air pollutants for a maximum of three to five days.

Trends

No trends in air quality can be documented, except in the city of Bend where average CO concentrations have decreased, visibility has increased slightly, and PM_{10} show no significant change from 1988 to 1992. In general, impacts to air quality in Newberry Caldera from campfires and motor-vehicle exhaust can be expected to increase with increasing visitation.

11. Water Quality

Surface Water

Background & Current Situation

Surface water in the Monument and adjoining Special Management Area is confined to Paulina Creek on the west slope of Newberry Volcano, Paulina Lake and East Lake in the caldera, and several smaller lakes and ponds in the caldera and near the Deschutes River. (The Deschutes River itself is just outside the Monument's northwest boundary, which is defined as the river's high-water mark.)

East and Paulina Lakes

The surface of East Lake has an elevation of 6,370 feet (1943 m) above mean sea level and covers 1,044 acres (505 hectares). Lake level has varied by less than 20 feet in this century, with seasonal changes normally less than two feet. Two unnamed ponds are associated with East Lake, one at its northeast corner and one near its west shore. The lake and its watershed are bounded to the north, east, and south by Newberry's steep caldera walls. Maximum water depth is 180 feet (55 m). Less than 12% of the lake is less than ten feet deep. The average residence time of water in East Lake is estimated to be 18 years (Johnson et al. 1985).

Paulina Lake is located about a mile west of East Lake. The surface of Paulina Lake stands at 6,331 feet, about 40 feet lower than East Lake. Paulina Lake covers 1,531 acres (741 hectares) and is one of the deepest lakes in Oregon, with a maximum depth of 250 feet (75 m). The caldera walls forming the lake bed here are so steep that less than 3% of the lake is less than ten feet deep. Average residence time of lake water is estimated at 46 years (Johnson et al. 1985).

Water is supplied to Paulina and East Lakes mainly from the subsurface. Snowmelt and rain water tend to percolate down through the permeable volcanic substrata and enter the lakes as shallow groundwater. Some of this groundwater is heated by geothermal activity before emerging as hot springs at the bottom and edges of the lakes. Some of these springs are evident along the southeast shore of East Lake, where sulfur- and soda-charged water bubble up at 120°F (50°C), and at the northeast corner of Paulina Lake, where hot springs rich in dissolved elements filter through lakeshore gravels at 96-113°F (35-45°C). It is possible that these springs represent drowned fumaroles, where gases rising from warmer regions heat water in the lakebed and add chemical constituents to it (Phillips and VanDenburgh 1968; Brook et al. 1979). Alternatively, ground water may seep deep enough to be heated at depth, causing it to dissolve minerals from volcanic deposits and then rise to contribute substantial amounts of water to the lakes (Johnson et al. 1985; Chitwood 1993).

Very little surface runoff occurs in the caldera because the soil and rocks are so permeable. Neither of the lakes are fed by streams. East Lake has no surface outlet; however, surface water leaves Paulina Lake by way of Paulina Creek to the west. This outflow is controlled by a small dam, first installed in 1899, that augments the lake up to four feet above its natural level. A fish weir is also located here, in an attempt to prevent the stocked trout and salmon from leaving the lake.

Surface temperatures of Paulina and East Lakes are commonly about 63°F (17°C) in the summer and around freezing in the winter. Bottom temperatures remain near 40°F (5°C) year round. The lakes are believed to have two yearly overturns, or periods of circulation. They become thermally stratified in the summer, with a warm, well-mixed zone near the surface giving way to markedly cooler water through a "thermocline" 20-60 feet (6-18 m) below the surface.

Dissolved oxygen levels, which are important for sustaining underwater life, are near saturation throughout all but the deepest parts of Paulina Lake. East Lake, on the other hand, has high concentrations of dissolved oxygen only at shallow levels, and shows a gradual depletion below the thermocline.

The biologic productivity of both lakes can be classified as low to moderate, based on water transparency and available plant nutrients. Water transparency in both lakes is good; however, it appears to have decreased markedly in recent years compared to measurements taken in 1940 (Aquatic Analysts 1990; Daggett and Petersen 1993). See also Monitoring program in Monument Plan.

Both lakes, but especially Paulina, have unusually high electrical conductivities for high-elevation lakes. This indicates that the lakes contain high concentrations of dissolved ions, such as sodium, calcium, magnesium, silica, and sulfate (Johnson et al. 1985, Crumrine and Morgan in press). Some minor elements also contribute. Boron levels, for example, are high compared to other mountain lakes, though they do not pose a health concern for humans. Arsenic levels are also naturally high, especially in Paulina Lake. Arsenic is not considered a threat to aquatic life, based on state and federal chronic criteria. However, arsenic levels exceed current standards set to protect humans who consume aquatic organisms from the lakes. Actual arsenic

concentrations in fish tissues are being measured by DEQ and interpreted by the Oregon Health Division; results are not yet available. With regard to mercury, it has not yet been determined with appropriately sensitive techniques whether levels in the lakes exceed standards for protection of aquatic life. However, as with boron and other elements, the organisms present apparently tolerate these natural conditions. After analyzing fish tissues from both lakes for mercury, the Oregon Health Division has issued an advisory recommending that people limit their consumption of fish from East Lake (see also Fish and Wildlife section).

Paulina Lake has a particularly high capacity to assimilate or buffer influxes of acidic components without significantly affecting the pH of its water, based on its high alkalinity (320-344 mg/L as $CaCO_3$, Crumrine and Morgan in press). This lake can also assimilate considerable amounts of organic nutrients without stimulating excessive algal growth. These neutralizing capabilities are less pronounced in East Lake (alkalinity 100-0106 mg/L as $CaCO_3$, Ibid).

The US Geological Survey began monitoring water levels, temperatures, and certain inorganic chemical constituents of East and Paulina Lakes in 1991. Data collected so far, including that from earlier studies, are insufficient to establish any clear changes in these characteristics.

Lost Lake: Lost Lake is actually a pond in the caldera, located in a depression on the southeast side of the Big Obsidian Flow. Its elevation is approximately 6,370 feet. It is fed entirely by snowmelt and rainwater, so its depth and size vary from year to year; however, depth rarely exceeds three feet. No hot springs are present at Lost Lake, although sulfur-rich gases can be detected, bubbling up from fumaroles, when the water level is high. No water quality data is available for Lost Lake, but the water appears quite transparent.

Paulina Creek: Paulina Creek is the only perennial or intermittent stream in the Monument. It issues from the SW corner of Paulina Lake, where its flow is controlled by a dam, and flows west for about 1 3/4 miles through the Monument and Special Management Area. The creek bed is composed primarily of gravel, cobbles, and rocks. Approximately 3,780 acre ft. of creek water per year is appropriated for irrigation of private lands downstream. (This is equivalent to about the top two and one-half feet of Paulina Lake.) Due to this usage, Paulina Creek is essentially dry by the time it reaches its confluence with the Little Deschutes River in the La Pine basin.

Within the Monument and Special Management Area, the flow in Paulina Creek is maintained at an average of 15 cubic feet per second (cfs) during the irrigation season. The average maximum discharge from 1983 to 1986 was 52 cfs during spring snowmelt; the average minimum discharge in fall and winter of the same years was 0.24 cfs.

Available temperature data for Paulina Creek show water temperatures ranging from 48 to 66°F (9-19°C) in late August of 1989. The water chemistry of Paulina Creek is similar to that of Paulina Lake, based on data collected by the US Geological Survey in 1991-1993 (Crumrine and Morgan, in press).

There are 20 waterfalls along Paulina Creek within the Monument and Special Management Area. The largest one, called Paulina Creek Falls, is less than half a mile downstream from Paulina Lake. Its channel splits to form side-by-side falls with a vertical drop of approximately 100 feet (30 m), followed by another 100-foot drop through tumbling falls.

Paulina Creek is being studied by the Forest Service to determine if it is suitable to be recommended for inclusion in the National Wild and Scenic River System as a Recreation River. In the meantime, the creek is being managed to assure that its chances for nomination are not

compromised. At a minimum, this means meeting the standards for recreational sections of Wild and Scenic Rivers, as set forth in the Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990, Chap. 4, pp. 18 & 157). No hydroelectric power facilities are allowed. No new dams, diversion works, rip rap, flood control works, or other such structures are allowed. Construction of new roads along the stream banks and/or new bridges may be allowed. Campgrounds, picnic areas, and other recreational or residential structures may also be established in close proximity to the creek. Standard vegetation management activities are allowed to protect the immediate stream environment, water quality, scenic quality, fish and wildlife, riparian plant communities, and other values.

Deschutes River and ponds: On its northwest side, NNVM is bordered by approximately 10 miles of the Wild and Scenic Deschutes River. This stretch of the river is highly diverse, including rocky canyons, meadows, slack water, and cascading waterfalls. The major falls here are Benham, Dillon, and Lava Island Falls.

The Monument boundary is defined as the high-water mark on the east bank of the Deschutes River. Thus, the river itself is outside of the Monument; it is described more fully in the Deschutes National Forest Land and Resource Management Plan (1990).

Numerous, small intermittent backwater ponds associated with the river do lie within the Monument. These ponds occupy riparian areas between the Lava Butte Flow and the Deschutes River. They are filled by water that overflows and infiltrates from the river channel during the irrigation season (April-October), when the river level is highest. The ponds are less than 400 feet (120 m) from the river. The six largest ones range from 700 to over 1,000 feet (200-300 m) long and from 200 to 500 feet (60-150 m) wide. Only one of these is over four feet deep and retains water year round.

Water quality in the ponds is directly related to the water quality of the Deschutes River, as well as to their own physical and biological characteristics. No water quality information is available for the ponds. Data for the Deschutes River, collected approximately five miles SW (ten river miles upstream) of NNVM, suggests generally good water quality except for seasonally high turbidity (DEQ 1992b, Felando 1993). This turbidity is caused mainly by severe erosion of the river banks when large volumes of water are released from Wickiup Reservoir for irrigation use each spring. Turbid water affects the ponds by contributing sediment, which tends to settle out and decrease water depths. The ponds are probably becoming shallower from year to year. If so, then their water temperatures can be expected to rise.

Ground Water

Background & Current Situation

Characteristics of subsurface water flow in the Monument merit further study, but four major features can be noted:

(1) Volcanic deposits that comprise the bedrock in the area are generally highly permeable. That is, water passes through them easily.

(2) Ground water beneath Newberry Volcano is recharged to a large extent by seepage from the lakes, as well as by direct downward percolation of snowmelt. This results in "mounding," or "piling up," of ground water beneath the caldera relative to the lower regional water table. (Sammel 1983; Sammel et al. 1988; Chitwood 1993). In the caldera, the water table is located approximately at lake levels, or about 6,300 feet above sea level.

(3) Within the caldera, some geothermally heated ground water rises to the surface and near-surface. This is evidenced by the dissolved-ion-rich hot springs in the lakes and heated waters found in some wells.
(4) Regional migration of deep ground water appears to be generally to the north beneath the caldera and the southern flanks of Newberry Volcano and to the northeast beneath the long northern "neck" of the Monument, based on static water levels in wells (Black 1983, Chitwood 1985).

Twelve water wells are currently in use inside NNVM. Eleven of these are shallow (less than 80 feet deep) and supply water to campgrounds, private resorts, and summer homes within the caldera. The other well is much deeper (508 feet) and serves Lava Lands Visitor Center. Six of the Monument wells supply drinking water for public use. These systems are monitored monthly for coliform bacteria and yearly for nitrates by the Forest Service. Water quality is generally good: 89% of routine monthly tests were bacteria-free from 1989-1992, and nitrate levels are low. However, one water system (serving Paulina campground and day-use areas, the Paulina Guard Station, and the maintenance yard) has an unusually high incidence of contamination. Only 60% of routine tests of this system were bacteria-free from 1988-1992, due to an aging wooden water tank that facilitates bacterial growth.

Since 1991, the US Geological Survey has monitored levels of inorganic constituents in ground water and hot springs in the Newberry caldera area. Three drinking-water wells have been tested: at Paulina Lake Lodge, Paulina Guard Station, and Newberry Group site. Water quality appears to be excellent in all of these wells; however, the Paulina Lake Lodge well exhibits naturally high levels of iron and manganese that exceed state ground-water guidance levels for aesthetic quality. These levels have not been shown to adversely impact human health, but they do affect the taste and color of the water. Hot-spring waters in the caldera also tend to be high in iron and manganese and are somewhat acidic, with natural levels of mercury that exceed state surface-water standards for protection of aquatic life (Crumrine and Morgan, in press). (See also East and Paulina Lakes above and Monitoring in the Management Plan.)

Trends

Few trends are known for surface-water or ground-water quality in the Monument. Drinking-water sources are generally quite good, with the exception of the Paulina Lake system, which experiences problems due to bacterial growth in its aging wooden storage tank. Underground wastewater disposal systems (septics) appear to be operating well; however, heavier use in the future could accentuate any effects to ground water and the lakes. Paulina Lake and East Lake have experienced a noticeable decrease in water transparency in the last 50 years. This is probably related to an increase in biologic productivity and could possibly signal an adverse impact on water quality by human activities, such as wastewater disposal (see Monitoring in the Management Plan). Intermittent ponds adjacent to the Deschutes River may be filling in with sediment and warming up due to seasonally high turbidity of the river. The turbid waters are a result of flow regulation, for irrigation purposes, that began in the 1940's. Information that is currently unavailable or missing is explained at the end of Chapter 4.

12. Scenery

Background and Current Situation

The Monument is located within a landscape of dynamic and diverse scenic beauty. Situated in the High Lava Plains of Central Oregon, the landscape character reflects the dry climate in its shape and vegetation. Broad, black fields of lava, dense woodlands of pine and other conifers, mountain lakes, a rushing creek, abrupt cinder cones, dramatic obsidian flows, and rugged volcanic cliffs collectively create a unique combination of features.

The broad form of Newberry Volcano differs markedly from the pointed white peaks of Cascade volcanos to the west. Flat, low and wide, this shape is relatively subtle. Small buttes are scattered throughout the forested lava.

Many of the vistas located in the Monument include glimpses of geologic formations. It is the combination of these distinct geologic landforms -- and the fields of lava, nearby river, clear blue lakes, and green forest -- that gives this area its special character.

Elevation and topography determine the many distinctive landscape character types within the Monument. Plant communities include predominately: ponderosa pine, lodgepole pine, mixed conifer, hemlock, meadows and riparian areas. Lava flows in the area range from chunky, sharp obsidian to both smooth and rough fields of black basalt. The various lava flows and plant communities each have distinctive colors, forms, and textural qualities which provide a wide range of settings and viewing opportunities.

Scenery enhances recreational experiences. Scenery occurs along a spectrum from the far-off viewing of distant landscapes, to close-up elements visible in great detail. Travel routes into an area set the tone and begin the forest experience for many visitors. Areas adjacent to recreational facilities, where visitors spend long periods of time, play a key role in the overall quality of the recreational setting. How vegetation is managed, the type of building materials, style of construction, spatial distribution and screening buffers all contribute to the recreational experience.

Landscape Character

Scenery can be discussed in terms of landscape character and scenic condition. Landscape character is "an overall visual impression of landscape attributes; it's the physical appearance of a landscape that gives it an identity and 'sense of place'." Landscape character attributes are used to describe past, existing, and desired landscape characters, variations on landscape character themes, or landscape character goals (USDA Forest Service 1993d). Landscape character attributes often include landform, rockform, waterform, vegetation and cultural elements.

The broad character types within the Monument have been further subdivided in 13 "Landscape Character Subtypes" (map available in the planning record). The following discussion describes the character (and occasionally references the current condition) in these areas. Some of these areas correspond with areas on the Vegetation map in the map packet.

THE RIVER'S EDGE: The Deschutes River moves swiftly through diverse scenery from low, marshy wetlands to steep, sandy banks and nearby lava fields. The river borders the northwestern part of the Monument. Along the rocky edges are inland meadows, ponderosa pine, masses of willow and other riparian shrubs, and some pockets of aspen and white fir trees. The texture of the riparian plants contrasts with the rocky banks and sharp lava fields.

Positive scenic elements associated with the river's edge are the views of the water and falls from several angles, the soft pockets of fir and pine along the edges, views of the lava flows, and occasional glimpses of wildlife.

Landscape systems can be evaluated according to their inherent ability to screen structures or facilities. This is referred to as their visual absorption capacity; for the river it is low. The river can be viewed from both sides and from several high viewpoints. It attracts many people; therefore, it has a very high level of scenic sensitivity associated with its viewshed.

PAULINA CREEK: Paulina Creek flows through the riparian area westward from Paulina Lake. Downstream a short distance, at Paulina Falls, it cuts dramatically through rocky cliffs, exposing views of Newberry Volcano's strata. The water is clear and blue-green, cascading 100 feet over a rocky overhang.

The positive scenic elements are the views of the creek and falls, as well as the vegetation surrounding the creek and views of the rocky banks and exposed geology. Negative scenic elements are the chain-link fence surrounding the falls (built for safety, but detracts from the visual experience), and the soil compaction and erosion taking place along the banks from informal foot trails.

UNVEGETATED LAVA: There are several large unvegetated lava flows in the Monument. Along with other non-vegetated areas, they make up almost 25% of the total acreage of NNVM. Mostly sharp and chunky in texture, these dark grey to black flows are both interesting and desolate. The Big Obsidian Flow, in the caldera, is one of the more visible lava flows. The flow is a prominent grey form, appearing impassable and contrasting with its surroundings in both color and texture. The form is massive and sharply-faceted. Open vistas and long views from Paulina Peak make this flow a sensitive feature. In the Lava Cast Forest area, lava is the primary landform element; there are many areas with only a few patches of trees. The absence of a forested cover creates a low visual absorption capacity. Some of the positive scenic elements associated with lava forms include sparkles of obsidian and the unusual isolated trees that decorate the tops of the flows in some areas. The massive expanses of unvegetated lava in the Monument appear as natural landform sculptures.

FORESTED LAVA: There are places within the Monument where the lava forms a sharp edge between forested and unforested areas; however, in some cases a softer transition occurs across a landscape of forested lava. The vegetation in these areas is thin, with few trees, mostly ponderosa and lodgepole pines. The dark grey lava provides a striking contrast to the green trees. There are some long views from the forested lava towards mountain peaks or nearby buttes. The visual absorption capacity is moderate in these areas, low in places where there are few trees, and higher in areas where trees are dense. Positive scenic elements include the lava fields nearby, the openness of the stands, and open views towards the mountains.

BUTTES: There are numerous small conical buttes in the Monument. These buttes are strong vertical statements in the landscape. Where vegetated they commonly host ponderosa and lodgepole pine, along with low-growing shrubs and grasses. Both the colors (reddish, grey or black) and forms of the buttes make a strong visual contrast to the surrounding forest. They can be seen from a long distance, so visual absorption capacity is low. Views from the buttes themselves make the surrounding areas more sensitive in terms of scenic considerations, vegetation management and development of facilities and roads. Some positive scenic elements

associated with the buttes are views from the top, contrasting form and color, and the vertical forms in the landscape. Negative scenic elements include visible user trails along the sides of some buttes. In these areas there is little or no screening available for any new developments, trails, facilities or otherwise.

LAKES AND LAKE EDGES: The lakes are a deep aqua-blue, in contrast to the green trees surrounding them in the caldera. In some areas, the riparian edge is bright green, offering a pleasing contrast. Positive scenic elements include this bright riparian vegetation, the red and whitish rock-slide areas, views of Paulina Peak, views of wildlife, and the water itself. Negative elements include the visibility of cars from the water, the presence of debris piles and development scars, and the areas of disturbed riparian vegetation. The visual absorption capacity from the south slope of the caldera to the water is extremely low. Because anglers and campers are in the caldera for longer periods of time, the duration of these views in this area are among the longest in the Monument.

ROCKY OUTCROPS: Rocky outcrops are visible in many places within the Monument. These dramatic rocky forms can be seen from great distances, making their visual absorption capacity low; any development on or near these outcrops would be seen from far across the Monument. The color of the rock is mostly shades of grey, but reddish and whitish sections are also present. The textures are sharp and coarse, except for smoother patches of talus which can be seen cascading down the sides of the rock. The form of the outcrops is distinctly vertical, rising above the fairly continuous and dense forest. These outcrops are also important viewpoints from which to see other areas of the Monument, particularly the area within the caldera which is not visible from outside the Monument. These areas have little to no ability to screen facilities, roads, and trails. The positive scenic elements associated with rocky outcrops are the sharp vertical forms, the views from above these rocky formations, and the geological rock formations themselves. The negative scenic elements are the views of roads and other unnatural linear features in the caldera.

PONDEROSA PINE FOREST: This forest type currently makes up about 8% of the total acreage of the Monument. These areas vary in current appearance based on their management history, fire occurrences, and insect infestation. Much of the ponderosa pine currently appears even-aged, as it was clearcut in the 1930's and 1940's. These areas of 50- and 60-year old trees lack structural and visual diversity, and in places beetles and moth damage is evident. Generally these forests are dense (with good screening). Closer to the river and near lava edges, there are some outstanding large pines offering scenic vistas and viewing opportunities. Typically the foliage is green to brown and trunks are distinctive orange-brown on older trees and dark brown on younger trees. In older trees the foliage is high on the trees, making the trunks the primary visual element in the stands.

Historically (prior to European settlers) ponderosa pine stands in this area appeared more open and park-like, with little understory vegetation other than a few young pines, grasses, and some low shrubs. In these "historic" ponderosa pine stands it was often possible to see for long distances through the trees because there was little understory vegetation. In these places the trees appeared some-what even aged because most of them were large; however, there could have actually been hundreds of years differences among the large pines. These areas had multiple stories of vegetation and are texturally and visually diverse. Some area in NNVM currently have similar characteristics.

Historically there were also areas in the ponderosa pine forests where the vegetation was dense and viewing through the trees was limited or not possible. The difference between the open and the denser forests was primarily due to how frequently or infrequently fires had burned through the area. These denser areas can be characterized as having multiple stories of vegetation with clumps of young pines growing in naturally occurring sunny gaps in the forest canopy. These areas are visually and texturally diverse and are referred to here as fire-excluded, or "ecologic" conditions.

The positive scenic opportunities and elements associated with the "historical," open ponderosa pine communities include: distant views of buttes and mountain peaks, the open feeling of these stands, and the color and texture of the bark on the larger pines. Negative elements in park-like areas include little potential screening and a lower visual absorption capacity. Positive elements associated with "ecologic" old-growth ponderosa pine include structural and textural diversity as well as large orange trunks and good screening potential.

LODGEPOLE PINE FOREST: This type of forest currently makes up the largest percentage of acreage in the Monument -- about 40%. The lodgepole pine forests are made up of dense thickets of small-diameter pines. Some individual trees are tall. The textural quality is coarse, upright and rigid. These stands are continuous, except where disturbance has occurred. The color is a yellow-green with seasonal orange-brown tips at ends of branches. A relatively large portion of the lodgepole in the Monument currently consists of dead standing trees from recent beetle activity, and in most cases these trees appear grey. Patches of dead trees first turn red, then a warm grey.

The positive scenic elements are the visual density of the stands, screening potential, and good regeneration. Currently the most negative element is the high mortality of trees due to insect damage; these areas cannot be easily be thinned without creating obvious openings. Up close these dense stands contain many fallen or leaning trees and appear impassable. The visual absorption capacity is high.

MIXED PINE FORESTS: This type of forest commonly occurs in the areas where the ponderosa pine community transitions towards a lodgepole pine community, or visa-versa . These areas are associated with topographical and elevational changes in the landscape. In the Monument, the classification of "mixed pine" forests describes a range of potential proportions of ponderosa and lodgepole pine. In areas where one pine type is largely dominant, it will be called a ponderosa pine or lodgepole pine forest, rather than mixed pine.

In mixed pine areas, large ponderosa pines often form the upper canopy of the forest, and the understory and middlestory are filled with dense thickets of dark green lodgepole pines. These stands can appear as having two or more distinct layers of vegetation. The upperstory has a lighter, softer texture than the rigid lodgepole below. The trunks of the large ponderosa pines are often not visible because of the dense understory vegetation.

The positive elements in mixed pine forests include visual diversity and good screening potential. Negative elements exist where there is a high occurrence of dead lodgepole. Visual absorption capacity is generally good; however, it is commonly difficult to manipulate stands without creating obvious visual changes.

MIXED CONIFER AND PINE/FIR FORESTS: These forest types currently make up about 6% of the total acreage of the Monument and are made up of lodgepole pine, ponderosa pine and white fir. In some areas, the characteristics of the lodgepole pine dominate the overall

appearance, giving the stands a continuous and dense texture, where there are few understory plants other than young pine, fir and some grasses. In general these areas have a variety of textures and colors forming the forest canopy. Firs have a horizontal layered form with floppy branches and thick needles. They provide visual contrast when scattered among the orange trunks and light-textured foliage of the ponderosa pines and the rigid upright form of the lodgepole pine.

Positive scenic elements are the contrasting foliage and trunks, screening potential, and visual diversity of the stands. The negative elements are the mortality of lodgepole pines due to insect damage and the density of the understory. The visual absorption capacity is high.

HEMLOCK FORESTS: This type makes up about 10% of the total acreage and appears bright green and dense. The texture is heavy but not coarse or rigid, and the color is medium green with grey trunks. There is little understory. Trunks are upright with horizontally-layered branching, and the form is densely wooded and shaded. This forest type has historically had little harvest activity associated with it; therefore, there is little evidence of human alterations in these areas.

DEVELOPED AREAS: Most developed recreation areas are located within or adjacent to areas of high scenic viewing potential, or near places with interesting geology, archaeology and vegetation. These areas vary in their existing condition. Many of the structural facilities within the sites are in need of repair or upgrading. In some cases, the facilities do not blend with or complement the landscape. The campgrounds and day-use areas in the caldera generally co-exist in the same space with little or no separation between overnight use and day use. There is minimal vegetation or visual buffering between campsites, which affects the potential for privacy in the campgrounds. (For a complete description of the existing recreational facilities see Recreation Chapter 3.)

Winter

The Monument is a different place in winter. Around the caldera, in areas of reliable snowfall, a white blanket transforms the Monument's textures and colors. The forest is softened to a bluish-green and white, the lakes become white expanses, and the lava flows take on a marbled black and white appearance. The developed recreation areas in the caldera all but disappear in the snow. The contrasts between open and closed canopies in the surrounding forest become more pronounced. From high points such as Paulina Peak, the evidence of past management outside of the Monument becomes more evident. Winter scenic experiences include opportunities to meander through areas where snow weighs down the branches of the trees and ice dangles from frozen needles.

Scenic Condition

Scenic condition is a measure of differing degrees of human alteration or deviation from the attributes of the natural landscape character. Scenic condition can be used to describe an existing situation or a desired future condition. Scenic condition and landscape character are related, but distinctly different.

Most of the existing scenic condition in the Monument is directly related to past vegetation management, especially for the "managed" species including: ponderosa pine, mixed pine species, and mixed conifer plant communities. Hemlock and riparian communities generally have had little to no vegetation management.

In the past, many of the ponderosa pine communities at lower elevations were altered by logging. Extensive clearcuts in the 1930's and 40's are responsible for the relatively dense, even-aged character in many of the forests. However, the altered state of these forests is not readily obvious. Approximately 71% of the Monument is forested, of which 6% has had recent management activities (since 1972). Of this 6%, over half of the areas currently appear altered as viewed from above. Almost all of these areas are in lodgepole pine. Most of these activities have taken place in four main areas; along Highway 97, along Road 9710 south to Road 9735, adjacent to Road 9723, and south of Road 21 at the western entry to the caldera. A few other areas are scattered throughout, including near Cinder Hill campground.

The existing scenic condition is also affected by human occupation and recreational activities. Some compacted, denuded, and eroded conditions exist, especially in camping and day-use areas, and along trails due to high use. Many of the recreational facilities are old and in need of repair or restoration. Safety and resource protection concerns have resulted in highly-visible chain-link fences in a few high-use areas. An overhead powerline within the caldera and a roadcut on the way to Paulina Peak result in unnatural lines in the landscape.

An additional discussion of scenic condition (by management zone) can be found in Chapter 4, Scenery.

Scenic Condition along Travelway Corridors

Much of the viewing within the Monument occurs while traveling along roads and trails. The character along these routes is relative to the landscape character subtype in any particular area. The following discussion describes the existing viewshed condition, or how much evidence of management activities is currently visible along these routes. The road viewsheds along the boundary of the Monument are technically half in and half outside of the Monument; however, experientially, visitors are not likely be aware of this land-use boundary.

The term "natural-appearing" is used to describe an area if there is little or no evidence of human alteration (i.e. stumps, slash piles, etc.). A "modified" condition reflects obvious, dominant, human alteration (primarily due to past harvest activities).

Highway 97 and Road 9702 pass through areas that are predominately even-aged (50-60-year-old) ponderosa pine forests. These corridors are natural appearing. However, there is currently a vegetation removal project on Road 9702, near Annie's Garden; this area is expected to appear modified in the short term.

Road 9710 north of Road 9720 consists mostly of natural-appearing, even-aged Ponderosa pine. Some old slash piles, relic landings, and stumps are evident. Just north of Road 9720, outside of the Monument, a large modified area is visible. Opportunities for scenic enhancement of old ponderosa pine exist along this corridor. Road 9710 south of Road 9720 corridor consists of lodgepole pine with many areas (within and outside of the Monument) where modifications including old clearcuts, stumps, and slash are evident and dominant.

Along the Transferal Corridor (Road 9735) are areas of dense lodgepole and mixed conifers. Lava is dispersed throughout this corridor as are some pockets of young lodgepole. There is significant evidence of human alteration both at the western and eastern edges of this corridor. Towards the middle of this corridor, the landscape appears natural and attention is drawn to the northwest towards the Cascade peaks and buttes in the distance.

Road 9720 is made up of areas of lodgepole pine, ponderosa pine, lava flows, and two buttes (including Mokst Butte). The lodgepole to the south of the road is of medium density and appears predominately natural; however, stumps are readily evident. Pockets of large, old ponderosa pine can be seen within the large lava flows and could be highlighted. This road is modified in many areas outside of the Monument, and it currently serves as the main access route to the Monument in this area (this situation is also true along Road 9723). A spur road (950) off of Road 9720 connects up with Lava Cast Forest day-use area. This corridor is natural-appearing.

Road 9723 is predominantly dense ponderosa with some lodgepole and lots of wild-appearing and overgrown manzanita. Old recovered clearcuts exist, but generally appear natural. With one exception, the only remaining evidence of human alteration is the young even-aged character. However, beneath the deep manzanita cover it is likely that many stumps could become visible again in the event of a fire.

Road 21 at the entrance to the caldera currently appears modified as does the view from this area of the road to Paulina Peak. Within the caldera, openings are evident around and to the south of Cinder Hill campground. The northern portion of Road 2121 and one area along the northern edge of the Transferal Area also have modified areas visible from the travelway. The remainder of the travelways within the Monument have not had management activities within the recent past (since 1972) and are assumed to be natural-appearing.

Trends

Existing Standards (VQO's)

The 1990 Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990) utilizes the Visual Quality Management system as the tool for managing scenic quality. (This has been recently updated and is now referred to as the "Scenery Management System".) This system has established "Visual Quality Objectives" (VQO's, or SQO's in the new system) which are standards developed for measuring and evaluating levels of visible alteration as a result of management activities. Direction in the Forest Plan currently includes the following VQO's within the Monument:

33% Retention: Management activities are not visually evident
35% Partial Retention: Management activities may be evident but not visually dominant
13% Partial Ret./Mod.: See above and below descriptions.
19% Modification: Management activities may be dominant but must borrow line, form, color, and texture from the surrounding landscape.

A more complete description of these standards and planning processes can be found in National Forest Landscape Management (USDA Forest Service 1974), The Visual Management System (1974) and the recent Forest Service draft document Landscape Aesthetics, a Handbook for scenery Management (USDA Forest Service 1993a). Some of the other interagency tools used for conducting inventories and establishing scenery standards include; variety class maps, sensitivity ratings and seen-area maps. Details pertaining to all of these are available in the planning record.

The 1990 Record of Decision for the Forest Plan acknowledged the potential for creation of the Monument, and directed that the lands in question be managed in a way the would protect the values important to its establishment (including scenic quality).

Characteristic and Conditions
(Existing Direction)

The following summary highlights the expected future condition of NNVM, according to the existing management direction in the Forest Plan. It can be used as a basis for comparison for the effects discussion in Chapter 4 Scenery. It describes only those vegetation communities that are typically "managed;" these include ponderosa pine, lodgepole pine and mixed conifer. Scenic condition would be expected to be consistent with the VQO standards.

PONDEROSA PINE: Under the existing Forest Plan, ponderosa pine forests along major roads, trails, and river viewsheds are managed to promote park-like old growth. Older, yellow-barked trees are featured, with stands of younger trees adding depth and diversity. Old-growth characteristics will be evident in fifty years but insignificant in a ten-year time frame. Travelway viewsheds in areas where wildlife objectives are a priority exhibit similar characteristics as described above; however, denser stands and multiple-layered canopies are more common.

Views of ponderosa pine from key viewpoints/vistas will consist of few individual large trees with full crowns amid stands of uneven-aged younger trees. Natural-appearing openings ranging from 1/4 to 20 acres exist, exposing rock outcroppings and openings resulting from recent management activities. Recreation and interpretive sites will be noticeable to the forest visitor but remain subordinate in the landscape. Areas managed for wildlife objectives will exhibit the above characteristics; however, openings will be smaller and stand densities higher. Research Natural Areas seen from key viewpoints/vistas may be perceived as pockets of differing textural quality as natural processes affect these areas. Encroaching lodgepole pine, insects, aging of trees, and potential future wildfires will contribute to the textural changes. Old-growth ponderosa pine sites are expected to have more two-storied stands as older trees die and replacement occurs, generally complementing the character of views seen from key viewpoints/vistas. Screening of facilities and openings created to enhance views will appear natural.

LODGEPOLE PINE: Lodgepole pine forests along major road, trail, and river corridors will consist of even-aged stands with natural-appearing openings. Age classes will vary among stands, and younger-aged stands are common. Species diversity will increase with the addition of ponderosa pine, and the forest floor will be commonly open and park-like with ground litter, shrubs and grasses providing additional variety. Evidence of any management activities will not be visible.

Views of lodgepole pine forest from key viewpoints/vistas will reveal a consistent and uniform texture of canopy closure with openings of younger stands. Openings may range from 3 to 40 acres, although larger openings are likely to exist due to beetle kill. Species diversity will increase and ponderosa pine will be more common. Wildlife, recreation, and interpretive objectives will be met, yet remain subordinate in the landscape. Old-growth lodgepole pine is expected to experience some mortality from beetle kill in a ten-year time span. Numerous trees are expected to fall, leaving patches or openings in the canopy where younger lodgepole pines

will fill in. Long-term conditions favor stand replacement fires and serve to continue the mosaic character. Screening of facilities and openings created to enhance views will appear natural.

MIXED CONIFER: Mixed conifer forests along major road, trail, and river viewsheds will be characterized by visually dense growth and natural-appearing openings. Old-growth characteristics will be evident. Openings of 1/4 to 5 acres will exist and species diversity will have increased, including ponderosa pine, aspen, currant and western larch, offering new textures and colors.

Views of mixed conifer forest from key viewpoints/vistas will reveal a continuous canopy with patches of natural-appearing openings composed of young trees, accented with scattered older trees. Snags are evident and diversity is enhanced with ponderosa pine, aspen, and currant. Management activities are subordinate to the landscape. Recreation and interpretive developments may be noticeable, yet are not dominant in the landscape. Screening of facilities and openings created to enhance views appear natural.

Natural Disturbance Cycles

Insect infestations have affected and will continue to affect both ponderosa and lodgepole pine. In affected stands, many of the trees appear stressed or dead, changing from green to yellow, rust and grey. The textural qualities in pandora moth-infested ponderosa pines change from large fluffy branches, to tight, constricted needles concentrated at the ends of branches. Most of the current and future mortality in the lodgepole pine is expected to be due to the mountain pine beetle. These areas generally appear grey and create a green/grey mosaic in the forest canopy.

One half of the forested vegetation in the Monument currently has little to no mortality (0-10%), 27% has a low (11-25% incidence of mortality), 14% has moderate (26-55% incidence), and 9% has high levels (over 55% incidence). (See Forest Mortality map, in packet.). The lodgepole community has the highest percentage of areas with mortality, followed by mixed ponderosa/lodgepole communities. Ponderosa pine communities have relatively little mortality.

Areas where recent wildfire activity has occurred are typically small and not readily evident, with one key exception. To the east of the caldera and only slightly within the Monument boundary, the 1988 Paulina Fire has transformed the predominately lodgepole forest into expanses of dense, upright, standing grey and black trunks. Wildfire suppression has affected and will continue to affect most of the vegetation in the Monument. Fire suppression typically alters the vegetation composition. However, its effect is not readily evident to the casual observer, as most of the vegetation appears healthy and diverse. A chart of recent activities and Mortality is located in Chapter 4, Scenery.

13. Law Enforcement

The Forest Service, Deschutes County Sheriff, and Oregon State Police all have law enforcement authority and responsibility in the Monument. Public safety is the primary responsibility of the Sheriff and State Police. The Forest Service has the primary responsibility to protect the natural resources, public property, and public employees.

The Forest Service coordinates closely with these other agencies to ensure that adequate resources are provided to meet a reasonable level of public safety. The Forest Service will also provide regular patrols by Law Enforcement Officers in the Monument. The Forest Service intends to assign a Law Enforcement Officer to the Monument 50% of a person year as use in the area increases. This will provide adequate assurance of quality protection to the public and government interests.

In addition to this Law Enforcement Officer presence, non-enforcement personnel will be assigned to provide public awareness and education toward appropriate behavior and activities in the Monument. Prevention will be everyone's primary objective. A strong Forest Service presence will have both the smiling interpreter with helpful information -- and the strict Law Enforcement Officer.

14. Local Communities

See Ecological Overview in Introduction to this chapter. See also Chapter 4 for effects of the alternatives on local communities.

15. American Indian Involvement

Background

Historically, American Indians have used some parts of the lands within what is now the Monument for at least 10,000 years. It is the policy of the United States to protect and preserve the American Indians' inherent right of freedom to believe, express and exercise their traditional religions as an individual right and interest (Public Law 95-41 (92 Stat. 469) American Indian Religious Freedom Act 1978).

Several Indian bands or Tribes have used the lands that are now within the Newberry National Volcanic Monument. Based on the information we know to date, this land was used in common for at least the last 1,000 years by descendants of the Northern Paiute, Klamath, Tenino, Molalla, Cayuse, Nez Perce, Umatilla, and Warm Springs Tribes. In the mid-1800's resource competition, disease, and continuing conflicts resulted in a United States policy to make treaties with Indian tribes. A series of Indian wars in Oregon in the 1800's ended many of the armed conflicts and brought most American Indians to reservations by the end of the century.

Current Situation

Consultation with the Confederated Tribes of the Warm Springs Reservation of Oregon, Burns Paiute Tribe, and the Klamath Tribes and the current cultural resource inventory have so far concentrated on historic and cultural archaeological properties and have yet to identify continuing religious practices or current traditional uses within Newberry National Volcanic Monument.

A review to assess any existing Treaty Reserved rights within the Monument was made pursuant to consultation with affected parties. No reserved Treaty rights exist within Newberry National Volcanic Monument. However, the Forest Service does have a responsibility to consult with American Indian Tribes on all projects that have the potential to affect cultural resources within NNVM.

The Klamath Tribes were reinstated in 1978 as a Federally recognized Tribe with certain rights and privileges including restoration of the Federal trusteeship with the Tribal governing body on former reservation lands. The Klamath Tribes now share management responsibility with the State of Oregon Department of Fish and Game for hunting mule deer and other wildlife species within the former reservation boundaries (see the Executive Order of 1901 and the Termination Act of 1954) which does not include any lands within Newberry National Volcanic Monument.

The Tribes of the Middle Oregon Treaty of 1855 involved the American Indians we know as the Confederated Tribes of the Warm Springs Reservation of Oregon. This Treaty remains in effect, however all lands within the Monument are south of those described within the Treaty as "ceded" lands.

The 1978 Court of Claims, Indian Claims Commission, judicially established land area map shows insufficient data regarding aboriginal title to lands within the Monument. The ceded land principle applied by this Court was that a Tribe could not file claims against nor "cede lands" to the United States for which there was no Indian title.

Trends

The United States Forest Service policy (FSM 1563) and the American Indian Religious Freedom Act provides that the setting and location of sites once important for religious purposes be protected from disturbance and available for use by American Indians. The Deschutes National Forest and Newberry National Volcanic Monument personnel will continue to cooperate with the Confederated Tribes of the Warm Springs Reservation of Oregon, the Klamath Tribes, and the Burns Paiute Tribe in identifying and maintaining traditional uses of the lands within the Monument, per the American Indian Religious Freedom Act and Section 106 of the National Historic Preservation Act. If any sites important for religious purposes are discovered, their setting and location may be protected from disturbance and made available for their use; consistent with our regulatory procedures and Federal Law.

16. Special Uses

Utility right-of-ways

Four entities all have right-of ways through the Monument, as guaranteed in the Monument legislation (Public Law 101-522). The corridors are generally between two to eight miles long and 10 to 120 feet wide.

Bonneville Power Administration - powerline.
Midstate Electric Cooperative - powerlines.
US West Communications - telephone lines.
Pacific Gas Transmission - gas pipeline.

The Congressional report accompanying the passage of Monument legislation (Public Law 101-522) indicated that the Monument Plan should "Specify the criteria to be evaluated to accommodate the....potential expansion of these corridors..."

Any future expansion of utility lines or facilities within the existing rights-of-way would be subjected to a site-specific NEPA analysis. Among the criteria used to evaluate any expansion would be:

- A justification that the proposed expansion was necessary for human health and safety,
- Assurances and provisions that the new facilities could be easily maintained with a minimum of environmental damage.
- Consistency with Monument goals and values.

More information is in the Monument Plan Standards and Guidelines.

State of Oregon Department of Transportation

The State of Oregon Department of Transportation has an easement adjacent to Highway 97 and a small weather station installed near Lava Butte.

Central Oregon Irrigation

Central Oregon Irrigation District has a special use permit for four dikes on the east side of the Deschutes River near Benham Falls. These were built in the late 1960's to prevent the loss of water from overflow in the Deschutes River. The levees or dikes prevent overflow water from spilling out into the small ponds adjacent to the river.

Oregon State Water Resources Department

The Oregon State Water Resources Department has a gauging station on the Deschutes River near Benham Falls, and a precipitation gauge near Paulina Lake.

Oregon Department of Fish and Wildlife

ODFW operates a fish weir at the outlet of Paulina Lake. They use this weir to allow water to go down Paulina Creek, but keep fish in the lake. The kokanee spawn in this area, and their eggs supply hatcheries throughout the Northwest.

Kellems, Taylor Water Rights

The Kellems estate and the Taylor property have water and irrigation rights to parts of Paulina Lake and Paulina Creek. These rights were consolidated and established between 1899

and 1909. They give these landowners the right to 3,780 acre-feet of Paulina Lake, equal to about the top three feet of the lake. The landowners control the amount of this irrigation water by a small dam at the outlet of Paulina Lake. The water coming out of Paulina Lake at the dam is adjusted six to eight times per year, usually in summer and fall, and has minimal impact on recreational use of Paulina Lake, according to Bob Main, Deschutes County Watermaster.

East Lake Resort & Paulina Lake Lodge

John and Leslie Hofferd own and operate East Lake Resort, which has a restaurant, store, 12 guest cabins, boat rentals, and a small RV park. The East Lake permit is for 11.4 acres. The Hofferds also own and operate Paulina Lake Resort, which has about a dozen guest cabins, a restaurant, boat rentals, and a small store. The Paulina Lake permit is for 16.2 acres.

Snowmobile outfitter guide

Bill's Bobcat Service, run by Bill Baker, offers snowmobile tours and rents snowmobiles to visitors during the winter in the crater. In 1991, he served 219 people; in 1992, he served 477 people.

Fishing guides

A few guides have special use permits to fish Paulina and East Lakes. They include:

Todd VanderZwiep
Bigfoot Guide Service - Craig Vaage
Central Oregon Guide Service - Ken Jones
Garrison's Guide Service - John Garrison
Sunriver Guides and Outfitters, Ltd. - Bruce Bischof
Whitewater and Wild Fish - Craig Lacy
Mickey Finn Guide Service - Pat Schatz.

Traditionally, most of the fishing at Paulina and East is done by people on their own. In the last three years however, the demand for fishing guides has increased.

Lava Butte shuttle bus

A private company contracts to run a shuttle bus to the top of Lava Butte during the summer season (Memorial Day to Labor Day). A small fee is charged. Gayle Lowe had the special use permit for the 1993 season.

Lava River Cave

A concessionaire rents lanterns and staffs an information booth for summer visitors to Lava River Cave. A small fee is charged and lanterns are rented to visitors under the special use permit. The season runs mid-May to end of September. Dan Sisson has had this special use permit for the past few years.

Chief Paulina Horse Endurance Ride

Each year a horse endurance ride is held in the Monument, with up to 100 riders going on a long trail ride through some of the backcountry areas in and around the Monument. This is usually a two-day event.

Burlington Northern Railroad

The railroad has a right-of-way through the Monument near Benham Falls.

Recreation Residences

These six residences are located along the south shore of Paulina Lake. They are permitted under the Forest Service summer home special uses authority.

US Geologic Survey - seismograph on Red Hill

This is part of a network of seismographs that are monitoring the Cascades throughout Washington, Oregon and northern California.

Permit to be issued

The US Geologic Survey is seeking special use permits for three water gauging stations located on Paulina Lake, Paulina Creek, and East Lake.

FAA requirements

An existing FAA regulation requests that all pilots maintain an altitude of at least 2,000 feet above all national parks and monuments. This does not apply to firefighting efforts or emergency landings.

Trends

The demand for special use permits in the Monument is growing. The areas with the most demand are snowmobiling in winter and fishing and sightseeing in summer. Summer home owners in general like the present system of Forest Service management, and do not seek big changes. Paulina Lake Resort was sold to the Hofferds in 1993.

The Forest Service may have to place limits on the number of special use permits (number of people, days) to preserve a quality recreational experience.

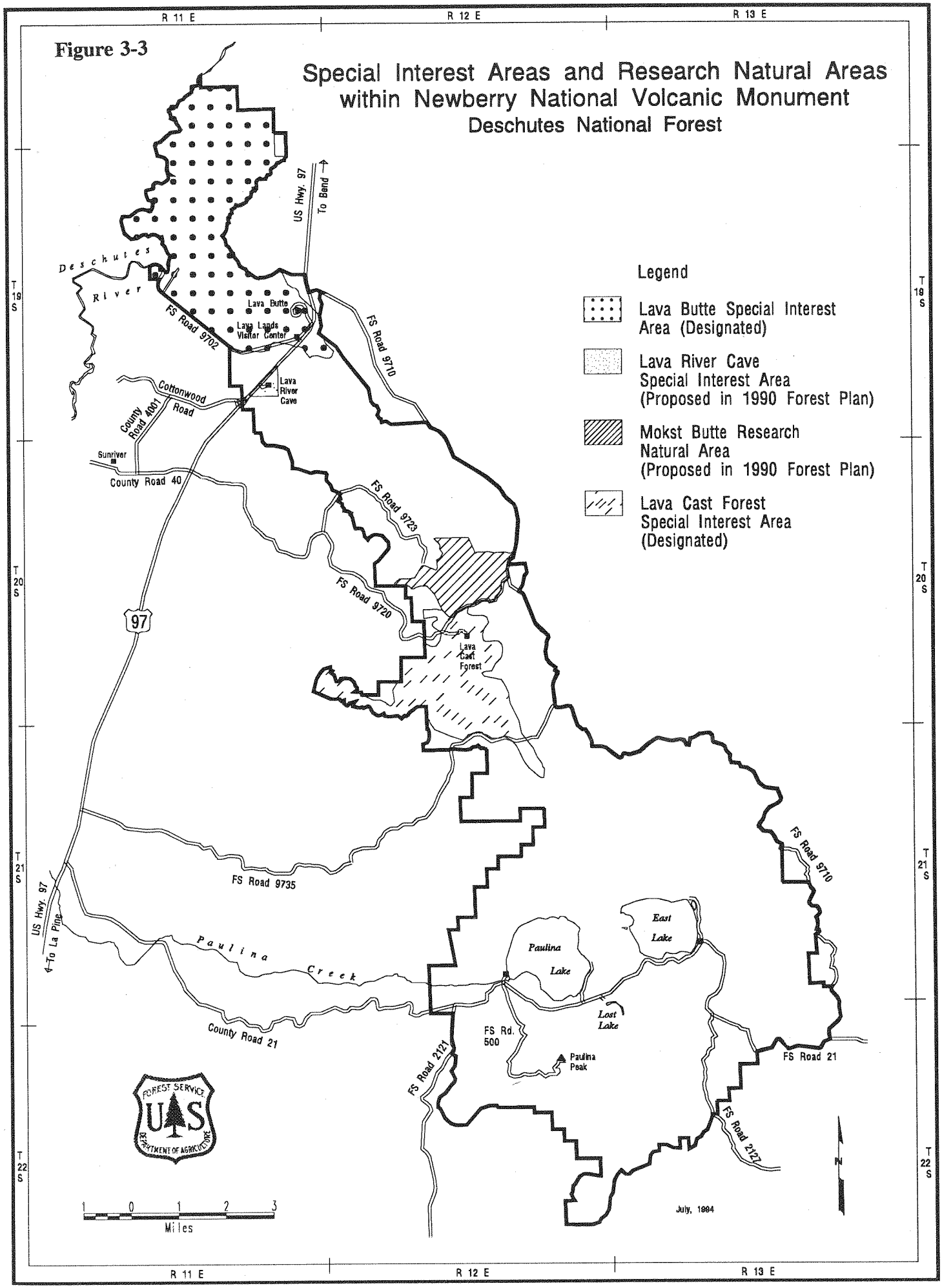
Land Status

Land Ownership

Newberry National Volcanic Monument encompasses about 50,800 acres, and the Special Management Area and Transferal Areas adjacent to the Monument include an additional 8,800 acres. These lands fall under the jurisdiction of the United States Department of Agriculture (USDA) Forest Service, with minor exceptions. The State of Oregon owns one parcel of 600 acres within the Monument, and LPP Limited Partnership owns 160 acres in the caldera. Efforts are underway to bring these parcels under Forest Service management through mutually agreeable exchanges. The Great Northern Railway also owns a small corridor for its tracks in the northern part of the Monument.

The Monument encompasses and includes two other areas that were referenced in the 1990 Forest Plan and managed by the Forest Service: the Lava Butte and Lava Cast Forest Special Interest Areas.

Figure 3-3


Special Interest Areas and Research Natural Areas
within Newberry National Volcanic Monument
Deschutes National Forest
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
Legend
Lava Butte Special Interest Area (Designated)
Lava River Cave Special Interest Area (Proposed in 1990 Forest Plan)
Mokst Butte Research Natural Area (Proposed in 1990 Forest Plan)
Lava Cast Forest Special Interest Area (Designated)
US Hwy. 97
To Bend
Deschutes River
FS Road 9702
Lava Butte
Lava Lands Visitor Center
FS Road 9710
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
FS Road 9723
FS Road 9720
97
Lava Cast Forest
FS Road 9735
US Hwy. 97
To La Pine
Paulina Creek
County Road 21
FS Road 9710
East Lake
Paulina Lake
Lost Lake
FS Rd. 500
Paulina Peak
FS Road 2121
FS Road 21
FS Road 2127
FOREST SERVICE
US DEPARTMENT OF AGRICULTURE
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July, 1994

Mokst Butte Research Natural Area

The Mokst Butte Research Natural Area (proposed in the 1990 Forest Plan) is located near the center of NNVM. It contains about 1,250 acres, mostly lodgepole pine, ponderosa pine, and white fir. Mokst Butte rises 500 feet above the surrounding landscape, and is an excellent example of a forested cinder cone. Research Natural Areas are lands designated to preserve representative examples of particular ecosystem types. The area is geologically diverse, with a number of other cinder cones and lava flows nearby, and is has good examples of Mazama ash soils and deposits.

Roadless Areas

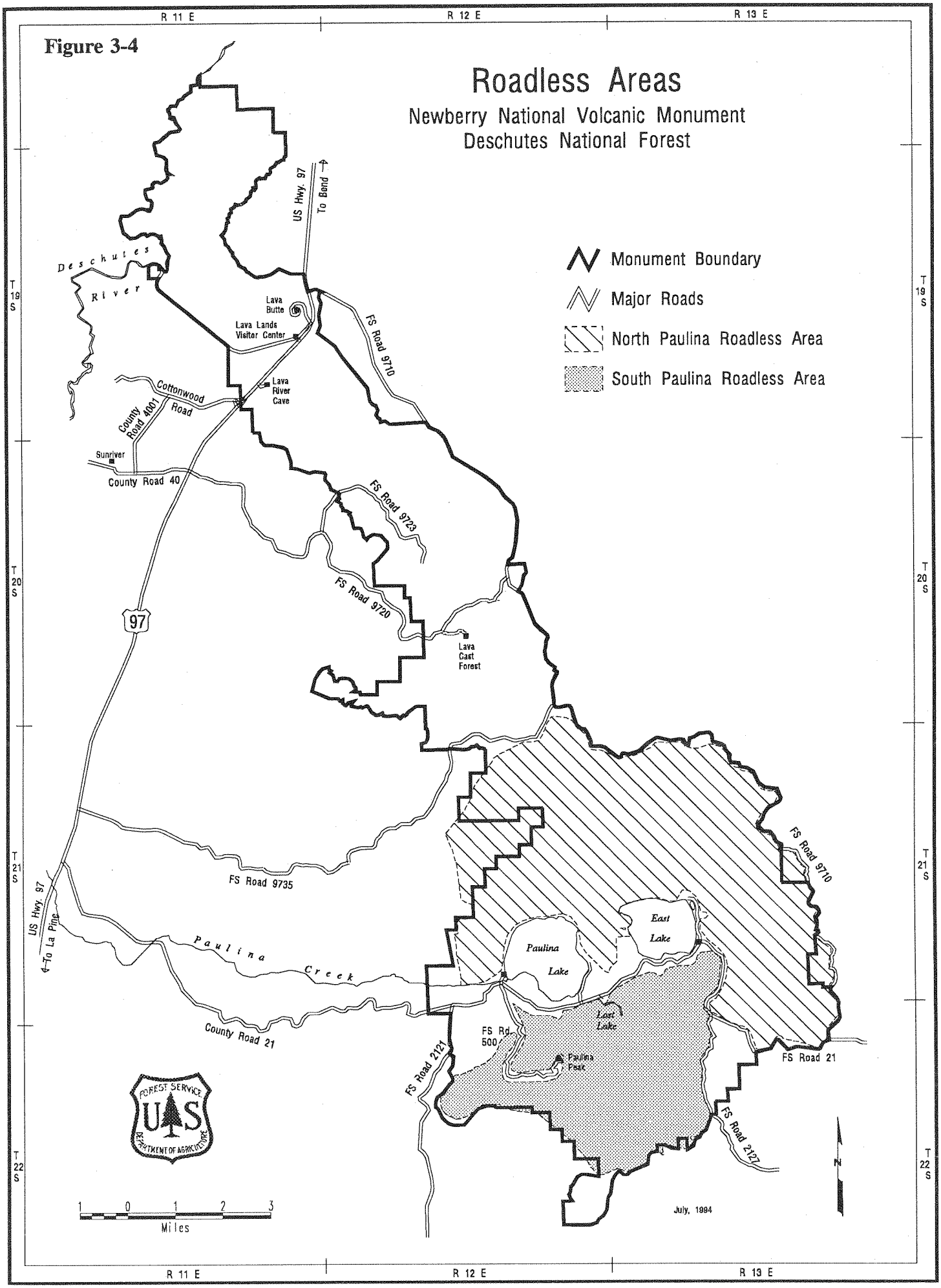
Background and Current Situation

The North and South Paulina Roadless Areas form two crescents surrounding Newberry Caldera. The North Paulina Roadless Area contains about 22,000 acres, and the South Paulina Roadless Area encompasses about 10,000 acres. Both of these areas were considered for formal wilderness designation during the Roadless Area Review and Evaluation (RARE II) process in the 1980's. They were not included in formal wilderness designation. They were allocated to various management area emphases in the 1990 Forest Plan, including Scenic Views, old Growth, Bald Eagle Management, Dispersed Recreation, and Intensive Recreation. The Record of Decision for the 1990 Deschutes Forest Plan deferred any scheduled timber harvest in the Roadless areas for the next decade; firewood cutting and geothermal exploration are both mentioned as activities which could occur. The North and South Paulina Roadless areas were absorbed into Newberry National Volcanic Monument with Monument legislation in 1990 (see map).

The North Paulina Roadless Area stretches from inside the caldera between the lakes north up to the rim of caldera, and then down the flanks of Newberry Volcano toward Lava Cast Forest, ending south of Road 9735. The area includes a number of cinder cones, buttes and lava flows. The plant communities here include lodgepole pine, mountain hemlock and mixed conifer, with the majority of the area (about 85%) being in lodgepole pine. A large part of this lodgepole forest is mature or old (lodgepole pine has an average life span of 80-100 years in Central Oregon and trees are considered old when they reach this age). Many of these large old trees are dead, or dying, from recent mountain pine beetle attacks. Fires have been suppressed here for most of this century, allowing the build-up of dead vegetation and aging of trees. At the north end of the roadless area, descending the flanks of the volcano toward Lava Cast Forest, some stands of mixed conifers and ponderosa pine appear.

There are about 15 miles of recreational trail within the North Paulina Roadless Area. The principal trails are the Newberry Crater Rim Trail (#57), the trail connecting East Lake to the rim (#58), and the Swamp Wells Trail heading north from the rim (#61). Recreational use is moderate. Some hiking, horseback riding, mountain biking, and backcountry exploring occur in the summer; a handful of hunters come to the area in the fall; and snowmobiling is popular in the winter.

Figure 3-4


Roadless Areas
Newberry National Volcanic Monument
Deschutes National Forest
Monument Boundary
Major Roads
North Paulina Roadless Area
South Paulina Roadless Area
R 11 E
R 12 E
R 13 E
T 19 S
T 20 S
T 21 S
T 22 S
US Hwy. 97
To Bend
Deschutes River
Lava Butte
Lava Lands Visitor Center
Lava River Cave
Cottonwood Road
County Road 4001
Sunriver
County Road 40
FS Road 9710
FS Road 9723
FS Road 9720
Lava Cast Forest
97
FS Road 9735
US Hwy. 97
To La Pine
Paulina Creek
County Road 21
FS Road 2121
FS Rd. 500
Paulina Peak
East Lake
Paulina Lake
Little Lake
FS Road 21
FS Road 2127
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Most of the wildlife in this roadless area is associated with the "late successional" (mature) lodgepole forests. Species include American marten, mule deer, a few elk, black bear, black-backed woodpeckers, goshawks, and a variety of other birds and small mammals. A pair of bald eagles nest on the north shore of East Lake, in a designated Bald Eagle Management Area within the roadless area.

The North Paulina Roadless Area has a number of attributes and resources. It has interesting geologic features, and from a few high points, offers outstanding views across to the high Cascade mountains. The area has natural integrity in that it has not had much human impact (except fire suppression) in the last 50 years or so. It provides good habitat for wildlife species that are especially sensitive to human disturbance, and moderate opportunities for solitude and semi-primitive recreation experiences.

The South Paulina Roadless Area,(about 10,000 acres) forms another crescent south of the caldera. The north part of this roadless area is adjacent to an area of developed recreational use, including a number of popular day use areas in the caldera, such as The Big Obsidian Flow and Paulina Peak. This roadless area also includes mostly lodgepole pine forests, with some mountain hemlock and mixed conifer communities present as well. By percentages, approximately 20 % of this roadless area is unvegetated lava, 40% is lodgepole pine, 20% percent is mountain hemlock, and 20% is mixed conifer, including some ponderosa pine. Like the northern roadless area, a large part of the lodgepole forest is mature or old. A recent mountain pine beetle epidemic has killed many trees in this area. Fires have been suppressed here for most of this century, allowing the build-up of vegetation and the aging of trees.

There are about 17 miles of recreational trail within the South Paulina Roadless Area. The principal trails are the Newberry Crater Rim Trail (#57), and two trails running from the floor of the caldera to the rim -- one to Paulina Peak, and one just east of the Big Obsidian Flow. Recreational use is moderate, similar to the North Paulina Roadless Area. However, the proximity of this area to developed day use sites means that more visitors will "spill over" into parts of the roadless area for recreation.

Most of the wildlife in this roadless area is associated with the "late successional" (mature) lodgepole forests. Species are generally the same as the North Paulina Roadless Area, with some exceptions. No known bald eagles nests are located in the southern area; however peregrine falcons have been observed soaring near Paulina Peak on a few occasions. Deer, elk, ground squirrels, American marten, black bear, and a variety of birds are the principal species of observed wildlife in this area.

This roadless area also has a number of attributes and resources. It has unique geologic features, including part of the Big Obsidian Flow, and outstanding scenery. The view along Paulina Peak ridge can only be described as spectacular. On a clear day you can see all along the spine of the Oregon Cascade mountains well into Washington and California. To the south and east, you can look off into the Oregon High Desert, including Fort Rock, site of one of the oldest archaeological finds in North America.

Trends

In the United States, there is a growing demand for recreational opportunities that offer solitude and challenge in settings associated with roadless areas. Many people, of all ages and interests, seek out the kind of experiences that can only be provided away from the sights and sounds of motorized vehicles and other people.

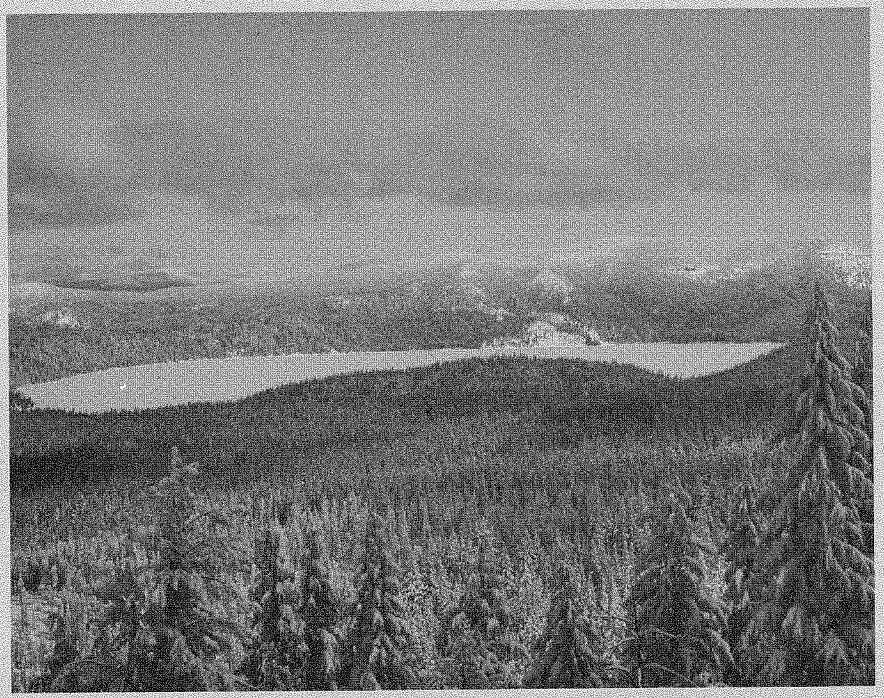
Nationally, as our population grows, there is increasing pressure on the roadless areas that do exist, especially in the lower 48 states. Roadless areas that are somewhat accessible (such as the North and South Paulina Areas) are especially in demand.

These two roadless areas around the caldera presently draw only a handful of visitors in the summer, and somewhat more people in the winter. Most of the use is recreational exploring.

These areas include large stands of lodgepole pine trees, and in many areas, a mountain pine beetle infestation in recent years has left a number of these trees weakened or dead. One of the trends we see in these areas is increasing mortality from this wide-spread insect attack. As these trees die, the fire hazard and the fuel loads in the roadless areas will increase.

CHAPTER FOUR

ENVIRONMENTAL CONSEQUENCES



Changes between Draft and Final

Environmental effects of the new alternative, C-Modified, are analyzed in this chapter, for each of the different resource areas (Recreation, Roads and Non-Recreation Facilities, Vegetation, Fish and Wildlife, etc.). Effects on the North and South Paulina Roadless Areas have been added in a new section called "Land Status."

Updated information on air and water quality, recreational visits, and other key components of the Monument's ecosystems have been added to charts and tables. In some cases, new measures have been included in comparison charts to better display the effects of the various alternatives. As in other chapters, parts of the document have been rewritten and revised for clarity and better understanding.

Introduction

This chapter outlines the environmental consequences of the different alternatives for managing Newberry National Volcanic Monument. The chapter is organized by resources (issues) in the same order as the rest of the document: Recreation, Roads and Facilities, Vegetation, Fire and Fuels, etc.

In order to do a complete analysis of the effects of the various alternatives, the Forest Service interdisciplinary team made some assumptions. These are key components of this chapter, and are listed as part of the description for each resource.

The effects discussed here include direct and indirect effects, effects on other ecosystem components, and mitigation measures. After the discussions of all the issues, there are separate sections on:

- Potential for Cumulative effects;
- Incomplete/Unavailable Information;
- Other environmental effects.

1. Recreation

Direct & Indirect Effects

The direct/indirect effects discussion includes responses to the three key issues identified for recreation during the scoping process; (1) Opportunities/Activities, (2) Experience, and (3) Access.

Each alternative varies the type, amount, and location of the different recreational opportunities. This discussion compares the Recreation Opportunity Spectrum (ROS) classifications; illustrates the mixtures of ROS classes by management zone, and compares the potential for recreation activities.

1. Opportunities/Activities

Each of the action alternatives provides a range of recreational opportunities including Rural (R), Roaded Natural (RN), Semi-Primitive Motorized (SPM) and Semi-Primitive Non-Motorized (SPNM)(see descriptions in Chapter 3, Recreation).

The following tables and illustrate the different ROS proportions for the Monument as a whole, and by management zone. Some of the key points include:

* Roaded Modified occurs only in the no-action.
* Rural occurs in less than two percent in all alternatives.
* In all alternatives large portions of SPNM change to become SPM allocations in the winter.
* Portions of all SPNM areas in all action alternatives will not technically be able to provide (reliably) an SPNM experience. These areas include a 1/2 mile buffer around

the peripheral roads (for example Road 9710) adjacent to designated routes 2127 and 21 and near East Lake. These areas are allocated as SPNM and will function as internal buffering areas within the Monument.

* In all alternatives, the SPNM area near the river is zoned for non-motorized use year round. The SPNM areas elsewhere in the Monument convert to motorized activities in the winter (see ROS maps - winter).
* The Transition Zone has the most differences comparing the alternatives.
* Roaded Natural Non-Motorized is included with (RN) for comparison charts (see ROS Table 3-3), and is only in Alternative A.
* Alternative B is the only alternative with SPM in the summer. This area provides opportunities for primitive road access into semi-primitive settings.

The Effects of Alternatives on Recreation Opportunities (by Zone)

Alternative D is used as the basis for comparison in this section. It is based on the ROS map that was produced in conjunction with the 1990 Deschutes National Forest Land management Plan. Table 4-1 displays the differences between the alternatives, and by Zone. Figure 4-1 displays where the ROS areas occur, by alternative in the summer and winter.

Key points concerning the effects of changes to ROS classes within each zone are listed below. Additional information is available in the planning record.

RIVER ZONE: There would be no change from the existing ROS classification (SPNM) in either Alternatives A, C, or C-Modified; however, the standards would become more restrictive in terms of access. Within the River Zone, construction of trails or facilities would be prohibited. Recreational opportunities would include self-guided, self-discovery experiences within an area of limited access and difficult terrain.

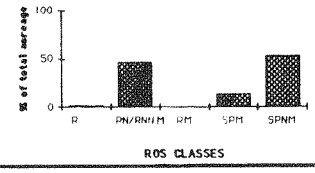
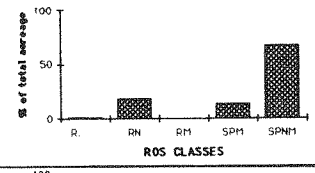
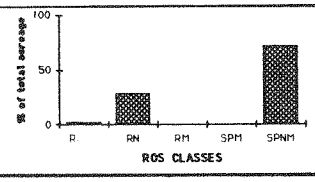
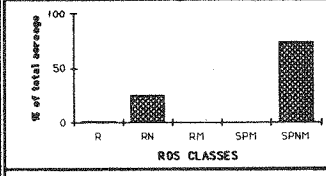
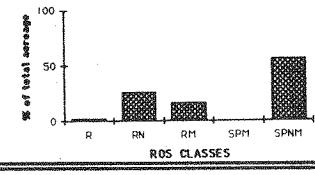
Alternative B would have only a slight change of the existing ROS classes in this zone. (The River Zone occurs in a much larger area in this alternative.) New recreational uses would not be encouraged in this area. New facilities and/or trails would not be consistent, in this area with the exception of managing existing use in order to protect other resources.

LAVA BUTTE ZONE: Alternatives A, C, and C-Modified would both change the existing ROS classification near the Deschutes River (north of Benham Falls day-use area) from SPNM to RN. In alternatives A, C and C-Modified the area (RN) would extend approximately 1 mile, .5 mile, and 1.5 miles (respectively) north along the river.

All alternatives change a portion of the RN area (north of the highway) to an R classification near or encompassing Lava Lands Visitor Center. Alternatives A, C, and C-Modified would allow for opportunities to provide for many new visitors in this zone. This could result in a facility or complex that attracts new people to this area.

Alternative B would provide opportunities for R type development in a small area immediately surrounding Lava Lands. The existing facility size in conjunction with the current recreational growth rate may result in crowded conditions in the near future.

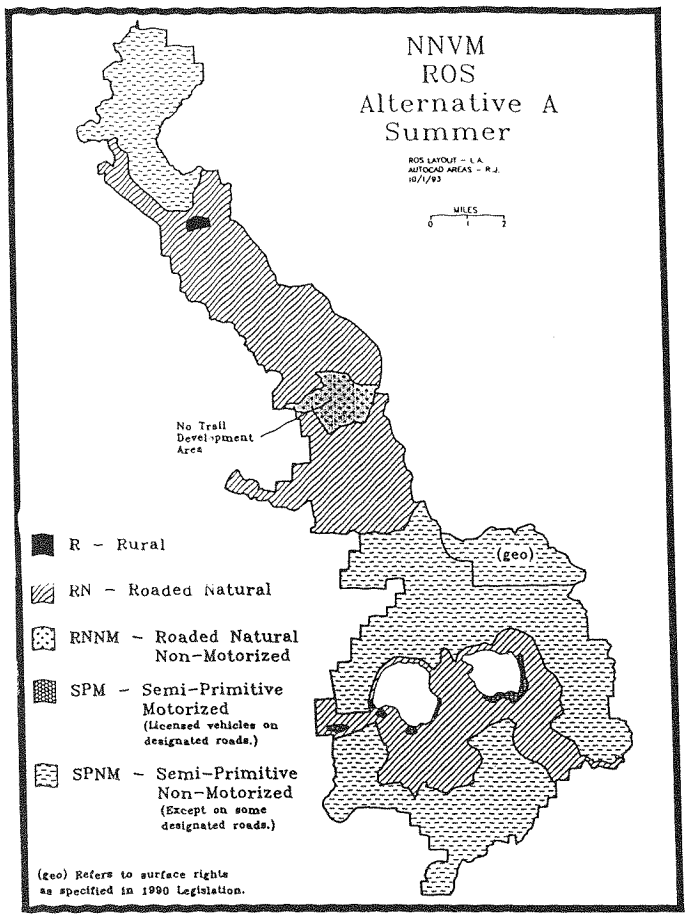
Table 4 - 1 RECREATION OPPORTUNITY SPECTRUM (ROS) DIRECTION
- SUMMER -
COMPARISON BETWEEN ALTERNATIVES

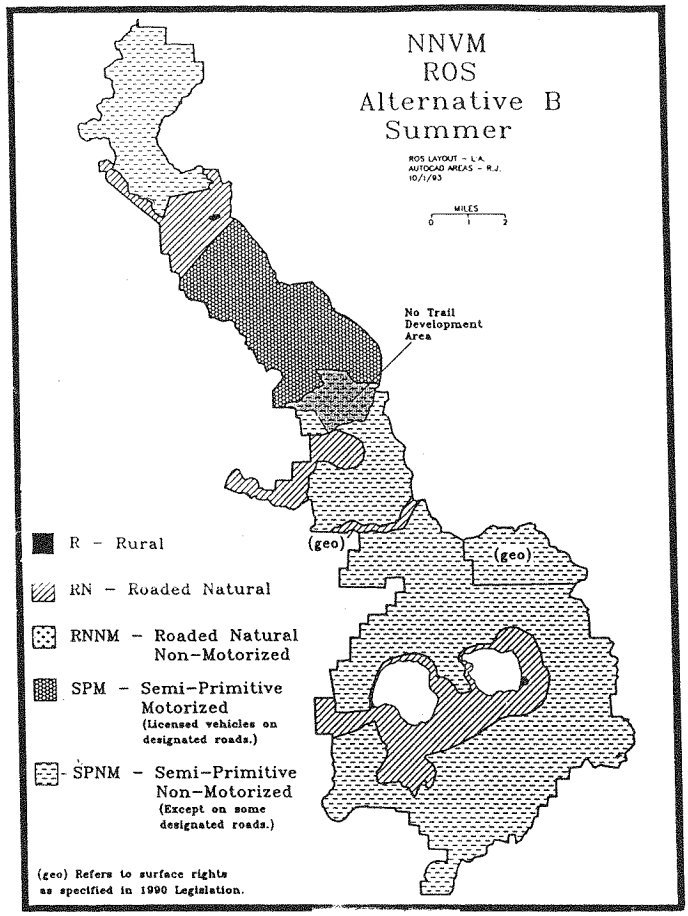
Alternative	Summer ROS	River	Lava Butte	Transition	Flanks	Caldera	NNVM Total
	A R	--	2%	--	--	3%	<1%
	RN	--	62%	100%	--	73%	46%
	SPM	--	--	--	--	-0-	2%
	SPNM	100%	36%	--	100%	24%	53%
	B R	--	1%	--	--	<1%	<1%
	RN	117%	99%	14%	--	56%	19%
	SPM	--	--	50%	--	--	14%
	SPNM	89%	--	36%	100%	44%	67%
	C R	--	2%	--	--	2%	<1%
	RN	--	63%	45%	--	54%	28%
	SPM	--	--	--	--	--	--
	SPNM	100%	35%	55%	100%	44%	72%
	C-Mod R	--	2%	--	--	4%	<1%
	RN	--	72%	58%	--	37%	26%
	SPM	--	--	--	--	--	--
	SPNM	100%	26%	42%	100%	59%	74%
	D R						2%
	RN	N/A	N/A	N/A	N/A	N/A	26%
	RM						17%
	SPNM						56%

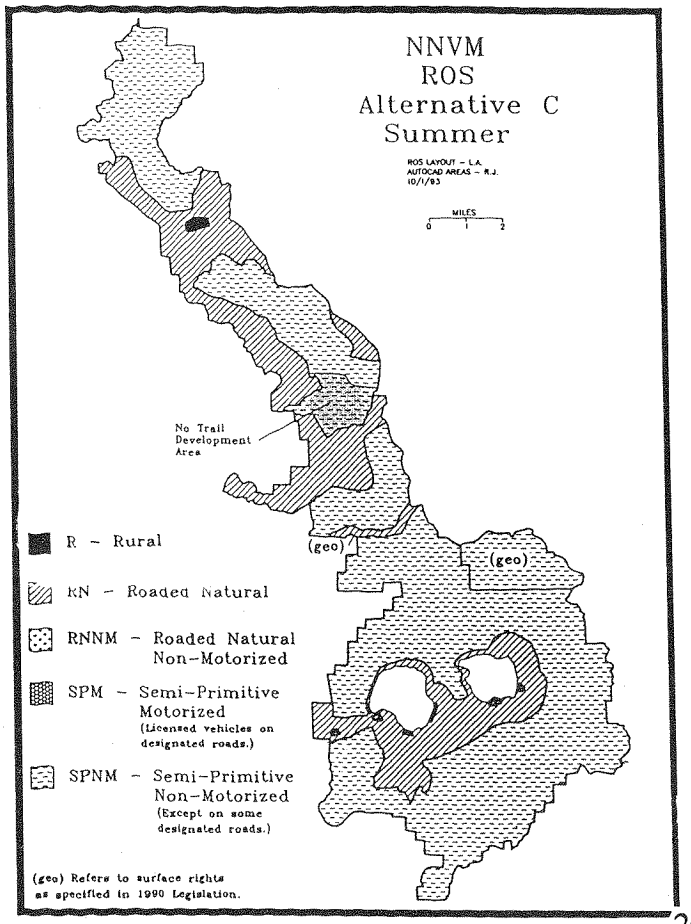
R - Rural
RN - Roaded natural (and roaded natural non-motorized in Alt. A)
SPM - Semi-primitive motorized
SPNM - Semi-primitive non-motorized
RM - Roaded modified
(For detailed description of ROS classes see Recreation in Chapters 2 and 3.)

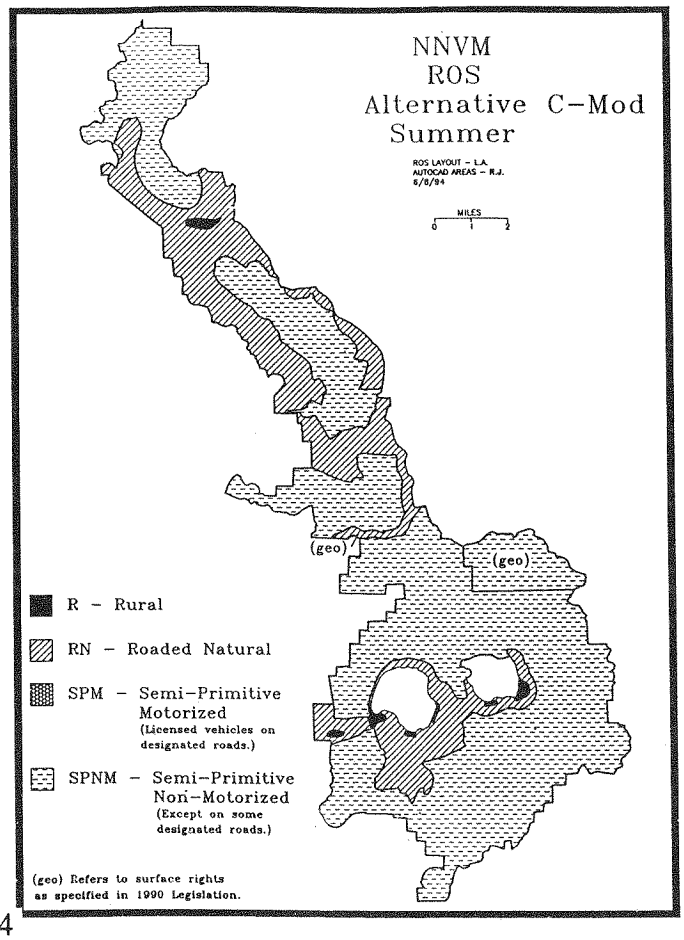
Recreation Opportunity Spectrum (ROS) by Alternative - SUMMER

Figure 4 - 1



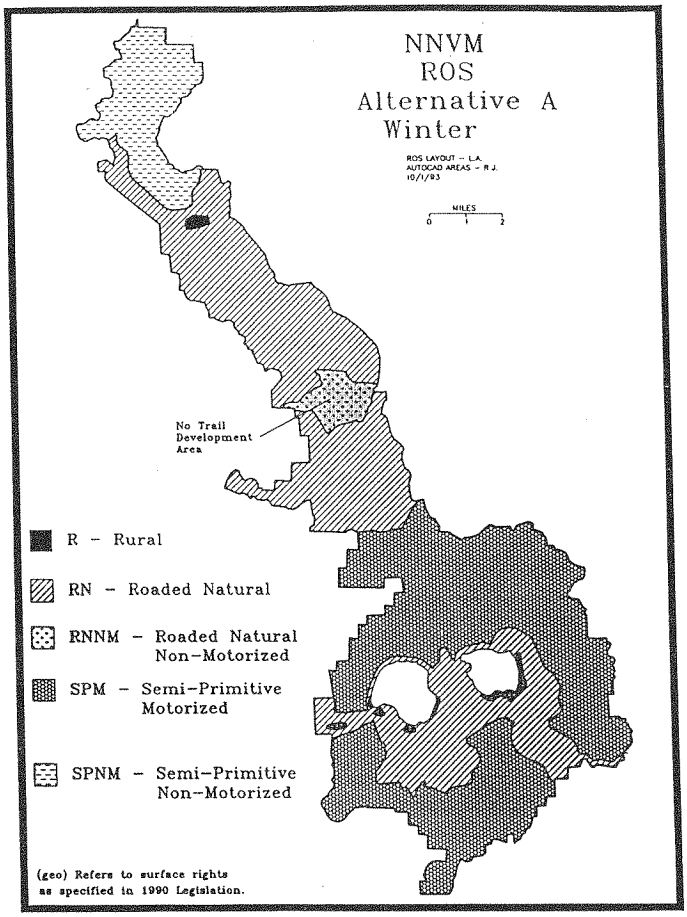


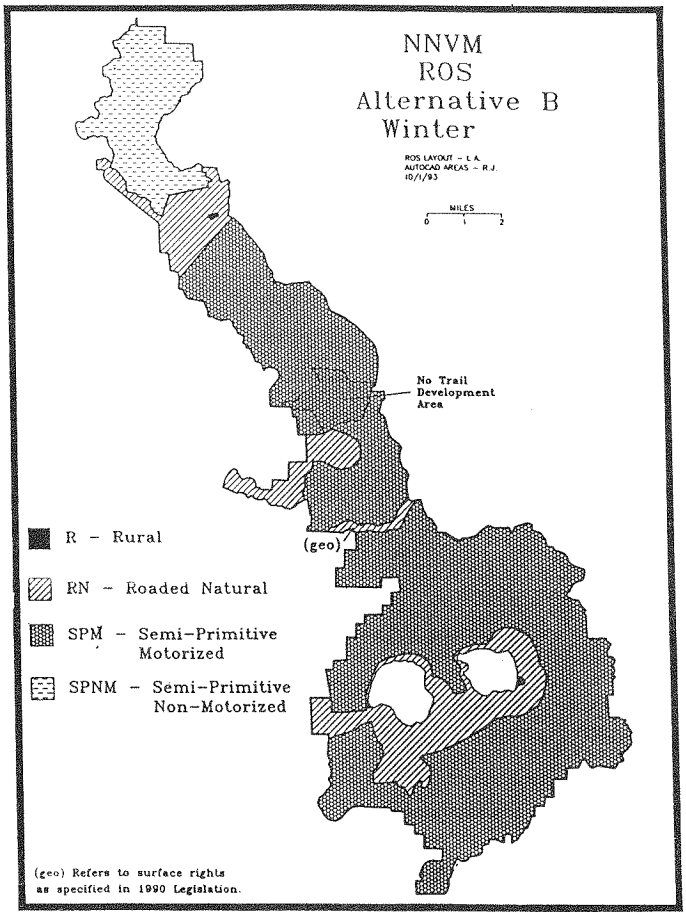


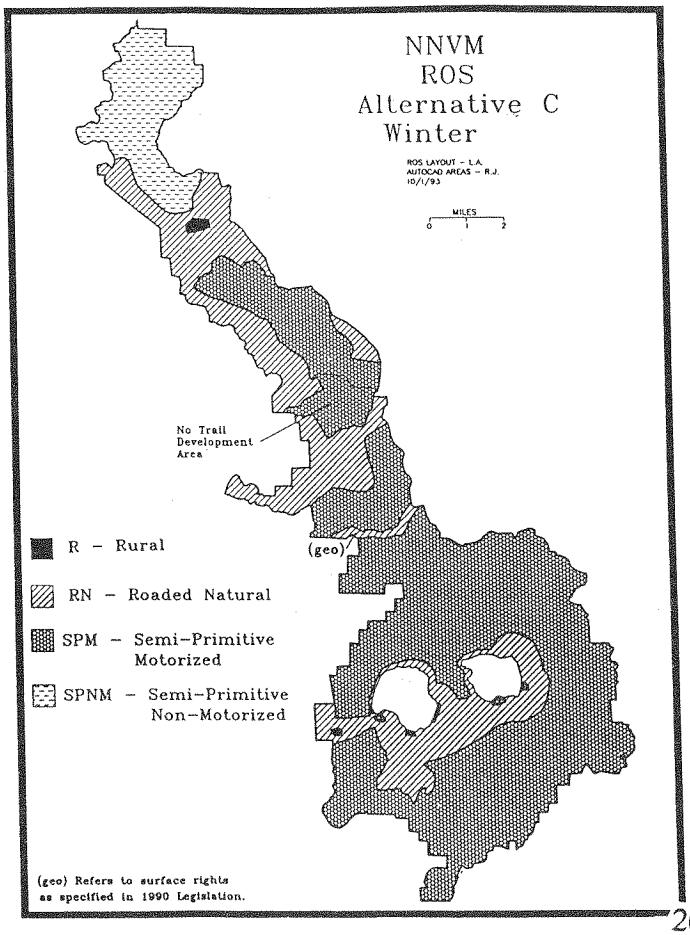


Recreation Opportunity Spectrum (ROS) by Alternative - WINTER

Figure 4 - 1







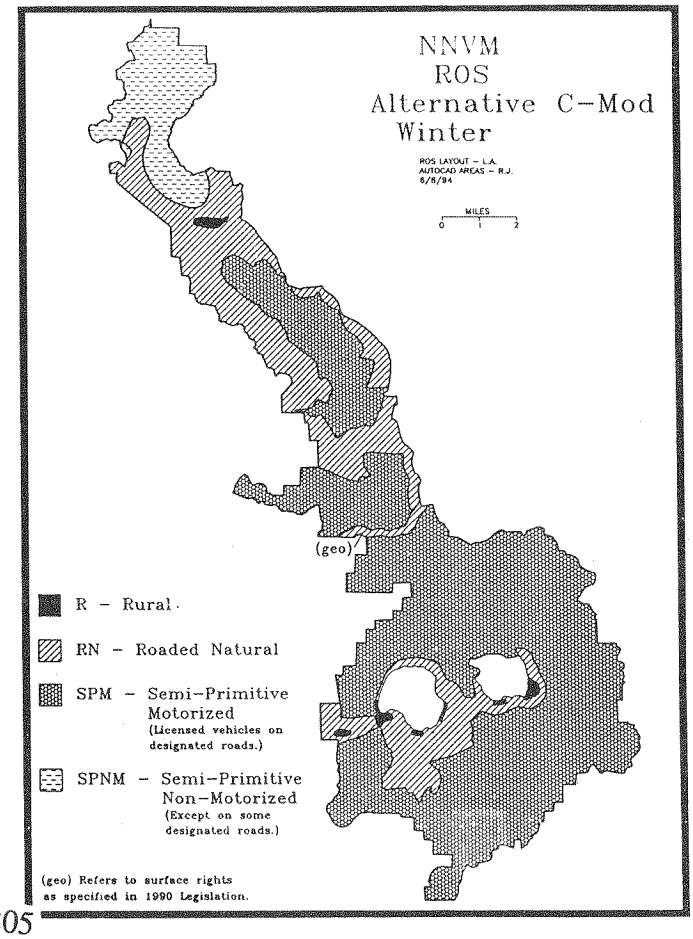
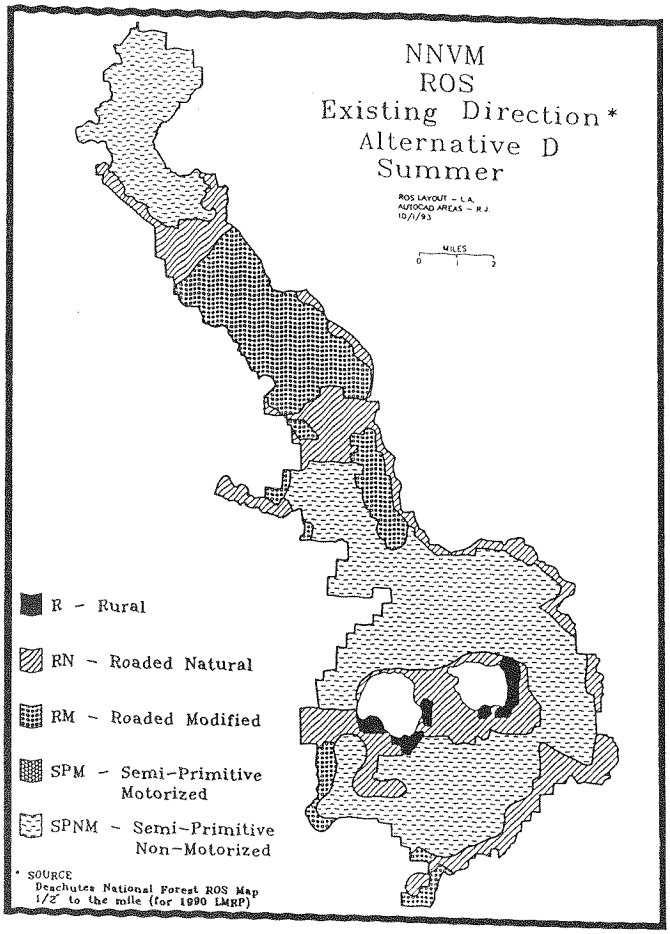


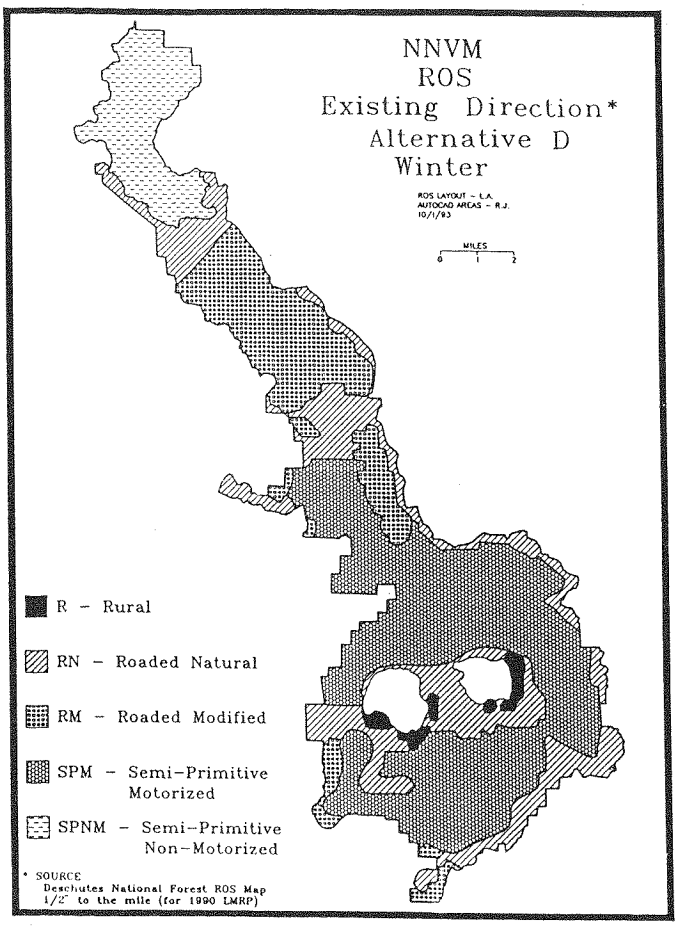
Figure 4 - 1

Recreation Opportunity Spectrum (ROS) by Alternative -

SUMMER



WINTER



TRANSITION ZONE: Alternative A: This alternative is all RN in this zone. Alternative A would increase the potential for both new developed day-use and overnight facilities (currently there are no developed overnight facilities here). This alternative includes the opportunity to develop new scenic travel routes (road and trail) connecting Lava Butte Zone to the Flanks and Caldera Zones. These travel routes could result in more vehicles being directed into and through the caldera. The road could also disperse day use and overnight recreational use throughout the Monument.

A trail spanning the length of the Monument and connecting the different management zones is an opportunity in Alternative A. The trail would pass through this zone and provide non-motorized trail access. This would increase dispersed camping opportunities away from developed areas. Increasing day-use and developed camping could displace current dispersed camping along the edges of the flows. New day-use and overnight developments in this area would likely warrant the provision of water or a well (none currently exists). The addition of water into the area would greatly affect the attractiveness of this area to recreationists and could be an attraction to dispersed campers as well.

The uniform RN allocation in this zone would provide for significantly more visitors than present. This alternative provides for a trail "through access only" corridor for ATV's in this zone. This corridor would result in a designated route across the Monument which might increase the use in that area. Currently there are no motorized trails in this area.

Alternative B: This alternative increases the range of different semi-primitive opportunities in this zone. Opportunities for semi-primitive self-discovery recreation would increase in an area where some roads are open and intended for (licensed) motorized vehicles. Opportunities could include self-discovery interpretive day hikes, discovery packs and other choices at a near-by visitor center. If demand into this area increased too rapidly, use levels might necessitate limiting use in the area in order to achieve the desired SP social encounter goals.

The RN portion towards the center of the zone would provide for increased day-use (facility-based) opportunities in this area and improve access towards the SPNM area adjacent.

A RN band exists over the transferal corridor and could provide an access point to the interesting geologic features in the nearby SPNM Flank Zone to the south.

Alternative C, and C-Modified: The RN areas would allow for more day-use opportunities and closer access to the semi-primitive areas. These alternatives are similar, they both include opportunities to develop a scenic loop route and day-use trail connections between this area and the Lava Butte hub area. Alternative C would establish a new road; C-Modified would use existing routes. This could result in more facility-based, Monument-related opportunities available near the Lava Butte Zone for visitors arriving along highway 97 and could take some of the pressure off the caldera by providing a second hub of recreational opportunities.

Increasing day use in this area could displace or conflict with the existing dispersed camping. This alternative includes the opportunity to develop an overnight campground for use by educational or research groups. This would provide an area for school groups or other interested groups to stay in conjunction with learning more about the Monuments special features. This could result in less pressure in the developed camping areas in the caldera and would add a new type of activity in the Monument. New day-use and overnight developments in this area would likely warrant the provision of water or a well (none currently exists). The addition of water into the area would greatly affect the attractiveness of this area to recreationists

and could be an attraction to dispersed campers as well.

A RN band exists over the transferral corridor and could provide an access point to the interesting geologic features in the nearby SPNM Flank Zone to the south.

The different spatial configuration of C-Modified compared with C is based on consistency with the integrated "Areas of Concern and Opportunity" in Alternative C-Modified.

The Research Natural Area (RNA) has different ROS classes assigned to it in the different alternatives. In order to be consistent with the goals of the RNA, recreation is not to be directed into this area (occasional dispersed use is consistent). Preliminary discussions regarding trail easement through this area have been considered and are a possibility; however, no decision has been made at this point and this is not a decision of this plan. If no easement is approved, trails will need to be routed around this area. Alternatives that include new scenic roads would need to route the road around the RNA. They would go outside of the Monument and either increase pressure to improve scenic quality in "general forest" land management allocations, or not meet visitor expectations. Alternative C-Modified routes its scenic loop on existing roads which travel through extensive general forest. This could have a similar impact (over a larger area). The RNA is not marked "no trail development" on the map because this is addressed in the "Areas of Concern and Opportunity" section of the Plan.

FLANKS: In all action alternatives this zone is entirely zoned as SPNM. There are some areas south of road 21 (approximately 1125 acres) and towards the southern boundary of the Monument would change from RM to SPNM which could result in a decrease in snow play areas.

A portion of all action alternatives are allocated as SPNM (geo). This area reflects the boundary where surface rights for geothermal exploration exist as specified in the 1990 Monument legislation. These areas would be managed as consistent with direction for SPNM unless geothermal exploration is undertaken in this area. It is possible and probable that in all alternatives, should projects be approved in this area, SPNM opportunities would no longer be provided.

In addition to the roads (and lake) mentioned in the key points section (earlier this section), some areas within the Flanks Zone would not reliably provide an SPNM experience due to the potential motorized activities such as helicopters and/or chainsaws that may be used on a few occasions in order to lower fuel hazards (this is applicable for all action alternatives). These activities could also negatively affect the semi-primitive recreational setting if stumps and other human alterations become visible.

Alternative A has a larger GEO area allocated than the existing legislated boundary. This results in extending the boundary where surface activities (road construction) could occur in this alternative. This would decrease the net opportunities for undiscovered, undeveloped, non-motorized activities (should geothermal activities occur). If road access occurred in the GEO area in Alternative A, it could be coordinated with increasing visitor access into this part of the Monument.

Both Alternatives B, C, and C-Modified have the same SPNM (geo) boundary as the legislated surface rights allocation. Although a "stub road" would not be designed in the Flanks Zone for the purpose of recreation access, it could still be considered in this zone if it would mitigate potential adverse impacts to resources such as soils and scenic quality that could result from transportation systems for geothermal exploration in the transferal area (see Roads). In this case, effects to recreation would be the same as in Alternative A. These alternatives allocate the maximum acreage to SPNM designation in this zone and both provide a continuous

area, connected across Road 21. These alternatives change the corridor along Road 21 (on the eastern side of the caldera) from a RN, SPNM combination to a SPNM area. Visitors would not be encouraged to use road 21 beyond East Lake Resort, this would decrease access to The Dome. However, the road would be maintained as an maintenance and emergency access route (it would become a designated motorized route within the SPNM area).

In Alternative B The Dome trail would be eliminated and information about this hiking/ interpretive viewing opportunity would be reduced or eliminated. Visitors would access this area inadvertently through self-discovery and unguided hiking.

In Alternatives C and C-Modified, The Dome trail would be coordinated with SPNM interpretive opportunities. Visitor access into this area would be more directed and guided than at present. This area would become a place to interpret and educate visitors about resource sensitivity and damage (for information on The Dome in Alternative A, see Caldera Zone).

CALDERA ZONE - Caldera Recreation Unit references are made parenthetically throughout this section (see Caldera Recreation Units Maps in Chapter 2).

Alternative A

Alternative A would increase developed day-use and overnight opportunities in the caldera area. Alternative A increases the acreage of RN classification in this zone by converting areas of SPNM (south of the lakes), into RN allocations. The area around the horse camp, and summer homes would change from R to RN.

In all action alternatives, the direction would be to develop "rustic" facilities within this zone in order to help protect the rustic character within the caldera and prevent long-term conversion towards facilities and structures that have a high level of refinement or synthetics in their materials or design. There would be a decline in SPNM (summer) opportunities in this alternative.

In Alternative A expansion and new facility development would attract visitors into the area and create a denser, more crowded environment in the caldera. More people around the lakes would result in more noise travelling across the water and adjacent to developed areas. More boats would be visible on both lakes. Cars would increase in the caldera as a response to increased recreational opportunities and also as a result of the scenic driving route into the caldera. Day-use areas (especially those adjacent to the water) and campgrounds would need to be redesigned in order to accommodate larger numbers of people (many in RV's and/or towing trailers), prevent conflict between near-by overnight guests, and to provide a high quality recreational experience.

Day-use adjacent to both lakes (Lakeside Recreation Unit)

The lakeside area would be managed to accommodate approximately 15-30% more (above 1991 use levels) developed day-use area visitors. This would necessitate facility development, most likely close to the lakes in order to provide boat access. This could mean either developing new water access in undeveloped areas, or moving some of the developed campsites currently located adjacent to the water away from the edge of the lake. New or expanded facilities would be developed to accommodate a size range of boats (see Incomplete Information section) consistent with a 10 mph speed limit. New or improved facilities would likely draw additional boating and fishing use which would result in more boating opportunities in the roaded natural and rural classification, and more boats on the water of both lakes.

Overnight areas (Lakeside Recreation Unit)

The lakeside recreation unit area would be managed to provide 15-30% more (above 1991 use levels) developed general-use overnight camping opportunities (this does not include boat-in, group, or horse camping areas). This could mean either expanding, renovating and putting to use, or developing new campsites or a new campground. In this alternative more people would be able to enjoy camping near or adjacent to the lakes and the camping experience would include a relatively high level of interaction with other visitors. The sights and sounds of other visitors would be obvious, and there may be more evidence of visitor management controls. The overnight boat-in campsites would remain on Paulina lake; however, the degree of remoteness (from present) would likely decline due to increased boating and trail use visitors.

Day-use away from the lakes (Flow Recreation Unit)

In this alternative developed day-use away from the lakes would be managed to provide up to 200% (above 1991 use levels) more developed recreation capacity for visitation. This would necessitate facility expansion and/or new development. This could mean an expansion of the existing day-use areas and some new, currently undeveloped areas would be established. The visitors using the campgrounds and resorts would have a wider range of day time recreational opportunities to choose from and there would be more opportunities for visitors who are visiting the caldera for day use only.

Under Alternative A The Dome trail would be a day-use destination point. Visitation would increase as would on-site facilities and controls. In Alternative A there would be an easement provided for a designated corridor along Road 21 towards the east end of the zone for an ATV "access only" trail. This trail would create legal trail access into the caldera in the summer, in order that ATV users could access East Lake Resort. ATV's would not be permitted to travel off trail; however, the potential for dispersed use would increase. An ATV access route would create legal trail access into the caldera, a use that was restricted by a recreation order in 1987.

(Portal Recreation Unit)

This alternative includes the opportunity to enhance the entry experience and more clearly delineate arrival to Newberry Crater by creating a portal area where the primary function is to greet and orient visitors to the area and direct them to the different opportunities within the caldera. The portal area would likely include a facility (located along road 21 where most visitors arrive at the caldera) which could provide short duration information, interpretation and orientation to the caldera portion of the Monument. This entry area would also provide areas for managing visitor use in the caldera and could be a staging area for public transportation into the caldera (shuttles etc.). By providing information at a check point in this area, it is possible to inform visitors that they are entering the caldera of a volcano (a message that is not currently clear). This could enhance the arrival experience for those not familiar with the local geology. In the summer this facility,in conjunction with the day-use opportunities in the caldera, would bring more day hikers, walkers, and short-term visitors to this area. This portal could also provide for improved winter access, provided the road was plowed to it, and could enhance winter activities in the caldera (especially cross country by providing close-in access to the lakes). Winter facility development would attract more winter recreationists and result in a greater diversity (and more crowded) motorized and non-motorized activities (see recreation access).

(Eagle Recreation Unit)

In Alternative A the eagle management area would remain in the same area as it is now (see wildlife).

(Undeveloped Recreation Unit)

Semi-primitive allocations within the caldera would decrease. Dispersed camping would continue to be allowed in conjunction with designated trail use over a smaller area. This would not apply to the "access only" trails for ATV's.

Alternative B

Alternative B would maintain the developed day-use areas around the lakes to accommodate visitor numbers at the present levels. Alternative B would increase the amount of roaded natural overnight opportunities and would decrease the numbers of overnight visitors in the caldera. ROS classes would remain R, RN, and SPNM. However, all of the Forest Service campgrounds would change from R to RN (resorts stay R).

Day-use adjacent to both lakes (Lakeside Recreation Unit)

The lakeside area would be managed to provide approximately the same number of visitors (as 1991 use levels). Facility renovation would occur and inadvertently attract more use into the area which could lead to limiting visitor access (see Quality of Experience section). In conjunction with renovation of facilities, some day-use areas could be relocated to accommodate other management goals (such as improving scenic quality or enhancing riparian habitat, and separating uses). This could mean either developing new water access in undeveloped areas, or expanding or consolidating some day-use areas and/or eliminating others. In conjunction with renovation, facilities would be redesigned to accommodate a size range of boats (see unavailable information) consistent with a 10 mph speed limit. Boating and fishing opportunities would remain in the roaded natural classification.

Overnight areas (Lakeside Recreation Unit)

The lakeside recreation unit areas would reduce overnight campsites by approximately 15-30% (from 1991 levels). The camping opportunities would be consistent with a RN ROS classification and would be designed to maximize opportunities for privacy and solitude. This could mean reducing the number of sites in a campground and increasing screening or buffering within the campgrounds. In this alternative visitors would be able to enjoy camping near or adjacent to the lakes within a setting that is lower-key than present use and includes a moderate level of interaction with other visitors. The sights and sounds of other visitors would be obvious in some areas and not evident in others. The overnight boat-in campsites would not remain on Paulina Lake and this opportunity would no longer exist within the caldera.

Day-use away from the lakes (Flow Recreation Unit)

In this alternative developed day-use away from the lakes would be managed to accommodate approximately the same number of visitors as today in developed day-use areas. This could mean a renovation of the existing day-use areas. Facility renovation could inadvertently attract new visitors in the short term and could necessitate limiting use in these areas.

(Portal Recreation Unit)

Under this alternative a new portal facility would give visitors information and orientation to the Newberry Crater, directing them to the different opportunities within the caldera. This facility, located along road 21 where most visitors arrive at the caldera, would be designed to disperse information, to regulate use into the caldera, and would not be expected to draw new use itself. In the winter the portal facility would not be open, nor contribute improved (closer-in) access for cross-country skiers. Improved cross-country ski access would originate from the 10-mile snow park.

(Eagle Recreation Unit)

In Alternative B the eagle management areas would cover 90% more acreage than existing. This would increase the possibility for viewing eagles in the caldera and would result in eliminating the boat-in campgrounds on Paulina Lake (see wildlife).

(Undeveloped Recreation Unit)

Areas allocated as semi-primitive within the caldera would amount to slightly more than what currently exists. Dispersed camping would continue to be allowed in conjunction with designated trail use over a slightly larger area.

Summer ATV access would not be provided and all ATV opportunities would remain as they currently exist within the caldera rim boundary.

Alternative C, and C-Modified

These alternatives would increase developed day-use and keep overnight use levels similar to existing. Current occupancy and use levels could result in a slight increase in the number of overnight campsites; however, the goal would be to improve existing facilities to meet current demands, no to increase overnight visitation levels. This increase in campsites would accommodate current use levels at a lower density level than present. ROS classes would remain R, RN, and SPNM; however, these alternatives increase the acreage of RN classification in this zone by converting some areas of SPNM (south of the lakes), into RN allocations. Some R areas around the lakes would change to RN classifications lowering the net density potential in these areas from current allocation standards.

Changes in ROS classification in these alternatives would result in providing more of a range of overnight opportunities including RN.

In this alternative the two lakes are managed to provide approximately the same amount of recreational use as present; however, there would be more diversity based on the density of recreational activities. More concentrated R activities would be emphasized around Paulina Lake, while lower-key RN opportunities would occur at East Lake.

Day-use adjacent to Paulina Lake (Paulina Lake/ Lakeside Recreation Unit)

The lakeside area would be managed to attract faster paced recreation, oriented towards interaction between visitors. This could mean more people and might necessitate some lakeside facility development, in conjunction with campground renovation. This could mean either developing new water access in undeveloped areas, or shifting some of the developed campsites currently located adjacent to the water, away from the lake. New or expanded facilities would be developed to accommodate a size range of boats (see unavailable information) consistent with a 10 mph speed limit. New or improved facilities would likely draw additional motorized boating and fishing use. Visitor restrictions or limitations could become necessary.

Day-use adjacent to East Lake (East Lake/ Lakeside Recreation Unit)

The lakeside area would be managed to attract lower-key recreation providing more opportunities for privacy and quiet. This would result in facility renovation with some reorganization of use patterns. New or renovated facilities would be developed to attract smaller, non-motorized boats while maintaining provisions for larger boats. (These boat sizes would occur within the current range of boat sizes (12-16' typical, 21' maximum.) New or improved facilities would likely draw additional boating and fishing use which would result in more boating use.

Overnight areas (Lakeside Recreation Units - Both Lakes)

The lakeside recreation unit would be managed to provide approximately the same number of overnight visitors as today; however, some new campsites could be developed or redesign would take place in order to lower the net overall campground density in the caldera. Unless some type of management system is developed for limiting use levels in the near future, the net density will continue to grow beyond current levels (see quality of experience) and could become unacceptable to many visitors. Accommodating existing use levels could mean either expanding and/or renovating existing sites or developing new campsites.

In conjunction with the described day-use objectives, different developed overnight opportunities would be emphasized in the general-use campgrounds at the two lakes (R at Paulina Lake and RN at East Lake). The camping experience at Paulina Lake would include a relatively high level of interaction with other visitors. The sights and sounds of other visitors would be obvious, and there may be more evidence of visitor management controls. The overnight boat-in campsites would be relocated (possibly to East Lake- the areas for relocation would be determined at a site specific level of analysis). The design of any "relocated" boat-in sites could be different from the existing campground configurations.

Day use away from the lakes (Flow Recreation Unit)

In this alternative developed day-use away from the lakes would be managed to provide up to 150% (above 1991 levels) more capacity for visitation. This would mean facility expansion and/or new development. This could mean an expansion of the existing day-use areas and the establishment of some new currently undeveloped areas. The visitors using the campgrounds and resorts would have a wider range of day time recreational opportunities to choose from and there would be more opportunities for visitors who are visiting the caldera for day use only.

(Portal Recreation Unit)

Under these alternatives a new portal facility would give visitors information and orientation to the Newberry Crater, directing them to the different opportunities within the caldera. This facility, located along road 21 where most visitors arrive at the caldera, could provide short duration interpretation to the caldera portion of the Monument. This entry area would also provide areas for managing visitor use in the caldera and could be a staging area for public transportation into the caldera (shuttles etc.). By providing information at a check point, it is possible to inform visitors that they are entering the caldera of a volcano (a message that is not currently clear) enhancing the arrival experience for those not familiar with the local geology. In the summer, this facility, in conjunction with the day-use areas in the caldera, would bring more day hikers, walkers, and short-term visitors to this area. This portal facility could

also provide improved winter access and increase the opportunities for cross-country skiing and snowmobiling when 10-Mile sno-park is filled during low-snow years.

(Eagle Recreation Unit)

In Alternative C and C-Modified the eagle management area would increase in area around the east side of East Lake (see Wildlife) to include approximately 38% more acreage than existing (acreage is not adjacent to lake edge).

(Undeveloped Recreation Unit)

In Alternative C, areas in the semi-primitive allocations within the caldera would be slightly less than what currently exists (see Caldera Recreation Unit Map). Dispersed camping would continue to be allowed in conjunction with designated trail use over a smaller area. Alternative C-Modified has management direction that shows semi-primitive recreational settings applying all the way to the edge of East Lake.

The assumed time frame for all new developments to occur varies between alternatives; A, B, and C estimate 20 years, C-modified estimates 40 years. Rate of actual development will depend on numerous funding sources. The following tables (4-2) display the effects on recreational activities.

Table 4 - 2

EFFECTS ON RECREATIONAL ACTIVITIES

ACTIVITIES	ALTERNATIVE A					
	River ZONE	Lava Butte ZONE	Transition ZONE	Flanks ZONE	Caldera ZONE	Overall
DAY USE:						
Sightseeing/Picnicking	--	MM	MM	S	MM	MM
Sightseeing - Auto	--	MM	MM	--	MM	MM
Wildlife Viewing/Nature	S	MM	MM	S	M	MM
Visiting Interp. Complexes	--	MM	MM	--	MM	MM
Self Discovery Interp	--	--	S	M	--	S
Lakeside Day Use	--	--	--	--	MM	M
Fishing/Boating	S	S	--	--	MM	M
OVERNIGHT:						
Camping, Dev. Site	--	--	M	--	M	M
Group Camping	--	--	--	--	S	S
Semi-Prim. Camping	--	--	L	M	L	L
Resort Stays	--	--	--	--	MM	M
Boat-in/Bike-in/Hike-in	--	--	M	--	S	S
SUMMER AND WINTER TRAILS:						
Motorized (Summer)	--	--	M	--	M	M
Interpretive						
Low - Medium Std.	--	S	M	--	S	S
Med - High Std.	--	M	M	--	M	M
Interp. Multi-Use						
Low - Medium Std.	--	--	--	--	--	--
Med- High Std.	--	--	--	--	--	--
Hiking						
Low - Medium Std.	--	M	S	--	M	M
Med - High Std.	--	--	--	--	MM	M
Hiking, Multi-Use						
Low - Medium Std.	--	--	M	MM	S	M
Med - High Std.	--	MM	MM	--	MM	MM
Snowmobile (primary user)	--	--	M	M	MM	M
Cross Country Ski	--	M	M	M	MM	MM
Snow ATV	--	--	M	M	MM	M

MM = Many More M = More S = Slightly More or the Same L = Less -- = Not /Applicable

Table 4 - 2

EFFECTS ON RECREATIONAL ACTIVITIES

ACTIVITIES	ALTERNATIVE B					
	River ZONE	Lava Butte ZONE	Transition ZONE	Flanks ZONE	Caldera ZONE	Overall
DAY USE:						
Sightseeing/Picnicking	S	M	S	S	S	S
Sightseeing - Auto	S	S	S	--	S	S
Wildlife Viewing/Nature	S	S	M	S	M	M
Visiting Interp Complexes	--	M	S	--	S	S
Self Discovery Interp	S	--	M	M	M	M
Lakeside Day Use	--	--	--	--	S	S
Fishing/Boating	S	--	--	--	S	S
OVERNIGHT:						
Camping, Dev. Site	--	--	--	--	L	L
Group Camping	--	--	--	--	S	S
Semi-Prim. Camping	--	--	M	M	S	M
Resort Stays	--	--	--	--	S	S
Boat-in/Bike-in/Hike-in	--	--	--	--	L	L
SUMMER AND WINTER TRAILS:						
Motorized (Summer)	--	--	--	--	--	--
Interpretive						
Low - Medium Std.	S	S	MM	--	--	M
Med - High Std.	--	S	S	--	--	S
Interp. Multi-Use						
Low - Medium Std.	--	--	--	--	--	--
Med- High Std.	--	--	--	--	--	--
Hiking						
Low - Medium Std.	--	--	--	--	S	S
Med - High Std.	--	--	--	--	S	S
Hiking, Multi-Use						
Low - Medium Std.	M	M	--	M	S	M
Med - High Std.	--	--	--	--	M	S
Snowmobile (primary user)	--	--	S	S	S	S
Cross Country Ski	--	M	M	S	M	M
Snow ATV	--	--	S	S	S	S

MM = Many More M = More S = Slightly More or the Same L = Less

Table 4 - 2

EFFECTS ON RECREATIONAL ACTIVITIES

ACTIVITIES	ALTERNATIVE C					
	River ZONE	Lava Butte ZONE	Transition ZONE	Flanks ZONE	Caldera ZONE	Overall
DAY USE:						
Sightseeing/Picnicking	--	MM	MM	S	M	MM
Sightseeing - Auto	--	M	M	--	S	M
Wildlife Viewing/Nature	S	MM	S	S	M	M
Visiting Interp Complexes	--	MM	MM	--	M	MM
Self Discovery Interp	--	--	M	M	--	M
Lakeside Day Use	--	--	--	--	M	S
Fishing/Boating	S	S	--	--	M	S
OVERNIGHT:						
Camping, Dev. Site	--	--	--	--	S	S
Group Camping	--	--	M	--	S	S
Semi-Prim. Camping	--	--	S	M	S	S
Resort Stays	--	--	--	--	M	S
Boat-in/Bike-in/Hike-in	--	--	--	--	S	S
SUMMER AND WINTER TRAILS:						
Motorized (Summer)	--	--	--	--	--	--
Interpretive						
Low - Medium Std.	--	M	MM	--	M	MM
Med - High Std.	--	M	M	--	MM	MM
Interp. Multi-Use						
Low - Medium Std.	--	--	--	--	--	S
Med- High Std.	--	S	M	--	M	S
Hiking						
Low - Medium Std.	--	--	--	--	S	S
Med - High Std.	--	--	--	--	S	S
Hiking, Multi-Use						
Low - Medium Std.	--	--	--	M	M	M
Med - High Std.	--	MM	MM	--	M	MM
Snowmobile (primary user)	--	--	S	M	M	M
Cross Country Ski	--	M	M	M	M	M
Snow ATV	--	--	L	L	L	L

MM = Many More M = More S = Slightly More or the Same L = Less

Table 4 - 2

EFFECTS ON RECREATIONAL ACTIVITIES

ACTIVITIES	ALTERNATIVE C-MODIFIED					
	River ZONE	Lava Butte ZONE	Transition ZONE	Flanks ZONE	Caldera ZONE	Overall
DAY USE:						
Sightseeing/Picnicking	--	MM	MM	S	M	MM
Sightseeing - Auto	--	M	M	--	S	M
Wildlife Viewing/Nature	S	MM	S	S	M	M
Visiting Interp Complexes	--	MM	MM	--	M	MM
Self Discovery Interp	--	--	M	M	--	M
Lakeside Day Use	--	--	--	--	M	S
Fishing/Boating	S	S	--	--	M	S
OVERNIGHT:						
Camping, Dev. Site	--	--	--	--	S	S
Group Camping	--	--	M	--	S	S
Semi-Prim. Camping	--	--	S	M	S	S
Resort Stays	--	--	--	--	M	S
Boat-in/Bike-in/Hike-in	--	--	--	--	S	S
SUMMER AND WINTER TRAILS:						
Motorized (Summer)	--	--	--	--	--	--
Interpretive						
Low - Medium Std.	--	M	MM	--	M	M
Med - High Std.	--	M	M	--	MM	M
Interp. Multi-Use						
Low - Medium Std.	--	--	--	--	S	S
Med- High Std.	--	--	--	--	S	S
Hiking						
Low - Medium Std.	--	--	--	--	S	S
Med - High Std.	--	--	--	--	M	S
Hiking, Multi-Use						
Low - Medium Std.	--	--	M	MM	M	M
Med - High Std.	--	MM	MM	--	M	MM
Snowmobile (primary user)	--	--	S	M	M	M
Cross Country Ski	--	M	M	M	M	M
Snow ATV	--	--	L	L	L	L

MM = Many More M = More S = Slightly More or the Same L = Less

Table 4 - 2

EFFECTS ON RECREATIONAL ACTIVITIES

ACTIVITIES	ALTERNATIVE D					
	River ZONE	Lava Butte ZONE	Transition ZONE	Flanks ZONE	Caldera ZONE	Overall
DAY USE:						
Sightseeing/Picnicking	--	S	S	S	S	S
Sightseeing - Auto	--	S	--	--	M	S
Wildlife Viewing/Nature	S	S	S	S	S	S
Visiting Interp Complexes	--	S	S	--	S	S
Self Discovery Interp	--	S	--	--	--	S
Lakeside Day Use	--	S	--	--	S	S
Fishing/Boating	S	S	--	--	S	S
OVERNIGHT:						
Camping, Dev. Site	--	--	--	--	M	S
Group Camping	--	--	--	--	S	S
Semi-Prim. Camping	--	--	--	S	S	S
Resort Stays	--	--	--	--	S	S
Boat-in/Bike-in/Hike-in	--	--	--	--	S	S
SUMMER AND WINTER TRAILS:						
Motorized (Summer)	--	--	--	--	--	--
Interpretive						
Low - Medium Std.	--	S	--	--	--	S
Med - High Std.	--	S	S	--	S	S
Interp. Multi-Use						
Low - Medium Std.	--	--	--	--	--	--
Med- High Std.	--	--	--	--	--	--
Hiking						
Low - Medium Std.	--	--	--	--	S	S
Med - High Std.	--	--	--	--	S	S
Hiking, Multi-Use						
Low - Medium Std.	--	--	--	S	S	S
Med - High Std.	--	--	--	--	S	S
Snowmobile (primary user)	--	--	S	S	S	S
Cross Country Ski	--	S	S	S	S	S
Snow ATV	--	--	S	S	S	S

MM = Many More M = More S = Slightly More or the Same L = Less

2. Quality of Recreational Experience

Effects of visitor numbers

The quality of a recreational experience is based on a visitor's preference for different types of opportunities and settings as well as the reliability of achieving that experience. The scoping process clearly identified a voice of "don't overdevelop." This voice comes from a broad array of individuals each with a different definition of what overdevelopment looks and feels like. Currently there are no visitor preference studies for the Monument that would quantify and/or clarify the elements that constitute overdevelopment. The alternatives present a palette of options for different types and levels of development throughout the Monument. These options have different inherent abilities to accommodate larger or smaller numbers of visitors. Regardless of the level of recreational development selected for the Monument, it will probably become necessary to limit visitor access to some degree in order to reliably provide a high quality recreation experience. The alternatives vary according to when that point in time might be reached.

All three action alternatives would need to limit visitor use in the caldera (and possibly in other areas as well) at some point in time in order to provide a high quality recreational experience, assuming that recreational growth trends continue to increase. This type of limitation would be necessary at different points in time based on the density of visitation consistent with each alternative. Restricted access and or a permit/reservation system would occur earliest in Alternative B, then C, and C-Modified, then A. Visitor preference studies identifying the indicators that would trigger action are not currently available.

These tables represents a comparison of the potential for developed recreational visitor days (RVD) and visitor numbers between the alternatives (compared with the existing condition).

Alternative A has the potential for the most developed recreation visitor days, with day use and overnight use both increasing.

Alternative B has the potential for a slight net RVD increase, with day use increasing and overnight decreasing.

Alternative C has the potential for a large increase in developed RVD almost entirely due to increasing day use.

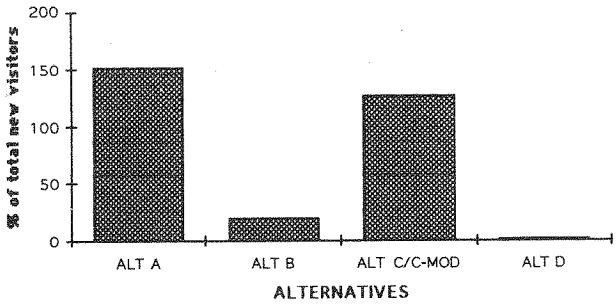
Alternative D has the potential for a slight net RVD increase, almost entirely due to increasing overnight use.

Currently there is little reliable data that quantifies or describes types, quantities, and patterns of dispersed recreation in the Monument (see incomplete information). Alternatives A, C and C-Modified respond to some degree to future growth trends and demands for developed recreation opportunities. The facility development that would occur in order to supply these opportunities and the subsequent numbers of new visitors could displace dispersed activities currently taking place in those areas.

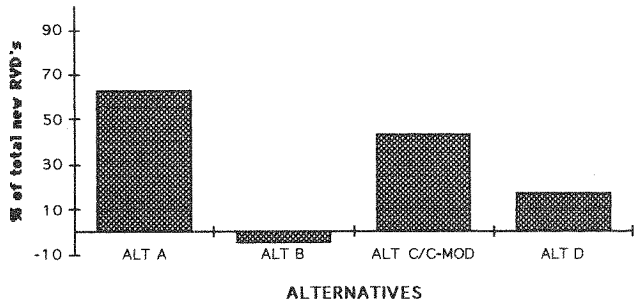
All of the action alternatives project new trail development within their management strategy. New trails, (primarily hiking trails) would increase access into new areas, thus increasing the potential for dispersed recreation activities. New hiker-only and multiple-use non-motorized trails (non-interpretive) occur to the largest degree in Alternative A, to a moderate degree in Alternatives C and C-Modified, to a lesser degree in B, and not at all in Alternative D. These trails would provide dispersed opportunities relative to the ROS classes they respond to in any given alternative.

Table 4 - 3 Visitors/ RVD's

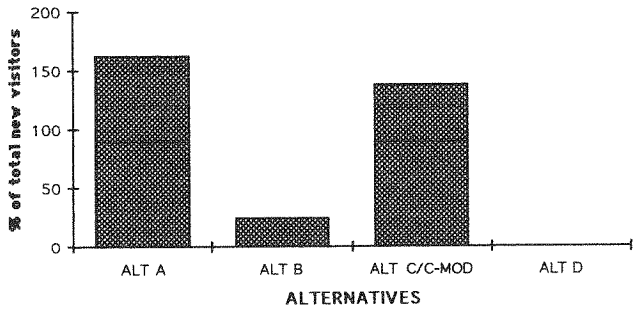
Developed Recreation Potential For Visitors
(as compared with existing , long term >50 years)



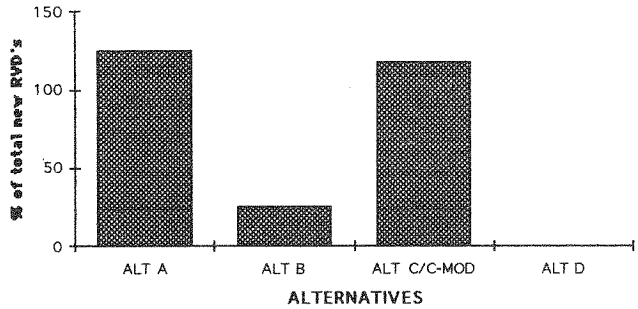
Developed Recreation Potential For RVD's
(as compared with existing , long term >50 years)



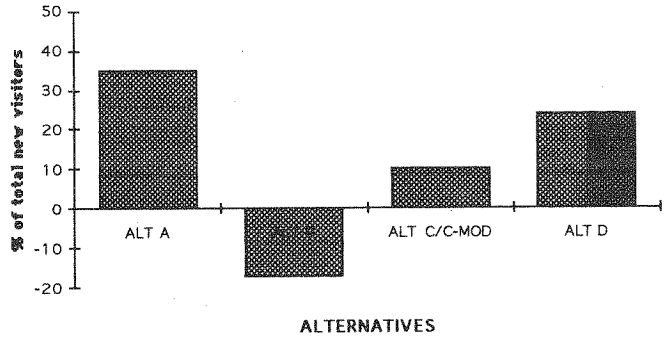
Developed Recreation Potential For Day Use Visitors
(as compared with existing , long term >50 years)



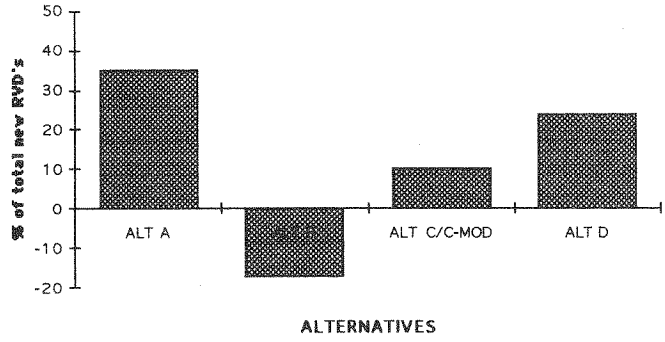
Developed Recreation Potential For Day Use RVD's
(as compared with existing , long term >50 years)



Developed Recreation Potential For Overnight Visitors
(as compared with existing , long term >50 years)



Developed Recreation Potential For Overnight RVD's
(as compared with existing , long term >50 years)



Effects on Visitor Use

The Monument attracts a wide range of visitors with different expectations and preferences for recreational opportunities. These visitors include local, regional, national, and international recreationists. For the purposes of this discussion visitor groups are divided into two broad categories; "traditional," and "Monument." "Traditional" visitors include "local" and Oregon recreationists with primary interests in fishing, camping, sightseeing, hiking, horseback riding, mountain biking, snowmobiling and skiing. "Monument" visitors include non-local, regional, national and international visitors whose interest is primarily based on Newberry's status as a national monument. These visitors are closely linked with the tourism industry, and their numbers will likely continue to grow as the Monument gains exposure through maps and guide books. "Monument" visitors generally have recreational interests that emphasize interpretation and sightseeing. These two broad categories of visitors are not meant to be all inclusive nor preclude those persons falling into both groups. These two groups are presented in order to discuss how the alternatives would affect recreational uses of the Monument and the implications of future visitation trends. As a nationally designated special area located within Central Oregon and in the vicinity of Highway 97, the Monument has the potential to complement the recreational opportunities available for both groups of recreationists.

Alternative A would increase the amount of developed day-use and developed overnight use in the Monument. Increase in day use will result in a greater need for overnight accommodations either within or outside the Monument. Some of the new visitors will be able to be accommodated in expanded campgrounds both inside and outside the caldera. Dispersed camping and campground use in the vicinity (outside) of the Monument would likely increase as would the demand for overnight accommodations, resorts, hotels, and motels, in the communities near the Monument.

Alternative A would accommodate the highest number of people with a mixture of "Monument" and "traditional" groups. The "traditional" activities in the caldera would have a layer of new visitors integrated with them. Noise, crowding, night illumination, and traffic would increase and likely require mitigation. Noise, crowding, night illumination, and traffic would become key issues of maintaining a high quality recreational experience in the short term while limited or restrictive access for recreationists would be a lesser issue initially. On-site controls, site hardening, vegetative screening, limited private vehicular access, and public shuttles all would be more evident in this alternative. This alternative would require reorganization and redesign of the developed recreation areas, and it would require more extensive physical maintenance in order to provide a high quality experience for more people.

Alternative B would slightly increase the amount of day-use in the Monument, primarily near Lava Lands. This could result in overcrowded facilities in the short and long term. Fewer people would be accommodated within the campgrounds inside the caldera, and the type of overnight opportunity would shift to lower key camping with fewer people and less crowded experiences. Dispersed camping and use of campgrounds in the vicinity (outside) of the Monument would increase in response to growing demand and perhaps to people wanting to get into the Monument. There would not be a lot of new attractions (day use) that would increase overnight use in adjacent areas; however, this demand could develop due to population growth.

Alternative B would accommodate the fewest number of people with an emphasis on the "traditional" groups. The "traditional" activities in the caldera would have a reduction in the numbers of visitors participating in them. Limiting access for recreationists would become the key issue in the short term; and noise, crowding, night illumination and traffic would be lesser issues initially. Noise, crowding, night illumination, and traffic would decrease from the

existing condition. This alternative would require more extensive visitor management in order to provide a high-quality, low-key experience.

Alternatives C and C-Modified would increase the amount of day use in the Monument. The day-use activities would create new opportunities that would result in an increase in demand for overnight accommodations either within or outside of the Monument. Very few additional persons would be accommodated within the campgrounds inside of the Monument. Dispersed camping and use of campgrounds in the vicinity (outside) of the Monument would increase as would the demand for overnight accommodations, resorts, hotels, and motels, in the communities near to the Monument.

Alternatives C and C-Modified both would accommodate more people than existing with an emphasis on "Monument" visitors while also providing for "traditional" groups. The "Monument" visitors would be accommodated, in part, away from the caldera. The "traditional" activities in the caldera would have a layer of new visitors integrated with them around Paulina Lake while East Lake would be managed to accommodate fewer people than existing. By lowering densities (through design or management) in some recreation sites, the overall number of overnight visitors in the caldera would remain approximately the same; however, there would be two densities, or levels, of recreational development. Noise, crowding, night illumination, and traffic would become key issues of maintaining a high quality recreational experience around Paulina Lake. On-site controls, site hardening, vegetative screening, limited private vehicular access, and public shuttles all would become key issues of maintaining a high quality recreational experience around East Lake. Noise, crowding, night illumination, and traffic would decrease from the existing condition; however, it could be difficult to keep visitors more concentrated around Paulina Lake and less concentrated around East Lake in the event that Paulina Lake becomes overcrowded. In this scenario, visitors would likely shift over to East Lake and decrease the low-key atmosphere in that portion of the caldera. For these reasons, these alternatives would require more extensive visitor management in order to provide a high quality experience, and a more diverse range of opportunities for future visitors. These alternatives would also require more extensive physical maintenance, especially around Paulina Lake in order to provide a high quality experience for more people.

Alternative D would increase the amount of overnight use in the caldera while not increasing the amount of day use in the Monument. This would result in no additional overnight demand in the areas adjacent to the Monument due to increase day use.

Alternative D would accommodate more overnight visitors in the caldera emphasizing "traditional" groups with little to no provision for "Monument" visitors. The "traditional" activities in the caldera would have a layer of new visitors participating in them due to the growing recreational demand and Monument interest; however, no provision for limiting visitor use would be in place and the facilities would eventually be exhausted. Noise, crowding, night illumination, and traffic would continue as key issues of maintaining a high quality recreational experience in the short term and long term. On-site degradation, lack of vegetative screening, and increased car, trailer, and RV's would be more evident in this alternative.

Table 4 - 4 **EFFECTS ON QUALITY OF RECREATION EXPERIENCE**
(compared to existing)
IN DEVELOPED SITES

Effects	Alternative			
	A	B	C/C-MOD	D
Noise	much more	less	more*	more
Crowding	more	less	more*	more
Night Illumination	much more	less	more*	more
Traffic/Evidence of cars	much more	less	more	more
Site hardening	more	less	more	same
Public shuttles	more	same	more	same
Vegetative screening	much more	much more	much more	less

* Less at East Lake in the caldera

3. Level and Type of Recreational Access

Effect of access on recreation

The primary changes associated with access in the action alternatives include changes to roads (new development, upgraded, closed, or obliterated) and the addition of new trails. New circulation and functional relationships are formed based upon visitor patterns of movement. Each alternative offers different road and trail opportunities (Alternative D is equivalent to the existing condition).

ALL ACTION ALTERNATIVES: All action alternatives would increase the amount of short loop trail around developed facilities which would disperse visitors into the areas immediately surrounding recreation areas and increase the opportunities for day hiking. Shuttle opportunities in the alternatives are possible strategies for future automobile congestion problems.

ALTERNATIVE A: New trails would emphasize a multiple-use trail linkage across the Monument. This would allow visitors the opportunity to plan trail trips across the Monument and could increase the need for parking at different points of access. This alternative would substantially increase the amount of trails in the Transition and Lava Butte Zone. The amount of trail access in the Flanks would double and in the caldera, access would increase approximately by a third. This alternative substantially increases the potential for dispersed recreation within the Monument.

ALTERNATIVE B: New trails would emphasize multiple-use hiking and interpretation, and would allow visitors more dispersed access. This alternative would substantially increase the amount of trails in the Transition and Flanks Zone. The amount of trail access in the Lava Butte Zone would almost triple and in the caldera, access would increase by approximately a quarter.

ALTERNATIVE C: New trails would emphasize interpretation and multiple-use trails. This alternative would substantially increase the amount of trails in the Transition, and Lava Butte Zone and emphasize linkage between Lava Butte Zone and the Transition Zone. The amount of trail access in the Flanks would increase slightly and in the caldera it would increase by approximately by a quarter. This alternative substantially increases the potential for dispersed recreation access.

ALTERNATIVE C-MODIFIED: This alternative is similar to C; however, trail linkage is emphasized across the Monument (similar to A). This trail linkage is commonly referred to as the "Monument trail" (in A and C-Modified, it connects the Monument; in C, it connects Lava Butte Zone with Lava Cast Forest area).

Winter Access

All action alternatives would rely upon coordinated efforts to achieve plowing of Road 21 farther up towards the caldera in the winter months in order to improve closer-in access to the caldera. Alternatives A, C, and C-Modified would place a strong emphasis on providing closer-in access to the caldera, improving opportunities for cross-country skiing (due to the three mile uphill climb from the existing sno-park to the caldera). New trail development could improve nordic opportunities, provided trails are clearly marked according to the primary user and snow play areas are planned in conjunction with motorized winter trails. New trail development for snowmobiles would also occur.

Alternative A would greatly increase winter trail access through development of new groomed winter trail systems and the addition of a year-round portal facility that would provide closer-in access to caldera.

Alternative B would improve access to the Monument and some new trails would be developed to encourage self-discovery and semi-primitive activities. Closer access to the caldera would not occur.

Alternatives C and C-Modified would improve access to the Monument by providing a closer-in year-round portal facility. Winter trail systems would be increased and guided interpretive winter programs would be encouraged.

Alternative D would not improve access into the Monument. Snowmobiling would remain the primary winter activity and nordic skiing opportunities would continue as a minor component of winter recreation.

ATV Access

Current management prohibits ATV access, trail-use, and off-trail use in the summer within the caldera boundary as described in the 1987 recreation order (USDA Forest Service 1987). All other areas of the Monument currently have no specific restriction of off-trail use; however, many of the existing management areas retain the authority to restrict or prohibit use should it threaten resources. There are currently no designated ATV trails (summer) in the Monument, all trails are non-motorized in the summer. Licensed vehicles can use roads as consistent with state laws. Winter ATV use is not currently prohibited in the Monument with adequate snow cover (except for on blue-diamond ski trails).

Alternative A provides ATV access through the Transition Zone (on a designated trail) and into the Caldera Zone to East Lake Resort (on a designated trail originating east of the Monument). Parking provisions would be made for ATV's at the portal facility; however, there would be no trail into the caldera beyond this point. There would be no ATV trails in other areas of the Monument. There would be no off-trail ATV activity permitted within the

Monument. Alternative A could result in more dispersed ATV use adjacent to designated corridors. Winter use would not change from existing condition.

Alternative B does not permit any ATV access, trail-use or off trail-use within the Monument in the summer. This could result in dispersed "illegal" use of ATV's crossing the Transition Zone or entering the caldera. ATV winter use would not change from existing condition.

Alternatives C and C-Modified do not permit any ATV access, trail-use or off trail-use within the Monument in the summer. This could result in dispersed illegal use of ATV's crossing the Transition Zone or entering the caldera. ATV winter use inside the Monument would not be permitted in Alternative C and C-Modified (see Chapter 2, Advisory Council Advice).

Alternative D would not change from existing condition for summer or winter. This could result in ATV use increasing in zones other than the caldera.

Road Access

Road development, improvement, obliteration and/or closure all affect recreation. New roads create different recreational opportunities and affect the type and numbers of recreationists.

High and medium standard roads (paved and two-lane gravel) provide access for most vehicle types and create opportunities for recreation in the R and RN classifications.

Primitive and semi-primitive roads create access for private vehicles. They increase semi-primitive motorized and decrease semi-primitive non-motorized opportunities. These roads can function as informal trails.

Road obliteration and/or closure affect recreation by limiting access into an area. In many cases the roads that are closed are primitive and semi-primitive. Therefore, road obliteration and/or closure can increase the opportunities for semi-primitive non-motorized activities. Road closure can also provide opportunities to formally change a road to a trail, often increasing non-vehicular access.

Road closures are a part of Alternatives A, B, C, and C-Modified in approximately the same overall proportions; however, in Alternative B more closures are expected in the Transition Zone and less in the Lava Butte Zone. No road closures are expected in Alternative D.

ALTERNATIVE A: Alternative A substantially increases road access into the Monument. Access increases in all zones and connects all zones. Alternative A includes an opportunity for a scenic road (paved) connecting all of the zones and continuing out of the eastern end of the caldera. This would result in dispersing visitors away from the Lava Lands area, directing them through the Transition Zone, through the general forest, then into the caldera and out the eastern side. This type of scenic road would provide high standard access into and throughout the monument and encourage use in many areas, currently difficult to access, primarily in the Transition Zone where there is a low level of visitation. This influx of visitors would change the character throughout new roaded areas of the Transition Zone. High standard access throughout the Monument would make the unique, unusual, and scenic features of the Monument very accessible and visible to many people. Traffic, congestion, and views of cars would become a larger part of the recreation experience, especially in congested areas like the entry to the caldera. A scenic road would disperse large numbers of visitors into other areas of the Monument; however, it would also direct and funnel most of the visitors into the caldera.

A scenic road linking to the caldera would require crossing Paulina Creek (currently eligible for Wild and Scenic designation as a recreation river). The scale, type, and location of

a bridge (that could be required in order to create roaded linkage) is not determined at this time; however, bridges are permitted across wild and scenic rivers classified as recreation rivers.

A scenic road connecting Lava Lands to the caldera would likely result in increased downhill traffic along highway 21. The expectations of visitors frequenting this route might be higher in conjunction with a scenic route. This route would take travelers through areas outside of the Monument (general forest), near the Mokst Butte proposed Research Natural Area (RNA), and also into an area where geothermal development is proposed.

Other road improvements in this alternative would increase the traffic flow around the periphery of much of the Transition Zone. Road access close to or adjacent to the proposed RNA could inadvertently increase dispersed recreation into this area (as could improved trail access). Alternative A provides opportunities for substantially increasing recreational use in the Transition Zone. Directing recreational use into an RNA is not consistent with the goals of an RNA (USDA Forest Service 1990).

ALTERNATIVE B: Alternative B does not change the road type or amount much from the existing condition. The primary effect of roads on recreation in this alternative is to maintain and increase the relative difficulty (by closing roads) in gaining access into the Transition Zone. This would greatly increase semi-primitive opportunities in this area. Traffic, congestion, and views of cars would not play a large role in the recreational experience in the Monument. Bumpy gravel and dirt roads would remain as the only access routes into the Transition Zone. Visitors would continue to travel through areas that are not currently natural appearing in order to access the Transition Zone of the Monument.

ALTERNATIVE C: Alternative C substantially increases access into the Monument. Roaded access increases in many of the zones and links Lava Butte Zone with the Transition Zone. The linkage (a scenic loop road) would provide and encourage visitor use into an area where there is currently a low level of visitation. This influx in visitors would change the character throughout new roaded areas of the Transition Zone, while increasing opportunities for visitors to access and experience the special features in this area. A scenic loop road would disperse visitors into other areas of the Monument thus relieving some of the future demand pressure from focusing on the caldera. Traffic, congestion, and views of cars would become a larger part of the recreation experience. The proposed scenic loop road is included as part of this analysis for purposes of estimating effects. As discussed in the Chapter 2 section on Advisory Council Advice, construction of this road would be a low priority, and not anticipated within the first decade of this Plan.

This scenic route would take travelers through areas outside of the Monument (general forest) near the Mokst Butte proposed RNA. Other road improvements in this alternative would increase the traffic flow around the periphery of much of the Transition Zone. Road access close to or adjacent to the proposed RNA could inadvertently increase dispersed recreation into this area. Alternative C provides more opportunities for people and increases recreational use in the Transition Zone. Directing recreational use into an RNA is not consistent with the goals of an RNA (USDA Forest Service 1990).

ALTERNATIVE C-MODIFIED: Alternative C-Modified substantially increases access into the Monument. Roaded access increases in many of the zones and links Lava Butte Zone with the Transition Zone. This linkage (a scenic route) would be established on existing roads and would provide and encourage visitor use into an area where there is currently a low level of visitation. This influx in visitors would change the character along the new scenic route, while increasing opportunities for visitors to access and experience the special features in this area. Like Alternative C, this route would relieve some pressure from the caldera; however,

traffic congestion and views of cars would become a larger part of the recreation experience. The access road likely to be used for this route runs through areas that are not currently natural appearing. Road access close to the RNA could inadvertently increase dispersed recreation into this area.

ALTERNATIVE D: Alternative D provides no additional road improvement, development, closure, or obliteration. This alternative does not increase or decrease opportunities for recreation from what is existing.

Access into Lava River Cave varies between the action alternatives. Alternative A is open both summer and winter to the public and maximizes the public's experience of this place. Alternative B is closed to the public in winter and is guided tour only in the summer. This heightens public awareness of wildlife (bat) issues and decreases public access to the cave. In Alternatives C, and C-Modified the cave is open to the public in the summer and by guided tour only in the winter. This allows moderate access, year-round.

Effects of other Ecosystem Components on Recreation

WILDLIFE/FISH: Wildlife components of the alternatives affect recreation through creating, or enhancing wildlife habitat thus increasing the potential for viewing wildlife. This discussion focuses on the short-term potential for viewing large animals in each alternative (see also Wildlife, Vegetation).

Alternative A increases the potential for hiding cover while increasing access into the Monument. This alternative greatly increases the potential for wildlife viewing.

Alternative B increases the potential for hiding cover and improves habitat areas while only slightly increasing access into the Monument. This alternative moderately increases the potential for wildlife viewing.

Alternatives C and C-Modified decrease the potential for hiding cover while increasing access into the Monument. This alternative slightly increases the potential for wildlife viewing.

Alternative D increases the potential for hiding cover and does not improve access into the Monument. This alternative slightly increases the potential for viewing wildlife.

Long-term potential for large animal viewing would be relative to natural disturbance cycles. Small animal viewing will increase in all alternatives relative to the number of people who would be able to visit the area. In Alternative B the diversity of wildlife viewing opportunities would be the greatest.

Fishing in the lakes will continue in all alternatives. The lakes are currently stocked and are not presently at (fish) capacity. The need for additional fish is not expected to be limiting for some new opportunities; however, other fishing related concerns could be and would be subject to a site specific analysis. The resource sensitivity associated with hot springs could necessitate restricting or limiting use in these if the natural character of the hot springs becomes threatened.

VEGETATION/FIRE: Vegetation management affects the recreational experience primarily through scenery, screening, and safety. The effects of the alternatives on scenery are discussed in another section (see Scenery).

Alternatives A, B, C, and C-Modified all include the assumption that developed overnight facilities would be renovated or enhanced. The vegetation in developed area would also be enhanced and/or reestablished in order to provide for screening between campsites, increasing

the physical capacity and enhancing privacy. In addition, the campgrounds can be designed to accommodate the vehicle type that is common in the Monument. Currently, large RV's and trailers are using sites originally designed for smaller vehicles. Redefinition and revegetation in some areas will improve circulation and decrease site degradation. Vegetation management plans in recreation areas will also help ensure that proper clearances are established and maintained around campfire areas thus lowering the risk of wildfires and improving safety.

Recreation in Alternatives B, C and C-Modified are more affected by eagle management than A and D. Alternatives B, C, and C-Modified have less potential area (from existing condition) for recreational development in response to eagle habitat requirements and have the potential for increased viewing of eagles in the caldera. In Alternative B, boat-in camping is displaced from the caldera in the effort to improve habitat for eagles, thus lessening the range of overnight opportunities. In Alternatives C and C-Modified the boat-in camping opportunity is moved (possibly to East Lake) to another location within the caldera in the effort to improve habitat for eagles. Alternative D would not necessarily include vegetation management plans as a component of future planning. This alternative has no net loss or gain in acreage for potential recreational development due to eagle management (as compared to existing condition).

ARCHAEOLOGY/ GEOLOGY: Archaeological and geological resources affect recreation opportunities in the Monument. Access to these resources increases opportunities for interpretation (see Interpretation).

Effects on other Ecosystem Components

Vegetation/ Wildlife/ Fish/ Soil

* The development of recreation areas and travel corridors in undeveloped areas could eliminate or adversely impact the habitat for some plant and wildlife populations.
* Increased recreational use would increase the risk of wildfire.
* Recreational use may increase harassment of wildlife (by people or pets).
* Recreational use may cause soil compaction, erosion, and vegetation species changes that would impact habitat for plant and animal species.
* Dispersed recreational use (including gathering of forest products) could adversely affect some plant and animal species and/or reduce suitable habitat for some species.
* Recreational use in or near riparian areas could impact riparian vegetation and habitats and/or increase sedimentation which would affect fish.
* Increased recreational use could cause increased pressure and impact on fishing resources.

Geology/ Archaeology

* Recreational use could increase damage, vandalism, or removal of cultural and geological resources and artifacts.
* Recreational use could result in more on-site controls and/or law enforcement in order to protect resources. Protection measures remains the same in all alternatives.

Scenic/ Interpretive/ Social/ Economic

* Increased recreational use would increase the visual sensitivity of the Monument.
* Increased recreational use could increase the demand for interpretation and education.
* Increased recreational use could increase jobs and income for the tourist industry in the area.

* Increased recreational opportunities could result in exhausting the on-site infrastructure and/or reduce the effectiveness of the community (off-site) infrastructure.

Air/ Water

* Recreational use would result in campfires and automobile use and reduce air quality.
* Dispersed recreational use off trails could create erosive soil conditions that result in channeling water.
* Recreational use could cause water pollution and necessitate improved sewage systems.
* Increased motorized activities on or near water, wetlands, and hot springs, would increase the risk of contamination of water sources with petroleum sources.

Mitigation

Recreation mitigation would include methods which focused on managing impacts between Monument visitors and the resources, as well between visitors. Mitigation measures would be intended to ensure that the recreational qualities within the Monument are protected. The following list identifies some of the methods that could be used as mitigation measures (this list is not exhaustive).

* Close roads or trail access (completely or seasonally) as necessary to protect other resources.
* Limit visitor access into the caldera and at developed recreation sites as necessary to ensure protection of recreational and resource qualities.
* Change non-permitted campgrounds (or campsites) permitted campgrounds and or reservation sites.
* Establish permits for dispersed recreation.
* Limit boat use on lakes.
* Restrict lighting and establish noise standards.
* Increase site hardening and improve vegetative screening within campgrounds.
* Renovate and redesign campgrounds and recreation areas
* Interpretation -- Interpretation can be an effective mitigation technique by influencing visitors' behavior. In general, the more people understand natural features and processes, the more they respect them and take on a stewardship role. Interpretation encourages visitors to learn by presenting information in a way that is enjoyable, accessible, and relevant to their lives.

Assumptions

Recreational and interpretive demand will increase according to the growth predictions in the ECO Northwest (Demand for Recreation at the Newberry caldera) and the Dean Runyan (Feasibility Study- Deschutes National Forest Interpretive Complex) study (see APPENDIX).

The physical capacity of recreational facilities (PAOT) and use areas (+ managed season) is directly proportional to the potential to accommodate future developed recreational growth.

The dispersed recreation potential is proportional to the acreage allocated to PM and SPNM areas and level of access.

Recreational use at the Monument will be managed at a level consistent with the facility (physical), biological, and social desired experience capacities (see APPENDIX).

Activity growth and setting preferences and projections as identified in the State Comprehensive Outdoor Recreation Plan (SCORP) and the Outdoor Recreation Coalition of

America (ORCA) will continue into the next decade.

There are two broad categories of visitors interested in recreating in the Monument: "Monument" visitors (primarily international, national, regional and non-local origin) who have a primary interest in interpretation, sightseeing, and other day-use activities (tied closely with the tourism industry), and "Traditional" visitors (generally local and near-local) who have a primary interest on camping, fishing, hiking, skiing, and snowmobiling (and often have historical ties to this place).

ROS in alternative D (no-action) is proportionally similar to the inventory map printed in conjunction with the 1990 Deschutes National Forest Plan. The ROS map is often used to direct and plan projects.

See also numerous quantifiable estimates regarding capacity of facilities, occupancy rates, numbers of trails, and use levels (based on traffic counters) in the planning record. These estimates were derived in a manner that would support the recreational goals and objectives of the alternative and provide a quantifiable method for analyzing the effects of an alternative (available in planning record).

2. Roads

Since the Monument is not an isolated entity, a study of the transportation system needs to address access to the Monument as well as access within the Monument. Any changes to the facilities provided in the Monument could affect the level of road access to those facilities. Since many of the existing access roads are outside of the Monument boundary, any changes to those roads could affect not only the flow of traffic to the Monument, but through the Monument or to other parts of the Forest. For each Alternative, the transportation system would be designed, managed, and maintained to meet the objectives of that alternative.

Assumptions Common to All Alternatives

- Reconstruction of County Road 21 would continue from Highway 97 to East Lake Resort.
- Geothermal development would occur on the northwest flank of the caldera with Road 9735 providing the primary access.
- Road maintenance would occur as needed to provide user comfort and to protect the integrity of the transportation facilities.
- Traffic to and through the Monument would increase a minimum of 3% per year.

Alternative D- No Action

Assumptions

- Access to and within the Monument would utilize existing roads, and they would remain in their current condition. Existing Monument access points off Highway 97 would not change.

Effects

Under this alternative, there would be about 97 miles of road within the Monument- 18 miles paved, 12 aggregate surface, and 68 native surface. Road density would be approximately 1.0 mile per square mile. Roads would occupy about 326 acres or 0.6% of the Monument area. There would be no road closures except as needed to protect resources or public safety.

Access would be provided to existing key Monument features, but new facilities/features and the roads to access them would not be developed. The transportation system would tend to fragment the Monument since there would be primary access in the north at Lava Lands Visitor Information Center (VIC) and in the south at the caldera, but there would be no physical connection between the two where public use is encouraged.

There would be dispersed access for a variety of recreational pursuits using low standard roads. Since these roads receive no current maintenance, there would be continued degradation

of the road surface and increased erosion potential. With more visitors and the lack of means to control or direct their use, there could be potential resource impacts to sensitive features.

The road density in the Lava Butte Zone would continue to exceed current Forest Plan standards and guidelines. Increased use on these roads could adversely effect wildlife using the migration routes that pass through this corridor.

There would be no effect on road densities outside of the Monument boundary.

Though traffic on Highway 97 would continue to increase as would traffic bound for the Monument. Ingress and egress to Road 9710, Lava Lands Visitor Information Center, Lava River Cave, and Lava Cast Forest would become increasingly difficult and the risk to public safety would increase.

The cinder surface on Road 9720 to the Lava Cast Forest is difficult to maintain in a condition that provides an acceptable level of visitor comfort and safety. As use increases and maintenance budgets continue to decrease, the condition of the road would continue to deteriorate. The width of the road is minimal to accommodate a mix of commercial and recreation traffic causing commercial traffic to be restricted. Potential conflicts between Monument traffic and general forest traffic would increase.

The road to Paulina Peak, Road 2100-500, would continue to be rough and unmaintainable. Problems with control of surface water would continue. The mix of road standards, from single-lane to double-lane and everything in between, would be confusing to an increasing number of visitors using a variety of vehicles. There would be more conflicts between motorized and non-motorized users of the road.

Common to All Action Alternatives
(A, B, C, and C-Modified)

Assumptions

- The Cottonwood interchange on Highway 97 would be reconstructed and would provide the only access to Monument features/facilities on the north end. This would include a double-lane paved road on the west side of the highway providing access to Lava Lands VIC and Benham Falls day-use area. There would be a double-lane paved road on the east side of the highway from Cottonwood to Lava River Cave. Cottonwood Road would also provide access to Road 9720 and the Lava Cast Forest. Roads 9721 and 9721 300 would be reconstructed and commercial truck traffic from Camp Abbot Cinder Pit would be routed over these roads and use Cottonwood Road as access to Highway 97. As a minimum, the existing ramps at Cottonwood would be modified to accommodate traffic turning in different directions and a southbound acceleration lane would be added.

- Existing access points from Highway 97 to Road 9702 (Lava Lands and Benham Falls), Lava River Cave, and Road 9720 (Lava Cast Forest and Camp Abbot Pit) would be closed and rehabilitated.

- Road 2100-500 to Paulina Peak would be reconstructed to a single-lane standard with gravel surfacing.

Effects

Outside of the Monument, there would be about one mile of new paved road needed to link Lava Lands VIC and Lava River Cave access to the Cottonwood interchange. Other roads needed vary --- see individual alternative descriptions.

The volume of traffic using the Cottonwood interchange would increase, but the service level of Cottonwood Road would not decrease.

Ingress and egress from Highway 97 to Monument features would be faster, smoother, and safer than the current condition.

With fewer junctions along Highway 97, traffic flow on the highway would be improved. The visual quality along the Highway 97 corridor would also be improved.

Commercial traffic from Camp Abbot Cinder Pit would have improved access to Highway 97, but southbound trucks would have about 4 miles of back haul.

The Lava Lands access would be an additional road open all year. A portion of this road (running north and south) would bisect the big game migratory corridor.

The longer access (about two miles vs. 1/4 mile now) to the VIC would increase winter snow removal costs. The new access may provide a more dramatic "sense of arrival" at the VIC and the Monument.

Winter parking could be provided along the Lava Lands access road to enhance nordic skiing opportunities in the Benham Falls area. There would be an opportunity to construct a sno-park on the east side of the highway for winter access to a largely unused portion of the Forest and the Transition Zone of the Monument.

Access to Lava River Cave would be enhanced and could be more effectively regulated if needed.

The reconstruction of the Paulina Peak road would enhance user comfort and safety. Resource impacts would be reduced and more economical and efficient road maintenance could occur. The flow of traffic would be increased, but the road would be constructed to provide a unique driving experience. Since the road would not be a "highway," some visitors would choose not to drive to the peak.

Alternative A

Assumptions

- Under this alternative, the road from Cottonwood Road to Lava River Cave would continue northeast as a double lane-aggregate road around the toe of the lava flow to link with Road 9710. The existing Road 9710 access to Highway 97 would either be closed or be utilized by northbound traffic only.

- From the new access point, Road 9710 would be reconstructed to a double-lane standard and surfaced with stabilized crushed rock to Road 9735. From Road 9735 to Road 21, Road 9710 would remain in a primitive condition.

- In the north Flank Zone, a low standard single-lane road would be constructed for 0.8 mile from Road 9710 south about 0.8 mile to a trailhead that would provide trail access to North Paulina Peak, the vent of the Lava Cascade Flow, and other Northwest Rift Zone features.

- Cottonwood Road would also provide access to a Monument Scenic Drive which would link all of the Monument Zones together. It would be single-lane, paved (bituminous surface treatment), and would use a combination of new and existing roads to access Lava Cast Forest, Lava Cascades, and would tie into Road 21 in the vicinity of the Road 2121 junction. The road would be about 17 miles long and would require the construction of a bridge across Paulina Creek.

- Road 9720 would be reconstructed as a single-lane gravel road from Road 9710 to the Lava Cast Forest. The rest of Road 9720, from the Monument Scenic Drive to Camp Abbot Pit, would remain in its existing condition and would be used by general forest traffic.

- Road 9735 would be reconstructed to a double-lane gravel standard from Road 9710 to its junction with the Monument Scenic Drive. The rest of the road would remain in its current condition to its junction with Highway 97.

- Road 21, from East Lake Resort east to the Monument boundary, could be improved and traffic would be encouraged to use it.

- The Benham Falls day-use area would be moved to the bench above the river and the existing site. Road 9702 would be closed and rehabilitated for about 1/4-mile into the existing site. Primitive access to a boat ramp would be provided.

Effects

With this alternative, the number of miles of paved road within the Monument would increase about 10 miles, there would be three more miles of aggregate roads, and there would be 44 fewer miles of native roads. In all, there would be 67 miles of road which constitutes a 30% decrease from the current condition. Overall road density would be reduced to 0.7 miles/square mile. Acres impacted by roads would decrease 18% to 269 acres. Approximately 42 miles of roads would be closed on either a temporary or permanent basis.

Outside of the Monument, there would be about one mile of new double-lane paved road needed to link to the Cottonwood interchange. To complete the Monument Scenic Drive, there would be about 5 miles of new construction and 4.5 miles of reconstruction. About 6 miles of Road 9710 would be reconstructed and graveled and about 1.5 miles would be constructed to complete the tie to the Lava River Cave and Cottonwood access. There would be about 2.1 miles of single-lane gravel reconstruction needed to access Camp Abbot Cinder Pit. The road density outside of the Monument would increase slightly.

Access to and through the Monument would increase. Primary roads would have a higher Service Level which would increase traffic flow and provide greater degree of visitor comfort and safety and reduce road maintenance costs. Most low-standard roads would be closed which would reduce access for dispersed recreation. This action could help protect and control use of Monument resources, but could also displace some traditional users.

The Monument Scenic Drive (MSD) would wind through the lavas and provide vistas that would produce a unique and scenic driving experience. Motorized access to some Monument features would be increased, and those with impaired mobility would have more opportunity to

view the various portions of the Monument. Those wishing to escape the sights and sounds of motor vehicles would have less opportunity to do so.

The MSD would connect all of the zones of the Monument and provide continuity. Visitors would be exposed to more than just Lava Lands VIC and the caldera. Interpretive opportunities would increase and visitors would have more of a feeling of being "in" the Monument.

The MSD would improve the flow of traffic to and through the Monument and would provide a low-key loop opportunity for Monument visitors. Visitors would have the option to spend more time and take different routes to view Monument features. Monument traffic on Highway 97 and Road 21 would be decreased.

In order for the MSD to connect into the Road 21/2121 junction, a one-lane bridge would have to be built across Paulina Creek which is a proposed Wild and Scenic River. This would be allowable since recreation is the outstanding value for this portion of the river. The river is in a box canyon at this location, so the bridge would have no effect on the river itself or riparian zone. The Peter Skene Ogden trail would be bisected by the road and bridge which may detract from the experience of some trail users. However, the VIC at the Road 21/2121 junction could also serve as an access point to the trail and the bridge would facilitate that access. The VIC parking area would be used as a sno-park in the winter and the unplowed MSD and bridge would greatly improve access to the northwest flanks of the caldera. The opportunity for Nordic access and trails would be increased.

The MSD and Roads 9710, 9720, and 9735 would provide loop routes through and around the Transition and Lava Butte Zones which would enhance recreational opportunities.

Road 9710 and/or the MSD would provide the primary access to the Lava Cast Forest. These roads would have maintainable surfaces that would increase visitor comfort and decrease road maintenance costs. These also would provide more views of the lava flows and less of the general forest which would make the trip to Lava Cast Forest a more visually pleasing experience.

Access to Road 9710 would be encouraged through the use of Cottonwood Road which would greatly reduce the potential for turning traffic at the existing Highway 97 junction. This in itself would reduce safety risks at this junction. The junction could be further regulated by not allowing left turns for southbound highway traffic and by allowing only northbound traffic to enter the highway from Road 9710- southbound traffic would be required to use Cottonwood Road. These actions would further increase the safety of this junction.

The new 9710 access road from Cottonwood would increase the number of vehicles driving through the big game migratory corridor which could effect wildlife use in this area or the pattern of that use.

Since recreation traffic would be removed from the majority of Road 9720, potential conflicts with commercial or general forest traffic would be reduced. Road 9710 would be improved to a double-lane standard that can accommodate a mix of commercial and recreation traffic. Rock trucks from Camp Abbot Cinder Pit would be mixing with recreation traffic for less than a 1/4 mile on the access to Cottonwood Road.

The road to the trailhead in the north Flank Zone would provide access to short interpretive trails that would loop through some unique and seldom visited features. These would enhance the recreational and interpretive opportunities, but would decrease the area available for a semi-primitive non-motorized experience in the Flanks Zone. This road could also be used as temporary access to the Transferal Area for geothermal exploration. The use of this route would circumvent the steep hillside that lies between Road 9710 and the Transferal

Area and could be more effectively rehabilitated if no viable geothermal resource was found. To construct a road up that hillside would require switchbacks with large cuts and fills that would be very visible and very difficult to rehabilitate.

If the east access of Road 21 were improved, more loop road opportunities for Monument visitors would be provided. Users would be encouraged to use this road to access the ice caves, Fort Rock, Crack-In-The-Ground, and other features of the Northwest Rift Zone. This could enhance interpretive opportunities. Some use would be dispersed outside of the Monument which would slightly decrease traffic in the caldera and on Road 21 west access. Control of the flow or numbers of vehicles entering the caldera could be more difficult.

Changing the terminus of Road 9702 would remove the sights and sounds of motor vehicles from the immediate proximity of the river. Aesthetics from the river and from the trails would be improved. Since Road 9702 changes suddenly from double-lane to single-lane at this point, the standard of the road would be made consistent which would improve the safety of the road. Accessibility for those with impaired mobility would be more difficult.

Alternative B

Assumptions

The Cottonwood interchange would be used to provide access to Lava Lands VIC and Lava River Cave as discussed above in Assumptions Common to All Action Alternatives.

Access to Road 9720 would be provided by Roads 9721 and 9721 300 which would be reconstructed to a double-lane gravel standard. Road 9720 would be reconstructed to the Lava Cast Forest as a double-lane gravel surface road. From the Lava Cast Forest to Road 9710, the remainder of Road 9720 would stay in its current condition.

Roads 9710 and 9735 would also remain in their current condition.

The Benham Falls day-use area would be moved to the bench above the river and the existing site. Road 9702 would be closed and rehabilitated for about 1/4-mile into the existing site. Primitive access to a boat ramp would be provided.

Effects

Within the Monument under this alternative, the number of road miles would be reduced the most. There would be about two more miles of paved road, three more miles of aggregate roads, and 46 fewer miles of native roads. There would be 56 total miles of road, or a reduction of 42%. Road density would be about 0.6 miles/square mile, and 232 acres, or 0.4% of the Monument would be impacted by roads. About 41 miles of road would be closed.

Outside of the Monument, there would be about one mile of new paved road needed to complete the ties to the Cottonwood interchange. There would be about nine miles of road reconstructed to a double-lane gravel standard. The road density outside the Monument would not increase measurably.

Primary access would be provided Lava Lands VIC and Lava River Cave in the Lava Butte Zone, to the Lava Cast Forest in the Transition Zone, and to the lakes in the Caldera Zone. Traffic Service Levels of the primary access roads would increase which would benefit flow and user comfort. There would be no developed connections between the zones, and the fragmentation that exists in Alternative D would continue.

Overall access to the Monument would be decreased from the current condition. Most low standard roads would be closed, and dispersed access would be discouraged. Roads 9710 and 9735 would not be improved and Monument traffic would not be encouraged to use them. These actions may displace some traditional recreation users. These actions could also help protect Monument resources and those wishing to escape the sights and sounds of motor vehicles would have more opportunity to do so.

Monument and Forest traffic would likely use Road 9710 as they do today, and, though not encouraged, that use would be expected to increase. Increased use of the Highway 97/9710 junction which is not designed to accommodate frequent turning traffic would increase the potential safety risks at this location.

There would be no designated loop road opportunities which would cause visitors to return by the same route they came and would diminish the recreation experience. Monument traffic on Highway 97 and Road 21, and Road 9720 would increase. Visitors to all three zones would spend more time driving through general forest and less time viewing Monument features. There could be less of a feeling of being "in" the Monument.

The reconstruction of Road 9720 would allow efficient and cost-effective maintenance to occur. The double-lane standard would accommodate a mixture of commercial and recreation traffic, however, this mixed use would occur for nine miles and conflicts could result. Rock trucks would be sharing the road with Monument visitors for two miles.

Seasonal closure of Lava River Cave to protect hibernating bats would be more effective since the parking area just off the highway would be eliminated and those wishing to hike into the cave would have a 3/4-mile walk using the new access road instead of less than 1/4-mile.

Changing the terminus of Road 9702 would remove the sights and sounds of motor vehicles from the immediate proximity of the river. Aesthetics from the river and from the trails would be improved. Since Road 9702 changes suddenly from double-lane to single-lane at this point, the standard of the road would be made consistent which would improve the safety of the road. Accessibility for those with impaired mobility would be more difficult.

Alternative C

Assumptions

- The Cottonwood interchange would be used to provide access to Lava Lands VIC and Lava River Cave as discussed above in Assumptions Common to All Action Alternatives.

- As in Alternative A, the road from Cottonwood to Lava River Cave would continue northeast as a double lane-aggregate road around the toe of the lava flow to link with Road 9710. The existing Road 9710 access to Highway 97 would either be closed or be utilized by northbound traffic only.

- From the new access point, Road 9710 would be reconstructed to a double-lane standard and surfaced with crushed rock to Road 9720. From Road 9720 to Road 21, Road 9710 would remain in its current condition.

- Cottonwood would also provide access to a Monument Scenic Drive which in this alternative would be a loop road. It would be double-lane, gravel road which would use

a combination of new and existing roads, as in Alternative A, to access the Lava Cast Forest.

- As part of the Monument Scenic Drive, Road 9720 would be reconstructed as a double-lane gravel road from the Lava Cast Forest to Road 9710. The rest of Road 9720, from the Monument Scenic Drive to Camp Abbot Pit, would remain in its existing condition and would be used by general forest traffic.

- Road 9735 would remain in its current condition and Monument traffic would not be encouraged.

- The Benham Falls day-use area would be moved to the bench above the river and the existing site. Road 9702 would be closed and rehabilitated for about 1/4-mile into the existing site. Primitive access to a boat ramp would be provided.

Effects

Within the Monument, this alternative would increase paved roads by two miles, increase aggregate roads by 8 miles, and reduce native roads by 46 miles. In all, there would be 62 miles of road for a reduction of 35% from the current condition. About 41 miles would be closed which would yield a road density of 0.7 miles/square mile. About 261 acres, or 0.4% of the Monument, would be comprised of roads.

Outside of the Monument, there would be about one mile of new paved road needed to link to the Cottonwood interchange. To complete the Monument Scenic Drive, there would be about 4.5 miles of double-lane gravel construction and 5.5 miles of double-lane gravel reconstruction, and there would be about 2.1 miles of single-lane gravel reconstruction needed to access Camp Abbot Cinder Pit. The road density outside of the Monument boundary would increase slightly.

The Traffic Service Level of the primary access roads would be increased which would increase user comfort and safety and decrease road maintenance costs. Access using the remainder of Road 9710 or Road 9735 would not be encouraged. Most low-standard roads would be closed which would reduce access for dispersed recreation. This action could help protect and control use of Monument resources, but could also displace some traditional users.

Access to Road 9710 would be encouraged through the use of Cottonwood which would greatly reduce the potential for turning traffic at the existing Highway 97 junction. This in itself would reduce safety risks at this junction. The junction could be further regulated by not allowing left turns for southbound highway traffic and by allowing only northbound traffic to enter the highway from 9710- southbound traffic would be required to use Cottonwood. These actions would further increase the safety of this junction.

The new 9710 access road from Cottonwood would increase the number of vehicles driving through the big game migratory corridor which could effect wildlife use in this area or the pattern of that use.

Since recreation traffic would be removed from the majority of Road 9720, potential conflicts with commercial or general forest traffic would be reduced.
Rock trucks from Camp Abbot Cinder Pit would be mixing with recreation traffic for less than a 1/4 mile on the access to Cottonwood.

Road 9710, from the new Cottonwood access point to Road 9720, would be improved to a double-lane gravel standard which would safely accommodate a mix of commercial and recreation traffic. This would also reduce the potential for conflicts and increase the experience of the recreation user.

The Monument Scenic Drive, using the route from Cottonwood to the Lava Cast Forest as in Alternative A, Road 9720 across the Lava Cast Forest flow, and returning using Road 9710 to Cottonwood, would provide visitors with a loop driving opportunity which would improve the flow of traffic to and through the Monument. Nearly all of the MSD would be within the Monument boundary or in close proximity to it which would provide more views of the lavas and a feeling of being "in" the Monument. These would enhance the recreation experience and expand interpretive opportunities. All the Monument zones would not be connected by the MSD which could affect the continuity between zones and fragment the Monument experience.

Motorized access to some Monument features would be increased, and there would be more opportunity to view some scenic portions of the Monument. Those wishing to escape the sights and sounds of motor vehicles would have slightly less opportunity to do so.

Without connecting to Road 21, the MSD would not reduce Monument traffic on Road 21 or Highway 97.

Seasonal closure of Lava River Cave to protect hibernating bats would be more effective since the parking area just off the highway would be eliminated and those wishing to hike into the cave would have 3/4 mile to walk instead of less than 1/4 mile.

Changing the terminus of Road 9702 would remove the sights and sounds of motor vehicles from the immediate proximity of the river. Aesthetics from the river and from the trails would be improved. Since Road 9702 changes suddenly from double-lane to single-lane at this point, the standard of the road would be made consistent which would improve the safety of the road. Accessibility for those with impaired mobility would be more difficult.

Alternative C-Modified

Assumptions

- The Cottonwood interchange would be used to provide access to Lava Lands VIC and Lava River Cave as discussed above in Assumptions Common to All Action Alternatives.

- The road from Cottonwood to Lava River Cave would be double-lane paved. As in Alternative A, this road would continue northeast as a double lane-aggregate road around the toe of the lava flow to link with Road 9710. The existing Road 9710 access to Highway 97 would either be closed or be utilized by northbound traffic only.

- From the new access point, Road 9710 would be reconstructed to a double-lane standard and surfaced with crushed rock to Road 9720. From Road 9720 to Road 21, Road 9710 would remain in its current condition.

- Access to Road 9720 would be provided by Roads 9721 and 9721 300 which would be reconstructed to a double-lane gravel standard. Road 9720 would be reconstructed to the Lava Cast Forest as a double-lane gravel surface road.

- The remainder of Road 9720, from the Lava Cast Forest to Road 9710, would be reconstructed as a single-lane gravel road.

- Road 9735 would remain in its current condition and Monument traffic would not be encouraged.

- Lava River Cave would be closed in the winter, except to guided interpretive tours.

- The Benham Falls day-use area would remain on the river plain and access by Road 9702 would remain in its current location.

Effects

Within the Monument, this alternative would increase paved roads by two miles, increase aggregate roads by 7 miles, and reduce native roads by 46 miles. In all, there would be 60 miles of road for a reduction of 38% from the current condition. About 41 miles would be closed which would yield a road density of 0.7 miles/square mile. About 256 acres, or 0.4% of the Monument, would be comprised of roads.

Outside of the Monument, there would be about one mile of new paved road needed to link to the Cottonwood interchange. There would be about 1.5 miles of double-lane gravel construction and 13.0 miles of double-lane gravel reconstruction. The road density outside of the Monument boundary would increase slightly.

The Traffic Service Level of the primary access roads would be increased which would increase user comfort and safety and decrease road maintenance costs. Access using the remainder of Road 9710 or Road 9735 would not be encouraged. Most low-standard roads would be closed which would reduce access for dispersed recreation. This action could help protect and control use of Monument resources, but could also displace some traditional users.

Access to Road 9710 would be encouraged through the use of Cottonwood which would greatly reduce the potential for turning traffic at the existing Highway 97 junction. This in itself would reduce safety risks at this junction. The junction could be further regulated by not allowing left turns for southbound highway traffic and by allowing only northbound traffic to enter the highway from 9710- southbound traffic would be required to use Cottonwood. These actions would further increase the safety of this junction.

The new 9710 access road from Cottonwood would increase the number of vehicles driving through the big game migratory corridor which could effect wildlife use in this area or the pattern of that use.

The reconstruction of Road 9720 would allow efficient and cost-effective maintenance to occur. The double-lane standard would accommodate a mixture of commercial and recreation traffic, however, this mixed use would occur for nine miles and conflicts could result. Rock trucks from Camp Abbot Cinder Pit would be sharing the road with Monument visitors for two miles.

Road 9710, from the new Cottonwood access point to Road 9720, would be improved to a double-lane gravel standard which would safely accommodate a mix of commercial and recreation traffic. This would also reduce the potential for conflicts and increase the experience of the recreation user.

The route from the Cottonwood interchange to the Lava Cast Forest, Road 9720 across the Lava Cast Forest flow, and returning using Road 9710 to Cottonwood, currently provides

visitors with a loop driving opportunity. Upgrading road surfaces with rock and other safety improvements in terms of width and turn-outs would improve the flow of traffic to and through the Monument and enhance recreational and interpretive opportunities.

Not all the Monument zones would be connected by this existing loop road which could affect the continuity between zones and fragment the Monument experience. Compared to Alternative C, there would be about 9 miles of the loop road which would not be within or in close proximity to the Monument boundary. There would be fewer views of the lavas and may be less of a feeling of being "in" the Monument.

Motorized access to some Monument features would be increased but to a lesser extent than Alternative C, and there would be slightly less opportunity to view some scenic portions of the Monument. Those wishing to escape the sights and sounds of motor vehicles would have slightly more opportunity to do so.

The Monument Scenic Drive, as proposed in Alternative A, would not exist. Without an "internal" Monument link to Road, 21, Monument traffic on Road 21 or Highway 97 would naturally be greater than if the MSD existed.

Year-round access to Lava River Cave would increase snow removal costs, but in high snow years, the parking area could be used as a sno-park.

Without changing the terminus of Road 9702, the sights and sounds of motor vehicles would remain, and likely increase, in the immediate proximity of the river. Accessibility would be increased.

Road closures represent an estimate of the roads that would not be needed for continual, long-term recreation and other resource access. Those roads that are not needed at all would be obliterated and rehabilitated. Those roads that may be needed for intermittent resource access would be blocked to general traffic. The majority of the closures would occur in the Transition and Lava Butte Zones. Further analysis as well as public input would be required to identify specific roads to be blocked or obliterated. All alternatives would lose between 40 and 45 miles of road.

Table 4 - 5

MILES OF ROADS

ZONE		ALTERNATIVE									
		A		B		C		C-Mod		D	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
River	Paved	0	0	0	0	0	0	0	0	N/A	N/A
	Aggregate	0	0	0.3	0.3	0	0	0	0	N/A	N/A
	Native	0	0	2.7	0	0	0	0	0	N/A	N/A
	Total	0	0	3.0	0.3	0	0	0	0	N/A	N/A
Lava Butte	Paved	5.0	7.2	5.0	6.9	5.0	6.9	5	6.9	N/A	N/A
	Aggregate	1.8	3.3	1.8	0.6	1.8	3.6	1.8	3.3	N/A	N/A
	Native	20.8	4.4	10.3	3.9	20.8	4.4	20.8	3.5	N/A	N/A
	Total	27.6	14.9	17.1	11.4	27.6	14.9	27.6	13.7	N/A	N/A
Transition	Paved	0	7.2	0	0	0	0	0	0	N/A	N/A
	Aggregate	7.4	5.4	7.4	7.3	7.4	10.2	7.4	9.0	N/A	N/A
	Native	27.4	9.5	34.6	9.2	27.4	9.5	27.4	9.5	N/A	N/A
	Total	34.8	22.1	42.0	16.5	34.8	19.7	34.8	18.5	N/A	N/A
Flanks	Paved	0	0	0	0	0	0	0	0	N/A	N/A
	Aggregate	0	0	0	0	0	0	0	0	N/A	N/A
	Native	7.9	6.1	10.4	7.1	10.4	7.1	10.4	7.1	N/A	N/A
	Total	7.9	6.1	10.4	7.1	10.4	7.1	1.4	7.1	N/A	N/A
Caldera	Paved	12.6	13.5	12.6	12.6	12.6	12.6	12.6	12.6	N/A	N/A
	Aggregate	2.3	6.3	2.3	6.3	2.3	6.3	2.3	6.3	N/A	N/A
	Native	12.3	3.8	9.5	1.9	9.5	1.9	9.5	1.9	N/A	N/A
	Total	27.2	23.6	24.4	20.8	24.4	20.8	24.4	20.8	N/A	N/A
Monument	Paved	17.6	27.9	17.6	19.5	17.6	19.5	17.6	19.5	17.6	N/A
	Aggregate	11.5	15.0	11.8	14.5	11.5	20.1	11.5	18.6	11.5	N/A
	Native	68.4	23.8	67.5	22.1	68.1	22.9	68.1	22	68.1	N/A
	Total	97.5	66.7	96.9	56.1	97.2	62.5	97.2	60	97.2	N/A

N/A Not Applicable

Note: The values for "existing" on this chart change by Zones and by Alternative due to shifts in the Zone boundaries.

3. Vegetation

Vegetation Management Activities

The monument legislation states that "Land management activities shallow natural ecological succession of vegetation to continue to the maximum extent practical." It also recognizes that because of past human activities such a fire suppression and timber harvest that focused on the removal of large ponderosa pine, further vegetation management activities may be necessary to allow natural successional processes to be restored and to continue. These issues should be addressed in a manner, "consistent with the purposes for which the Monument and Special Management area were established." Issues addressed will include: 1) "Vegetation, including consideration of a full range of management options, and a program to reestablish old-growth ponderosa pine ecosystems." and 2) "Fire and fuel management prescriptions, including consideration of a full range of management options for fuel hazard reduction and prescribed fire and fire control strategies to minimize the risk of catastrophic wildfire and to meet other resource objectives."

Direct and Indirect Effects on Vegetation

The management activities described in the various alternatives will have direct and indirect effects on vegetation. The extent of the direct and indirect effects on vegetation depends almost entirely on the type, size, location, and timing of the management activities.

The average number of forested acres likely to be treated per year to deliver various objectives (such as restoring old growth, reintroducing fire into the ecosystem, or reducing fire hazard) ranges from zero (0) acres for Alternative D to 550 acres in Alternative C. This includes both mechanical treatments and prescribed burning treatments. (The estimated activities for each alternative are described in detail later in this section.)

Management activities can affect the species composition, density, health, vigor and growth rate, and age of the Forest. The activities can also affect the forest's vertical structure (canopy layers of trees, shrubs, grasses and herbaceous plants in a given location) and horizontal structure (spatial arrangement of plant species, density, and age over the landscape). Vegetation management activities described for a particular alternative may affect the physical characteristics of the site (soil productivity, water regimes, etc.,) either by physically altering the site itself through erosion, soil compaction, etc., or by altering the biological features. Prescribed burning or cutting and removing vegetation may have obvious effects on the forest ecosystem. However, activities which may involve little alteration of present forest conditions, such as recreation management, can also have effects, although they may not be as direct or evident.

Due to the nature of the analysis process and the interrelationships that exist between various Forest components (for example, vegetation size/structure and wildlife habitat for selected species or vegetation management for visual quality), many of these effects are covered in other parts of this chapter. Principal indirect effects will be on soil, water, wildlife and wildlife habitat, air quality, riparian areas, fish habitat, recreation and visual resources. Also see the following section on fire and fuels for additional information about effects of management activities on vegetation.

Cutting, Removing and Rearranging Vegetation (Mechanical Treatment)

This activity includes cutting and removing or rearranging trees, shrubs and other vegetation primarily to:

1) Reduce high fuel loadings that resulted from past fire exclusion (fire suppression). Reducing fuel loadings in turn will allow the reintroduction of natural or historic fire regimes as an important element in the ecosystem and will ensure that fire does not threaten resources within or outside of the Monument;
2) Allow more rapid attainment of certain vegetation conditions such as the large tree component of old growth;
3) Reduce threats to vegetation and other resources within and outside the Monument from insect and disease by enhancing plant vigor and reducing sources of infection or infestation;
4) Enhance habitat for selected species of wildlife and plants including providing dead woody material such as snags and downed logs;
5) Enhance views or aesthetics;
6) Create conditions favorable for the regeneration of selected plant species;
7) Maintain a safe environment in designated recreation, work areas, and transportation corridors.

The extent, location, timing, and prescription for the vegetation cutting and/or removal determines the overall scope of the effects, but the general effects for each piece of land treated do not vary among alternatives. Cutting and removing vegetation has the following direct and indirect effects on forests and plant diversity: changes plant species composition and age distribution; changes amount and arrangement of organic material such as logs, and branches; alters or kills existing vegetation; alters nutrient cycling and availability to plants and increases growth rates on remaining plants; alters a "natural-appearing condition;" changes the risk and incidence of tree-root disease, insects, and other diseases which affect vegetation; alters microclimate and will increase surface winds, possibly increasing tree windthrow; changes wildlife and domestic grazing patterns which in turn affects grass, forb and shrub consumption; disturbs soil which affects erosion potential, compaction, and nutrient availability for plants and plant growth; may alter macroclimate, and possibly contribute to global warming; increases or decreases fire hazard and ability to control fires that could destroy vegetation; may alter the amount and species of soil microbes and fungi and the processes they sustain.

Because a large portion of the Monument area is dominated by forest land, vegetation management activities will most frequently involve forested land. Many treatments described may also be applied to non-forest vegetation, however. Descriptions and direct effects of specific types of vegetation management activities involving cutting, rearranging and removing vegetation are discussed below:

Reforestation and Revegetation Activities (Mechanical Treatment)

These activities introduce desired species and genotypes into areas where the vegetation has been cut, burned, trampled, etc. The objective is usually to enhance ecological or aesthetic values or to prevent soil erosion. General effects of these activities may include changing species composition or diversity, decreasing erosion potential and helping to maintain long-term soil productivity.

Natural regeneration of plants by seed or vegetative sprouting maintains the presence of existing plant species and species diversity.

Planting of vegetation can replenish or restore diversity that has been diminished as a result of catastrophic events such as wildfire or insect and disease outbreaks. The use of planting is not expected to be extensive within the National Monument. However, it may be considered as an option following a catastrophic event or in limited cases such as rehabilitating disturbed areas, providing screening around recreation sites, or enhancing diversity in riparian areas. Supplemental planting of seral species (mainly pine species) in forests managed under uneven-aged silvicultural systems may be necessary to ensure the continued presence of the species over time.

Many of the effects of reforestation activities are covered under even-aged and uneven-aged regeneration practices. Revegetation activities often begin with site preparation to expose mineral soil or to remove competing and unwanted vegetation. The objective is to provide an environment conducive to the establishment, survival and growth of the new forest or vegetation. These activities can be classified as mechanical, prescribed burning, chemical, and a combination of methods. The effects of chemical and prescribed burning methods are discussed in later sections.

Mechanical site preparation can involve either the use of hand tools or heavy machinery to remove existing vegetation and accumulated organic matter. A direct result of the practice is a reduction of the existing vegetation and increased opportunity for survival and growth of species that benefit from these conditions. If improperly conducted, it can lead to soil damage or displacement, loss of soil nutrients, and reduced site productivity.

Artificial regeneration (planting) provides the most control over the timing and composition of future vegetation. With natural regeneration there is less control over species composition and stocking (numbers). For example, in tree species, many years may pass before weather and other growing conditions coincide to allow for good natural regeneration. Vegetation that is planted rather than naturally regenerated is frequently more uniform in size, age, and spacing.

It is generally believed that genetically diverse populations are best able to withstand certain catastrophic events and that they exhibit other, often desirable traits, such as high growth rates. Selection of desirable individuals that will remain to provide seed is an important consideration with natural regeneration. For tree species, uneven-aged management with natural regeneration favors inbreeding while even-aged management favors outcrossing (parent plants are not closely related). In coniferous species, inbreeding can have substantial impacts on such traits as reduced growth rates in subsequent regeneration.

Prescribed fire can be used as a tool to naturally thin forest vegetation (especially ponderosa pine). The effects of prescribed burning are discussed in later sections.

Even- and Uneven-aged Regeneration Treatments

Regeneration cutting is the removal of all or a portion of the tree component of the forest, for the purpose of establishing a new stand.

Even-aged regeneration methods include shelterwood, seed tree and clearcut treatments. In clearcut cuttings, all trees to be cut are removed in one operation. In shelterwood and seed tree cuts, the trees to be cut are removed in two or more operations. The final removal cut takes place when reproduction is established. In all of these types of cuttings, trees are often reserved (never removed) to provide future snag habitat and downed logs for some wildlife species.

Regeneration cutting promotes the establishment of new stands of trees. It provides growing space, and reduces competition for sunlight, water, and nutrients. With even-aged

management, regeneration occurs during a relatively short period of time and creates a new even-aged stand. Both artificial (planting) and natural regeneration practices are used. Stands regenerated with even-aged practices favor the establishment of "sun-loving" or seral species of trees such as lodgepole pine and ponderosa pine.

Even-aged stands have essentially a single canopy level and most of the trees within a stand will be within 20 years of age of one another. The structural diversity that results from even-aged harvest will be less than for uneven-aged harvest, but overall diversity can be increased by creating mosaics of even-aged stands of varying ages, successional stages and size classes. Lodgepole pine stands are the most likely candidate for even-aged management within the Monument because stands naturally develop that way. Shelterwood treatments are likely to be the most frequently-used even-aged cutting method.

The shift to early successional stages following even-aged management will increase the grass, forb, and shrub components of the stands. Vegetation changes tend to be most rapid after clearcutting. Shelterwood cutting moderates the amount of solar radiation passing to the ground and there is generally less understory response than in clearcutting. The amount of forage and browse available to wildlife decreases as the amount of tree crown closure increases.

Uneven-aged regeneration treatments are initiated by single tree or group selection cutting methods. With single tree selection, individual trees are cut to create a desired distribution of age classes. In group selection, small openings (generally less than two acres) are made to create a desired distribution of age classes composed of small groups. Uneven-aged cuttings generally have more frequent periodic entries than even-aged cuttings to achieve a greater number of age classes, with fewer trees per acre being cut during each entry.

With uneven-aged management, continuous high forest canopy is maintained when viewed from a stand basis, although small group openings can occur with group selection. Regeneration is a continuing process with each entry and occurs naturally or through planting. In an uneven-aged stand there are three or more age or size classes, occurring as scattered individuals or in small groups. Single tree selection tends to favor those species that can regenerate and grow under shaded conditions such as white fir. The seral species in mixed conifer stands (generally pine) will decline in number over time unless measures such as group selection are taken to ensure their continued presence. Damage to the residual stand can occur with uneven-aged cutting similar to that described for thinning (above).

Multiple canopy layers that result from uneven-aged cutting can contribute to the spread of tree diseases such as dwarf mistletoe. This can also occur with seed tree and shelterwood cuttings when diseased trees are left in the overstory.

Much less forage and browse is produced in an uneven-aged stand due to the reduced light and changes in microclimate brought about by the remaining canopy. Group selection patches will generally produce more forage and browse than single tree selection areas, but less than even-aged stands.

Manual or Mechanical Release (Cleaning or Weeding)

Planted seedlings or natural regeneration occupy space vacated by other vegetation. In many cases the residual plants will sprout or grow from "stored" seed and compete with the newly-established individuals. The effect of these activities includes the removal or setting back of growth rates of the unwanted vegetation. This may decrease the overall diversity of the site. Growth rates for the desired species will increase. Improper disposal of the unwanted vegetation may result in the buildup of fuel hazards.

Thinnings and Sanitation Treatments

Thinning reduces competition for light, water, and nutrients, and generally removes trees that are suppressed or weakened, leaving the best trees in an enhanced growing condition. Stand density is decreased and diversity within the stand is often diminished. Thinning often results in an increase in the average size of the residual trees and makes a stand more resistant to insect and disease attacks and losses.

Sanitation cutting is the removal of trees that are dead, dying, damaged, or deteriorating, as well as those susceptible to insect attack. When this is done before the wood loses its commercial value, it is called salvage cutting. Sanitation and salvage treatments decrease the amount of dead and down trees in the forest, reducing this aspect of forest diversity.

Both thinning and sanitation treatments can cause damage to residual trees by mechanical wounding either from equipment or falling trees. Improper equipment selection or poor project design can compound these problems.

Application of Chemicals, Trapping, Hunting, and Construction of Animal Barriers

This includes the application of chemicals such as fertilizers, herbicides, pesticides, repellents; construction of mechanical barriers to prevent damage to selected plants; and selective removal of animals which damage valuable resources. The objective is to protect existing vegetation or re-establish native vegetation. An example might be the use of herbicides to control the introduced reed canary grass in wet meadows in the caldera. General effects on vegetation include: increase in the growth rates of treated or protected species, damage or mortality in treated vegetation, and damage or mortality to plants outside the target area. It is anticipated that the use of these measures within the Monument will be limited.

Areas With Limited Vegetation Management Activities

All alternatives provide areas with little or no vegetation management activities. They have the effect of maintaining "natural appearing" forest conditions and contribute to forest diversity. In these areas, trees will tend to become larger and older. Trees in stands of mixed species will tend to slowly change from those dominated by early successional, shade-intolerant species including ponderosa pine or lodgepole pine to shade-tolerant species such as white fir or mountain hemlock. Wildfire can inhibit succession to tolerant species. The management of these areas tends toward long-term, stable communities unless the areas are influenced by fire, major windstorms, insect and disease outbreaks, or other natural disasters. In the absence of such major disturbances this type of management:

-Maintains or increases the amount and arrangement of organic materials on a given site;
-Generally maintains overall genetic and species diversity;
-Increases average age of vegetation.
-Increases risk from wildfire, and decreases ability to control fires;
-Catastrophic events could result in major changes to species composition, age, structure, organic material and soil productivity;

Creation of Habitat Improvement Structures and Areas

These include water developments, protective fencing, flooding, wetland creation, and nesting structures. This type of activity can change microclimate in the case of flooding. Habitat improvement structures can concentrate wildlife or domestic grazing animals, which

increases consumption of vegetation, damage to vegetation, and nutrients available for vegetation growth.

Transportation Related Activities
Including Roads, Landings, and Trail Construction and Maintenance

These activities sometimes require heavy equipment (tractors, trucks, and earth movers) to develop stable surfaces capable of supporting cars, horses, people and equipment for vegetation management activities. Such activities remove vegetation temporarily or permanently from roadways, trails, and landings; provides access which allows for more alternatives in carrying out vegetation management activities; increases access for legal vegetation removal activities such as gathering firewood; increases access for illegal vegetation removal activities such as firewood or Christmas tree theft; may add to the visual sensitivity of an area which limits the alternatives that can be considered in carrying out vegetation management activities; may impair visual quality; and increases the risk of human-caused fire starts but increases accessibility for fire control.

Off-Highway Vehicle (OHV) and All-Terrain Vehicle (ATV) Use

The magnitude of the effects depends on the season, amount of use, soil type, plant community and size of vegetation. Off-highway vehicle use may damage or kill young trees and other vegetation, introduce unwanted vegetation species and may increase fire risk and associated fire effects on vegetation.

Construction, Maintenance, and Use of Recreation Facilities

Providing new recreation facilities such as parking areas, shelters, signs, campgrounds, interpretive facilities and snow-play areas involves the construction of various buildings, concrete footings, sign posts, pavement, etc. Construction, maintenance and use removes or damages vegetation in popular high-use areas, changes species composition, and concentrates people in certain areas, which may compact soil and disturb vegetation. Air pollution from vehicle emissions could also impact vegetation.

Livestock and Wildlife Grazing

Grazing or browsing by both wildlife and livestock can affect the amount, species composition, and condition of grasses, forbs, and shrubs, as well as coniferous and hardwood trees. It can act to increase, decrease, or have few effects on forest diversity. Grazing generally decreases the abundance of the preferred species and leaves growing space available for less-preferred species. The impact of grazing on vegetation is generally small, site-specific, and not predictable over a large area. In areas where animals sometimes congregate, such as riparian areas, the impacts of grazing can be magnified. Grazing activity encourages early successional stages of vegetation, affects species composition, affects the vigor of grasses and forbs, affects species diversity, provides fertilizer in high use areas, damages or removes existing vegetation often leaving roots intact, and may introduce undesirable or exotic species. In some cases grazing by domestic livestock has been used successfully as a tool to achieve vegetation management objectives.

Managing for Big Game Hiding and Thermal Cover

Managing for maintaining or increasing the cover for deer and elk decreases individual tree growth and vigor when trees are left in conditions with high densities to provide hiding or

thermal cover. The production of understory vegetation also tends to be reduced in these areas and the susceptibility of these stands to insects and diseases increases.

Visual Resource Management

Visual management generally maintains or adds to the structural diversity at a landscape level. Management to achieve visual diversity can result in a range of stand tree ages and sizes with natural to altered appearances. Managing to obtain certain visual objectives can slow the growth of vegetation and meeting short-term visual objectives could decrease the overall health and vigor of vegetation, where large areas are in need of extensive treatment. Without catastrophic events such as intense fires or large-scale insect infestations, forest stands with high visual quality objectives (retention or partial retention) will tend toward larger trees and climax successional stages. Where visual objectives call for large trees, the general effect could be to broaden plant diversity at the landscape level in terms of age and size distribution, and could result in species shifts to more shade-tolerant species such as white fir, and increases in forest insects and diseases associated with these species.

Wildlife Habitat Dead Tree (Snag) Management

Snag management involves leaving standing dead trees or creating snags from living trees for wildlife habitat. Snags and down trees increase forest diversity and assist in maintaining long-term site productivity; however, they also contribute to increased fuel loading.

Gathering of Miscellaneous Forest Products and Fuelwood

The interactions of gathering fuelwood are discussed under fuel treatment (following). The gathering of conifer boughs, leaves, cones, fungi, etc., may have the kinds of effects that are similar to those as discussed under cutting, removing and rearranging vegetation. In many cases such as for gathering conifer boughs, leaves and cones the effects would generally be smaller in magnitude than for other vegetation treatments. The effects of gathering fungi are not well understood. However, it is known that fungi play beneficial roles in the decomposition of organic material and that mycorrhizal fungi, associated with plant roots, increase the availability of water and nutrients to the host plant.

Effects of the Alternatives on Vegetation

Vegetation Management Activities

The extent of the direct and indirect effects depends on the size, location and timing of the activities prescribed for each alternative. The degree to which each alternative exhibits the effects previously discussed in the interactions section is expected to be proportional to the number of acres treated. The discussion of the effects of vegetation management activities is organized by broad forest and other vegetation communities. A site-specific analysis may find that small amounts of other types of management treatments may be warranted. Significant effects from any vegetation management are captured here. The effect of other types of activities on vegetation such as recreation, grazing, and road and trail construction are consolidated for all vegetation types by activity.

Forests Dominated by Ponderosa Pine - Including Old growth

Alternative D: The use of vegetation management for restoration activities would be very limited for this alternative. Consequently, there would be little, if any effect from

vegetation management on existing ponderosa pine and existing ponderosa pine old growth. Existing old-growth ponderosa pine forests generally exceed the minimum characteristics for old growth described in "ecological definitions" (fire suppressed). Conditions do not reflect those found in pre-EuroAmerican forests ("historic"/fire-based old growth). These characteristics will continue to be perpetuated for the short-term in the absence of epidemic insect attacks or large, stand replacement wildfires. Over time the likelihood for such events will continue to increase as fuels build up from continuing fire suppression. Stands will become more crowded with trees, and more susceptible to insect attack. In stands of mixed lodgepole and ponderosa pine, the amount of lodgepole pine could be expected to increase in the event of stand replacement wildfires.

Much of the ponderosa pine within the Monument is comprised of even-aged stands of small- to medium-sized trees less than 18 inches in diameter. Over 15% of these forests at the north end of the Monument were recently thinned to provide protection from the mountain pine beetle that had previously devastated the lodgepole pine. Without further vegetation management (thinning), these forests will develop very slowly into conditions that surpass the minimum definitions for "ecological"/fire-suppressed old growth. Understory vegetation that has been enhanced or perpetuated by recent thinning activities will be crowded out as tree canopies close or pine seedlings establish themselves in the understory. Potential stand replacement fires or severe insect infestations could greatly increase shrubs, grasses and other herbaceous plants. These forests will not reflect conditions found in pre-Euroamerican forests ("historic"/fire-based old growth).

Trees in stands that are dominated by ponderosa pine and that include true fir will tend to slowly change from those dominated by early successional, shade-intolerant species including ponderosa pine and lodgepole pine to shade-tolerant species such as white fir.

Alternative A: Vegetation management activities are designed to restore "historic," fire-based old growth on 1,000 acres within the Monument. These treatments will also reduce fuel loading and fire risk. About 100 acres would be treated (generally by underburning) each year, on a cycle of 8-12 years. The area treated amounts to about 10% of the land base where ponderosa pine is one of the dominant species. Within 90 to 100 years these stands will have substantially developed old-growth characteristics.

Existing old-growth areas would be managed to retain or enhance their present characteristics which may include multiple canopy layers, down woody material, snags, shrub component, etc. These stands will not resemble "historic," fire-based old growth. Untreated areas would respond as described for Alternative D.

Alternative B: Vegetation management activities are designed to restore "historic" fire-based old growth on 1,000 acres, similar to Alternative A. In addition, about 60% (6,000 acres) of stands with a significant component of ponderosa pine (includes mixed pine species and ponderosa pine/white fir) will be managed to exceed the minimum characteristics for "ecological" old growth. Uneven-aged regeneration cutting will generally be used to create and maintain multiple canopy layers and fire will be limited to preserve snags and downed woody material. About 150 acres would be treated annually on a cycle of about 40 years between treatments on each acre. Initial entries in stands of medium-sized pine would resemble thinnings to increase vigor and diameter growth. Within 90-100 years these stands will have substantially developed old-growth characteristics. Uneven-aged stands would exhibit a continuous forest canopy including large trees over time. It would be punctuated by small openings filled with regenerating trees.

Existing old-growth areas would be managed to retain or enhance their present characteristics which may include multiple canopy layers, down woody material, snags, shrub component, etc. These stands will not resemble "historic," fire-based old growth. Untreated areas would respond as described for Alternative D.

Alternative C: Vegetation management activities would restore "historic" fire-based old growth on about 8,000 acres or 80% of the area dominated by ponderosa pine (includes mixed pine stands). About 250 acres per year would be treated (generally by underburning) to imitate the frequent, low intensity fires found in "historic" old-growth stands. In about 20 years, when fuels have been reduced, the area treated would increase to 750 acres per year to imitate the 8-12 year fire return interval to which ponderosa pine has adapted. In stands of mixed pine species (lodgepole pine and ponderosa pine), burning would naturally favor ponderosa pine over lodgepole pine. Within 90 to 100 years these stands will have substantially developed old-growth characteristics. Over time, insect activity, fire and other natural processes should help to develop a mosaic of various stand conditions. This mosaic of seral conditions will mimic historic stands and provide for increased biodiversity and the opportunity to manage the entire old-growth tract for long periods of time.

Some existing old-growth areas would be managed to achieve "historic" conditions by re-introducing fire regimes that feature frequent, low intensity fires. Untreated areas would respond as described for Alternative D.

Alternative C-Modified: Activities to restore fire-based ponderosa pine ecosystems would occur on about 3,200 acres or 30% of the ecosystems dominated by ponderosa pine. In addition, about 500 acres or 5% of the ponderosa pine plant communities would be treated over time by manual or mechanical means such as thinning or selection cutting to provide characteristics such as larger trees, snags, downed wood or multiple canopy layers which could not generally be provided using prescribed fire. Restoration activities will also reduce unnaturally heavy fuel loads and wildfire risk. Between 120 and 400 acres would be treated during the first ten years of the Plan. Restoration activities would focus on evaluating and, if necessary, maintaining existing old growth and on the reintroduction of fire in ponderosa pine ecosystems using prescribed fire. Over the long term the average annual acreage treated would be about 160 acres. In order to provide opportunities to achieve greater diversity within some ponderosa pine stands, by developing a shrub or other understory layer, the range for fire return interval was lengthened for this alternative to 8-35 years. The interval chosen for a particular area would be based on site-specific analysis. Landscape patterns will be a mosaic comprised of generally untreated multi-storied stands (70% of the area) and fire-based, open and park-like stands (30%) of the area. Untreated areas would respond as described for Alternative D.

Table 4 - 6

Activities Involving the Restoration of Ponderosa Pine Old Growth

Short-Term: Next Ten Year Total (Acres) 1/

Alternative	A	B	C	C-Mod	D
Activities to Restore "Historical," Fire-Based Old-Growth Ponderosa Pine 2/	1000	1000	2500	70-300	0
Activities to Maintain "Ecological," Fire-Excluded Old-Growth Ponderosa Pine 3/	0	1500	0	50-100	0

1/ Area includes ponderosa pine plant associations that are now occupied by ponderosa pine, mixed pine (ponderosa pine and lodgepole pine) or mixed ponderosa pine and white fir forests. The areas are estimates for effects analysis only. They are not intended to imply a rigid schedule.

2/ The total area during the first ten years of the Plan where restoration activities would provide "historic," fire-based, old-growth ponderosa pine. Prescribed fire is the preferred method of treatment; however, mechanical pre-treatment or manual rearrangement of fuels may be necessary in some areas to reduce unnaturally heavy fuel accumulations which have resulted from fire suppression.

3/ The total area during the first ten years of the Plan where restoration activities would provide "ecological," fire-excluded, old-growth ponderosa pine. Treatments could include mechanical treatments such as thinning or selection cutting to provide desired characteristics including multiple canopy layers.

Table 4 - 7

Activities Involving the Restoration of Ponderosa Pine Old Growth

Long-Term: Beyond Ten Years (Acres) 1/

Alternative	A	B	C	C-Mod	D
Annual Average Area of Restoration Activities for "Historical," Fire-Based Old-Growth Ponderosa Pine	100	100	250	135	0
Annual Average Area of Maintenance Activities for "Ecological," Fire-Excluded Old-Growth Ponderosa Pine	0	150	0	25	0
Total Area Where Restoration Activities Would Occur for "Historical," Fire-Based Old-Growth Ponderosa Pine 2/	1000	1000	8000	3240	0
Total Area Where Maintenance Activities Would Occur for "Ecological," Fire-Excluded Old-Growth Ponderosa Pine 3/	0	6000	0	520	25
Total Area of Ponderosa Pine Restoration Activities	1000	7000	8000	3760	25

1/ Area includes ponderosa pine plant associations that are now occupied by ponderosa pine, mixed pine (ponderosa pine and lodgepole pine) or mixed ponderosa pine and white fir forests. The areas are estimates for effects analysis only. They are not intended to imply a rigid schedule.

2/ Prescribed fire is the preferred method for restoration; however, mechanical pre-treatment or manual rearrangement of fuels may be necessary in some areas to reduce unnaturally heavy fuel accumulations which have resulted from fire suppression. The long-term objective is to rely on natural processes (prescribed natural fire) where possible or to mimic natural fire regimes using prescribed fire where prescribed natural fire is not feasible.

3/ Activities could include mechanical treatments such as thinning or selection cutting to provide desired characteristics including multiple canopy layers, as well as, prescribed fire.

Forests Dominated by Lodgepole Pine - Including Old Growth

Lodgepole pine is a short-lived tree species. The oldest known stands average about 170 years old. As lodgepole pine forests approach maturity and assume old-growth characteristics, a number of natural forest pathogens and pests often become serious problems. Consequently, old-growth Sierra lodgepole pine with fully developed old-growth characteristics may only exist for a short time before falling prey to insects or disease. (Hopkins 1993).

Alternative D: Many of the large lodgepole pine trees were killed in the recent mountain pine beetle epidemic. Trees that survived will grow at faster rates and become large trees over time, making new areas that exceed the minimum definitions for most characteristics of "ecological" old growth. Without vegetation management, old-growth lodgepole pine will exist on a boom and bust cycle due to mountain pine beetle epidemics. At any given time one could expect very little lodgepole pine old growth, because of the effects of insect factors.

In open areas, lodgepole pine seedlings will regenerate to create large, dense, even-aged forests (or two-storied conditions where trees in the original forest have not all been killed). The threat of insect epidemics will continue or increase, as will the risk of wildfire from old, decaying trees. Understory vegetation associated with these stands will increase for the short term, but as young trees gain maturity, the understory vegetation will be crowded out. Potential wildfires or insect infestations could greatly increase shrubs, grasses and other herbaceous plants.

Alternative A: Alternative A will restore fire as a natural process to about 10% of the lodgepole pine ecosystems within the Monument. An estimated, additional 15% of the lodgepole pine plant communities would be treated over time by mechanical or manual means such as thinning or regeneration cutting to provide desired characteristics such as larger trees, snags or downed wood that might otherwise be consumed by fire. Restoration and other activities will also reduce heavy fuel loads which have resulted from mountain pine beetle mortality combined with past fire suppression. About 100 acres would be treated each year, on average, with the cycle between treatments for a given area being approximately 100 years. Because lodgepole pine forests do not develop old-growth characteristics until about the age of 120 years, the treated acreage will not contribute significantly to the amount of old-growth lodgepole. For untreated areas (75%), see Alternative D.

Alternative B: Alternative B will restore fire as a natural process to about 40% of the lodgepole pine ecosystems within the Monument. An estimated, additional 30% of the lodgepole pine plant communities would be treated over time by mechanical or manual means such as thinning or regeneration cutting to provide characteristics such as larger trees, snags or downed wood that might otherwise be consumed by fire. Restoration and other activities will also reduce heavy fuel loads and wildfire risk. About 135 acres would be treated each year, on average, with the cycle between treatments for a given area being 120 years. landscape patterns will resemble the mosaics found in "historic," pre-Euroamerican lodgepole pine forests but the trees will be older and larger. In the long term, at least 15% of the lodgepole pine stands will have an average age of between 100 and 120 years. The remainder of the lodgepole pine type (30%) will remain untreated and cycle through periods of boom and bust for lodgepole pine old growth as described for Alternative D.

Alternative C: Alternative C will restore fire as a natural process to about 55% of the lodgepole pine ecosystems within the Monument. An estimated, additional 30% of the lodgepole pine plant communities would be treated over time by mechanical or manual means such as thinning or regeneration cutting to provide characteristics such as larger trees, snags or downed wood that might otherwise be consumed by fire. Restoration and other activities will also reduce

heavy fuel loads and wildfire risk. About 270 acres would be treated initially each year, on average, with the cycle between treatments being about 100 years. Over the very long term the average annual area treated would drop to about 200 acres per year. Landscape patterns will resemble the mosaics found in "historic," pre-Euroamerican lodgepole pine forests, but the trees will be older and larger because fire frequency may be less than occurred historically. Treated acreage will not contribute significantly to old-growth lodgepole pine. The remainder of lodgepole pine forests (15%) will remain untreated and cycle through boom and bust cycles of old growth as described for Alternative D.

Alternative C-Modified: Alternative C-Modified will restore fire as a natural process to about 40% of the lodgepole pine ecosystems within the Monument. About three quarters of this area would eventually be managed using prescribed natural fire. An estimated, additional 15% of the lodgepole pine plant communities would be treated over time by mechanical or manual means such as thinning or regeneration cutting to provide characteristics such as larger trees, snags or downed wood that might otherwise be consumed by fire. Between 170 and 760 acres would be treated during the first ten years of the Plan. Initial restoration activities would focus on the reintroduction of fire in lodgepole pine ecosystems using prescribed fire. Additionally, areas that have high fuel hazard and risk associated with high levels of human use would also be treated to reduce wildfire risk. Over the long term the annual area treated would average about 70 acres per year (acreage does not include prescribed natural fire) and the interval between burning or other treatment would be between 100 and 120 years. Landscape patterns will resemble the mosaics found in "historic," fire-based ecosystems on about 50% of the area, but trees will generally be older and larger. The remainder of the lodgepole pine forests (45%) will remain untreated and cycle through boom and bust periods of old growth as described for Alternative D.

Table 4 - 8

Activities Designed to Restore Natural Processes in Lodgepole Pine and to Meet Other Resource Objectives

Short-term: Next 10 Year Total (Acres) 1/

Alternative	A	B	C	C-Mod	D
Activities to Reduce Fuel Loading in Areas of High Fire Hazard/Risk 2/	1000	1350	2700	170-760	0

1/ Area includes lodgepole pine plant associations. The areas are estimated for effects analysis only and are not intended to imply a rigid schedule.

2/ The use of prescribed fire will be tested, particularly in less accessible areas. Activities could include the use of mechanical treatment or pretreatment (where fuels must be reduced prior to burning) in accessible areas such as travel corridors. In less accessible areas chainsaws and the manual rearrangement of fuels may be necessary to allow for future restoration activities. Activities will be designed to minimize the area treated (example - fuel breaks) and to optimize treatment effectiveness in reducing fire hazard and risk. Prescribed fire is the preferred method of treatment with the long-term goal being the reintroduction of fire in lodgepole pine ecosystems.

Table 4 - 9

Activities Designed to Restore Natural Processes in Lodgepole Pine and to Meet Other Resource Objectives

Long-Term: Beyond Ten Years (Acres) 1/

Alternative	A	B	C	C-Mod	D
Annual Average Area of Restoration Activities to Restore Fire to Lodgepole Pine Ecosystems 2/	40	80	170	40	0
Annual Average Area of Activities Designed to Meet Recreation, Scenic, and Wildlife Objectives 3/	60	55	100	30	0
Total Area Where Restoration Activities Would Occur to Restore Fire to Lodgepole Pine Ecosystems 4/					
Prescribed Fire:	2480	9541	12656	2340	0
Prescribed Natural Fire:	0	0	0	7460	0
Total Area Where Activities Are Designed to Meet Recreation, Scenic, and Wildlife Objectives	3720	6559	7444	3145	0
Total Area of Lodgepole Pine Restoration and Other Activities	6200	16100	20100	12945	0

1/ Area includes lodgepole pine plant associations. The areas are estimates for effects analysis only and are not intended to imply a rigid schedule.

2/ Prescribed fire is the preferred method for restoration; however, mechanical pre-treatment or manual rearrangement of fuels may be necessary in some areas to reduce unnaturally heavy fuel accumulations which have resulted from fire suppression. Acreage does not include prescribed natural fire.

3/ Activities could include mechanical treatments such as thinning or selection cutting to provide desired characteristics such as larger trees, snags or downed wood.

4/ Restoration of natural processes (prescribed natural fire) is the long-term goal in all areas where feasible.

Table 4 - 10

Risk Rating for Mountain Pine Beetle Epidemics in Lodgepole Pine

Based on susceptibility of stands (age distribution), within the Monument

Risk	Alternative				
	A	B	C	C-Modified	D
Short-term	low-moderate	low-moderate	low-moderate	low-moderate	low-moderate
Long-term	high	low-moderate	low	moderate-high	high

Forests Dominated by Mixed Conifer Species - Including Old Growth

Alternative D: Forests of mixed species that include ponderosa pine and lodgepole pine but which are dominated by true fir will gradually exclude the shade-intolerant species (ponderosa pine and lodgepole pine) in the absence of disturbance such as fire. Understory vegetation associated with these stands will continue to decline. The potential for severe insect infestations will increase along with increased plant competition and stand replacement wildfires will become more common as fuels continue to build up. Such events would greatly increase the open areas conducive to shrubs, grasses and other herbaceous plants, and lead to the eventual replacement by lodgepole pine.

Alternative A: Few vegetation management activities are planned under this alternative. Mixed conifer forests will become increasingly dominated by shade-tolerant white fir as described in Alternative D.

Alternative B: About 70% of mixed conifer forests (1900 acres) would be treated to benefit selected wildlife species. Some fuel treatment would also occur in areas of heavy buildup. Treatments would generally entail mechanical thinning or uneven-aged cutting with burning or utilization of slash (to maintain multi-storied canopies, early successional species, snags and/or dead woody material that would otherwise be consumed by fire) or underburning. In untreated areas, mixed conifer forests will become increasingly dominated by shade-tolerant white fir as described in Alternative D.

Alternative C: Underburning activities in stands of mixed conifer species will encourage regeneration of early successional species (pines). About 30 acres would be treated annually with a cycle of about 100 years. These forests will resemble "historical" conditions where fires were infrequent (25 to 100 years) and burned at generally moderate intensities. These fires also included significant areas of low and high intensity fire, with some stand replacement resulting in overall patchiness and a diversity of vegetative conditions. Areas of shrubs, grasses and herbaceous plants would increase. In untreated areas, mixed conifer forests will become increasingly dominated by shade-tolerant white fir as described in Alternative D.

Alternative C-Modified: The use of small prescribed fires and manual or mechanical treatment such as thinning or uneven-aged cutting would occur on about 50% of the area covered by forests of mixed conifer species that are dominated by white fir. The purpose of the treatments would be to restore and maintain these ecosystems where fire burned every 25 to 100

years, generally at moderate intensities. These fires also included significant areas of low and high intensity fires with some stand replacement, resulting in overall patchiness and a diversity of vegetative conditions. One of the primary goals of the treatments would be to create forest openings of sufficient size to allow for the continued reproduction of ponderosa pine over time. during the first 10 years a total of about 30-50 acres (1-2%) would be treated with efforts designed to improve or maintain the vigor of ponderosa pine trees (especially old-growth individuals) that now occur in these stands. About 13 acres would be treated annually over the long term. In untreated areas, mixed conifer forests will become increasingly dominated by shade-tolerant white fir as described in Alternative D.

Table 4 - 11

Activities Involving the Restoration of Mixed Conifer Stands to Retain Ponderosa Pine Diversity

Alternative	Short-Term: Next Ten Years Total (Acres) 1/ A	B	C	C-Mod	D
Activities to Restore Ponderosa Pine in Mixed Conifer Species Forests 2/	0	150	300	30-50	0

Alternative	Long-Term: Beyond Ten Years (Acres) A	B	C	C-Mod.	D
Annual Average Area of Restoration Activities to Restore Ponderosa Pine in Mixed Conifer Species Forests	0	15	30	13	0
Total Area Where Restoration Activities Would Occur for Ponderosa Pine in Mixed Conifer Species Forests	0	1900	2400	1300	0

1/ Area includes mixed conifer plant associations. The areas are estimates for effects analysis only. They are not intended to imply a rigid schedule.

2/ Treatments could include mechanical treatments or the use of fire to create openings in mixed conifer species forests of sufficient size to allow for the reproduction of ponderosa pine over time.

Forests Dominated by Mountain Hemlock - Including Old Growth

Alternative D: Although no old-growth definition has been developed for mountain hemlock series, it is believed that many existing stands currently reflect conditions typical of

"ecological old growth" as defined for other species. This forest type represents the most long-term stable state for forest types found within the Monument. In the absence of a high intensity wildfire, mountain hemlock is expected to increase in number and size, and shade-intolerant lodgepole pine will continue to decrease in these stands. As fuels continue to build up, the threat of high intensity wildfire will increase. Stand replacement fires would favor the establishment of lodgepole pine. Existing understory vegetation in forests dominated by mountain hemlock is generally sparse when compared to other forest plant associations.

Alternatives A, B, C and C-Modified: Few vegetation management activities (except those contributing to visitor health and safety) would occur in mountain hemlock forests. The effects would be similar to Alternative D.

Vegetation Associated with Lava Flows, Minor Species, Locally Unique Plant Associations

All Alternatives: Species that occur in minor amounts such as whitebark pine, Douglas-fir and other plant species would be favored when vegetation management activities are planned. Plant communities bordering lava flows are especially rich in tree, shrub and herbaceous species. The condition of this vegetation is generally good.

Alternative D: Vegetation management activities would be very limited for this alternative as would the effects of such activities on vegetation. Over the long term there will be a decrease in shade-intolerant plant species including plants such as aspen and dry land willows that depend on disturbance such as fire to stimulate new growth. Species diversity would decline in the absence of planned treatment or wildfire.

Alternative A: Few vegetation management activities are planned with minimal effects from these activities. Long-term trends are the same as described for Alternative D.

Alternatives B, C and C-Modified: A small but unknown acreage would be treated based on findings from site-specific analysis to restore decadent aspen and willow and early successional plant species. Burning or mechanical treatment (cutting) would be used as appropriate. Species diversity would be maintained or could increase.

Riparian Plant Communities

Alternative D: There are approximately 260 acres of riparian vegetation within the Monument. Most of it is in good condition. Vegetation management activities would be very limited for this alternative as would the effects of such activities on vegetation. Over the long term, riparian areas will contain gradually increasing areas with dead and dying (decadent) woody plants such as willow and alder. Existing areas damaged by trampling will continue to deteriorate and affected areas may increase with further disturbance.

Alternative A: Few vegetation management activities are planned with few or no effects from these activities. Long-term trends are the same as described for Alternative D.

Alternatives B, C and C-Modified: A small but unknown acreage would be treated periodically, based on the findings of site-specific analysis. Treatments would be designed to restore decadent riparian vegetation, such as willow and alder and areas damaged by compaction or trampling. Treatments would generally include cutting, burning or planting of vegetation. Effects would be minimal. Overall health of riparian vegetation would be maintained at high levels.

Threatened, Endangered and Sensitive Plants

Recreation activities and vegetation management activities have the greatest potential for adverse impacts on these species.

All Alternatives: Threatened and Endangered plants will continue to be protected. Current intensive monitoring activities would continue on two populations of *Botrychium pumicola* (a sensitive species) and some monitoring would be done on all sensitive plant populations. Surveys to locate new plant populations will generally be limited to areas where projects with a potential for disturbance are planned. In alternatives where there are potentially ground-disturbing activities, the likelihood of finding additional populations will increase.

A small but unknown acreage may be treated periodically, based on the findings of site-specific analysis. Treatments would be designed to protect or enhance the plant population. Effects would be minimal on treated vegetation and beneficial to the threatened or endangered plant species.

Alternative A provides a self-discovery, interpretive/education approach in heavily used recreation areas where there are known populations of grape-fern. **Alternative B** seeks to protect populations by directing people away from them. **Alternatives C and C-Modified** also provides interpretation about sensitive plants but uses interpretive guides to help monitor access to the known populations. The effects of vegetation management will be mitigated by surveying for and protecting populations of sensitive plant species in all alternatives.

Alternatives B, C and C-Modified: Intensive monitoring activities would be expanded to additional populations of threatened and endangered plants.

Ecosystem Health

This section attempts to integrate some of the key components necessary for a healthy ecosystem. One of the goals of ecosystem management is to make sure that the components are sustained in some measure across the landscape. A more complete discussion of several of the following, as well as, other indicators of ecosystem health can be found in parts of the document dealing with wildlife, fire, soils, water, air, old growth, etc.

Old growth - Some of the stand development processes, such as tree growth and mortality, and understory establishment, can be accelerated through vegetation management activities. Alternatives A, B, C, and C-Modified provide in varying degrees for the acceleration of these processes in younger stands and for the retention of existing old growth. Other processes such as maturation of tree crowns, thickening of bark, and decay of tree boles are not readily accelerated through management activities. Because of our limited knowledge of late-successional and old-growth processes and lack of management experience, there is no certainty that these conditions can be created.

In the warm, dry physiographic province of the Eastern Cascades, fire is a generally frequent event occurring at low to moderate intensities and is part of the internal dynamics of forest stands. Recently, fire control and timber harvest have decreased the abundance of some types of old growth, including ponderosa pine, that are dependent on this historical fire regime. Alternatives A, B, C, and C-Modified provide in varying degrees for the re-introduction of fire into these ecosystems at frequencies, and in sizes and intensities that are believed to have occurred in pre-Euroamerican times. Alternative C provides for the highest amount of "historical" old-growth, fire-based stands.

Alternative B provides for (at an accelerated rate) additional old growth, referred to in this document as "ecological" old growth because its characteristics are described from data collected on ecology plots (see Chapter 3). This type of old growth is allowed to develop through fire exclusion by humans. It contains the large tree component of "historical" stands along with other characteristics such as extensive areas of multi-storied canopies, downed woody material and snags. All alternatives will eventually develop "ecological" old growth in untreated

areas at a much slower rate than in areas treated with fire, uneven-aged management or thinning. Some areas have and will continue to undergo a continued decrease in early seral species (mainly pine) and an increase in white fir because of fire exclusion.

In all alternatives, lodgepole pine will continue to have a high proportion of relatively large trees and structural complexity as compared to historic conditions. Landscape patterns, reflecting a mosaic of age classes and islands of large trees, are provided for in abundance in Alternative B and Alternative C and to a lesser extent in C-Modified. These patterns are believed to have been evident in historical forests of lodgepole pine.

Dead Wood and Snags - The large area of medium-sized, relatively young ponderosa pine stands found in the Monument contain the smallest amounts of both snags and downed woody material of any forest type within the Monument. Historically, large accumulations of downed wood were thought to be uncommon in both ponderosa pine and lodgepole pine forests based on the examination of soil profiles and historical accounts. In the short term, Alternative B would create the most potential for enhancing this ecosystem component, generally by mechanical cutting. Alternatives C and C-Modified would sustain an element of dead wood through killing some trees by fire; however, fire would also consume much of the dead organic material that existed prior to burning. The alternatives contain varying areas of forest that would remain untreated by cutting or burning of vegetation. Wildfires would continue to be suppressed and dead wood would accumulate. Alternative A and Alternative D would have the most acreage in this condition over the long term. Escaped, high intensity wildfire could significantly reduce this ecosystem component.

Soil Productivity - Soil productivity can suffer when soils are impacted through compaction or displacement. They can be damaged by high temperatures generated during wildfires (see wildfire discussion below) or when piles of fuel are burned. Alternative B, followed by Alternatives C, C-Modified, and A, have the greatest potential for compaction from heavy equipment, based on the amount of acres treated by mechanical means prior to burning. Alternative A, followed by Alternatives C and C-Modified, have the largest potential for compaction from recreation-related activities, and road and trail construction. Soil productivity could also decrease with frequent underburning, especially in ponderosa pine. The potential effects would be the highest for Alternative C, followed by Alternative C-Modified, Alternative B, and Alternative A.

Undesirable Exotic Plant Species - Alternatives A, B, C and C-Modified would treat areas to reduce or remove known populations of these plant species. The major known existing problems consist of populations of knapweed and cheatgrass along the two to three miles of Highway 97 that bisect the Monument, and populations of reed canary grass along the western shore of Paulina Lake and near the lake's outlet. Treatments that include hand pulling, cutting and the possible use of herbicides (especially in the case of reed canary grass) will affect other plant species that occur in the treated areas. Potential problems for the further spread of undesirable exotic plants from outside the Monument also occur along the approximately five miles of utility corridors bisecting the Monument and along roads.

Insects and Disease Occurrence - Endemic or moderate to low levels of insect and disease activity are considered natural, even beneficial. Forest insects and disease-causing agents utilize trees and plants for part of their life cycle, and may, however, interfere with the growth, development, or form of the affected plant. Forest insects and diseases have a significant effect on the forest ecosystem. At high levels, these agents can threaten long or short-term resource management objectives for an area. Bark beetles, defoliators, root and stem diseases and dwarf mistletoes are the insects and disease agents of greatest importance.

The mountain pine beetle is believed to be the agent with the greatest potential for impacting vegetation. Vegetation management activities can both increase or decrease insect and disease risk. Chapter 4 of the Environmental Impact Statement for the Forest Land and Resource Management Plan for the Deschutes National Forest discusses in great detail the interaction of management activities, vegetation and forest insect and disease levels. (Incorporated here by reference).

Epidemic levels of mountain pine beetle and western pine beetle are known to have occurred historically. Forest diseases have also been present but were believed to have been kept under control by fire. It is believed that insect epidemics and disease levels have increased in size and severity because of conditions created by fire exclusion. The presence of the western pine beetle may have actually declined as the number of large ponderosa pine have declined. The overall level of stem and root diseases may have increased because of increased exposure to mechanical wounding during timber harvest or from recreation activities. These diseases along with dwarf mistletoe also have become more prominent with the continued exclusion of fire.

Alternative D and Alternative A: Under these alternatives, the levels of forest diseases may increase slowly in the absence of wildfire. Insect activity will also increase as recently-thinned ponderosa pine stands begin to close and are stressed by competition or drought. As lodgepole pines become larger in diameter and competitive stress between trees increases, a food base will develop for future mountain pine beetle epidemics. As the number of large ponderosa pine trees increases, western pine beetle may become more prominent over the long term.

If left untreated and without the re-introduction of a sanitizing agent such as fire or thinning, dwarf mistletoe is expected to increase slowly but substantially. With the spread of this disease there will be decreased growth, higher levels of mortality and deformities in future regeneration.

Defoliators should not increase under these alternatives. However, an increase in host species (white fir) for the spruce budworm could lead to localized infestations.

Alternatives B, C, and C-Modified: Alternative B treats most of the ponderosa pine stands to achieve uneven-aged, multi-storied conditions and the risk of tree wounding and spread of root and stem diseases and dwarf mistletoe may increase in these stands, especially if they are improperly conducted. High levels of prescribed burning and/or mechanical treatments in Alternatives B and C, and to a lesser extent, Alternative C-Modified could control the spread of dwarf mistletoe in treated stands. Prescribed burning in Alternative C and to a more limited extent in Alternatives C-Modified and B, could have the eventual effect of reducing the amount of root and stem diseases present.

Recommendations to reduce the severity of future epidemics of mountain pine beetle involve recognizing the risks at both the Forest level and at the level of the individual tree. At the Forest level the risk of severe epidemics can be reduced by creating a mosaic of tree age and therefore size classes. This will reduce the amount of area of trees that are highly susceptible at any given time. Mitchell (1988) recommends limiting the amount of susceptible stands at any particular time to about 20%-30% of the total area. For the short term the risk from another epidemic of mountain pine beetle is low in all alternatives.

Alternative C would come the closest to reaching the 20-30% susceptible objective in lodgepole pine over the long term. The mosaics created by prescribed burning would leave between 30% and 45% of the total acreage of lodgepole pine in a susceptible state during any given period of time. Alternatives B and C-Modified would leave between 40% and 70% in a

susceptible state depending upon the time period considered. At the stand and individual tree level resistance to beetle attack can be improved by thinning stands to improve individual tree vigor. A small amount of thinning would occur in all the alternatives to meet this objective in high value areas containing lodgepole pine. These may include important wildlife stands or recreation areas. Prescribed burning in Alternative B and C can also be used as a thinning tool, but its reliability in lodgepole pine is not thought to be high, because the thin barked lodgepole pine are easily killed by high temperatures.

Alternative B, Alternative C, and to a lesser extent Alternative C-Modified treat large proportions of the ponderosa pine forests using prescribed burning or uneven-aged management. These treatments result in thinned stands over time with a lower susceptibility to bark beetle attack. With an increased acreage of large ponderosa pine, the western pine beetle could play a more important role in ecosystem dynamics than it does today.

Defoliators such as the pandora moth in pines and spruce budworm (in Douglas-fir and true firs) have played somewhat minor and relatively temporary roles in the ecosystem of the Monument. Management strategies that allow the development of multiple canopy layers may benefit both of these defoliators. Management that allows the increase or maintenance of host species for spruce budworm will contribute to increased risk of an infestation. Large areas where fire is excluded in mixed conifer stands or stands where white fir is an associated species would contribute to such a risk, especially in Alternatives A and B, followed by C-Modified.

Application of Chemicals, Trapping, Hunting, and Constructing Animal Barriers

All Alternatives: The objective for using these methods would be to protect vegetation or eliminate unwanted vegetation (see undesirable exotic plant species) in localized areas where maintaining the existing vegetation or establishing native vegetation is important. The need for the use of such methods is minimal in all alternatives. A small but unknown acreage could be treated in any of the alternatives, based on the findings of site-specific analysis.

Creation of Habitat Improvement Structures and Areas

All Alternatives: Water developments would be minimal in all alternatives. All alternatives could feature small structures such as nesting boxes for birds that would have little effect on vegetation.

Alternative B: This alternative emphasizes wildlife habitat enhancement for selected species. Some small ponds could be flooded year-round, covering the existing vegetation along a small portion (< 10 acres) of the Deschutes River. Alternative B could also involve some fencing to improve safety associated with deer crossing Highway 97. This could reduce wildlife grazing along the road shoulders. Fencing could also exclude livestock from grazing on portions of the Monument (also in Alternatives A, C and C-Modified).

Transportation Related Activities
Including Roads, Landings, and Trail Construction and Maintenance

Alternative D: There is no proposed construction of roads or trails, nor are there proposed road closures.

All action Alternatives: All action Alternatives propose the closure of about 40 miles of roads within the Monument. The timing of road closures and method of closure (i.e., Would the road bed be revegetated?) may differ between the alternatives. Site-specific analysis is necessary to make such determinations.

Alternative A: This alternative constructs approximately 12 miles of new road. The amount of this length that would cross vegetated areas cannot be determined until a site-specific determination of road location is made.

Alternative B: There is minimal new road construction (Cottonwood Road access) for this alternative. Where utilization of wood fiber occurs in conjunction with vegetation management, there would be some associated landings and skid trails and other temporary access.

Alternative C: The alternative constructs about six miles of new road. As in Alternative A, the amount of vegetation clearing that would occur in order to construct the road cannot be determined without a site-specific evaluation. The impacts associated with mechanical treatment would be similar to those in Alternative B in lodgepole pine, but less in ponderosa pine forests.

Alternative C-Modified: The alternative constructs about four miles of new road. As in Alternatives A and D, the amount of vegetation clearing that would occur in order to construct the road cannot be determined without a site-specific evaluation. The impacts associated with mechanical treatment would be minimal in ponderosa pine forests and the least of all "action " alternatives in lodgepole pine based on the number of acres where mechanical treatment could occur (mechanical treatment on maximum 15% of the area occupied by lodgepole pine).

Off-Highway Vehicle Use

All Alternatives: Vehicles licensed for street use are allowed to operate on roads.

Alternative D: There is presently a small amount of ATV use occurring across the power transmission corridor that bisects the Monument and a minor amount of traffic that enters the caldera from the east to access East Lake Resort. Most traffic follows existing clearings, however, some damage to vegetation has occurred from vehicles travelling cross country or leaving cleared travel routes.

Alternative A: The alternative would designate access across the Monument in one location and access to East Lake Resort.

Alternatives B, C and C-Modified: These alternatives would not allow any special off-road ATV access to the Monument. Street-legal ATV's may enter on any Forest Service Road.

Construction, Maintenance, and Use of Recreation Facilities

Alternative D: There would be few effects associated with construction activities. Maintenance activities would include the removal of hazard trees or encroaching vegetation. There would also be impacts on vegetation from visitor use, especially near recreation facilities.

Alternatives A, C and C-Modified: These alternatives would see a large increase in the number and size of some key visitor facilities (overnight facilities, day-use facilities, visitor centers, etc.). With an increase in facilities there would be an associated increase in use of these areas. There would be clearing of vegetation associated with new construction and increased impacts on vegetation from visitor use.

Alternative B: This alternative would reduce the number of overnight sites and expand some day-use facilities. The overall effects would be similar to the Alternative D.

Livestock and Wildlife Grazing

There are two existing cattle and horse allotments that are partially located within the Monument. One of the allotments is inactive. Presently about 2700 acres of the Monument area is within domestic livestock allotments. About 2400 acres of these areas are within the active

allotment. In Alternative D grazing would continue. For Alternatives A, B, C and C-Modified, grazing would be discontinued within the Monument.

The magnitude of impact from vegetative competition and potential damage due to wildlife grazing or browsing is generally small, site-specific, and not predictable over a large area.

Managing for Big Game Cover

Managing for big game cover will have some effect on vegetation, including reduced growth, reduced understory vegetation, and higher insect and disease levels due to the higher stand densities required. Big game cover may also be difficult to provide in areas where the restoration of fire-based ponderosa pine stands takes place. Alternative C calls for the most ponderosa pine restoration activities followed by C-Modified, A, and B.

Visual Resource Management

Alternative D: Current visual quality objectives ensure that human activities have minimal impacts on the visual resource. Vegetation activities are limited to those that appear natural.

Alternatives A, B, C and C-Modified: The alternatives are designed with high visual quality objectives in mind. Many areas will have large trees and a diversity of species, sizes and age classes. Retaining shade-tolerant species (white fir) to enhance visual diversity, for example, could conflict with objectives of reintroducing fire that would favor seral species (pines).

Alternatives A, C and C-Modified: These alternatives develop more facilities, travel routes and places from which the landscape can be viewed.

Alternatives B and C: Short-term visual objectives are most likely to conflict with vegetation management activities in these alternatives due to the amount of changes to vegetation that will be taking place. Meeting short-term visual objectives could slow the rate at which the desired condition for vegetation can be reached. Vegetation management that appears "natural" or mimics natural processes would not generally conflict.

Gathering of Miscellaneous Forest Products and Fuelwood

Alternative D: Presently, forest product permits for the gathering of fuelwood are not issued for the Monument, pending the completion of the Monument Plan. Some mushrooms have been gathered within the Monument as of 1993 and further increases are likely.

Alternatives A, B, C, and C-Modified: The gathering of these products would only be allowed if they contributed to the attainment of management goals and objectives as outlined in the Monument Plan. Possible examples are the removal of fuelwood to help reduce the level of hazardous fuels or hazard tree removal. Such activities, if permitted, would only be allowed in designated areas.

Mitigation

Mitigation Measures Relating to Mechanized Equipment Used for Treating Vegetation and Fuels

The choice of appropriate mechanized equipment for felling, skidding, utilization and other vegetation management practices will be made as needed to reduce physical damage to

sites or loss of desirable residual vegetation. Such measures are effective in reducing damage but will not eliminate it.

Slopes over 30 percent are considered sensitive to soil displacement, gouging and mixing during use of ground based equipment. Consider using aerial or cable systems that suspend at least one end of logs where fuels are heavy or yarding distances are long. Measures are effective in reducing undesirable effects.

Designate travel routes for heavy machinery involved in vegetation management activities to avoid sensitive areas such as sandy swales between basalt ridges, areas with high water tables or fine textured soils and to minimize the area impacted. Measures are very effective but complete avoidance may not be possible.

Consider seasonal restrictions on machinery operation to periods of time when soils are dry, frozen or covered with snow to minimize compaction and surface disturbance. Measures are considered very effective.

In areas suitable for the use of mechanical tree harvesters care should be taken to minimize the amount of area traveled over by the machine. Consider the use of boom types of machinery to reduce damage to soils. Measures are effective in reducing damage but not eliminating it.

Machine piling of slash during fuels treatment operations should be limited to situations where no other alternative method will accomplish the objective. Machine piling should be especially limited on slopes exceeding 30 percent. Impacts of machine piling can be minimized by piling only concentrations to break up fuel continuity or by piling over frozen ground. Measures are effective in reducing damage where they can be applied.

Mechanical soil tillage is justified to restore soil following detrimental disturbance due to compaction but is not always effective (e.g. in areas of very rocky soils or soils that are continually wet). The most effective approach is to avoid damage initially.

Use low impact, manual methods including handtools to achieve objectives of fuel reduction or vegetation management in sensitive areas. Effects would be substantially ameliorated.

Mitigation for Maintenance of Plant Diversity

Regeneration: the regenerated mixture of species will be planned to preserve plant diversity. Adequate measures will be taken to insure regeneration success to the degree necessary to meet management objectives. The measure is effective where the knowledge of plant establishment and growth requirements are known. It will vary by species and site conditions.

Appropriate Species: forests and other vegetation communities remain healthier when species are grown where they are ecologically adapted. The measure is effective to the extent that knowledge of plant requirements are known. It will vary by species.

The degree and arrangement of various successional stages found within a given old-growth area should support vegetation representing mid, late, and very late (decadent) conditions to provide for biodiversity in addition to providing for the management of the old-growth tract over long periods of time. The measure would generally lower the risk of catastrophic consequences from uncontrollable environmental disturbances such as those from wildfire or insects and diseases.

Prescribe activities that will provide for the enhancement and long-term maintenance of unique plant communities. The measure is effective to the extent that plant requirements are known. This will vary by species.

The use of natural regeneration is encouraged over planting where feasible. Natural regeneration cannot always be assured. Effectiveness will vary with plant species and site conditions.

Prevent further encroachment of undesirable exotic plant species by promptly establishing native plant species in disturbed areas.

Mitigation Related to Recreation Activities

Avoid high levels of trail or facility development in or near riparian areas. Design facilities and trails to channel visitors away from important or sensitive plant habitats. The measure would substantially reduce impacts but would not prevent individuals from entering these areas on occasion.

Provide information to visitors through interpretive signing or other means about protecting threatened and endangered plants and sensitive plant habitats. The measure would generally be effective but would not prevent instances of damage from a few individuals.

Where OHV's are permitted, require them to stay on designated routes. The measure would generally be effective but would not prevent damage in isolated instances. Generally motorized vehicles are heavier and have a greater range than non-motorized travel methods and can create more damage in a short time period. This mitigation measure applies only to Alternative D.

Limit or prohibit concentrated dispersed camping in wetland areas. The method would ameliorate but would not eliminate effects.

Miscellaneous Mitigation

Survey areas for threatened, endangered or sensitive plant species, prior to ground disturbing activities. The measure is very effective when conducted properly.

Use appropriate animal damage control measures to prevent unacceptable impacts to forest vegetation. Effectiveness varies depending on the vegetation and damaging agent.

Assumptions

The extent of the direct and indirect effects depends on the size, location, timing, and prescription of activity by alternative. The degree to which each alternative exhibits the effects discussed in the interactions section is expected to be proportional to the number of acres treated. Exceptions to this are discussed under cumulative effects.

In order to facilitate the comparison between alternatives for risks from wildfire and maximum acreage burned, it is assumed that local firefighting forces are staffed at present levels and that there will be an available and fully staffed Regional firefighting force (i.e., air tankers, crews, overhead, etc.).

Caution would be used in re-introducing fire in forests where heavy fuel loads and multi-storied canopies (ladder fuels) have developed. These heavy fuel loads may need to be manually or mechanically manipulated first, so prescribed fire objectives can be met. In addition, several successive burns of low intensity may need to occur to reduce the surface fuels to acceptable levels before employing fire on a larger scale in order to mimic natural processes or to achieve desired conditions.

Fuel treatments will be arranged to optimize their effectiveness.

There is no clear distinction between "historical" and "ecological" definitions for old growth.

The distinction is made to facilitate the discussion of desired conditions for the alternatives. See explanation in Chapter 3.

Minor species (local abundance is low) will be featured or maintained in vegetation management treatments.

The current epidemic of mountain pine beetle is winding down. Thinning treatments in "blackbark" or medium-sized ponderosa pine will be largely effective in reducing the spread of mountain pine beetle into these stands over the short-term.

Roads would not be developed in the unroaded portion of the Flanks Zone for vegetation management activities. In other areas, additional access for management would be developed for short-term use only, and areas will be restored as activities are completed. Low impact methods of mechanical treatment would be used.

The law requires that the "natural forest" be used as the basis for evaluating the maintenance of diversity. However, existing conditions have been so thoroughly influenced by humans that "natural" references are difficult to find and apply, and what is commonly viewed in the Forest is not "natural."

Utilization of wood fiber will be permitted where it is compatible with or contributes to the attainment of objectives for which the Monument was established.

Timber within the Monument and Special Management Area shall not be considered part of the allowable sale quantity for the Deschutes National Forest.

Timber removal within the Monument and Special Management Area shall be permitted only to the extent necessary to achieve the purposes of the Monument Legislation and to protect health and safety.

Vegetation management activities will be designed to meet prescribed visual quality objectives. See scenery management.

Potential Conflicts with Plans and Policies of Other Jurisdictions

Vegetation management activities will comply with the Regional Environmental Impact Statement for Managing Competing and Unwanted Vegetation and the mediated settlement. Burning of vegetation and debris will comply with the State of Oregon Smoke Management Plan.

4. Fire & Fuels

Forest fires have been a natural part of the ecosystem of the Pacific Northwest for thousands of years. Prior to fire suppression activities, an average of 800,000 acres burned annually in the region (Agee 1978). Wildland fires, along with volcanism and natural hydrocarbon emissions from vegetation, were dominant sources of natural air pollution. Today, wildfires are generally suppressed because of the hazards to human life, health, and property.

Wildfire Fire Hazard and Risk

Fire hazard and risk are important terms to understand in the context of wildfire prevention. Hazard is a rating assigned to a fuel (such as pine needles, twigs, logs, and brush) defined by: the kind, volume, arrangement, condition and location (reflecting its susceptibility to ignition), the wildfire behavior and severity it would support and/or the suppression difficulty it represents. Hazard ratings are subjective, relative rankings that range from very low (green

grass and conifer litter) to extreme (cured grass and heavy slash). Risk levels are indices used to give an overall picture of risk by combining information about the presence of a causative agents such as lightning, campfires or chainsaws with the existing level of fuel hazard, and the values to be protected from destruction by fire. If there is continuing high risk, the only alternative to prevent or to minimize the effects of wildfire is to reduce the hazard.

Hazard reduction is as planned treatment or manipulation of naturally-growing vegetation or activity fuels for the purpose of reducing the rate of spread (how fast it burns) and fire intensity (how hot it gets). If we avoid treating high hazard areas, some serious conditions can arise: Instead of low-damage, stand-maintenance fires, fires become severe, high damage, stand replacement fires; Species are converted from fire-resistant species to fire-intolerant species; Fires are more difficult and costly to control; Fires cause an increased danger to firefighters; Fires pose an increased threat to wildland/urban interface values; There is an increased potential for higher particulate matter emissions as fuel loads and understory vegetation increase.

Fuel treatment methods or alternatives used to reduce hazards include one or a combination of the following: manual methods (cutting, scattering, pulling, piling), biological methods (grazing), mechanical methods (clearing, crushing, chipping, disking, piling, chopping), and prescribed burning (broadcast, underburning, jackpot, pile burning).

Hazard reduction strategies include the following:

1) Remove all ignitable fuels within small, high-risk areas to eliminate ignitions from known sources.
2) Remove all fuel in a strip surrounding high-risk areas, to isolate and limit the spread of fires starting inside those areas.
3) Remove all fuel in a strip surrounding high-value or high hazard areas to exclude fires starting outside those areas.
4) Reduce or remove fuels in strategically-located blocks to augment natural fire barriers.
5) Eliminate fine and intermediate fuels (less than one inch (1") diameter) from extensive areas to reduce wildfire spread rate.
6) Eliminate fuels extending from the ground to the tree crowns (ladder fuels) to reduce the danger of crown fires.
7) Remove standing dead trees (snags) which can produce embers that can be readily carried across fire control lines.

Manual or Mechanical Fuel Treatments

The objectives of piling, crushing or otherwise rearranging cut vegetation include lowering the hazard of wildfire by reducing or rearranging woody fuel. Fuels buildup can be a result of past fire suppression, residue resulting from vegetation management treatments, or vegetation killed by insects or disease. If improperly conducted (especially with mechanical methods), treatment can lead to compacted or displaced soils, nutrient loss, and reduced site productivity. If piles are subsequently burned, soil structure can be destroyed or damaged, further reducing site productivity. Mechanical treatments can also disturb soil by removing protective duff layers causing surface erosion and further loss of soil productivity.

Prescribed Burning of Vegetation or Organic Material

An effective strategy for reducing fuel loads is prescribed burning. Unlike wildfire, which tends to occur when fuels are dry, conditions are selected to be cool and moist, which results in relatively low-intensity fires. Prescribed fires can frequently be designed so they do

not burn hot enough to kill large trees of many species and do not consume all of the available fuels. They also burn more efficiently, with less smoldering than wildfires, so prescribed fires produce only about half as much smoke per acre.

Wildfires usually start in fine fuels (less than 1/4" diameter). Removing twigs and small branches less than one inch (1") from the forest floor significantly reduces fire hazard. The ability to remove only these fine and intermediate fuel classes is an advantage prescribed fire has over other fuel reduction methods. Prescribed fires can be designed to consume these fine fuels, leaving the larger fuel unburned. Although fire can be used to achieve these objectives, caution must be used in re-introducing fire in forest stand types where heavy fuel loads and multi-storied canopies (ladder fuels) have developed due to the absence of fire. These heavy fuel loads may need to be manually or mechanically manipulated first, so prescribed fire objectives can be met. In addition, several successive burns of low intensity may be needed to reduce the surface fuels to acceptable levels before using fire on a larger scale.

Prescribed fire can be used to regulate stand composition, reduce plant competition and modify vegetation patterns over the landscape. Natural fuels or fuels resulting from human activities, such as cutting vegetation can be burned. Natural fuels include those created by blowdown and insect mortality. Burning methods include broadcast, jackpot, underburning, and burning of piles. Burning can take place in cut-over areas, natural stands, or meadows. Objectives vary and may include any or all of the following: to lower hazard of wildfire by reducing fuel and creating natural barriers; to reduce or discourage growth of competing vegetation; to increase sunlight and nutrients for desired trees or forage species; to aid tree planting or establishment of natural regeneration; to reduce low growing vegetation and slash; to provide a seed bed with higher levels of available nitrogen; to preserve or enhance natural processes in ecosystems; to restore and maintain rangelands; and to create varied habitats with mosaics of burned and unburned areas.

Burning has the following effects on vegetation although the effects are highly dependent on the environmental conditions of the site and the plant community that exists prior to the fire:

-encourages or discourages establishment of target plant species;

-may damage or kill target or nontarget plant species;

-alters microclimate and may alter macroclimate, which affects plant survival and growth;

-changes the amount and availability of nutrients for plants;

-reduces risk of wildfire or the difficulty of suppressing wildfires, which can have a major effect on vegetation;

-creates smoke which adds to carbon dioxide levels, affecting macroclimate and microclimate, plant growth and survival;

-frequent, repeated burning, even at low intensities, may have a negative impact on site quality.

Prescribed fire operations will take place only from late fall through late spring, when fuels are relatively moist and air circulation tends to be good. Such conditions insure very low smoke emissions that are quickly diluted and dispersed. These are also the seasons of lowest visitation to the Monument; thus, potential exposure of people to smoke and inconvenience from any road closures will be minimized.

All prescribed burning will be managed to comply with the Oregon State Smoke Management Plan, the Oregon State Implementation Plan, the Deschutes National Forest Land and Resource Management Plan, and the Final Environmental Impact Statement for Managing

Competing and Unwanted Vegetation (USDA Forest Service 1988). Smoke production and dispersion from prescribed fires will be monitored. If adverse impacts occur or are predicted to occur, the firing operations will be suspended. Smoke to downwind communities (e.g. Bend, La Pine, or Sunriver) and to popular recreational areas (including nearby Class I (i.e., clean air) Wilderness Areas) will be controlled by burning only when unstable air conditions are carrying smoke away from these sensitive sites.

Table 4 - 12

Acres Projected to be Burned Annually by Prescribed Fire

Alternative	A	B	C	C-Modified	D No Action
Short-term (first 10 years)					
Broadcast/Underburn	100	150	400	45	0
Pile/Jackpot Burn	100	250	150	75	<5
Total	200	400	550	120	<5
Long-term (after 30-120 years)					
Broadcast/Underburn	125	190	900	245	0
Pile/Jackpot Burn	35	210	0	75	<5
Total	160	400	900	320	<5

Direct and Indirect Effects

The number of acres anticipated to be burned annually by prescribed fire in each alternative is shown in Table 4-19. Most of the areas burned would be in ponderosa pine forest, or ponderosa mixed with fir or lodgepole pine, or relatively pure stands of lodgepole pine. See vegetation section for total acreages treated. Prescribed fire reduces hazard levels by reducing fuels. When the level of fire suppression is also taken into account, it is possible to predict the maximum acreage that would burn annually by wildfire.

Alternative A: This alternative treats hazardous fuels in small areas of ponderosa pine and lodgepole pine to reduce hazards to the forest visitor, protect high-value resources, and create "historic" open old-growth ponderosa pine stands. Alternative A would have the most visitors and therefore an increased risk of human-caused wildfire. Present levels of natural fuels are heavy in areas of lodgepole pine mortality and in the understory vegetation of ponderosa pine forests. The current and short-term risk of wildfire is high, and a maximum of two to three wildfires of 300-400 acres each are predicted annually. Over the long term, fuel treatment could reduce the risk of wildfire to a moderate level. Aggressive suppression efforts must occur to prevent unacceptable losses.

Alternative B: Planned treatments in ponderosa pine stands would create "historic," park-like conditions with lower fuel loadings on about 1,000 acres (similar to Alternative A).

Treatments would also create extensive, multi-storied stands along with snags and down woody material for wildlife. Treatments in lodgepole pine would treat considerable acreage to create mosaics for sustainable wildlife habitat for selected species. The short-term risk for wildfire would be slightly less than Alternative A. Over the long term, the risk of wildfire would be lowered. Aggressive suppression efforts may be necessary in some areas to prevent unacceptable losses.

Alternative C: This alternative would involve an extensive prescribed burning program to create "historic" conditions in ponderosa pine forests. The alternative would also include prescribed fire, mechanical treatments, and utilization of slash to accelerate removal of hazardous fuels in beetle-killed lodgepole pine. Alternative C would also start a program to reintroduce fire for restoring "natural ecological succession" of vegetation on a large scale. Treatments would be arranged to effectively reduce wildfire risk levels and shorten the time period necessary to achieve fuel reduction goals. With the high level of treatment and acres treated annually, the short-term risk level for wildfire would be moderate and the long-term risk level of high intensity fire would be low. An aggressive suppression effort may be necessary in some areas but in the majority of areas it would rarely occur.

Alternative C-Modified: This alternative would implement a medium-sized prescribed burning program (relative to the other alternatives) to eventually restore fire to its natural role in lodgepole pine and ponderosa pine communities. Both prescribed fire and prescribed natural fire would be used in lodgepole pine forests. The alternative would include manual and mechanical treatments, and utilization of slash in some areas, prior to burning. Pre-treatment may be necessary, especially for initially where fuels are heavy or extensive ladder fuels exist. Given the proposed level of treatment and acres treated annually, the short-term risk level for wildfire would be high and the long-term risk level of high intensity fire would be moderate. An aggressive suppression may be necessary in some areas, especially for the short-term.

Alternative D: Alternative D would treat a very limited area to reduce hazardous fuels to respond to health and safety concerns, especially around high-use recreation areas. The short-term risk level for wildfire would be the same as Alternative A. With few activities designed to reduce hazardous fuel levels, and a continuing build-up of natural fuels, the risk of wildfire will increase over time, even with aggressive fire suppression efforts.

Table 4 - 13

Wildfire Risk

Alternative	A	B	C	C-Modified	D
Short-term Outlook (first 10 years)					
Annual Acres Burned*	600-1200	500-1000	300-400	600-1200	600-1200
Risk Level	high	mod-high	moderate	high	high
Long-term Outlook (after 30-80 years)					
Annual Acres Burned*	500-1000	300-400	200	300-400	700-1400
Risk Level	mod-high	moderate	low	moderate	very high

* Maximum acres predicted to be burned annually by high-intensity wildfire.

Mitigation

All prescribed burning will be done in accordance with the Oregon Smoke Management Plan to protect visibility, prevent smoke from intruding into designated sensitive areas (e.g. Bend), and meet all federal, state, and local air quality regulations. Visibility and overall air quality in Class I areas, such as the Three Sisters and Mount Washington Wilderness Areas, will be protected during periods of high visitor use (i.e. in the summer season).

All prescribed fires must have a written, site-specific burn plan approved in advance. The plan includes clearly defined resource objectives and measures to protect the site and the environment. Through the proper burn prescription, which specifies weather, fuel moisture, and fuel loading criteria, the fire can be kept under control, produce the desired results, and minimize effects to air quality. To limit consumption of down woody material and protect soil and duff layer, burning can be done at the highest possible fuel moistures.

Other ways to reduce smoke from prescribed fire include extensive utilization of forest residues prior to burning, rapid fire ignition, burning only when optimum atmospheric conditions exist, and not allowing material to continue smoldering after it burns. Ignitions will also be coordinated with surrounding land managers to avoid overloading local air masses.

Other measures can substantially reduce other negative environmental impacts of prescribed burning. Avoid burn piles or the burning of high concentrations of fuel on sensitive soils. Locate piles on adjacent sites, crush with machinery, jackpot or underburn at light or moderate intensities. Avoid burn piles on steep slopes. Consider machine crushing, jackpot or underburning at light or moderate intensities to leave large woody debris intact and protect against future soil displacement through erosion. Arrange fuel treatments to maximize effectiveness and minimize undesirable effects. This measure is very effective where it can be

applied. Protect riparian vegetation and reduce sedimentation into lakes and streams by leaving an unburned buffer. This measure is effective in reducing sedimentation and protecting vegetation. Timing to achieve the proper fuel moisture, weather and fire behavior can reduce scorch heights and mortality to standing live trees. This measure is effective, however, isolated scorching and mortality will still occur. Pull fuels away from areas that require protection during prescribed burning. Snags, downed wood and live trees can best be protected in this manner and scorch heights can be reduced. Crushing of fuels can also reduce scorch heights and mortality to live trees. The measure is very effective. Burning prescriptions should be designed to limit disturbance to soil litter and duff deposits to the amount necessary to achieve the burning objectives. The measure is effective but results can be expected to be variable.

Assumptions

In all alternatives, all available fire-suppression forces will be deployed to fight wildfires. Forces are assumed to be maintained at current levels. For other fire and fuels assumptions, see Vegetation.

5. Fish and Wildlife

Threatened and Endangered Species

There are two animals known to occur in the Monument which are protected under the Endangered Species Act. There are no threatened or endangered plants. Effects on the two animals are summarized here. A more detailed analysis is in the Biological Evaluation.

Northern Bald Eagle (threatened)

All Alternatives: Expected increases in human visitation to the Caldera Zone may cause an increase in displacement of eagles from hunting perches along the lakes. Anglers may cause eagles to avoid certain perches or to change their hunting periods. The magnitude of effect would be different in the alternatives. Different alternatives would promote bald eagle nesting success and would contribute to meeting recovery goals for the High Cascades Recovery Zone to different degrees. The alternatives would incorporate parts or all of the recommendations received from the Oregon Eagle Foundation (Niehuser et al. 1992).

Fish populations in the lakes would continue to meet angler demands and food requirements of bald eagles. Control of non-game fish (chubs) in the lakes would continue. Adverse effects of chub control to eagles would be avoided through site-specific project planning and mitigation.

Submerged springs in the lakes contribute minerals to the lakes. Water samples raised suspicions about mercury concentration in the water, which ten raised questions about mercury levels in the fish. Fish tissues from fish in the lakes were recently tested (Oregon Health Division 1994). The average for samples taken from Paulina Lake was less than 0.05 parts per million (ppm). Based on research by Bowerman (1994), this level is too low to affect eagle productivity. Fish tissues from East Lake averaged 0.64 ppm mercury. The effects of the higher natural levels on eagles is unknown at this time. No alternative proposed would affect the mercury levels in the water.

Alternative A: Bald eagles would continue to nest in the existing BEMA in the caldera (Recreation Unit Map Alternative A, Chapter 2, Alternatives by Resource Program, Recreation, Caldera Zone). Vegetation management to reduce wildfire hazard within the existing nest area may occur. Summer recreation use would increase by 15-30%, resulting in increased potential for displacement of eagles from preferred hunting locations. Some interpretive programs and facilities would be designed to draw people away from known eagle foraging areas, leading to improved foraging conditions for eagles. However, more people would remain in the caldera longer, so they would be more likely explore off-trail areas, potentially disturbing nesting or foraging eagles.

An additional pair of eagles would not be expected to nest in a presently unoccupied potential nest area because the area would continue to be occupied by dispersed campsites. These conditions would not support recovery goals in the High Cascades Recovery Zone, because unoccupied habitat needed for an expanding breeding population would not be protected.

Alternative B: The existing BEMA and two additional BEMA's would be managed to provide habitat (Recreation Unit Map Alternative B, Chapter 2). The two presently unoccupied areas would remain undeveloped and suitable for occupation by nesting pairs. Vegetation management would reduce the potential for wildfire. Additionally, with three potential nesting areas, there would be less risk of total loss of nesting habitat from wildfire. Overnight camping

would be reduced and the existing dispersed lakeshore camping areas would be closed, removing most disturbances from potential nesting areas. Trails would remain adjacent to the two unoccupied nest areas. The unoccupied BEMA's would remain available until used by bald eagles as their populations recover in the region. The recommendations of the OEF would be fully incorporated.

Overall, fishing pressure would remain near present levels. However, numbers of anglers would increase at Paulina Lake and decrease at East lake, reducing the potential for displacing foraging eagles at East Lake.

Alternative C and C-Modified: One additional BEMA would be established, bringing the total to two (Recreation Unit Map-Alternative C, Chapter 2). Although the BEMA on the north side of Paulina Lake would not be designated, this third suitable unoccupied area would be managed to preserve characteristics which would attract eagles there. To accomplish this, the existing dispersed campsites within one nesting area may be relocated. The non-motorized trail around Paulina Lake would be open in summer and winter; mitigation to avoid disturbance to eagles is described below. The area would be held in reserve for future occupancy by nesting bald eagles. Increased interpretation facilities would educate visitors about the sensitivity of eagles to disturbance during nesting and winter periods. Vegetation management would reduce wildfire hazard within the suitable nesting areas, reducing the possibility of loss of all suitable nesting sites. The intent of the recommendations of the OEF would be incorporated, but only two of the three proposed BEMA's would be formally designated.

Fishing pressure would increase on Paulina Lake by about 15% to 30%. Pressure on East Lake would remain similar to present levels. The increased human activity on Paulina Lake could cause displacement of eagles from preferred hunting perches and reduce the suitability of presently unoccupied habitat. More people may land their boats around the lakeshore, reducing the suitability of the adjacent forests for nesting. These alternatives would meet bald eagle recovery objectives in the High Cascades Recovery Zone.

Alternative D: The single pair of bald eagles would continue to nest within the BEMA in the caldera (Recreation Unit Map Alternative D). Small vegetation treatments around existing nest trees would reduce wildfire hazard in the immediate area. However, the potential for a wildfire to burn a large part of the BEMA would increase due to the increased number of visitors and continuing fuel accumulations. Increases in visitor numbers may place a higher risk of disturbance to nesting activities as more people explore areas within the caldera. Lakeside dispersed camping would continue to reduce the potential for a second pair of eagles to nest in the caldera. Effects of these actions would not support bald eagle recovery objectives in the High Cascades Recovery Zone.

Peregrine Falcon (endangered)

All Alternatives: No activities or developments which could affect suitability of nesting habitat would occur near cliffs. Nesting and foraging habitat would remain available for peregrine falcons. If peregrine populations increase in Oregon following re-introduction efforts, they may begin to nest in suitable habitat in the caldera. Interpretive programs would explain to visitors the decline and recovery of the falcons.

Mitigation

All Alternatives:

During site-specific project planning, Biological Evaluations of possible effects on TES plants and animals will be completed. Review Biological Evaluation completed as part of the programmatic EIS for recommended mitigation.

Cooperate with ODFW and USFWS to monitor bald eagle productivity and harmful substances in fish prey.

Review monitoring results from Newberry Geothermal Pilot project to assess possible need for action to reduce risk of effects of power plant emissions on bald eagles.

For at least one year before management activities occur, complete ground surveys using standardized protocol (Pagel 1992) for peregrine falcon habitat at medium, medium-high, and high potential cliff sites. Surveys will be completed for activities which occur within about two miles (three miles for blasting or helicopter work) of the cliff system. If peregrines are found to nest in NNVM, develop a nest site management plan, using guidelines by Pagel (in press).

Alternatives B, C, and C-Modified:

Monitor visitor use in occupied and unoccupied bald eagle nest stands and in key prey perch sites to assess possible effects on eagle use of the area.

Programs to encourage people to stay on the trails or to relocate the trails would be implemented if off-trail travel in winter or summer is found to disturb nesting eagles around the lakes.

Fish

Direct/Indirect Effects

Actions which would affect the amount and quality of aquatic habitats for fish and other animals include vegetation management on slopes bordering the water bodies; location and size of facilities (e.g. trails and roads, interpretive facilities, boat ramps, campgrounds, parking areas); and numbers of anglers. Changes in boat launch design or size would affect the number or proportion of large and small boats on the lakes. These changes could affect the fishing pressure and the fishing experience. Anglers who fish from the shore, from float tubes, or from small boats (carried on tops of cars), would not be as affected by boat launch facilities as would people who fish from large boats.

Bank stability and amount of soil entering the lakes, river, or creek could be affected by facility locations and vegetation management. Increased sediment entry into the water would cause reduction in fish productivity by reducing food sources. Off-trail hiking along the river- or lake-shore would increase vegetation trampling and increase the potential for soil erosion.

Increases in fishing pressure would reduce the number of fish caught per hour of fishing, or would reduce the size of the fish caught, or both. Changes in fishing regulations or, up to a limit, increased fish stocking, would be required to maintain these aspects of angler experience.

Changes in fish and other aquatic animal populations would affect other animals which depend on them for food. Osprey, eagles, kingfishers, and otters would be directly affected by increases or decreases in fish and crawfish numbers.

All Alternatives: Oregon Department of Fish and Wildlife (ODFW) would continue periodic chub control to reduce negative effects of high chub populations on trout productivity

and on angler experience. Chub control would maintain trout productivity and would reduce the numbers of chub caught by anglers. Depending on the methods of chub control used, there could be negative effects on amphibian populations. If chemical methods (rotenone) were used, the effects could cover a limited area (one acre). Effects on common species (i.e., Pacific tree frog and western toad) would be limited because of their widespread distribution within the crater. Negative effects on less common species (i.e. long-toed salamander) could be greater because of their more limited distribution and lower populations in the crater. Chub control using fish traps would have little effect on amphibians, but at the present time, the method is less effective for chub control than are chemical methods. Another chub control strategy is continued stocking of brown trout which prey on chubs. Another effect of stocking of brown trout is reduced populations of amphibians which are fed on by brown trout.

Alternatives considered would have no effect on concentrations of mercury in the lakes on fish.

Alternative D: Visitor access to the east side of the Deschutes River would not be changed. Anglers would continue to use the undeveloped trail along about 1/4 mile of the river, trampling minor amounts of vegetation. Slight amounts of soil would enter the river from the trail, and riverbank stability would be slightly reduced.

The commercial crawfishing operation will continue to be permitted. This would continue to be a minor source of conflict between sport anglers and the commercial operation, having a negative impact on fishing experience. Commercial harvest of crawfish would remain at a level which could be sustained through time.

Risk of soil erosion following a wildfire would be high for fires burning on the slopes surrounding parts of the East and Paulina Lakes and Paulina Creek shorelines. The erosion could affect production of foods for fish by burying and smothering aquatic insects and plants growing in the shallow water areas. Unless the fires and subsequent erosion were extensive, affecting several hundred acres, the effects would last less than one year.

Alternatives A, B, and C: Commercial crawfishing would no longer be permitted, reducing conflicts between sport anglers and the commercial operation. Angling experience would be improved.

Rerouting vehicle access to Benham Falls day-use area would have no direct effect on fish habitat in the Deschutes River. The boat ramp access would remain in its present location. Moving the day-use area to the bench above the river would reduce trampling of vegetation near the river, resulting in a decrease in the amount of sediment reaching the river.

Alternative A: Visitor access to the east side of the Deschutes River within the Lava Butte Zone would be improved by a short trail, inviting more people along about 1/2 mile of the east side of the river. Although the trail would avoid most riparian areas, more anglers would use the trail to fish from the east side of the river, causing more riverbank vegetation to be trampled, ultimately leading to minor amounts of soil entering the river.

The existing interpretive trail at the Benham Falls day-use area would remain in its present location. Use on the trail could increase by as much as 50%, leading to increased potential for riverbank vegetation to be trampled and more soil entering the river.

Potential effects of wildfire in the caldera and adjacent to Paulina Creek on aquatic habitats would be similar to those of Alternative D because there would be little management to reduce fuel loads on the forested slopes. Wildfires would remove vegetation, resulting in a higher potential for soil to enter the water.

Fishing pressure on East and Paulina Lakes would increase by 15-30% as boat launch facilities, hike-in/boat-in campgrounds, and day-use areas increased adjacent to the lakes

(Lakeside recreation unit). Effects of the increase could vary to include reduction in the numbers of fish caught by individual anglers, reduction in average size of fish caught, and more people fishing at one time.

The net effect would be a reduction in the quality of angler experience. The effects on fish size and catch rate could be mitigated by increasing the numbers and size of fish stocked, or by changing fishing regulations so more fish would be released. With more people fishing at one time, the people who desire a less crowded experience would find lower quality. Others would not be affected by the increase in boats on the lakes. Effects of the hike-in/boat-in camps along Paulina Lake shore would be to increase vegetation trampling of shoreline vegetation, leading to a increase in soil exposed to erosive forces of wind and water.

Alternative B: Visitor access to the east side of the Deschutes River would be similar to the present. Some anglers would continue to use the undeveloped trail along the river bank. Effects would be similar to those in Alternative D.

The existing interpretive trail at the Benham Falls day-use area would remain in its present location. Use on the trail would remain similar to its present level, causing minor amounts of soil compaction and trampling of riverbank vegetation with subsequent minor soil movement into the river.

Fishing pressure on Paulina and East Lakes may increase slightly as more visitors would come to the caldera, but boat launching capacity would not increase. Angler experience would be similar to the present. Removal of the hike-in/boat-in campgrounds would eliminate much of the trampling of lakeside vegetation, reducing the potential for soil erosion into the lake.

Risk of wildfire and subsequent soil erosion into the lakes and creek would be reduced substantially because vegetation management to reduce fuel loading would occur on the forested slopes adjacent to the lakes. Some erosion may occur due to management activities, but the effects would be limited.

Small acreages of cutting or burning of willow and alder along the river, lakes and creek would improve riparian vegetation condition. Bank stability would be maintained, aiding aquatic habitats along the banks. Trees on the banks would be left to fall into the water, increasing the cover for fish and other aquatic wildlife.

Habitat for amphibians would be improved. Vegetation management would emphasize maintenance of logs on the ground within the riparian/water edge areas. Effects would be to increase survival of amphibians.

Alternative C: Visitor access to the east side of the Deschutes River would be improved by a trail located along the lava flow, but away from the riparian area. Anglers would probably not use the trail to access more of the river, so there would be no increase in trampling of vegetation along the river banks. The existing interpretive trail at the Benham Falls day-use area would remain in its present location. Use on the trail could increase by as much as 50%, leading to increased potential for riverbank vegetation to be trampled and more soil to enter the river.

Fishing pressure on Paulina Lake would increase by about 10-15% with increased boat launch facilities and day-use areas adjacent to the lake. Pressure on East Lake would remain similar to present levels and would emphasize fishing from small boats or from the bank. Angler experience would change on both lakes, with Paulina Lake providing for boats as at present and East Lake providing for smaller boats.

There would be no regulations concerning boat sizes on the two lakes, but launch facilities would be designed to accommodate small boats on East Lake. Launch facilities on Paulina Lake would be designed to accommodate boats of similar size as those that presently use

the lake. With no change in fish stocking levels by ODFW, the effects on the fisheries in Paulina Lake would be to reduce the size and number of fish which survive from one fishing season to the next in Paulina Lake. There would be no change in fish size or populations in East Lake.

As in Alternative B, small acreages of cutting, burning, or planting willow and alder along the river would improve riparian vegetation condition. Effects would be identical to those in Alternative B.

Habitat for amphibians would be improved as in Alternative B. Effects would be identical.

Alternative C-Modified: Alternative C-Modified would be similar to Alternative C in its effects on fish. The only difference would be that the Benham Falls day-use area would not be moved. Minor amounts of sediment from the day-use area would continue to enter the river.

Mitigation

Vegetation management activities and wildfire rehabilitation on steep slopes adjacent to lakeshores would include measures to prevent soil erosion from entering the lakes. Measures could include placing logs on the slope contour to trap soil and prevent erosion.

Removal of logs from riparian areas near campgrounds in the caldera would reduce habitat for amphibians. Campers may cut these logs for camp firewood. A program to protect these habitat components would be needed to prevent removal of needed logs.

Timing and location of chub control operations by ODFW will be coordinated with Monument management to limit effects on amphibians.

Where vegetation along river, stream, or lakes has been removed because of trampling, measures will be implemented to revegetate the areas to prevent soil movement into the water and to increase bank stability.

Assumptions

ODFW will continue the stocking program in East and Paulina Lakes at a similar level to 1993. The Upper Deschutes River Basin Plan (to be completed in the summer of 1994 by ODFW) will not change the major objectives for Paulina and East Lake fisheries. Chub control will continue, under the direction of ODFW, with chemical control as the primary method. Fishing regulations (season length, catch limits, size limits) will remain the same.

The Deschutes River Wild and Scenic River Plan (in progress) will reduce the seasonal variations of water flow in the river. The low flows will be higher than they are at present.

The 10 mph speed limit will remain unchanged on the lakes. Sail boats and wind surfing recreation will remain at low levels and will not affect anglers' experience.

Wildlife

Direct and Indirect Effects

The different alternatives would affect the amount and quality of wildlife habitats, the diversity and arrangement of these habitats, and, eventually, the variety and populations of wildlife in the Monument. Changes in vegetation, and differences in human presence and activities are the key ways the alternatives affect wildlife.

Vegetation changes affecting wildlife would include forest succession, plant species composition, and specific habitat components (e.g. snags, logs, canopy cover). A single

vegetation change may be positive for one species and negative for another. For example, thinning a dense mixed conifer forest would improve habitat for bluebirds, but would degrade nesting habitat for goshawks.

The alternatives feature different amounts of "historic" fire-based old growth versus the amount of "ecological" fire-suppressed old-growth ponderosa pine. With different program emphasis for the two old-growth types, different wildlife habitats would be featured. Fire-based old-growth ponderosa pine would favor species which live in relatively open stands dominated by larger trees with grass-dominated ground vegetation. Frequent, low-intensity fires would return every 8 to 12 years. The uniformity would be broken by small openings (1/2 to 5 acres) and by small areas of smaller ponderosa pine trees. Chapter 3, Vegetation, Background & Current Situation for Forest Vegetation Communities and Old-Growth Forests describes the processes and conditions for the vegetation. Fire-based old-growth forests, with sufficient snags present, would favor nesting and foraging habitat for white-headed woodpeckers and flammulated owls; elk would have suitable forage but little hiding cover.

In contrast, "ecological"/fire-suppressed old-growth ponderosa pine would be composed of dense stands, generally with more than one tree canopy layer. Openings would be likely to be dominated by shrubs, including bitterbrush. There would be little ground vegetation under the dense trees. These conditions would be more favorable for goshawk habitat; deer would find some suitable forage on the shrubs.

Human use of an area has the potential to disturb many wildlife species. Unintentional disturbance is probably the primary way that recreational activities have an impact on wildlife (Knight and Cole 1991). Effects of human presence and activities on wildlife vary with level, predictability, and location of human activity; the animal species; time of year; the quality of habitat in which activity occurs; previous experience of the individual animal as related to human activity; and animal nutritional condition, to name a few. For example, goshawks, as well as many other hawks, will abandon their nest and young if frequently approached during the nesting period. Townsends big-eared bats will die during the winter if they are awakened from hibernation too many times. At other times of the year, disturbances may occur with little effect.

Positive effects on wildlife may occur through interpretive programs in which people learn about animals and their habitats. With increased knowledge, people would be more aware of their potential impacts on wildlife.

Wildlife species and habitats which were analyzed in detail include peregrine falcon, bald eagle, goshawk, flammulated owl, mule deer, marten, Townsends big-eared bat, and snags and fallen log habitat. Reasons for in depth analysis of these is given in Chapter 3--Habitats and Animals Given Detailed Analysis. Table 4-14 displays approximate acres of suitable habitat that would be available at a given time for different species and habitats.

Habitat Sustainability

Discussion in Chapters 3 and 4 of Vegetation ("historic"/fire-based and "ecological"/fire-suppressed old growth), Ecosystem Health, and Fire and Fuels; provide background information for this section. The Region 6 Interim Old Growth Definitions (1993) were also used to describe conditions.

Habitat conditions are not static. Vegetation succession, insect and disease activity, and wildfires are natural causes of the changes which occur to some extent whether or not humans manage the vegetation. The natural changes may result in a widespread decline in habitat conditions for a species or a group of species. For example, extensive areas could be dominated

by dense forest with little understory vegetation. These areas would have hiding cover value for mule deer, but would have few plants for deer to eat. If high intensity fires burned the area, there would be little hiding cover, but forage would be plentiful.

Fire suppression in NNVM and the District generally causes fuels to build up (increasing the risk of stand-replacing wildfires) and insect and disease populations to increase (increasing the risk of large scale tree die-off). The result is a large area with a high risk of stand=replacing wildfire and a large proportion of dead trees. Although this provides high value habitat for some wildlife species, it is also at high risk to be replaced by large openings with few live trees. The result is a boom and bust cycle of available habitat for a variety of species resulting in wide fluctuations of some wildlife populations. Viability and distribution of some species may be affected by the boom and bust cycle.

Another example of how wildlife may be affected by the boom and bust cycle is the American marten. Mature and old-growth lodgepole pine and mixed conifer forests provide their habitat. It includes large fallen trees, large and small snags, and a high degree of canopy cover. These conditions may remain for a relatively short period (30 Years) in lodgepole pine forests until insects, disease, and possibly stand-replacing wildfires kill most of the trees, reducing habitat suitability. Although the post-fire forest would include patches of older trees with many snags and fallen trees, it would be 40 to 60 years before optimal marten habitat would again be present in that stand.

Other types of vegetation treatments, described in Vegetation Effects and in Fire and Fuels Effects, may be designed to reduce the risks of high intensity wildfire and high levels of insect and disease activity. These treatments may be used to sustain habitat conditions for a variety of wildlife across NNVM and across the District. The different alternatives would sustain the variety of habitats in different amounts (Table 4-14).

Alternatives A and D: The amount of habitat for some species would fluctuate by a factor of two to three (see Table 4-14 for examples). There would be little vegetation management other than fire suppression. Forests would mature into optimal habitat for some species until fuels increased to the point where wildfires would burn extensive areas. The cycle of forest succession and replacement would be controlled by insects and disease, summer weather, and the occurrence of wildfires. Habitat for wildlife using young or old forests would go through a boom and bust cycle.

Alternatives B, C, and C-Modified: Mature forest habitats would be more evenly available through time, fluctuating by a factor of 0.2 to 0.9. In these alternatives, vegetation management would occur on about 70%, 85%, and 45% of the forested habitats, respectively. Management would sustain mature habitat conditions to ensure that populations would be maintained. Differences between Alternatives B, C, and C-Modified are discussed below.

Snags and Down Woody Material

To assess effects of alternatives on snags and wildlife associated with them, it was assumed that the absence of suitable nest sites is the usual limiting factor for cavity-nesting bird populations (Thomas 1979). However, both foraging habitat and nest sites must be present for a given species to occur in an area. For example, mountain bluebirds would not live in dense forests even if there are many snags because they prefer to forage in open forest or grassland (Sharp 1992). Conversely, if there are many old snags in a large opening, northern three-toed woodpeckers would not live there because they prefer to forage in dense forests.

For woodpeckers which nest in eastern Oregon forests, models using their territory requirements, nesting habits, and snag suitability have shown that 180 snags per 100 acres in

lodgepole pine forests, and 225 snags per 100 acres in ponderosa pine and mixed conifer forests meet their nesting requirements (Thomas 1979, USDA 1994). If snag density is above these levels, there would be no further increase in the breeding density of woodpeckers, assuming that other habitat components were present.

In meadows and riparian areas, there are sometimes scattered snags where single trees grew because of some past environmental conditions. These snags are heavily used as perches by hawks and owls hunt for rodents in the meadows; they are also used by swallows and bluebirds for nesting and perching. Fallen trees in riparian areas are used by amphibians for shelter. The dead wood is an important component to habitat diversity.

The following discussion is organized by vegetation type. Alternative effects are described within each type. Descriptions of old-growth forest characteristics for different forest types are in Chapter 3, Old-Growth Forests, Background & Current Situation. See also the table titled "Interim Old Growth Definition Summary Table for Ponderosa Pine" in Chapter 3 which describes the range of both fire-based and fire-suppressed old-growth stands.

The alternatives differ in the amount and type of treatment, and in the frequency of treatment.

Ponderosa Pine - Alternative A: About 1,000 acres (10%) of forest where ponderosa pine is dominant or co-dominant would be managed to restore **"historic"/fire-based old-growth**. Fire frequency would range between eight and 12 years. Snags will generally average three per acre (>14" in diameter) in late- to very late-seral conditions (90 to 100 years from present). Snag density would vary between none and ten per acre. In the short term, treatments would be designed to increase snag density in those areas where snags are scarce. Because the second growth ponderosa pine stands have few large diameter trees (>18"), the initial treatments would only slightly increase numbers of larger snags. In the long term, snag levels in the fire-based old-growth stands may sometimes fall below those which would provide nesting habitat for maximum woodpecker populations; subsequent treatments would be designed to raise the snag numbers to within the typical range for old-growth forests.

In the fire-based treatment areas, down logs and fallen trees would be present, but at densities generally at or below the low end of the typical range (three to six logs/acre). Project design to create protect fallen tree habitat may be applied where site-specific analysis indicates a need.

The remaining 9,000 acres (90%) with ponderosa pine would be **managed with fire suppression only**. In the short term, snags would increase as "ecological"/fire-suppressed old-growth developed. As fire suppression continued, the likelihood of stand replacement wildfire would increase. High intensity fires would create many snags for the short term, but there would be few live trees to replace fire-created snags. The fallen snags would provide downed wood habitat at increasing levels until another wildfire reduced the log density. With repeated high intensity fires, lodgepole pine density would increase, and large ponderosa pine snags would decrease. Even with recurring wildfires, downed wood habitat would remain above the typical range of "ecological" old growth as defined in the Region 6 - Interim Old Growth Definition. Over the long term, snag numbers would go through wide fluctuations, with periods of very low numbers of larger size classes.

This alternative would favor habitat for woodpeckers which use denser stands where lodgepole pine is more frequent, (e.g. black-backed and three-toed woodpeckers). Habitat for white-headed woodpeckers which depend on larger ponderosa pine forests would decrease.

Ponderosa Pine - Alternative B: As in Alternative A, about 1,000 acres (10%) of ponderosa pine would be treated to restore **"historic"/fire-based old growth** conditions. Effects would be identical to Alternative A.

An additional 6,000 acres (60%) would be managed in the long term as **"ecological"/fire-suppressed old growth**. Because the second growth ponderosa pine stands have few large diameter trees (>18"), the initial treatments would only slightly increase numbers of larger snags in the short term. In the long term, these stands would provide snags and downed woody material within the typical range of old growth characteristics (see Chapter 3 table titled "Interim Old Growth Definition Summary Table for Ponderosa Pine"). Snag and fallen tree habitat would be present at levels to support woodpecker populations near their maximum population density.

The remaining 3,000 acres (30%) with ponderosa pine would be **managed with fire suppression only**. Effects would be similar to Alternative A except that more area would be affected.

This alternative would balance habitat needs for white-headed and black-backed woodpeckers by maintaining some fire-based habitat, some mixed lodgepole/ponderosa pine forests, and some fire-suppressed stands where lodgepole pine would increase.

Ponderosa Pine - Alternative C: Over the long term, about 8,000 acres (80%) would be managed to restore **"historic"/fire-based old-growth** conditions. Frequent fires (8 to 12 year interval) to maintain the fire-based old growth. Effects on snags and downed woody material would be as described in Alternative A except that more area would be affected.

There would be no areas managed as **"ecological"/fire-suppressed old growth.**

The remaining 2,000 acres (20%) with ponderosa pine would be **managed with fire suppression only** (effects described in Alternative A).

This alternative one would provide the most habitat for white-headed woodpeckers. It would not favor black-backed or three-toed woodpeckers.

Ponderosa Pine - Alternative C-Modified: Over the long term, about 3,200 acres would be managed with fire to restore **"historic"/fire-based old-growth** conditions. Fire frequency would be between 8 to 35 years to develop greater ground vegetation diversity. Effects on snags and downed woody material would be as described in Alternative A except that more downed woody material would accumulate between fires.

A total of about 500 acres would be managed to restore and sustain **"ecological"/fire-suppressed old-growth** (effects described in Alternative B).

The remaining 6,300 acres with ponderosa pine would be **managed with fire suppression only**, as described in Alternative A.

Long-term management would provide snags and fallen tree habitat at levels to support woodpecker populations near their maximum population density. The net effect on snag habitat would be similar to Alternative B for white-headed woodpeckers, and intermediate between Alternatives C and B for black-backed woodpeckers.

Ponderosa Pine - Alternative D: There would be no treatments to restore **"historic"/fire-based** or **"ecological"/fire-suppressed old growth**. All except very minor acreage would be **managed with fire suppression only**. Effects are described in Alternative A for stands where fire suppression is the only treatment.

This alternative would favor habitat for woodpeckers which use denser stands where lodgepole pine is more frequent, (e.g. black-backed woodpeckers). Habitat for white-headed woodpeckers would decrease as lodgepole pine replaced ponderosa pine.

Lodgepole Pine - Alternative A: About 2,480 acres (10%) of the lodgepole pine forests forest would be managed to **restore fire as a natural process** in the system. Another 3,720 acres (15%) would be **treated mechanically or manually** to meet other objectives, including snag habitat. Treatment cycles (both for fire and manual treatments) would be at about 100 years. Manual treatments would include objectives to provide at least two snags per acre to meet nesting habitat needs of woodpeckers. In the fire-based treatments, there would be many snags within 10 years after treatment. However, following an initial boom of snag numbers, there would be a period when snag numbers may drop below two per acre. Some snags would remain in the area because of uneven fire intensities, but as the area regenerated, there would be holes with few snags. Additionally, fully developed old-growth characteristics with larger diameter snags (>12") would not occur with the 100 year fire return interval. Treatments would be designed to limit the negative effects to snags.

The remaining 17,280 acres (75%) of the lodgepole pine would be **managed with fire suppression only**. These stands would go through the boom and bust cycle described in Habitat Sustainability. With continued fire suppression, snag numbers and downed woody material would increase. Many areas would develop "ecological"/fire-suppressed old growth lodgepole pine characteristics (120 to 150 trees/acre over 12" diameter, five snags/acre over 12" diameter, 12 to 20 fallen trees/acre, one to two canopy layers, with minor amounts of shrub and herbaceous vegetation, and natural gaps up to one half acre). However, fuel loading would also increase, raising the risk of high intensity wildfire. Eventually, wildfires would burn many of the fallen trees and snags, and would create new snags from live trees. There would be an immediate boom in snag numbers. Woodpecker populations would increase, but snag densities would decline in about 10 years when most snags fell. Snags would remain at low levels within the high intensity fire areas for 50 to 80 years. Because most fires burn with a mosaic of intensities; some areas within fires would continue to contribute to snag habitat while the rest of the fire area recovered.

The overall effect of fire suppression in lodgepole pine forests would be to go through boom and bust cycles of snag numbers. Downed wood habitat would also go through wide fluctuations. The risk of larger, higher intensity fires would be high, so it would be likely that during some periods there would be large areas with little woodpecker nesting habitat; other periods would have high levels of woodpecker habitat.

Lodgepole Pine - Alternative B: About 9,540 acres (40%) of the lodgepole pine forests would be managed to **restore fire as a natural process** in the system. Another 6,660 acres (30%) would be **treated mechanically or manually** to meet other objectives, including snag habitat. Treatment cycles (both for fire and manual) would be about 120 years. Effects would be similar to those in Alternative A in treated lodgepole pine forests except that the forests would have old-growth characteristics with larger diameter snags (>12") because the treatment cycle would be longer. Within mechanically or manually treated stands, there would be less risk of snag densities falling below two per acre because there would be more control over which trees would remain alive after treatment; selection of trees by fire treatment would be less sure.

The remaining 7,280 acres (30%) of the lodgepole pine would be **managed with fire suppression only**. These stands would go through the boom and bust cycle described in Habitat Sustainability. Effects would be as in Alternative A.

The combined effects of different management would provide a fairly even distribution of snags in time and location. Treatment areas would be planned to ensure even distribution of habitat conditions on the landscape.

Lodgepole Pine - Alternative C: About 12,660 acres (55%) of the lodgepole pine forests would be managed to **restore fire as a natural process.** Another 7,440 acres (30%) would be **treated mechanically or manually** to meet other objectives, including snag habitat. Treatment cycles (both fire and manual) would be about 100 years. Effects would be similar to those in Alternative A in treated lodgepole pine forests.

The remaining 3,380 acres (15%) of the lodgepole pine would be **managed with fire suppression only.** These stands would go through the boom and bust cycle described in Habitat Sustainability (effects as in Alternative A).

The combined effects of different management would provide a fairly even distribution of snags in time and location. The boom and bust cycle would be least evident in this alternative.

Lodgepole Pine - Alternative C-Modified: A total of about 9,800 acres (40%) of the lodgepole pine would **restore fire as a natural process.** In the long term, about three quarters of this area would be managed by prescribed natural fire. About one quarter would be treated with prescribed fire. An additional 3,150 acres (15%) would be **treated mechanically or manually** to meet other objectives, including snag habitat. Treatment cycles (for both manual and prescribed) would be between 100 and 120 years.

Effects would be similar to different elements described in Alternatives A, B, and C. Treatment interval would be longer than in Alternative A, allowing for greater development of old-growth characteristics. Effects of prescribed natural fire would be similar to those for prescribed fire, except the arrangement would be less predictable. Mechanical or manual treatment effects would be similar to those of Alternative B.

The remaining 10,540 acres (45%) of the lodgepole pine would be **managed with fire suppression only.** These stands would go through the boom and bust cycle described in Habitat Sustainability (effects as in Alternative A).

The combined effects of different management would provide a fairly even distribution of snags in time and location but with less predictability than in Alternatives B and C. The boom and bust cycle would be evident on about half the lodgepole pine forests. There would be some gaps where snag densities may drop below those needed for maximum woodpecker populations.

Lodgepole Pine - Alternative D: Nearly all 23,480 acres (100%) of the lodgepole pine would be **managed with fire suppression only.** These stands would go through the boom and bust cycle described in Habitat Sustainability (effects as in Alternative A). Gaps in snag habitat for woodpeckers would be evident throughout the landscape.

Mixed Conifer - Alternative A: This forest type would be **managed with fire suppression only.** Snags would increase as stand density increased; ponderosa and lodgepole pine would be replaced by white fir. Likelihood of high intensity wildfire would increase, leading to gaps in snag habitat across the landscape as well as loss of the preferred ponderosa pine snags. Effects on snag levels would be similar to those for ponderosa pine, Alternative A.

Mixed Conifer - Alternative B: About 1,900 acres (70%) of the mixed conifer would be managed to provide cavity nesting habitat, migratory songbird habitat, big game thermal cover, and habitat for other wildlife using this forest type. **Prescribed fire (underburning) and mechanical treatments** would maintain snags and downed woody material to support high levels of nesting woodpeckers.

The remaining 780 acres (30%) would be **managed with fire suppression only.** Effects would be similar as those for Alternative A.

Mixed Conifer - Alternative C: About 2,400 acres (90%) of the mixed conifer would be managed to resemble **"historic"/fire-based conditions** (fire frequencies between 25 to 100 years). Snags and downed woody material would be somewhat unevenly distributed through this forest type due to variations in fire intensities and frequencies. There would be no time gaps when few snags would be present.

The remaining 280 acres (10%) would be **managed with fire suppression only**. Effects would be similar as those for Alternative A.

Mixed Conifer - Alternative C-Modified: About 1,300 acres (50%) would be managed to restore **"historic"/fire-based conditions** with treatment frequencies ranging between 25 to 100 years. Small prescribed fires and manual or mechanical treatments would be used to maintain ponderosa pine in this forest type. Due to the patchiness of treatments, snags and downed woody material would be more unevenly distributed than in Alternative B. There would be no time gaps with low snag numbers.

The remaining 1,380 acres (50%) would be **managed with fire suppression only**. Effects would be similar to those in Alternative A.

Mixed Conifer - Alternative D: All 2,680 acres would be **managed with fire suppression only**. Effects would be identical those for Alternative A.

Other Vegetation Types - Alternatives A and D: There would be few treatments to manage snags or downed woody material in this alternative. Time gaps of 70 to 150 years would occur before a fallen snag would be replaced by another. Effects on cavity nesting birds would be to reduce their populations within the immediate area only. Effects on perching raptors would be to reduce their hunting efficiency with minor effects on their ability to capture prey. Wildlife viewing opportunities would be lost for long time periods.

Other Vegetation Types - Alternative B, C, and C-Modified: Treatments to maintain snags and downed woody material in riparian areas and some meadows would occur. Some time gaps of three to 10 years may occur before fallen snags would be replaced. Replacement may include placing a snag into the area. Effects on cavity nesting birds would be to maintain their populations within the immediate area. Effects on perching raptors would be to maintain their hunting efficiency. Wildlife viewing opportunities would be maintained.

American Marten

Marten habitat in the Monument includes mid-successional stages or older lodgepole pine, mixed lodgepole/ponderosa pine, mixed conifer, and mountain hemlock forests. Pure ponderosa pine forests may be used, but apparently are not preferred. Suitable habitat includes fallen trees and a canopy of live trees. High quality habitat has large numbers of fallen trees and dense canopy. Forest openings are usually avoided in winter, but may be used if prey density is high, if fallen tree density is high, and if some cover protrudes above the snow. Marten use holes formed between the snow and leaning trees or fallen logs to move through the snow while hunting. The also use these travelways to find denning and resting places. Foods eaten by marten include hares, squirrels, chipmunks, mice, birds and eggs, as well as insects, fruits, nuts, and berries.

Marten populations are very high along the north and east sides of Newberry Crater. They are seen other places on the District, but their population status is unknown.

Assumptions used to evaluate effects were (a) suitable habitat in the Monument includes all forest types except pure ponderosa pine, (b) suitable forest habitat is provided in stands older than 40 years since a stand-replacement event (with no removal of burned trees), (c) suitable habitat in the Monument presently has adequate downed woody material and snags, and (d) foods

are available to support marten in forests with these characteristics. Alternatives that would affect these characteristics would have effects on marten habitat.

Alternatives A, B, and C: Marten may be affected by recreation activities. Low levels of human activity (e.g. trails, small dispersed campsites) would have little effect because marten appear to be relatively tolerant of low level human activities. More extensive developments (e.g. parking areas, buildings) within the Caldera and Transition Zones would cause loss of habitat as facilities were constructed. Other recreation effects could be the attraction of marten to foods associated with humans. The attraction could lead to population declines because the attractant may act as a population sink. Surrounding areas (Flanks Zone) would be a source of marten to the sink (Caldera Zone) where they may be controlled or killed if they become a nuisance to people. (A population sink is a situation where animals from surrounding areas are drawn to areas where there is high mortality with very little successful reproduction.)

The wildlife refuge would increase by about 1,400 acres to 12,300 acres; effects would be similar among alternatives. Marten trapping would not be permitted within the refuge. Marten populations would remain high unless marten become dependent on foods associated with people, as noted above, in which case populations may slightly decline.

Management of mountain hemlock forests would be the same in all alternatives--there would be few treatments. Nearly all of this forest type would be suitable habitat. Risk of stand-replacing wildfires would increase as fuels build up, but the risk of wildfire would not be great because these forests occupy cool and moist sites.

Alternative A: About 2,500 acres (<20% of potential marten habitat would be managed to reduce risk of catastrophic wildfire and insect epidemic. The remaining 30,000 acres (80%) would go through vegetation succession to become "ecological" old growth associated with fire suppression. The extent of habitat would increase until a wildfire burned through the forest. Habitat availability would go through a boom and bust cycle, varying between 14,500 acres and 32,800 acres if wildfires were successfully suppressed (Table 4-).

The primary effect on habitat would be to reduce links among suitable habitat patches, exposing marten to predators as they move from one location of suitable habitat to another location.

Alternative B: Of the 10,000 acres of forests dominated by ponderosa pine, about 3,200 acres of the managed forests would provide suitable habitat containing some lodgepole pine and/or white fir. Another 1,600 acres of suitable habitat would not be treated and thus would be susceptible to stand-replacing wildfire in the long term. The untreated forests would cycle through "ecological" old-growth conditions in the "boom and bust" described in Habitat Sustainability.

Available suitable habitat in all forest types would cover a total between 22,500 and 28,100 acres, depending on the occurrence of stand-replacing wildfire. Vegetation management would focus on maintaining habitat on about 18,800 acres in the Monument. The overall effects would be to maintain a stable amount of habitat through time, providing a source from which marten could occupy other areas in the Monument or District as habitat occurred there.

Alternative C: Most (80% or 8,000 acres) of forests dominated by ponderosa pine would be managed as "historic"/fire-based old growth, unsuitable for marten. The remaining 20% (2,000 acres) of ponderosa pine forests would not be treated. These areas would develop into "ecological" old-growth conditions, suitable for marten, ranging between 400 and 1,100 acres, in a boom and bust cycle.

Suitable habitat in all forest types would cover a total between 11,800 and 20,200 acres, depending on the occurrence of stand-replacing wildfire. Although vegetation management

would not focus on providing marten habitat characteristics, mitigation to maintain larger trees, snags, and down woody material within suitable treatment areas would be integrated into site-specific planning. The overall effect would be to maintain a stable amount of habitat through time. Sufficient habitat would be available to provide a source from which marten could occupy other areas as suitable habitat occurred there.

Alternative C-Modified: A total of about 12,400 acres of mixed pine (ponderosa/lodgepole), lodgepole pine, and mixed conifer would be managed in a manner which would provide suitable habitat for marten. Treatments would emphasize the restoration of fire processes to the forest. Prescribed fire and prescribed natural fire would be the primary treatments; mechanical treatments would be secondary. Snags and downed woody material would remain through the treatment cycle (8-35 years in mixed pine, 100-120 years in lodgepole pine, and 25-100 years in mixed conifer).

The remainder of potentially suitable habitat (23,000 acres) would be managed with fire suppression only. In these areas, forests would develop into high quality habitat. Fire suppression would increase the likelihood of stand-replacing wildfires which would reduce habitat quality for up to 40 years, depending on fire intensity.

Total available suitable habitat would vary between 24,100 acres and 35,400 acres, depending on wildfire occurrence and intensity. The overall effect would be to maintain a stable amount of habitat through time.

Alternative D: There would be no management to sustain marten habitat through time. Forest conditions which provide marten habitat would be extensive. The potential for stand-replacing wildfires would increase as fuel loads increased due to insect and disease caused mortality of lodgepole pine. A "boom and bust" cycle of suitable habitat area would occur, with busts occurring following extensive, high intensity wildfires through forests with high fuel loads. Booms would occur after lodgepole pine forests had again developed into mid-successional or older stands following wildfires. Moderate habitat quality would exist in stands between 40 and 60 years following wildfires.

Existing suitable habitat (about 34,000 acres) could increase to a maximum of 36,700 acres as lodgepole pine and white fir increased within ponderosa pine stands. However, with further increases and with the high fuel loads, risk of stand-replacing wildfire would also increase. Extensive wildfires could decrease habitat availability to a minimum of 14,800 acres over the next 50 years. Effects of the decrease would be to reduce their populations periodically and to reduce their ability occupy suitable habitat in other areas.

Townsends Big-eared Bat

There is one known hibernation cave occupied by a few Townsends big-eared bats within the Monument. Monitoring in the winter of 1993 indicated that the few Townsends big-eared bats which hibernate in the cave awakened and moved, probably in response to visitors. Although there have been no other recorded sightings of these bats within the Monument, it is likely that they forage during spring, summer, and fall, and that they roost in crevices within lava flows. More detailed analysis of effects on this species is in the Biological Evaluation (on file in the planning record).

All Alternatives: Prey habitat would occur in untreated forests which would develop into "ecological" old growth. Where trees are very dense, the bats may forage more above the canopy instead of closer to the ground. Vegetation treatments in forests would have little effect on foraging habitat because the bats hunt insects in a wide variety of forested and non-forested conditions. Previously undiscovered caves used by big-eared bats would more likely be found

in alternatives which have extensive vegetation treatments. Discovery of the caves would also expose bats to increased risk from human disturbance.

Alternative A: Lava River Cave would be open to the public year round. Improved road access to Lava River Cave from the Cottonwood interchange on Highway 97 would increase visitation to the cave in summer and winter. Access to the cave would remain open year round. Winter visitors to the cave between November and April would disturb big-eared bats attempting to hibernate. The disturbance would (1) awaken hibernating bats, causing them to use up the stored fat they need to survive until spring, (2) potentially prevent bats from using the cave, and (3) potentially cause further declines in the populations or to slow the recovery of the populations.

Alternative B: Lava River Cave would be open to the general public from early May to mid-September. Interpretive programs at the visitor center and at the cave would describe how bats, their habitat, and people interact. Effects would be to increase public awareness of benefits of bats to ecosystems.

The cave would be closed to visitors during the entire hibernation period. A gate may be installed at the cave entry which would effectively prevent disturbance of big-eared bats. One effect on the bats would be to increase over-winter survival; the bats would not be awakened during winter when there is no insect prey. Another effect would be to provide more undisturbed hibernation habitat than at present. This could lead to increased numbers of big-eared bats hibernating in the cave and their increased survival, contributing to their recovery in Central Oregon.

Although a new access road would be constructed past Lava River Cave from the Cottonwood interchange on Highway 97, access to the cave itself would be more easily controlled. The present access and small parking area at the gate adjacent to the highway would be closed. A winter seasonal closure of the cave would be more effective since motor vehicles would not be able to drive as close to the cave.

Alternative C and C-Modified: Lava River Cave would be open to the general public from mid-March to late October. It would be open to a limited number of guided interpretive tours in the winter. Interpretive programs would describe how bats, their habitat, and people interact, as in Alternative B.

With mitigation, effects would be similar to those in Alternative B. Mitigation to prevent disturbance to hibernating bats would include: interpretive programs at the visitor center emphasizing to cave visitors the importance of not disturbing bats and limiting the number of tours. Other mitigation may include a closed gate on the access road, and installation of a gate at the cave entry.

Alternative D: Lava River Cave would continue to be open to the general public from mid-March to late October. Although the cave would be closed during most of the winter hibernation period, visitors would still be able to enter the cave. Road access to the cave would remain visible from Highway 97, allowing people to park near the gate and walk to the cave. Disturbance to hibernating bats would occur with effects similar to Alternative A.

Mule Deer

The following discussion of effects in generally organized as follows: winter and transition range, migration areas, summer range. The winter and transition range covers about 3,600 acres in the Monument; summer range occurs on 39,500 acres.

Action Alternatives (Alternatives A, B, C, and C-Modified): The visitor center in the Lava Butte Zone would be open year round. Disturbance to deer would increase within the

transition and winter range. During winters with snow accumulation less than one foot, deer would stay in the visitor center area. With deeper snow, they would move to the east and north to lower elevation. Displacement of deer from the area would be greatest during winters with little snow; these tend to be "easy" winters for deer. During "hard" winters (e.g. 1992/1993), displacement would not occur because no deer would be in the area.

New access roads between the Cottonwood interchange with Highway 97 and Lava Lands Visitor Center west of the highway and Road 9710 on the east side are described in Chapter 4, Roads, Direct/Indirect Effects. The roads would increase traffic through transition/winter range and through **migration** areas.

Overall effects of disturbance and traffic would be twofold: deer would move out of the suitable transition/winter range to other range north and east of the Monument; and, deer/vehicle collisions would increase. The displacement would put more pressure on a limited amount of winter forage adjacent to the Monument. During **migration** and daily movements, collisions would increase because deer would spend more time in the highway corridor while attempting to cross the roads. Deer may panic if they become trapped between the access roads and the highway. When panicked, they would more likely get hit or cause an accident. Survival would decline because of increased pressure on winter forage and because of increased disturbance and mortality of deer attempting to migrate through the Lava Butte Zone. There would be a slight decrease in the North Paulina deer herd winter population.

The wildlife refuge boundary would change from its present location on the rim of Newberry Crater to extend west to include the Caldera Zone entry area with its facilities. It would increase by about 1,400 acres to total nearly 12,300 acres. The refuge boundary would align with the Caldera Zone boundary in Alternatives B, C, and C-Modified. The boundary also would be located on features more easily found on the ground (roads, trails, creek). Effects of the refuge on deer would be the same as those for Alternative D. Effects on hunters and enforcement of regulations would be to increase compliance. Hunters would know more readily whether they were inside or outside the refuge. Hunting opportunity would decrease by 1,400 acres.

Hunting would continue in all areas except the refuge. The potential for conflict between hunters and non-hunters would focus in areas around campsites where people with different values would most likely interact. These conflicts would occur in the Transition and Flanks Zones where most of the hunting presently takes place. Hunters and non-hunters may displace each other from campsites. The numbers of conflicts would be different in the alternatives, with Alternative A having the highest potential due to the greatest development in the Transition and Flanks Zones. Alternative B would have the lowest potential because it has the least facility development. Alternative C and C-Modified would be intermediate. In any alternative, there probably would be fewer than 10 negative interactions per year; the interactions would be limited to verbal exchanges.

Alternative A: The large increase in the number of visitors in the **transition and winter range** would affect deer use of the Lava Butte Zone. Deer would avoid the areas of high human activity. The trail linking the Lava Butte Zone and the High Desert Museum would pass through deer transition/winter range. People on the trail would displace deer from the immediate trail area.

Migrating deer would be affected by high levels of human activity in **migration areas** in the Lava Butte and Transition Zones. In the Transition Zone visitor numbers would substantially increase with development of one or two new campgrounds, additional recreation trails, and the Monument Scenic Drive. Most of the human activity would occur outside the

spring and fall migratory periods, but there would be effects to deer migration. Deer attempting to move through the area would seek areas away from the occupied campground(s), trails, and roads. This would require travelling greater distances through more difficult terrain.

Vegetation in the transition and winter range is dominated by pure ponderosa pine forests. Treatments would restore "historic" old-growth forests from their present condition (even-aged, 60-year-old trees with scattered small young trees). Treatments would cover about 600 acres. Mitigation would maintain at least 10% of these stands in hiding cover to reduce displacement of deer. The remaining forested areas (2,600 acres) in the transition and winter range would be managed with fire suppression only. They would develop into "ecological" old-growth forests. If no wildfires occur, the entire untreated area would be hiding cover within 50 years. These stands would be susceptible to insect and disease outbreaks and to wildfire as described in Habitat Sustainability.

Forage would be dominated by grasses with little winter or fall forage value in the "historic" old-growth ponderosa pine. Bitterbrush, the most important winter forage, would decline. It would be limited to small, scattered unburned patches of several acres. Within the 2,600 acres of untreated forests, bitterbrush would also decline as the forest canopy increased and shaded out the shrubs. The net result would be a decline in winter forage quality and quantity from the present 2,200 acres to about 800 acres, most of which would have marginal nutritional value. Deer could find greater amounts of higher quality forage in the winter and transition range northeast of the Monument. Bitterbrush in adjacent ranges would gradually decline in quality and amount as deer from the Monument moved there to find food.

Mule deer **summer range** covers about 39,500 acres in the Monument (in the Transition, Flanks, and Caldera Zones). Recreation activities (e.g. hiking, dispersed camps, horseback riding, mountain biking) in the Flanks Zone would temporarily displace deer from areas immediately adjacent to the activities. High levels of activity for extended periods could cause deer to abandon areas within several hundred feet of trails and camps. Effects on deer survival would be minor because there is extensive undisturbed summer range in the area.

The 15-30% increase in visitors in the Caldera Zone would cause a few deer to abandon the caldera as part of their home range; other deer would become more tolerant of human activities and not change their use patterns.

Vegetation management in summer range would occur on about 20% of the forested areas. The remaining forested areas would not receive treatments and would develop into "ecological" old growth with extensive hiding cover and little forage. Hiding cover would be present on about 67% of the summer range in 50 years even with large wildfires.. Thermal cover would follow a pattern similar to that of hiding cover, but would take longer to develop after a stand-replacing event. Eventually, hiding cover and forage areas would follow the "boom and bust" cycle described in Habitat Sustainability.

To summarize effects of vegetation management in this alternative, foraging areas would be below the optimum on winter and summer ranges. The number and/or productivity of deer in the Monument would be slightly reduced below its optimal capacity.

Alternative B: As in other action alternatives, the visitor center in **winter range** in the Lava Butte Zone would remain open year-round. The area would be a busier place than at present, causing deer to change their use patterns. However, a change in migration and winter habitat use would be less evident than in other action alternatives because visitor numbers would increase less.

Migrating deer would benefit from construction of under- or over-passes across Highway 97. Deer mortality and deer/vehicle collisions would be reduced to near zero in the Monument.

Barrier fences would direct deer to the crossings, resulting in increased safety to highway drivers along about 4 miles of the migration area. The crossings would also affect movements of some other wildlife. Larger species (e.g. coyotes and elk) would learn to use the crossings. Smaller species (e.g. squirrels, marten) may be able to pass through the barriers.

In contrast to Alternatives A, C, and C-Modified, development in the migration area in the Transition Zone would not include a campground. Deer attempting to move through the migration area would be less likely to encounter human activity.

Treatments of forest vegetation in the winter and transition range would include three approaches: (a) treatments to restore about 600 acres of "historic"/fire-based old-growth ponderosa pine, with patches of dense trees to provide hiding cover; (b) treatments to restore about 1,900 acres of "ecological"/fire-suppressed old growth; and (c) fire suppression in about 800 acres. After 50 years of treatments and succession, about 51% of the transition and winter range would provide hiding cover. Thermal cover would also increase from its present level. High levels of hiding cover would reduce disturbance to deer from activities associated with roads, facilities, and hunting. Increased thermal cover would enable deer to conserve more energy through the winter. Survival would increase slightly (<5%).

Forage within the "historic" old growth would be identical to that described in Alternative A. Within treated "ecological" old growth, bitterbrush would occupy about 1,200 acres in small openings of the transition and winter range.

Recreation developments in deer **summer range** would cause minor displacement of mule deer. Visitor numbers and use seasons of facilities would be similar to those at present. Reducing lakeside campsites would reduce disturbance, making water more accessible to deer. Other effects would be similar to those of Alternative D.

Vegetation treatments in summer range in the Transition, Flanks, and Caldera Zones would occur on about 70% of the forested areas. "Ecological" old-growth conditions would provide a total of 28,400 acres (72% of the summer range) of hiding cover.

Summer range forage quantity and quality would remain below the optimal level of 60%. Forage areas would be limited to openings created by vegetation treatments or by openings created by insects, disease, or wildfire.

In summer, hiding and thermal cover would be slightly above optimum levels on transition and winter range, and greatly above optimum levels on summer range. Although summer forage levels would remain below optimal, they would increase above present levels and have a minor contribution to increased deer survival. Bitterbrush within the winter and transition range would be maintained in good condition, continuing to provide the necessary fall and winter forage. Opportunities to improve forage conditions could be pursued in cooperation with non-Federal organizations.

Alternative C: The large increase in the number of visitors in the **transition and winter range** would affect deer use of the Lava Butte Zone. Deer would avoid the areas of high human activity as described above for all action alternatives. Survival would decline because of increased pressure on winter forage and because of increased disturbance and mortality of deer attempting to migrate through the Lava Butte Zone. Deer mortality along Highway 97 would increase due to high traffic levels and disturbance in the area. The North Paulina deer herd winter population would decrease.

Forest vegetation management in the winter and transition range would include treatments to restore about 2,500 acres of "historic"/fire-based old-growth ponderosa pine, with patches of dense trees to provide hiding cover; and fire suppression in the remaining 800 acres.

Migration would be adversely affected by increased numbers of visitors, by reduction of hiding cover in migration areas due to restoration of "historic"/fire-based old growth, and by increased traffic on new roads through the migration areas.

In 50 years, hiding cover would occupy about 30% of the transition and winter range. Thermal cover would decrease slightly from its present level. Effects of decreased hiding cover would be to increase displacement of deer from activities associated with roads, facilities, and hunting. Decreased thermal cover would increase energy needs of deer during the winter.

Forage within the "historic," fire-based old growth would be dominated by grasses, as described in Alternative A. Bitterbrush would gradually decline due to high fire frequency and due to increased canopy cover in the "ecological," fire-suppressed old growth. Mitigation treatments would maintain bitterbrush in areas away from concentrated visitor use. Long-term cover and forage conditions would reduce the number of deer in the transition and winter range in the Monument.

Increased recreation daytime activity in **summer range** would displace some deer from new trails and facilities. A few deer may abandon areas near overnight facilities in the Transition and Caldera Zones.

Vegetation treatments in deer summer range in the Transition, Flanks, and Caldera Zones would occur on about 85% of the forested areas. The combination of treatments, stand-replacing wildfire, and vegetative succession would sustain about 67% of the area in hiding cover.

Forage areas in the summer range would be limited to openings created by vegetation treatments or by tree mortality from insects, disease, or wildfire. Forage areas would remain below optimum.

In summary, hiding and thermal cover would be below optimum on transition and winter range; hiding cover would be below optimal levels in migration areas; forage areas would be below optimum on summer range. These conditions would reduce the number and/or productivity of deer in the Monument. Mitigation to avoid the reduction would not be included in this alternative because: (1) the Monument provides habitat for wildlife species other than deer which depend on more extensive areas of mature forests; (2) extensive vegetation treatments needed to increase forage would not be consistent with other Monument values; and (3) the unfragmented forests within the Monument relative to surrounding landscapes are a relatively rare pattern. Fragmenting the forests within the Monument to provide optimal habitat for deer is not an objective of this alternative. Mitigation which would be included in this alternative is maintenance of 10% of "historic," fire-based old-growth ponderosa pine forests to provide hiding cover.

Alternative C-Modified: Recreation programs would be similar to those of Alternative C except that visitor numbers would be higher within the Lava Butte Zone. The increase in visitor numbers in the **transition and winter range** would cause deer to avoid the areas of high human activity (effects described above for all action alternatives). Survival would decline because of increased pressure on winter forage and because of increased disturbance and mortality of deer attempting to **migrate** through the Lava Butte Zone. Deer mortality along Highway 97 would increase due to high traffic levels and disturbance in the area. Under- or over-passes may be constructed to reduce deer/vehicle collisions. There would be a decrease in the North Paulina deer herd winter population. Mitigation in terms of vegetation management is described below.

In contrast to Alternative C, there would be much more hiding cover in the transition and winter range. The three approaches to vegetation management described for Alternative B would be identical; there would be a different mix. "Historic"/fire-based old-growth ponderosa

pine would be restored on about 1,000 acres. Treatments would restore about 200 acres of "ecological"/fire-suppressed old-growth. The remaining 2,100 acres would be managed with fire suppression only. These activities would provide about 2,200 acres of hiding cover within 50 years. The high level of hiding cover would mitigate some of the adverse recreation effects to deer by shielding them from visitor activity.

Forage conditions would be improved in some of the "historic"/fire-based old growth because areas treated with the longer cycle (up to 35 years) would permit development of vigorous bitterbrush.

Recreation effects in **summer range** would be similar to those for Alternative C.

Vegetation treatments in summer range in Transition, Flanks, and Caldera Zones would occur on about 11,400 acres in all forest types except mountain hemlock. Treatments would cover about 30% of the summer range. The combination of treatments, stand-replacing wildfire, and vegetative succession would sustain about 68% hiding cover in summer range, an amount nearly equal to that in Alternative C. The nearly equal hiding cover in the two alternatives resulted from assumptions made about recovery rates after wildfire and the extent of wildfire occurrence.

To summarize effects of this alternative on deer, hiding and thermal cover would be above optimum levels on transition and winter range. The high levels would help reduce adverse effects of increased visitor activities. In summer range, hiding and thermal cover would also be above optimum levels.

Alternative D: The unmanaged ponderosa pine forests **in deer transition and winter range** would develop into "ecological" old growth. Hiding and thermal cover would increase to a maximum of 3,200 acres in 50 years. Cover would increase until insects, disease, or wildfire opened the forest. Effects of increased hiding cover would be to reduce disturbance to deer from activities associated with roads, facilities, and hunting. Effects of increased thermal cover would be to moderate extremes in winter temperature and wind, enabling deer to conserve more energy through the winter.

As successful fire suppression continued, fall, winter, and spring forage would decline as bitterbrush, forbs, and grasses were shaded out. At present, there are about 2,200 acres of forage within the 3,600 acre winter and transition range. Forage could decline to about 400 acres over the next 50 years, if no wildfires occurred. Forage would remain available in transition and winter range bordering the Monument. Deer would move outside the Monument in search of forage, resulting in increased consumption of bitterbrush on adjacent transition and winter range.

Deer mortality and vehicle/deer collisions along Highway 97 would increase as traffic increases (projected at 3%/year) and with anticipated highway widening through the Lava Butte Zone.

In **summer range**, with no treatment, present forests would continue to age, developing into "ecological" old growth with denser stands and extensive hiding and thermal cover and little forage. Eventually, the "boom and bust" cycle, described in Habitat Sustainability, would occur. With stand-replacing wildfires hiding cover would occur on about 64% of the summer range. Thermal cover would follow a pattern similar to that of hiding cover, but would take longer to develop after a stand-replacing fire.

Forage areas would decrease until wildfires opened the forests. The increase in forage areas would improve habitat conditions for deer.

In summary, forage areas would be below optimum on all seasonal ranges until wildfire opened the forest canopy. With wide fluctuations in forage and cover habitat, the populations

within the Monument would also fluctuate. These fluctuations could increase or decrease the Paulina Deer Herd by less than 2%

The existing wildlife refuge (10,900 acres) in the caldera would not change boundaries. No hunting would be allowed in the refuge. The boundary would remain difficult to locate on the ground, leading to continued enforcement problems. Effects of the refuge on deer would include: increased tolerance of people in the caldera and increased foraging during daylight hours in areas with no hiding cover.

Flammulated Owl

Flammulated owl habitat includes open forests where old and large ponderosa pine grow. Forest canopies in preferred habitat have two levels, but the canopy is usually not dense, allowing ground vegetation to grow to support insect prey (primarily grasshoppers and moths). They nest in cavities created by woodpeckers; flickers are the common woodpecker excavator in their habitat in the Monument. They roost in dense clumps of trees or against the trunk of a large diameter ponderosa. They migrate south in the winter, arriving back on the breeding range in May.

Potential habitat within the Monument includes extensive forests dominated by ponderosa pine and limited areas of mixed conifer species which include of ponderosa pine. The different alternatives would manage these forests differently.

All Alternatives: Effects of recreation on flammulated owls would be minor. Because these small owls appear to tolerate human presence within their home ranges, effects on reproduction would occur only if people deliberately disturbed the nest tree or foraging owls. Winter recreation would not affect the owls because flammulated owls do not arrive in their breeding areas until May.

Alternative A: About 1,000 acres of forests dominated by ponderosa pine which would be managed to restore "historic," fire-based old-growth conditions which would provide suitable nesting and foraging habitat. Inclusion of small, dense patches of younger ponderosa pine trees would provide day roosting habitat.

The remaining 9,000 acres of ponderosa pine forests would not be managed. They would develop into "ecological," fire-suppressed old growth with greater snag numbers than at present, but with limited foraging habitat. Habitat acreage would vary with occurrence of insects, disease, and wildfires which would create openings for dense prey populations.

In forests with mixed conifer species, there would be few treatments. Habitat suitability would decrease as tree density and white fir increased and as ponderosa pine decreased. Small openings would occur as clumps of trees died, providing habitat for prey species.

Table 4-14 summarizes habitat acreage for all alternatives. In this alternative, flammulated owl habitat could increase by nearly 60% from the present, and would fluctuate depending on extent of suitable habitat.

Alternative B: As in Alternative A, about 1,000 acres of ponderosa pine forests would be managed to restore "historic," fire-based old-growth forests with dense patches younger ponderosa pine. Another 6,000 acres of ponderosa pine forests would be managed in "ecological," fire-suppressed old-growth conditions. High quality nesting and roosting habitat would occur in over half of these conditions within 50 to 100 years. Fallen trees and snags (over 20" in diameter) would be plentiful to provide habitat for common flickers which create cavities used by flammulated owls.

The remaining ponderosa pine forests (3,000 acres) would not be managed except for fire suppression activities. It would develop into "ecological" old growth, generally too dense to provide high quality habitat.

In forests of mixed conifer species, a limited amount (< 800 acres) of habitat would be provided in managed and unmanaged forests. In this alternative, habitat would increase by over 60% from the present, and it would be sustained at a high level (Table 4-14).

Alternative C: About 8,000 acres of ponderosa pine forests would be managed to restore "historic," fire-based old-growth forests with some dense patches of younger ponderosa pine, providing extensive habitat. Large diameter snags (over 20" in diameter) in the park-like stands would be present, but not as plentiful as in the "ecological," fire-suppressed old-growth forest because of greater fire frequency. There would also be fewer fallen trees for feeding sites for common flickers. Most of these forests would provide habitat in 50-100 years. The remaining unmanaged ponderosa pine forests (2,000 acres) would develop into "ecological" old growth.

In forests of mixed conifer species, up to 2,400 acres would be treated (primarily with prescribed fire) to encourage early successional conifers (lodgepole and ponderosa pines). Between 1,300 and 1,400 acres of habitat would occur in the managed and unmanaged forests. In this alternative, habitat would more than double over the present, and it would be sustained at a high level (Table 4-14).

Alternative C-Modified: About 3,200 acres of ponderosa pine forests would be managed to restore "historic"/fire-based old-growth forests with some dense patches of younger ponderosa pine, providing flammulated owl habitat. Another 500 acres would be managed as "ecological"/fire-suppressed old growth, providing high quality habitat on about half of the area. The remaining ponderosa pine forests would not be treated except for suppressing fires. It would provide between 2,000 and 3,700 acres of habitat.

In mixed conifer forests, management to restore natural processes including fire would maintain about 700 acres of habitat. The areas where fire suppression would be the only management would provide between 400 and 700 acres of habitat, depending on wildfire occurrence and intensity.

A total of 6,600 to 8,600 acres of high quality habitat would be available through time (Table 4-14).

Alternative D: Vegetation would not be managed to provide habitat. Limited habitat would occur where tree density was reduced by insects, disease, and small wildfires. Low quality habitat would be available as the forests developed into "ecological" old growth. Snags and fallen trees would be plentiful, with a wide range of sizes, but there would be little habitat to support prey species.

Over the long term, suitable habitat acreage would vary widely, depending on conditions created by the "boom and bust" cycle described in Habitat Sustainability.

Northern Goshawk

Northern goshawks nest in most coniferous forests within the Monument. Exceptions may be the higher elevation forests. Nesting habitat has dense canopy cover with some trees over 12" in diameter capable of supporting a nest. Mid- to very late successional forest stands at least 30 acres in size generally provide nesting habitat. Preferred foraging areas are forests with large, mature trees where they can maneuver on the wing while hunting. Their prey includes birds (e.g. flicker, robin, jays) and mammals (snowshoe hare, tree and ground squirrels). Nesting activity begins in April; young begin flying in late July, but remain

dependent on adults for at least another month. The adults aggressively defend their nest areas when young are present. They are sensitive to human disturbance in their nesting areas. Goshawks frequently changes nest locations and will use different nest sites in different years.

For the analysis, it was assumed that most forests below about 6,500 to 7,000 feet in elevation could provide suitable nesting habitat. Above that elevation, apparently either the prey base or forest structure is not suitable.

Vegetation management in the different alternatives would affect the amount of nesting habitat. Prey species would also be affected, primarily by favoring one prey species over another. The net effect on prey would not affect productivity of goshawks; the primary limiting factor is most probably suitable nesting habitat.

Alternatives A, B, C, and C-Modified: Goshawk nesting success may be affected by recreation activities. Nesting activity begins before the peak visitor season begins, so when goshawks begin to nest, they may select an area which has little activity. If that site is near a hiking trail which is used by many people later in the season, nesting success of that goshawk pair would probably be reduced. They may abandon that nest site in following years. The alternatives differ in amount of habitat potentially affected by recreation activities (Table 4-14).

Alternative A: Less than 20% of the potential goshawk nesting habitat would be treated to reduce risk of stand-replacing wildfire and/or insect outbreaks. The remaining 80% would not be treated and would go through vegetation succession to become "ecological," fire-suppressed old growth. The extent of habitat would increase until wildfires burned through portions of the forest. Habitat availability would go through a boom and bust cycle described in Habitat Sustainability and Alternative D.

Nesting habitat would be present on about 1,100 acres at any one time within the treated forests. An additional amount (between 6,800 and 16,100 acres) would be present within the unmanaged forests. (Table 4-14)

Visitor facilities could affect a total of 2,600 acres of suitable nesting habitat. The effects could prevent goshawks from establishing nests near the developments or could cause them to abandon their nests. Once the facilities were established and goshawks learned the area, goshawks with established nesting areas in that area would no longer be likely to attempt to nest there.

Alternative B: Most of the potentially suitable nesting habitat would be managed to sustain habitat conditions. In ponderosa pine forests, about 6,000 acres would be managed in multiple canopy, "ecological" old-growth conditions. Canopy cover would be high, and the forests would be dense, providing high quality nesting habitat. About 1,000 of the ponderosa pine forests would be managed in "historic," fire-based old growth which would not provide suitable nesting habitat. Remaining areas of potentially suitable habitat would be managed with fire suppression only; habitat suitability would fluctuate with wildfire occurrence.

About 70% of the lodgepole pine forests would be managed on a 120 year cycle to maintain "ecological" old growth, providing about 3,000 acres of nesting habitat at one time.

In forests of mixed conifer species, about 70% would be treated to benefit selected wildlife species. Goshawks would be one of these species. About 400 acres of these forests would provide nesting habitat through time.

To summarize, nesting habitat would be present on about 9,500 acres at any one time within the treated forests. An additional amount (between 2,300 and 5,500 acres) would be present within the unmanaged forests in the boom and bust cycle described in Habitat Sustainability. Visitor facilities and recreation activities could affect up to 2,400 acres of otherwise suitable nesting habitat.

Alternative C: The 8,000 acres of restored "historic," fire-based old-growth ponderosa pine forests would generally be too open to provide goshawk nesting habitat. The untreated potentially suitable habitat would be managed with fire suppression only. Habitat suitability would fluctuate with wildfire occurrence.

In lodgepole pine forests, up to 90% would be managed on a 100 year cycle to reduce fuels. Although "ecological" old-growth conditions would not occur within this treatment cycle, mitigation measures would ensure that about 1,600 acres of habitat would be maintained through time. There would be some habitat (900 acres) which would be managed with fire suppression only and would periodically provide suitable habitat.

In forests of mixed conifer species, up to 90% the of potentially suitable habitat would be treated to encourage early successional conifers (lodgepole and ponderosa pines). The treatments would resemble pre-EuroAmerican conditions when fires burned at 25-100 year intervals at a variety of intensity, including stand-replacement fires. About 200 acres of these forests would provide nesting habitat during periods between treatments.

To summarize, nesting habitat would be present on about 1,700 acres at any one time within the treated forests. An additional amount (between 600 and 2,700 acres) would be present within the untreated forests in the boom and bust cycle described in Habitat Sustainability. Visitor facilities and recreation activities could affect up to 2,600 acres of otherwise suitable nesting habitat.

Alternative C-Modified: About 400 acres of potentially suitable habitat would be managed to restore "ecological" fire-suppressed old growth in the ponderosa pine forests. Restoration of "historic" fire-based old-growth would reduce habitat suitability on about 2,600 acres. The remaining areas would be managed with fire suppression only and would periodically provide up to 5,600 acres of suitable nesting habitat.

Lodgepole pine management would emphasize restoration of fire-based processes. Nesting habitat would be provided periodically in burned stands to maintain about 2,400 acres through time. The remaining areas would be managed with fire suppression only.

In forests with mixed conifer species, management on about 400 acres would maintain 300 acres of suitable habitat. Fire suppression on the remaining potentially suitable habitat (400 acres) would periodically provide habitat.

To summarize nesting habitat would be maintained with treatments on about 3,100 acres through treatments. The remaining habitat would vary between 2,100 and 9,500 acres, depending on wildfire occurrence.

About 2,800 acres would be affected by visitor facilities. Effects are described in Alternative A.

Alternative D: There would be no vegetation management to sustain wildlife habitat through time. Forest conditions which provide goshawk habitat would be extensive during some periods. As fuel loads continue to increase from present levels, the potential for stand-replacing wildfire would increase. A boom and bust cycle of suitable habitat would occur with busts following extensive wildfires. Booms would occur after the forests had recovered sufficiently to provide habitat (estimated to be 60 years post-wildfire). The time for recovery would be extremely variable, depending on wildfire intensity and size. Between 7,800 and 17,300 acres (Table 4-14) of the potential habitat would be suitable at any one time through the cycle.

Existing developments (e.g. roads, campgrounds, trails) would continue to be managed as they are, affecting about 2,200 acres of suitable nesting habitat. The present activities associated with the developments are not likely to cause nest failure of goshawks, but they may prevent goshawks from occupying the habitat.

Table 4 - 14

Effects of Alternatives on Wildlife and Habitat

SPECIES/HABITAT OF INTEREST	ALTERNATIVE					PRESENT HABITAT
	A	B	C	C-Modified	D	
Northern Bald Eagle						
◂ Acres managed for nesting habitat	515 ac	980 ac	710 ac	980 ac	515 ac	515 ac
◂ Potential nesting pairs	1	2	2	2	1	1
Northern Goshawk						
◂ Nesting habitat present in 50 years						
• in PP 1/	3,800-8,700 ac 2/	7,200-8,700 ac	300-1,700 ac	1,300-6,100 ac	3,800-8,700 ac	1,800 ac
• in LPP 1/	3,700-7,600 ac	4,100-5,600 ac	1,900-2,400 ac	3,500-5,800 ac	3,500-7,800 ac	5,200 ac
• Total in PP, LPP, MC 1/	7,800-17,100 ac	11,800-15,000 ac	2,300-4,400 ac	5,200-12,600 ac	7,800-17,200 ac	6,300 ac
◂ Habitat affected by facilities 3/	3,000 ac	2,400 ac	2,600 ac	2,800 ac	2,200 ac	2,200 ac
Flammulated Owl						
◂ Habitat present in 50 years	4,000-6,900 ac	6,000-6,900 ac	9,800-10,400 ac	6,600-8,600 ac	3,200-6,400 ac	3,500 ac
American Marten						
◂ Habitat present in 50 years	14,500-32,800 ac	22,500-28,100 ac	16,400-19,000 ac	24,100-35,400 ac	9,300-36,700 ac	34,000 ac
• in PP 1/	1900-4,800 ac	4,400-4,800 ac	400-1,100 ac	1,600-3,600 ac	2,100-5,300 ac	5,000 ac
Mule Deer						
◂ % (ac) of transitional winter range - hiding cover in 50 yrs.	72% 2,600 ac	51% 1,800 ac	30% 1,100 ac	61% 2,200 ac	89% 3,200 ac	39% 1,400 ac
◂ % (ac) of summer range - hiding cover in 50 years.	67% 26,500 ac	72% 28,400 ac	67% 26,300 ac	68% 26,700 ac	64% 25,200 ac	83% 32,800 ac

1/ PP = Ponderosa Pine LP = Lodgepole Pine MC = Mixed Conifer Species
2/ Range indicates minimum and maximum depending on wildfire extent.
3/ Roads, trails, campgrounds, picnic areas, etc.

Wildlife Diversity

The landscape elements that animals use are different for different species. Some animals, such as mule deer, are "edge" species, whose populations tend to be higher where forest openings and dense forests are interspersed. Other species, such as black-backed woodpeckers, are forest "interior" species whose populations tend to be denser where large areas (>500 acres) of unbroken lodgepole pine forests occur.

Different vegetation patterns will favor different mixes of wildlife species. The same total number of species may occur in different landscape patterns, but different sets of species may be in different patterns. Wildlife diversity not only varies with landscape patterns, but it also depends on the scale. If a pattern within the Monument boundaries is different from the pattern of the surrounding landscape, the larger scale diversity is increased by the pattern within the Monument.

All Alternatives: Landscape diversity would increase. Large blocks of similar vegetation conditions (e.g. similar age, species mix, canopy) would contrast with the surrounding landscape of smaller forest patches 20-60 acres) interspersed with openings (40-100 acres) of young trees.

Alternative A: Large scale diversity would increase by retaining large blocks of forest with few management activities other than fire suppression. When or if these large blocks are killed by insects and/or disease, or burn in a wildfire, the resulting landscape will have relatively large blocks of similar vegetation. About 1,000 acres of ponderosa pine forests would be restored to "historic" old-growth conditions. A total of 20% of forest vegetation would be managed to prevent insect and disease outbreaks and to reduce wildfire hazard. These areas would add to habitat diversity within the Monument because they would be different from the rest of the forest vegetation.

Alternative B: Large scale landscape diversity would increase by managing large blocks of lodgepole pine for long-term sustainability of habitat for species such as black-backed woodpecker and northern goshawk. Sixty percent of the ponderosa pine would be managed to maintain multi-storied conditions with high canopy cover. As in Alternative A, about 1,000 acres of the ponderosa pine forest would restored to "historic" old-growth conditions. A total of 70% of the ponderosa and lodgepole pine acreage would be managed for habitat sustainability.

Alternative C: Large scale landscape diversity would increase by managing large areas of ponderosa pine in "historic" old-growth conditions. Fire would be used to mimic early fire patterns in lodgepole and ponderosa pine, resulting in a different vegetation mosaic than in the surrounding landscape. The mosaic in lodgepole pine would be made up of a wide variety of stand sizes of different tree ages and densities, depending on the conditions when they burned. About 85% of the ponderosa and lodgepole pine forest would be managed to create and retain forest conditions similar to those that occurred with pre-EuroAmerican fire frequencies.

Alternative C-Modified: Large scale landscape diversity would increase by restoring fire to about 40% of the lodgepole pine forests through prescribed natural fire and prescribed fire. Blocks of lodgepole would go through fire succession in a wide range of sizes. These areas would differ from patterns surrounding the Monument. Ponderosa pine forests would contribute to diversity in two ways -- by restoring "historic," fire-based old growth to about 30% of the forest, and by retaining fire suppression management large areas where "ecological," fire-suppressed old growth would develop. These areas would increase diversity at a large scale by adding another forest succession process to the area.

Mitigation

All Action Alternatives: Maintain 10% of the "historic," fire-based old-growth ponderosa pine forests to provide hiding cover for deer, roosting sites for flammulated owls, and within-forest diversity for other species which use the habitat patches. The patches (several acres in size) would be distributed throughout the fire-based forests and would "move" in time;

different areas would have these conditions at different times. The patches would also contain higher levels of fallen trees and snags than in the fire-based areas.

During planning management prescriptions for "historic," fire-based ponderosa pine old growth in deer winter and transition range, include evaluation of forage quality and hiding over arrangement in relation to facilities with high visitor levels.

Interpretive programs would describe how bats, their habitat, and people interact. Increased understanding of bats would reduce adverse impacts from people.

Consider bat roosting requirements when planning projects to remodel, maintain, or construct buildings and bridges.

Alternatives B, C and C-Modified: Cooperate with ODFW and Oregon Department of Transportation to assess need for under- or over-passes across Highway 97 to reduce deer/ vehicle collisions.

Alternative C and C-Modified: During the bat hibernation period (early November to mid-April) access to visitors to lava River Cave would be limited to guided tours only. The taros may be limited to avoid disturbance to hibernating bats.

Alternative C-Modified: Snags would be maintained across the landscape to support high levels of woodpeckers in the various forest types. There may be gaps in time and location where snags do not support the maximum potential woodpecker populations, but these areas would be limited.

Assumptions

In all alternatives, habitats in the Monument would contribute to the Forest goals to maintain viable populations of wildlife.

Assumptions made to assess effects on habitat and populations are described in detail in the planning record. They include, for example, assumptions about post-fire succession rates and processors.

6. Interpretation

Direct and Indirect Effects

Interpretive services would be expanded in all of the action alternatives (A, B, C, and C-Modified) and would provide a variety of engaging, theme-driven programs encouraging resource protection. The main visitor center/education complex in the Lava Butte Zone would be open year round, with new opportunities to serve the many winter recreationists who come to Central Oregon. A, B, C and C-Modified would all include some increases in interpretive staffing and at least minor improvements to facilities. To help offset the higher costs of these programs, we would seek more partnerships with other agencies, organizations, and businesses. All action alternatives would include interpretation of geology, archaeology, ecosystems, wildlife (e.g. bats), and vegetation management in the NNVM area.

Interpretation would be geared to serve the most people in Alternatives A, C and C-Modified. In these alternatives, we would likely have more indoor and outdoor facility space for interpretive programs. Displays would be more extensive, and more guided interpretive programs would be available for visitors. Interpretive tours by shuttle-bus would probably be expanded to include such destinations as Paulina Peak and features in the Transition Zone. A portal facility would provide information to visitors entering the Caldera Zone. These

alternatives would more closely meet the increasing demand for educational experiences in the Monument. They would also reach the most people with our interpretive messages.

Alternative B, on the other hand, would provide lower-key interpretive programs to smaller numbers of people. It would offer the most opportunities for self-directed discovery and exploration, which would call for many low-standard (semi-primitive) trails. Chances for seeing a variety of wildlife and learning about habitat enhancement would be maximized. This alternative would also offer the most roving interpreters to interact informally with visitors.

Alternative D would provide the lowest level of interpretation overall, requiring the lowest level of facilities and staffing. Under this alternative, we would continue to underserve visitors with crowded, outdated facilities and little emphasis on continuity of programs. No clear interpretive messages would be presented, and resource damage by vandalism and carelessness would continue to increase as the number of visitors rises. Because the Deschutes National Forest Plan contains no overall direction for interpretive services, the need for improvement is likely to be ignored.

Alternatives C and C-Modified would encourage the most research activities in the Monument and would make these projects most accessible to visitors. The public would have the most opportunities for interacting with scientists and learning about how science works. Cooperative, hands-on involvement would also help foster visitors' sense of stewardship for land and its natural inhabitants. A campsite for educational groups in the Transition Zone would be included in long-range planning to facilitate in-depth learning and field projects. Increased research and educational efforts in these alternatives would provide more information about natural features and processes in the Monument area. This information would be available to incorporate into interpretive programs and aid in resource management. Alternatives C and C-Modified would also afford the best opportunities for interpreting the role of fire in Newberry's ecosystem.

Interpretation and the Recreational Opportunity Spectrum

The amount of land available for particular types of interpretive experiences would vary by alternative, as a result of varying land allocations under the Recreational Opportunity Spectrum (ROS) system. (See Recreation, Chapter 3 for explanation of ROS.) Table 4-15 shows some of the important characteristics of interpretation under different ROS classifications.

Table 4 - 15

Typical Interpretive Experiences by ROS class 1/ for all Alternatives 2/

ROS Class	Contact with Interpreters	Interpretive Facilities
Rural	frequent	complex 3/
Roaded Natural	limited	simple 4/
Semi-Primitive	none	none

1/ See explanation of Recreational Opportunity Spectrum (ROS) in Table 3-3.
2/ See maps of ROS allocations for each alternative in Chapter 2.
3/ For example, visitor centers, displays, kiosks, signed interpretive trails.
4/ For example, signed interpretive trails and viewpoints.

None of the alternatives designates more than 1-2 percent of the Monument as rural, where social interaction and activity is high. Alternatives A, C, C-Modified and D would offer the largest areas for Rural, including the Lava Butte Zone's interpretive/information center, and the Caldera Zone's portal facility in A, C, and C-Modified. Alternative B would have the smallest area available for this kind of interpretation.

Opportunities for roaded natural interpretation, where interpreters are available at certain times and locations for guided programs in the summer season, is maximized in Alternative A. In this alternative, nearly all of the Lava Butte, Transition, and Caldera Zones are allocated to roaded natural and would be accessible via the Monument Scenic Drive and Road 21 (see Roads and Facilities). Alternatives C and C-Modified would offer the second-most roaded natural interpretive opportunities, but would also incorporate large areas for semi-primitive interpretation (self-directed discovery) in the Transition and Caldera Zones. Alternative B would have the most semi-primitive areas for interpretation; roaded natural interpretation would be limited mainly to the Lava Butte Zone, Benham Falls day-use area in the River Zone, Lava Cast Forest area in the Transition Zone, and part of the Caldera Zone. In all action alternatives, the Flanks Zone would be reserved for semi-primitive interpretation only.

Alternative D would provide the smallest area for roaded natural interpretation of all the alternatives. It would also have relatively little area for semi-primitive interpretation (about the same as A). This is because Alternative D would designate a large portion of the Monument as roaded modified. This ROS class permits human alternations to the landscape, such as clearcuts and buildings, that would create an unnatural appearance. Roaded modified lands could not be relied on to provide suitable settings for interpretation.

Interpretive Facilities and Trails

The overall physical capacity of interpretive facilities (including trails) would be greatest in Alternatives A, C, and C-Modified, much lower in B, and lowest in D (Table 4-16). The biggest changes in Alternatives A, C and C-Modified would take place in the Transition Zone, with the development of several new interpretive trails, day-use areas, and waysides. Although interpretive trails and trailheads would also be added in Alternative B, they would accommodate fewer people because of their intended Semi-primitive experience (see ROS discussion above). The alternative offering the highest capacity for interpretation in the Lava Butte Zone would be C and C-Modified, in accordance with their greatly expanded programs for science-based learning. The interpretive/information complex area in these alternatives would likely be able to serve 1050-1400 people at one time, compared to 700-1050 people in Alternative A. Current visitorship to the Lava Lands Visitor Center already commonly exceeds 1000 people daily in the summer and is expected to continue to increase. (See also Chapter 3, Trends sections for Interpretation and Recreation.) Alternative A would provide for the largest increase in interpretive use in the Caldera Zone, with the construction of the largest portal facility west of the caldera along Road 21 (accommodating about 200-350 people, versus 100-225 in Alternatives C and C-Modified) and major expansions and additions to interpretive day-use areas.

Alternative B would attempt to respond to the growing demand for interpretation in NNVM mainly by increasing staff rather than facilities. However, the Lava Lands Visitor Center and Paulina Visitor Center (in the Paulina Guard Station at Paulina Lake) would probably see modest renovations and/or expansions. Alternative D would make no changes in interpretive facilities and would fail to accommodate growing numbers of visitors.

Alternatives C and C-Modified would have the greatest increase in number of trail miles used for interpretation, followed by A, B, and D, in that order (Table 4-17). Interpretive trail

miles would increase substantially in the Transition Zone in all action alternatives and in the Lava Butte Zone in Alternatives A, C, and C-Modified. The large increase shown for the Caldera Zone in Alternative C reflects the likely addition of interpretive signs to major portions of the existing Paulina Lake and Paulina Peak trails. (The Paulina Peak trail would probably retain its multiple-use status for hikers, bikers, and horseback riders.) Overall, Alternatives C and C-Modified would provide the most opportunities for visitors to learn in a variety of trail settings. Alternative A would provide fewer of these experiences; D would provide the fewest.

Table 4 - 16

Anticipated Capacity of Interpretive Facilities

(Including Trails)

ZONE [1/]	ALTERNATIVE				
	A	B	C	C-Modified	D [3/]
Lava Butte and River Zones					
PAOT [2/]	910-1250	645-950	1220-1550	1220-1550	645
Transition Zone					
PAOT	560	50-100	530-640	530-640	40
Caldera Zone					
PAOT	645-960	210-240	430-750	430-750	215
NNVM Total					
PAOT	2110-2760	900-1290	2190-2940	2190-2940	900

1/ No interpretive facilities exist or are planned in the Flanks Zone.
2/ People at one time.
3/ Same as existing. Current levels of use commonly exceed these capacities.

Table 4 - 17

Anticipated Number of Miles of Interpretive Trails [1/]

ZONE [2/]	ALTERNATIVE				
	A	B	C	C-Mod.	D [3/]
Lava Butte and River Zones	9	4	8	8	3
Transition Zone	7	7	9	9	1
Caldera Zone	3	<1	10	10	<1
NNVM Total	19	11	27	27	4

1/ Rounded to the nearest mile.
2/ No interpretive trails exist or are planned in the Flanks Zone.
3/ Same as current condition.

Effects on other ecosystem components

The type and level of interpretive services would affect the numbers of people coming to visit NNVM and would influence their behavior once they got here. Alternatives A, C and C-Modified would involve the most construction for interpretive purposes (buildings, roads, high-standard trails, etc.) and attract the most visitors to participate in their programs. Consequently, A, C and C-Modified may be expected to take relatively heavy tolls on the Monument's sensitive features. On the other hand, the strong interpretive efforts in these alternatives--especially C and C-Modified--would help prevent resource damage by increasing many people's awareness and motivation to act responsibly. Alternative B's interpretive programs would attract and reach fewer people than programs in A, C or C-Modified. Enhancement of dispersed, unguided interpretive activities in B could have specific effects such as increased disturbance to wildlife and greater difficulty in preventing and fighting human-caused wildfires. Alternative D would draw and serve the fewest people for interpretation. It is difficult to rank the alternatives' interpretive programs overall, yet the education emphasis of Alternatives C and C-Modified would be expected to provide more protection for NNVM's natural resources than A. Similarly, interpretation in B would be more protective than the low level of programming in D.

Issues that could be affected directly by interpretive programs in all alternatives are: Recreation (including its enhancement by interpretive opportunities as well as possible conflicts between interpretation and other recreational uses), Roads and Facilities, Vegetation and Scenic Quality (as affected by roads and facilities used for interpretation), Water Quality, Air Quality, Geology, Archaeology, Wildlife, Science and Research, Law Enforcement, Local Communities, American Indian Involvement, and Special Uses. Please refer to these sections for more discussion. The particular locations of interpretive programs, facilities, and trails in each

alternative would greatly influence the effects on these issues. Site-specific analysis is beyond the scope of this document and would be done prior to siting any significant new interpretive programs or construction of facilities or trails.

Mitigation

The effects of drawing more people into the Monument, whether for interpretation or for other recreational activities, can be mitigated by a variety of techniques. For example, sites can be protected by making them less accessible--such as with traffic barriers--and/or by posting interpretive signs explaining management concerns. See Recreation section for a more complete discussion.

Assumptions

Assumptions made about the capacities, number, and general locations of new interpretive facilities and trails can be found in the Planning Record. The physical capacities of interpretive trails reflected in Table 4-16 were derived from the projected number of parking spaces available at trailheads. Also for this table, half the visitor use of Benham Falls day-use area was considered to be interpretive. New day-use facilities in the Transition Zone were all assumed to be interpretive in Alternatives C and C-Modified, compared to half interpretive in A.

7a. Heritage Resources

Direct and Indirect

Although alternatives have varying levels of potential effects to cultural resources, the standards for protection are the same. Cultural resource inventories will be conducted for all proposed activities which have the potential to affect cultural resources. Historic properties will be evaluated for their significance and potential to be nominated to the National Register of Historic Places and treatment or mitigation plans will be prepared to ensure their protection by preservation or minimizing impacts to significant resources.

All actions will comply with federal historic preservation laws, including Executive Order 11593, the National Historic Preservation Act, the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, the Antiquities Act and the standards and guidelines which implement the above mentioned laws and regulations.

Management of cultural resources located within Newberry National Volcanic Monument consists of four main components: 1) Cultural resource location and identification; 2) Determination of significance and eligibility to the National Register of Historic Places; 3) Protection, preservation or mitigation of the effects on cultural resources; and 4) Interpretation of cultural resources for the benefit of all.

Although none of the alternatives proposes site-specific activities or undertakings, the direct effects to cultural resources are related to the proposed levels of recreational use and related activities under each alternative. The types of impacts of these activities and uses are predictable, however the location and extent are unknown until they occur on a more site specific basis.

Direct effects on cultural resources are related to the amount of land-disturbing activities such as road construction, wildlife habitat improvements, grazing, vegetation manipulation, trail

construction, building maintenance, campground placements, boat ramps, and other recreational developments and activities. Alternatives calling for more recreational developments and more intensive management such as Alternatives A, C and C-Modified would have the greatest potential for directly and indirectly affecting cultural resources.

Increased recreational access and activities can also indirectly cause effects to cultural resources that are difficult to mitigate. For example, off-trail hiking or dispersed camping can cause effects by creating new access or increased site looting. Therefore, alternatives that increase recreational use, such as Alternatives A, C, and C-Modified (in that order) would have more potential for indirectly impacting cultural resources than other alternatives.

Geomorphic features that favor recreational sites and road and trail construction, such as flat areas or bodies of water, also coincide with higher probability areas for cultural resources. Because of this, comparing direct effects based on acreage alone needs to be made with caution. Acre for acre, they have a greater potential to effect cultural resources than the small acreage might indicate. Features that attract people today are the same ones that people of the past were drawn to.

Indirect effects also occur when peoples' activities cause landscape changes that expose cultural resources. An example is recreational activities along lake shores that destabilize the cultural resource. Natural effects include wind and water erosion, rodent activity, tree upheaval, frost heave, lake level fluctuations and snow melt. The effects to cultural resources are a result of people-made activities and natural erosion and the interaction between the two. Alternative A includes the highest level of land disturbance which affects the exposure of cultural resource sites and poses the greatest indirect effects to them.

Prescribed burning, wildfire and suppression activities can result in effects to both historic and prehistoric cultural resources. Wood, glass, and metal artifacts can be burned or destroyed by heavy equipment as well as exposing artifacts, leaving them more vulnerable to looting but also increasing the effectiveness of cultural resource inventories by enhancing ground visibility in areas with a high fuel loading. High intensity burning can result in fire induced cracked rock as well as change the chemical composition of some stone artifacts. This results in affecting the reliability of future testing results for aging artifacts and identifying the sources of the artifacts.

All alternatives would require a cultural resource inventory when a site-specific project could affect cultural resources. Alternatives A, C and C-Modified, with higher levels of ground-disturbing activities (new trails, facilities, etc.,) would increase the need to complete the required cultural resource work. Therefore, an increase in funding for cultural resources would be needed. Non-project related cultural resource work has been non-existent on the Monument. When cultural resource support costs do not match the appropriate workload and/or time is not available to properly inventory, evaluate or mitigate effects to sites, then the protection for the resource usually occurs in the form of avoidance. While this may protect the resource for a short period of time, it does not further the understanding of the resource and causes avoiding areas that may or may not be significant and increases costs over the long run.

Alternatives with higher levels of ground disturbing activities, Alternative A and Alternatives C and C-Modified to a lesser extent, would also increase the need to evaluate cultural resource sites. Alternatives C and C-Modified would increase the number of evaluations due to educational and interpretive opportunities rather than for ground disturbing activities. Again, an increase in funding for cultural resources would be needed. The same is true for mitigation where Alternative C would require less mitigation than Alternative C-Modified or Alternative A would call for.

Alternative C and C-Modified, with their emphasis on interpretation, education, and scientific research, are the only alternatives that would emphasize non-project cultural site evaluations to better understand and protect the resource. These alternatives also meet the intent of Section 110 of the NHPA, which is to ensure that historic preservation is fully integrated into the on-going programs and missions of federal agencies. These alternatives could require increased budgets and personnel to accomplish such evaluations, though some funding could be found through partnerships and other cooperative ventures. Alternative A and B would meet minimum historic compliance standards. Interpretive programs can directly affect the cultural resources by increasing public awareness and a sense of stewardship of the resource. Increased public awareness can also enhance the value of the resource which in turn affects the market value of illegal activities. Interpretive programs need to be designed so that they do not contribute to the degradation of the resource.

In summary, all of the alternatives emphasize cultural resource protection by identifying opportunities for the development of site management or treatment plans in areas of high recreational use, such as campgrounds and resorts. Effects to cultural resources can be both direct and indirect. Proposed activities can effect or damage a site and they can also provide a vehicle for learning about the resource. Increased recreation affects more significant cultural resources. While mitigation of adverse effects is an option, it is not always prudent to mitigate all sites. Preservation is also a goal so that a percentage of significant resources are left for the future. Careful consideration of the fragile balance between recreational activities and significant, non-renewable cultural resources is needed.

Effects to American Indians

Special consideration and requirements may be needed for cultural resources, based on consultation with American Indians and Tribes, such as with the Confederated Tribes of the Warm Springs Reservation of Oregon, the Burns Paiute Tribe, and the Klamath Tribes. The American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act and the National Historic Preservation Act all call for consultation measures in order to preserve and protect religious sites. Religious or spiritual beliefs are an integral part of traditional cultural values. The location of religious sites is considered to be extremely sensitive, particularly with certain religious traditions. It may be more preferable in some instances for some American Indians to let a site be impacted rather than to point out the location of certain places. In those situations, the environmental setting could be changed to the point that the value as a religious use area would be lost. Practices which contribute to the loss of the natural conditions of an environment, negate the importance of isolation, privacy and "purity," required for some religious or traditional cultural uses. Thus far, no sites have been specifically identified as having religious significance or use, though inventory has focused on historic and archaeological properties. While there is a growing dependance on the non-Indian economic system, living Indian traditions and values are inextricably linked to the land and firmly rooted in the past. It should be noted that there is a high potential for sacred or religious sites to exist within the Monument based on its inherent features such as obsidian quarries, hot springs, and wildlife when combined with 10,000 years of use by American Indians.

Effects on Other Ecosystem Components

A large number of significant cultural resources are located in Newberry National Volcanic Monument. Cultural resources are an issue to many people who are concerned about the

resource and how it is being protected. The more land areas that are open for development, the more challenging it becomes to protect these resources.

The main effects to other ecosystems resulting from cultural resource protection are: higher costs, especially for evaluation and mitigation; project delays in order to address cultural resources; and sometimes project cancellation due to high costs or to avoid a site; and the potential to cause environmental consequences, for example, a broken sewer line located in a significant cultural resource site for which no treatment plan exists. These measures can affect vegetation treatment, silvicultural practices, road construction, vegetation or wildlife enhancement, such as spring development, or recreational development. Historic properties also enhance the natural forest setting. They provide the public with a tangible experience of the landscape as it was in the past, and evoke stimulating questions for interpretation.

Mitigation

Mitigation minimizes the effects to cultural resources caused by human activities and natural depredation. A mitigation methods effectiveness is in part due to the resources value, uniqueness, potential for information and interpretive opportunities. Data recovery for example, is not appropriate for a site whose value lies in its location, such as a site of religious value to American Indians. Mitigation methods do not differ by alternative.

Mitigation methods include but are not limited to, the redesign of a proposed project, cancellation of a project, site avoidance, data recovery, restricting impacts to insignificant portions of a total site area, interpretive opportunities, adaptive reuse, fill on top of sites, relocation of a resource, fencing or barriers, and documentary methods. Mitigation measures are site specific and based on consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation when a property is potentially eligible to the National Register of Historic Places; and when appropriate, consultation with American Indians and Indian Tribes. Cultural resources represent different values to the Indian peoples, scientific community, and the historic preservation oriented general public. Whether the effects to a cultural resource are caused by direct, indirect or cumulative effects, the effects may not be entirely mitigated through any measures. The most effective way to avoid affecting historic properties is to carry out the inventory and evaluation responsibilities during project planning.

Mitigation of adverse effects to significant cultural resources, such as data recovery will ultimately free up the mitigated area for future project activities as well as increase the scientific knowledge of the resource. Mitigation by data recovery is the controlled and scientific retrieval of information but nonetheless, it is the destruction of a cultural resource site. Once data recovery is undertaken, the effects to the site are irreversible for future analysis. Mitigation by avoidance will restrict or prevent future proposed activities within the area of effect and it does not increase the knowledge of the resource.

Assumptions

Data recovery efforts represent the scientific and controlled destruction of a cultural resource site. Professional archaeological personnel, techniques and methods are employed for inventory, testing, evaluation and mitigation of archaeological resources. Each cultural resource site, property or district, depending on its size and its potential to answer specific research questions, is mitigated to different standards. Even though the full scope of cultural resources in the Monument is unknown, the recorded cultural resources are representative of the general resource

base. Preservation in place, and adaptive reuse of historic properties, is often the preferred method of treatment for cultural resource properties.

Each alternative will employ the historic preservation laws, regulations and policies through application of the standards and guidelines. These laws, regulations and policies dictate inventory, evaluation, preservation and protection of the cultural resources that have the potential to be affected by management activities; as well as evaluating sites for their eligibility to the National Register of Historic Places and avoiding or mitigating adverse effects to eligible and potentially eligible properties.

Projects which affect cultural resources can cause irreversible effects to non-renewable resources. As the number of unevaluated sites increases, the potential for adverse effects will increase. Some forms of recreational public use, such as dispersed camping and off-trail hiking, contribute to cultural resource damage, theft and vandalism. The amount of artifact collecting, site looting and damage will increase over time as more sites are discovered, made more accessible and publicized in the media. The general public is genuinely interested in cultural resource protection and preservation. The knowledge of cultural resources has been directly proportional to the amount of developmental activity and to subsequent data recovery, due to the funding process. Recreational development has the greatest effect to cultural resources under all of the alternatives.

7b. Geology and Soils

Geology

Direct and Indirect Effects

Land-disturbing projects have both direct and indirect effects on the geologic resources and are related to the amount of disturbance created by the construction of roads, trails, and other facilities. These impacts are generally confined to discrete areas where construction occurs and are long term and irreversible in nature. Additional effects may occur from fish and wildlife enhancement projects, vegetation management practices, and other activities under each alternative. These additional impacts can also be direct or indirect in nature, with long term and irreversible effects. The level of activity proposed under an alternative is one indication of the potential for effects but of even more importance is the actual location of the activity. In this programmatic document the actual proposed location of future activities is unknown so is not addressed here, but will be addressed by future site-specific NEPA analysis.

Land-disturbing projects have both positive and negative direct effects. The main positive effect is the gain in geologic knowledge from the new exposures created during excavation for projects. Some of the possible negative effects include disturbance by burial or excavation, disruption of natural stratigraphy by the mixing of strata, and the alteration of natural drainage patterns. Some considerations for comparing the effects of development on geologic features include: 1) the sensitivity of the feature to disturbance; 2) the proportion of the feature affected; 3) the location of the development in relation to the feature (on the margin or in the center); 4) the uniqueness of the feature; 5) the severity of the impacts; 6) the potential for mitigation; 7) the duration of impacts; and 8) the potential cumulative effects.

Additional effects on geologic resources are related to the level of visitation and access provided to geologic features. These effects are generally limited to smaller-scale features which

are sensitive to removal or destruction by vandalism or overuse. These impacts are also long-term and irreversible in nature. When there is access to geologic features, there is also some trade-off between vandalism and overuse. At low levels of visitation, vandalism is more likely, but at high levels of visitation there may be more unintentional destruction by overuse.

Table 4-18

Potential for Damage to Geologic Features

ACTIVITY	A	B	C	C-Mod	D
Construction of new Roads	5	2	4	3	1
Construction of new Trails	5	2	3	4	1
Construction of new Facilities	5	2	4	3	1
Reconstruction of Campgrounds	2	2	2	2	1
Vegetation treatment - mechanical	2	5	4	3	1
Wildlife enhancement projects	2	5	4	3	1
Scientific Research	2	3	5	4	1
Vandalism (low use levels)	1	4	3	2	5
Overuse (high use levels)	5	1	4	3	2

1 = lowest potential
5 = highest potential

Mineral Claims and Leases are addressed by the Monument legislation, all lands withdrawn from Mineral Claims and Oil & Gas Leases, but no-surface occupancy Geothermal Claims are allowed in Special Management Areas and surface occupancy Geothermal Claims are allowed in the Transferral Area. (See the Monument legislation in the Plan.) Saleable Materials (cinders, hardrock, gravel, etc.) are not addressed by the legislation, but to be consistent with the legislative intent for no commercial sale of products from the Monument, the action alternatives (A, B, C, and C-Modified) would allow the use of Saleable Materials for Monument uses only. In addition due to low quality material and potential visual problems all existing pits and quarries within the Monument are considered closed unless opened by site-specific NEPA project analysis.

Effects on Other Ecosystem Components

Geology is the base of the ecosystem. The largest effect on other ecosystem components will probably result from constraints placed on various management activities to protect geologic resources.

Mitigation

All project areas will be professionally inventoried for geologic resources. Roads, trails, and facilities will be located so that construction activities avoid known significant geologic features.

During project planning, all projects within the Monument will be evaluated for their potential to add to our knowledge of the Monument's geology. All contracts for projects within the Monument should include a "stop work" clause if significant geologic features are encountered.

A strong educational program for the protection of geologic features would ensure the public's understanding of the importance of the Monument's geology. Location of unique geologic features will be kept confidential when needed to protect the features.

Assumptions

Currently known geologic resources within the NNVM are representative of the resource as a whole, but site-specific information is missing in many areas.

Projects that disturb geologic resources cause irreversible damage to non-renewable geologic resources. The amount and kind of damage to geologic resources is dependent on the level of land disturbance and the scale of the resource disturbed.

Some forms of recreation and public use of NNVM (e.g. hiking, fishing) are difficult to control and can contribute to geologic resource damage by collection and vandalism.

Soils

Direct and Indirect Effects

As a rating of soil sensitivity, the Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990) recognizes nine soil management limitation classes based on the Soil Resource Inventory (Larsen 1976):

1. Soil that will compact when moist;
2. Low productivity soils due to low annual rainfall;
3. High elevation cold soils with short growing season;
4. Cold air pockets in basins with radiation frost problems;
5. Slopes over 30 percent;
6. Soils that are stony or have exposed lava flow rock;
7. Soils that are unstable to wind and water erosion;
8. Areas with seasonal high water tables;
9. Shallow (less than 20 inches) soils over hard rock.

The fact that examples of all classes, except #2, can be found within the Monument, is indicative of the potential sensitivity of the soils within the Monument.

Vegetation management practices and to a lesser extent fish and wildlife habitat enhancement projects have the greatest potential to affect large areas of soil productivity. These impacts can be direct or indirect in nature, with long-term and irreversible effects. These effects can vary in intensity and severity depending on the amount of soil which has been compacted, displaced, eroded, or otherwise damaged. The level of impact will vary depending upon the extent of activity and the soil types, but any management activity which includes the use of heavy equipment has the potential of reducing soil productivity.

Land-disturbing projects such as construction of roads, trails, and other facilities have both direct and indirect effects on soil resources and are related to the amount of disturbance created by the construction activity. Direct impacts are generally confined to discrete areas where construction occurs and are long-term in nature. The main impact from construction of these facilities is to bury, remove, or compact the soil.

Additional effects on soil resources are related to the level of visitation to areas with facilities. These effects can include surface drainage problems from overuse and compaction, loss of fertile topsoil from dust, or accelerated erosion which reduces the revegetation potential.

Table 4 - 19

Potential for Effects to Soil Resources

ACTIVITY	A	B	C	C-Mod	D
Construction of new Roads	5	2	4	3	1
Construction of new Trails	5	2	3	4	1
Construction of new Facilities	5	2	4	3	1
Reconstruction of Campgrounds	2	2	2	2	1
Vegetation treatment - mechanical	2	5	4	3	1
Vegetation treatment - fire	2	3	5	4	1
Wildlife enhancement projects	2	5	4	3	1
Livestock Grazing	1	1	1	1	2
Scientific Research	2	3	5	4	1
Overuse (high use levels)	5	1	4	3	2

1 = lowest potential
5 = highest potential

Effects on other ecosystem components

Productive soil conditions have an important influence on other ecosystem components, especially the vegetation. In addition, water quality may be affected due to erosion of soils into nearby lakes or streams. Air quality may be impaired by windblown dust.

Mitigation

The design of vegetative management projects will consider the effects various methods will have on the soil resource.

Maintenance of erosion control structures on trails as well as the rehabilitation of damaged areas will help reduce the negative effects associated with recreational pursuits.

Assumptions

The greater the amount of ground-based activity allowed in an area, the greater will be the impact on long-term productivity.

8. Science and Research

Direct and Indirect Effects

Science and research projects have the potential for a wide range and level of effects dependent on the type and location of proposed research activities. The effects of geologic research could range from the removal of small rock samples for chemical testing to the construction of drilling pads for research drilling to understand the geology of the caldera. The effects of archaeologic research could range from minor surface site testing to a major evaluation impacting a large area. Biologic research could have effects ranging from the collection of small

numbers of biologic samples for study to the effects associated with the study of methods of reintroducing fire to the ecosystem. The end result of all research should be greater public understanding of the geology, archaeology, and ecology of the Monument through active interpretation of research results.

For the action alternatives, the potential level of science and research activities is lowest under Alternative A and highest under Alternative C.

Effects on Other Ecosystem Components

Any ecosystem component could be affected by scientific research depending on the type and location of proposed research projects.

Mitigation

All proposals for research will need specific evaluations for compatibility with Monument values. All research permits issued will include mitigation requirements to deal with their effects. Some of the evaluation criteria will include:

- Can this research only be done in the Monument?
- Proposed location of research project.
- Length of time research project will take.
- To what extent does the research project meet legislative intent?
- Potential for impacts (noise, dust, site damage, visibility, etc.)
- Potential for conflict with other users.
- Are the results of the research available to the Forest Service?
- Will the research support the Monument's themes, goals, values, and resources?
- How will results be made available to the public?
- Does the research aid in the public's understanding of the Monument's ecosystems and how natural processes work?
- Usefulness of information for management of the resource in the Monument.
- Does the research proposal include an effective monitoring plan?
- Does the research follow all of the applicable laws, regulations and policies?
- Written analysis should be finalized within two years after completion of field work.
- Criteria specific to archaeology/heritage resources:
  - Significance of cultural resource.
  - Presence or potential presence for Mazama or Pre-Mazama component.
  - Existing or potential disturbance to a significant cultural resource.
  - Research is guided by previous and current research designs and methodologies relevant to the specific research questions.
  - Resource protection.
  - The integrity of the cultural resource is maintained.
  - Evidence of consultation with local or "traditionally used" American Indians and documentation of any concerns should be included as a part of the proposal.
  - When applicable, research shall follow the Secretary of the Interior's Standards and Guidelines for Rehabilitation and other applicable standards.
  - Protects resource in lieu of a mitigation or treatment plan for that resource.

Assumptions

The identified research opportunities within the Newberry National Volcanic Monument are representative of a much larger spectrum of potential research opportunities.

9. Monitoring

Monitoring would be conducted in NNVM in all alternatives, in accordance with the NNVM legislation. The purpose and methods of monitoring would not differ significantly among alternatives. (See Monitoring program in the Monument Plan.)

10. Air Quality

Air quality in the area of the Monument is considered to be good. Frequent frontal passages, surface heating, and broken terrain all contribute to efficient air circulation. However, air masses occasionally stagnate during periods of temperature inversions, allowing air pollutants to accumulate. This occurs most commonly during late fall and early winter. Inversions rarely last more than a couple of days.

The main air pollutant of concern in Central Oregon, including NNVM, is particulate matter. Other important air pollutants affected by the different management alternatives for the Monument are carbon monoxide, nitrogen dioxide, and hydrocarbons.

Particulates are dispersed airborne solid and liquid particles that remain suspended in the atmosphere from a few seconds to several months. They constitute a health hazard to humans who breathe them. Particulates may also damage vegetation, harm animals that feed on vegetation covered with toxic particulate matter, and soil and corrode building materials and textiles (DEQ 1992). Moreover, particulates scatter light, thereby decreasing visibility. Very small particles can travel great distances and contribute to regional haze. Particulates come from a variety of sources, including wood stoves, wildfires, prescribed fires, motor vehicles, windblown dust and pollen, eruptions of volcanic ash, and industrial activities. Most of Central Oregon's particulates come from two sources: (1) wood smoke produced mainly by wildfires in summer and home heating in winter; and (2) windblown dust from various sources (P. Allen, DEQ personal communication 1993).

Almost all particles from wood smoke and other combustion processes are small--less than 10 microns in diameter. Much windblown dust is also this size. Such particles (called PM_{10}) are particularly hazardous because they are small enough to be inhaled and can remain in the lungs for years. Particulates may cause health problems in three ways: (1) The particles may be inherently toxic because of their chemical characteristics. (2) The particles may interfere with or damage mechanisms that normally clear the respiratory tract. (3) The particles carry other adsorbed toxic substances (DEQ 1992). PM_{10} appear to impact human health even at low concentrations (at least down to 10-15 micrograms per cubic meter or $\mu g/m^3$; Schwartz 1993, Schwartz et al. 1993). Medical studies have shown a correlation between increases in PM_{10} and the number of hospital admissions for respiratory infections, cardiac diseases, bronchitis, asthma, and emphysema. Human mortality also appears to rise during and immediately following periods of increased particulate concentration (e.g. Schwartz and Dockery 1992a & b, 1993); these effects are especially pronounced for elderly people and people afflicted with respiratory

diseases. Children, on the other hand, appear to be particularly at risk of decreased lung function and increased prevalence of respiratory disease due to exposure to PM_{10} (Schwartz et al. 1993).

Wood smoke contains other substances besides particulates. These include: carbon dioxide, water vapor, and hundreds of toxic chemicals such as carbon monoxide (CO), sulfur oxides, nitrogen oxides, ozone, lead, hydrocarbons, and aldehydes. Some of the toxic components--in particular polynuclear aromatic hydrocarbons--are known carcinogens. While these various constituents of wood smoke are fairly well known, their relative quantities vary considerably, depending on factors like fuel moisture and fire temperature. Firefighting personnel may be exposed to wood smoke in high enough concentrations to cause acute, short-term effects ranging from eye and throat irritation to coughing and shortness of breath. Heavy smoke can asphyxiate people.

Carbon monoxide (CO) is produced mainly by motor vehicles and wood smoke. It is a colorless, odorless gas, which, when inhaled, reduces the oxygen-carrying capacity of the blood and impairs the functions of oxygen-dependent tissues like the brain, heart, and muscle. CO can cause decreased mental capacity, increased incidence of heart disease, diminished athletic performance, and even death. Newborn and unborn children, as well as people with heart ailments or circulatory disorders, are especially sensitive to its effects (DEQ 1992).

Nitrogen dioxide (NO_2) is a reddish-brown gas emitted in Central Oregon primarily from motor vehicles. High levels of NO_2 are toxic to humans. This compound is important in the photo-chemical reactions that lead to formation of ozone, and it can combine with moisture in the air to form corrosive nitric acid. NO_2 has been linked to suppressed growth rates in some plants; however, at low concentrations it can act as a fertilizer. Few data are available on adverse effects to plant species in the Pacific Northwest. As a general guideline, ambient levels above .015 parts per million (ppm) (equivalent to .029 $\mu g/m^3$) have the potential to injure some kinds of plants (Peterson et al. 1992).

Volatile organic compounds (VOC) are a large family of chemicals composed mainly of hydrogen and carbon. As defined by the Oregon Department of Environmental Quality (DEQ), VOC include non-methane, non-ethane hydrocarbons and hydrocarbon derivatives. These compounds are generated by motor vehicles and other combustion (e.g. wood-burning) and by some high-tech industries. VOC are important contributors to ozone and smog. Some VOC (e.g. the hydrocarbon benzo-a-pyrene) are known carcinogens, but there are no federal or state standards for them (DEQ 1992).

The Clean Air Act and its amendments define responsibility for air quality. In an attempt to protect human health and welfare from common pollutants that have been shown to be harmful, the U. S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for PM_{10}, CO, NO_2, sulfur dioxide (SO_2), ozone and lead. Individual states must set standards at least as stringent as the national ones. Oregon's air quality standards for these pollutants are identical to NAAQS except for sulfur dioxide, in which case state standards are stricter. States also must develop Implementation Plans and set standards for the Prevention of Significant Deterioration (PSD) to air quality. The latter limit emissions from new or modified sources, such that pollutant concentrations do not exceed allowable increases over baseline concentrations. Oregon has established PSD increments for total suspended particulates, SO_2 and NO_2 (OAR, Ch. 340, Div. 31). Applicable air quality standards will not be exceeded under any of the management alternatives.

Direct and Indirect Effects

The management alternatives would influence air quality in NNVM mainly by affecting two types of emissions: wood smoke and motor-vehicle exhaust. In all of the alternatives, as well as in the current situation, wood smoke is produced in the Monument by wildfires, prescribed fires, campfires, and woodstoves. Effects from the latter two sources and from motor-vehicle exhaust are important only locally, inside Newberry caldera.

PM_{10} from Wildfire and Prescribed Fire

Table 4-20 shows the expected maximum annual PM_{10} production in the Monument from prescribed fire and wildfire, calculated for each alternative. In the first decade after the Monument Plan is enacted, emissions from prescribed fire would be highest in Alternative C, next highest in B, lower in A and C-Modified, and lowest in D. However, prescribed fire emissions would be more than offset by the PM_{10} expected from wildfire in every alternative. Under current conditions in the Monument, wildfires can be expected to produce an average maximum of 310-620 tons of PM_{10} annually. In the short term, wildfires would generate an average of 50-70% less PM_{10} annually in Alternative C and 17% less in Alternative B. Wildfire hazard in Alternatives A, C-Modified, and D would remain about the same as today. The combined effects of prescribed fire and wildfire would cause overall annual PM_{10} emissions to increase slightly in Alternatives A and C-Modified, remain about the same in D, decrease slightly in B, and decrease substantially in C.

Table 4 - 20

Projected Yearly PM_{10} [1/] Emissions from Forest-fire Smoke

Alternative	Prescribed Fire [2/]	Wildfire		Total	
	Tons	Tons	Change from Present	Tons	Change from Present
Short-term Outlook (first 10 years)					
D No Action	<2	400-790	none	400-790	none
A	26	400-790	none	420-820	up 3-7%
B	50	330-660	down 17%	380-710	down 4-10%
C-Modified	22	400-790	none	420-810	up 3-6%
C	78	200-260	down 50-70%	270-340	down 30-60%
Long-term Outlook [3/]					
D No Action	<2	460-920	up 17%	460-920	up 17%
A	17	330-660	down 17%	350-680	down 12-14%
B	47	200-260	down 50-70%	240-310	down 40-60%
C-Modified	47	200-260	down 50-70%	240-310	down 40-60%
C	103	130	down 70-80%	230	down 40-70%

1/ PM_{10} refers to fine particulate matter, less than 10 microns in diameter.
2/ Currently, prescribed fire in the Monument contributes negligible amounts of PM_{10}.
3/ After 60 - 120 years for prescribed fire; after 30 - 80 years for wildfire.

Over the long term, the alternatives offer an even wider range of total PM_{10} emissions (Table 4-20). Emissions from prescribed burning would not change greatly through the years. However, the likelihood of large wildfires would continue to increase in Alternative D, which does little or nothing to manage the continued build-up of fuel materials on the forest floor resulting from fire suppression. All of the action alternatives (A, B, C, and C-Modified) would reduce the number of acres burned annually by wildfire. Alternative C would provide the most dramatic reduction--down to 20-30% of current expected current levels--due to its relatively aggressive fuels-reduction program by prescribed fire. Expected wildfire emissions would be 30-50% of today's in Alternatives B and C-Modified, and about 83% of today's in A. Thus, in the long run, total smoke emissions in the Monument would be highest under Alternative D and lowest under B, C, and C-Modified. In other words, the No-Action alternative would

produce the most PM_{10} and would have the greatest detrimental effect on regional and statewide air quality. Likely impacts in Central Oregon include more common impairment of visual quality and greater risk of long-term effects to humans, animals, vegetation, and property (described above). Alternatives B, C, and C-Modified would produce the least PM_{10} and make the smallest contributions to air pollution.

In all alternatives, emissions from wildfire would have more prominent effects than those from prescribed fire. Wildfire would contribute at least half of the total forest-fire smoke in all alternatives. Unlike prescribed fires, wildfires occur under uncontrolled conditions when winds may carry smoke into sensitive areas. Locations that could be affected by wildfire smoke include, but are not limited to: nearby population centers and subdivisions in Bend, La Pine, and Sunriver; U.S. Highways 97 and 20, and State Highway 31; the Pine Mountain Astronomical Observatory east of the Monument; and the Three Sisters Wilderness Class I airshed to the west. Larger fire crews are also needed to fight wildfires than to conduct prescribed fires--and wildfires are more likely to subject these people to heavy smoke. In addition, large wildfires occur during the summer, when the potential for exposing large numbers of outdoor recreationists to smoke is highest.

Wood smoke and motor-vehicle emissions within Newberry caldera

Air quality within Newberry caldera is an issue of concern because the caldera tends to trap pollutants during stable air conditions. The caldera is an essentially circular topographic depression, with an average diameter of four and a half miles. The height of the caldera rim ranges from 1650 feet above the surface of Paulina Lake at Paulina Peak, to zero feet above lake level at its outlet to Paulina Creek. The average rim height is about 760 feet above the lakes.

The caldera is a focal point for recreation in the Monument. It accounts for most or all of the overnight camping, and all of the resort and motorized-boat use in the Monument in all of the alternatives. It also draws and accommodates a large number of automobiles in the summer season. Significant sources of air pollutants in Newberry caldera in the spring, summer, and fall are campfires, woodstoves, automobiles, and motorized boats. Emissions are much lower in the winter, when access is limited to over-the-snow vehicles.

In this analysis, we use a simple box model of the caldera's air mass and consider peak summertime emissions and potential accumulation of PM_{10}, CO and volatile organic compounds (VOC) from wood smoke and motor vehicles, and NO_2 from motor vehicles. Pollutant production is calculated based on projections for the maximum number of campsites, allowable resort expansions, and automobile and motorized-boat use expected and/or accommodated under each alternative. Thermal inversion periods that may hold an air mass within the caldera are common during the cold summer nights and occasionally last one or two days. For a worst-case scenario, we consider projected growth in visitation, maximum physical capacity and use of developed sites, maximum expected emissions per vehicle, and five consecutive days of stagnant air. This combination of conditions is not anticipated to occur, but it gives us an upper bound for air-quality impacts. Background levels of pollutants are estimated from other, similar locations and added to the calculated pollutant production within the caldera (see Assumptions below).

Maximum potential PM_{10}, CO, and NO_2 accumulations at the end of the longest typical (2-day) and worst-case (5-day) thermal inversions are shown in Table 4-21. (Figures for the alternatives are estimated for the year 2004. The current potential is shown for comparison.) In both the typical and worst-case scenarios, the caldera's air would have the highest pollutant concentrations under Alternative A. For PM_{10}, Alternative D would have the next-highest

levels, C and C-Modified would be lower, and B would be the lowest. CO and VOC levels would be highest in Alternative A, lower in C, C-Modified and D, and lowest in B. (Note that VOC levels considered here represent only the potential impacts of smoke and motor-vehicle exhaust, as no background value was available. VOC are also produced naturally by transpiration of vegetation. In the caldera, the most important contributor of VOC to the atmosphere in any alternative would be the tree canopy.) NO_2 levels would be highest in A, C and C-Modified, lower in D and lowest in B. We can conclude that overall impacts from air pollution in the caldera would tend to be highest in Alternative A and lowest in B, with C, C-Modified and D falling in between these extremes.

Table 4 - 21

Maximum Air Pollutant Concentrations in Newberry Caldera

	Typical (2-day) Inversion				Worst-Case Inversion			
	PM_{10} ($\mu g/m^3$)	CO (ppm)	NO_2 ($\mu g/m^3$)	VOC[1/] ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	CO (ppm)	NO_2 ($\mu g/m^3$)	VOC[1/] ($\mu g/m^3$)
Current (1992)	25	.35	8.8	59	63	2.1	38	620
Alt. A	31	.39	10.0	75	82	2.5	42	810
Alt. B	23	.32	8.4	64	56	1.7	29	570
Alt. C	27	.36	10.0	70	68	2.1	36	690
Alt. C-Modified	27	.36	10.0	70	68	2.1	36	690
Alt. D	29	.38	9.8	70	77	2.1	35	650

Ambient Air Quality Standards for PM_{10} are 150 $\mu g/m^3$ (24-hour average) and 50 $\mu g/m^3$ (annual arithmetic mean); for CO, 35 ppm (1-hour average) and 9 ppm (8-hour average); for NO_2, 100 $\mu g/m^3$ (annual arithmetic mean); no standard for VOC.

1/ No estimate of background is available for VOC; background excluded.

Applicable ambient air quality standards would not be exceeded in any alternative. Annual average concentrations of all air pollutants would be well below the values shown for a typical inversion, because inversions lasting a day or two are estimated to account for less than a couple of weeks (i.e. 4%) of each year. During the other 351± days a year, air circulation is good (allowing pollutants to disperse outside the caldera) and/or visitorship and polluting activities are minimal due to snow (typically late November through mid-May).

PSD (Prevention of Significant Deterioration) increments would not be violated in Newberry caldera. For both total particulates (including PM_{10}) and NO_2, the pollutant levels given for 1992 in Table 4-21 can be used as approximate baseline values. (This is justified because Forest Service records show that camping and day visits to the caldera in 1992 did not exceed those in 1978 or 1988--defined as baseline years for these pollutants by the State of Oregon Department of Environmental Quality.) The difference in the typical-inversion pollutant concentrations between Alternative A (the most polluting alternative) and current (1992) is 6 $\mu g/m^3$ for PM_{10} and .008 ppm for NO_2. These are well below the allowable increases (19 $\mu g/m^3$ and .013 ppm, respectively) for annual average concentrations. The difference between A and 1992 is higher in the worst case (18 $\mu g/m^3$), but still far below the allowable 37 $\mu g/m^3$ for a 24-hour average.

In any of the alternatives, the worst-case pollutant levels in Table 4-21 could cause some adverse effects to ecosystem health, including humans. It is extremely unlikely that the worst-case scenario would occur, because this would require worst-case meteorological conditions and maximum capacity of the caldera's facilities to be realized simultaneously. Nevertheless, we could (and would) limit air-polluting activities in the caldera if necessary (see Mitigation below).

Dust

Dust from the pumice soils in the NNVM area is a source of airborne particulate matter. Many of these particles are larger than PM_{10}, so they settle relatively quickly and do not have as significant effects on human health or visibility as smoke. Most of the airborne dust in the Monument is caused by motor-vehicle traffic on unhardened roads. Winds blowing through unvegetated areas are another important source. Road construction and maintenance operations (e.g. rock crushing) are also contributors. All of these are fairly local phenomena and of short duration.

In Alternatives A, B, C, and C-Modified, the number of miles of gravel, cindered, and native-surface roads open to automobiles in the Monument is expected to decrease by about 50% from present (see Roads and Non-Recreation Facilities in this chapter). The existing 80 miles of these roads would remain open in Alternative D. Alternative A would also allow for all-terrain vehicle (ATV) access on two designated trails: one across the Transition Zone and one to East Lake from the southeastern edge of the Caldera Zone. Alternatives B, C, and C-Modified would prohibit ATV traffic everywhere in the Monument, except for street-legal vehicles on Forest roads. Alternative D would continue to allow incidental ATV use (on and off trails) everywhere except inside the caldera. We can conclude that Alternatives B and C would provide the fewest locations for potential dust emissions from motorized vehicles. Alternative A would provide more, and Alternative D would provide by far the most.

The **frequency** of dust emissions from roads will depend on the number and speed of the vehicles and is difficult to assess. The most significant expected increase in road dust from the current condition would result from the gravel scenic loop road projected to be established eventually in the Lava Butte and Transition Zones in Alternatives C and C-Modified. Short-term dust emissions from road construction would be highest in A and C, during development of the Monument Scenic Drive and the scenic loop road, respectively. These emissions would be somewhat lower in C-Modified, where the scenic loop would be developed completely from existing road segments, with no new road construction. Emissions from ground disturbances during road maintenance would not vary significantly among the alternatives.

Differences among the alternatives in windblown dust emissions from unvegetated areas would correlate with differences in the number of acres burned annually (see Fire and Fuels section). Wildfire would have the most pronounced impacts, since it tends to burn hotter, killing

more vegetation and exposing the soil more completely. Expected emissions from this type of windblown dust in the next ten years would be lowest in C, next lowest in B, and highest in A, C-Modified, and D. In the long-run (after 30-60 years), these emissions would tend to be lowest in Alternative C, a bit higher in B and C-Modified, higher in A, and highest in D.

Overall, we can conclude that dust emissions in NNVM would probably be relatively low in Alternative B, higher in A, and still higher in D. The impact of the scenic loop roads in Alternatives C and C-Modified on dust is uncertain, but effects on air quality would be mitigated if necessary (see Mitigation below).

Effects on other Ecosystem Components

Air quality can affect water quality when airborne particles settle out onto a water surface. Particulates may also deposit onto rocks, soil, or vegetation and later get washed into a nearby body of water or permeate into groundwater. Depending on their chemical properties, these particulates may be toxic to fish or other aquatic life. For further discussion, see sections on Water Quality and Fish in this chapter.

Air quality may also have impacts on the quality of visitors' recreation experiences in the Monument (e.g. due to odor or effects on health) and the health of vegetation (see introduction to Air Quality). If air quality impairs visibility, the scenic quality is also degraded temporarily (see section on Scenic Quality for more discussion).

Mitigation

All prescribed burning will be done in accordance with the Oregon Smoke Management Plan to protect visibility, prevent smoke from intruding into designated sensitive areas (e.g. Bend), and meet all federal, state, and local air-quality standards and regulations. (See Fire and Fuels section.)

If particulates, CO, NO_2, or other pollutant levels prove to be unacceptable for visitors' health, safety, or enjoyment, or for protecting other resource values, we would implement restrictions on campfires, woodstoves, and motorized vehicles, as needed, in the caldera. With an effective meteorological monitoring program in place (See Plan), conditions conducive to air stagnation could be predicted and mitigated in advance.

If dust emissions from vehicle traffic become excessive, we will use Best Available Control Technologies (BACT) to correct the problem. For example, if visitors complain of reduced visibility or degradation of scenic quality due to road dust, we can reduce emissions by surfacing dirt roads with gravel or stabilizing gravel roads with lignon sulphonate. Roads can be chip-sealed or paved, if necessary.

Assumptions

For wildfire and prescribed fire:

In all alternatives, all available fire-suppression forces will be deployed to fight wildfires. Forces are assumed to be maintained at current levels. Total PM_{10} emissions were calculated according to the simple method described by Peterson (1993). See Tables 4-12 and 4-13 in Fire and Fuels for the maximum acreages predicted to be lost each year to wildfire and the number of acres to be burned annually by prescribed fire. Prescribed fire fuel loadings were assumed 10-40 tons/acre, depending on the amount likely to be utilized before burning. These fires were assumed to consume 100% of jackpot and piled fuels, 63-70% of fuels in ponderosa pine stands, and 53% of fuels in lodgepole pine. Emission factors used were 19 lb. PM_{10} per ton of fuels

for jackpot and piled burns and 25 lb./ton for broadcast (e.g. underburn) operations (Peterson 1993). For wildfire, fuel loadings were assumed to be 40 tons/acre. All fuels and a small proportion of live trees were assumed to be consumed, with a fire-average emission factor of 25 lb. PM_{10} per ton of material (Ibid.).

For wood smoke and motor vehicle emissions in Newberry caldera:

In both the 2-day and 5-day thermal inversions, 20% of the pollutants produced inside the caldera were assumed to leak out during the inversion period. Background levels of pollutants were then added to the 80% of the pollutants remaining.

Background concentrations of PM_{10} were taken from the Crater Lake area (9.5 $\mu g/m^3$); background CO and NO_2 were assumed typical for the western U.S. (.1 ppm and 1.9 $\mu g/m^3$, respectively) (SAIC 1993). No background VOC were available, so no background was added to the figures shown in Table 4-21. It is expected that background levels would greatly exceed all calculated VOC input from human activities.

For wood smoke, we assumed: Maximum number of overnight units (campsites, resort cabins) projected in each alternative; a fire in every campsite (worst case) and in 75% of campsites ("typical") each night; a fire in every resort cabin's woodstove every night; 30 lb. wood burned in each fire over a 24-hour period; emission factors for campfires of 19 lb. PM_{10} and 169 lb. CO/ton wood (Peterson 1993) and 11.6 lb VOC/ton wood (Hardy and Wood 1993), and for woodstoves 49.6 lb. PM_{10}/ton wood (USDA Forest Service 1991) and 385 lb. CO and 13.0 lb. VOC/ton wood (Ward 1993).

For motorized boats, we used: Average horsepower of 11; average three hours/day engine use (typical) and 6 hours/day (worst case); emission factors: .10 grams PM_{10}, 39.45 grams CO, .32 grams NO_2, and 16 grams VOC per horsepower-hour (EPA 1991); for typical inversion, 225 boats per day in caldera currently on a busy weekend (Oregon State Marine Board 1993b) with increases proportional to projected increase in lakeside day-use and boat-launch facilities; for worst case, number of boats per day equal to maximum capacity for motor vehicles at lakeside day-use areas and one boat per campsite in general-use lakeside drive-in campgrounds.

For on-road vehicles, we used: Worst-case number of vehicles equal to one per day-use parking spot and 1.43 vehicles per overnight parking spot; typical busy weekend vehicles equal to 75% of current worst case, then projected to the year 2004 based on anticipated annual growth rate (4.6%/year) and maximum expected capacity; daily miles driven = 6 at 30 mph, .5 (typical) and 1 (worst case) at 25 mph, 1 (typical) and 1.7 (worst case) at 4 mph; emission factors for 1992: .136 grams PM_{10}/mile (EPA 1993), 30.97-184.04 grams CO/mile, 2.88-4.09 grams NO_2/mile, 1.87-14.72 grams VOC/mile (DEQ 1993 MOBIL.5 computer model); emission factor for the year 2000 (2004 unavailable): .134 grams PM_{10}/mile (EPA 1993); emission factors for 2004: 17.13-90.58 grams CO/mile, 2.14-3.03 grams NO_2/mile, 1.81-14.72 grams VOC/mile (DEQ 1993 MOBIL.5 computer model).

11. Water Quality

Direct and Indirect Effects

Sediment and turbidity

Soil compaction and destruction of riparian vegetation can have important impacts on surface water quality. Alternatives A and D would be most likely to cause short-duration increases in

management-associated sediment and turbidity from construction activities near lakes, campgrounds, day-use facilities, and along roads. These alternatives would include construction of the most campsites in the caldera near East and Paulina Lakes. Alternative A would also allow for construction of a Monument Road, which would require a bridge crossing of Paulina Creek. Construction activities and resulting impacts to nearby water would be lower in Alternatives C and C-Modified, and lowest in B.

The greater the amount of recreational use near water, the greater the ground disturbance, potential for soil movement, and therefore sedimentation, erosion, and turbidity of the adjacent water bodies. Alternative A would accommodate and encourage the highest levels of recreational use along shorelines, such as on trails and in campgrounds, resorts, and day-use areas (including boat-launching facilities). This alternative would also allow construction of a new trail along the Deschutes River in the Lava Butte Zone. Expected changes in the level of activity at the edge of East and Paulina Lakes and the Deschutes River in NNVM (Table 4-22) were calculated based on the projected maximum number of recreation-use hours that could occur in adjacent campgrounds, resorts, and day-use areas. Alternatives C, C-Modified, and D would accommodate less recreational use than A near shorelines. Alternative B would have the least, so turbidity and sedimentation would be the least. Effects of turbidity include decreased scenic values and harmful effects to fish (See sections on Fish and Scenery in this chapter.)

Table 4-22

Projected Change in Maximum Level of Use for Developed Sites Near Water*

ALTERNATIVE	A	B	C	C-Mod	D
East & Paulina Lakes	+31%	-10%	+ 9%	+ 9%	+19%
Deschutes River	+212%	+ 0%	+110%	+110%	+ 0%

* Based on the maximum number of Recreational Visitor Days (equal to 12 hours of use) possible if sites are full. Differences among alternatives are somewhat exaggerated, because the numbers do not account for potential overcrowding of sites beyond their designed capacity. Overcrowding would occur more commonly where site capacities are smallest, such as in Alternative B at East and Paulina lakes and in B and D at the river.

Wildfire may affect water quality by increasing sedimentation and mass soil movement through destruction of vegetation and exposure of mineral soil to increased run-off. When ash is flushed into streams or lakes, it may alter the concentration of some chemical elements, but this effect on water quality is not well understood. The loss of vegetation due to fire in riparian areas exposes the water to increased solar radiation, which directly affects water temperature (see section on Fish). Fire suppression measures can also degrade water quality. Based on expected annual loss of vegetation to wildfire in each alternative, we can expect the likelihood of these impacts to water quality in the next decade to be highest in Alternatives A, C-Modified, and D, and lowest in C. In the long term, effects to water quality would be highest in Alternative D, followed by A, B, C-Modified, and C, in that order. Prescribed burning and

other vegetation management practices also have the potential to affect the water resource, but these activities would not be conducted near enough to water bodies to have significant effects in any alternative.

Toxic Materials

Contamination of soils and water by petroleum products is expected in areas where motor vehicles are concentrated. Areas such as campgrounds and boat-launch facilities are likely to experience inadvertent spills of petroleum products from automobiles and motorized boats. These materials move rapidly through porous pumice or rocky soils in the Monument and may contaminate surface and ground water. Some spills may occur directly to surface water, such as Paulina Lake or East Lake. Petroleum products also have the potential to contaminate well water used for drinking.

The actual amount of such contamination is highly variable, and some amount of petroleum contamination would be likely to occur in all alternatives. The risk of oil, diesel, or gasoline spills would be related to the amount of recreational use near water and would be highest in Alternative A, next-highest in C, C-Modified and D, and lowest in B. In Alternatives C and C-Modified, spills would be more likely to affect Paulina Lake than East Lake, due to the differential development of the two lakes.

Another means of water contamination is by deposition of particulate matter. For example, exhaust from automobiles, motorized boats, and snowmobiles contains sulfate and sulfur dioxide, which could cause some acidification of the lakes if deposited in very large quantities. Significant impacts from deposition are not expected in any of the alternatives. However, based on the relative amounts of anticipated motor-vehicle exhaust and wood smoke, any effects would be most likely in Alternative A, less likely in C, C-Modified, and D, and least likely in B.

Disease organisms

Drinking water for public use in the Monument comes from wells. The likelihood of contamination of this water from human or animal waste is low in all alternatives. However, alternatives with the most people would create the highest strain on wastewater disposal (septic) systems and therefore have the highest potential for contaminating water in nearby wells. This would be most likely in the caldera where ground water is shallow. Lake water and Paulina Creek could also be affected, decreasing water clarity (see Water Quality, Chapter 3).

Drinking contaminated water could result in a high incidence of bacterial and intestinal diseases to visitors. Based on the expected stress to septic systems by heavy use, the risk of intestinal disease would be highest in Alternative A, lower in C and C-Modified, and lowest in B and D.

Another important risk factor for bacteria in drinking water is the condition of the water system. Obsolete systems, such as the one serving Paulina Lake campground and day-use areas, are particularly prone to high bacterial levels. If not replaced, this system would affect the highest number of Monument visitors in Alternative A, fewer in C and C-Modified, and fewest in B and D.

Effects on other ecosystem components

The quality of recreational experiences, including fishing, can be affected by water quality. Petroleum products in surface water would have harmful effects to aquatic life, fish, birds, and other wildlife (see Fish and Wildlife section). Scenic quality could also be degraded, due to visible material on the water surface.

Mitigation

Septic systems will be investigated to detect failures early. Ground water flow patterns can be studied to identify possible seepage of sewage into the lakes. If necessary, a sewer system can be developed to pump waste to drain fields outside the caldera.

The drinking water storage tank at Paulina Guard Station can be replaced. Monthly tests for bacterial contamination of wells will continue. Wells will be closed if contamination is detected, and water will be trucked into the location of a bad well to maintain a constant water supply for visitors.

If motor-vehicle exhaust or wood smoke is found to be unacceptably affecting water quality, use can be regulated and reduced to correct the problem.

Assumptions

This analysis assumed that variability of the flow in the Deschutes River would remain as it is now. If we returned to a more natural flow regime, ponds would end up smaller than they were before regulation and manipulation of the flows (1940's), because the water level would be lower during spring and summer.

12. Scenery

The 1990 Monument legislation states that one of the purposes of the Monument is to provide for the conservation, protection, interpretation and enhancement of its scenic resources (Public Law 101-522).

Scenery is affected by different resource management issues and concerns. Vegetation and recreation are the predominant resources affecting scenery; however, other issues are significant. This chapter discusses the effects of the alternatives on scenery starting with the effects from vegetation management, then recreation, followed by a summary of the effects from other resources. (See also Visual Quality Objectives, in the Monument Plan.)

Direct & Indirect Effects

Vegetation Effects on Scenery

Vegetation management strategies affect scenery by changing the landscape character and the scenic condition of a place (terminology pertaining to these discussions is described in the glossary, scenery, and the Scenery Standards and Guidelines section of the plan). This section discusses the effects in the short term (0-10 years), long term (50 years), and by total area affected (beyond 50 years). A description of the management direction for the desired landscape character (by "managed" vegetation type) according to the 1990 Forest Plan can be found in Chapter 3 and can be used as a basis for comparison. Additional information is summarized on Tables 4-23, 24, & 25. These three tables describe the key elements of the different landscape character types identified in the alternatives and how much of each would evolve. (For the purposes of the tables, these terms have the following meanings; Historic= Pre-fire suppression, Ecologic= Emphasizing wildlife habitat enhancement, Unmanaged= No activity except fire suppression).

Ponderosa Pine Landscape Character

(Includes ponderosa pine, mixed pine, and pine/fir communities). NOTE: Some general effects pertaining to fire are discussed in this section, in addition, there is a subsequent discussion specific to the effects of Fire on scenery.

Landscape character change is expected to take a long time before it is noticeable to a significant degree. All of the action alternatives have strategies that begin to move the pine towards old-growth ponderosa pine communities. The alternatives vary in the type and qualities of old-growth pine communities they would be re-establishing; "historic" old growth, refers to very open, park-like stands of large yellow barked pines, and, "ecologic" old growth refers to multiple storied stands of pine with large yellow barked pines interspersed with the other vegetation and woody debris.

The short term effects of the alternatives vary in the amount of acres and the type of treatment that would occur in ponderosa pine areas. All action alternatives intend for existing large old pines to be protected. In many of these areas the existing large pines are expected to become more visible. In some areas they would become highlighted, and more healthy, as a result of removing some of the vegetation from their immediate surroundings and lessening their competition. This is likely to be one of the most obvious character changes in the short term, and it would occur in all action alternatives.

Another character change in the short term would be relative to the density and composition of the pine forests. Treatments to restore "historic" old growth would result in less dense stands and the trees would appear to be medium-sized and relatively even-aged. Total areas treated in 10 years is assumed to be: Alternative C = 2500 acres, B & A = 1000 acres, C-Modified = 490 acres, and D = none. Treatments to restore "ecologic" old growth would result in less dense forests that would appear to be medium-sized trees with young pines, downed wood and shrubby understory vegetation. (Totals in 10 years: Alternative C = 1500 acres, C-Modified = 25 acres, D, B & A = none) (NOTE: The amount of treatment analyzed in these effects assumes the rates of vegetation management discussed in the DEIS for Alternatives A, B, and C. Some of these rates of treatment were found to be likely to EXCEED the Scenery management standards for the alternative and therefore would not be implementable without adjustment. Alternative C-Modified was developed, in part, in order to address these concerns and suggest rates of treatment (assumptions) that are consistent with meeting scenery standards. A complete discussion of these rates and the effects of the rates is found under Scenic Condition, following this character analysis.)

In the long term, ponderosa pine forests would begin to take on more, "older" characteristics. Some of the areas would have trees beginning to look quite large (much of the pine is approximately 50 years old now and would have 100 year old characteristics by then; however, in an additional 40-50 years the old-growth characteristics will be much more evident). Areas treated to restore "historic" old-growth would have a more open character with relatively even-aged medium sized to large trees and little understory. Total areas treated in the long term are assumed to be: Alternative C = 8000 acres, C-Modified = 3240 acres, B & A = 1000 acres, D = none. Areas treated to restore "ecologic" old growth would appear multiple-storied with many vertical layers and large pine trunks interspersed and often highlighted. (Totals in long term: Alternative B = 6000 acres, C-Modified = 520 acres, D, C & A = none).

In both the short term and the long term, fire will become a more visible component of the ponderosa pine forest (and the Monument landscape in general). Prescribed fires and their visual effects (such as burned grasses, ground debris, shrubs, charred tree trunks, and orange needles) will be visible along roads, trails, and in the distance.

Table 4-23

Landscape Character Type (Ponderosa Pine)

Key Features of Ponderosa Pine Character Types				Assumed % Treatment by Alternative					
Ponderosa pine and ponderosa pine/mixed communities (10,000 acres)	Structural & Visual Diversity	Forest Floor	Viewed at a Distance (Canopy)		A	B	C	C-Mod	D
"Historic" Ponderosa Pine	Forest appears open with park-like qualities. Stands have an even-aged character with large orange-trunked pines as the dominant structural component.	Few shrubs and small trees. Minimal large dead woody material. It is possible to see for long distances through the woods. Young pine in sunny openings.	Even textured, regular. Individual trees may be distinguished. Some openings between trees, and some larger pockets are created where trees have fallen.	Short term (0-10 years)	10%	10%	25%	3%	0%
				Long term (50 years)	10%	10%	80%	32%	0%
				Total area treated	10%	10%	80%	32%	0%
"Ecologic" Ponderosa Pine	Uneven-aged qualities. Visually diverse, includes vertical layer of vegetation with different colors and textures. Large orange-trunked pines often evident or highlighted.	Vegetation is comprised of many vertical layers. Downed woody material is typically present. Young pines present in sunny openings. Typically it is possible to view a short to moderate distance through the forest.	Some areas appear similar to "historic" ponderosa pine but more dense and not as even textured. Ponderosa pines are often mixed with fir and other pines. Forest appears dense and texturally diverse.	Short term (0-10 years)	0%	15%	0%	1%	0%
				Long term (50 years)	0%	60%	0%	5%	0%
				Total area treated	0%	60%	0%	5%	0%
Untreated (except for fire suppression) Ponderosa Pine	Uneven-aged qualities, growing in clusters. Dense and thickly vegetated with diverse colors, textures, and forms. Some areas would appear even-aged in the short term due to past management activities.	Thick understory vegetation forms many vertical layers. Some openings where trees have fallen. Young pines typical in sunny openings. Typically it is possible to view a short distance through the forest.	Moderate visual diversity, appears as a mass and not as individual trees. The canopy is textured and made up of multiple layers, with small open areas throughout the forest.	Short term (0-10 years)	90%	75%	75%	96%	0%
				Long term (50 years)	90%	30%	20%	63%	0%
				Total area treated	90%	30%	20%	63%	100%

The scenery will evolve in areas that are not treated. Although the actual patterns and changes will be somewhat random and relative to disturbance cycles, some successional estimates of change can be anticipated. In the short term, areas that have mostly even-aged (approximately 50 year old) trees today would stay dense in their character, and their health and appearance would not change too dramatically; however, some areas could begin to decline as they become stressed by limited nutrients and they could appear unhealthy (some appear unhealthy now). By the long term the structure of these areas will be changing, and as some of the stressed trees die and fall to the forest floor, openings in the canopy will occur. Young pines would begin to grow in these sunny openings. Large areas of dead trees could be evident, and some trees will be growing larger.

Some of the areas where the ponderosa and lodgepole pine are mixed together currently look like two-storied forests; lodgepole pine forms a dense understory and large ponderosa pine form the upper canopy. In untreated areas in the short term the lodgepole will become taller and continue to be dense. Large ponderosa pine trunks will become less visible. In the long term disturbance cycles would be expected to have caused or be currently causing decline or death in the lodgepole (it is a relatively short lived species compared with the ponderosa). Young pines (lodgepole and/or ponderosa) would likely be growing in new openings and there could be a great deal of dead trees on the forest floor. Untreated areas in the short term: Alternative C-Modified = 9510, A = 9000 acres, B & C = 7500 acres. Untreated areas in the long term: Alternative A = 9000 acres, C-Modified = 6760 acres, B = 3000 acres, C = 2000 acres, D = all). (See Table 4-23.)

Lodgepole Pine Landscape Character

In the lodgepole pine, Alternatives A, B, and C all have strategies that begin to move the lodgepole towards a mosaic character using two basic methods. One approach is using mechanical treatments which (designed to be consistent with partial retention (PR) and retention (R) visual quality objectives [VQR]) would result in a small grain mosaic-like canopy. Small openings would be created which from a distance, would appear as a textural change in the forest canopy. The canopy would appear less dense and less grey. If any projects, were designed to exceed the minimum standards for partial retention (such as creating large, obvious openings) the result could appear unacceptable with a decrease in scenic quality. In the short term mechanical treatments would occur over 4% of the lodgepole in Alternative C, 3% in A and B, and none in D; in the long term it would occur over 21% in Alternative C, 13% in Alternatives A and B and none in D; the potential amount affected overall would be 30% in Alternatives C and B, and 15% in A. C-Modified is discussed separately below.

The other methods used in the lodgepole pine in Alternatives A, B, and C include combinations of fire and mechanical treatments. These would create openings (0 - 50 acres) throughout what is currently a relatively continuous canopy of a mixture of green and grey trees. These openings would be obvious and dominant and would be designed to reflect natural fire patterns. The result would be a patchy mosaic of openings in the forest canopy. In the short term this would occur over 8% of the lodgepole in Alternative C, 3% in B, 2% in A, and none in D; in the long term it would occur over 38% in Alternative C, 17% in B, 9% in A, and none in D.

Untreated areas will continue to evolve in character. In the short term, areas of dead standing lodgepole pine would begin to fall and create a mosaic of openings in the forest canopy. Openings would also occur as a result of wildfires (these would occur in treated areas as well). In Alternative D untreated areas would include 100% of the lodgepole area, 96% in C-Modified,

Table 4-24

Landscape Character Type (Lodgepole Pine)

Key Features of Lodgepole Pine Character Types				Assumed % Treatment by Alternative					
Lodgepole pine communities (23,000 acres)	**Structural & Visual Diversity**	**Forest Floor**	**Viewed at a Distance (Canopy)**		**A**	**B**	**C**	**C-Mod**	**D**
Treated Lodgepole Pine (treated primarily with prescribed fire)	Even-aged within stands, with various size and age classes between stands. Forest often appears impenetrable. Some snags are evident. Tree trunks are thin and close together. Some areas are open. Large trees are not typical (greater than 6-8" diameter). Large patches of standing or fallen dead, burned trees are visible.	Little understory vegetation. Shrubs and grasses are evident in areas where there are openings. Burned areas could have a lot of fallen trees on the ground.	Large fire patches are visible forming a large scale mosaic pattern.	Short term (0-10 years)	2%	3%	8%	1%	0%
				Long term (50 years)	9%	17%	38%	8%	0%
				Total area treated	10%	40%	55%	55%	0%
Lodgepole Pine (treated primarily with mechanical methods)	Even and uneven-aged qualities. Younger trees of non-fire resistant species are present and add structural diversity. Larger trees (relate to prescribed fire area).	More snags are visible and there is understory vegetation. Patchy appearance with larger trees in some areas.	Small openings may be visible; however, the canopy has a relatively uniform texture. Red or grey patches of trees may be visible and/or larger openings due to wildfire or insects.	Short term (0-10 years)	3%	3%	4%	3%	0%
				Long term (50 years)	13%	13%	21%	6%	0%
				Total area treated	15%	30%	30%	15%	0%
Untreated Lodgepole Pine	Stands appear dense and impenetrable and have an even-aged character. Some smaller even-aged stands, openings, and clusters of dead trees are evident. Large trees (greater than 6-8" diameter) are not typical.	Little understory vegetation. Shrubs or grasses are evident in open areas.	Forest appears as a large scale mosaic of lodgepole pine stands. Mosaic is coarse, and openings due to wildfires and insects are visible. Some grey or red patches of trees are visible.	Short term (0-10 years)	95%	94%	88%	96%	100%
				Long term (50 years)	78%	70%	41%	85%	100%
				Total area treated	75%	30%	15%	45%	100%

95% and 94% respectively in A and B, and 88% in Alternative C. In the long term untreated areas would include 100% of the lodgepole area in Alternative D, 78% in A, 70% in B, and 41% in C. C-Modified would have a prescribed natural fire program as described below.

Alternative C-Modified has a somewhat different approach to managing the lodgepole. In areas that are visible from either Paulina Peak or from the recreation areas within the caldera, the short term character change would be modest with the canopy texture becoming lighter and less dense in some areas (including the northwest area of the Flanks and a few areas within the caldera (north edge of East Lake, northeast of Paulina Lake and an area south of road 21]-- see partial retention areas on the VQO-NNVM map in Standards and Guidelines). In the long term this area would be managed to retain a relatively green, even textured forested canopy. Grey and sometimes red colors would be present in the canopy at different times. Some dominant openings would likely be visible and would have occurred as a result of beetle kill and wildfires.

In C-Modified, areas not visible from Paulina Peak or the recreation areas inside the caldera would have a different effect. In the short term, on the northwest and northern areas of the Flanks, large (up to 200 acres) fire patches could be evident (shown on the VQO-NNVM map in the Plan as preservation-b areas). The fire patches would be designed to appear as if they occurred naturally and they could be visible from Lava Butte and other high points in the surrounding landscape. These areas would function as experimental areas for using prescribed fire in lodgepole pine forests. If the option to use fire is not chosen during project development, the forested grey-green canopy in these areas could become lightly textured, opened slightly, and grey trees could be removed. In the long term in this alternative, a prescribed natural fire program would become established throughout a much larger area (see PLT areas on the VQO-Long Term Intent-NNVM map in the plan). In these areas, prescribed natural fire(s) would be expected to burn anywhere from 0- 1500 acres, and the resulting mosaic of openings would include many different sizes and shapes of burn patterns. Prescribed fires of 0-200 acres in selected areas would also be evident throughout the area. The resulting character would become a patchy mosaic of burn patterns scattered throughout the forested canopy. It is not yet known what level of mechanical treatment will be necessary or feasible when treating lodgepole pine with prescribed fire. When our understanding increases, more specific effects to scenery will be evaluated and management direction will change accordingly.

In all of the action alternatives, the visual effects of created or prescribed natural fire patch areas or openings within the lodgepole pine canopy could be considered unacceptable and/or an unpleasant change to visitors. This has the highest probability of occurring in Alternatives C, then B, but could occur in C-Modified and A. This is discussed in more depth under scenic condition and is addressed in monitoring. See also Table 4-24.

Mixed Conifer Landscape Character

In general, the mixed conifer areas are not highly visible in sensitive foreground viewsheds (with the exception of the western entrance to the caldera and in the northeast areas of the caldera). Therefore, a majority of the character change would be realized viewing the forest canopy from a distance. In Alternatives A and D, few management activities are expected and the resulting visual character would be a function of naturally occurring openings which could be obvious in some areas. Textural differences in the canopy would also occur. In some areas, the coarse grained ponderosa pine canopy will evolve into a denser and darker colored lodgepole pine or fir canopy. Some of these changes could be evident in the short term; however, they are likely to be visually more substantial by the long term. Up close these forests would appear dense with structural and textural diversity. In the short term 98% of Alternative

Table 4-25

Landscape Character Type (Mixed Conifer)

Key Features of Mixed Conifer Character Types				Assumed % Treatment by Alternative					
Mixed Conifer Communities (2,700 acres)	**Structural & Visual Diversity**	**Forest Floor**	**Viewed at a Distance (Canopy)**		**A**	**B**	**C**	**C-Mod**	**D**
Mixed Conifer (treated primarily with mechanical methods)	Forest is texturally diverse; bright green low branching firs mixed with pines. Small openings would be evident. Underburns would result in more ponderosa pine in some areas.	Texturally diverse with a range of vegetation density relative to the amount of sunlight. Young pines would typically be growing in open areas.	Forest would have a relatively contiguous, texturally diverse canopy. Small breaks in the canopy would be evident where treated mechanically or with small underburns.	Short term (0-10 years)	0%	6%	0%	2%	0%
				Long term (50 years)	0%	28%	0%	24%	0%
				Total area treated	0%	70%	0%	50%	0%
Mixed Conifer (treated primarily with prescribed fire)	Forest decreases in visual diversity and appears more open and even-aged. Little understory with qualities similar to "historic" ponderosa pine forests.	Appears open with little understory vegetation or downed wood. Depth into the forest would increase.	Canopy would decrease in density and color diversity. It would become more like "historic" old-growth ponderosa pine forests. Opening would be larger than other areas.	Short term (0-10 years)	0%	0%	11%	0%	0%
				Long term (50 years)	0%	0%	56%	0%	0%
				Total area treated	0%	0%	88%	0%	0%
Untreated Mixed Conifer	Forest appears densely vegetated with a dominant presence of floor. Low branching, densely spaced fir could appear impenetrable. Some openings would be evident as a result of natural disturbance cycles. Other species would be evident in some areas.	Texturally diverse with a range of vegetation density relative to the amount of sunlight. Young pines would typically be growing in open areas.	Forest would have a relatively contiguous, dense canopy except where natural disturbance cycles have resulted in openings.	Short term (0-10 years)	100%	94%	89%	98%	0%
				Long term (50 years)	100%	72%	44%	76%	0%
				Total area treated	100%	30%	12%	50%	100%

C-Modified, 94% of B, and 89% of C would also fall into this category. In the long term, these areas would include 76% of C-Modified, 72% of B, and 44% of the mixed conifer areas in C.

The mixed conifer vegetation management strategies are similar in Alternatives C-Modified, C, and B; however, the techniques used to treat the vegetation would be different as would the amount of area treated. Both would result in different visual effects. In C the treatments would include substantial treatment with fire, which would result in a coarse grained (ponderosa pine) lighter green canopy. There would be little understory vegetation resulting in less density (Alternative C treats 11% of the area in the short term and 56% in the long term). Some areas could appear slightly opened. In Alternative C the effects to landscape character would be most obvious because of the use of fire and the extent of the areas treated. Viewed up close, some of these areas would appear like the more open ponderosa pine forests and would loose their visual diversity and multiple-storied character.

The effects in Alternatives B and C-Modified would be similar to each other. C-Modified would utilize some fire and therefore, some areas could resemble those described for C. Treatment in both B and C-Modified would generally result in texturally diverse canopies that are less dense and slightly opened in some areas. In these alternatives the management assumptions include primarily mechanical manipulations in order to improve or protect wildlife habitats and would not be expected to create large openings in the forest canopy. In general the visual character change in these alternatives would include a textural change in the canopy due to small openings viewed from a distance. See also Table 4-25.

The effects on landscape character in all the other types of forests (excluding ponderosa pine and ponderosa pine mixed species, lodgepole pine, and mixed conifer forests) would be relative to processes of ecological succession. Natural disturbance cycles would define where canopy openings would occur and how large they would be. The scenic condition effects in these areas would be little to none. The evidence resulting from hazard tree removal and fire suppression activities would constitute the majority of human alterations in these areas.

Scenic Condition

The visible evidence resulting from human alterations results in a change in the scenic condition of a place. Table 4-26 describes the amount of recent management activities within the Monument (with the exception of proposed activities along Road 9702). In addition this table displays mortality levels in the Monument. Figures were derived from the GIS database and Alternative C management activities and mortality; percentages are approximate. The amounts of recent activities shown in Table 4-26 can be compared in general with the anticipated future activities in Tables 4-23, 4-24, and 4-25. For example, most of the lodgepole in NNVM occurs in the Flanks Zone, where $<2\%$ of this forest type currently appears altered by humans. In Alternatives A, B, C, C-Modified and D, 3%, 3%, 4%, 3%, and 0% of the lodgepole in the Monument, respectively, is expected to be treated in the first ten years. The future condition of these treated areas will depend on the type and success of treatment methods. For example, prescribed fire may or may not successfully mimic a naturally occurring fire. Potential condition changes are discussed below, by vegetation community type.

Ponderosa Pine/Scenic Condition

Changes in the appearance of the ponderosa pine forests would be the most obvious along the roads and trails in the Monument. All of the action alternatives promote a vegetation strategy which restores old growth ponderosa pine forest ecosystems. There are a variety of conditions that could occur within the context of that definition and a variety of management

Table 4-26

Recent** Vegetation Management Activities and Mortality Levels

	RIVER*			LAVA BUTTE*			TRANSITION*		
	% of forested area in zone	% with recent management activity**	% with high mortality	% of forested area in zone	% with recent management activity**	% with high mortality	% of forested area in zone	% with recent management activity **	% with high mortality
PONDEROSA PINE	73%	^^^	^^^	100%	35%	^^^	18%	5%	<2%
P. PINE/FIR MIX	^^^	^^^	^^^	^^^	^^^	^^^	6%	1%	5%
P. PINE/L. PINE MIX	18%	^^^	^^^	^^^	^^^	^^^	49%	5%	24%
LODGEPOLE PINE	9%	^^^	^^^	^^^	^^^	^^^	25%	3%	41%
MIXED CONIFER	^^^	^^^	^^^	^^^	^^^	^^^	2%	^^^	5%
HEMLOCK	^^^	^^^	^^^	^^^	^^^	^^^	<1%	^^^	^^^

	FLANKS*			CALDERA*		
	% of forested area in zone	% with recent management activity**	% with high mortality	% of forested area in zone	% with recent management activity**	% with high mortality
PONDEROSA PINE	1%	^^^	<1%	^^^	^^^	^^^
P. PINE/FIR MIX	<<1%	^^^	^^^	^^^	^^^	^^^
P. PINE/L. PINE MIX	3%	<1%	11%	2%	^^^	11%
LODGEPOLE PINE	69%	<2%	9%	63%	<3%	5%
MIXED CONIFER	9%	^^^	3%	5%	^^^	^^^
HEMLOCK	17%	^^^	2%	30%	^^^	2%

* Existing management areas do not have these zone boundaries--Alternative C and C-Modified zone boundaries were used as representative boundaries.

** Recent refers to the mid 1970's and 1980's (from Deschutes National Forest [DNF]-GIS database).

^^^ Indicates non-applicable.

treatments that could be used in order to move the existing vegetation towards that goal. The evidence of human activities (such as mechanical equipment, large trucks, etc...) would be apparent and could be visible from many of the roads and trails within the Monument.

Treatments to re-establish "historic" old-growth ponderosa pine will typically involve using fire as a tool in combination with some mechanical treatment. These areas will appear thinned out and the understory vegetation could be all or partially removed prior to burning. This process could result in areas that look significantly manipulated following treatment and there will be a decrease in scenic quality. Once burned these areas will look less altered by people but will appear burned. Some will consider this unattractive, others will find it interesting. As the grasses and understory vegetation begins to grow back, there will be less evidence of fire or mechanical treatments and scenic quality will improve. The impacts of the mechanical pretreatments will be most evident in the short term because many of the existing pine areas have significant amounts of fuel (vegetative material) build up due to fire suppression activities. The effects associated with these treatments would be the most pronounced in Alternative C, followed by B, A, and C-Modified, with 2500, 1000, 1000, and 300 acres (respectively) treated within the next 10 years (none in D).

Treatments to re-establish "ecologic" old-growth ponderosa pine typically involve mechanical methods that allow for maintaining the understory vegetation. Treated areas would appear thinned out and the understory vegetation would be retained in many areas. Around the trunks of larger trees there is typically more thinning in order to highlight the trunks and improve the health of the tree. Clumps of small trees and dense areas provide visual variety. These areas could look significantly altered immediately following treatment; however, treatments would be designed to meet visual quality standards which involve clean-up times of one to two years following the activities (this is true in all vegetation management activities in the Monument). There would be some effects from prescribed burning in these areas; however, underburning large areas would be less common in "ecologic" old-growth restoration than in "historic" old-growth restoration. The effects associated with these treatments would be the most pronounced in Alternative B, followed by C-modified, with 6000 and 100 acres (respectively) treated within the next 10 years. Alternatives A and C would not have these types of treatments. Alternative D would not have either "historic" or "ecologic" old growth restoration treatments.

Treatments in the ponderosa pines are not assumed to create large openings in the forested canopy. When viewed from a distance the treated areas could look texturally different; however, the focus of the initial treatments is on thinning the main structure of the existing even-aged stands, and/or decreasing the fuel levels on or near the ground.

In addition to the types of treatments, the rate of treatment and the potential amount of affected area would affect the scenic condition. In the short term the rates of treatment of ponderosa pine forests would be the fastest in Alternatives C and B (250 acres/year), followed by A (100 acres/year) and C-Modified (40 acres/year). In the long term Alternatives C and C-Modified rates would both increase (C = 750 acres/ year; C-Modified = 160 acres/ year). The rate increase in Alternative C is not expected to be consistent with the Visual Quality Objective Standards for the alternative (based on cumulative standards for retention and partial retention areas [USDA Forest Service Manual, FSM 2300]). If this alternative is selected, the assumptions for the rate of vegetation management would either not be met or would need to be changed in order to meet the scenery standards (reduce to between 250 and 500 acres). If this assumption change does not occur and this alternative is selected, a heavily altered scenic condition could result, which many visitors w\may find unacceptable.

The feasibility of individual projects and the exact number of acres involved would be evaluated at the site-specific level. Projects would be designed to meet within the scenery standards for the Monument or a plan amendment would be necessary. The exact number of allowable acres of treatments for each alternative that would be consistent with scenery standards cannot be predicted with precision at this scale of planning. The numbers used are based on estimates that assume every treatment is visible. Actual acreage numbers could be either higher or lower as long as they meet within the standards. The potential amount of area treated by vegetation management activities affects scenic condition. Treated areas potentially have evidence of human alteration that are either obvious, like deliberately created openings, or subtle, such as low stumps on the forest floor. The potential affected area varies between the alternatives with 88% in C, 70% in B, 32% in C-Modified, and 10% in A.

In C-Modified treatments in the short term would be expected to be more obvious along Road 9723 and possibly towards the middleground as viewed from Road 9710, north of Road 9720. Areas marked as partial retention on the map VQO-NNVM would be likely to have more obvious treatment, and be visible for longer periods of time (two years before projects are to be cleaned up under this standard). Treatments could also be visible in the very short term in all of the areas described as retention. This includes most of the ponderosa pine areas.

Lodgepole Pine/Scenic Condition

Treatments in the lodgepole pine would be most obvious when viewing the forest canopy, but they would also be evident along roads and trails. Lodgepole pine species tends to grow densely and visual changes from mechanical thinning, etc., tend to be obvious. This is especially true when viewed up close in the foreground. With few exceptions foreground areas along roads and trails would be managed to meet retention visual quality objectives within the Monument (exceptions include along the transferal corridor and on Road 9710 south of 9720). There could be evidence of human alteration for up to one year following projects within the context of these standards. Assuming project consistency with these standards, visual changes along roads and trails would be designed to be subtle in seen area viewsheds. In areas outside of sensitive seen areas, for those wandering off trails, there could be visual evidence of human alterations in the lodgepole pine forests. Some people could find these changes unacceptable and/or unattractive. This could occur in all action alternatives.

The change in lodgepole that would be the most obvious would occur in areas that are being treated in the steeper, more remote sections of the Caldera and Flanks Zone. Here all changes would be potentially noticeable and/or obvious from some viewer locations. Most or all of the projects would be designed to appear as natural fire patches. There is not much available research to substantiate what the public perception of these changes is likely to be. It is possible that these changes could be unacceptable to the public; however, to some degree peoples' acceptance may depend on how successfully a prescribed fire can mimic a natural fire and/or how well the role of fire is interpreted and explained. This will be evaluated project by project on a site-specific level and is addressed in monitoring and project planning. Prescribed fire in lodgepole pine is anticipated to necessitate some mechanical pretreatment of fuel levels prior to burning. These treatments would create condition changes in the short term which would change into appearing as fire patches when the project is burned. However, mechanical treatments could result in stumps on the forest floor in areas where there currently are none and could necessitate motorized sounds (chainsaws etc.) in unmotorized areas. Some of these sounds could be mitigated by limiting the treatment to low-use times and seasons. Most of the areas where this potential exists is being managed for semi-primitive recreational experiences. The

percentage of the overall lodgepole pine expected to be affected by these mechanical/fire treatments is 55% in Alternative C, 40% in Alternatives B and C-Modified, and 10% in A. The total area potentially affected by any mechanical treatment (not limited to mechanical/fire combinations) in all of the lodgepole is expected to be 88% in Alternative C, 70% in B, 55% in C-Modified, and 25% in A. D is not expected to be treated.

In addition to the types of treatments, the rate of treatment would affect the scenic condition. In the short term the rates of mechanical treatment of lodgepole pine forests would be the fastest in Alternative B (150 acres/year), followed by C (95 acres/year), A (60 acres/year), C-Modified (28 acres/year) and D (no acres). In Alternative C, the assumed rate of the treatment as currently described is not expected to be consistent with the Visual Quality Objective Standards. If this alternative is selected, the assumptions for the rate of vegetation management would either not be met or would need to be reduced by 45 acres/year in order to meet the scenery standards. If this does not occur, a heavily altered, unacceptable scenic condition could result. Alternative A could expect to have more burning after treatments in order to mitigate the effects of human altered conditions.

In the short term the rates of mechanical/fire treatment of lodgepole pine forests would be the fastest in Alternative C (175 acres/year), followed by B (77 acres/year), A and C-Modified (39-40 acres/year), and D (no acres treated). The rates of the treatments are not be expected to be consistent with the Visual Quality Objective Standards in Alternatives B and C. If these alternatives are selected, the assumptions for the rate of vegetation management would either not be met, or need to be reduced by 67 acres/year in Alternative B and 142 acres per year in Alternative C in order to meet the scenery standards. If this does not occur, an unacceptable scenic condition could result.

In Alternative C-Modified short-term treatments would be expected to be visible in those areas shown as partial retention on the VQO-NNVM map. Within the caldera some of these areas are north of East Lake, north of Paulina Lake, and a smaller area south of Road 21 and between the lakes. From Paulina Peak there could be visible changes on the northwest flank of the volcano (these could potentially be visible from other high points in the adjacent landscape and/or highway 97) and farther north. The preservation-b areas could have large fire patches created (these are not visible from Paulina Peak or the recreation areas in the caldera). Projects could also be apparent along Road 9710, south of 9720 to 9735.

Mixed Conifer/Scenic Condition

As discussed under landscape character, most of these areas do not occur in highly sensitive foregrounds. The visual quality standard assigned to these areas is either retention or preservation. Most treatments are intended to improve or protect wildlife habitat, and while they could be visible to the recreationist wandering off trail, treatments are not expected to be dominant as viewed from roads, trails, and recreation areas. Table 4-26 describes some of the existing mortality levels within the Monument and where recent management activities have taken place.

In summary, changes in scenic condition within the Monument would be realized as a result of individual project activity and as a cumulative effect of treated areas. Individual projects would be designed with the scenery standards for a given area. The rates of treatment mentioned throughout the previous discussion would have cumulative impacts. The rates in Alternatives B and C would need to be refined in order that at any one time there would not be an unacceptable amount of visible activity and decrease in scenic quality.

Visual Quality Objectives

The following discussion compares the scenery management strategies for the different alternatives. Visual quality objectives have been developed for each action alternative. The descriptions for Alternatives A, B, C, and D (and corresponding maps which are available in the planning record) show management concepts, and if selected would need to be refined and made consistent with vegetation management assumptions for rates of treatments. They are to be used for comparison purposes between the alternatives. Alternative C-Modified map is in the Plan (VQO-NNVM map) (the additional map titled VQO-long term intent-NNVM illustrates the long term intent for management. It is not direction and is not used in this comparison). There are descriptions in the plan for the various visual quality objectives in the scenery standards and guidelines section of the Plan.

Alternative D (No-Action) corresponds with existing direction from the 1990 Forest Plan (see Chapter 3 Scenery). See also USDA Forest Service document Landscape Aesthetics (1993, draft) for more information regarding specific standards for achieving VQO's.

In Alternative A, preservation would apply in all areas in the Monument except the Highway 97 corridor, Lava Cast Forest corridor, and Road 21 all the way through the Monument and around the recreation sites in the caldera; these areas would be managed at the retention standard.

In Alternative B, preservation would apply to the following areas: RNA, The Dome recreation site, the Swamp Wells trail in the Flanks Zone, areas in the Flanks Zone and the Caldera Zone that do not have ponderosa, lodgepole, and mixed conifer vegetation types, and approximately 20% of the lodgepole in the Flanks Zone. Paulina Peak and caldera viewshed along with mixed conifer areas, the Highway 97 corridor, all recreation sites, and any remaining areas (that are not described as preservation or partial retention) are managed at retention. Partial retention applies to 80% of the lodgepole pine in the Flanks Zone and an area of lodgepole in the southeast corner of the Transition Zone.

In Alternative C, preservation would apply in the same areas of preservation as in Alternative B. In addition some areas within the Paulina Peak caldera viewshed would also be preservation. Road 21 into the caldera and the recreation sites in the caldera would be retention as would almost all areas north of the transferal corridor. Areas of partial retention would be similar to those areas in Alternative B.

The standards for Alternative C-Modified are shown on map VQO-NNVM. They include some adaptations of the visual quality objectives in order to reflect the goals of restoration and the reintroduction of fire.

The percentages of the entire Monument would vary in VQO classifications as follows: preservation A (78%), B (11%), C (29%), C-Modified (includes preservation-b areas = 40%); retention A (22%), B (70%), C (53%), C-Modified (47%); partial retention A (0%), B (19%), C (18%), C-Modified (13%). (D would remain as described in Chapter 3 Scenery.)

Wildfire and Prescribed Fire: Managing vegetation with fire, as well as the potential for wildfires varies between the alternatives. The effects of fire on scenic quality differ with the environmental conditions of the site, the existing plant community, intensity of the fire, and the location of the site in the viewshed. The following discussion highlights the key differences related to the effects of fire in the different vegetation types. It is intended to be representative of the key visual effects of different types of fires (all effects do not necessarily occur in all situations).

Ponderosa Pine

Low Intensity Fires burn grasses, shrubs, and ground litter. The result is a removal of the ground cover, some scorching of tree trunks (up approximately 6' high), burning of lower limbs and smaller trees. Patterns are typically small pockets or mosaics. Larger trees may shed charred bark within 5 years, younger trees could take considerably longer. Effects to visual quality would change quickly as revegetation occurs and could be improved three years following low intensity fires (Taylor and Daniel 1983). Along roads and trails, short-term effects of low intensity fires would be visible. The overall effect is one of a cleared understory with charred bark, noticeable but not likely to be dominant. Revegetation could serve to enhance scenic quality.

Prescribed fires are commonly of low intensity. The effects of low intensity fires as visible from key viewpoints are expected to be perceived as minimal changes in the textural mosaic of the forest. Crown cover should remain unchanged; however, open areas where burns have occurred may show pockets of textural differences. Long-term effects would begin to reflect historical patterns and old-growth characteristics (open, park-like stands with revegetation in open areas) would become more common.

Moderate Intensity Fires would burn understory vegetation, char tree trunks (up 10-15' high), and kill some trees. Such fires could include prescribed fires in areas with significant fuel buildups. Standing dead trees would leave a charred skeleton with orange needles. The trees would fall in approximately 10-20 years following the fire, and could remain on the ground for over 100 years (unless removed or burned in another fire). Along roads and trails the short-term visual effects would be a forest with cleared understory. Charred bark and branches, shrub stumps, and dead orange needles are likely to be evident. Revegetation could reduce the negative effects.

The effects of fires of moderate intensity as viewed from key viewpoints would likely be perceived as minimal changes in the textural mosaic of the forest. Crown cover should remain unchanged however, open areas where burns have occurred are likely to show pockets of textural differences. Individual or pockets of standing dead trees may be noticeable. Long-term effects would begin to reflect historical patterns and old-growth characteristics (open, park-like stands with revegetation in open areas) would become more common.

High Intensity Fires or wildfires have obvious effects on scenic quality. Wildfires are very likely to kill all or part of the trees, remove understory vegetation and litter, leaving exposed soils. Visually, charred dead tree trunks and exposed soils generally dominate the landscape. Depending on the impact to the soil, grasses and shrubs can be expected to revegetate quickly, while tree revegetation is likely to require many years before it becomes significant visually. Standing dead trees are likely to remain visually dominant for many years. Dead trees on the ground may remain over 100 years. Along roads and trails, affects would be obvious and dominant. From key viewpoints, fires may leave irregularly shaped openings with patches of living trees or may leave an entire view burned.

Lodgepole Pine

Low Intensity Fires are likely to burn understory brush and litter with the possibility of igniting small clusters of densely stocked stands. Lodgepole is easily killed by fire. Short-term effects include charred trunks, branches and needles, and pockets of dead trees. Short-term visual effects are likely to diminish as standing dead trees fall within an approximate 10 year period. Young lodgepole pine would quickly reseed itself. Treatments along roads and trails would likely be visually evident. Views from key viewpoints would also be affected and the

large scale mosaic of forest cover could be altered. Long-term effects to visual quality would include an evolving mosaic pattern created by repeated burning and revegetation.

Moderate Intensity Fires would have visual effects similar to those of low intensity fires; however, a heavier charring of trunks, branches, needles and larger pockets of dead trees is expected. Effects as seen in the viewsheds are similar to those described above; however, these fires are likely to occur in areas with higher fuel loads and to cover larger areas.

High Intensity Fires in lodgepole pine stands will typically be stand replacement fires that would kill most or all of the overstory and start secondary succession. Seas of charred trunks would dominate the landscape. Depending upon the intensity of the fire the black portion of the bark would begin falling off the trees (leaving gray trunks) after approximately 10 years. Revegetation could be noticeable within two years, thus reducing some of the effect to scenic quality; however, it could take considerable time for the effects of fire to be eliminated. Effects of high-intensity fires would have enormous impact in high-use areas and along travelways. From key viewpoints there would likely be visible mosaic patterns of burn areas that meander along slopes, or entire viewsheds may be burned. These fires typically cover large areas.

Mixed Conifer

All Intensities: Most of the conifers in these stands are easily killed by fire, even fires of low intensity. Fires in mixed conifer forests could be expected to kill the trees leaving open pockets of charred snags. These openings are likely to be replaced with ponderosa or lodgepole pine in the long term. Views along travelways and in use areas would include all of the effects of fires: removal of understory, tree kill, charred bark, branches and exposed soils. These effects may be seen as pockets or as large burned areas depending on the intensity of fire. As ponderosa and/or lodgepole pine replace these areas the character of the sites will change. From key viewpoints views would include these effects, which would appear as pockets or mosaics of openings in the landscape.

Perception

Perceptual effects of fires in ponderosa pine forests have been studied and described by Taylor and Daniel. "Light fire improved scenic quality for a 3-5-year period; severe fire seriously detracted from scenic quality for an unknown length of time exceeding the 5-year period tested." (Taylor and Daniel 1983). In the short term (up to about three years after light underburning in ponderosa pine) the effects of fire will be visible. The immediate visible impact from burning could be perceived as negative by some visitors. Individual projects can be designed to mitigate and reduce the visible impacts; however, visitors will see and experience a stronger presence of fire in the Monument in the future. The perceptual effects of fires in lodgepole pine and mixed conifer forests is not well understood and would be greatly affected by the methods, timing, and design of each site specific vegetation management project. Burning in these types of communities will kill the trees that form the upper canopy; openings will be visible. The high contrast and visibility of burning projects could appear unacceptable to some people. The rate of treatment and further quantification of how much is too much will be addressed through monitoring.

In the following discussion, 'short-term' refers to less than 10 years, 'long-term' means up to 50 years. The potential for wildfires correlates with the fire regime and potential for burning (fuel levels). For more information see sections pertaining to Fire and Fuels and Air Quality.

Alternative A: Forested areas could be expected to have 3.3% of the area (annually) impacted by wildfires in the short term dropping to 2.8% (annually) in the long term. There

would be about 59% more travelway and recreation areas viewshed corridors from which to view these burned areas.

Low intensity burns (prescribed broadcast/underburns) in ponderosa pine could occur and be visible in or near travelway and recreation area corridor viewsheds on approximately .5% (annually) of the total acreage of corridor viewsheds in the short term and 1% (annually) in the long term. In lodgepole and mixed conifer communities these burns could be visible in none of these corridors in the short term, and .5% (annually) in the long term.

Alternative B: Forested areas could be expected to have 2.8% (annually) of the area impacted by wildfires in the short term dropping to 1.1% (annually) in the long term. There would be about 11% more travelway and recreation areas viewshed corridors from which to view these burned areas.

Low intensity burns (prescribed broadcast/underburns) in ponderosa pine could occur and be visible in or near travelway and recreation area corridor viewsheds on approximately 1.4% (annually) of the total acreage of corridor viewsheds in the short term and 2% (annually) in the long term. In lodgepole and mixed conifer communities these burns could be visible in approximately .2% (annually) of these corridors in the short term, and .5% (annually) in the long term.

Alternative C: Forested areas could be expected to have 1.1% (annually) of the area impacted by wildfires in the short term dropping to 0.6% (annually) in the long term. There would be about 25% more travelway and recreation use area viewshed corridors from which to view these burned areas.

Low intensity burns (prescribed broadcast/underburns) in ponderosa pine could occur and be visible in or near travelway and recreation area corridor viewsheds on approximately 5% (annually) of the total acreage of corridor viewsheds in the short term and 16% (annually) in the long term (this could exceed acceptable levels based on public perception). In lodgepole and mixed conifer communities these burns could be visible in approximately 1.5% (annually) of these corridors in the short term, and 1% (annually) in the long term.

Alternative C-Modified: Forested areas could expect to have 3.3% (annually) impacted by wildfires in the short term, dropping to 1.1% annually in the long term. There would be about 35% more travelway and recreation viewshed corridors from which to view these burned areas.

Low intensity burns (prescribed broadcast/underburns) in ponderosa pine forests could occur and be visible in/or near travelway and corridor viewsheds on approximately 3.3% (annually) of the total area in the short term and would be monitored not to exceed 10% of the forested area at any on time. Burns in lodgepole pine and mixed conifer communities could be visible in .2% of the corridors in the short term and would not to exceed 5% of the viewshed at any one time in the long term.

Alternative D: Forested areas could be expected to have 3.3% (annually) of the area impacted by wildfires in the short term and in the long term. There would be the same amount (as existing) of travelway and recreation areas viewshed corridors from which to view these burned areas. Low intensity burns would not occur or be visible.

Recreation Effects on Scenery

Sensitivity

Sensitivity is a measure of numbers of people visiting an area and reflects the level of concern for scenic quality. The alternatives provide for various types of recreational activities

within the Monument; including day-use and overnight opportunities, both developed and undeveloped. Day-use areas can accommodate more total visitors than overnight areas (acre by acre) because visitors do not typically visit for long periods of time. In overnight areas visitors will potentially spend extended lengths of time viewing the adjacent landscape. The alternatives vary in their potential to accommodate future visitor use, varying the ratio of day use and overnight opportunities. This affects their relative scenic sensitivity. Regardless of all action alternatives, the existing condition already has a high level of scenic sensitivity.

Scenic quality sensitivity as it relates to developed recreational visitors would be the highest in Alternative A, then Alternatives C, C-Modified, B, and D respectively.

Scenic quality sensitivity as it relates to dispersed recreational visitors (in particular those visitors seeking semi-primitive recreational settings) would be the highest in Alternative B, then Alternatives C-Modified, C, D, and A respectively.

Viewsheds

A viewshed describes the visible landscape as seen from one or more vantage points. Three main types of viewsheds include; corridor, basin, and feature (USDA Forest Service 1993). Each of these viewshed types have different implications for management. See Table 4-27.

Corridor/Use Area Viewsheds: A corridor viewshed occurs along a travelway (road, trail, river) and is linked to an experience that occurs as a sequence, over time and space. Corridor viewsheds in the Monument include summer trails, winter trails, primary and secondary roads. Recreation areas such as campgrounds and picnic areas are often found in conjunction with or at the terminus of some of these corridor viewsheds.

Travelway corridors and use areas generally are linked with vegetation management practices that emphasize scenic quality enhancement and safety. Alternatives A, C, C-Modified, B, D, would have most to the least travelway corridors and developed use areas within the Monument boundaries respectively.

The Monument is bounded by travelway corridors. The viewshed corridors along the perimeter generally fall half within and half outside of the Monument. Some of these corridor viewsheds outside of the Monument are in the 'Scenic Views' land management allocation (USDA Forest Service 1990) which requires management for a high level of scenic quality. Some of these corridors are in the other land management allocation 'General Forest' which generally permits a lower level of scenic quality than typically associated with a scenic travel route. A scenic road, loop road or travel route that crosses land outside the Monument (as in Alternatives A, C, and C-Modified) could indirectly affect visitor expectations for scenic quality (along the scenic travel route) creating incentive to change Forest Plan management objectives on some lands outside of the Monument. The location of the proposed Mokst Butte RNA (in the Transition Zone) would require any roads in this area to go outside NNVM, in order to comply with the goals of RNA management. Alternatives A and C would likely include a new road in this area. Alternatives A, C, and C-Modified would plan for a trail in this area. Trails too could be inconsistent in the RNA; however, after preliminary discussions concerning the feasibility of a trail easement through the area, it appears that this could be possible within the goals and objectives framework for the RNA. Nothing final has been decided at this time. (Alternative D would have no new trails.)

Basin Viewsheds: Basin viewsheds are the portion of the landscape visible from within a landform. In the Monument there is one large basin viewshed, the caldera. The two lakes are the prominent elements in this basin and it is from the water that some of the most outstanding and comprehensive views of the surrounding landscape are visible.

The caldera basin viewshed area remains constant between the alternatives. The difference is relative to the numbers and type of visitors that may be accommodated in these areas and the type of recreational activities. The potential for developed recreational visitors in the caldera is highest in Alternatives A, C, C-Modified, respectively. Alternatives B and D are almost identical in visitor numbers; however, B has more potential for day-use visitors (short-term, often sightseeing) and Alternative D has more overnight visitors (long viewing duration) (see Table 4-3). The potential for semi-primitive opportunities within the caldera is relatively similar in all alternatives except A (it is lower in A).

Feature Viewsheds: Feature viewsheds include prominent landscape elements such as buttes and peaks. Paulina Peak and Lava Butte currently are developed as key viewpoints, offering panoramic vistas of the surrounding landscape. Areas within these feature viewsheds include Monument lands, adjacent forest lands, as well as surrounding and distant public and private lands. It is possible to create additional feature viewpoints within the Monument that view areas outside of the Monument.

Paulina Peak and Lava Butte (two existing feature viewsheds) would remain constant in all alternatives. The potential for new feature viewsheds would increase substantially in Alternative A, moderately in Alternative C, and C-Modified, remain the same in Alternative D, and decrease in Alternative B. More in-depth discussion of these viewsheds can be found in the planning record.

Seen Areas

The action alternatives would increase the amount of areas visible within the Monument based on the amount of increased access and recreational development that occurs. These areas would increase the most in Alternatives A, C, and C-Modified, to a lesser degree in B and little to none in D (see also summary viewshed condition rating standards).

Other Alternative Effects on Scenic Quality

Wildlife/Fish: Creating or enhancing wildlife cover can affect scenic quality by providing visual and structural diversity of vegetation species, age, and sizes. Cover vegetation can also function to screen areas and break down the scales of open areas. Wildlife habitat enhancement typically involves the use of more mechanized methods for treatments (rather than fire) which can result in more evidence of activities and fewer burned areas.

Fish and riparian habitat enhancement can affect the scenic quality of streams and lakes and improve wildlife viewing opportunities.

All action alternatives could be affected to some degree by vegetation management that emphasizes habitat enhancement. Alternative B would have the most wildlife cover and forage enhancement and would result in the most visible evidence of habitat management.

Archaeology/Geology: Unique archaeological and geologic elements can become viewing opportunities and can be coordinated with interpretive and educational planning. Protection of these resources may place constraints on management activities.

All alternatives could potentially benefit from viewing opportunities of unique elements. Alternatives A, C, and C-Modified would have more new development (than B or D) and would increase opportunities the most.

Interpretation: Interpretation can be linked with scenic viewing opportunities. It can be used to combine a story or message with a visual image. Management activities, such as reintroducing fire into the ecosystem, could be enhanced through public education and project visibility.

Table 4-27

Viewsheds

Alternative	Travelway Corridor/Use Areas [2/]						Basin		Feature
	Percent Increase in Acreage						% Potential increase for developed recreation	Potential increase for dispersed semi-primitive recreation [1/]	Number of potential new areas
	River	Lava	Trans	Flanks	Caldera	Overall			
A	0	160	139	35	18	57	225	5	5
B	7	20	31	9	0	10	5	1	0
C	4	85	76	13	0	25	120	3	3
C-Modified	4	85	108	14	0	35	120	2	3
D	0	0	0	0	0	0	5	4	0

1/ Ranked highest to lowest (1-4) according to expected increases.
2/ The majority of these increases are due to increases in trail miles. See also Roads section.

Alternatives C and C-Modified would have the strongest interpretive programming of all the action alternatives followed by A, then B and D.

Air Quality: The smoke resulting from wild, camp, or prescribed fires and/or windblown dust could affect scenic quality. Air that contains these particulates could reduce visibility of scenic resources, impacting the quality of a visitor's experience and degrading scenic value. Reduced air quality in the caldera resulting from particulates associated campfire smoke and motor-vehicle exhaust would potentially be the greatest in Alternative A, lower in D, still lower in C and C-Modified, and lowest in B. Temporary impacts to scenic viewing due to reduced air quality resulting from prescribed burning in the first ten years would be the highest in Alternatives C, B, A and C-Modified, in that order (none in D). Smoke resulting from potential wildfires in the first ten years would have much greater effects; these would be greatest in D, A, and C-Modified, followed by B and C, respectively. (See also Air Quality section.)

Airborne dust resulting from traffic on unpaved roads would likely be greatest in Alternative D, and less in the action alternatives. (See Air Quality.) The impact of dust on scenic quality in the caldera would not be expected to be a problem as most roads are paved. In the Transition Zone; however, Alternative C includes an opportunity for an unpaved scenic loop road and Alternative C-Modified has the opportunity for a scenic loop route (on existing roads), that could increase dust problems or necessitate dust abatement maintenance if there is a significant traffic increase. In general, all of the action alternatives close many roads (non-paved) and would decrease the potential for road dust (see Chapter 4 Roads) as compared with the existing condition.

Water: Water quality can also affect scenic quality. Color and clarity of water could be affected by soil erosion and sedimentation into lakes and streams (see Assumptions), which increase turbidity. Although significant differences between the alternatives are not expected, more people and increased use around the lakes (in Alternatives A, D, and to some degree C and C-Modified) could affect the stability of the lake edge and/or contribute to increased water pollutants. (See Water Quality section.)

Recreation/Facilities/Roads: Recreational use could affect the visual sensitivity of the Monument (see earlier discussion). Additional roads, trails, and facilities could cause short-term reduction in scenic quality, primarily during the construction phase (see also dust discussion under Air Quality). Scenic roads or travel routes and new viewpoints (in Alternatives A, C, and C-Modified) would increase visitor expectations for outstanding scenery (see Viewshed section of this chapter).

Effects on other Ecosystem Components

Vegetation:

Management to achieve visual objectives could include some removal or retainment of vegetation in order to create or prevent openings, enhance viewing depth, and provide visual diversity. Vegetation management in visually sensitive areas can necessitate more restrictive treatment methods and mitigation measures in order to provide for high quality scenery. These more conservative treatments can affect biological diversity and also increase the potential for larger and more severe wildfires in these areas. Such methods can also result in larger, slower-growing trees. These treatments are likely to be more expensive than treatments in areas with lower visual sensitivity. Along scenic travelways, recreation areas, and in key viewsheds special treatments to preserve scenic quality are expected to be most necessary in Alternative C, and least needed in Alternative D. As discussed earlier, scenery changes related to vegetation could affect wildlife, fish, and their habitats.

Interpretive/ Geology/ Archaeology:

Geologic and cultural resources will be protected in all alternatives; however, landscape changes could increase their exposure or visibility. This, in turn could affect accessibility and interpretation of the resources to the public.

Recreation/ Roads/ Facilities:

Scenic quality enhancements such as revegetation and renovation of facilities would occur in all action alternatives. Scenic driving opportunities would be highest in A, followed by C and C-Modified.

Mitigation

As a minimum, the Visual Quality Objectives (VQO's) of Preservation, Retention, and Partial Retention will be met unless there is a plan amendment (see VQO - NNVM map). Structural development and renovation projects would be consistent with the architectural theme guidelines for the Monument. The guidelines are within a document called the Deschutes National Forest Recreation Facilities Handbook (working draft 1993). See Standards and Guidelines in the Plan for more information. Some of the mitigation measures to be used in conjunction with vegetation management in the Monument would include (this list is not exhaustive):

- If trees are removed along travelway corridor and recreation areas, fell them directionally away from use areas and corridors.
- Cut stumps within 150' of travelways or recreation areas to 4" or less.
- Paint mark trees on the side of the tree not visible from the travelway or recreation area.
- Design skid trails which may cross travelways or occur near recreation areas to eliminate or reduce potential impacts.
- Locate landings out of sight of the travelway or recreation areas
- Hand pile slash within 200' of travelways or recreation areas
- Flush cut stumps in recreation areas
- Total activity slash clean-up would occur in recreation areas
- Minimum ground disturbance in recreation areas or areas in the foreground viewshed of travelways or recreation areas.
- Design road closure structures which may be visible from travelways or recreation areas to meet VQO's.
- Along travelways and recreation areas, in areas managed with fire, reduce fuel levels and pull fuel out from under tree canopies in order to reduce potential for scorching.
- Use interpretation related to vegetation management as mitigation and educational opportunities, and include interpretation in site project planning
- Design vegetative treatments that mimic the natural forest patterns (shapes and sizes) and reflect the forms, lines, colors and textures of the characteristic landscape.
- Revegetate areas in order to reduce any negative impacts and/or enhance scenic quality.
- Design all prescribed fires to be light burns only in seen areas in travelway corridor and recreation area viewsheds.
- A landscape architect will be involved in the planning and design of treatments.

Assumptions

Corridor viewsheds assumptions for Table 4-27 occur within 1/4 mile of roads, trails, and use areas. Viewsheds will be created consistent with recreation and vegetation objectives. Vegetation management will occur in a uniform distribution across travelway and use area corridors in Alternatives A and B, and would be distributed relative to "managed" vegetation type in Alternative C.

Soil conditions would be managed at acceptable levels according to established standards, and would not degrade scenic value.

Specific methods and locations for vegetation management have not been identified, other than they will be consistent with VQO standards which are spatially depicted on the VQO - NNVM map (other maps are available in the planning record). The techniques of management along scenic travelway corridors, use areas, and key viewsheds will be consistent with meeting the prescribed VQO's and summary viewshed condition objectives for that area.

Openings in the managed vegetation range from 1-50 acres (Alternatives A, B, C, and C-Modified) for lodgepole pine; little to none in the ponderosa pine communities (except for areas with a large amount of dead lodgepole); and 3-5 acres in mixed conifer areas. In lodgepole pine, Alternative C, fire patch openings will be 1-200 acres for prescribed fires and 1-1500 acres in prescribed natural fire areas. Mechanical treatments in lodgepole pine will not exceed the partial retention standard. Treatments will be designed to blend with the surrounding characteristic forest and, if evident, will mimic natural disturbance patterns.

All viewsheds are based on potentially-seen areas. These were generated in GIS from digital elevation models (DEM) and have not been field-verified. All future projects will require site-specific analyses for effects on scenic quality, which should include project evaluation by a Landscape Architect.

The Monument landscape will be managed to preserve and or enhance the high level of scenic quality that currently exists. Vegetation-management projects will either focus on scenery enhancement or will create a "natural" appearing forest setting, where evidence of management is either not evident or visually subordinate to the landscape. Exceptions to this may occur where recreational developments are located and structures or facilities will be present. Structures and facilities will be consistent with the architectural and signing guidelines for the Monument.

Other assumptions pertaining to this analysis are available in the planning record.

13. Law Enforcement

A law enforcement presence would be necessary under all alternatives to provide for public safety and resource protection. Historically, conflicts between visitors have been rare in the Monument even on busy holiday weekends. Protecting the special features of the Monument (including obsidian, lava casts, and cultural resources) is a particular concern.

Under all alternatives, the Forest Service, Deschutes County Sheriff, and Oregon State Police would continue to have law enforcement authority and responsibility in the Monument. The primary responsibility of the Forest Service is to protect the natural resources, public property, and public employees. The Forest Service plans to assign a Law Enforcement Officer to the Monument 50% of a person-year by Fiscal Year 1995.

Some effects to law enforcement would vary in degree by alternative. Under Alternative A, the expected increase in visitors, especially in the Caldera Zone, would increase the potential for conflicts and resource damage. Improved roads would increase visitation to previously remote areas and require more law enforcement presence in those areas than in the past. The reduction in the number of campsites in the caldera in Alternative B would be expected to reduce the potential for conflicts between campers. This alternative emphasizes dispersed recreation and reduces road access. With infrequent law enforcement presence, some remote features could be vandalized. Roving interpreters would mitigate some of this problem. Day use would increase in Alternative C in response to expanded interpretive programs. These programs and the presence of interpreters on site would help to reduce resource damage. Under Alternative D, overnight use in the caldera is expected to increase, (although less than in Alternative A) increasing the potential for conflicts between campers and the potential for resource damage.

14. Local Communities

Direct and Indirect Effects

The alternatives affect the social and economic settings of local communities primarily through the blend of recreation opportunities each provides. Other resource objectives (old-growth restoration, fuels reduction, vegetation management activities, fish and wildlife habitat management) would affect communities primarily through their influence on recreation resources and opportunities.

The effects of the alternatives on local communities are assessed in terms of:

- Economic impacts resulting from Monument recreationists' expenditures;
- National Forest payments to counties; and
- Quality of life for local residents.

Economic Impacts - Expenditures by visitors to the national monument make important contributions to the area's economy. Whether expenditures increase or decline in the future, and the magnitude of the change depends for the large part on visitation levels and recreational opportunities (including capacity of recreational facilities). Predicting future visitation levels is difficult because it depends on a number of factors (e.g. population change, changing preferences, the overall level of economic prosperity, and the amount of other recreational opportunities available).

Central Oregon offers a wide variety of recreational pursuits. We assume that this variety, along with a new national monument, will continue to draw recreationists to the area. It is also possible that people will come just to visit a national monument. Population in the Northwest and the region have grown at a steady pace for over a decade, contributing to increases in all forms of recreational activity.

Based on recreation capacity, Alternative A provides the greatest potential for growth in recreation related jobs and income, followed by Alternative C, C-Modified, B, and D. Alternative A provides an increase in developed recreation capacity of up to 78% over the present and the highest capacity for dispersed recreation activities. Alternatives C and C-Modified provide up to a 53% increase in developed recreation capacity, Alternative B, up to a 3% increase and Alternative D, a 17% increase. Alternative D has the second highest dispersed recreation capacity followed by Alternatives C, C-Modified, and Alternative B.

Although the developed recreation capacity varies widely between the alternatives, the economic impacts that may accrue in the near future (within the 10-15 year, probable life of the Plan) may not vary so widely. This is because the capacity for developed recreation, exceeds projected use for most alternatives for at least a decade. This case is also expected to be true for dispersed recreation.

Projected use in developed recreation was analyzed using two different assumptions for growth rates: 1) assuming a trend of two percent growth per year (based on statewide population trends) and 2) assuming a trend of 7.3 percent growth per year (based on a synthesis of local studies by Runyan and Associates (1991), and ECO Northwest (1989). Under both growth scenarios, developed facility capacity should stay generally ahead of projected use, except for Alternative B and possibly for Alternative D at the 7.3% per year growth rate. For these two alternatives, an estimated 100 jobs, and about $1 million in income would be foregone because the developed recreation capacity would not be sufficient.

With the above exception for Alternatives B and D, it is assumed that all alternatives would make similar contributions in terms of jobs and income to the local economy. As Monument use grows over the decade, it is estimated (based upon the assumptions) that several hundred jobs and several million dollars would be added to the economy, under all alternatives.

As the demand for developed recreation grows beyond the first decade, the differences in economic impacts between the alternatives could widen as increased developed recreation capacity is required. If growth rates increase above 7.3% per year, differences between the alternatives could also occur sooner.

Payments to Counties - In the 1991 fiscal year, the Monument collected approximately $131,000 in camping and special use fees. Based on the 25% formula for payments to counties, about $33,000 was distributed to Deschutes, Jefferson, and Klamath counties. Developed recreation (campground fees) make up the bulk of the returns to the treasury which are generated from the Monument. If developed recreation (camping) increases two to 7% per year, the associated payments to counties would also be expected to increase somewhere between these rates for all alternatives.

Quality of Life

The Newberry National Volcanic Monument contributes to the quality of life of local residents by providing a variety of amenities, nearby recreation opportunities, educational opportunities through interpretive programs, and employment and income from the recreation trade. None of the alternatives varies enough from Alternative D (No Action) to greatly alter community character, but each modifies the physical environment, amenities or economic conditions of some local residents as described below.

Congestion - U.S. Highway 97 is the major road artery providing access to the Monument. There are several points of access into the Monument from Highway 97 at junctions that lead to the caldera, Lava Lands Visitor Center/Benham Falls, Lava River Cave and Lava Cast Forest. Between 1985 and 1989 (prior to Monument designation), traffic counts on this stretch of Highway 97 showed an increase of just over 6% per year. Alternatives that increase recreation capacity (Alternatives A, C, and C-Modified) may allow for higher visitation levels, which could lead to increased traffic and congestion, and increased pressures on community infrastructure and services over time. It is likely that traffic and congestion will increase regardless of the alternative selected.

Educational Opportunities - Interpretive programs such as those provided at the High Desert Museum, the Oregon Museum of Science and Industry travelling programs, and Monument interpretive programs at Lava Lands Visitor Center and within Newberry caldera -- all offer a variety of learning opportunities for locals and visitors alike. These programs provide enrichment and add variety to local public and private educational programs. (See also Interpretation in the Cumulative Effects section.)

Interpretive programs are somewhat expanded in Alternative A, with more facilities for this purpose. Alternative B does not significantly alter the level of interpretive facilities but programs and staffing would be increased. Additional interpretive programs are made available in Alternative B through low-key, outdoor programs. Alternatives C and C-Modified would provide the most thorough interpretive program. Many new opportunities would be available, including chances to participate in hands-on, professionally-led projects such as wildlife research or archeological excavations. In all alternatives, there would be a strong interpretive emphasis on geology, archeology and vegetation management within the Monument, all of which are topics of increasing public interest. (See also Interpretation in this chapter.)

Additional Employment Opportunities - In addition to visitors' recreation expenditures discussed under economic impacts, some employment opportunities would also be provided by Forest Service expenditures for vegetation management activities as well as from utilization of wood fiber. Much of this work would likely be accomplished through contracts, generating employment opportunities in the private sector. Alternative B treats the most acres without fire and would probably be the most labor-intensive. Utilization (of wood) would also be the highest. Alternative C would provide the next highest level of employment opportunities, followed by Alternative C-Modified and Alternative A. Presently there has been little ongoing vegetation management and few related employment opportunities. This would be expected to continue under Alternative D.

Property Values - It is hard to estimate the overall impact of the alternatives on the value of property located near the Monument. The direction and degree of change in property values would depend on proximity to the Monument, and whether prospective buyers view changes brought about by the alternative as positive or negative. Congestion related to Monument visitation could result in reduced property values, assuming home buyers are concerned about it. On the other hand the attraction of more people to visit the Monument could result in more people wishing to move to the area and property values might increase.

Budgets - The following table compares the estimated capital investment costs and operations and maintenance costs of the alternatives. Capital investment costs reflect the total capital expenditures anticipated during the first ten years of the Plan. Operations and maintenance costs are expressed on an annual basis. Both figures are displayed in 1993 year dollars in Table 4-28. Capital investment costs are those expenditures for improvements such as campground construction and reconstruction, interpretive facilities, roads and trails. A more detailed explanation of these improvements can be found under the appropriate section for each within this document. Operations and maintenance costs are those necessary to maintain the facilities previously mentioned, as well as, costs required to carry out interpretive programs, law enforcement, fire protection, vegetation management and monitoring activities, wildfire suppression costs are not included in the estimate because they are highly variable.

Table 4 - 28

Alternative Budgets

	Alternative A	Alternative B	Alternative C	Alternative C-Modified	Alternative D
Average Annual Costs for Operations and Maintenance	$1,853,000	$1,274,000	$1,821,000	$1,746,000	$670,000
Total Capital Investment Costs (through first 10 years)	$17,020,000	$8,798,000	$14,706,000	$14,574,000	$7,200,00

Costs for vegetation management activities vary considerably among the alternative methods employed and among the different vegetation types where activities would occur. Underburning in ponderosa pine stands is estimated to cost about $100 per acre. If crushing by machine is required, prior to burning it would cost approximately $40 more per acre. Mechanical treatment in heavy lodgepole pine mortality (where it is necessary to reduce fuels prior to implementing a prescribed fire program) could be expected to cost more, but this might be offset by exchanging salvage materials for services via a service contract. Broadcast burning in lodgepole pine could be expected to cost about $200 per acre or $50 per acre if only concentrations of fuel (e.g. piles) are burned. Uneven-aged regeneration treatments or thinning using mechanical means would cost about $250 per acre (for these cases it might also be expected that some of the costs could be offset with salvaged material). In all cases, salvage material would be expected to be largely dead and/or small diameter trees. The value of salvage material was not considered in computing cost estimates.

Mitigation

Measures would include developing cooperative efforts and partnerships between the Forest Service and local communities that seek to market their services to Monument visitors, and working with Oregon Department of Transportation to reduce congestion and improve safety in affected areas.

Assumptions

Visitor use would grow by between 2% and 7.3% per year over the next decade.

The economy during this time period would be relatively static and made up of existing industries similar to today.

Communities closest to the Monument, especially those that are small and the least economically diverse, would be most affected by changes in Monument use.

15. American Indian Involvement

The intent and extent of involvement of American Indians in Monument activities and management would not differ significantly among alternatives. In all alternatives, The Klamath, Burns-Paiute, and Confederated Tribes of the Warm Springs Reservation would be consulted and involved in identifying and maintaining traditional uses of lands within NNVM, giving advice on potential disturbances and excavations of sites, and providing input for interpretive programs. (See also American Indian Involvement in Chapter 3 and Heritage Resources in Chapter 4.)

16. Special Uses

Direct and Indirect Effects

Alternative A: Some effects of implementing Alternative A would be more traffic, more visitors, and more noise and congestion in the caldera. A higher level of occupancy for Paulina and East Lake Resorts could result as more people come to visit the Monument. The quality of experience for those staying in the resorts, however, might be different from the relatively low-key experience provided at present levels of use.

Direct, indirect, and cumulative effects on other special uses would be minor. Summer home owners could see some increase in vandalism, if more visitors included people who vandalized others' property. Increased law enforcement, which would be needed under this alternative, could mitigate this problem.

Effects on fishing guides, snowmobile rentals, horse endurance rides, and other short-term events and activities would be minor. More people coming to the Monument could mean an increase in business for guides. The potential increase might be offset by a diminished experience if visitors perceive the Monument, and especially the caldera, to be overcrowded.

Effects on permanent right-of-ways, like the railroad, utility and gas lines, would be negligible. These facilities are "grandfathered" into the Monument. Their use will likely continue similar to present-day use, without major changes.

Alternative B: Some effects of implementing Alternative B would be a decrease in the number of visitors to the caldera because of reduced capacity to accommodate visitors. This could affect the occupancy for Paulina and East Lake Resorts in two different ways. If the resorts are perceived as being "civilized retreats" in a somewhat primitive area, and if they offer a high-quality experience, they could meet the demand of an increasingly urban population for a retreat to "get away from it all." Demand and occupancy could increase. The other possibility would be that if the Monument offers less in the way of interpretive programs or recreation opportunities, fewer people would stay at the resorts, buy meals, gasoline, fishing tackle, etc.

Effects on fishing guides, snowmobile rentals, horse endurance rides, and other short-term events and activities would be minor. Outfitters could attract more business from those seeking a guided experience in a relatively undeveloped area.

Effects on permanent right-of-ways, like the railroad, utility and gas lines, would be negligible. These facilities are "grandfathered" into the Monument. Their use will likely continue similar to present-day use, without major changes.

Alternative C and C-Modified: Some effects of implementing Alternative C or C-Modified would be some moderate increases in traffic, visitors, and noise and congestion in the

caldera. A higher level of occupancy for Paulina and East Lake Resorts could result as more people come to visit the Monument. The emphasis in these alternatives on education and interpretation could draw a new kind of clientele, who come to the Monument to learn and grow and explore. Examples might be university field classes, Elderhostel seminars for senior citizens, and others.

Direct, indirect, and cumulative effects on other special uses would be minimal. Summer home owners could see some increase in vandalism, if more visitors included people who vandalized others' property. Increased law enforcement, which might be needed under this alternative, could mitigate this problem.

Effects on fishing guides, snowmobile rentals, horse endurance rides, and other short-term events and activities would be minimal. More people coming in to the Monument could mean an increase in business for guides. If the Monument becomes well known as a place to learn and explore, outfitter-guides could tailor their trips to interpretive themes, and attract a wider audience than people just out for a recreational "good time."

Effects on permanent right-of-ways, like the railroad, utility and gas lines, would be negligible. These facilities are "grandfathered" into the Monument. Their use will likely continue similar to present-day use, without major changes.

Alternative D: The effects from the Alternative D would be similar to those observed today except that the number of visitors is expected to continue to grow, due to population growth and the popularity of Central Oregon as a vacation destination. Occupancy in the resorts would continue to increase. Outfitter/guides would continue to provide services to people who want their services. Special events, such as endurance horse rides would continue to be held once or twice a year.

Assumptions

The Forest Service will evaluate, on a case-by-case basis, any new requests for special use permits. Individuals or companies who have a service to offer in NNVM must demonstrate a real need and demand for the service, and show how their proposal enhances Monument values and goals.

All alternatives would take proper measures to protect Monument resources, including archaeology, geology, plants, animals, lakes, and scenic views.

17. Land Status

Direct and Indirect Effects

North and South Paula Roadless Areas

All Action Alternatives (A, B, C, and C-Modified): No new permanent roads are expected to be built in the roadless portions of NNVM in any of the alternatives, with the exception of a short (.8 mile) low-standard road for trail access in Alternative A (see Roads section). Any vegetative treatments in the roadless areas would focus on thinning and prescribed fire in order to create ecological mosaics on a landscape scale. Road building for treatments would be avoided (see Vegetation section). This would help provide habitat diversity for wildlife, while mimicking natural processes such as fire. Restoring ecological processes would be the primary goal. Since fuel loads in the roadless areas are at high levels because of a century of fire suppression, these treatments would create openings and diversity in what is now

a generally old and uniformly mature forest. Although the roadless areas are predominantly lodgepole pine, there are other forest communities present as well. At higher elevations, mountain hemlock are common; lodgepole pine mixes with ponderosa pine and white fir at lower elevations. The roadless areas within NNVM have a total of about 32,000 acres. (See Figure 3-4.)

Alternative A: Alternative A proposes to treat about 1,000 acres of lodgepole pine in the Monument in the first decade. The long-term (50+ year) total for lodgepole treated would be 6,200 acres. These treatments would include prescribed fire and mechanical thinning. A bit of this could occur in unroaded areas in the Flanks Zone, since that is where the majority of lodgepole pine forests are located; however, vegetation management in Alternative A would be focused around developed recreation sites and travelways, not in unroaded areas.

Alternative B: Alternative B proposes to treat about 1,350 acres of lodgepole pine in the first decade. Some of these stands would be in the roadless areas surrounding Newberry caldera. The long-term (50+ year) total acres treated would be about 16,000. These treatments would include prescribed fire and mechanical thinning, with the emphasis on mechanical treatments to provide optimum wildlife habitat and diversity.

Alternative C: Alternative C proposes to treat about 2,700 acres of lodgepole pine in the first decade. Some of these stands would be in the roadless areas surrounding Newberry caldera. The long-term (50+ year) total would be 20,000 acres. These treatments would include prescribed and prescribed natural (lightning caused) fire, with mechanical thinning only as absolutely necessary. The roadless areas have a total of about 32,000 acres.

Alternative C-Modified: This alternative was developed between draft and final, in response to public comments, especially concerning the extent of vegetation management. Alternative C-Modified proposes to treat between 170 and 760 acres of lodgepole pine in the first decade. A few of the these stands could be in the roadless areas surrounding Newberry caldera, if there were a compelling need to treat there (extremely high fire hazard, insect outbreak). However, the overall goal of this alternative is to stay out of the roadless areas unless absolutely necessary. The long-term (50+ year) total of acres treated in the lodgepole pine stands would be about 13,000. These treatments would include prescribed and prescribed natural fire, with mechanical thinning only when absolutely necessary. This alternative would rely the most on prescribed natural (lightning-caused) fire in the roadless areas, but not all natural fires would be allowed to burn.

Alternative D (no action) would feature minimal to no vegetative treatments in the roadless areas. Fire suppression would continue under present policies. Due to this fire suppression, fuels would build up to high levels in many parts of the roadless areas, making them more susceptible to insects, disease, or very hot, stand-replacing fires. This could impact the scenic and recreational attributes of these areas.

(See Recreation, Roads, and Vegetation sections of this chapter for more details on the effects of alternatives to the roadless areas.)

Other Lands Issues

In all alternatives, the Forest Service would continue efforts to negotiate a land exchange with private and state landholders who hold property in the Monument. The Mokst Butte Research Natural Area, as identified in the Forest Plan, would continue to be managed as an RNA under all alternatives. However, in Alternatives A, C, and C-Modified an easement would be established at the western end of the RNA for the Monument trail. The RNA's emphasis on science and research is consistent with Monument goals and values. In all alternatives, the

Special Interest Areas designations described in the Forest Plan (USDA Forest Service 1990) and shown in Figure 3-3 for Lava Butte, Lava River Cave, and Lava Cast Forest would be obsolete. All of the action alternatives (A, B, C, and C-Modified) would officially incorporate these designations into the Monument.

Potential for Cumulative Effects

Recreation Demand

Recreational demand in Central Oregon continues to grow as local and outlying population and tourism increases. Central Oregon is a popular recreation destination for Oregon residents as well as out of state, national, and international visitors. Recreational demand is expected to continue to increase faster than population growth (Oregon State Parks 1991). Eventually the demand for recreational opportunities will exceed the potential supply, as the recreational land base is fixed.

The Monument lies within this context and will be affected by continued growth trends. As visitor numbers increase, developed recreational opportunities (rural and roaded natural) have the potential to accommodate the most people; however, these opportunities satisfy only a portion of the public interest. There is also demand for primitive and semi-primitive recreational opportunities. For example, of the activities that take place in the Monument, the four that are expected to increase the most (between 1987-2000) in Central Oregon are nature and wildlife observation, day hiking on trails, outdoor photography, and non-motorized lake boating (Oregon State Parks 1991). Semi-primitive and primitive are the preferred settings for these activities (the Monument cannot technically supply a 'primitive' setting). This suggests a strong day-use trend emerging, as well as a demand for less-developed settings and less crowding. Semi-primitive opportunities, by nature, accommodate fewer people than rural and roaded natural.

There are short-term and long-term consequences associated with meeting or not meeting growing recreational trends. Assuming the projected growth rates (Runyan 1989, and ECO Northwest 1989) (see also Assumptions in Recreation, Chapter 4) the alternatives some of the key developed facilities can be expected to accommodate additional recreational demand for approximately the following number of years:

Table 4 - 29

Accommodation of Recreation Demand, in years

DEVELOPED FACILITIES	ALT A	ALT B	ALT C	ALT C-MOD	ALT D
Benham Falls	9	0	1	1	0
Lava Lands	12	9	14	14	4
Lava River Cave	12	12	12	12	12
Lava Cast Forest	20+	0	20+	20+	0
Caldera: Overnight Campgrounds	<1	0	0	0	<1

Numbers of years in the table are based on maximum estimates of visitor numbers.

As growth continues in Central Oregon, the cumulative impact of visitors will result in overcrowding of facilities or necessitate limiting visitor use. This will occur more quickly in Alternatives B and D and over a longer period in Alternatives A, C, and C-Modified.

Semi-primitive (summer) opportunities will also be affected by future growth trends. The relative availability of these areas as well as the amount of access into or adjacent to these areas will determine the long-term outcome. Semi-primitive experiences do not involve much visitor interaction. If large numbers of people begin to frequent a semi-primitive area, it will lose its ability to supply this experience. Permits and/or restricting visitor access would be necessary to manage use under these circumstances. Alternative A would decrease the acreage (compared to existing) of semi-primitive non-motorized (SPNM) lands. This alternative would greatly increase medium-to-high-standard access around the perimeter of these areas. Alternative A would have the lowest potential to supply long-term semi-primitive experiences (without user restrictions). Alternative B would increase the acreage of semi-primitive designations (both motorized and non-motorized). This alternative would slightly increase medium-to-high-standard access near and into some of these areas. Alternative B would have moderate-to-high potential to supply long-term semi-primitive experiences (with or without user restrictions). Alternative C and C-Modified would increase the acreage of SPNM. These alternatives would increase medium-to-high-standard access around the perimeter of these areas. Alternatives C and C-Modified would have a moderate potential to supply long-term semi-primitive experiences (it

would likely necessitate user restrictions). Alternative D would see no change in the acreage of SPNM. This alternative would not increase access into the Monument. Alternative D would have a moderate-to-low potential to supply long-term semi-primitive experiences.

In the winter, semi-primitive activities would be least likely in Alternatives A, C, and C-Modified (due to improved access), remain approximately the same in Alternative D, and increase slightly in Alternative B. The 10-Mile sno-park will be affected by how much activity is drawn to the caldera in the winter. Alternatives A, C, and C-Modified would have a portal facility that would be used in winter. Initially, this new portal could help alleviate some of the overcrowding at 10-Mile sno-park. However, in the long run, the portal facility could become overcrowded, too. In Alternatives B and D, overcrowding at 10-Mile sno-park would not be relieved, even in the short term, because no winter parking would be available at the portal location.

East Fort Rock OHV Area

An off-highway vehicle (OHV) recreation trail project was recently approved east of the Monument. This project will result in 318 miles of designated and maintained OHV trails. It will have two trailheads and three staging areas. It will decrease existing non-designated user trails by approximately 180 miles and close approximately 160 miles of forest roads (some of these roads are converted to trail). This project will span an area of approximately 110,000 acres east of the Monument with the closest point approximately two miles from the Monument boundary. Within this 110,000-acre area, OHV use will be restricted to trails. This project will increase OHV use in the area east of the Monument.

NNVM would be affected differently by the OHV Area in the various alternatives. In Alternative A, the cumulative effect of the OHV project on the Monument would likely be to increase the number of OHV riders entering Newberry caldera, as well as the numbers of riders crossing NNVM on the designated route in the Transition Zone to get to and from the OHV Area. In Alternative B, C, and C-Modified, the OHV Area would not affect the Monument as much; OHV riders would be required to go around the Monument rather than across it, if they were traveling to and from the OHV Area from the Highway 97 corridor (e.g. Sunriver). In Alternative D, the OHV Area probably would increase the number of riders using the Monument, except in the caldera where their entry would continue to be prohibited.

Roads

With the ever-increasing recreational demand on both the Forest and the Monument, continued uncontrolled access could lead to a decline in the recreational experience and to degradation of resources.

Due to the topography in the Transferal Area, if geothermal exploration begins in that area, roads would have to be built with switchbacks, involving large cuts and fills. These impacts would be visible from many viewpoints and it would be difficult to effectively restore and revegetate the area. Alternatives A, C, C-Modified, and D would allow for a "stub" road into the Flank Zone and would reduce this impact.

The Monument Scenic Drive in Alternative A would pass along the west flank of Newberry Volcano (outside the Monument and Special Management Area boundaries) in the general location where geothermal development is expected to occur. If not properly planned and sequenced, this road, in combination with roads to potential well pads and plant sites, could increase road density in the area with the potential to negatively affect wildlife and the visual

quality of the area. The geothermal development could provide interpretive opportunities for Monument visitors using this road; it could also detract from the desired visual and driving experience.

To varying degrees in different alternatives, the transportation system in and leading to the Monument would be designed, managed, and maintained to accommodate an expected increase in visitors. This would facilitate the flow of traffic and would enhance the experience of those visitors, while providing necessary resource protection. It could also increase potential for some kinds of resource damage such as disturbance of cultural resources or geologic features. Site-specific route location decisions could mitigate some of the potential for this kind of damage.

Alternative A: The Monument Scenic Drive would pass through the northwest side of the caldera where geothermal development is expected to occur. If not properly planned and sequenced, this road, in combination with roads to potential well pads and plant sites, could increase road density in the area with the potential to negatively affect wildlife and could negatively affect the visual quality of the area. Though the geothermal development could provide interpretive opportunities for Monument visitors using the MSD, the development could also detract from the desired visual and driving experience of the MSD.

Alternative B: Due to the topography in the Transferal Area, when geothermal exploration begins, roads would have to be built with switchbacks involving large cuts and fills. These would be visible from many viewpoints and would be difficult to effectively restore and revegetate.

Alternative C: Due to the topography in the Transferal Area, when geothermal exploration begins, roads would have to be built with switchbacks involving large cuts and fills. These would be visible from many viewpoints and would be difficult to effectively restore and revegetate.

Alternative C-Modified: Due to the topography in the Transferal Area, if and when geothermal exploration begins, roads would have to be built with switchbacks involving large cuts and fills. These would be visible from many viewpoints and would be difficult to effectively restore and revegetate.

Alternative D: With the ever-increasing recreational demand on both the Forest and the Monument, continued uncontrolled access could lead to a decline in the recreational experience and to degradation of resources.

Due to the topography in the Transferal Area, when and if geothermal exploration begins, roads would have to be built with switchbacks involving large cuts and fills. These would be visible from many viewpoints and would be difficult to effectively restore and revegetate.

Vegetation

The Monument contains the pumice grape-fern, *Botrychium pumicola*, a sensitive plant species that grows in pumice soils, generally in frost pockets. Potential habitat for an additional 12 sensitive plant species also occurs within the Monument. Adverse effects to these species as a result of management actions on the Monument could affect overall species/community abundance over their range. This is especially true for the pumice grape-fern and possibly true for *Artemisia ludoviciana* ssp *estesii*, a probable in habitant of the Monument. All alternatives would protect known populations. Alternatives that provide for the most vegetation management and recreation activities will have the greatest probability of affecting potential habitat (positively or negatively) for sensitive species.

Examining the age (including vegetation size and structure) of vegetation communities at the landscape level and higher also helps to assess cumulative effects. Taken together, the diversity and abundance of plant species and vegetation age define overall biodiversity. Cumulative effects on more common plant communities will therefore depend on management activities taking place on surrounding state, county, and private lands. Lands administered by the United States Forest Service are located directly adjacent to most of the Monument. These lands lie predominantly within the General Forest and Scenic Views management areas of the Deschutes National Forest. Activities on these lands frequently call for uneven-aged management of ponderosa pine and even-aged management of lodgepole pine. Much of the lodgepole pine has incurred heavy mortality from the mountain pine beetle. Many areas have been salvaged and are regenerating to new stands of trees. The Monument also borders the 13,000-acre Paulina fire. Much of this area burned at a high intensity, and tree regeneration is spotty because the fire destroyed most seed trees. Planting has reforested much of this areas.

The Monument has the opportunity to manage vegetation much differently than adjacent federal, state and private landowners because the objectives for managing the area include the restoration of old-growth ponderosa pine and the re-introduction, where possible, of "natural" ecological processes.

All alternatives, to varying degrees, provide areas where vegetation management activities (including prescribed fires) would not take place. Suppression activities would occur when wildfire threatens human safety or resources outside or within the Monument. Low-impact suppression methods would be used, where possible.. Unmanaged areas could provide diversity against the backdrop of vegetation management on lands that surround the Monument. At any given point in time, however, these areas might appear more homogeneous (for example, following a high intensity wildfire), leading to reduced diversity.

Alternatives that provide for vegetation management (all alternatives except Alternative D) could also have the effect of increasing landscape level diversity. Alternatives A, B, C, and C-Modified re-introduce fire as an agent of disturbance in varying amounts. In ponderosa pine forests, open and park-like stands would provide added diversity at a landscape level (highest in Alternative C in the first 10 years, with much smaller amounts in Alternatives A, B, and C-Modified). The amount of land managed in this manner currently and in Alternative D would be small, even when viewed at a regional scale.

Burning to create mosaics in lodgepole pine would not create a distribution of ages much different than in the surrounding, managed forest land. The amount of this activity would be highest in Alternatives B, C, and C-Modified and lowest in A. The use of prescribed fire would make treated lands appear more natural, however. Burning would mimic "natural processes" more closely and could provide important but subtle differences from surrounding land, where timber harvesting is extensive. Alternatives that create mosaics of sizes, ages and species composition through management activities will provide sustained levels of different vegetation conditions over time and space.

The implementation of large amounts of uneven-aged management, as in Alternative B, could contribute to increased diversity through an increase in vertical structure (multi-layered canopies, etc.). When coupled with the large amounts of uneven-aged management in ponderosa pine outside of the Monument, the amount of horizontal diversity over the entire landscape would be limited.

Old-growth forest vegetation is currently unique at all scales. Small areas are scattered across the landscape at fairly regular intervals on National Forest Land to meet the minimum needs of wildlife species that inhabit such areas. All alternatives would provide old-growth

vegetation in size and structure that would continue to meet the needs of these species. All alternatives would, in addition, provide large amounts and various conditions of old growth, especially in ponderosa pine and mountain hemlock. The rate at which old-growth characteristics are achieved will differ based on the rate of management activities.

Fish and Wildlife

Flows in the Deschutes River could probably change with implementation of the Wild and Scenic River Plan. While the Forest Service does not have decision authority for instream flow levels, the Wild and Scenic Rivers Management Plan for the Deschutes may make recommendations regarding instream flows. If such recommendations were implemented, the changes could affect water depth, water depth fluctuations, and surface water area in the ponds on the east side of the river. Water depths could decrease, reducing habitat for young fish by up to 25 acres from the present. Although habitat area would be reduced, fewer fish would be trapped in the ponds when water levels in the river drop at the end of the irrigation season. The net effect would be to increase survival of young fish in the river.

Decreased maximum water depth in the ponds east of the Deschutes River would reduce open water habitat for other aquatic animals, such as amphibians and insects. The ponds would be smaller, and their water levels would be more stable. For the ponds which are linked to the river by surface flows, river water flowing into the ponds would carry less silt, so the gradual silting-in of the ponds would be reduced. Although the net area of open water habitat would be reduced, water quality would improve. Additionally, with more stable water levels, emergent vegetation could increase, improving habitat diversity for amphibians and aquatic insects.

Oregon Department of Fish and Wildlife, in cooperation with other agencies including the Deschutes National Forest, is developing a fisheries management plan for the upper Deschutes River basin. The plan will address objectives for management for all the fisheries. Although changes in objectives for other lakes and rivers may affect angling pressure in East and Paulina Lakes or Paulina Creek, it is unlikely that the changes would have effects outside the range analyzed in the Monument plan. The ponds would also be more suitable nesting habitat for some waterfowl because water levels will not fluctuate as widely. The potential that nests would be flooded by high water levels would be reduced.

The Oregon Health Division issued an advisory recommending that people limit their consumption of fish from East Lake due to high mercury levels in the fish. One effect of the advisory could be that fewer people come to fish at East Lake; a second effect is that fewer fish will be taken from East Lake. The reduced fishing pressure would have an indirect effect on wildlife which prey on the fish. There would be less competition for the fish, probably leading to greater fishing success and less disturbance to the osprey and bald eagles.

Interpretation

Relationship to Other Interpretation in the Region

All of the action alternatives contribute significantly to interpretive programs offered in Central Oregon. The strength of NNVM's programs on American Indian heritage and geology--particularly in Alternatives C, C-Modified and A--would complement the pioneer West, wildlife, and art exhibits of the nearby High Desert Museum especially well. Alternative C and C-Modified's emphasis on hands-on nature study and provision for an educational group campsite would fill an important need for effective, economical environmental education in the region. The science focus of C and C-Modified would also integrate well with the expected

future development of a High Desert Forestry Learning Center by the Forest Service, adjacent to the High Desert Museum. Interpretation in Alternative B, with its attention to vegetation management for wildlife habitat, would also coordinate nicely with the Forestry Learning Center. In addition, Alternative B would respond best to the growing demand for wildlife watching in semi-primitive settings in Oregon and Central Oregon (Oregon State Parks, 1991; see also Recreation Trends in Chapter 3). The interpretive program in Alternative D would fail to meet regional and statewide needs and continue to operate as a "weak sister" to neighboring educational attractions.

Heritage Resources

Past management and recreational activities, as well as deterioration by natural forces, have disturbed and at times destroyed some of the cultural properties on the Monument. Timber harvesting, road construction, recreational facilities, mineral exploration, gas transmission lines, and illegal collecting of artifacts -- all have reduced the cultural resource date base over time. These activities result in a cumulative effect to cultural resources and the information they contain.

When a proposed project is found to have an effect on a cultural resource property, potentially adverse effects to the resource are mitigated through a variety of methods. Avoidance and data recovery are the most commonly used forms of mitigation. Data recovery can result in the recovery of data for scientific purposes but it also destroys the site and the potential for answering future research questions when techniques may be available. It will always be necessary to preserve a sample of cultural resource sites intact, if only for this very reason.

The cumulative effects to cultural resources both inside and outside of the Monument is essentially the same but only varies by degrees within the different alternatives and by various land management practices. Information on the history and lives of past peoples in Central Oregon and on a broader global basis, may be unavailable for future understanding. A resource can be lost because it was never identified in the first place, or was left unrecorded, or vandalized. The loss of cultural resources outside of the Monument also results in the loss of information, often valuable for comparative resource studies and resulting in an effect to the cultural resource data base and the ability to fully understand the resources within Central Oregon and within the Monument.

Alternatives that emphasize more recreational development and other improvements such as vegetation manipulation, road construction and trails have the potential for causing the greatest long-term cumulative effects to a non-renewable resource. However, these same alternatives also provide a greater opportunity for discovering sites through cultural resource inventories and increasing the scientific knowledge of the resource through evaluation and data recovery. In areas of extremely sensitive and significant resources, the effects of recreational activities could force trade-offs between cultural resources and recreational activities. More evaluation and mitigation, such as data recovery rather than avoidance, would be necessary. This would also increase the cost of managing those resources.

The cumulative effect of cultural resource losses by direct or indirect effects, intentional or unintentional theft and destruction, or through data recovery all result in the cumulative loss of the cultural resource data base. This can occur without full or partial knowledge of the meaning of the resources' significance and what it can tell us about our past and our future.

Geology

The geologic resources within Newberry National Volcanic Monument include some of the youngest and best-known features on Newberry Volcano. Every ground-disturbing activity has some potential to affect the geologic resources of the Monument. Activities outside the Monument can affect understanding of the geological events that occurred within the Monument by destroying evidence of these events. There is no adequate compensation for the physical loss of geologic resources because there is no way of predicting what will be important about the resource in the future when new methods of scientific study may have been developed. Scientific study of a site today only records what we recognize as important today and could destroy the rest of the information.

Air Quality

Smoke: Trends in vegetation management in Central Oregon, combined with the long-term effects of the action alternatives, would reduce impacts from smoke. For example, the practice of burning wood waste, or "slash," left after logging operations has become much less common in recent years. Most of the material that was burned in the past is now used to make pulp and paper. Much of the rest is burned in cogeneration plants to wood-products mills in Central and Eastern Oregon. These changes have substantially decreased wood smoke emissions in the region. Prescribed burning (e.g. of naturally accumulated fuels on the forest floor) is gaining in popularity as a method of vegetation management on the Deschutes National Forest and on nearby public lands. As a result, the wildfire hazard has decreased in some areas near the Monument, and less impacts occur from unplanned smoke. The cumulative effects of these practices, coupled with the long-term impacts of vegetation management strategies in Alternatives B, C, or C-Modified, would markedly reduce overall smoke and PM_{10} emissions in the Monument area.

In the first ten years in Alternatives A and C-Modified, however, prescribed burning in the Monument would likely add to the total smoke emissions in the area.

Impacts from wood smoke produced by home heating in Central Oregon are expected to remain constant over the next 10-15 years. Although the proportion of homes that burn wood will probably decrease, effects to air quality are expected to be offset by population growth.

Motor-vehicle exhaust: Increased visitation in the Monument would result in more motor vehicles traveling to and from NNVM on Central Oregon's highways. Emissions from these vehicles would have cumulative effects to the area. Alternative A could accommodate the largest number of visitors. Therefore, we can expect the greatest contribution to motor-vehicle emissions on Highway 97 and in Bend, La Pine, and Sunriver in Alternative A. Alternatives C and C-Modified would contribute less than A; B and D would contribute the least.

Dust: Several types of activities adjacent to NNVM could cause dust emissions in the area which, when considered together with airborne dust originating inside the Monument, could cause potential significant affects to air quality. For example airborne dust is generated by off-road vehicle use in the area. Many trails used by all-terrain vehicles (ATV's) are located just a few miles east and southeast of the Monument, within the Deschutes National Forest. The Forest Service plans to reduce the number of miles of these trails, which could decrease the total amount of dust generated. However, the trails' popularity is expected to increase, pending their designation as a formalized trail system. The overall effect on dust is uncertain. Dust from these trails could be visible at times from viewpoints in the Monument, such as Paulina Peak. However, prevailing winds would keep most or all of this dust outside the Monument

boundaries. Timber harvesting and other management activities adjacent to NNVM could also contribute dust and impair visibility from viewpoints. Such effects would be limited in duration.

Scenery

The scenic quality of lands adjacent to the Monument could potentially affect the Monument either by contributing to the "sense of arrival" at the Monument, or by being visible from internal viewpoints. Elements that could potentially affect scenery include: wild and prescribed fires, timber harvest, structural developments, and air quality.

Fire is a natural part of the forest ecosystem and will continue to occur within and outside of the Monument. Within the Monument the direction for managing fire is discussed in an earlier section. Outside of the Monument it is assumed that fire suppression will continue as it has been in the recent past; Newly burned areas ranging from very small areas to thousands of acres will continue to evolve in the surrounding landscape. There is no reliable method of predicting where a severe wildfire might occur and effect one alternative more than another. Therefore, the effects of fire on the visual quality on adjacent lands will be relatively similar in all alternatives. The effects of vegetation management, including prescribed fire, within the Monument are discussed under scenic condition (Chapter 4, Scenic Quality).

There are both private and public lands visible from within and in route to the Monument. It is assumed that a part of these lands will continue to have timber harvest activities and that the resulting visual effects (change in form, line, color, and texture) will be evident from some viewing locations within the Monument. This is most likely in forested areas characterized with lodgepole pine as management activities in these areas are generally more evident.

Nearby Geothermal Activities

A proposal for geothermal development in the area west of Paulina Lake, outside of the Monument has recently been approved (USDA Forest Service 1994). Surface developments are excluded from NNVM and the Special Management Area; however, subsurface development (wells) are allowed beneath the Special Management Area. Various measures will be required of the developer to mitigate environmental effects of this project. This project could still affect the Monument in a variety of ways:

ACCESS & RECREATION: Any roads to and around the power plant and well pads that were plowed and open to the public in the winter could attract recreationists, such as snowmobilers and nordic skiers. This would create new winter use patterns in the Monument and Special Management Area. Any new roads that are built in currently unroaded areas for geothermal development will be closed to the public.

Geothermal development could affect or displace dispersed recreation activities that currently occur in the project area. Recreationists near the development could at times see, hear, and/or smell the effects of the project.

INTERPRETIVE: Development of Oregon's first geothermal powerplant on the flanks of Newberry Volcano would provide opportunities to interpret geologic processes and energy technology for the Monument's visitors. Such interpretation would be most appropriate in Alternative A, because of improved access near the geothermal site along the Monument Scenic Drive, and in Alternatives C and C-Modified, because of their educational/scientific focus. Geothermal development would be less consistent with interpretive programs in Alternative B,

which emphasizes semi-primitive settings and activities. Geothermal resources would probably still be interpreted to some degree in both Alternatives B and D.

NOISE: Different types of noises not characteristic of a forest setting might occasionally be audible at some campground, at Paulina resort, on some trails near the development, and at one or two day-use facilities. Noise levels are not expected to exceed Oregon Department of Environmental Quality standards.

NIGHT LIGHTING: From some places within NNVM, night illumination of the geothermal project sites could decrease the nighttime level of darkness normally expected in a forest setting. Night glow of the power plant could be visible from Paulina Peak. Night lighting will be selected and designed to reduce these potential impacts.

ODOR: Odors associated with geothermal activity (primarily hydrogen sulfide's "rotten egg" smell) would be perceptible for short durations, a few times a year at most. Detection would be most likely at sites near Paulina Lake. The same odor also occurs naturally, in the vicinity of hot springs and fumaroles in the caldera. An odor complaint program will be implemented by the Forest Service to log any complaints by visitors or people in the area. If the number of complaints is significant and related to the geothermal development, additional mitigation would be required of the developer.

VISIBILITY: Geothermal development would include construction of a power plant and supporting facilities such as well pads, transmission lines, fences, and pipelines. Some of these elements might be visible from some points within NNVM (e.g. Paulina Peak and the Rim trail), as well as from access roads into the Monument (Highway 97 and Road 21). In addition, steam plumes will be visible at times from some points within and outside the Monument (e.g. from Paulina Peak and Highway 97). Where visible, these features could change the scenic condition and character of the forest environment. (See also Air Quality below.)

AIR QUALITY: Air pollutants from geothermal drilling and power production have the potential to contribute to overall changes in air quality within NNVM. Based on modelling using a predicted reasonable composition for the geothermal fluids (USDA Forest Service 1994), emissions associated with geothermal development (e.g. hydrogen sulfide, mercury, arsenic, boron, and other trace metals) are expected to be small enough that they would not have significant impacts on the health of humans, wildlife, plants, or other living things within the Monument.

Fugitive dust will likely be apparent during construction of the power plant and well pad facilities. This dust may affect visibility and PM_{10} concentrations within the caldera if winds are blowing from the west, which is especially common in the early morning hours (SAIC 1993). This dust, along with that generated on dirt roads inside and outside NNVM, may be noticeable from Paulina Peak and reduce visibility of the Cascade range at times. Continued geothermal exploration outside NNVM on leases west and northeast of Newberry caldera may also create short-term dust emissions.

Motor-vehicle exhaust would also be generated during construction, maintenance, and operation of the geothermal site. Like dust, these emissions may enter the Monument and Newberry caldera, depending on wind conditions. These air-quality impacts are not expected to be cumulatively significant.

WATER QUALITY: No significant cumulative effects are anticipated, based on the modelling conducted for the geothermal EIS (USDA Forest Service 1994). The natural chemistry of Paulina and East Lakes will buffer the small amounts of sulfate precipitates predicted, eliminating the possibility of acidification. Deposition of mercury, boron, arsenic, and other particulates from geothermal emissions could increase the concentrations of these

elements in Paulina and East Lakes; however, any increases are expected to be small. Only the projected increase in mercury is anticipated to be detectable by currently available water analysis methods. Levels of some metal ions (e.g. mercury and arsenic) are already high in the lakes relative to other high-elevation lakes in the Western U.S. (EPA 1987), due to natural input from the hot springs (see Water Quality in Chapter 3 and Appendix B).

FISH: No effects on fish are anticipated based on modelling of emissions from the development. Substances which could affect fish and other resources that depend on fish include hydrogen sulfide, arsenic, and mercury. Geothermal operations and design include mitigation to eliminate or reduce potential effects of these substances (see Water Quality above and in Chapter 3). The geothermal project is not anticipated to cause significant increases in the baseline levels of mercury in fish in East and Paulina Lake.

WILDLIFE: The geothermal development would increase roads and human activities year round. Effects on elk and mule deer will be to displace them from high-activity areas, causing them to spend more time in the Monument or in timber management areas to the west. Displacement could be daily during spring, summer and fall, depending on the patterns of operation. With the increase in roads, deer and elk will have greater dependence on the hiding cover and unroaded security provided in the Monument. Effects on elk and deer hunters will be to create more road access (assuming some of the new roads would be open), which will increase hunter density. About 10% of the hunting activity will be displaced from the development areas (ECO Northwest 1989) to other parts of the Fort Rock District or the Monument.

No effects on bald eagles are expected to occur from geothermal activities. Potential effects to their prey (primarily fish) are not anticipated. The levels of mercury already in fish in East Lake are not expected to increase significantly due to geothermal project development, based on the modelling conducted for the geothermal EIS (USDA Forest Service 1994). Mitigation measures include monitoring emissions from the wells and plant, and reducing them if it is found that they may cause increases in mercury levels in eagle prey.

Incomplete/Unavailable Information

Predictions of effects were made with the most current information available. The following information is either unavailable or incomplete. However, none of this information is essential for the decision maker to make a reasoned choice among the alternatives for a Monument Plan.

Recreation

The capacity, type, and level of dispersed recreational use in undeveloped portions of the Monument is not well known. Visitation and occupancy rates at some developed recreation areas in the Monument (including boat use on the lakes and trail use) are also unavailable. Specific information pertaining to boat sizes is not known at this time; however, the general range is use is 12'-16' long with a 21' maximum. All references that discuss "smaller" and "larger" boats are intended to fall within (or smaller than) this range.

Visitor preference for recreational experiences within the Monument and patterns of visitor use (including indicators of "overdevelopment"). Future demand for recreation inside of the Monument (with exception of the caldera). The effect of the quality of recreation experiences on visitation.

Vegetation

Vegetation conditions and their extent prior to EuroAmerican habitation are not well known. Techniques for developing or enhancing old-growth characteristics and providing for sustained old growth, including those for mountain hemlock, are not fully understood. The complete effects of management vegetation activities on fungi and soil microbes are also unknown.

Fish and Wildlife

Prebles shrew, a Category 2 species (see glossary), may occur near East or Paulina Lakes. Information on habitat relationships and on its populations in eastern Oregon is being collected. During site-specific project planning, information about habitat relationships would be included with local habitat surveys to assist with any decisions made.

Mercury levels may exceed the Oregon Department of Environmental Quality and Environmental Protection Agency standards for protection of aquatic life in East and Paulina Lakes. Whether these levels are affecting aquatic life is not known. None of the alternatives would affect mercury levels. Fish in East Lake have mercury levels averaging 0.6 parts per million (ppm). Research in other areas where fish had 0.5 ppm mercury levels found no correlation between bald eagle productivity and mercury in their fish prey (Bowerman 1994). It is unknown at this time if the mercury concentrations in fish in East Lake are affecting bald eagle productivity.

Interpretation

Data on the preferences of current Monument visitors for different types of interpretive experiences.

Data on the amount of semi-primitive interpretation, such as self-directed discovery, currently taking place in NNVM.

Data on the effectiveness of past or current interpretive programs in the NNVM area on resource protection (e.g. changes in rates of vandalism, accidental damage, or disturbance).

Heritage Resources

Some information about heritage resources within the Monument is unavailable, and offers opportunities for further research, including:

- Cultural resource inventory information that is non-project related.
- Analysis or written reports of some past cultural resource testing, evaluations and data recovery projects.
- Some cultural resource site records for the entire Monument.
- Glacial and post-glacial geological information about the Monument, especially as it relates to past climatic changes, eruptive sequences and dates, the origin of the two lakes in the caldera, and lake level fluctuations.
- Chemical signature information of obsidian found within the Monument. Especially "exotic" obsidians that have not been sourced to date and also distinguishing the signatures between local sources.
- The type and extent of illegal artifact collecting or looting within the Monument.
- How the early American Indians changed the environment and how such changes affected the subsequent use of the Monument.
- Oral interviews about places and sites in the Monument in an historic context with local people.

- Traditional cultural properties used in the past or currently being used, within the Monument.
- The effects of modern vegetation practices on cultural resources, for example, subsoiling. The potential effects to cultural resources would be addressed at a site specific level.

Geology

A detailed inventory of geologic resources within the Monument is not available. Current information resides mainly with two individuals and has been gathered largely on their own time or as a side benefit of other project work due to a lack of funding for inventory.

Air Quality

Although PM_{10} are clearly harmful to humans who inhale them, the health effects of wood smoke, which contains hundreds of toxic chemicals in addition to fine particulates, are not well known. It appears from recent studies that PM_{10} are hazardous to human health at levels below 10-15 micrograms per cubic meter. There may or may not be a threshold value, below which PM_{10} are harmless.

Methods for calculating incremental effects to air quality, in order to evaluate compliance with regulations for Prevention of Significant Deterioration (PSD) are not clearly stated in the Oregon Administrative Rules and are not routinely enforced in the state, except for permitting industrial facilities. Monitoring for changes in air quality would be done under any alternative. Unacceptable change would be corrected through management practices or restrictions on use.

Water Quality

The Deschutes River ponds have not been studied, and their water quality is unknown. We have inferred some information on the ponds from Deschutes River data on dissolved oxygen, Ph, and turbidity.

We do not fully understand the hydrologic system in the Monument, especially in the caldera. We do not know how groundwater circulates and migrates, for example between the two lakes. We do not know the condition of existing septic systems and their effectiveness in treating wastewater. This will be studied and monitored. We do not know the levels of bacteria or other sewage-induced elements in the lakes. (There has been no testing for coliform, nitrates, or nitrites.) It is not certain if water quality in the lakes is deteriorating, and we do not know how much human impact they can absorb and still remain relatively clean and clear. Monitoring for changes in water quality would be done under any alternative. Unacceptable changes would be corrected through changes in management practices or restrictions in use. We do not know whether levels of mercury occurring naturally in the lakes exceed the State of Oregon Standard for protection of aquatic life. This may be determine in future monitoring.

Scenic Quality

Site-specific detailed comprehensive evaluations of past management activities and field verifications of potentially-seen area viewsheds are unavailable.

Specific information as to the location of vegetation management activities that are not mapped in the Forest GIS database is unavailable. Each future project will require a site specific analysis in order to evaluate for consistency with the Legislative direction regarding scenic quality and with the Visual Quality Objectives (VQO's).

Information about the perceptual effects and effects on scenic quality with regard to managing with fire (primarily in lodgepole and mixed conifer forests). The size and scale of burned areas and or openings with regard to managing these types of communities is not clear at this time and therefore cannot be evaluated. (This will be monitored as projects are designed and planned.)

The site-specific location of new facilities and travelways is not known. Specific impacts for each project will not be known or evaluated until a site-specific analysis is conducted.

Local Communities

Future demand for recreation opportunities at NNVM.

Detailed community- and industry-specific information on economic effects of the alternatives.

Other Environmental Effects

Short-term Use Versus Long-term Productivity

Short-term use of the land includes the day-to-day and even year-to-year activities that visitors and Forest Service workers undertake while in the Monument. It includes both activities that physically remove resources from the land, such as fishing, hunting, and pine cone gathering as well as activities that simply occur on the land, such as scenery viewing, hiking, photography and bike riding. Short-term actions also include management activities like facility construction and vegetation treatment.

Long-term productivity refers to the land's continuing ability to produce for future generations the things people consume (such as fish, wildlife, water, and plant products) as well as the amenities they enjoy (like scenery, wildlife watching, and recreation opportunities). The land's ability to produce these things depends on our ability to manage it and use it in a way that does not: impair soil productivity, air quality or water quality to the point that habitat is lost; alter the natural landscape beyond its ability to recover; or change geologic features to the extent that they lose identity.

In creating Newberry National Volcanic Monument, Congress specifically recognized its unique geological, ecological, botanical, scientific, scenic, recreational, cultural, and fish and wildlife values. Management decisions for NNVM must be based on ensuring the land's continuing capability to provide these values over the long term.

- The continued build-up of natural fuels within the Monument increases the risk of catastrophic wildfire, which in turn could affect our long-term ability to maintain the ecological, botanical, scenic, and recreational values for which it was established (all alternatives).
- Increasing access to the Monument with new roads, trails, campsites and facilities would affect long-term soil productivity through loss of vegetation and soil compaction. Over the long term, increased access could reduce wildlife habitat for some species as a result of more disturbance (Alternatives A, C, and C-Modified).
- Short-term use of prescribed fire and mechanical treatments to reduce natural fuels and move ponderosa pine stands toward an old-growth condition would change wildlife habitats over both the short and long term. Habitat components such as hiding cover for deer would decrease. On the other hand, habitat would increase for species that thrive

in fire-based ponderosa pine ecosystems, such as white-headed woodpeckers and flammulated owls (all alternatives).

- Increasing the number and capacity of campsites, campgrounds and/or boating facilities within the caldera could affect water quality of the lakes and the creek over the long term. Increases in accidental boat fuel spills, bank sloughing from more wave action, and/or pollution of lake and creek water from careless camping practices could all contribute to a long-term decrease in water quality.

Unavoidable Adverse Effects

Implementing any alternative would result in some adverse environmental effects that cannot be avoided. Standards and guidelines and mitigation measures are intended to keep the extent and duration of these effects within acceptable levels, but adverse effects cannot be completely eliminated. The following adverse environmental consequences are associated to some extent with all alternatives.

Recreation: Loss or reduction of some opportunities because of development and/or management for other kinds of recreation opportunities or other resource objectives.

Vegetation and Plant Habitats: Reduction of some vegetation and plant habitats as a result of road, trail, or facility development, recreational use, wildfires, and/or vegetation treatments.

Reduction of habitat for some plant species as a result of ecological changes resulting from non-native species.

Roads and Facilities: Deterioration of roads, trails, and facilities resulting from more visitors and higher use levels.

Fire: Increase in fire hazard from increasing vegetation, coupled with higher levels of dispersed recreational use.

Fish and Wildlife: Reduction in habitat for some species as a result of vegetation treatments and construction of trails, roads, or facilities.

Displacement of wildlife when their habitat is disturbed by recreation use, vegetation treatments, or trail, road, and facility development.

Archaeology and Geology: Disturbance of prehistoric or historic evidence of human occupancy of the lands within the Monument resulting from trail, road and facility development; habitat management and vegetation treatments; and inadvertent or deliberate disturbance by visitors.

Inadvertent or deliberate destruction of geologic features or cultural sites by visitors to the Monument.

Scenery: Short-term reduction in scenic quality as the result of vegetation treatments, road, trial, or facility construction, or wildfires.

Air Quality: Short-term reductions in air quality from dust, smoke and vehicle emissions resulting from construction of trails, roads, or facilities; vegetation treatments; recreational use; and wildfires.

Water Quality: Potential for inadvertent spills of motor-vehicle fuel and oil near shorelines or in the lakes affecting water quality.

Research and Monitoring: Some reduction in scenic quality or recreation opportunities resulting from temporary or permanent installation of research and/or monitoring equipment (such as weather stations or water wells).

Irreversible or Irretrievable Resource Commitments

The term "irreversible resource commitments" describes the loss of future options. It relates primarily to nonrenewable resources, such as minerals or cultural resources, or to factors, such as soil productivity that are renewable only over long periods of time. Some examples of irreversible commitments include disturbance of archaeological sites, loss or destruction of significant geologic features, or the loss of critical habitats.

"Irretrievable resource commitments" applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. Other examples of irreversible resource commitments could include the loss of developed recreation opportunities in areas where wildlife habitat is the emphasis, or conversely, the loss of wildlife habitat opportunities in highly developed recreation areas. The production or use lost is irretrievable, but the action is not irreversible.

Irreversible Resource Commitments

All the alternatives would include standards and guidelines designed to protect resources that could be irreversibly affected. Nevertheless the potential for some irreversible loss remains, with the primary ones noted below:

- Soil-disturbing activities related to recreation uses and development, and vegetation treatments could result in the loss of soil productivity and cultural resources, in all alternatives.
- Fossil fuels used by Forest Service workers in managing the Monument and by visitors to the Monument is an irreversible resource commitment. Alternatives A, C, and C-Modified, which encourage higher levels of roaded access and visitation, would cause more fossil fuel consumption.
- Contamination of surface water and/or groundwater is an irreversible commitment that is more likely under those alternatives promoting higher levels of recreation use (Alternatives A, C, C-Modified, and D).
- Inadvertent or deliberate destruction of unique geologic features such as tree molds is an irreversible commitment also more likely under alternatives that promote higher levels of recreation use (Alternatives A, C, C-Modified, and D).

Irretrievable Resource Commitments

All four alternatives contain irretrievable resource commitments. They are unavoidable because managing resources for any given purpose necessarily precludes the opportunity to use those resources for other purposes. The major irretrievable resource commitments are listed below.

Recreation: Managing areas of the Monument for developed (and to some extent, dispersed) recreation reduces opportunities to manage them for wildlife and/or plant habitat. Managing some parts of the Monument for developed recreation precludes opportunities to manage them for dispersed recreation. Managing parts of the Monument for summer non-motorized forms of recreation precludes opportunities for motorized recreation in these areas. Increasing recreation access reduces opportunities for more quiet, remote, solitude-dependent forms of recreation. Increasing guided and attended forms of interpretation in some parts of the Monument reduces opportunities for self-guided discovery in those same areas.

Vegetation and Plant Habitats: Managing some areas of the Monument to create historic, "park-like" stands of old-growth ponderosa pine reduces opportunities in these areas to provide certain wildlife habitat components such as deer browse and hiding cover.

Managing some areas for "ecological" old-growth reduces opportunities to provide the historic old-growth ponderosa pine habitat preferred by such species as white-headed woodpeckers and flammulated owls.

Managing some areas to reduce fire risk reduces some scenic quality and wildlife habitat components, such as dead/downed wood and deer hiding cover.

Managing some ares in the Monument to provide protection for sensitive plants reduces some recreational opportunities such as hiking.

Managing areas of the Monument to provide certain vegetation or habitats reduces some recreational opportunities associated with facilities such as developed campgrounds and visitor centers.

Roads and Facilities: Building additional trails, roads, and facilities precludes opportunities to provide vegetation and wildlife habitat on these sites.

Fish and Wildlife: Managing wildlife habitats to favor certain wildlife species may reduce habitat opportunities for other species.

Managing areas to provide wildlife habitat for sensitive and/or easily disturbed species may reduce both developed and dispersed recreation opportunities in those areas.

Minorities and Women

The primary effect of the alternatives on minorities and women would be through changes in job, outdoor recreation opportunities, and educational opportunities provided by interpretive programs. Job opportunities would vary in terms of Forest Service jobs and contracts for goods and services, and also, in terms of local jobs created in response to Monument recreational outputs, payments to counties, and other expenditures. Forest Service policies ensure employment and contracting opportunities for people without regard to race, color, religion, national origin, sex, age or physical/mental disability. Although these policies would continue under all alternatives, the number of agency and contracting jobs would vary with program emphases and associated funding levels on the Monument (See Introduction to Chapter 4).

Recreation opportunities and educational opportunities available through interpretive programs on National Forest lands are also available to people without regard to race, color, religion, national origin, sex age or physical/mental disability. The types, amounts and locations of various recreation opportunities at Newberry National Volcanic Monument would vary depending on the alternative implemented (See Recreation Chapter 4).

Consistency With Other Plans and Policies

Plans and policies of various federal, state, county and city agencies were reviewed for consistency with alternatives described in this EIS. All alternatives were determined to be consistent with the 1980 Resource Planning Act, National Clean Air Act, the policies of Oregon Department of Forestry, and the policies of the Oregon Department of Environmental Quality. The following plans and policies are addressed more specifically:

Plant/Fish/Wildlife Habitat: No actions are proposed in the alternatives that would conflict with plant, fish, or wildlife habitat management plans of the U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife (ODFW), the Oregon Natural Heritage Program, or the Deschutes National Forest Land and Resource Management Plan. Existing

populations of all proposed, endangered, threatened and sensitive plant species would not be jeopardized in compliance with Forest Service policy (FSM 2670).

Oregon Department of Fish & Wildlife: All alternatives would meet ODFW goals by maintaining special habitats. Special protection to these habitats would be provided in some alternatives through more restrictive standards and guidelines. The Newberry Crater wildlife refuge established in cooperation with ODFW would remain, with slight boundary changes that have been proposed with ODFW concurrence. Hunting is permitted elsewhere in the Monument in concurrence with ODFW objectives.

U.S. Fish and Wildlife Service Recovery Plans: Bald Eagle - All alternatives would meet recovery plan objectives of protecting important foraging and nesting areas. Alternatives which are expected to increase recreation levels substantially (Alternatives A, C, and C-Modified) may slightly reduce suitability of lake habitat for foraging eagles.

Cultural Resources: All actions would comply with federal historic preservation law and regulations, including Executive Order 11593, the National Historic Preservation Act of 1966, the American Indian Religious Freedom Act, the Archaeological Resources Protection Act of 1979, the Native American Graves Protection and Repatriation Act, and the Archaeological and Historic Preservation Act (16USC469).

State Comprehensive Outdoor Recreation Plan (SCORP) & Recreational Needs Bulletin: The State Comprehensive Outdoor Recreation Plan (SCORP 1991) is prepared every six years by the Oregon Department of Parks and Recreation. It includes a supplemental Recreational Need Bulletin. These documents report current and projected supply and demand information for a variety of outdoor recreation activities. These activities are classified according to the ROS system (see Table 3-3) and profiled across the different regions of the state. SCORP is one of the most comprehensive and reliable sources of information dealing with future demand for recreation activities and settings at Newberry National Volcanic Monument.

SCORP data was integrated into the planning process during alternative development. All alternatives in this EIS provide varying amounts of rural, roaded natural, and semi-primitive non-motorized ROS classes. In the winter, all alternatives also provide varying amounts of semi-primitive motorized settings and opportunities. Alternative D (No Action) provides some acres in the roaded modified class, and Alternative B provides some acreage in the semi-primitive motorized ROS class for summer as well as winter use.

Oregon Department of Transportation (ODOT): All action alternatives would propose reconfiguring the Cottonwood Road interchange on Highway 97 to improve safety and traffic flow to the Lava Lands Visitor Center and Lava Cast Forest. This proposal was reviewed with ODOT and found compatible with their plans and objectives for expansion of Highway 97.

Oregon State Marine Board: The Oregon State Marine Board has developed a six-year plan (1993-1999) for managing recreational water bodies within the State of Oregon. Coordination with the Marine Board indicates that Alternative A would meet Marine Board boating facility management objectives for Paulina and East Lakes. Alternatives C and C-Modified would meet the intent of upgrading and improving boating facilities; however the locations of some developments could change. Marine Board objectives would not be fully met under Alternative B. All alternatives would comply with motorized boating speed limits established by the Oregon State Marine Board.

Watersheds: Protective measures for streams and soils within the Monument are generally more restrictive than required by the Oregon Forest Practices Act.

County Plans: County comprehensive plans must address 19 goals established by the Land conservation and Development Commission (LCDC). The alternatives in this EIS were

compared to the LCDC-approved comprehensive plan for Deschutes County, the county in which Monument lands lie. The uses and activities proposed in the alternatives were generally consistent with county goals. Since the county plan has been found by LCDC to comply with the statewide goals, consistency with the statewide goals is assumed.

The LCDC has left some provisions of the statewide planning goals to be administered by state agencies rather than local governments. These provisions are discussed below.

The Forest Practices Act administered by the Oregon Department of Forestry (Goals 5 and 17 and ORS 527.610 and 527.730)

All practices used to implement the Monument Plan alternatives would meet or exceed the Forest Practices Act.

Fish and Wildlife policies administered by the Oregon Department of Fish and Wildlife (Goals 16, 17, and 18 and ORS 496.012 to 496.162 and ORS 506.105 to 506.201)

All alternatives contain provisions to provide for the habitat needs of species identified on the state of Oregon Threatened and Endangered Species list.

Air and Water Pollution Control statutes administered by the Oregon Department of Environmental Quality (Goal 6 and ORS 468.275 to 468.345 and ORS 468.700 to 468.775)

The Forest Service complies with these requirements by obtaining permits and providing data as needed. For example, any burning conducted as a part of implementing an alternative will be authorized by DEQ. Any pollution control facilities would be operated according to DEQ standards and new facilities would be approved by DEQ before construction.

Regulations of Mining and Drilling administered by the Department of Geology and Mineral Industries (ORS Chapters 516, 517, and 520)

Forest Service permitted operations are required to obtain necessary permits before they commence. This would apply to any geothermal drilling conducted in the Special Management Areas or Transferal Areas.

Fill and Removal administered by the Division of State Lands (Goals 16, 17 and 18 and ORS Chapters 274, 517, and 541)

Any fill and removal operations conducted within the Monument would meet DSL permit requirements.

Regulation of water withdrawals administered by the Department of Water Resources (ORS Chapters 536 and 543)

Forest Service water use will comply with applicable Department of Water Resource requirements.

Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990) (also called the Forest Plan): The relationship of the alternatives considered in this EIS to the Forest Plan is described in detail in Chapter 2, Introduction.

Conditions Unchanged by Alternatives

There are some conditions on the Monument which would not be affected by implementation of any alternative. These are summarized below:

Left unrestricted, population growth and increased visitation will eventually exceed the recreational carrying capacity of the Monument and jeopardize high quality recreation settings and opportunities in all alternatives. Consequently, each alternative will eventually require that limits be set on visitor use, in order to provide high-quality recreation experiences and protect the values for which the Monument was established.

Under any alternative, eventual expansion of Highway 97 to four lanes through the Lava Butte Zone of the Monument will slightly decrease the land base available for recreation, increase traffic flow through this part of the Monument, and decrease habitat effectiveness of the deer migration corridor in this area.

Under any alternative, while at certain locations within the Monument, visitors might see or otherwise experience the results of management activities on lands outside the Monument. This could include hearing or seeing (or even smelling, in the case of geothermal development) the evidence of such activities as vegetation management, geothermal development, cinder pit excavation, or ATV recreation.

Energy Requirements of the Alternatives

Each of the alternatives would result in the consumption of fossil fuels and electricity. Some of this consumption would occur through activities carried out to manage the resources of the Monument (for example, vehicles and equipment used for vegetation treatments, facility maintenance and/or construction, and road maintenance/construction). Another source of energy consumption would be the fuel and electricity used by visitors to the Monument.

Under all alternatives, energy consumption would be expected to increase over present levels. This increase would be lowest for Alternative B, which decreases some overnight facilities, provides no new roaded access, and provides for an intermediate level of vegetation treatments. Alternative A, which adds a paved road linking most parts of the Monument, and which expands overnight facilities, would likely result in the highest increase of energy consumption over present levels.

Effects on Prime Farmlands, Forest Lands, and Rangeland

Prime Farmland: The USDA Soil Conservation Service has defined prime farmlands as: Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage and oilseed crops and is available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. The final environmental impact statement for the 1990 Forest Plan for the Deschutes National Forest concluded that no prime farmlands are found within the boundaries of the Forest. This determination also applies to Newberry National Volcanic Monument, since it was created from lands formerly included as part of the Deschutes National Forest at the time the 1990 Forest Plan was completed.

Prime Forest Land: Prime Forest Land has been defined primarily in terms of its ability to grow wood. The definition states: Prime timberland is land that has soil capable of growing wood at the rate of 85 cubic feet or more/acre/year (at culmination of mean annual increment) in natural stands and is not in urban or built-up land uses or water. Generally speaking, this is land currently in forest, but does not exclude qualifying lands that could realistically be returned to forest. Delineation of these lands will be in accordance with national criteria.

Under this definition, none of the forested land within the Monument would qualify as prime forest land.

Rangeland: Under all action alternatives, the boundaries of the Coyote and Sugar Pine grazing allotments would be changed to eliminate those portions of the allotments which fall within the Monument. While used for grazing at the present time, this land is not defined as "prime" rangeland. Prime rangeland is defined as: Rangeland which, because of its soil, climate, topography, vegetation, and location, has the highest quality or value for grazing animals. The (potential) natural vegetation is palatable, nutritious, and available to the kinds of herbivores common to the area.

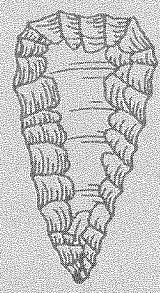
Effects on Wetlands and Flood Plains

Wetlands: Wetlands are those areas that are inundated by surface or ground water with a frequency sufficient to support and, under normal circumstances, do or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas, such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds.

The Monument contains some small wetlands acreages bordering the two lakes and the east side of the Deschutes River. Under all alternatives, these areas would receive special attention because of their habitat values. Recreation use in all action alternatives would be designed to minimize impacts to these areas. No facility development or other management activities would be permitted to reduce the wetlands acreage now present.

Flood Plains: The term "flood plain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood prone areas of offshore islands, including, at a minimum, those that are subject to a one percent or greater chance of flooding in any given year.

Effects on all flood plans within the Deschutes National Forest were analyzed in the 1990 Forest Plan. This EIS tiers to that analysis, which found that no significant adverse effects within areas of flood plains were anticipated (see USDA Forest Service 1990 p. 4-35).



GLOSSARY

GLOSSARY

ABORIGINAL AREAS A modern term used to describe historic and prehistoric lands where a Tribe(s) carried out food gathering or seasonal activities or traded with other Indian peoples.

ADVISORY COUNCIL ON HISTORIC PRESERVATION A group responsible for commenting to Federal agencies on undertakings that affect historic properties.

AERIAL FUELS All live and dead vegetation located in the forest canopy or above the surface fuels, including tree branches and crowns, snags, moss, and high brush.

ALL TERRAIN VEHICLE (ATV) Class I (three wheelers, four wheelers) and Class II (off-road motorcycles) all terrain vehicles as defined by the State of Oregon.

AMERICAN INDIAN RELIGIOUS FREEDOM ACT (AIRFA) 1978, S.1021, (P.L. 95-41) (92 Stat. 469)) This Act is to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religion, including access to.

ANDESITE A fine grained igneous rock with an intermediate silica content of 57 to 62%.

ANTIQUITIES ACT OF 1906 This Act prohibits unauthorized destruction or removal of archaeological and historic remains located on Federal lands and provides for the scientific investigation of these remains.

ARCHAEOLOGICAL AND HISTORIC PRESERVATION ACT (AHPA) This Act imposes additional requirements on an agency if a Federal project will affect historic properties that have archaeological value.

ARCHAEOLOGY The study of physical remains from people who have lived before us.

ARCHAIC A cultural manifestation and ecological adaptive strategy dating between 9000 and 300 years B.P. The period is sub-divided into three periods: the early, middle and late archaic periods.

ARCHAEOLOGICAL RESOURCES PROTECTION ACT of 1979 Prohibits the sale, removal, receipt or interstate transport of archaeological resources obtained illegally from public or Indian lands.

ASHFLOW A turbulent mixture of gas and pyroclastic materials of high temperature, ejected explosively from a vent, that travels swiftly down the slopes of a volcano or along the ground surface.

ASSUMPTION Something believed true for the analysis of effects.

BASALT A dark fine grained igneous rock with a low silica content of less than 52%, and rich in iron and magnesium.

BASALTIC-ANDESITE A fine grained igneous rock with a low silica content of 52 to 57%.

BEDROCK Rock that lies below all loose or unconsolidated soil and organic materials.

BIODIVERSITY The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

BUFFER Zone between a sensitive area and disruptive management activities. Usually includes minimally disturbed, vegetation communities.

BURNING PERIOD That part of each 24-hour period when fires will spread most rapidly.

CALDERA A large circular depression resulting from collapse of the land over a large emptying chamber of magna.

CANOPY More or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

CARBON DIOXIDE A colorless, odorless gas that, when inhaled, reduces the oxygen-carrying capacity of the blood and can result in adverse health effects.

CATEGORY 2 SPECIES Species under review by USFWS for protection under the Endangered Species Act. Listing of the species as threatened or endangered may be appropriate, but further information is needed to determine their status.

CEDED Refers to lands conveyed to the U.S. by a Tribe. There are no Treaty rights with regards to cultural, religious or spiritual resources or activities and practices.

CFS Cubic feet per second, a measure of the volume of water that flows past a given location.

CINDERS or **SCORIA** Dark colored pieces (usually black to red) of volcanic rock full of vesicles.

CINDER CONE Cone shaped pile of mafic tephra erupted from a central vent.

CRITERIA OF SIGNIFICANCE/EVALUATION Used to determine significance and nomination of historic properties to the National Register of Historic Places.

CODE OF FEDERAL REGULATION (CFR) A codification of general and permanent rules published in the Federal Register by the Executive Department and agencies of the Federal Government.

COMMUNITY An aggregation of living organisms having mutual relationships among themselves and to their environment.

COMPOSITE VOLCANO Usually a steep sided cone made of numerous layers of lava, ash, pumice, and cinders strengthened by numerous dikes and sills.

CORRIDOR A landscape element; a narrow strip that connects similar vegetation patches which differ from the surrounding vegetation (matrix).

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) Reviews federal programs for their effect on the environment, conducts environmental studies and advises the President on environmental matters.

CRATER A bowl or funnel shaped depression usually at the top of a volcanic cone formed during explosive eruptions.

CROWN FIRE A fire that advances form top to top of trees or shrubs more or less independently of the surface fire.

CULTURAL OR HERITAGE RESOURCES The remains of sites, structures or objects used by humans in the past, historical or archaeological. This includes ancient sites as well as living traditions.

DACITE A glassy to fine grained igneous rock with an intermediate silica content of 62 to 67%.

DATA RECOVERY Mitigating adverse effects to historic properties by recovering a representative sample of data.

DEAD AND DOWN MATERIAL Dead, woody plant material, usually trunks and branches of dead trees, lying on or near the soil surface.

DESIRED FUTURE CONDITION (DFC) Collection of resource goals translated into descriptions of biological and physical conditions that are created, maintained or restored.

DIAMETER AT BREAST HEIGHT (DBH) The diameter of a tree measured 4.5 feet from the ground on the uphill side.

DISCOVERY PACK A packet of supplies to facilitate independent learning and exploration. Contents could include: maps, field guides, magnifying glass, etc.

DEVELOPED RECREATION Recreation use that occurs within a site or facility specifically established and constructed for public recreation purposes.

DIKE A sheet like body of formerly molten rock that intruded steeply into bedded rock.

DISPERSED RECREATION Recreation use outside of a developed recreation site.

DISPERSED CAMPSITE Designated area for overnight dispersed recreation, not facility based.

DISTURBANCE A short term event, whether natural or human induced, that causes a significant change from the predicted pattern in an ecological system.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) The draft statement of environmental effects which is required for major federal actions under Section 102 of the National Environmental Policy Act and released to the public and other agencies for comment and review.

DUFF A mat of partially decomposed organic matter immediately above the mineral soil, consisting primarily of fallen foliage, herbaceous vegetation and decaying wood.

"ECOLOGICAL" OLD GROWTH Climax forest conditions where fire has been suppressed.

ECOLOGICAL PROCESS the major actions or events that regulate of influence the function, structure, composition and pattern of ecosystems and tat link organisms and their environment.

ECOSYSTEM A community of living plants and animals interacting with each other and their physical environment.

ECOTONE A relatively narrow overlap zone between two ecological communities.

ENDANGERED SPECIES Species of animal or plant that is in danger of extinction throughout all or a significant portion of its range.

ENVIRONMENTAL CONSEQUENCE Projected effect of a federal action or actions on the social and biological environment.

ESCAPED FIRE A fire that has exceeded initial attack capabilities.

ESCAPED FIRE SITUATION ANALYSIS A documented decision analysis process with alternative strategies for management of an escaped fire.

ETHNOGRAPHY The study of present day humans.

EUROAMERICAN SETTLEMENT The period of time in the mid to late 1800's marked by a large increase in immigrants of predominately European ancestry with associated increases in grazing, logging, and fire suppression end of fire-based vegetation management by American Indians.

EXECUTIVE ORDER 11593 Requires Federal agencies to inventory and evaluate cultural resources and to nominate eligible properties to the National Register.

EXECUTIVE ORDER TRIBES Refers to tribes whose reservations were established by Executive Order of the President of the United States between 1871 and 1910. Off reservation rights or privileges were rarely included.

EXTREME FIRE BEHAVIOR Erratic and sometimes dangerous wildfire behavior that ordinarily precludes methods of direct control action.

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) Final version of the statement of environmental effects required for major federal actions under section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses.

FINE FUELS Fuels such as grass, leaves, draped pine needles, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

FIRE ENVIRONMENT The surrounding conditions, influences, and modifying forces that determine the behavior of

fires.

FIRE INTENSITY The rate of heat release for an entire fire at a specific point in time.

FIRE MANAGEMENT An extension of the concept of wildfire decision making which takes into account resource values, role of fire in the environment, the level of protection required, opportunities for prescribed use of fire, consideration of fire effects, and the efficiency of fire control operation.

FIRE OCCURRENCE The number of wildland fires started in a given area over a given period of time.

FIRE PREVENTION Activities directed at reducing fire occurrence.

FIRE REGIME A combination of environment, plant species characteristics, and fire ignition patterns.

FIRE RETURN INTERVAL The average time between wildfires in a given ecosystem.

FIRE RISK The probability that a wildfire will start as determined by the presence and activities of causative agents.

FIRE SUPPRESSION STRATEGIES

CONFINE Allowing a fire to burn so long as it remains or is predicted to remain within predetermined natural boundaries.

CONTAIN Restricting a fire to a certain area by using natural or constructed barriers that stop fire spread under the prevailing and forecasted weather conditions.

CONTROL Using aggressive suppression tactics to establish firelines around a fire to halt its spread, and to extinguish all hotspots.

FIRE SUPPRESSION TACTICS The science and art of deploying and maneuvering forces against wildfires.

FIRELINE INTENSITY The rate of heat energy released during combustion per unit length of fire front, expressed in BTUs/second/foot.

FLAME LENGTH The distance measured from the tip of the flame to the middle of the flaming zone at base of the fire.

FORAGE To feed; or the material on which animals feed.

FORB Herbaceous plant species other than those in the *Gramineae* (grass), *Cyperaceae* (sedge), and *Juncaceae* (rush) families.

FUEL LOADING The weight of fuels in a given area, usually expressed in tons per acre.

FUEL TYPE An identifiable association of fuel elements of distinctive species, form, size, arrangement, of other characteristics.

GEOMORPHIC PROVINCE A region that has similar surface landforms and underlying geologic structures resulting from a similar history of geologic processes. The geomorphic provinces of Oregon were described by Dicken (1965).

GREAT BASIN The area of internal drainage in the western United States comprising Nevada, eastern California, southeastern Oregon, southern Idaho and western Utah.

GROUND FUELS All combustible materials lying beneath the ground surface including deep duff, roots, rotten buried logs, peat and other woody fuels.

GROUND WATER Water beneath the earth's surface that accumulates as a result of seepage from the surface and serves as the source of springs and wells.

GUZZLER A structure which provides water to wildlife, consisting of a large apron (400-600 sq. ft.) which collects

rainwater and snowmelt, stores the water in a tank (600 to 2000 gallons), and provides the water in a basin.

HABITAT The place where a plant or animal naturally or normally lives and grows.

HAZARD A fuel complex that forms a special threat of ignition or of suppression difficulty.

HAZARD TREE A tree which poses threat to life or property due to its condition or attitude.

HEAVY FUELS Fuels of large diameter such as snags, logs, and large limbwood that ignite and are consumed much more slowly than fine fuels.

HERBACEOUS PLANT A seed-producing plant that does not develop persistent woody tissue, but dies down to ground level at the end of the growing season.

HIDING COVER Cover used by animals to hide from predators and/or provide a sense of security.

"HISTORIC" OLD GROWTH Climax forest conditions in the absence of fire suppression.

INDICATOR Qualitative measure of ability to respond to an Issue, Concern, or Opportunity (ICO). It includes outputs, uses or conditions that can be measured and described to judge how well the various alternatives resolve issues.

INDIRECT EFFECTS Effects on the environment that were triggered by changes in the environment directly caused by some action. Indirect effects, compared to direct effects, are later in time or farther removed in distance but are still reasonably foreseeable.

INTEGRATED PEST MANAGEMENT (IPM) A process for selecting strategies to regulate forest pests in which all aspects of a pest/host system are studied and weighed.

INTEGRITY The authenticity of a property's identity, evidenced by the survival of physical characteristics that existed during the property's period.

INTERMITTENT STREAM A stream or portion of a stream that flows only at certain times of the year.

INVENTORY (Heritage resources) An organized compilation of information on properties that have been evaluated against the National Register criteria.

IRRETRIEVABLE Term that applies to losses of production, harvest or use of renewable natural resources.

IRREVERSIBLE Term that applies primarily to use of nonrenewable resources, such as minerals or cultural resources, or to factors such as soil productivity that are renewable only over long time periods. Also includes loss of future options.

JACKPOT BURNING Hand ignition of woody fuel concentrations that lie in a random fashion like "pick-up sticks."

KIPUKA An area surrounded by a lava flow.

LADDER FUELS Fuels which allow fire to carry by convection from surface fuels into the crowns with relative ease.

LANDSCAPE CHARACTER TYPE (AND SUBTYPE) Geographical areas (or subareas) which have similar visual characteristic of landform, vegetation, rock form and water form.

LANDSCAPE ELEMENTS The three common structures of a landscape: the matrix, corridors and patches.

LANDSCAPE FLOWS Materials, energy and organisms which move across and interact with a landscape.

LAVA A general term for molten volcanic material on the earth's surface; also used for the rock which solidifies from it.

LAVA TUBE A roofed over channel that develops within a fluid lava flow through which lava travels to feed the

advancing front of the flow. When lava ceases to pour out of the vent, the lava in the channel may flow out the end leaving a hollow winding cave.

LITHIC SCATTER A prehistoric surface manifestation with a contiguous cluster of ten or more artifacts and no more than one feature.

LITTER The uppermost layer of loose debris composed of freshly fallen or slightly decomposed organic materials such as dead sticks, branches, twigs, and leaves or needles.

LIVESTOCK ALLOTMENT Area where livestock are permitted to graze.

MAFIC Pertaining to igneous rocks rich in magnesium and iron and comparatively low in silica, includes rocks classified as basalt, basaltic-andesite, and andesite.

MAGMA A term for molten volcanic material below the earth's surface.

MATRIX The most extensive and connected portion of a landscape which is thought to exert strong control over movement of landscape flows (materials, energy and organisms) because of the connectivity of habitat it provides.

MAXIMUM POPULATION POTENTIAL The greatest number of wildlife that can live within a given area. For cavity-dependent wildlife, the number is often expressed as a percentage of potential, where snags are assumed to be the factor which limits populations. 100% of the population potential cannot be exceeded due to territorial requirements of the animals.

MIGRATION CORRIDOR Normal path followed by animals during regular, seasonal travel.

MITIGATION An action to minimize, ameliorate or compensate for the adverse effects of certain management activities.

MONITORING The collection of information to determine the effects of resource management and to identify changing resource conditions or needs.

MOSAIC A landscape pattern composed of variably sized and shaped patches of different plant species, ages, and stand structures. Mosaics are created and changed by natural disturbances (fire, wind, insects and disease) or vegetation management.

NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT (NAGPRA) Establishes requirements for Federal agencies in the identification and protection of American Indian graves and associated cultural items.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969 Promotes efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity.

NATIONAL FOREST MANAGEMENT ACT (NFMA) Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Regional Guides and Forest Plans and regulations to guide them.

NATIONAL HISTORIC PRESERVATION ACT (NHPA) 1966, amended 1992. Created the National Register of Historic Places and the Advisory Council on Historic Preservation.

NATIONAL REGISTER OF HISTORIC PLACES A register of cultural resources of national, state or local significance, maintained by the Department of the Interior.

NEOTROPICAL MIGRATORY BIRDS Birds which migrate from wintering grounds in Mexico, Central and South America, and the Caribbean to breeding grounds in Canada and the USA; includes most songbirds.

NONGAME WILDLIFE Wild animals which are not hunted, fished or trapped during any part of their life cycle.

OBSIDIAN Black to clear volcanic glass form a lava flow or dome with a high silica content.

OBSIDIAN HYDRATION ANALYSIS A technique of determining the age of volcanic glass surfaces by measuring the depth of water penetration.

OPPORTUNITY Something which might occur in the future but is not currently a proposal.

PALEO-INDIAN People who adapted to and exploited Pleistocene flora and megafauna.

PATCHES A landscape element; areas of vegetation that are relatively homogenous internally with respect to composition, successional stage, etc. and differ from what surrounds them; stand.

PEOPLE AT ONE TIME (PAOT) A measurement of designed or physical capacity that indicates the maximum number of people who can use a facility or area at one time. (Not to be confused with Recreational Carrying Capacity).

PERENNIAL STREAM Stream which normally flows throughout the year.

PLANT COMMUNITIES Association of plants in a given area or region in which various species are more or less interdependent upon each other.

PLEISTOCENE The geologic epoch dating from approximately 2 million years ago to 10,000 years ago.

PM_{10} Fine particulate air pollution consisting of solid particles or liquid droplets that are less than 10 microns in diameter and may cause adverse health effects.

PREHISTORIC The time before the coming of Europeans. In central Oregon, prior to 1800 A.D.

PRE-MAZAMA Prior to the eruption of Mt. Mazama, approximately 7600 years ago.

PRESCRIBED FIRE The burning of forest or range fuels on a specific area under predetermined conditions so that the fire is confined to that area and fulfills management objectives.

PRESCRIBED NATURAL FIRE A fire ignited by natural means (usually lightning) which is permitted to burn under specific environmental conditions, in preplanned locations, with adequate fire management personnel and equipment available to achieve defined objectives.

PRESERVATION The identification, evaluation, recordation, documentation, curation, acquisition, protection, management, rehabilitation, restoration, stabilization, maintenance, research, interpretation, conservation, or education of a property.

PRE-SUPPRESSION Activities in advance of fire occurrence to ensure effective suppression action.

PROPOSAL An improvement which is expected to occur (not to be confused with opportunity).

PUMICE Light colored pieces of volcanic rock so full of vesicles that they will often float on water.

PUMICE CONE Cone shaped pile of silicic tephra erupted from a central vent.

RADIO CARBON DATING (or Carbon-14 Dating) A means of establishing absolute dates for organic materials by measuring the ratio of radioactive C-14 present.

RECONSTRUCTION Reproducing by new construction the exact form and detail of a vanished building, structure or object.

RECREATIONAL CARRYING CAPACITY The type and level of visitor use that can be accommodated without substantially diminishing the quality of the recreation experience or the physical environment.

RECREATION OPPORTUNITY SPECTRUM (ROS) A system to categorize the expected recreation experience in

a given area based on access, remoteness, naturalness, facilities, social encounters, visitor impacts and visitor management.

RECREATION VISITOR DAYS (RVDs) Twelve hours of recreational use of a site or area by one or more visitors.

REGENERATION HARVEST A cut in a particular stand of timber designed to remove existing volume and start a new crop.

REHABILITATION Returning a property to a state of utility through repair or alteration which makes possible a contemporary use while preserving the significant features of the property.

RESTORATION Actions taken to return an ecosystem in whole or in part to a desired condition.

RHYODACITE A glassy to fine grained igneous rock with a high silica content of 67 to 72%.

RHYOLITE A glassy to fine grained igneous rock with a high silica content of more than 72%.

RIPARIAN AREA Terrestrial areas where the vegetation and microclimate are influenced by perennial or intermittent water or both, associated high water tables and soils which exhibit some wetness characteristics.

ROADLESS AREAS Areas that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process.

S.106 Refers to Section 106 of the National Historic Preservation Act (NHPA) of 1966 which requires Federal agencies to consider how each of its undertakings could affect historic properties.

SALVAGE Removal of insect infested, dead, damaged, or down timber not otherwise left for resource or environmental purposes.

SCOPING Process by which the Forest Service determines how inclusive and detailed an analysis is necessary to make an informed decision on a proposed action.

SCORCH HEIGHT The maximum vertical height at which lethal scorching of foliage occurs.

SENSITIVE SPECIES Plant and animal species identified by the Regional Forester for which population viability is a concern.

SERAL STAGE One of a series of ecological communities that succeed one another in the biotic development of an area.

SHIELD VOLCANO A gently sloping volcano in the shape of a flattened dome, built of flows of very fluid basaltic lava.

SHRUB Bush or low-growing, perennial plant, usually with several main stems arising near the ground.

SILICIC Includes rocks classified as dacite, rhyodacite, and rhyolite.

SILVICULTURE The art and science of controlling the establishment, composition and growth of forests.

SILVICULTURAL SYSTEM A planned sequence of treatments or prescriptions over the entire life of a forest stand.

SLASH Debris left after logging or resulting from wind or fire.

SNAG A standing, dead tree.

SNOWMOBILE A self-propelled vehicle capable of travelling over ice or snow which uses an endless belt, tread or

cleats, or a combination of tread and cleats as its means of propulsion; is steered wholly or in part by skis or sled type runners; and is not registered as any other type of vehicle.

SPATTER CONE A mound of welded clots of lava and cinders that were thrown a few feet into the air but were still molten when they landed.

SPATTER RAMPART A rim of welded clots of lava and cinders along a fissure.

SPOTTING Behavior of a fire producing sparks or embers which start new fires beyond the main fire.

STAND An aggregation of trees occupying a specific area and sufficiently uniform in composition, age and condition so as to be distinguishable from the forest in adjoining areas.

STANDARD AND GUIDELINE (S&G) Practice needed to achieve desired conditions or levels of environmental quality.

STATE HISTORIC PRESERVATION OFFICER Person responsible for direct implementation of the National Historic Preservation Act and subsequent regulations.

STOCKING The degree to which trees occupy the land. High stocking implies high density of trees.

SUCCESSION A process of plant community development that involves changes in species structure and community processes over time.

SUCCESSIONAL STAGE One in a series of usually transitory communities or developmental stages that occur on a particular site or area over a period of time.

SUPPRESSION All actions undertaken to extinguish or limit fire growth beginning with its discovery.

SURFACE FUELS All combustible materials lying on, or immediately above, the ground.

SUSTAINABILITY The ability of an ecosystem to maintain its organization and autonomy over time including but not limited to maintenance of ecological processes, biological diversity and productivity.

TEPHRA All rock fragments, molten or solid, thrown out of a volcano by expanding gasses.

THERMAL COVER Cover used by animals to lessen effects of weather.

THERMOCLINE In a thermally stratified lake, the horizontal layer of water in which temperature decreases rapidly with depth.

THINNING A cut made in an immature stand of trees to improve the vigor of the remaining trees.

THREATENED SPECIES A plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future.

TRADITIONAL CULTURAL PROPERTIES Eligible for inclusion on the National Register because of association with cultural practices or beliefs of a living community that are rooted in that community's history.

TRADITIONAL RECREATIONAL USES Recreational uses that the committee which drafted the Monument proposal recognized as regularly practiced within the area and agreed would be allowed to continue once the Monument was legislatively designated. These include: snowmobiling, nordic skiing, motorized and nonmotorized boating, fishing, hunting (outside the caldera), picnicking, camping, hiking, and horseback riding.

TRANSITION RANGE Areas used by deer and/or elk prior to onset of winter and in the spring before moving to summer range.

TREATY BOUNDARIES A modern term used to describe lands referred to as ceded lands in the original treaties, and qualified by the legal definition of original tribal occupancy issued in 1978 by the U.S. Court of Claims.

TREATY INDIAN TRIBES Tribes who have treaties ratified by the Congress and often have reserved rights off of reservations.

TREE MOLDS (LAVA CASTS) A cylindrical hollow (mold) which forms when lava surrounds the trunk of a living tree and solidifies.

TREE SCARRING FIRE A fire that leaves an injury on a woody plant.

TUFF A type of igneous rock resulting from solidification of volcanic ash and/or pumice.

TUFF CONE or RING A broad, low volcanic cone with a wide flat bottomed crater which result when magma encounters abundant ground water and huge amounts of steam are generated which drive a violent eruption of steam, water, and rock fragments.

UNDERBURNING Prescribed burning of the forest floor or understory for botanical or wildlife objectives, hazard reduction, or silvicultural objectives.

UNDESIRABLE EXOTIC PLANTS Non-native plant species which have the potential to out-compete and replace native vegetation or desirable non-native vegetation.

UNDERSTORY VEGETATION Grass, small trees, shrubs, and other plants found beneath the overstory (the trees comprising the canopy).

VENT The opening at the Earth's surface through which volcanic materials issue.

VIABLE POPULATION The number of individuals, adequately distributed throughout their range, necessary to perpetuate their existence in natural, genetically stable, self-sustaining population.

VISUAL QUALITY OBJECTIVES (VQOs) Categories of acceptable landscape alteration measured on degrees of deviation from the natural-appearing landscape.

VOLATILE ORGANIC COMPOUNDS (VOC) As used in this document, VOC's include hydrocarbons (except methane and ethane), aldehydes, and other hydrocarbon derivatives. They are produced naturally by trees and emitted in motor vehicle exhaust.

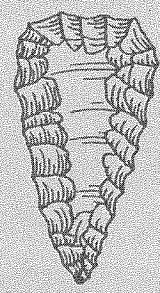
VOLCANIC ASH Fine tephra less than 2 mm in diameter.

WATER TABLE The level of groundwater beneath the land surface.

WILDFIRE An unplanned wildland fire requiring suppression action, or other action according to Agency policy.

WILDLIFE/FISH USER DAYS Twelve hours of recreation that is the result of fish or wildlife. See Recreation Visitor Days.

WORLD HERITAGE SITE A site determined by the Secretary of the Interior to be of international significance.



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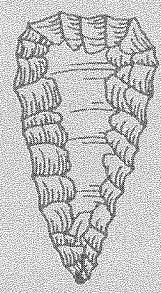


LIST OF PREPARERS

List of Preparers

Lisa Anderson — Landscape Architect

Education:
M.L.A., Landscape Architecture, 1993, Univ. of Oregon
B.L.A., Landscape Architecture, 1991, Univ. of Oregon
B.S., Biology, 1983, Colorado State University

Experience:
Forest Service, Jan. 1992, comprehensive sign planning, scenic resource analysis, preparing development suitability guidelines for special-use permit area. Private sector work has ranged in scale from comprehensive city planning, to municipal planning, to residential design and implementation.

Sharon Barton — Assistant Fire Management Officer of Suppression

Experience:
Began with the Forest Service in 1977; work has included silviculture, reforestation, pre-sale and as a lead forestry technician with the Young Adult Conservation Corps in addition to assignments in fuels management on two forests. A 1990 successful graduate of Technical Fire Management and a member of a National Interagency Incident Management Fire team since 1989.

Lew Becker — Wildlife Biologist

Education:
B.A. in biology, 1970, Hiram College, Ohio
M.S. Wildlife ecology, 1976, Utah State University

Experience:
Fifteen years professional experience as wildlife biologist/ecologist. District biologist with experience in interdisciplinary planning and implementation of wildlife, prescribed fire, timber management, mineral exploration, range and recreation projects.

Pam Beyer — Assistant Editor/Forestry Technician

Education:
B.S., Forest Biology, 1979, Colorado State University, Fort Collins, Colorado

Experience:
Six years in presale, silviculture and planning on two national forests.

Dick Dufourd — Civil Engineering Technician/OHV Specialist

Education:
B.S., Zoology, 1968, University of Illinois

Experience:
Employment on two national forests and with the Deschutes since 1977. Involved primarily with location and design of recreation projects and administering construction contracts. Member of Interdisciplinary Team planning and assessing an OHV trail system on the east side of the Fort Rock District.

Robert E. Evans — Resource planner

Education:
M.F., Forest Management, 1980, Utah State University
B.A., Political Science, 1972, University of Iowa

Experience:
Forest silviculturist, operations research analyst and forestry assistant experience on three national forests as well as Bureau of Land Management.

Randy Gray — GIS Analyst

Education:
B.S., Geography, 1988, Oregon State University, Corvallis

Experience:
Oregon State University Cartographic Service, 1988-1989; Cartographic/GIS Technician, Willamette National Forest, 1990-1992; Lead GIS Analyst, Eastside Ecosystem Management Study, Wenatchee Forestry Sciences Laboratory, 1992-1993.

Gail Hakola
Interpretive specialist/public affairs
Education: Washington State University, Pullman; Colorado State University, Ft. Collins; St. Martin's College, Lacey, Washington; Portland State University; University of Oregon, Eugene
Experience: Ten years' experience with the Forest Service on four forests, largely as an interpretive specialist in visitor centers with work in public affairs. Responsible for the planning record and workshop assistance.

Laurie Halloran
Archaeologist
Education: B.S., Anthropology, 1976, California State University, Long Beach
Experience: Fifteen years experience on four National Forests and three years on one National Park with duties as archaeologist, park ranger, and fire management specialist.

Harry Hoogesteger
Writer/editor
Education: B.A., English/Communications, Lewis and Clark College, Portland, Oregon
Experience: Experience as a writer/editor on two forests. Newspaper reporter, three years. Two dozen articles published in regional and national magazines.

Robert A. Jensen
Materials Engineer/Geologist
Education: B.S., Civil Engineering/Geology, 1973, Oregon State University, Corvallis
Associate of Science, 1970, Central Oregon Community College
Experience: Five years' project engineering work and fifteen years' geotech/geology work on Deschutes National Forest.
Author or co-author of four publications. Author of unpublished guides to geology of Central Oregon used in Central Oregon Community College geology classes and for training of employees and volunteers of Lava Lands Visitor Center.

Debra Mahanger
Landscape Architure Assistant
Education: B.A., Architecture, 1993, Yale University, New Haven, Connecticut
Experience: Written and graphic support for the analysis of effects and development of scenery management standards for NNVM, map overlays for "suitability" analysis, various project work on the Bend and Ft. Rock Districts of the Deschutes National Forest.

Eileen Obermiller
Landscape Architect
Education: M.L.A., Landscape architecture, 1988, University of Arizona, Tucson.
B.S., Recreation, 1981, Arizona State University, Tempe
Experience: District Landscape Architect since May 1993; Municipal Land Use Planning, New Jersey, 1988-1993.

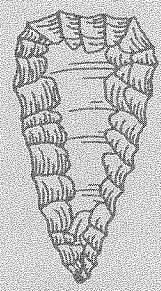
Lisanne Pearcy-Scott
Interpretive/resource specialist
Education: Ph.D., Geology, 1991, Stanford University, Palo Alto, California
B.A., Geology, 1982, Carleton College, Northfield, Minnesota
Experience: Interpretive Program Leader, Newberry National Volcanic Monument; post-doctoral teaching fellow, Whitman College; visiting professor of geology at Carleton College, Northfield, Minnesota; U.S. Geological Survey, in Oregon, Washington, Alaska and California.

Bill Queen
Monument Program Manager
Education: Continuing Education in Forest Ecology and Silviculture, 1980-1981, University of Montana, Washington State University, and University of Idaho.
M.S., 1977, University of Georgia
B.S., 1974, Clemson University, Clemson, South Carolina
Experience: Seventeen years experience on six National Forests with duties of Monument programs, environmental impact statements, silviculture, and timber management.

Carolyn A. Wisdom	Special Projects Coordinator
Education:	B.A., Biology, 1981, Sonoma State University
	B.A., French, 1973, University of California, Santa Barbara
Experience:	Twelve years experience on two National Forests including assignments as writer-editor for Forest Plans, forest environmental coordinator, Forest Plan implementation/monitoring coordinator, special projects manager, and assistant district ranger.

Other Contributors

Bob Bachman	Regional Air Quality Specialist
Karen Bennett	Forest Soil Scientist
Jane Brubaker	Landscape Architect
Mike Buffington	Computer Analyst
Jennifer Burns	Landscape Architect
Paul Claeyssens	Forest Archaeologist
Alice Doremus	Interdisciplinary Coordinator, Geothermal
Thomas Felando	Forest Hydrologist
Bill Hopkins	Area Ecologist
Cindy O'Neil	Ecologist/Botanist
Mark Reid	Forestry Technician
David (TJ) Tjomsland	Fire Management Officer



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- Executive Department
- Game Enforcement Department
- Governor's Forest Planning Team
- Oregon State Museum of Anthropology
- State Historic Preservation Office
- State Marine Board
- State Parks and Recreation
- State Recreation Planner
- Water Resources

Local Officials, Agencies, and Organizations

Officials

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- AAA Office
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- Deschutes Historic Society
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- Friends of the Metolius
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- Oregon Natural Resources Council
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Officials and Agencies, Other States

- Environmental Resources,
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Academic Institutions

- Bend LaPine Schools
- Bend Senior High School
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- Mountain View High School
- Mountain View Intermediate School
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World Trade Center

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Central Oregon Business Journal
The Eugene Register Guard
Frontier Advertising
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KWSO
The Madras Pioneer
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The Bulletin
The Oregonian
The Register-Guard
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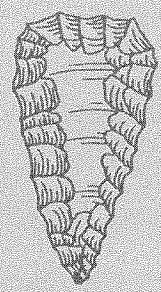

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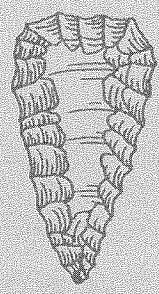


APPENDIX A

PUBLIC INVOLVEMENT

APPENDIX A

Public Involvement

Newberry National Volcanic Monument was created by the citizens of Central Oregon. The area had been considered for national park status many times in this century, but it wasn't until the late 1980's that a group finally put together the consensus proposal that won national designation for the area.

A small group of individuals originally became concerned about possible geothermal drilling in Newberry Caldera in 1987. They met periodically over the next three years, bringing in citizens from various interest groups including: hunters, anglers, backpackers, environmental interests, mountain bikers, horseback riders, timber and geothermal interests, snowmobilers and cross-country skiers. This Monument Citizens' Committee drafted a proposal for a new national monument encompassing about 50,000 acres. Special management areas ringing the Monument allowed geothermal lease holders certain rights for exploration and possible development. In effect, geothermal lease holders inside the new monument traded those leases for areas of equal "heat value" outside the new monument's boundaries.

Oregon Congressman Bob Smith backed the proposal, as did other members of the Oregon Congressional delegation. Both the House and Senate approved the formal bill, and President George Bush officially created the new monument on November 5, 1990, when he signed Public Law 101-522.

Because citizens had been so involved in this area's designation since the beginning, the Forest Service has worked closely with public groups and individuals to bring forward their thoughts and visions for this special place. In 1992, we held a meeting of the original Citizens' Committee to hear their ideas about a comprehensive management plan for the area.

In the summer of 1992, we also convened the Monument Advisory Council, as directed in the legislation. This 11-member group, representing various interests in the community, has continued to meet quarterly, giving us a valuable window on community opinion. Their specific advice is outlined in Chapter II.

In the fall of 1992, we distributed "Vision Maps" to an extensive mailing list of interested people. These Vision Maps allowed people to draw or write their ideas for Newberry Monument in a lively and creative way. People were encouraged to write about what qualities in NNVM they wanted to see conserved, protected and enhanced; what activities were appropriate in the national monument; and what worries and concerns they had. We also distributed these maps in the communities of Bend, Sunriver, and La Pine.

We also held a series of public workshops in late 1992 and invited people from all over the state to share with us their thoughts and interests in the Monument. These meetings were held in Bend, La Pine, Sunriver, and Salem.

We visited high schools throughout Central Oregon, and presented a slide show on the Monument, outlined some of the concerns and questions we were facing, and asked for the students' advice and input. This effort reached over 200 members of the next generation, and gave us good information about what is important to young people.

Throughout the planning process, the Forest Service identified key groups and individuals that had a "stake" in the Monument, based on their past interest. We regularly contacted these individuals to update them as the alternatives were drafted and developed, incorporating their thoughts and ideas as we went along.

We also met periodically with representatives of recreational groups, such as cross-country skiers, snowmobilers, mountain bikers, ATV riders, and hikers. Many of their ideas and suggestions have been incorporated into the plan.

Consultation with Indian tribes has been on-going throughout the planning process. Representatives of the Burns Paiute Tribe and the Confederated Tribes of the Warm Springs Reservation of Oregon visited the Monument for a consultation in the fall of 1993. Three Forest Service people involved in Monument planning visited with representatives of the Klamath Tribes in Chiloquin, Oregon in early 1994 to hear and review their advice to the Forest Service.

From all of this public involvement, we created a list of the issues that were important in managing the Monument. We identified six key issues. They are:

Recreation
Roads and Facilities
Vegetation
Fire and Fuels
Fish and Wildlife
Interpretation

We also considered a number of other issues that were important to people. They are:

Heritage/Geology
Science and Research
Monitoring
Air Quality
Water Quality
Scenic Quality
Law Enforcement
Local Communities
American Indian Tribes
Lands and Special Uses.

A more detailed description of these issues is found in Chapter I.

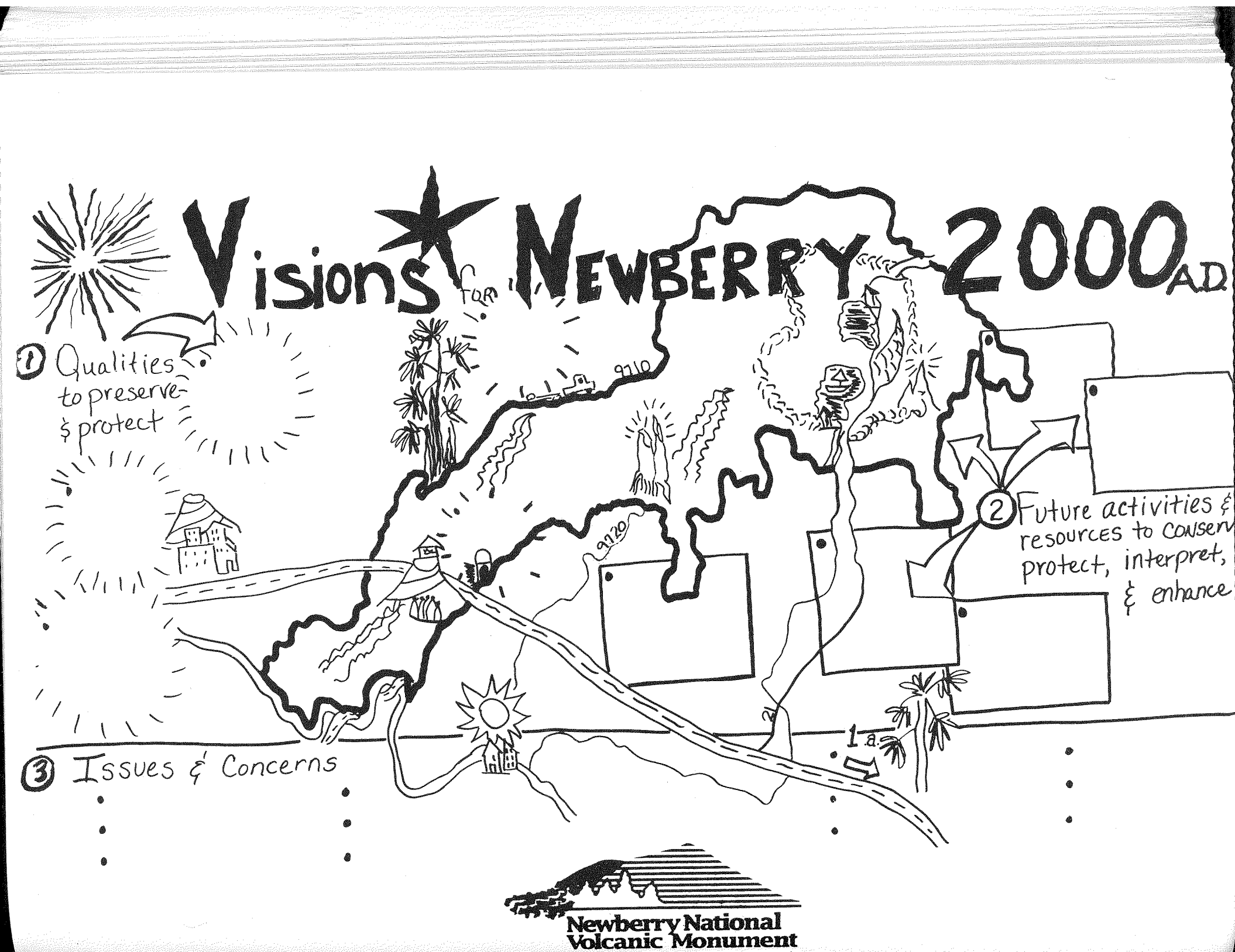
We published a draft EIS and accompanying management plan in December of 1993, and mailed the documents to over 700 people throughout Oregon and the United States. The public had 45 days to review the document during a formal comment period, which ended February 28, 1994. For a complete summary of the comments we received, please see the next section, "Response to Comments."

The Forest Service also held a series of open houses in February, 1994, throughout Central Oregon to inform people about the draft plan and answer any questions. About 60 people attended these open houses. The format was informal, including a slide show about the Monument's features, displays about the alternatives considered, and opportunities for people to learn about the Monument and express their concerns or comments.

A Forest Service representative also took the Monument slide show into the community and gave presentations at service clubs and schools to let people know about the management plan and its issues.

The Forest Service ID team carefully considered all the ideas received, and designed a new alternative (C-modified) after the draft and before the final, in an attempt to respond to public comment and Advisory Council recommendations. The team also developed a resource synthesis map in response to requests for more specificity about information on resources such as old growth ponderosa pine, sensitive soils, key viewsheds, wildlife corridors, and other resources. (See map accompanying management plan.) Other changes to clarify or add information in response to public comments have been included in Chapters I through IV of this FEIS, in the Response to Comments section, and in the Management Plan.

We thank everyone who took time to give us their thoughts on the management of our public lands, especially Newberry National Volcanic Monument.


Visions for Newberry 2000 A.D.
1 Qualities to preserve & protect
2 Future activities & resources to conserv protect, interpret, & enhance
3 Issues & Concerns
1 a.
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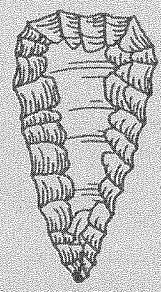
Newberry National Volcanic Monument



APPENDIX B

RESPONSE TO COMMENTS

Appendix B

Response to Comments

The Council on Environmental Quality Regulation (Section 1503.4) for implementing the provisions of the National Environmental Policy Act directs the Forest Service to respond to public comments. The Forest Service can respond by modifying the alternatives, developing new alternatives, improving the analyses, making factual corrections, or explaining why comments do not warrant further agency response. The number and content of comments received on a particular issue is viewed as a barometer of the intensity surrounding that issue; however, the Forest Service does not consider this a voting process. All comments are considered and analyzed regardless of numbers.

Table 1

Origin of Responses	Number
Central Oregon	121
Other Oregon and Washington	37
Other U.S.	3
Total	161

The draft EIS and management plan for Newberry National Volcanic Monument were published at the end of December, 1993 and distributed to an extensive mailing list of individuals and organizations in early January, 1994. The official notice of availability was published in the Federal Register on January 14, 1994. The public had 45 days to review the document and provide comments. We received 161 written responses, most of which contained comments on more than one issue.

Origin and Profile of Responses

The majority of responses (75%) came from Central Oregon, which we defined as Deschutes, Jefferson, and Crook Counties, plus Klamath County north of Crater Lake and Lake County north of Summer Lake. None of the communities in this area is farther than a two-to-three hour's drive from NNVM. All of the comments received originated in Oregon, Washington, or California. Table 1 shows a breakdown of where the responses came from.

The number of responses we received from different types of people is displayed in Table 2. Individuals submitted 75% (120) of the comments. Twenty-six of these were from La Pine Jr. and Sr. High School students.

Recreation groups submitted 11 comments. Two of these comments were from non-motorized recreational groups: a dog-sled club and an equestrian group. We also received three comments from two different snowmobile groups and six comments from four different off-highway vehicle (OHV) groups. One letter, on the subject of winter recreation, contained a petition with 21 signatures representing 11 different groups. Seven of the groups and nine of the individuals represented by the petition also submitted separate letters.

Three responses were submitted by environmental groups. The Oregon Mycological Society and the Bend Clean Air Committee each commented. A single letter was submitted by four groups: Sisters Forest Planning Committee, Central Oregon Chapter of the Audubon Society, the National Audubon Society, and the Wilderness Society.

We received 17 responses from government agencies. U.S.D.A. Forest Service comments came from specialists in archaeology, fire, silviculture, landscape architecture, hydrology, interpretation, geothermal planning, and air quality. (A few other Forest Service employees submitted comments as individuals.) Other federal agencies that responded were the Environmental Protection Agency and the Department of Interior. The latter submitted two comments, one from its Office of Environmental Affairs and one from the National Biological Survey. State agencies that commented were the Department of Fish and Wildlife, Department of Agriculture, State Marine Board, and State Division of Lands. One comment from Deschutes County came from the Planning Division. No comments were received from elected officials or local community governments.

Table 2

Type of Respondents	Number
Individuals	120
Recreational Groups	11
Environmental Groups	3
U.S.D.A. Forest Service	9
Other Federal Agencies	3
State Agencies	4
City/County Agencies	1
American Indian Tribes	2
Educational Institutions	1
Geothermal Business	2
Other Business	3
Media	1
Special Use Permittees	1
Total	161

We received comments from American Indian tribes at two meetings. The Confederated Tribes of the Warm Springs Reservation and the Burns Paiute tribe gave us their comments on Nov. 5, 1993. The Klamath Tribe relayed their input on Jan. 18, 1994.

Businesses that commented included an archaeological consulting firm, Pacific Gas Transmission Company (PGT), and Weyerhaeuser. CE Exploration, the company proposing to develop geothermal resources adjacent to NNVM, submitted two letters. Other respondents included a geology professor at University of Oregon, the Bend Bulletin newspaper, and a grazing permit holder.

The number of comments received in each subject area (Table 3) is an indicator of the level of concern about that issue. Each response was counted only once for a single subject area. For example, 125 of the 161 responses mentioned recreation. Some of those same letters

addressed other issue categories, for example wildlife, and were counted again in those categories. Therefore, the total of the table on Subject of Comments exceeds 161 responses. Recreation was the area of highest concern, followed by vegetation and fire, interpretation, and wildlife.

Out of 161 respondents, 111 preferred one alternative above the others (Table 3), although many liked different parts of more than one. Forty-five percent of those with a preference favored Alternative C, the Forest Service's preferred alternative. Thirty-five percent preferred Alternative A; 12% wanted B; and nearly 3% liked the No Action Alternative (D). Another 50 commentors did not indicate which alternative they liked best.

Table 3

Alternative Preference	Number
Alternative A	39
Alternative B	19
Alternative C (preferred)	50
Alternative D (no action)	3
No Preference Indicated	50
Total	161

Issues

Recreation 5
- Quality of experience and level of use
- Camping
- Trails
- Boating
- ATV use
- Winter recreation

Interpretation 29

Roads and Traffic 32

Facilities 37

Vegetation and Fire 39
- Old growth ponderosa pine
- Fire and fuels
- Natural ecological succession
- Other vegetation issues

Fish and Wildlife 51
- Fish
- Wildlife

Cultural Resources 64

American Indian Involvement . 66

Geology and Soils 68

Science and Research 70

Monitoring 71

Air Quality 73

Water Quality 74

Scenic Resources 77

Law Enforcement 79

Local Communities 79

Special Uses 81

Lands 84

Cumulative Effects 86

NEPA/Legal Issues 88

Miscellaneous 91

Summary and Response to Issues

This section contains a summary of the public comments received on each issue, followed by condensed versions of each comment with the Forest Service response. The Forest Service interdisciplinary team grouped related topics and comments to avoid cumbersome text duplications. The team then responded to all the issues and concerns expressed in the comments. A complete collection of the comments is available for review at: Fort Rock Ranger District, USFS Special Projects, 1230 NE 3rd., Bend, OR 97701.

Each comment we received was cataloged and numbered. The Forest Service reference number follows each comment, in parentheses. (123). If many comments said essentially the same thing, they were grouped as one comment number.

Recreation

Quality of experience and level of use

Concern about the level of use in the Monument brought 35 comments. Eight respondents said the area is already overused and use should be reduced, especially in the caldera. Another suggested we increase the amount of semi-primitive area (as in Alternative B) and discourage more visitor use. Another person asked that attractions outside the caldera be highlighted to spread out use. A couple of people requested monitoring to protect the area from overuse; two others felt that the Forest Service would have insufficient staff to protect the area from damage with increasing use. At the other extreme, three commentors asked that we not limit their access to the recreational pleasures of the Monument. Expansion of recreation uses is needed and would not adversely impact the area, according to one reviewer. Another person thought that the Monument has a unique opportunity to draw people away from the overused High Cascades. Four people told us that Alternative C would provide the right amount of use for NNVM.

Nine commentors asked that the quiet, slow-paced atmosphere be preserved. "Don't overdevelop" was a common sentiment. Six people requested that, in particular, we continue to offer high quality experiences in fishing and camping. One commentor asked that "unobtrusive" (i.e., quiet, nonmotorized) forms of recreation be encouraged.

Table 4

Subject of Comments	Number
Recreation (total)	125
Winter Recreation	39
Roads	11
Vegetation and Fire	27
Fish	5
Wildlife	18
Interpretation	24
Archaeology	3
Geology and Soils	4
Science and Research	6
Monitoring	6
Air Quality	4
Water Quality	7
Scenic Quality	9
Law Enforcement	3
Local Communities/ Socio-Economic	13
American Indian Involvement	2
Special Uses	12
Land Ownership	3
Cumulative Effects	4
Roadless/Research Natural Areas	4
Legal (e.g., NEPA) Issues	11
Other	35

COMMENT Keep it natural! Preserve the quiet, low-key atmosphere of the Monument. Keep it a quieter, slow-paced Monument where people have more opportunities to be alone and discover things on their own. Don't turn Newberry into something like Yosemite (overused and overcrowded). It's such a wonderful change from other national parks. (93, 94)

RESPONSE: Alternatives B, C and C-modified limit the number of people using NNVM by carefully controlling the number of overnight camping spots available. Alternative B reduces

the number of campsites, and Alt. C and C-modified call for about the same overnight capacity as exists now. Alternative A provides for some increase in overnight visitation in the future. All alternatives project an increase in day-use facilities and programs. The action alternatives provide different mixtures and amounts of both dispersed and developed recreational opportunities. Currently there is a significant amount of recreational use in the caldera. By providing different activities and opportunities during the day, we plan to disperse people outside the caldera, and distribute the use. The Plan seeks to strike a balance between serving an increasing number of visitors from around the world -- and preserving a quality recreational experience for those who do visit. The different alternatives offer different ways of meeting the goal of providing a high quality recreational experience. See Standards and Guidelines in Monument Plan for more information on preserving the present recreation experience.

COMMENT More roads and trails and other active areas would tear up the natural beauty. Let's keep it like it is as much as possible! (95)

RESPONSE The preferred alternative, C-modified, calls for reducing the miles of roads in the Monument, and proposes visitor travel between Lava Lands and Lava Cast Forest along existing roads. Some new trails would be built. These trails would direct use patterns with the intention of decreasing dispersed impacts. Some trails would include educational and interpretive information about resource management and land stewardship.

COMMENT The more people you bring into an area (by making improved trails and easy access) the harder it becomes to protect the natural resources; I am opposed to the Forest Service taking any steps which would increase visitor use. The fewer people, the better. (70, 104)

RESPONSE Alternative B focuses on resource protection and wildlife enhancement. It would have the least amount of trails and roads, and would have the most restrictions on human use. Alternatives C and C-modified call for preserving or enhancing the atmosphere that exists in the Monument now by improving recreational sites and dispersing people, while accommodating some slight increases in recreational use. The legislation establishing Newberry Monument requires the Plan to consider a full range of recreational opportunities. See also above responses.

COMMENT Prefer fewer people, more dispersed recreation and solitude. The area is already too congested in the summer; there is plenty of recreation at Newberry Monument now. (74)

RESPONSE Alternative B responds to this need. Also, in the preferred alternative (C-modified), we have increased the number of acres in semi-primitive, non-motorized summer ROS (Recreational Opportunity Spectrum) class. Standards and Guidelines allow for possible restrictions on use, such as a reservation system to preserve the quality of recreational experience, if needed.

COMMENT Please preserve and encourage the use of the Monument by quiet, non-obtrusive forms of recreation. Do not overdevelop it, nor cater to the Sunday-driver crowd, or the dirt-bike factions. (97)

RESPONSE See above responses. See ATV section below for other details.

COMMENT Make room for non-motorized uses of these lands, avoiding the syndrome of drive-thru, get out take some pictures, and go back to Portland -- like so many national monuments and parks. (96)

RESPONSE The Monument Plan provides a range of opportunities, including motorized recreation (boating, snowmobiling, driving, etc) and non-motorized activities (cross-country skiing, hiking, mountain biking, horseback riding, etc.). We have encouraged non-motorized activities in many areas, with ROS zoning. The ROS map areas defined as SPNM (semi-primitive non-motorized) show those areas that are managed for non-motorized summer activities. Non-motorized activities are also consistent within Rural and Roaded Natural ROS zones; however, motorized activities can occur there too. See details in Alternatives B, C, and C-Modified. The Flanks and River Zones are designed to provide opportunities for solitude and non-motorized uses in all alternatives.

COMMENT The Forest Service does not recognize the amount of environmental damage now occurring around the Paulina Lake area... You will be unable to provide the necessary staff to stop it from accelerating with increased use. The Forest Service doesn't have sufficient staff to protect this unique area from damage with increasing use. (68)

RESPONSE Rehabilitation of riparian areas (around lakes and streams) is an important priority of the Plan. The preferred alternative will direct use to prevent more damage, and will educate people to reduce future damage. Our goal is to increase efforts in education and interpretation to prevent future damage to resources throughout the Monument. See Standards and Guidelines in Plan.

COMMENT You have the opportunity now to prevent the many problems of overuse before they happen by choosing Alternative B; Prefer B because it increases the amount of semi-primitive designation; keeping NNVM undeveloped. (69)

RESPONSE The River Zone and Flanks Zone have minimal development in all alternatives. We have also added additional acres to the semi-primitive non-motorized ROS class in the final Plan. See Record of Decision (ROD) for details on choice of alternatives.

COMMENT Please monitor the growth in popularity of NNVM, i.e.: number of vehicles. Don't let it become a Yosemite. Monitor carefully to protect the area from overuse. (71)

RESPONSE Part of our monitoring program is designed to track how many visitors we receive, to help define a carrying capacity for the Monument that will allow for high-quality recreation without overuse. The monitoring program will also check how people feel about their experience in the Monument. Do they feel crowded? Satisfied? What would make their experience in the Monument better? All these answers will give us valuable information in preserving and protecting the overall level of use and visitors' experience in NNVM. Monitoring will also provide checks to be sure that visitors do not damage the Monument's resources. See also **Monitoring** section below.

COMMENT Limited overnight access is favorable for me - less pressure on the environment; consideration should be given to reducing the number of overnight facilities in the caldera. (73)

RESPONSE Alternative B would reduce the number of campsites in the caldera, and addresses this concern. Alternative C-Modified maintains overnight capacity at the same level as present, but seeks to increase privacy and quality of experience by providing more space between campsites, and managing for lower occupancy rates.

COMMENT Alternative C seems to be the most suitable for everyone's enjoyment; it provides for the best use of the area by the public with the least amount of change or possible environmental damage. The Forest Service has taken the right tack with the new Monument, laying out a plan that allows for cautious expansion of recreation and educational opportunities. (75)

RESPONSE Public support varied as to which alternative people preferred. Of those indicating a preference, the majority preferred Alt. C in the draft EIS. Alternative C-Modified (a refinement of Alt. C based on public comments on the draft) has been identified as preferred alternative by the Forest Service.

COMMENT Please do not limit our access to the recreational pleasures of the Monument. "Let's put Oregon's best foot forward and preserve this national monument for the people, not from the people." Don't lock it up for only a few to use. Preserve access for recreational users. (76)

RESPONSE Alternative A proposes to expand campground capacity to accommodate more visitors both within and outside the caldera. It also would have the most roads, trails, and facilities, making recreational access a primary goal of the Monument. Alternatives C and C-Modified provide for some increases in day-use recreation, allowing people to come and enjoy the Monument. Camping, trails, and interpretive programs are offered under all alternatives. See the Record of Decision (ROD) for the decision and rationale for alternative selection.

COMMENT This Monument will continue to be largely used by locals and Oregonians, and expansion of recreation uses is needed and would not adversely impact this area. (64)

RESPONSE See above response.

COMMENT Whether you prepare for a large number of visitors or not - they will come. (81)

RESPONSE All alternatives would provide for camping, boating, and other traditional uses. The level of use and visitors' experience would vary with alternatives. Mitigation measures would be necessary for each alternative to manage impacts from visitors on resources. See Chapter 4, Recreation for more information about mitigating visitor impacts, and Standards and Guidelines in the Monument Plan.

COMMENT The environment of the recreation area should remain both clean and natural while allowing access to the area by the greatest number of persons. (82)

RESPONSE Alternative A provides maximum recreational access. More visitors could require more on-site "controls" to prevent resource damage. Alternative C-Modified provides for increases in day-use opportunities while managing for high quality recreational experience and prevention of resource damage.

COMMENT I don't want to see more people in the caldera. Highlight the other attractions of the Monument outside the caldera to spread out the use. The area is already overused and use should be reduced, especially in the caldera. (78)

RESPONSE The Plan would offer interpretive opportunities outside the caldera to help disperse recreational use. There would be more developed recreational opportunities near Lava Lands and in the Transition Zone to help take pressure off the caldera.

COMMENT I think this DEIS should be progressive and set management levels within the caldera for certain resources. If you don't have a handle on what is too much, then set some reasonable limits and follow up with surveys or research to later update the plan. The Plan leads us to conclude that it proposes recreation use in excess of the carrying capacity of the Monument for the coming decade. There is at present not enough information on the Monument and we therefore urge a freeze on any additional recreation development within the Monument. Only after the Monument is completely surveyed....could additional human impacts be planned for the area. (80)

RESPONSE The recreational strategy in the Plan begins with rehabilitating existing facilities first, while keeping overnight use levels about at the same level as present. Concurrently, we will be monitoring visitor satisfaction, and inventorying the resources we have in the Monument to better quantify carrying capacity of the Monument. See also response to #147 in Interpretation, below.

COMMENT The Monument has a unique opportunity to act as a magnet to help draw visitors away from the over-used High Cascades region and put them into a bio-region that, for the moment at least, is better suited to handle large amounts of people. (92)

RESPONSE The Monument is a popular place for visitors, and does provide an alternative destination to the High Cascades. The Management Plan has Standards and Guidelines in place that preserve the quality of that recreational experience. Some areas of the Monument also are sensitive places that could be damaged by large numbers of people.

COMMENT Remember to consider the physically challenged in all recreational aspects of use in the Monument. (107)

RESPONSE One of the key opportunities listed in the Plan for all alternatives is to improve access for the physically challenged and to increase variety and challenge levels. Standards and Guidelines also call for improving access for the physically challenged. Many new trails built in the Monument will have portions designated as "barrier-free," providing a range of

challenges, and offering opportunities for physically challenged individuals and senior citizens. New facilities and trails will comply with regional accessibility guidelines.

COMMENT Senior citizens use these areas like the Monument a great deal. Keep senior citizens in mind in your planning. (56)

RESPONSE We have considered senior citizens in all aspects of planning, from facility design to interpretive programs. The Plan is designed to provide a range of recreational experiences with something for "children of all ages."

COMMENT Provide more recreational opportunities for children. (60)

RESPONSE There are many opportunities now for children in the Monument. Discovery packs and interpretive walk and hikes will provide additional possibilities and new ideas and programs.

COMMENT Give a fair hearing to any new "non-traditional" recreational activity that could be done in the Monument. (59)

RESPONSE A fair hearing will be given. The Plan is designed as a "Constitution" for NNVM, setting forth broad principles and guidance. But it does not address every use and cannot anticipate every future need. It is written to be flexible and responsive to changes.

COMMENT Combine Alt. A and Alt. C (91)

RESPONSE We developed Alternative C-modified, which includes parts of both A and C. For example, C-modified has a much-reduced vegetation program, like A, and also includes the Monument Trail, a key feature of Alt. A. C-Modified also includes most of the recreational opportunities of Alt. C.

COMMENT All the fancy graphs (ROS) doesn't mean squat to the public. (66)

RESPONSE ROS (Recreational Opportunity Spectrum) graphs and maps are technical ways to "zone" recreation. These zones correspond to areas where people can find and enjoy the kind of recreational experience they want. They are sometimes hard to understand. This EIS is also reviewed by multiple resource management and planning agencies, as well as the public.

COMMENT Too bad you recreation folks couldn't do better. I read Chapter 4 Recreation Effects three times and found it confusing and boring. There were a lot of "coulds," "shoulds," and weasel-wording. (457)

RESPONSE The Chapter 4 recreation section has been rewritten and updated.

Camping and campsites

We received nine comments specifically about camping and campsites, ranging from "eliminate overnight camping" to "the size and number of campsites is totally inadequate for growth." One respondent said that some additional camping spaces may be needed, while another wanted no additional campsites or campgrounds, and two others asked us to consider reducing the capacity of overnight facilities in the caldera. One commentor suggested that, if electrical hookups are added, use of generators be restricted to reduce noise. Two commentors suggested doing away with the boat-in campgrounds. One said that with the increase in boating and trail use, no one gets the privacy they really want.

Use permits were suggested by two commentors as a way to prevent resource damage, while another hoped we would not go to a permit/reservation system for camping.

COMMENT Providing more campsites in the caldera would only overcrowd the area. No additional campgrounds or campsites!!" (101)

RESPONSE: Alternatives B, C and C-modified limit the number of people using NNVM by carefully controlling the number of overnight camping spots available. Alternative B reduces the number of campsites. See also responses to 93, 94, above.

COMMENT Some additional camping space is needed. "The size and number of campsites (existing now) is totally inadequate for growth in Central Oregon." (142)

RESPONSE Alternative A responds to the needs of recreational growth and increased tourism in Central Oregon by providing for future additional overnight use in the Monument. Alternatives C and C-Modified provide for slight increases in the number of campsites, but seek to preserve the quality of the recreational experience first.

COMMENT I like Alternative C, but would like less development of campsites. (134)

RESPONSE Under Alts. C and C-Modified, campsites may be "rehabilitated" to improve screening and privacy, but the overall capacity could change slightly, if at all. The goal of these alternatives is to keep overnight camping at the same level of visitation, but to improve the quality of experience.

COMMENT Eliminate overnight camping. (62)

RESPONSE The legislation establishing the Monument requires that "traditional" uses taking place in the Monument continue to be provided for in the future. "Recreational uses and interpretive facilities shall be provided, including (but not limited to) trails, **campgrounds**, resorts ..." (Public Law 101-522 Section 2e).

COMMENT Do away with boat-in campgrounds (primitive campgrounds on Paulina Lake). With increasing day use boating and lots of people on the trail, no one gets the privacy experience they really want. (106)

RESPONSE Other people, including the Oregon State Marine Board, which oversees boating recreation on Oregon's lakes and rivers, recommended that the Forest Service keep the boat-in campgrounds. These two boat-in campgrounds on the north shore of Paulina Lake (Warm Springs and North Cove) provide a popular alternative to a developed experience in the fee campgrounds. Alternative C-Modified and the Management Plan propose to maintain these facilities for boaters. In the short term, the two boat-in campgrounds will be maintained. In the long term, other locations may be sought if the campgrounds need to be relocated because of concerns about wildlife or other resources.

COMMENT Forget the semi-primitive campgrounds. Eliminate these boat-in campgrounds, don't relocate them. (144)

RESPONSE See previous response.

COMMENT I think the new educational group camp in Transition Zone is great, but would hate to see group camp ONLY for educational groups. Educational groups should be able to reserve it, but when not full should be open to others. (140, 141)

RESPONSE The group camp in the Transition Zone is identified as an opportunity in Alternatives C and C-modified. It would be proposed and evaluated through a site-specific NEPA analysis, if demand for this facility is demonstrated. Decisions regarding specific uses and seasons would be determined at that time, and with the benefit of further public involvement. Making the campground available to others when not reserved for educational groups is certainly a possibility to be considered.

COMMENT Rather than designating campsites for dispersed camping, require a permit, and supply a map showing where camping is not permitted because of overuse or other resource concerns.... Use a permit system to limit the number of visitors and enforce regulations. This will preserve the natural beauty of the Monument. (55, 85)

COMMENT Do not institute a permit or reservation system for camping or visits. Opposed to any total reservation system -- if it must be done, then make no more than half of the sites in any campground available by reservation. A total reservation system would require locals to plan their weekend camping months in advance to compete with out-of-town vacationers. (86, 87)

RESPONSE (to 55, 85, 87) The Forest Service at this time sees no immediate need to institute a permit or reservation system to control camping. However, if our monitoring program shows environmental damage from overuse, or reveals that visitors feel crowded, we would look at other measures to control use, which could include some kind of permit or reservation system. Any dispersed campsite designations would occur in response to resource protection issues.

COMMENT If full or partial (electricity only) hookups are added at campgrounds, use of generators should be restricted to reduce noise levels. (102)

RESPONSE Some campground renovation is planned in the caldera to improve privacy and screening in the campgrounds. Part of this site-specific analysis could include providing electric hook-ups for motorhomes. A decision on whether to provide hook-ups and what mitigation measures would be needed would be made at that time.

Trails

Eight respondents favored adding more non-motorized trails in NNVM. Five of these indicated that they wanted the Monument Trail to be included in the preferred alternative. Other input included a request for more semi-primitive trails, and specific suggestions for new trails to spread out use or connect the Monument to locations outside. In addition, two commentors noted trails that needed maintenance. Closing overused trails to allow them to recover was suggested by one person.

Appropriate non-motorized uses of the Monument's trails was the subject of nine comments, ranging from "make all trails multi-use" to "mixed use is dangerous." In all, four reviewers specifically advocated combining uses, while two others preferred separating them. One commentor asked that only horses and hikers be allowed on trails, stating that nothing "mechanical" belongs in a natural setting. Another requested that horses not be excluded, while a third said that horses were hard on trails and that ecosystem preservation should be given priority.

COMMENT Support construction of Monument Trail from Lava Butte Zone to the Caldera Zone... Add Monument Trail to preferred alternative (28)

RESPONSE The entire Monument Trail is included in the preferred alternative, C-modified.

COMMENT Add more non-motorized trails.... Would like to see more semi-primitive trails. (30)

RESPONSE All action alternatives would feature an increase in the number of non-motorized trail miles in NNVM. Alternative C and C-modified would feature a number of new trails in keeping with the themes of education, interpretation and ecosystems. Some of these new trails would occur in semi-primitive areas.

COMMENT Construct loop trails or trail around entire mountain to cut down on wear and spread people out.... Want more trails, fewer roads; more trails to take pressure off the one Paulina Lake trail around the lake.... Support interlake trail system connecting campgrounds and major interpretive sites of caldera. Should have stabilized surface and be wide enough for two bikes to pass safely. (29, 31)

RESPONSE Alternatives C and C-Modified propose 30 to 45 miles of new summer trails. Some possible locations are from the floor of the caldera to the rim, and in the Lava Cast Forest

area. The exact location, mileage, surface, and width of these trails will be decided later, at the site-specific level. Loop trails and non-motorized multiple use trails would be consistent with the Plan.

COMMENT Establish feeder trails from the soon-to-be-rebuilt Swamp Wells Campground to the Monument. (32)

RESPONSE Trails outside the Monument are not within the scope of this Plan. However, if there is a high need for this link to the Monument, the Plan remains flexible enough to allow this possibility in the future.

COMMENT I don't see enough about horses in the Plan. Continue to allow horse use in NNVM.... Provide access for equestrians to the south peak summit ridge. This could be a hitching post at a discrete spot with a short hiking trail to the summit or a designated spot where horses are allowed near the rim.... Add hitching post at Lava Cast Forest... Don't exclude horse traffic on interpretive trails. (33, 37, 40)

RESPONSE Horse use would continue to be allowed in all alternatives. Many trails in the Monument are now open for horseback riding, and parts of new trails will be designed for horses. Specific locations of trails, and improvements (such as hitching posts) will be addressed during site-specific analysis to approve specific trail segments.

COMMENT Horseback riders are hard on trails and hikers. Natural ecosystem preservation should be given priority. (36)

RESPONSE Horseback riding was a traditional use taking place at the time of Monument legislation (1990). The Forest Service has interpreted the legislation to mean that traditional uses will be provided for. (See planning record for more information on traditional uses.) Horseback riding is also consistent with numerous requests to maintain a quiet, natural, low-key environment. Monitoring will evaluate recreational damage to trails. Funding priorities are to rehabilitate existing trails and facilities.

COMMENT Restrict all trails to horses and hikers. Nothing mechanical belongs in a natural setting. (35)

RESPONSE Monument trails (in the summer) are designed for non-motorized use, including horses, hikers, and mountain bikes. Roads and other facilities are provided for motorized use.

COMMENT Don't allow motorized vehicles in recreational sites because they are detrimental to the resources and do damage. (38)

RESPONSE See above comment and response. Many developed sites (campgrounds, day-use areas) have road/motorized access. Semi-primitive areas do not allow roaded access.

COMMENT All new trails should be multi-use trails and built to accommodate all user groups. If possible, new trails should have winter and summer uses. (39)

RESPONSE The Forest Service prefers to make some trails multiple use, where possible. For example, portions of the Monument Trail are envisioned to be open to horseback riders, hikers, and mountain bikers, providing a quality recreational experience to different groups of people. Building and maintaining one trail makes sense economically, if the uses are compatible and recreationists are educated to share courteously. Sometimes, however, it is preferable to separate uses to provide a better recreational experience and reduce conflicts. Site-specific analysis and public participation will be done as each new trail is planned and built to determine whether recreational uses in a specific area will be separated or combined.

COMMENT Trails need to be clearly posted for particular users. Mixed use is dangerous. Safety is a big concern in both winter and summer. (41, 67)

RESPONSE Safety is a primary concern in trail construction and use. In some cases, separating use clearly makes sense to avoid conflicts and improve safety. An example is a system of orange diamond (snowmobile) and blue diamond (nordic) trails. This minimizes conflicts between users and provide for a quality experience for both types of winter recreationists. Also see above comment and response.

COMMENT Alt. A is more open and friendly to the different trail uses. (42)

RESPONSE Alt. A does provide the most miles of trails, and its effects are analyzed in the FEIS. Recreational access is not the only value in the Monument, however. There is a need to balance recreational use with protection and enhancement of other resources.

COMMENT Would like any new trails designed so that it would draw people away from the caldera -- this would help with safety and ease congestion. (89)

RESPONSE Alternative C-Modified (preferred) proposes to build a number of new trails. Some of these would be designed to draw people away from the caldera.

COMMENT Close overused trails and redirect guests to other trails. Regeneration of vegetation can then happen on the overused trail before the problem becomes too serious.... Rework Trail 57 from Paulina Peak to Paulina Lake. Currently the trail is too steep and prone to erosion. (34, 90)

RESPONSE Maintenance of existing trails is a priority for the Forest Service. We are working hard, with partners, volunteers, and our employees and visitors, to fix the backlog of needed trail maintenance, and get Monument trails into top condition. This includes all caldera trails, including the Paulina Peak and Paulina Lake Trail. Specific trail projects will be addressed at the site-specific level. Re-routing of some trails where feasible to "rest the land" is also part of on-going trail maintenance and upkeep. Trail projects are designed to work in conjunction with the capital investment strategy for the Monument. The first phase of this strategy includes upgrading, renovating or mitigating existing trails in the Caldera and Flanks Zones.

Boating

Boating brought seven comments, addressing issues of motorized use, size of boats, and increasing use. One commentor asked that motorized boating be banned on at least one lake. Another wanted nonmotorized boating promoted on East Lake, while permitting small boats with electric motors so that those with physical limitations could use the lake too. Banning gasoline motors on both lakes was suggested by yet another person, in order to reduce pollution and noise. On another topic, people asked what we meant by "larger boats on Paulina Lake." Concentrating bigger and faster boats on Paulina Lake is "not the answer" to improving boating access, expressed one commentor. The Oregon State Marine Board supported the moderate increases in fishing and boating opportunities proposed in Alternative C, while cautioning against the increases in facilities in Alternative A and the decreases in B. The Board further recommended that boating facilities be improved and that the two lakes have similar access with a maximum BAOT target. Retaining opportunities for boat-in camping was also supported by the Oregon State Marine Board, but two others wanted to do away with these campgrounds.

COMMENT Ban gasoline motors on both lakes to reduce the potential for pollution and noise.... Motorized boating should be banned on at least one of the lakes in the caldera. (49, 105)

RESPONSE In reviewing the legislative history of how the Monument came to be, the Forest Service feels that motorized boating on both lakes was a traditional and wide-spread recreational use taking place for many years, and the intent of the legislation is to honor and provide for such uses. Therefore, all alternatives would continue to permit motorized boating on both Paulina and East Lake. If monitoring shows pollution from gasoline motors is damaging the lakes, corrective measures will be taken.

COMMENT Promote non-motorized boating on East Lake, but allow small boats with electric motors, especially for those with physical limitations to still use the lake." (47)

RESPONSE Non-motorized boats, boats with electric motors, and conventional outboard motor boats are all permitted on East Lake, thus offering a diversity of opportunities for people with physical limitations. In the preferred alternative, new boating facilities on East Lake would encourage non-motorized boating and smaller boats (12-16 foot). Paulina Lake facilities would accommodate the sizes of boats presently used, but would emphasize facilities for the larger boats in that size range (up to 21 feet).

COMMENT Both lakes should have similar access with a maximum BAOT (Boats At One Time) target. (79)

RESPONSE Over time (many years), we will look at encouraging smaller boats and non-motorized recreation at East Lake. This would offer a diversity of recreational experiences. Access to both lakes would remain as it is today. See above comment.

COMMENT Concerned with "bigger boats and more activities encouraged at Paulina Lake". What does this mean? Larger boats with bigger wakes would not improve the quality of experience. The 10 to 15% increase in fishing pressure and larger boats may not be compatible with the size of this lake. Prefer that fishing opportunities increase through greater numbers of smaller boats and bank fishing, rather than greater numbers of large boats." (48)

RESPONSE The Forest Service does not want to encourage "larger boats" (meaning sizes larger than presently use the lakes) on Paulina Lake. What was proposed in the draft EIS was gradually renovating and developing boat facilities at Paulina Lake to accommodate the "larger" boats of those in the size range that presently use the lakes (up top 21 feet), and encouraging smaller boats (car-toppers, etc) at East Lake. This would provide a diversity of boating opportunities. See above response to #47.

COMMENT Recreational boating is expected to increase from 18 - 77 % by the year 2000. The increased boating facilities in Alt A could pose a threat to high quality fishing and boating. The decreased facilities in Alt. B would be a detriment to boaters. We support the slight or moderate increases in fishing and boating opportunities provided in Alt. C. (50, 51, 52, 53)

RESPONSE The Forest Service had identified Alt. C-Modified as its preferred alternative, calling for a slight increase in boating opportunities, while maintaining the current quality of the experience.

COMMENT Need to improve boating access. (145, 406)

RESPONSE In consulting with the Oregon State Marine Board about boating opportunities in the caldera, the Forest Service has agreed that modest improvements of boating facilities are appropriate. This could include boat ramps, and parking areas for boat trailers. Again, site-specific analysis will determine the scope of these projects. This approach is consistent with Marine Board long-range planning for the lakes.

See also the sections on camping for comments on the boat-in campgrounds, and the section on water quality for other boating issues.

ATV Use

ATV use brought many comments with a wide range of viewpoints. Five commentors were happy to have ATV's excluded from NNVM in the preferred alternative; 32 others were upset by the proposal. The latter group felt there was no reason to exclude ATV's from NNVM. One respondent said that the document was anti-ATV; another thought we had no one knowledgeable about motorized recreation on the ID team or Advisory Council. One person felt that excluding ATV's would exclude the physically challenged from the trails. The East Fort Rock OHV project is not relevant to the Monument planning decision, according to yet another commentor. ATV riders had suggestions for specific trails and roads they would like to use in and near the Monument. Some commentors requested only a corridor for ATV's to get across the Monument. One person predicted that a designated corridor would reduce illegal use of

ATV's on trails and roads in NNVM. The five commentors who opposed ATV access generally felt that off-road vehicle use is inappropriate in the Monument and should be minimized, especially in the summer. Some said ATV's tear up the ground and disturb people and wildlife. One horseman wanted to assure us that motorcycles and horses are not compatible.

Winter ATV use brought many comments. Thirty-one responses, one of which was a petition with 21 signatures, requested that ATV's be allowed to use groomed snowmobile trails. Some of these reviewers noted that ATV fees help pay for grooming. One commentor felt the Advisory Council's recommendation to ban ATV's from snowmobile trails was not based on resource protection or factual data. Four other commentors requested that ATV's be prohibited, citing safety and concern that ATV's tear up the groomed surface and thereby decrease enjoyment for other trail users.

COMMENT Was glad that OHVs were excluded in the preferred alternative; happy that ATV access will be denied. (109)

RESPONSE The Newberry Advisory Council, which advised the Forest Service in the preparation of the management plan, recommended to the Forest Service that we restrict ATV use in the Monument. They gave a number of reasons for this recommendation, including potential damage to resources, problems with enforcing limits on ATV activities, excessive noise, incompatibility with Monument values, and other public input asking for quiet, low-key recreation.

COMMENT Keep motorized and ATV use to an absolute minimum. There seems to be a myth being perpetrated in management circles that motorcycles and horses are not only compatible, but are preferred company! The whine of dirt bikes is just as displeasing and disruptive to horses and riders as it is to hikers. (119)

RESPONSE See above response.

COMMENT We believe that the off-road vehicle use, particularly in the summer, is an inappropriate activity at the present time. We believe it to be essential, in an area this small, that people visiting the Monument, the wildlife, and the ecosystem not be subjected to off-road vehicle access. (120)

RESPONSE The Forest Service proposed eliminating ATV use in the Monument in Alternatives C and C-Modified.

COMMENT It is sad to note that some of the individuals who sit on the Monument Advisory Council are the same ones who virtually locked up the East Fort Rock ATV project, by appealing it. There is no knowledgeable motorized person on either the ID team or the Advisory Council, and members on the Council have gone on public record as opposing OHV use. ATV use is the only recreation pursuit that now occurs in the National Monument that is being eliminated in the DEIS..... It appears throughout the document that there is a very definite anti-ATV attitude..... It is stated that recreational ATV use could be damaging in many sections. This is a strong anti-people and anti-recreational position for the agency to take. (110, 114)

RESPONSE A Forest Service ATV specialist was part of the Monument interdisciplinary team that put together the Plan, and provided valuable input on ATV use patterns. See List of Preparers in the FEIS. On the Advisory Council, the representative for recreation did go on record opposing restrictions on ATV use. The Advisory Council, in their deliberations, voted to recommend eliminating ATV's from the Monument, 6-1.

COMMENT The East Fort Rock OHV project is NOT an area, but an integrated trail system like many other trail systems for many other users. The restriction of ATV use in the Monument will, in all probability, impact the trail system that was recently approved, more than the trail system will impact the Monument. The mention of an OHV trail system east of the Monument in another part of the Ft. Rock District is not relevant to the Monument planning decisions. (111)

RESPONSE The Forest Service has provided for a large ATV trail system some 10 miles to the east of the Monument. There have been many public comments asking that the Monument be preserved in its quiet, tranquil state, without additional noise and traffic. The Forest Service feels that, in this case, the approach of separating uses is beneficial. There is an opportunity for ATV enthusiasts to recreate in a large trail system. And there is a Monument for those who desire a quieter experience that does not include ATV recreation. A large ATV system close to the Monument is a relevant factor in making decisions about the Monument. NEPA and Council of Environmental Quality (CEQ) regulations require the Forest Service to consider cumulative effects, which includes "past, present, and reasonably foreseeable" activities in the vicinity of the Monument that may have an effect on Monument activities or environmental conditions.

COMMENT Want ATV access to East Lake Resort and a "pass through" ATV corridor in the north end of the Monument. (126, 127, and 30 others supporting ATV access)

RESPONSE The range of alternatives proposed by the Forest Service analyzed an opportunity for an ATV pass-through corridor and access to East Lake Resort (in Alternative A). The Forest Service received strong advice from the legislatively-mandated Advisory Council to eliminate ATV use in the Monument, and this approach is part of Alternatives C and C-modified. See "Advisory Council Recommendations" in Chapter II). There is a 300-mile ATV trail system 10 miles to the east of the Monument, offering other, nearby opportunities for ATV riders.

COMMENT I believe that ATV's should be allowed an access corridor along the powerlines, but not access to the Caldera. Access to the caldera would conflict with the wildlife refuge and disturb people as well. (112)

RESPONSE Alternative A analyzed ATV access possibilities, including a corridor across the Monument.

COMMENT Giving a corridor would decrease the possibility of resource damage due to illegal use. It is better to control the use and restrict it to one route; responsible shared use on designated trails is proven to be easier than chasing radical outlaws cross country. (113)

RESPONSE Alternative A analyzed ATV access possibilities, including a corridor across the Monument. See the Record of Decision regarding reasons for the decision made in the Plan about this issue.

COMMENT The exclusion of ATV use will exclude those more physically challenged to partake in the scenic trail beauty of the area. (116)

RESPONSE The alternatives would provide for a variety of other ways to enjoy trails. Some trails would be designed to provide easy access and opportunities.

COMMENT The owner of the resorts stated that ATV use was a very small activity. It seems that an inappropriate amount of negative, restrictive comments are in the DEIS for such a small activity. (117)

RESPONSE The Environmental Impact Statement tries to portray the potential effects of different alternatives, including ATV use, on all segments of the public, and the land itself. During the planning process we evaluated existing use patterns, and tried to assess future trends and growth rates for recreational uses. The Plan sets long-term management for this area, and therefore it is necessary to look well beyond the present condition.

COMMENT There has never been a fire in the area, state or region that has had an ATV involved. (118)

RESPONSE ATV discussions in the Advisory Council focussed on social values and resource damage. The relationship between ATV's and fire was not discussed.

COMMENT Keep ATV's to designated areas as they really tear up the ground... It's OK to designate some play areas, but not throughout the forest. (121)

RESPONSE There is a large ATV trail system to the east of the Monument. No play areas would be provided within the Monument in any of the alternatives.

COMMENT Many people do not have street legal ATV's and children under age 16 cannot be licensed. (122)

RESPONSE Safety, and possible conflicts among recreationists were among the reasons the Advisory Council recommended eliminating ATV's from the Monument.

COMMENT ATV riders feel that there is no reason to be excluded from the "new" Monument; our bikes don't do damage, people do. (123)

RESPONSE See above responses on ATV issues.

COMMENT Want an ATV trail from East Lake Resort to the Ft. Rock OHV area; this trail could easily be kept out of sight of Road 21. (124)

RESPONSE Access to East Lake Resort was analyzed in Alternative A. Providing such a link would increase potential cumulative effects of the type discussed in the FEIS. The Advisory Council recommended exclusion of ATV use from the Monument, for reasons discussed earlier. See Chapter 2 (Advisory Council Recommendations) and Record of Decision for a more complete discussion of this issue.

COMMENT Add summer ATV use on limited roads to services (resorts) and campgrounds within the caldera and in the common corridor. (125)

RESPONSE This proposal was provided for and analyzed in Alternative A.

COMMENT Request dual purpose (shared use road) designation of Road 21 from the east, from the Monument boundary to East Lake Resort, strictly as access -- not recreation. This corridor has been used historically by many OHV families for the past 15 years without incident. This use has been incidental in the past and is estimated at 300 or fewer riders per year. OHV recreationists feel this is a minimal request and should be provided in all of the alternatives. (126)

RESPONSE This option was analyzed in Alternative A. See Record of Decision for reasons for the decision in the Plan on this issue.

COMMENT Permit ATV's on trails and roads; want use of existing trails (128)

RESPONSE See above responses.

COMMENT Want to pass from the Bend metro area south on trails through the Monument; want an additional corridor for ATV use oriented north-south between Paulina Lake and Lava Butte. (129)

RESPONSE See above responses.

COMMENT We would like access to the area in and beyond the Monument (east of the Monument) from LaPine and Bend. We would like to have at least two trails through that area and two ATV areas in that location. (130)

RESPONSE See above responses.

COMMENT By banning ATV use winter and summer, it could have a serious impact on the snowmobile budget which, in turn, could impact grooming and the snowmobilers. (115)

RESPONSE The Forest Service is choosing to adopt the recommendation of the Congressionally-designated Advisory Council regarding ATV use..

COMMENT Want winter ATV use on groomed snowmobile trails. (131)

RESPONSE This was analyzed in Alternatives A and D. The Advisory Council recommended eliminating ATV use in all seasons. See discussion of their advice in Chapter 2.

COMMENT We felt the resolution to ban Class I ATV's winter use of snowmobile trails in the NNVM by the Monument Advisory Council was not based on resource protection or factual data but purely a social issue. (132)

RESPONSE There were a number of reasons given by the Advisory Council for their ATV recommendation. The Forest Service is required to consider both social and environmental effects of the different alternatives for a Monument Plan. Among them were safety concerns, resource damage, social issues, and enforcement problems.

COMMENT ATV's have to stay on groomed trails, or they won't even move. (133)

RESPONSE See above responses, and discussion in Chapter 2 on Advisory Council recommendations. See also discussion in Chapter 4, recreation.

Winter Recreation

Most of the 39 comments we received on winter recreation asked for improved or increased opportunities for winter activities. Requests for more trails, warming shelters, and parking for nordic skiing and snowmobiling were numerous. A new sno-park at the proposed portal facility in Alternative C was favored by some commentors, while others favored enlarging the 10-mile sno-park instead. Some snowmobilers did not want more trails or a new sno-park on road 21, because they felt that more users would be attracted to an already congested area. The portal ("12-mile") sno-park would extend the season of use, said one commentor. Several people requested that trails be developed from the proposed geothermal area sno-park outside the Monument.

Commentors had a wide range of opinions about use of snowmobiles in NNVM. A dozen respondents asked that snowmobile use be controlled to improve safety and provide quiet

areas for nonmotorized recreationists. Separating nordic and snowmobile use, or at least limiting mixing of the two uses, was suggested by seven people. We received requests from snowmobilers, as well as nordic skiers, to establish some areas where snowmobiles must stay on trails and/or certain areas that are off-limits to snowmobiles. One commentor wanted snowmobiling eliminated completely; another expressed a feeling that snowmobiles had "taken over" the Monument. On the other side of this issue, seven people asked that there be no restrictions on snowmobile use. Five of these comments particularly disapproved of speed controls. One person said "It would be too bad to see the nonmotorized-use people taking the area away from the snowmobilers."

The concept of a low-speed area (e.g., from the 10-mile sno-park to East Lake) also elicited a range of comments. Some respondents favored the idea; some opposed it. One commentor (a snowmobiler) suggested that the corridor be expanded to include the route from 6-mile sno-park to 10-mile sno-park and the route to Paulina Peak. Instituting a definite speed limit was also suggested by one person. Safety for all users was the concern given by those who favored the idea. Those who opposed the idea stated that it was an unnecessary restriction.

COMMENT Continue snowmobiling without any restrictions. (17, many others)

RESPONSE Snowmobile activities would continue under all action alternatives proposed by the Forest Service. Only one area in the Monument, the River Zone, would be off-limits to snowmobilers, because of wildlife concerns. Additional snowmobile trails would also be built. Safety concerns in congested areas might lead the Forest Service to post signs such as "Congested Area -- Go Slow", or other appropriate wording, or to ask in some areas that snowmobilers please stay on trails.

COMMENT Want as much access for snowmobiling as possible. (3)

RESPONSE See above response.

COMMENT No speed restrictions for snowmobiles; speed restriction not needed.... "There are no speed limits for snowmobilers now and the historic values should be protected. This will not be supported by the snowmobilers."; "We are opposed to posting a speed limit. It is another regulation that the FS probably will not be able to enforce." (24)

RESPONSE See above response.

COMMENT Rather than just low speed, make it a definite controlled or fixed speed for the main road from 6-mile sno-park to Paulina Lake and the same to Paulina Peak..... The growing use of this area and the national recognition we are getting means that we must take safety measures. (25, 27)

RESPONSE The Forest Service does not feel it is necessary to impose a speed restriction on snowmobiles at this time. However, if conflicts or accidents increase, in the future we could need to look at some kind of controls to ensure public safety in the area.

COMMENT I was particularly pleased with the suggestion to provide for a "speed-controlled corridor" from 10-mile sno-park to East Lake. Because this route provides major access to the area for all users, it seems that general safety and enjoyment for all must be maintained." (26)

RESPONSE There have been few conflicts or complaints about excessive speed. The Forest Service feels that a speed limit is not needed at this time. See also above responses.

COMMENT Want larger snowmobile trail system to spread out activity over larger area and keep up with increasing use of the area. (1)

RESPONSE Alternatives C and C-Modified would call for building new orange diamond (snowmobile) trails in various parts of the caldera and flanks. A snow shelter in the caldera would also be planned to enhance winter recreation.

COMMENT Do not increase the density of snowmobile trails. (4)

RESPONSE Additional trails will be built in a manner that disperses, not concentrates, use.

COMMENT "You need to remember that the snowmobilers have worked hard over the years making Paulina the attraction for winter use that it is today and it would be too bad to see the nonmotorized use people (cross country skiers) taking it away." (19)

RESPONSE See above responses. Both snowmobiling and cross-country skiing are "traditional" recreation activities that were taking place when the area became a national monument. The direction for the desired future condition for the Monument states that "Visitors using Monument trails experience minimal conflict with other trail users, and trails are planned and managed to reduce or prevent conflicts."

COMMENT More snowmobile trails, snow shelters, and sno-parks are needed to accommodate increasing numbers of snowmobile users. (2, 152)

RESPONSE Alternatives A, C and C-Modified call for the building of new winter trails and a new parking area and sno-park to help disperse use and accommodate winter recreationists. Snow shelters are also proposed.

COMMENT New winter facilities will make a longer season of use in NNVM. (153)

RESPONSE Alternatives A, C and C-Modified offer opportunities to extend the winter season. The proposed portal facility near the entrance to the caldera would be intended to function year-round, and could be used as a winter sno-park. A project proposal and maintenance plan would be part of a site-specific analysis. Because of topography and the variable snow line, the closer this facility is to the caldera, the longer the winter recreation season.

COMMENT Need more parking space for snowmobilers (2)

RESPONSE The new sno-park proposed in Alternatives A, C and C-Modified would provide additional parking spaces for winter recreational use. Specific design criteria for parking would be decided at the site-specific level.

COMMENT Should be able to ride up on the back rim for the great view and play in the rollercoaster and hell hole. All roads and trails open for summer use can be winter snowmobile trails. (9)

RESPONSE This area is open for snowmobilers' enjoyment now, and nothing in the alternatives would limit this access. Specific trail planning will be done as a later project.

COMMENT Need more nordic trails in the Monument. "Why do the snowmobilers have almost exclusive use of this beautiful area? The interpretive sign at the bottom said that there were 100+ miles of snowmobile trails, and only three miles of nordic trails!".... "The few miles of nordic trails that are available are covered with down trees and nearly impossible to ski --- which forced us to ski the road. Yuk!! Noise, fumes and too much commotion." (5)

RESPONSE All action alternatives (A, B, C and C-modified) would provide for additional nordic trails. These trails would be designed to reduce or eliminate conflicts between user groups. See Chapters 2 and 4 for descriptions of additional trail miles in alternatives. The proposed sno-park at 12-mile would also enhance nordic opportunities by providing easier access to the caldera.

COMMENT Eliminate snowmobiling (16)

RESPONSE The legislation establishing the Monument directed the Forest Service to consider in its Plan the full range of existing and appropriate new recreational facilities and programs. This has been interpreted to include "traditional" uses taking place at the time the area became a Monument (1990). One of these traditional uses was snowmobiling. Snowmobile groups were active participants developing the legislation that created the new Monument. All alternatives would allow for continuing snowmobile use.

COMMENT Would like some areas of the Caldera and/or Flanks that are off-limits to snowmobiles. (15)

RESPONSE Snowmobilers were active in the Monument Citizens Committee, which developed the legislative proposal for the Monument. After lengthy discussions about what were appropriate uses in the area, the Citizens' Committee recommended not to establish exclusive areas for snowmobile or nordic use. The Newberry Monument Advisory Council (required by the legislation and appointed to advise the Forest Service on the development of a Monument Plan) has also endorsed the "shared-use" concept. The Forest Service, in the alternatives for the Plan, has continued this approach. To date, nordic and snowmobile groups in the Monument have worked well together, and user conflicts have been rare. Our management approach is to encourage a good experience for both user groups through trail system designs that separate and disperse. If this is not feasible in some areas, we may ask users to stay on trails in some places. Such a decision would be part of a site-specific analysis for trail systems.

COMMENT Have some areas where snowmobiles must stay on trails; "Perhaps some regulated snowmobile use could be allowed to follow existing roads and snowmobile trails, but it must be carefully controlled and specified..." (18)

RESPONSE See above response and response to #17.

COMMENT Multiple use is certainly lacking for winter recreation opportunities - as the motorized vehicles have taken over the Monument! (23)

RESPONSE More nordic trails would be built under all alternatives, and the new portal facility would enhance non-motorized winter recreation by providing more access to popular areas. These steps are designed to improve non-motorized winter recreation opportunities.

COMMENT Limit mixing of snowmobiles and skiers; skiing and snowmobiling are not compatible. Please consider separating the uses. We need a safe and quiet area for nordic use. (6, 20)

RESPONSE Trail design (for blue diamond trails) and additional nordic trail miles, will provide enhanced opportunities for cross-country skiers. See also response to #15 above.

COMMENT Develop ski trails out of the geothermal site. (7)

RESPONSE Any trail development directly related to possible geothermal development is outside the scope of the Monument Plan. However, if geothermal development does proceed, linking winter trails from that site into the Monument would be studied and evaluated.

COMMENT Groomed trails should be listed as multiple use trails, not snowmobile trails. (8)

RESPONSE The shared use of groomed trails has, for the most part, worked well. Both nordic skiers and snowmobilers may use these groomed trails.

COMMENT Oppose a new sno-park (at 12-mile) because it would bring more congestion into an already congested area. (155, 156)

RESPONSE The new sno-park would be designed to ease congestion by providing more parking and dispersing use. Presently the 10-mile sno-park is full to overflowing on holidays and weekends in the winter. The intent of the new sno-park is to make winter parking and access flow more smoothly.

COMMENT Add dog sledding and skijoring to the list of uses allowed. (11)

RESPONSE Currently, no restrictions have been placed on dog sledding or skijoring.

COMMENT Exclude 4-wheel vehicles from certain well-used ski trails and dog sledding trails - they ruin areas for skiers and sledders in the winter and the summer just because of their poor judgement.... No 4-wheel vehicles to proceed above the 10-mile area on roads or trails. They tear up the groomed trails for snowmobilers and skiers. It is also very dangerous." (12, 13)

RESPONSE The Road 21 gate is closed at the 10-mile sno-park each winter when there is sufficient snow for snowmobiling and skiing. When the gate is closed, the road above the gate is not plowed and is not suitable for wheeled-vehicle use. Regarding ATV use of winter trails, the preferred alternative would exclude ATV use from the Monument in the winter.

COMMENT Allowing use of motorized vehicles (in the winter) provides handicapped access that cannot be provided by skiing and snowshoeing. (108)

RESPONSE Winter motorized use is provided with snowmobile trails and facilities.

COMMENT Provide a family play area (non-motorized) for sledding. 10-mile sno-park is being used for this, but is unsafe..... Need more winter opportunities for children, such as sledding areas, with warming facilities. (21, 158)

RESPONSE Because of liability concerns, the Forest Service does not choose to formally designate a sledding area at this time. However, there are many suitable areas in the caldera for good sledding. Warming shelters are also proposed in the Plan. See also above response to #15.

COMMENT Applaud your efforts to recognize the needs of diverse user groups and to strive to find a balance for different activities. (22)

RESPONSE Newberry winter recreationists have worked together in a spirit of cooperation and harmony, and the Forest Service seeks to continue this tradition of shared use and courtesy in the Monument.

COMMENT Suggestions for new sno-park location: Road 21, or Road 9735 near geothermal site. (9735 site would connect to Trail 80.) (154)

RESPONSE The exact location of any new sno-parks would be the subject of a site-specific analysis. Decisions about facilities on the geothermal project site are beyond the scope of this analysis. However, such a proposal has been made and evaluated as a possibility in the EIS for the geothermal project.

COMMENT Reasons to put new sno-park on 9735 (near geothermal site): "This is more desirable than the 12-mile site off Road 21. Would help ease congestion and parking problems; would help disperse winter traffic to new areas that are not used currently; would be much less expense for the FS and public, since geothermal developer would build it and plow up to it."....."Oppose sno-park at Road 9721 junction, as if that happens we will have a congested area far worse than Dutchman Flat." (155)

RESPONSE See above response for location of proposed new sno-park. See also response to #7.

COMMENT Enlarge 10-mile rather than build new sno-park at 12-mile..... Would not want a snopark at 12-mile because it would bring more congestion into an already congested area. (88, 156)

RESPONSE Engineers have done a preliminary study that shows expansion possibilities are very limited at 10-mile. The intent of the new sno-park would be to disperse use, provide more parking, and enhance winter recreation opportunities.

COMMENT Like the idea of a 12-mile sno-park. This would make the Crater area accessible to more skiers. (157)

RESPONSE This proposal is part of the preferred alternative.

COMMENT Need more description/explanation of new sno-park on Road 21. For example, size? overnight use? provide for vehicles with trailers?, etc. (159)

RESPONSE The size, location, and capacity of the proposed sno-park would be analyzed with a site-specific proposal.

COMMENT Winter use of ATV's should be allowed on groomed snowmobile trails.(14)

RESPONSE See responses in ATV section, above.

COMMENT We need good trail maps, especially for winter users.

RESPONSE New recreational maps for the Monument are in process to meet this need. Winter maps can also be found at the Bend/Ft. Rock Ranger Station in Bend.

Interpretation

Interpretive facilities and programs brought over a dozen comments. Some people felt that Lava Lands Visitor Center needs to be enlarged and updated. Others cautioned us to be sure to keep overall costs "in check." The proposed portal facility, which would orient visitors to the caldera, generally received support. One commentor said it could serve as a starting point for a shuttle service around the caldera and to Paulina Peak.

Some people wanted more and better interpretive programs. Several also requested more signs, booklets, and trailhead information. Four respondents particularly liked the emphasis on research in the Plan, with the results being made available to the public through some kind of interpretation. On the other hand, three commentors wanted less interpretation or research emphasis in the Plan.

Some people also offered specific suggestions for interpretive programs.

COMMENT "Renovation of the Paulina Peak viewpoint should be one of the highest priority projects. I have been on the summit numerous times and have almost always heard comments about the lack of any interpretive signs describing the view." (147)

RESPONSE As part of the preferred alternative's emphasis on interpretation and education, some kind of interpretation from the top of Paulina Peak would be appropriate. This could be a sign, a roving interpreter, or some combination of techniques. There are four priorities for making improvements to the Monument's recreational facilities: 1) Upgrade and improve existing facilities in the caldera and add a portal facility to inform and educate people about this unique area. 2) Upgrade and (perhaps) expand facilities in the Lava Butte Zone (including Lava Lands Visitor Center) to serve the expanded interpretive program. 3) Upgrade, expand and add new day-use opportunities in the Transition Zone, and 4) Add new day-use opportunities in the western part of the caldera.

COMMENT Make use of the CCC guard station for interpretation.

RESPONSE The Forest Service currently uses the existing CCC guard station for interpretation. That use and restoration of the facility in accordance with the National Historic Preservation Act would also be appropriate in the future.

COMMENT Some areas should be open to the public without a guide; I only want it (the Monument) open in certain sections, not the whole area. (77)

RESPONSE Most parts of the Monument are, and will continue to be, open to the public without a guide. Interpretive programs in semi-primitive areas (75% of NNVM in Alternative C-Modified) generally will be unguided; however, some limited guided opportunities may also be available. Lava River Cave will be open only to guided tours in the winter, in order to protect hibernating bats. The Cave will remain open in the summer to both guided and unguided use. The main purpose of the River Zone is to protect wildlife and wildlife habitat. Therefore, all recreation and interpretive use will be discouraged in the River Zone, whether guided or unguided. Parts of this Zone may be closed to all activities at certain times, for example to protect nesting waterfowl or wintering elk.

The preferred alternatives would provide for three "levels" of interpretation: 1) Short Term -- appropriate for visitors to Lava Lands or the caldera who only have a limited time for a visit, 2) Engagement -- learning about the Monument at a deeper level, with more hands-on activities, and 3) Discovery -- where there are few guides such as signs or booklets, and people discover things for themselves.

Interpretation will take place principally in the Lava Butte and Caldera zones. Many other areas, such as the River Zone and the Flanks Zone, will see minimal interpretation, allowing people opportunities to discover things on their own. Our intent is to offer a menu of interpretive choices, so that visitors can choose the duration and intensity of their experience. They could choose to visit Lava Lands, take a guided interpretive hike, read a brochure, check out a discovery pack, or explore on their own.

COMMENT Lava Lands Visitor Center desperately needs to be enlarged and updated. "It seemed small and limited in its displays and interpretation." ... Renovate Lava Lands, but keep overall costs in check. (138, 139)

RESPONSE The preferred alternative calls for a moderate expansion of Lava Lands Visitor Center to support an improved interpretive program. This "campus" at Lava Lands would offer flexible facilities that would enhance visitors' understanding of the unique wonders of the Monument. Cost of materials, maintenance, etc., for any expansion would be part of a site-specific analysis. See also response to #147 above.

COMMENT Directing visitors to specific areas with interpretive efforts made available is a very healthy approach for the Monument.

RESPONSE The Lava Butte Zone and eventually the Transition Zone would serve as interpretive "hubs" for the Monument.

COMMENT Make day use a little more interpretive. (58)

RESPONSE The preferred alternative, C-Modified, calls for an expanded interpretive focus. Most new day-use facilities would emphasize interpretation. This approach would offer opportunities for visitors to the Monument to learn more while they are enjoying day-use activities.

COMMENT I like self discovery and learning things on my own. (61)

RESPONSE Large areas of the Monument will be open for unguided, self-discovery type interpretation without signs or large tour groups. Semi-primitive areas (75% of the Monument in Alt. C-Modified) will be especially good for these types of activities. Our intent is to offer a menu of interpretive choices for people of all ages, backgrounds and abilities.

COMMENT Like emphasis on education and research, and the uniqueness of the area. (103, 298)

RESPONSE This is the focus of Alternative C-Modified, identified as the preferred alternative of the Forest Service.

COMMENT Too much emphasis given to interpretative programs. Prefer self-guided. (299)

RESPONSE Large areas of the Monument will be open for self-guided activities. See above response to #61.

COMMENT I like the idea of education areas (300)

RESPONSE Initially, most interpretive activities will occur in the Lava Butte and Caldera Zones. Eventually, the Transition Zone could also serve as supplemental interpretive/educational area.

COMMENT There's too much change in the natural environment to accommodate "on-site" education. (301)

RESPONSE Any on-site education would have the minimum impact possible on the environment.

COMMENT Would like information on Paleo-Indian life. (302)

RESPONSE This type of information will be a key part of the expanded interpretive program.

COMMENT Pipeline right-of-way is compatible with interpretive/educational uses of its surroundings. (303)

RESPONSE We agree. Interpretation will be designed to be compatible with various surroundings -- from the pipeline right-of-way to the lakes in the caldera.

COMMENT Uniformed roving greeters contact more people than designated hikers. (304)

RESPONSE Roving interpreters are an important part of the preferred alternative's interpretive program.

COMMENT Would like to see more signs & kiosks with shaded seating areas --- also booklets, handouts, trailhead info are all needed. (305)

RESPONSE These suggestions will be considered in long-range interpretive program planning.

COMMENT Scientific knowledge of our heritage and "world class" interpretation of that knowledge is the best means of sponsoring public appreciation and stewardship of fragile resources. (306)

RESPONSE See above responses

COMMENT Wants interpretive center, perhaps near the falls. (307)

RESPONSE The preferred alternative calls for improvements to Lava Lands Visitor Center and to the CCC guard station interpretive facility near Paulina Falls.

COMMENT Encourage visitors to come to the Transition Zone. Direct use to other areas in Central Oregon. (308)

RESPONSE The preferred alternative offers interpretive programs and opportunities that will direct people to locations outside the caldera, including the Transition Zone and other areas in Central Oregon.

COMMENT Educational classes and seminars are a real good idea. (309)

RESPONSE We hope to expand the interpretive program to include more classes, seminars and field study opportunity. Alternatives C and C-modified call for an expanded interpretive program.

COMMENT The idea of discovery pack sounds good but is risky. (311)

RESPONSE We will contact other national parks and monuments that use discovery packs to identify and hopefully minimize problems with their use.

COMMENT History and current information on geothermal activities should be interpreted. (312)

RESPONSE There is currently a prominent display on geothermal energy at the entrance to Lava Lands Visitor Center. Geothermal activities could provide interesting opportunities for interpretation and will be considered in interpretive planning.

COMMENT Like the idea of interpretive and educational facilities for bats. Bat Conservation International has good designs for bat boxes. (313)

RESPONSE Interpretation of bats and their habitats is an important part of the Monument's educational programs. One possibility is including public involvement in building and installing bat boxes.

Roads, Cars, and Traffic

Twenty respondents were concerned about roads and traffic issues in the Monument. Three of these asked for more information, such as locations of road closures and changes. One said that more road construction is needed, while another felt that all action alternatives had too much development. The Monument road should be included in the preferred alternative and deserves a priority commitment, according to three commentors. Some people asked for certain roads to be improved; others asked that particular roads be closed. One respondent asked that particular roads be left open for access to geologic sites. Another requested that no additional miles of road be plowed for winter access. The Oregon Department of Fish and Wildlife (ODFW) felt that no new roads should be built in the Flanks Zone, and that any existing roads there should be obliterated. The Department was also concerned about deer/vehicle collisions on Hwy. 97 and recommended deer underpasses. How do proposed roads relate to roads

adjacent to the Monument, future timber management outside the Monument, and possible roading for geothermal development? ODFW wanted to know. Two commentors requested more research or planning before roads are improved or constructed.

Management of motor vehicles within NNVM was a subject of concern for a number of commentors, who had a variety of concerns and questions. Four people asked that we consider shuttles to prevent popular areas from being overcrowded with vehicles; one person asked that we not restrict access during times when shuttle service was not available. Another respondent requested that we minimize use of private motor vehicles; yet another wanted to limit big motorhomes. One respondent asked that we continue to consider a loop drive opportunity, while another did not want us to "cater" to the drive-through syndrome. One commentor asked that we not allow "detrimental use" of recreation sites by motor vehicles.

COMMENT Road closures in this well-written document were not clear for each alternative..... Nowhere is there identification of what roads will be closed. At a minimum, the powerline road, the pipeline road, Road 9723, Road 9720 (the part crossing the Monument) and the old logging roads should be closed. (160, 175)

RESPONSE We have added more information in the FEIS about proposed road closures, in response to public comment. See the Roads section of Chapter 4. Road closures would require further site-specific analysis. See also the next comment and response.

COMMENT The Plan lacks a clear analysis of what will happen with roads. A big problem is the lack of a MAP which shows the proposed road changes, what will be built, what will be altered, what will be closed (and how). (161)

RESPONSE The map showing principal roads in the Monument (Chapter 3) has been improved. Since this is a programmatic (general) document, it does not make decisions about specific roads to be closed. General areas of road closure proposals have been identified. See Roads section of Chapter 4.

COMMENT There are problems with a lack of alternatives, specifically so-called "developments" which are apparently common to all action alternatives. Why are there significant developments which are designed to increase use in the area under all action alternative? (162)

RESPONSE All action alternatives would reduce the overall miles of roads compared to the present. The only "significant" facility development in the preferred alternative is the small portal facility near the caldera, which is designed to orient and disperse people and thereby reduce impacts on the land. Trail development varies by alternative, from minimal (D) to extensive (A). In the preferred alternative, trail development will provide for some increase in use, but will also better disperse this use.

COMMENT More roads and other developments would tear up the natural beauty of the Monument. (95)

RESPONSE See above response

COMMENT Separate the different areas of interest so as to not create traffic patterns that might cause congestion. (100)

RESPONSE The preferred alternative designates areas where there will be more people and traffic (Lava Butte Zone and Caldera Zone) and other areas where there will be no cars (River, Flanks). The preferred alternative provides opportunities for both motorized use and more "primitive" experience away from other people. Site-specific improvements to busy areas such as Lava Lands and the caldera will incorporate enhancements in traffic routing to reduce congestion.

COMMENT We hold the Sugarpine C & H grazing allotment adjacent to NNVM. Our concern is that if and when geothermal drilling takes place, there will be a dramatic increase in vehicular traffic on the two roads that flank the west side of the Monument, and traffic conflicts will increase dramatically. (358)

RESPONSE This issue is addressed in the geothermal FEIS, which was released in the summer of 1994. It is not specifically covered in the Monument Plan, because this traffic concern occurs outside the Monument boundary.

COMMENT Under Alt A, you talk about access roads on both the east and west sides of 97 that would essentially add four lanes of traffic and make the corridor an eight lane highway. Deer/vehicle collisions would definitely increase. Deer underpasses are needed. Paragraph three under this alternative (page IV-81 in Draft EIS) makes no sense. (163)

RESPONSE Alternative A was designed to provide maximum access for people to NNVM. Therefore, some impacts to wildlife, especially deer, would occur, and these impacts were disclosed as required by NEPA, in Chapter 4 of the DEIS. The Forest Service identified Alternative C as the preferred in the draft.

COMMENT A transportation plan should be completed and road management objectives identified. It should be done in this plan. (164)

RESPONSE We gave a great deal of thought and discussion to traffic management and roads. The preferred alternative provides a framework for managing traffic flow in the future, but does not set down specifics such as road width or surface. We identified traffic patterns and where we wanted use to occur, and how to minimize its impacts on the environment. Further site-specific analyses will be done before implementing road closures and campground reconfigurations. With respect to roads, the Monument legislation requires the Plan for the Monument to address the general location, design, construction and maintenance criteria; standards for motorized vehicle use; traffic management; and criteria for closing and obliteration of roads. All of these items have been addressed in management goals, objectives, desired future conditions, or standards and guidelines for the preferred alternative, C-Modified.

COMMENT How do proposed roads relate to possible roading should some degree of geothermal development take place? How does it relate to roading adjacent to the Monument and future timber management outside the Monument? (165)

RESPONSE The Monument Plan addresses road and traffic patterns within NNVM, while taking into account links to nearby areas, including the proposed geothermal development west of NNVM. Specific road links will be decided on a site-specific basis. This Plan provides the framework. See also previous response.

COMMENT Not enough attention to roads in Alt. C. Road conditions are important. (166)

RESPONSE The preferred alternative (C-Modified) calls for safety and maintenance improvements to existing roads. Improvements would be designed to provide safety and visitor comfort without encouraging substantially higher traffic levels. See also earlier responses.

COMMENT Roads to Lava Cast Forest and Benham Falls should be blacktopped ASAP. They leave visitors with an unfavorable impression. (167)

RESPONSE See above response.

COMMENT I don't want to see a lot of roads for motor homes because they would tear up the natural habitat.... I don't think tourists should have many big motorhomes. (45, 168)

RESPONSE Some of the Monument's roads are suitable for motor homes; many are not. This provides a variety of driving experiences for many segments of the public.

COMMENT Want the EIS to mention that no additional miles of road would be plowed for winter access. (169)

RESPONSE The only additional miles of road that might be plowed in the winter are the two additional miles of Road 21 above 10-mile sno-park leading to the proposed new portal facility, and (in the event of its development) the new access to Lava Lands Visitor Center.

COMMENT We believe the Monument Road as described in Alt A (to Rd 21) should be included in the long range plan, but only be constructed if use increases dramatically. If so, it would provide better north-south access.... I like the idea of the Monument Road; the Monument road proposal is a sound management decision and requires a priority commitment. (170, 171)

RESPONSE The Monument Road is part of Alternative A. The Forest Service received advice from the Advisory Council not to construct more roads. The preferred alternative (C-Modified) would upgrade the surface of existing roads (9710 and 9720) to provide a more pleasant loop drive than now exists.

COMMENT No more road construction is needed..... No more roads should be built or paved anywhere in the Monument until their cumulative effects (e.g. on wildlife migration) are understood. (172, 173)

RESPONSE Alternative C-Modified emphasizes no more road construction (except re-routing the entrance to Lava Lands and Lava River Cave via Cottonwood Road), utilizing existing roads, redesigning access for safety, and upgrading road surfaces with rock.

COMMENT More detail is needed on the proposed loop roads. People need to judge whether these will be too much development. (174)

RESPONSE The proposed new loop road, which was identified as an opportunity in Alternative C of the draft, has been dropped from Alternative C-Modified in response to public comment. Instead, Alternative C-Modified would upgrade the existing "loop" now formed by Roads 9710 and 9720 to provide more safety through turnouts, and a more durable, pleasant rock surface.

COMMENT Regarding the River Zone: All roads in this area except 9702 (from Lava Lands to Benham Falls), and the one to the top of Lava Butte should be closed to motorized traffic. This is an important migration corridor for deer. (176)

RESPONSE We have identified a number of roads in the River Zone which could be closed. Site-specific analysis will decide which ones will be closed. See Chapter 4, Roads section, for more details.

COMMENT Regarding the Flanks Zone, Transferal Area, Transferal Area Adjacent, Special Management Area: No new roads should be built in these areas. Any existing roads should be obliterated. (177)

RESPONSE We have identified a number of roads in these areas which could be closed. Site-specific analysis will decide which ones will be closed. See Chapter 4, Roads section, for more details. The Monument legislation provides for existing geothermal rights in the Transferal Area, which includes road development, if needed for geothermal development.

COMMENT Close the road to Paulina Peak during tourist season and have a shuttle; a shuttle system might be looked at to keep the amount of cars down in the caldera..... Improve road to Paulina Peak, but have shuttle to prevent overcrowding in small parking lot at summit. Don't restrict access to private vehicles when shuttle isn't running (also applies to Lava Butte). (44, 83)

RESPONSE A shuttle similar to the one now operating at Lava Butte is consistent with the preferred alternative, and may be implemented in the future. Private cars could go to the peak when the shuttle was not running.

COMMENT Encourage private contracts to provide shuttle services to "hot spots" around the Monument. Discourage heavy use of private vehicles. (84)

RESPONSE See above response. One option would be to allow shuttles originating at Lava Lands or the new portal facility and touring various parts of the Monument. This would reduce the number of private cars and provide a quality interpretive experience.

COMMENT Limit and minimize use of the Monument by motor vehicles..... There should be no detrimental effects to recreation sites by motor vehicles. (38, 43)

RESPONSE See above responses on shuttles. Also, Monument summer trails are designed for non-motorized use. Roads and other facilities are provided for motorized use.

COMMENT Like Alternative C, but would prefer to see fewer roads (134)

RESPONSE Alternative C-modified has fewer miles of road than Alternative C, in response to public comment.

COMMENT Guarantee access on roads 21 and 2127 for those who with to visit geologic sites. (63)

RESPONSE There are currently no plans to limit access or close either of these roads.

COMMENT Want fewer acres of roaded natural recreation (prefer fewer roads). (57)

RESPONSE Alternative C-Modified has fewer acres of roaded natural recreation in response to public comment.

COMMENT You still should consider a drive-through opportunity from the Lava Butte area to the caldera forming a loop opportunity. Newberry's future use will be mostly day use visitor. So, lets not bottle neck people and traffic in the caldera. (46)

RESPONSE Versions of a new Monument or loop road were considered in Alternatives A and C. Alternative C-Modified (preferred) features a number of new day-use opportunities to help disperse people outside the caldera. It upgrades an existing "loop" (9710 and 9720) to provide a better driving experience.

Facilities

With regard to facilities, two comments requested more detailed information in the plan, in order to judge whether new facilities would be too much development. Emphasis should be on improvements to and "cleaning up" existing facilities, said another respondent. Nine reviewers suggested specific facilities to be upgraded.

COMMENT Need more detail on proposed new facilities (e.g. loop road, portal, sno-park). "People need to judge whether these will be too much development." (136)

RESPONSE The Plan and FEIS are programmatic documents, outlining general areas where development might take place in the future. The size of the facilities (Lava Lands expansion, portal/greeting center, trails) will be decided at a site-specific level.

COMMENT Support the proposed portal facility, because it would allow all visitors to receive information on the caldera's features and facilities. It could serve as the starting point for a shuttle system around the caldera and to Paulina Peak. (146)

RESPONSE The portal facility is included in Alternative C-modified, the Forest Service's preferred alternative.

COMMENT Additions to existing facilities should be minimized. Emphasis should be on improvements to and "cleaning-up" existing facilities. (135)

RESPONSE Our first priority is to maintain and where possible improve existing facilities. See the Activity Schedule in the Monument Plan. One new facility we feel would be important is a new portal and greeting building near the entrance to the caldera. This would help orient and educate visitors to the crater's environment and help with environmental protection in the face of increasing visitation.

COMMENT Put more emphasis on recreational facilities for children. (60)

RESPONSE Facilities would be designed with children in mind.

COMMENT Keep senior citizens in mind. They use many of the Monument's facilities. (56)

RESPONSE Campsites, trails, and other facilities are designed to accommodate people of all ages. Visitors will find a range of different levels of challenge and safety in the Monument.

COMMENT "The new organization picnic area could use a covered picnic area." (149)

RESPONSE Where possible, shade could be provided by facility design, or using existing trees.

COMMENT "Provide for a parking area near the junction of Trail 61 and Road 9710 to facilitate dispersed recreation in the north area of the Monument. Nothing fancy is needed, but currently it is very difficult to park in this vicinity with a pickup and horse trailer." (150)

RESPONSE This area is outside the Monument, and therefore outside the scope of this Plan. We have passed the suggestion on to the Recreation staff of the District.

COMMENT The cost of change in capacity of interpretive facilities seems excessive. If there is an increase of facilities where will the extra money come from? We are asking the FS to provide more services at a time when funding is being cut. Would place an additional burden on the state to plow to new snopark. (385)

RESPONSE We have tried to be conservative in planning any new facilities. Two moderate projects (portal facility and Lava Lands expansion) are proposed in the preferred alternative, in addition to some day-use facility expansions. These are long-term projects, and the cost will be spread out over many years. Implementation will depend on available funds. We felt it was responsible, however, to plan some facilities to interpret this special area to increasing numbers of people.

Vegetation and Fire

Old growth ponderosa pine ecosystems

We received six comments about our plans to recreate old-growth ponderosa pine in the Monument. One respondent indicated that these ecosystems did not necessarily have to be fire-based and "pre-EuroAmerican" in character, based on the Monument legislation. Another said that species and structural diversity has increased with fire suppression, so "historical" may not be what we want. How to get to old-growth conditions needs further discussion, according to all of these commentors: One suggested more emphasis on silvicultural practices; some (including ODFW) favored as little mechanical treatment as possible. ODFW also emphasized preserving what variation currently exists in the landscape. One comment (a joint response from two national and two local conservation groups) said that anything other than natural ecological succession with a "hands-off" management policy needs to be limited, justified, and carefully explained. A discussion of present stand conditions was requested by one respondent for areas both inside and immediately adjacent to the Monument.

COMMENT Is managing for big game cover in conflict with development of historic old-growth? (181)

RESPONSE Some areas of the Monument will be managed for big game cover. Some areas will be managed for historic old growth pine stands. The open, park-like stands of large trees would offer less big game cover than exists in "fire-suppressed" stands today. We plan to ensure some of both. We have also lengthened the fire-based cycle in Alternative C-Modified to help provide big game browse. See Areas of Concern and Opportunity map and text for specifics.

COMMENT We agree that prescribed burning is a viable tool in ponderosa pine ecosystems and support its use to recreate and maintain "historic" ponderosa pine old growth. We suggest, however, that you might want to consider more emphasis on silvicultural practices in these stands. (185)

RESPONSE Both prescribed fire and mechanical means will be used. The Monument legislation speaks of allowing natural ecological succession of vegetation to unfold to the

maximum extent practical, and we have emphasized fire (a natural process) in some stands for that reason. A site-specific analysis will include costs, resource issues, and a determination of the most effective methods for treatment in each area.

COMMENT Another basic problem with the FS's interpretation of the Act is their view and emphasis that Section 6 authorizes "treatment" of so much of the Monument's forested acres. Section 6 requires only that certain issues like reestablishment of old growth ponderosa pine ecosystems and fire and fuel management prescription be addressed. (186)

RESPONSE The accompanying map of areas of concern and opportunity shows some areas where it would be feasible to move toward the open, park-like stands of old growth ponderosa pine. Because of past fire suppression, some of these areas now carry high fuel loads which could put present and potential old growth forests at risk. Therefore, in certain areas, we would propose light treatments designed to protect existing old growth, and restore conditions that enhance future old growth. These goals would be met by using prescribed fire, and in some cases, mechanical treatments. The Forest Service feels these actions are prudent in some areas because of the "unnaturally" high fuel loads.

Our proposal in the management plan for the next ten years is to identify priority areas for protecting the big ponderosa pines that are growing now. We envision perhaps five to eight projects of 50 - 200 acres each in the ponderosa pine forest during the next decade. Each one will be carefully planned and monitored, with a high level of public involvement and scrutiny. Site-specific NEPA analysis, including scoping and public involvement, will be a vital part of this process. We will also monitor carefully the results of any projects to be sure they are doing what they were intended to do.

COMMENT Any attempt by the FS to reach the state of a old growth ponderosa pine ecosystem other than by using natural ecological succession needs to be carefully explained and justified in great and specific detail, not the deliberately vague language of the draft Plan. Any "treatment" must be limited. (187)

RESPONSE Alternative C-Modified was developed in part to respond to this comment. It would treat far fewer acres than were proposed in the draft. The intent of any treatments is to return to a more "natural" condition, after decades of fire suppression has allowed high build-ups of fuels. Since this is a programmatic document setting broad guidelines, it was not as site-specific as some people desired.

COMMENT The Act's reference to reestablishing "old growth ponderosa pine ecosystems" does not necessarily mean what the FS interprets as a fire-based, preEuroAmerican old growth. The Act does not define such a "desired future condition." (188)

RESPONSE The intent of vegetation management in the ponderosa pine forests is to preserve and encourage the existing old growth trees, and to maintain biodiversity. Fire was a key component in the natural ecological succession of ponderosa pine before the advent of EuroAmericans. Low-intensity fires burned in this vegetation type on an average of 8-12 years. We feel that using fire to play a role as close to its natural role as possible most closely meets the mandate of the legislation to provide for natural ecological succession of vegetation to the maximum extent practical. We do not intend to turn the entire forest into fire-based open

park-like stands of big trees. There are places where fire-suppressed old growth with lots of firs and mixed conifers may be useful to provide a diversity of wildlife habitats, and to provide ecological mosaics. Some areas (but not all) would be suitable for the open, park-like, preEuroAmerican stands. We intend to provide both "types" of old growth. See Chapter 3, Vegetation, for more complete definitions. See also map and text of Areas of Opportunity and Concern.

COMMENT While the department (ODFW) supports a return to old growth PP conditions, the means to this end needs further discussion. The department recommends that no PP be cut that is 20" or over in size.....Our department would like to see as little mechanical treatment as possible. (189)

RESPONSE Prescribed fire is the preferred method of treatment. However, mechanical thinning is sometimes cheaper, easier, faster, and has less impact on air quality. Therefore we have included some flexibility for treatments. Each site will evaluated to determine the best method(s). Our intent is not to cut any ponderosa pine trees larger than 20", except in cases where a tree might threaten human life or safety (hazard tree in a campground or day-use area.)

COMMENT A discussion of present stand conditions needs to be given for PP stands inside and immediately adjacent to the Monument. (190)

RESPONSE See Map of Areas of Concern and Opportunity and Vegetation Map for inventory of ponderosa pine stands within NNVM. Additional information has been added to Chapters 3 and 4, Vegetation. Areas of ponderosa pine stands outside the Monument are documented in Fort Rock District files and were used in this analysis, but are not displayed in this FEIS.

COMMENT There is some degree of variance already present. Let's not undo what is presently existing. (191)

RESPONSE One of the goals of vegetation management is to promote and enhance biodiversity. We will encourage variety of vegetation and habitat across the landscape. It is important to remember that ecosystems are dynamic and always changing, so it is impossible to "freeze" or hold them in a static condition.

Fire and Fuels

About twenty respondents commented on our proposed use of prescribed fire in vegetative management. Most people liked the idea of reintroducing fire; however, a few were concerned that we might rule out appropriate mechanical treatments. One commentor preferred natural fires over prescribed fire. ODFW suggested dividing the Monument into three management zones: suppression, conditional and prescribed natural fire. Several people asked for more information on the roles that fire and mechanical treatments will have in lodgepole pine. Some concerns included: costs and potential limitations of prescribed fire, impacts of mechanical treatments in undeveloped areas, lack of knowledge of the historic burn patterns in lodgepole pine stands, and the high danger of wildfires. ODFW was worried that too much use of fire will leave too little vegetative cover for wildlife.

COMMENT I like the reintroduction of fire; burning is essential. Fire management should be included as that is a natural part of any forest ecosystem. (207)

RESPONSE The FEIS and Plan reflect current thinking that fire is an appropriate and necessary part of this ecosystem. However, there are some locations where mechanical treatments may be a better choice (adjacent to a developed campground, for example.)

COMMENT Please don't subscribe to the theory of "No fire control" or "Let's have fires in certain years"..... Controlled burning - yes. Wildfire - no! (208)

RESPONSE Fires that threaten human life or property in the Monument will be suppressed. The Deschutes National Forest has an existing policy that includes strategies to confine, contain, and control fires, based on their severity and location.

COMMENT PGT supports Alt. C's more aggressive fuels reduction policy and use of prescribed fire to decrease the potential effects of wildfire in the Monument. (209)

RESPONSE Prescribed fire is a cornerstone of Alternatives C and C-Modified.

COMMENT Prefer natural fires instead of prescribed burns. (210)

RESPONSE Forest Service fire officials feel that the fuel loads now present in many areas of the Monument are too high to allow a lightning-caused fire to burn. They would usually suppress a fire because of the risk to human life and other resources within and outside the Monument. However, the goal of Monument legislation is to allow natural ecological succession, which has historically included disturbance agents such as fire. Prescribed fires (sometimes combined with light mechanical treatments) are a way to mimic the effects of wildfire in a controlled situation to prevent unacceptable losses of wildlife habitat, scenery or other resources. Prescribed fires also have an advantage in protecting public safety and property. They can also reduce fuel loads to where a prescribed natural fire strategy could be applied. (See glossary and discussion of prescribed natural fire in Chapters 3 and 4.)

The Areas of Concern and Opportunities map, and accompanying text in the Plan, were both developed to respond to public comment and questions about where fire might be appropriate. See these descriptions for possible areas where fire could be re-introduced. With some treatments, we hope to gradually move towards conditions where fires are allowed to play their "natural" role in the Monument's ecosystem. One of our first tasks in implementing the Plan will be to determine the areas where fire can be re-introduced.

COMMENT The cost of prescribed burning is a consideration you may want to think about. There may be less costly options. These options should be fully explored before making any final decisions. (211)

RESPONSE Prescribed fire is the preferred method of treatment. However, mechanical thinning is sometimes cheaper, easier, faster, and has less impact on air quality. It is also sometimes the best way to achieve management objectives. Therefore we have included some flexibility for treatments. Each site will evaluated to determine the best method(s).

COMMENT Will prescribed fire in lodgepole ecosystems create and maintain the kinds of forests people expect to see in a national monument? (212)

RESPONSE The goal of vegetation management in the lodgepole forest communities is to promote biodiversity and to mimic, as closely as possible, natural processes, including disturbance agents such as insects, fire and disease. Many kinds of forests, and old-growth areas, will be part of the landscape. Some impacts to scenery will occur. These are discussed in the Scenic section of Chapter 4.

COMMENT Divide the Monument into three management zones: Suppression, Conditional, and Prescribed Natural Fire. (213)

RESPONSE Fires that threaten human life or property in the Monument will be suppressed. The Deschutes National Forest has an existing policy that includes strategies to confine, contain, and control fires, based on their severity and location. Part of the Plan is to identify areas where prescribed natural fire (caused by lightning) may be appropriate, within the strict parameters of fire management strategies previously developed for those areas. See also the above response to #210.

COMMENT Alternative B needs more fire management towers. (214)

RESPONSE The Monument is covered by four fire lookout towers: Lava Butte Lookout, East Butte Lookout, Spring Butte Lookout, and Round Butte Lookout. Forest fire officials feel this is sufficient coverage.

COMMENT I still have an unclear picture of the management scheme for lodgepole pine. What role will fire play? When will mechanical treatments be used? What kind of mosaic is desired? How large will stands be? (215)

RESPONSE The goal of vegetation management in the lodgepole forest communities is to promote biodiversity and to mimic, as closely as possible, natural processes, including disturbance agents such as insects, fire and disease. The Areas of Concern and Opportunities map, and accompanying text in the Plan, were both developed to respond to public comment and questions about where vegetative treatments might be appropriate. See these descriptions for possible areas where fire could be re-introduced, or mechanical treatments used. Site-specific analyses would be used to determine parameters of the treatments and the best methods to be employed. In general, the more remote areas and the roadless areas will be left alone, except for some small areas where prescribed burning could be planned. (See Areas of Concern and Opportunity map and text). The more accessible areas (near roads, campgrounds, and developed sites) could be mechanically treated, if there was a need (high fire danger, thinning to promote old growth stands, etc.). Prescribed fire would be used where appropriate to restore natural ecological processes.

COMMENT We agree that aggressive measures are needed to reduce fuel loads, minimize fire risk, and restore forest health. Our primary concerns involve the heavy emphasis on prescribed fire. Will mechanical means be used first? Can fire be used in thickets? How will mechanical and prescribed fire be used in the Flanks zone? We are also concerned about the time that will be required to effectively treat the lodgepole pine component (too long). (216)

RESPONSE Alternative B evaluates the extensive use of mechanical treatments. The range of alternatives provides a diversity of choices, including a reduced use of fire and mechanical treatments in Alt. C-Modified. This alternative would take a longer time (because of a reduction in the acres treated) to restore natural processes. Part of this alternative would include an active public involvement process and intensive monitoring, to ensure that what we are doing is understood and supported, and is achieving the desired results. In some cases, mechanical treatments would probably be used prior to burning. See also above response to #215.

COMMENT Soil productivity will likely decrease with the underburning and prescribed fire. (242)

RESPONSE More information on this topic has been added to the Fire and Fuels section in Chapter 4.

COMMENT The FEIS should clearly explain both the costs and potential limitations of prescribed burning, especially in lodgepole pine ecosystems. It also should compare these factors to the costs and potential benefits of other vegetation management techniques. (217)

RESPONSE The Chapter 4, Vegetation section discusses the environmental costs, benefits, and limitations of mechanical treatments and prescribed fire. A discussion of the economic costs involved for the various treatment methods has been added to the section on "Local Communities" in Chapter 4.

COMMENT Low impact mechanical treatments, salvage of dead timber, thinning, and use of stewardship contracts --as recommended by the Advisory Council-- could be used in lieu of prescribed burning to minimize air quality problems and reduce costs. (218)

RESPONSE Both prescribed fire and mechanical means will be used for vegetative treatments. A site-specific analysis will include costs, resource issues, and a determination of the most effective methods for treatment.

COMMENT Do options exist to use mechanical treatments in the Flanks Zone that would not seriously compromise the plan's objective to maintain the undeveloped character of this area? (219)

RESPONSE Any treatments in the Flanks Zone would be designed to produce the minimum impact possible on the environment. They would also be scrutinized carefully to be sure they are meeting project objectives. See Opportunities and Concerns map for specific locations, as well as Standards and Guidelines.

COMMENT ODFW would like to see less intrusion into the lodgepole pine stands. There is some degree of inherent risk of bug infestation and fire in almost every plant community. We suggest leaving lodgepole pine much more to natural processes except in areas where fire would jeopardize human safety. Roadless areas should remain roadless with no roads permanent or temporary being built into these areas for reasons of thinning or other treatments. (220)

RESPONSE Alternative C-Modified has dramatically reduced the number of acres treated, in response to comments like these. In Alt. C of the DEIS, we assumed treatment of about 2700 acres of lodgepole pine in the first decade. In Alt. C-Modified of the FEIS, we have assumed a range of 170 - 760 acres in the same time frame. In the lodgepole pine communities, we propose to let natural processes occur to a large extent, except where there is a serious threat of fire, insects or disease to resources outside the Monument; or values such as wildlife habitat would be unacceptably reduced without human intervention. See Chapter 4 for details of Alt. C-Modified.

COMMENT One of the stated research needs is looking at historic fire burn patterns in lodgepole pine stands. This points to the lack of knowledge relative to this forest type. Our department recommends that this work be completed before the proposed management of the extreme nature in Alternative C is adopted. (221)

RESPONSE Ongoing research is a high priority under the Plan, and we need to learn more about the role of fire in lodgepole pine in the Monument. We do know, however, that many stands now have "unnaturally" high levels of fuels because of past fire suppression activities, and that fires have not been allowed to burn as they have in the past. Alt. C-Modified represents a cautious approach to vegetation management and prescribed fire. It will include thorough public involvement and appropriate monitoring to ensure we are meeting objectives.

COMMENT Be sure to acknowledge that there may be some short term visual impairment when you use prescribed fire. (195)

RESPONSE This statement has been added to the Fire and Fuels and Scenic sections of the FEIS. Alternative C-Modified is designed to meet all visual quality objectives.

COMMENT How would soil compaction be healed after vegetative treatments? Does research support this? Only the compaction at the surface would be healed. (198)

RESPONSE Appropriate explanation has been added to the Vegetation sections (Chapter 3 and 4) of the FEIS.

COMMENT Why mention tree species that don't even occur in the Monument? Would read better if discussion on fire regimes was described in terms of Monument vegetation only. (199)

RESPONSE The discussion of fire regimes has been changed to focus on Monument species only.

COMMENT What treatments would be considered to reduce fuels? (201)

RESPONSE We will consider both prescribed fire and mechanical thinning, using the best method(s) available, based on site conditions.

COMMENT Approximately "270 acres" of lodgepole will be treated (under Alternative C). What will be the size of these (treatments) and what will be their spatial arrangement? Will burning be used to thin the stands, or to regenerate them? (202)

RESPONSE The Forest Service developed Alternative C-modified in response to concerns about vegetation management. This alternative has scaled back the acres to be treated, and assumes only 170 to 760 acres will be treated during the first decade of the Plan. There will be a variety of sizes, shapes, arrangements and patterns on the landscape, designed to mimic naturally-created disturbance patterns. In lodgepole pine, the usual effect of a treatment will be to regenerate a stand and provide more ecological mosaics. Each project will have a site-specific analysis and the opportunity for public involvement.

COMMENT The document states that roadless areas are in a natural state, unaffected by human influence. Every acre within the Monument has been affected by past fire exclusion policies. No stands are in a perfectly natural state. (205)

RESPONSE The roadless area section has been revised, improved and expanded. See Chapter 3, Lands Status, Roadless.

Natural Ecological Succession

Natural ecological succession was a subject that seven comments addressed and two respondents wrote extensively on. Three commentors (including ODFW) requested additional explanation of why so much human intervention is needed for the landscape to reach conditions where natural ecological succession can be allowed to occur. The joint comment from four conservation groups asked for more explanation of what type of vegetative treatments will occur where. ODFW and the conservation groups felt that, although human intervention may be necessary, less area should be treated than proposed by Alternative C. ODFW also questioned the need for planting within NNVM.

COMMENT There needs to be additional explanation in the EIS of why man-caused manipulation of the vegetative landscape is needed to reach condition where "natural ecological succession" can be applied. The EIS needs to improve its educational explanation of this very complex concept and clear up any ambiguity. The EIS needs a better explanation of how Administration and Management Plan sections of the Act fit together as policy guides. (231)

RESPONSE The Vegetation section of Chapter 4 has been rewritten to address these concerns. In addition, Alternative C-Modified has been developed, emphasizing more "natural ecological processes" such as prescribed natural fire -- and less human alteration of vegetation.

COMMENT There has been an increase in both species and structural diversity in both forest and rangeland ecosystems with fire suppression. My point is that "historical" MAY not be what we want. (232)

RESPONSE The Plan will emphasize a diversity of landscapes, including areas of historical, open, park-like stands -- and the more commonly-seen mixed forest communities of varying structures, sizes and ages.

COMMENT I am concerned that vegetation management will err on the side of over-management, rather than allowing natural processes to proceed. There is no reason to cut any more trees! (233)

RESPONSE The Forest Service developed Alternative C-modified in response to concerns about vegetation management. This alternative has scaled back the acres to be treated, and proposes only five to eight projects of 50-200 acres each during the first decade of the Plan. Each project will have a site-specific analysis and the opportunity for public involvement. Specifics about location, acreage, and objectives (fire-restoration or fire-exclusion, for example) will be determined later. The Areas of Concern Map outlines the general areas where some of these projects could occur.

COMMENT The public ought to be able to know under the Newberry Plan exactly where natural processes will be allowed to evolve without vegetative "treatments." This Plan should identify areas where vegetative treatments will occur in the coming decade or life cycle of the Plan. The kind of treatment should be specified. (234)

RESPONSE See Areas of Concern Map in Monument Plan. We have tentatively identified some areas that should be treated to preserve existing old growth (old growth ponderosa pine along Highway 97, and north side of Mokst Butte, for example), but in this programmatic document, we haven't decided exact locations. Further site-specific NEPA analysis with public involvement is needed before approving specific projects.

COMMENT The attitude towards lodgepole pine is also inappropriate because it emphasizes fuels treatment. The objective is not even necessarily historic, natural stands, as is the stated objective for ponderosa pine. The Plan calls for "conditions such that 30% or less of the lodgepole pine stands are in a susceptible state (to Mtn. Pine Beetle) at any given time. This arbitrary figure has no basis in the Act. (235)

RESPONSE Silviculturists and entomologists used research showing that when more than 30% of a lodgepole pine stand is susceptible to insect attack, the likelihood of such an attack increases substantially. Wording in Standards and Guidelines has been changed to reflect the broader intent to ensure that conditions in lodgepole pine do not seriously threaten resources outside the Monument, and that they provide enough regeneration of different seral stages to provide for perpetuation of old growth.

COMMENT The idea that the ecological processes in the only unentered forests in the area are so unnatural that the forest must be entered and "treated" speaks volumes to how convoluted is the Forest Services's interpretation of the Act. (236)

RESPONSE Because of past fire suppression (a human intervention), conditions in the unaltered forests are approaching unnaturally high levels of fuels. This means the potential for severe and large wildfires (larger than historic occurrences) has increased. Allowing fires to go unchecked or forever suppressing fires both have undesirable consequences to ecological processes or to human health and safety. The challenge is to find the least intrusive way feasible to return the unnatural situation created by human activities to more natural conditions, so that ecological processes such as fire and insects operate without creating unnaturally large or severe disturbances (when compared to their historic disturbance patterns). The alternatives examined different ways this might be done.

The Forest Service developed Alternative C-Modified in response to concerns about vegetation management. This alternative has scaled back the acres to be treated, and proposes only five to eight projects of 50-200 acres each during the first decade of the Plan. Each project will have a site-specific analysis and the opportunity for public involvement. The Areas of Concern Map outlines the general areas where some of these projects could occur.

COMMENT We are not opposed to all "vegetative treatments" within the Monument. Obviously, Congress intended to allow it to occur occasionally since the Act provides for natural ecological succession only to the maximum extent practical. It must be clearly understood, though, that such "treatment" is the rare exception, while natural ecological succession is the overwhelming rule. (237)

RESPONSE The Forest Service intends to let natural ecological succession continue wherever this can be done while meeting other requirements of the Monument legislation. Some intervention may be necessary to encourage the health of old growth ponderosa pine stands, and restore conditions where fire can play its role in the ecosystem. Alternative C-Modified was developed to respond to these concerns and comments. In addition, there may be some times when some vegetative treatments are appropriate to meet other management objectives. Two examples are: a wildlife habitat enhancement project, or to enhance scenic views.

COMMENT Alt. C will have human-directed disturbance over 86% of the vegetated area. This is an interesting interpretation of "allowing natural ecological processes to continue to the maximum extent practical." (238)

RESPONSE See above responses. See also description of C-Modified in Chapters 2 and 4.

COMMENT Mountain pine beetle, disease and fire hysteria seems to be the main driver in Alt. C. While some human intervention may be necessary to undo our previous management, it needs to be carried out more subtlety, less intrusively. (239)

RESPONSE See above responses in this vegetation section.

Other Vegetation Issues

COMMENT I agree with the preferred alternative, but only under the condition that all populations of sensitive plant species will be protected, and that thorough surveys for sensitive plants will occur in areas where potentially threatening projects are planned. (222)

RESPONSE All alternatives would protect sensitive plant species, and ensure that they would be protected in the future. Any projects would have a botanical survey to determine the presence of sensitive plants before proceeding.

COMMENT Allow only foot traffic on trails, and build new trails only after citizen input. Mountain bikes and other motorized vehicles should remain on paved roads. When snow cover is light, snowmobiling should be restricted and closely monitored. This is a remote place, and it is easy for private collectors of rare or endangered plants to help themselves. For this reason, labelling of rare and endangered plants should NOT occur. (223)

RESPONSE The location of rare and endangered plants is not disclosed to the general public. That information is contained in locked Forest Service files. To protect the plants from damage, they are not labeled in the field. In the Monument, the preferred alternative proposal is for no motorized vehicles on trails (but mountain bikes are permitted). Alternatives C and C-Modified provide for limited interpretation about sensitive plants, using trained interpreters to help monitor access and provide education about known populations.

COMMENT Mushroom collecting should be controlled. Fungi in the soil is necessary for a healthier forest. (224)

RESPONSE See Vegetation section of Chapter 4, miscellaneous forest products. This sentence has been added: "It is known that fungi play beneficial roles in the decomposition of organic material and that mycorrhizal fungi, associated with plant roots, increase the availability of water and nutrients to the host plant." It is the intent of the Monument Plan to discourage commercial uses of Monument resources, unless it can be demonstrated that such uses further the goals of the legislation to protect and enhance Monument resources. Standards and Guidelines are written to reflect this intent. See also Monument Plan.

COMMENT Some discussion could be given to the use of domestic livestock as a non-natural tool which con be used to manage vegetation.....Include a statement about the idea that livestock grazing does reduce annual fuel loading. (192, 225)

RESPONSE Additional information has been added to the vegetation section of Chapter 4, including this sentence: "In some cases, grazing by domestic livestock has been used successfully as a tool to achieve vegetation management objectives."

COMMENT OHV's may provide the greatest potential threat to the vegetative resource. This is due to the large and varied introduction of exotic plants which OHV's can introduce because of their use patterns, origins, mobility and design. (226)

RESPONSE The Forest Service's preferred alternative in the draft and final would eliminate OHV's (Class I, II, and III ATV's) from the Monument, because of resource and social concerns. A statement has been added to the vegetation section in Chapter 4.

COMMENT Alt C doesn't seem to address riparian protection or enhancement around the lake shoreline. I think this DEIS could move towards managing the zone as a greenway or set back zone. (65, 227)

RESPONSE The Plan Standards and Guidelines include protection measures for riparian habitat around both lakes.

COMMENT Our department (ODFW) questions the need for planting within the Monument. Are we, or are we not going to leave the communities to natural processes? Management guidelines should be written that prohibit or severely restrict planting activities. (228)

RESPONSE Standards and Guidelines in the Monument Plan emphasize allowing natural processes and native plant communities wherever possible. However, there may be some times when planting could be appropriate (vegetative screening in campgrounds, soil stabilization on steep slopes, others). We would use local seed sources and native species to the maximum extent feasible.

COMMENT We would like to see maps showing: forest conditions outside the Monument, blackbark thinning, Paulina fire, migration corridors, areas that have not been treated in the past, railroad logging, old growth stands, and stands near old growth condition. (230)

RESPONSE Some of this information (within the Monument) is included in the Areas of Concern and Opportunity Map. Some of the others (Paulina fire, blackbark thinning, conditions outside NNVM) are contained in Monument planning records and Fort Rock District files, and are available for review.

COMMENT Has the habitat enhancement project for pumice grape-fern in the caldera occurred? (240)

RESPONSE Yes. Updated information on pumice grapefern is contained in the sensitive plant section of Chapter 3.

COMMENT Support leaving mountain hemlock-dominated forests untreated. (229, 282)

RESPONSE This approach is a key piece of Alternatives C and C-Modified.

COMMENT There are conflicts between visual resources (scenery) and big game cover (overstocked, beetle killed stands). Annie's Garden is an example. (243)

RESPONSE Information about these conflicts has been updated, and is displayed and discussed in the Scenic section of Chapter 4.

Fish and Wildlife

Fish

Management of fish and crayfish populations in the lakes brought five letters with a number of comments. One reviewer requested that fishing regulations and stocking levels be managed to maintain the size and number of fish for anglers. Two respondents (including ODFW) wanted to maintain opportunities for chub control; however, one reviewer was concerned that ODFW does not consult with the Ft. Rock District prior to chemical treatments. Controlling chubs with large numbers of brown trout or bull trout was suggested by two commentors. One person did not want Atlantic salmon stocked in East Lake, because they are not native to the area. Yet another respondent was concerned that the concentrations of trace elements in the lakes and their potential effects on fish were not portrayed accurately in the document. ODFW noted that they would not object if the Forest Service decided not to re-issue the commercial crayfish permit.

COMMENT Need to reevaluate conclusions on possible high accumulations of trace elements and effects to fish. Want us to accurately reflect USGS and SAIC data base. Need to state that accumulation is not expected to be a problem but should be monitored for over the long term. (246)

RESPONSE New information gathered between draft and final EIS has been included in Chapter 4 in both the water quality and fish and wildlife sections to address this comment.

COMMENT Want to maintain opportunities for chub control, for example with large numbers of brown trout. Another suggestion was stocking bull trout, because they are native to the region. (247)

RESPONSE Brown trout are present in the lakes, and do prey on chubs. Bull trout could not sustain their numbers in the lakes without planting additional hatchery fish, because spawning habitat is not present. Stocking them in the lakes in the Monument would detract from efforts to restore their populations in other areas on the Forest.

COMMENT Need to be more strict in defining how coordination between ODFW and Monument managers will take place to control undesirable fish populations. Concern that ODFW does not consult with the Ft. Rock District resource specialists prior to chemical treatments. How can we make sure they will in the future? (248)

RESPONSE The Forest Service coordinates with the Oregon Department of Fish and Wildlife to manage the fishing resources on East and Paulina Lakes. This process includes the consideration of issues such as chub control, the species of fish in the lakes, and angling opportunities. On-going consultations will consider these issues. ODFW is also producing a "master plan" for the upper Deschutes basin fisheries, including these lakes, and Forest Service and public input will be an important part of this plan. Communication and coordination have increased and improved during the preparation of this plan for Newberry Monument, and we expect that closer relationship to continue.

COMMENT Concern that Atlantic salmon are not native to the area and should not be stocked in East Lake. (249)

RESPONSE There is no evidence that there were fish in the caldera lakes prior to 1912. Pioneers in Central Oregon originally stocked these lakes with trout. Since then, wildlife managers have used different strategies in maintaining viable fish populations. Some of these have been the introduction of brown trout and Atlantic salmon, species which prey on chubs and do provide a challenge for anglers.

COMMENT Please correct information on Paulina Falls, and fish populations in the lakes, in Chapter 3. (250)

RESPONSE Corrections have been made to this section in Chapter 3.

COMMENT We disagree that stricter catch regulations would be necessary if rainbow stocking efforts were renewed in Paulina Ck. ODFW would not likely change its policy of encouraging people to catch stocked fish. (251)

RESPONSE Language has been changed after consultation with ODFW.

COMMENT ODFW does not object if the FS decides to cancel the commercial crawfish permit. However, ODFW notes that "no notable effect on the crawfish population" has occurred "from the allowed harvest." (252)

RESPONSE The intent of the Monument Plan is to ban commercial extraction of Monument resources, unless such extraction contributes to protection and enhancement of Monument resources. Standards and Guidelines in the Plan reflect this intent.

COMMENT The ponds along the Deschutes provide good, not "marginal," rearing habitat and have abundant feed. Note that water control stemming from irrigation use is the most limiting factor at this time. (253)

RESPONSE The correction has been made in the document.

COMMENT Maintain a quality fishing experience; keep in mind that fishing pressure will probably increase with more people. (98)

RESPONSE The preferred alternative proposes to maintain the quality fishing experience that now exists in the caldera, while recognizing that moderate improvements to facilities (boat ramps, parking areas) would be possible. Alternative C-modified would maintain about the same number of overnight camping spots, which will help stabilize the number of anglers. We anticipate some increases in day use for fishing, picnicking, hiking, and other activities. If the quality of the fishing experience declines, the Forest Service, in cooperation with ODFW, could adjust management of fishery habitat to ensure a quality experience.

COMMENT It is important that recreation is controlled to a level that maintains the quality of the fishery...ODFW estimates the fishery can sustain a moderate increase in anglers during the next decade without sacrificing fish quality. (72)

RESPONSE See above response to Comment 98.

COMMENT Would like to see more recreation opportunities for children, for example fishing docks. (151)

RESPONSE Improvements to fishing facilities are part of Alt. C-Modified and are consistent with the Oregon State Marine Board.

Wildlife

Fourteen of the eighteen respondents who addressed wildlife issues voiced support for wildlife protection and preservation. Specific suggestions included: having some areas off-limits to humans, including species diversity and abundance as management objectives (ODFW), not letting bear or cougar numbers be reduced for public safety reasons, building bat and bird boxes in old-growth areas, and increasing the size of the River Zone to be more like Alternative B. Another commentor, however, asked why the River Zone was so large, because it is mostly rugged lavas and not high quality habitat. Some reviewers thought that riparian areas need to be protected and enhanced. One was especially concerned that chemical treatments of the pond on the east side of East Lake may have detrimental effects on amphibian populations. ODFW was concerned that overall wildlife diversity would be reduced under Alternative C. Comments received on Lava River Cave supported bat protection by enforced winter closure. One person suspected that allowing human visitation in winter is illegal, because further depletion of the sensitive bat population would require listing to protect it. Another commentor suggested we open only the east side of the cave in the winter and only the west side in the summer, if visitors must be accommodated year round. Monitoring for bat use and interpretation of bat sensitivity to visitors were encouraged.

We received four comments supporting bald eagle management areas (BEMA's). All three BEMA's should be included in the preferred alternative, according to a comment from the U. S. Department of Interior's Oregon Wildlife Cooperative Research Unit (ORWCU), a joint response from two national and two local conservation groups, and one individual's letter. If

only two BEMA's are included in the preferred alternative, ORWCU requested that the second one be on Paulina Lake because it melts off earlier in the spring and could support another pair of eagles. ODFW cautioned that disturbance of nest sites is unacceptable. Some commentors asked that recreation impacts on bald eagles be monitored and minimized. Recommendations included eliminating the boat-in campsites and educating the public.

A few reviewers felt that the needs of raptors other than eagles were inadequately addressed in the draft. ODFW wanted more habitat maintained for goshawks, and other commentors were concerned that trails to kipukas in the Lava Butte Zone might disturb raptors nesting there. More study was suggested in both cases.

Habitat for cavity nesters and neotropical migrant birds concerned some commentors. In particular, ODFW wanted more snags and downed woody material left for cavity nesters. A species inventory was also suggested. Mechanical treatments or prescribed fire in lodgepole pine stands could degrade habitat conditions for neotropical migrants, according to ODFW.

Increased development and decreased cover in big-game migration corridors concerned ODFW and the conservation groups, who felt that carrying capacity will be reduced and more deer will be hit by vehicles. Suggestions included identifying and protecting migration corridors, putting tunnels under Hwy. 97, and not improving roads in the area.

ODFW also asked for a wildlife species list according to plant community and more discussion on American marten in the document. In particular, they asked us to consider what areas the marten use and what the habitat needs are of their prey animals. They recommended that vegetation treatments be designed to leave the required structural habitat.

General

COMMENT A number of commentors voiced support for wildlife protection and preservation. This included having some areas off-limits to humans or increasing the size of the River Zone in C to be more like B. (254)

RESPONSE Forest Service planners recognize that people and animals will co-exist in the Monument; that this place is home to many species. We plan to provide for undisturbed areas, with large zones designed to manage human use and provide wildlife habitat. For example, the River Zone and the Flanks Zone will remain undeveloped, with a minimum of human use and impact. On the other hand, in the Lava Butte Zone and in the Caldera Zone, there will be many people recreating or visiting at different times of the year. Other areas receiving special attention for wildlife include sensitive bat habitat areas and the two Bald Eagle Management Areas (BEMA's) in the caldera. The entire Newberry Crater is a designated wildlife refuge.

COMMENT Alt. C represents a good balance between human visitors' and wildlife residents' needs. (257)

RESPONSE See above response.

COMMENT Why is the River Zone so big? 80% of it in Alternative C consists of rugged lavas, which are not high-quality habitat. At least half of this zone should be transferred to the Lava Butte zone, but still be left largely undeveloped. (258)

RESPONSE Many people told us during the public comment period that wildlife protection was very important to them. The River Zone represents a contiguous area adjacent to the Deschutes River where wildlife needs will be paramount. If the Lava Butte Zone was expanded down to the riparian area of the river, there would be impacts on wildlife from the more people-oriented activities in the Lava Butte Zone.

COMMENT ODFW recognizes the important role of fire in shaping wildlife habitats; however, they want management objectives to include species diversity and abundance. Managing for "historic old-growth" doesn't have to mean sacrificing wildlife values. (259)

RESPONSE Alternative C-Modified has integrated wildlife values and concerns with its approach to vegetation management and recreation. Alternative C-modified was developed to respond to public concerns that vegetation treatment had gone "too far" towards managing the land, and used "too much" fire. This alternative (C-modified) designates large areas where natural ecological succession will occur. Not all areas of ponderosa pine in the Monument will be managed for "historic old growth." In fact, the number of acres managed for this condition is reduced significantly in Alternative C-Modified. Historic ponderosa pine old growth is a habitat component that is rare at landscape and regional scales. Restoring some acreage to this condition would increase habitat values for species affiliated with this habitat such as flammulated owls and white-headed woodpeckers.

Bats

COMMENT Make sure that bats are considered in construction and reconstruction plans for buildings. (137, 179)

RESPONSE Bats are considered in any new construction or reconstruction of buildings, facilities, and campgrounds. Including bats' and other wildlife needs is now part of the Deschutes National Forest Recreation Facility Handbook (1994 draft) which describes architectural guidelines for developments within the Forest, and Newberry Monument. Standards and Guidelines in the Plan also address this topic.

COMMENT Access to the cave (Lava River Cave) should be carefully controlled during winter to protect bats. During summer, let it be open to public without guides. Access to this cave in the winter may even be illegal because disturbance to the sensitive bat populations (Plecotus) could reduce their numbers and cause them to be listed on the Endangered Species List..... Inform and educate people about bats. (54, 255, 278, others)

RESPONSE Alternative C-modified would limit Lava River Cave to guided tours in the winter. This restriction would protect bat populations. Bat studies and monitoring efforts continue as we learn more about these fascinating creatures. Bats (especially Myotis species) use caves, rock crevices, and building sites as roosting areas and maternity sites. The Monument Plan Standards and Guidelines provide protection for any bat colonies and habitats known or discovered.

COMMENT Identify and protect habitat for fringed Myotis (a bat species) in lower elevation forested areas. (277)

RESPONSE Surveys to identify all species of bats are ongoing. These bats use caves, rock crevices and buildings as day and night roosts, and as maternity sites. We don't know a great deal about their winter habitat yet.

Eagles

COMMENT Not enough attention is paid to BEMA's in the action alternatives. The BEMA's are mentioned as being displayed on the action alternative maps, but they are not. Also, there may be a conflict with intensive recreational emphasis in the Caldera Zone. (260, 456)

RESPONSE The section on the BEMA's in the document has been rewritten and improved. There are "units" in the caldera that separate human recreational use (trails, roads and campgrounds) from the BEMA's to minimize disturbance to these birds. Bald eagles are a key element in the Monitoring program. If they are being disturbed, measures will be taken to reduce human impacts. The BEMA's are shown on the caldera recreation unit map in Chapter 2 and in the Plan.

COMMENT "At the very least, Alternative B proposal for BEMA's should be adopted. If there is not current eagle nesting by Paulina Lake, perhaps possible recreation impacts could be examined and modified."... Recommend all three BEMAs be in preferred alternative. If only two are designated, put one on Paulina Lake. (261, 264)

RESPONSE The Monument Advisory Council recommended that the area around Paulina Lake be managed as a "de facto" BEMA (minimum disturbance) but without the formal designation, because there are no eagles nesting there now. Alternative C-Modified is consistent with this advice. If a pair of eagles do nest there, the area could be designated a BEMA in the future.

COMMENT Do away with the boat-in campground on Paulina Lake, in favor of increased BEMA and wildlife emphasis. (262)

RESPONSE The Oregon State Marine Board and others recommended keeping the boat-in campgrounds to provide a variety of boating experiences. The alternatives provide a diversity of options on these campgrounds (remove, relocate, keep). The preferred alternative would keep them for now, monitor any disturbances to wildlife, and eventually relocate these campgrounds if needed.

COMMENT Need to better address how we will monitor and prevent disturbance of eagle nest sites. Immediate measures must be taken to curb disturbance if it increases. Education and interpretation should help. (263)

RESPONSE The Monitoring program addresses this concern, by asking questions such as "Is the occupied habitat for eagles being protected from day-to-day threats from human visitors, maintenance activities or environmental factors?" Funding levels and program activities will ultimately determine the extent of monitoring that is done.

Deer and Elk

COMMENT Migration corridors through the Monument need to be identified. Also, some provision for encouraging the DOT (Department of Transportation) to build tunnels under the highway should be part of the Plan. (265)

RESPONSE Migration corridors for deer and elk were identified as part of the landscape analysis process that created large management zones for the Monument. They are also identified in the text accompanying the "Areas of Concern Map." Migration corridors are also defined and mapped in the Planning Record. Any proposed project would go through a site-specific NEPA analysis for assessment and mitigation of impacts to migration corridors. The Plan would allow for tunnels for big game to safely cross Highway 97.

COMMENT Road 9702 should not be paved to access Lava River Cave because of effects to big game migratory corridor, which is already heavily impacted by Highway 97. (266)

RESPONSE In the preferred alternative, there are no plans to pave Road 9702. Specific impacts from road improvements are addressed in Chapter 4.

COMMENT Concern that increased development and decreased cover in the Lava Butte Zone will be detrimental to deer migration and populations. The amount of hiding cover (lost) would be significant, and displacement to other areas is not possible, so carrying capacity for deer will be reduced. (267)

RESPONSE Large areas of the Deschutes National Forest are managed specifically for big game habitat. In the Monument, we will provide some habitat for deer and elk, but some other areas may be managed to provide habitat for other, non-game species to promote biodiversity on a landscape scale. Hiding cover and migration areas would be maintained and protected to the greatest extent feasible, consistent with other ecosystem restoration objectives in Alternatives B, C, and C-Modified.

COMMENT The discussion of hiding cover acreages is confusing. Need clearer explanation. (268)

RESPONSE This section has been rewritten and clarified.

COMMENT Deer do use lava flows to a certain extent (284)

RESPONSE Corrected in document.

COMMENT Need to note that overall (table p. IV-89 in DEIS), Alternative C is least favorable for big game and overall wildlife diversity. Alt. B would have the least impact to big game and other wildlife because of less fragmentation and better cover to forage ratios in mosaic throughout the landscape. (269)

RESPONSE Alternative B is the most "favorable" to wildlife. However, Alternatives C and C-modified also provide a broad range of habitats and opportunities for biodiversity across the landscape. Alternative C-Modified also significantly reduces the acres of vegetation treated. The Monument legislation instructs us to consider other values as well as wildlife. Some of these other values include recreation, vegetation, cultural resources, and interpretation. See also response to #267 above.

COMMENT In big game discussion, how were road densities calculated? Do they include lava fields and water bodies? (288)

RESPONSE The explanation has been included in Chapter 4.

COMMENT Chapter 3 states that an estimated 300-500 deer migrate thru the Monument. The management objective for the N. Paulina WR is 5500 deer. 3300 animals summer in the N. Paulina unit, so an estimated 2200 migrate through the Monument. (285)

RESPONSE Corrected in document

COMMENT In reference to wintering elk, note that the majority of them winter to the east along the Ft. Rock valley. (286)

RESPONSE Corrected in document

Raptors

COMMENT Questions wildlife standards and guidelines for raptors in DEIS Plan. Do we really need all these? (270)

RESPONSE The Standards and Guidelines have been rewritten to eliminate redundancy. Essential Standards and Guidelines to manage habitat for raptors have been retained.

COMMENT A trail system to the kipukas in the Lava Butte Zone might unacceptably disturb the raptors nesting there. Need to conduct a Biological Evaluation, and Environmental Analysis before building any trails there. (271)

RESPONSE Analysis of all proposed activities will occur as part of site-specific planning. A biological evaluation of effects on threatened, endangered, and sensitive species would be part of that analysis. Monument Plan Standards and Guidelines protect osprey and red-tailed hawk nesting activities from disturbance. However, disturbances from people on trails could occur if the raptors nested near an existing trail. Use on existing trails would not be prohibited if a new nest occurred there. Surveys would occur to find nesting bald eagles, osprey, goshawks, and red-tailed hawks during planning of new trails. Locations of active nest sites for red-tailed hawks, goshawks, osprey and other raptors are maintained in an electronic data base. Every effort is made in the Monument Plan to protect these sites from disturbance, and enhance their viability.

COMMENT Habitats for goshawks are inadequately addressed in the plan. More habitat needs to be maintained for this species. Surveys are necessary. Nest territories should be mapped and protected. Prey habitat needs requires more attention. (272)

RESPONSE Acres of nesting habitat for goshawks are displayed in Chapter 4, Wildlife. The assumptions used to estimate acres of habitat are in the planning record. The description of habitats has been rewritten for clarity and better explanation. Alternatives A and D provide short-term goshawk habitat. Alternatives B, C, and C-Modified were designed for long-term habitat maintenance for goshawks. See also response to #271 above.

Cavity nesters

COMMENT The standards used in the plan for providing snags and woody debris need to be replaced. The concept described in the plan is oriented toward heavy logging, and would allow up to 90% of the live trees to be removed! This is not appropriate for a national monument. More up-to-date information, based on needs of different types of cavity nesters and excavators needs to be incorporated. (273)

RESPONSE This section of the Plan has been rewritten in response to public comments. The measure used was not intended to be associated with timber harvest. It was simply a way to display snags and woody debris as habitat components for cavity nesters. See Standards and Guidelines in the Plan and the wildlife section of Chapter 4.

COMMENT Managing for higher numbers of snags and downed woody material needs to take precedence over having stands totally free of risk from beetles and wildfire. (276)

RESPONSE Within the fire-based old growth areas, fallen trees and down woody material will be protected in some areas and not in others. The result will be a range of conditions and habitats for wildlife. Open, park-like stands of ponderosa pine, featured in Alternatives C and C-Modified, are a favored habitat for white-headed woodpeckers and certain other cavity nesters. All alternatives would re-establish and promote (at varying rates and extent) some of these fire-based old-growth ponderosa pine stands. In other areas of the Monument, the intent would be to provide both fire-based and fire-excluded old growth areas, to provide a variety of habitats for a number of species. Part of the science and research emphasis of the preferred alternative is learning how to best encourage these species that favor historic old-growth ponderosa pine. Alternative C-Modified recognizes that insects, diseases, and fires are all natural disturbance agents that are important parts of the Monument's ecosystems.

COMMENT The species using these habitats need to be inventoried and given more attention in the plan. (274)

RESPONSE The preferred alternative's emphasis on science and research would support more learning, (including wildlife surveys of selected populations) to better understand the Monument's ecological systems. See also above response to #273.

COMMENT Monument guidelines should supersede the DNF Plan's guidelines. (275)

RESPONSE They do. Monument guidelines supersede 1990 Forest Plan Standards except as specifically noted in the Monument Plan. In some cases, particular Forest Plan Standards and Guidelines were found to be consistent with and supportive of goals for the Monument and were incorporated as part of the Monument Plan. The list of these particular Standards appears at the end of the Standards and Guidelines section in the Monument Plan. The only time a DNF guideline is employed is when something is not addressed in the Monument Plan.

Neotropical Migrants

COMMENT More weight needs to be given to the needs of these species in the plan. They are dependent on old-growth forests and are generally suffering population declines in North America. Concern that our management of lodgepole pine will move those stands farther away from "old-growth conditions." (283)

RESPONSE Vegetation management has been re-evaluated and re-designed in Alternative C-modified to respond to these concerns. Providing a diversity of habitats is a priority. Many areas of old growth lodgepole pine will be provided.

American Marten

COMMENT Further surveys for marten are necessary to identify areas of use within NNVM.... Further discussion of the marten prey animals and their habitat needs should be added to the plan. Also discussion of winter and summer habitat requirements, and relation of marten populations inside the Monument to those in the rest of the DNF. (279, 280)

RESPONSE The section on the American marten in Chapter 4 has been revised in response to this comment. Further surveys on the marten are also planned.

COMMENT Treatments in areas of marten use should leave structural habitat (abundant downed woody) designed to meet their needs. This should be addressed in the document in terms of management of lodgepole pine in marten areas. (281)

RESPONSE Habitat needs for marten are addressed in more detail in Chapter 4, wildlife, and Standards and Guidelines in the Plan. Alternative C-Modified would provide abundant down woody material, a habitat component favored by marten.

Amphibians

COMMENT Concern that more needs to be done to protect the important habitat for amphibians in the pond east of East Lake. The pond has been chemically treated in the past without any documentation of the effects to resident amphibian populations. (256)

RESPONSE The Forest Service continues to monitor amphibian populations in selected ponds and lakes in NNVM. The Forest Service has done habitat improvement projects for amphibians in the caldera, and will continue to coordinate with ODFW to reduce effects to amphibians from chub control efforts.

Miscellaneous Wildlife

COMMENT Bears outside the caldera and within NNVM are estimated at 20-25 animals. (287)

RESPONSE Corrected in document

COMMENT Would like to see a wildlife species list according to plant community association, a table depicting species/habitat relationships, and a discussion of how species or species groups will be affected by the proposed treatments in each alternative. (289)

RESPONSE A species list is part of the Monument Plan, although it is not broken out according to plant community. A table depicting species/habitat relationships would be desirable, but time and cost considerations do not permit it. How different species are affected by the alternatives is discussed in Chapter 4 in the wildlife section.

COMMENT Don't let bear or cougar numbers be reduced for public safety reasons, and please build bat and bird boxes in old-growth areas. (254)

RESPONSE Bear and cougar populations in the Monument are stable, and nothing in Alternatives B, C or C-Modified would reduce their numbers. Bat and bird boxes are usually put up in campgrounds or near developed sites, some of which are near old growth areas.

COMMENT Would like to see a map of major wildlife habitat. (See Mt. St. Helen's plan p. 90). Have core bear and cougar habitat been identified and recreation access reduced accordingly? Much of the "Incomplete and Unavailable Information" (IV-144 to 147 in Draft EIS) requires research before any new development occurs. (290, 291)

RESPONSE The Areas of Concern Map and accompanying text do outline areas of important wildlife habitat. Key habitats for bear, cougar and other species are identified and mapped in the planning record. For some species (bald eagles, for example) the locations of nests are not normally published to prevent unnecessary disturbance to the species. Any projects proposed for the future will have a site-specific analysis which will include a biological evaluation. New developments proposed in Alternatives B, C and C-Modified that could impact wildlife are minimal (small portal facility, Lava Lands expansion).

COMMENT Need a map of the surrounding area, so that the public can know what conditions exist adjacent to planned activities/conditions in the Monument. (e.g. Paulina fire area needs to be included). (292)

RESPONSE Time and money prevent us from including this information in the Monument Plan. The information does exist in Fort Rock District files and has been used in this planning effort.

COMMENT Need to identify the areas of the Black Bark thinning project within the Monument, and what effects this is having on habitat, including food sources (insects) for birds. (294)

RESPONSE See above response to #292. Also, some of the effects of the black bark thinning, especially on food sources for birds, are evaluated in Chapter 4.

COMMENT Note that in order for the caldera wildlife refuge to be a cooperative refuge, a memorandum of understanding with ODFW would be required. (293)

RESPONSE An agreement defining the wildlife refuge was co-signed by the Forest Service and ODFW in 1992. It is in effect for the next 10 years, and can be renewed.

COMMENT The potential effects of geothermal development on wildlife are overemphasized and not put in context of all activities (natural processes, recreation, industrial, fire). Need to say that geothermal emissions are not expected to be a problem. (296)

RESPONSE A section has been added to address cumulative effects to wildlife that are unrelated to geothermal development (see Cumulative Effects section, Chapter 4). It is not certain, based on the information currently available, whether geothermal emissions would impact wildlife. The potential of detrimental effects has been updated and presented as accurately as possible in the Cumulative Effects and Incomplete/Unavailable Information sections of Chapter 4.

COMMENT Disagree with statement in Incomplete/Unavailable Information section (Chapter 4 of DEIS) that "Mercury levels at times exceed ODEQ and EPA standards in some areas of East and Paulina Lakes," because mercury measured by the USGS in the lakes is all below the detection limit of .1 ppb mercury. (295, 297)

RESPONSE Samples of lake water analyzed by the USGS in 1992 were indeed all below detection limits with respect to mercury. However, in 1993, one of four samples collected from Paulina Lake and one of two samples collected from East Lake were reported by the USGS to contain mercury in concentrations equal to the detection limit of .1 ppb. Thus, it appears that the DEQ and EPA standard for protection of aquatic life (chronic fresh water criteria) of .012 ppb mercury is exceeded at the locations where the samples were taken. Further sampling and analysis, using more sensitive detection techniques, is necessary to more accurately determine mercury levels in the lakes. Tissue sampling for mercury content in fish as been completed. The analysis results have been incorporated in Chapter 3. The statement that the commentor found objectionable has been revised and clarified. See also updated discussions of water quality in Chapter 3, and in Chapter 4 Incomplete and Unavailable Information.

COMMENT Incomplete/Unavailable Information section (Chapter 4) on Fish and Wildlife is too speculative. In particular with respect to potential effects of mercury emissions from geothermal development on the food chain. Refer to deposition modelling done for the geothermal EIS. (295, 297)

RESPONSE The purpose of the Incomplete/Unavailable section is to explain the uncertainty involved in analysis of effects. This section has been updated based on information currently available. This includes modelling results from the geothermal EIS that is being prepared. Additional analysis is also in the Biological Evaluation of threatened, endangered, and sensitive animals, which is part of the Record of Decision for this Plan.

In addition to these species-specific measures, parts of Chapter 4 have been rewritten and clarified in response to public comments. Further direction and wildlife protection measures are found in the plan's Standards and Guidelines, in the sections on biophysical ecosystem components.

Cultural and Heritage Resources

Protecting cultural resources was a concern for three commentors. One asked that recreational development in certain sensitive areas be restricted until studies are done according to the Section 106 process of the National Historic Preservation Act. Another reviewer felt that avoiding sites is a poor mechanism for "preserving" them, and that it is more important to protect archaeological data by actively gathering it under a research-driven interpretive program.

On other subjects, there were concerns that the Burns Paiute Tribe had not been considered in the draft EIS. One suggested collection of ethnographic data from tribal elders. Another reviewer was concerned that our language about use of sites for religious purposes needs to be clarified so as not to imply a right of unrestricted access to federal land. Other comments suggested clarifying some of the standards and guidelines. (See also American Indian Involvement.)

COMMENT Some archaeological resources, especially in the caldera, are particularly sensitive to damage resulting from increased access and use. Recreational development in these areas should be restricted until these resources can be fully studied. (314)

RESPONSE Any future recreational development in the Monument would require a site-specific analysis which would address cultural resources. The intent of the management plan is to avoid sensitive cultural sites wherever possible. We believe most of these sites are part of the precious heritage of our past, and should remain intact and untouched. However, some sites can offer valuable clues to understanding the past. A good example is the recently-excavated Paulina Lake site, which revealed that early people were in the caldera 10,000 years ago. This is an exciting, significant piece of the puzzle in understanding our past.

Site-specific analysis of cultural resources is an on-going process conducted by professional archaeologists, who have an overall picture of the Monument and Central Oregon's heritage.

COMMENT A very effective way of protecting archaeological data is to begin gathering information under a research-driven interpretive program where the general public is invited to participate in the exploration of their heritage. (315)

RESPONSE This is the direction and policy of the preferred alternative.Interpretation of cultural resources is a key element of interpretive programs.

COMMENT I question the interpretation of the American Indian Religious Freedom Act in the DEIS (316, 317, 318, 321, 398)

RESPONSE The Forest Service Manual 1563 states that if religious purposes or activities are discovered on federal land, those sites will be protected. This Plan will obey all applicable laws and regulations concerning cultural and heritage resources. A further discussion of this issue, including opinions from various Forest Service archaeologists, is available in the planning record.

COMMENT Correct spelling is "funerary" in regards to Indian rights. (319)

RESPONSE Corrected in document.

COMMENT Questions the interpretation of the Native American Graves Protection and Repatriation Act. (320, 333)

RESPONSE It has been the policy of the Deschutes National Forest to respect the guidance of the appropriate Tribal elders in instances of Native American burials and associated funerary objects. See planning record for further discussion.

COMMENT Questions the State Historic Preservation Officer program for inventory and research design. (322)

RESPONSE See Standards and Guidelines in Monument Plan and planning record discussion.

COMMENT Questions the need for re-stating parts of the National Historic Preservation Act in Monument Standards and Guidelines.. (323, 325, 330, 331, 332)

RESPONSE Parts of the document have been clarified and rewritten (Cultural Resources section). Monument Plan Standards and Guidelines have also been modified. Further discussion in planning record.

COMMENT Questions the interpretation of "integrity" of sites disturbed by archaeological digs and a standard and guideline in the DEIS. (326, 329)

RESPONSE Appropriate consultation with the Klamath tribe occurred on the recent Road 21 reconstruction. Monument Standards and Guidelines are consistent with the National Historic Preservation Act and the meaning and intent of "integrity" in that law. See planning record for additional details.

COMMENT Asks for clarification of standard and guideline. (327)

RESPONSE Corrected in document.

COMMENT Could the artifacts from the caldera (Paulina site and others) be on view somewhere? (334)

RESPONSE Artifacts recovered during the reconstruction of Road 21 are currently being analyzed by archaeologists. When that is complete they will become part of the collection of the Oregon State Museum of Anthropology. Eventually they will become part of the Monument's interpretive programs and displays.

COMMENT Include the Burns Paiute Tribe in the list of tribes consulted. (335, 336)

RESPONSE The Burns Paiute Tribe was consulted along with the Confederated Tribes of the Warm Springs Reservation and the Klamath Tribes. Representatives of the Burns Paiute Tribe and Warm Springs Indians visited the Monument in late 1993 for a consultation about cultural and religious freedom issues. Three members of the Forest Service visited the Klamath Tribe in early 1994 to brief the Klamath Indians about the Monument plan.

Parts of the document concerning cultural resources and American Indian issues were written with the help of these consultations. In addition, some portions of the document have been rewritten and clarified in response to comments received from the tribes between draft and final..

Additional information, including discussions among Forest Service archaeologists about the best way to approach cultural resources protection and interpretation, is included in the planning record.

American Indian Involvement

The Klamath tribe and others wanted assurances that traditional religious practices and the interrelatedness of different resources (e.g., air, water, plants) would be honored in the Monument. They also wanted us to minimize or eliminate disturbance to heritage (cultural) sites during any construction or development projects. They hoped for tribal employment and involvement in a number of areas, including interpretive projects, gift shop, and monitoring construction projects.

The Confederated Tribes of the Warm Springs felt uncomfortable about making recommendations for the NNVM area, because the Monument was a land traditionally used by many tribes for a variety of purposes. Tribal representatives have told us, however, that their ancestors did use the area for food purposes, particularly deer hunting. They may be interested in collecting certain plants here. They are interested in helping with interpretation of heritage resources.

COMMENT Oppose any excavations to recover artifacts. Want to be assured that there will be minimal or no damage to existing sites. Trail construction, campground expansion, etc., should have Klamath tribal members hired as "monitors" to evaluate any cultural materials that might be found. (397)

RESPONSE Appropriate consultation with Indian Tribes will occur before beginning any projects, such as trail construction or campground improvements. In the Monument, every effort will be made to consult with Tribes for their input. We will look at ways to directly involve Tribal members

COMMENT Want assurances that religious practices will be honored in the Monument, and that traditional religious sites will be protected. (Rights to the area are retained under the American Indian Religious Freedom Act --AIRFA.) (398)

RESPONSE The Forest Service will follow all applicable laws, including AIRFA, which speaks to traditional Indian rights regarding religious practices.

COMMENT Would like the Plan to consider the Monument as a whole: the circle and interrelatedness of the air, water, plants, animals, and people's cultural practices. (399)

RESPONSE A new introduction has been added to Chapter 3, which describes the existing conditions in the Monument. In addition, we have tried to take a more holistic, ecological approach to the management of this special place in the FEIS.

COMMENT Would like to see tribal members hired in the Monument and involved in a number of ways: e.g., developing interpretive materials, working in gift shop, monitoring for on-the-ground projects. (400)

RESPONSE We will look at programs to involve Tribal members, including partnerships for interpretive services, monitoring, and other opportunities.

COMMENT Request specific wording changes in the plan, regarding the continuity of Indian ways in Central Oregon, and the American Indian Religious Freedom Act. (401)

RESPONSE Changes have been made in Chapters 2 and 3 after consultation with the Tribes to reflect these concerns about the continuity of the Indian culture in Oregon, and Indian religious freedom.

COMMENT Tribal members hunted on this land in the past, and may have collected plants. We would like to help with interpretation. (458, 459, 460, 461)

RESPONSE The Forest Service would welcome help with interpretive programs from the Tribes.

Geology and Soils

Four commentors expressed a variety of concerns regarding geology and soils. The U. S. Department of Interior Office of Environmental Affairs noted that the draft makes no mention of Newberry Crater's status as a National Natural Landmark. This office also favored discontinuing the use of saleable materials (cinders, gravel, etc.) even for projects within the Monument. ODFW was concerned about the abilities of different soil types to regenerate habitats for wildlife. They asked that impacts from soil compaction and subsequent tillage be minimized or avoided altogether, in part, to prevent invasion by exotic plant species. ODFW also requested we provide a more in-depth discussion of soil relationships and vegetative communities. Finally, another commentor asked that we recognize the geothermal resource as an important part of the natural geology and volcanism of the area.

COMMENT The draft EIS makes no mention of Newberry Volcano as a National Natural Landmark, and its inclusion on the National Register of Natural Landmarks. This registry is maintained by the Department of the Interior and includes nationally significant geological and ecological features. Newberry Crater was designated as a national landmark in January of 1976, and represents one of the largest Quaternary volcanoes in the contiguous United States.(337)

RESPONSE The designation of Newberry Crater as a National Natural Landmark is now discussed in Chapter I.

COMMENT Since the Monument was established to "Preserve and protect for present and future generations....." , we have a concern regarding saleable materials (cinders, hardrock, gravel, etc.) Although this issue is not addressed in the Monument legislation, it would appear to be in keeping with the intent of the legislation to discontinue the use of these materials even for projects within the Monument. (338)

RESPONSE The general intent of the Monument Plan is to discontinue any commercial use of the Monument's resources, including geologic materials. Standards and Guidelines close all quarries and pits to future entry without further site-specific NEPA analysis. However, the Forest Service feels there might be a project where a small scale use the use of native, indigenous materials could be appropriate (rock, gravel, cinders).

COMMENT A more in-depth discussion of soil relationships and vegetative communities is needed. This discussion needs to include site potential to grow trees and impacts to sites from various kinds of disturbances. Disturbances discussed should include all those proposed for use in "treatment" of the Monument's stands. (339)

RESPONSE The section on vegetation in Chapter 4 has been updated to include this information. In addition, the accompanying map of Areas of Concern and Opportunity includes descriptions of soil and vegetation sites, and identifies areas of sensitive or fragile soils. Any project proposed in the Monument would first have a site-specific analysis that would evaluate any potential impacts to soils. A more detailed explanation of soil compaction and its effects is included in the Vegetation section of Chapter 4.

COMMENT The plan leaves opportunities for soil compaction to occur, and then be followed by tillage to try and undo it. Activities which result in such impacts should be minimized or avoided altogether. We question how these activities are tied to natural ecologic processes. (340)

RESPONSE Alternative C-Modified was developed to respond to concerns about "too much vegetation treatment," including soil compaction. Alternative C-Modified proposes to treat only a fraction of the acres proposed in Alternative C in the DEIS, and to focus on restoring and encouraging old growth ponderosa pine. Standards and Guidelines call for the minimal impact feasible to soils, consistent with other ecosystem restoration objectives. In some cases, mitigation measures such as tilling could be required.

COMMENT You have an opportunity to demonstrate multiple use here, and show off a successful project (the geothermal pilot project). This should be included in several parts of the document..... The geothermal resource should be recognized as an important part of the natural geology and vulcanism of the area. (341, 342, 349)

RESPONSE Proposed geothermal activities adjacent to the Monument are mentioned in many parts of the FEIS. In addition, the relationship between the youthful geology, geothermal resources, and designation of the Monument is specifically discussed in Chapter 3 of the FEIS. Geology (and associated volcanic processes, including geothermal activity) is recognized as a key interpretive topic.

COMMENT It would be helpful to have maps of ecological features, wildlife habitat and geologic resources. (343)

RESPONSE This information is contained in the Areas of Concern Map and accompanying text in the Monument Plan.

Science and Research

All comments received on this topic agreed with the preferred alternative's focus on science and research. In particular, respondents mentioned the importance of NNVM studies of archaeology, geothermal resources, and various plants.

COMMENT The preferred alternative foreshadows the exciting potential for actualistic studies (experimental archaeology; replication of prehistoric technologies; flintknapping) as a method of researching and interpreting prehistoric living represented by sites in NNVM. (344)

RESPONSE The preferred alternative focuses on interpretation of prehistoric lifeways as a key component of education and research.

COMMENT Prefer Alternative B over C except I would like to see emphasis on science and research with the results made available to the public. (345)

RESPONSE Alternative C-Modified includes elements of both Alternatives B and C, while retaining the emphasis on science, research and education.

COMMENT We value the Paulina Peak area, for the unique opportunity it affords us to study the fungus flora of Central Oregon. (346)

RESPONSE The study of fungus flora has been added to the list of Research Topics identified to date. Specific criteria for evaluating science and research projects are contained in the Monument plan.

COMMENT I believe in the education and research, but not as outlined in Alt. C. It should be dispersed, with private enterprise providing support services, such as food and lodging in Bend and LaPine. This would assist the local economy. (347, 391)

RESPONSE Alternative C-Modified proposes to keep the number of campsites in the caldera about the same as now. This would mean that additional overnight visitors to the Monument, for sight-seeing, "ecotourism," or science and research projects, would to some extent seek lodging in nearby communities. We have allowed for moderate increases in day-use, and improved the quality of the interpretive and educational programs to offer more for visitors to do in the Monument. Again, some of these increases would be absorbed by the visitor service section of the local economies.

COMMENT I especially like the focus on education and research. (348)

RESPONSE See the opportunities in this area in Chapter 2 for more ideas on science and research.

Monitoring

The four comments we received on monitoring asked for strong, fundable, issue-oriented programs. In addition, one commentor suggested we establish a budget to fund quantitative monitoring by non-Forest Service personnel, similar to an environmental audit. Another wanted to be sure that effects of recreational activities and natural processes be monitored over the long term. The need for monitoring of air quality, water quality, and biological productivity was also emphasized. One person wanted to know how we will determine what levels of pollutants will be acceptable in NNVM and how we will limit activities if necessary.

Three reviewers specifically addressed monitoring for the effects of geothermal development on NNVM. One was concerned about what levels of pollutants and frequency of odor would be acceptable. Active monitoring was also requested, with and emphasis on the cumulative effects of pollutants through the life of the geothermal project.

COMMENT The effects of Monument activities (campfire smoke, automobile exhaust, gasoline motor pollution) should also be considered and monitored, in addition to geothermal effects. This is a Class 2 (air quality) area, but maybe some place like a national monument should aim to do better than downtown Bend in terms of air quality. Monitoring will be important. How will you determine what levels of pollutants are acceptable? How will you limit activities if levels are exceeded? These should be addressed in the Monument Plan. (350)

RESPONSE The Forest Service recognizes that monitoring is a vital part of assessing the effectiveness of any plan. Some monitoring projects were put in place during 1992-1994. They include:

- **Air quality.** A new study of lichen in and around the Monument will give us valuable information about air quality. Lichen are among the most sensitive organisms in registering measurable air pollution. The study will assess impacts from possible geothermal development, and automobile traffic. In addition, there are two meteorological monitoring stations, one at the proposed geothermal power plant site, and one in the caldera at Paulina Lake.
- **Water quality.** A continuing water quality study measuring changes in possible pollutants in the water of Paulina Lake, Paulina Creek, and East Lake is being conducted by the U.S. Geological Survey. In addition, California Energy, Inc., the company that is exploring for geothermal resources adjacent to the Monument, has cooperated with ODFW in fish tissue studies to measure background levels of possible pollutants (mercury, arsenic) in the fish in the lakes. Other monitoring to be done will include monitoring of hydrogen sulfide (for odor) at receptors near the geothermal site and near Paulina Lake. Please see the Monitoring program in the Monument Plan for more information on this topic.

COMMENT Air and water quality should be monitored, including the effects of geothermal development expected nearby, as is required by the NNVM legislation. Standards for certain pollutants, such as H2S (hydrogen sulfide), should be established in the Monument's Plan. The odor of H2S could be an annoyance. What frequency and level of odor will be acceptable in the Monument? If you cannot answer this yet, then at least set up a monitoring schedule and decide how you will answer this question..... All pollutants that are emitted in significant

amounts from the geothermal project should be monitored inside the Monument. For example, boron, mercury, and arsenic could cause problems to aquatic life and other biota. What levels in the lakes and in the air will be considered acceptable? Please consider also the cumulative effects of pollutants through the life of the geothermal project. (356)

RESPONSE See above response, and Monitoring program in Plan. A full discussion of geothermal effects on the area's resources is contained in the geothermal FEIS, published in the summer of 1994. See also the summary of the Monitoring program for the Newberry geothermal pilot project, contained in the Record of Decision for that project. Among the many items to be monitored are hydrogen sulfide levels.

COMMENT Monitoring is well covered in the Draft Plan. It's a must to keep this program active. My concern is the geothermal project now being developed. What we know now, and what we might discover five years from now is essential. (357)

RESPONSE See above response to #350, and Monitoring program in Plan.

COMMENT My only caution is that we develop a monitoring plan that both addresses the issues and is economically feasible. We can't monitor every aspect of the ecosystem, so we must be wise on what we choose to monitor and check to see -- "Does it answer our questions in the area of concern?"... I would like to see a strong monitoring plan that is adequately funded. (351, 352)

RESPONSE This Plan cannot determine funding levels. Those are set by Congress. We can, and have, established a Monitoring program we intend to carry out, contingent on funding levels. See Monitoring program in Plan for details.

COMMENT There must be an emphasis on quantitative monitoring to the maximum extent possible. The monitoring provisions (in the draft EIS) are typical of past monitoring efforts that have invariably failed. A budget for outside monitoring, as done in environmental auditing, is necessary. (353)

RESPONSE The Monitoring section has been rewritten and revised. The Forest Service is increasing its emphasis on funding for monitoring, but funding levels are dependent on Congress. Outside monitoring would be one way to ensure objective, timely results. We will look at the most cost-effective and efficient way to do the necessary monitoring, given the funding made available to us.

COMMENT Concern that natural, recreational, industrial and fire emissions that impact air and water also be monitored over the long term (in addition to geothermal emissions). (354)

RESPONSE See above response to #350.

COMMENT Concern that nearby emissions from all sources will impact wildlife. Desire for long-term monitoring. (355)

RESPONSE See Monitoring program.

Air Quality

Maintaining or improving air quality was emphasized by various reviewers. Suggestions included designating Newberry a Class I (Clean Air) area and performing rigorous professional modeling of potential air pollution. The latter would be cheaper in the long run than quantitative monitoring, according to the person who recommended it. Clearer explanations of expected air emissions of toxics and potential odor from the geothermal project were requested by another reviewer.

COMMENT Support designating Newberry a Class I (Clean Air) area. Crater Lake is Class I, and Newberry is similar. Prevent the air from becoming more polluted. (359)

RESPONSE Wilderness areas are currently the only National Forest System lands that are designated Class I. All other National Forest System lands are Class II. Because of the long, narrow shape of NNVM and its proximity to an urban area in the north, the Monument would be very difficult to manage with the stringent standards required for Class I. The Monument Citizens Committee decided against nominating NNVM for Class I status in the Monument legislation.

COMMENT Visitors to the Monument expect a clean environment, in both winter and summer. (360)

RESPONSE The Monument Plan and monitoring program will ensure that visitors concerns regarding cleanliness and air quality are recognized and addressed. (See Monitoring program in Monument Plan.)

COMMENT Alternative C is good because it supports efforts to improve and/or maintain air quality. (361)

RESPONSE Alternative C-Modified is similar to Alternative C in this respect; however, C-Modified proposes to proceed more slowly with introducing prescribed fire to the Monument. This means that progress toward reducing smoke emissions from wildfires will also be slower. See Chapter 4 discussion of Air Quality for more explanation.

COMMENT Professional, rigorous modelling of potential air pollution is recommended. It is far cheaper than the monitoring that may have to be done later if increased use leads to air quality problems. (362)

RESPONSE The Forest Service does not have the capability to do such rigorous modelling in-house. Funds are not currently available to contract for this service. This might be done in the future if monitoring detects any problems with air quality.

COMMENT Concern with misrepresentation of geothermal (SAIC) modelling of potential odor of hydrogen sulfide at Paulina Lake in the Cumulative Effects section. (363)

RESPONSE H2S modelling results have been more clearly represented and explained. See Cumulative Effects section.

COMMENT Concern that the discussion about air emissions of toxics from geothermal development is incorrect and overestimates the potential detrimental effects of mercury. (364)

RESPONSE Modelling of air toxics emissions and potential impacts to lakes have been explained in more detail, based on the updated Appendix L of the geothermal FEIS. See Cumulative Effects section.

Water Quality

The water quality of Paulina and East Lakes was of concern to several commentors. One respondent suggested we phase out gasoline motors on East Lake, because it has no outlet and pollutants would build up more easily. Another reviewer wanted clarification on the current levels of mercury in the lakes and the potential effects of air pollutant deposition from the proposed geothermal project.

COMMENT The water quality of Paulina and East Lakes was of great concern to commentors. Requests for: "stronger protection measures," including eventual restrictions allowing electric trolling motors only on both lakes to reduce pollution from petroleum spills and leakage. One commentor suggested phase-out of gasoline motors on East Lake only (because it has no outlet and pollutants would build up more easily). (365)

RESPONSE The Forest Service intends to protect water quality in the lakes. (See Monitoring section of the comprehensive management plan.) Although there is no evidence indicating that pollution from gasoline outboard motors is a problem now, these concerns need to be taken seriously. If pollutants from human use are found to threaten the quality of the lakes or the fishing experience, the Forest Service would take appropriate measures to correct or prevent the problem. For example, some combination of "electric motors only" or reduced use of gas-powered motors could be considered. Gasoline-powered motors may be eventually phased out on East Lake. (See Recreation Chapter 4.) Refueling procedures will be monitored by special-use permit inspections of the resorts. Anglers are also requested not to litter the lakes, in order to keep the shorelines and the water clear and clean.

COMMENT Concern that, based on discussion in Chapter 3, Water Quality section, readers will infer that hot spring contributions to lakes are large, and that the hot springs are directly linked to the deeper geothermal reservoir. (366)

RESPONSE The issue of the degree and nature of connection between these two systems (hot springs and deeper geothermal reservoir) is subject to scientific debate. It is clear that water is flowing into the lakes through hot springs and that the hot springs play a role in lakewater chemistry. See revised explanation in Chapter 3, Water Quality section.

COMMENT Concern over the use of the word "exceptional" for Paulina and East Lake water quality. "Exceptional" normally means very low dissolved solids, whereas these levels are high in the lakes. (367)

RESPONSE The word "exceptional" has been deleted to avoid confusion. See revised discussion in Chapter 3, Water Quality section.

COMMENT Concern that we are misrepresenting the lakes as high in dissolved metal ions, when most lake water samples show very low amounts, as expected due to major input from snowmelt. (368)

RESPONSE The lakes in fact contain high levels of some dissolved metal ions compared to other high-elevation lakes in Oregon, higher than expected if input were solely from snowmelt. For example, calcium levels in both lakes range from 25-29 mg/L (Crumrine and Morgan in press). Measurements of the total concentration of ions in the lakes' water by electrical conductivity also show high levels. (Conductivity increases as the level of dissolved ions increases.) East and Paulina Lakes have "uniformly high water column conductivities of 393 and 698 umho/cm, respectively" (WATER 1993). This compares with values ranging from 2 to 35 umho/cm for all other high mountain lakes that were sampled in the Deschutes National Forest (WATER 1993).

COMMENT Concern that we are representing the lakes' boron levels as "high," when they are lower than the hot spring levels and not so high when it comes to effects on plants. (369)

RESPONSE Based on USGS data from 1991-1993, boron ranges from 850 to 1000 ppb in the lakes and from 850 to 1200 ppb in the hot springs. The lake levels are high compared to other high-elevation lakes in Oregon (EPA, 1987). The average level of boron in natural fresh waters is 10 ppb (Wetzel, 1983). Boron levels in Paulina and East Lakes are high enough to reduce growth or yields for sensitive types of agricultural crops, if the lake water were used to irrigate them (Ayers and Westcott 1985).

COMMENT Boron, arsenic and mercury concentrations in lakes and Paulina Creek should be portrayed as low, because concentrations of these elements in general are not detectable in a large number of the samples taken from the lakes. (370)

RESPONSE Boron and arsenic are detectable in all samples of lake water analyzed by the USGS (Crumrine and Morgan, in press). Boron is present at 850-1000 ppb; its detection limit with the method used is 10 ppb. There is no state or federal standard for boron for protection

of aquatic life; however, the measured levels are about 100 times the average for fresh water (see preceding response).

Arsenic measures 2-16 ppb in the lakes, which is quite high compared to other mountain lakes in Oregon. The detection limit with the method used is 1 ppb. The arsenic levels in Paulina and East Lakes fall well below the standard for protection of aquatic life (190 ppb for As3+ - no standard is in place for total As). The federal standard for protection of human health when consuming organisms from the water is .14 ppb As. Results of recent analyses of Paulina and East Lake fish for As by DEQ are not yet available, so we don't know yet if they are high enough to pose a health concern for humans who eat the fish.

Mercury is generally below the detection limit of the method used by the USGS. Out of 12 samples from the lakes in 1991-1993, ten had <.1 ppb Hg, and two were reported at the detection limit of .1 ppb Hg. (Some samples from hot springs, warm water wells, and Paulina Creek showed levels up to .3 ppb Hg.) Analysis by a more sensitive technique is possible and would yield total mercury measurements with detection limits of .00005 ppb. This would allow a determination of whether or not background mercury levels exceed the State of Oregon standards. The chronic criteria for health of aquatic life is .012 ppb; the standard for human consumption of aquatic organisms is 0.15 ppb. These standards are very low because even small amounts of mercury can be toxic. A Health Advisory was issued on June 29, 1994 by the Oregon Health Division for consumption of fish in East Lake, due to their high mercury levels (a copy is available in the planning record). (See also response below and Chapter 3 section on Fish).

COMMENT Current mercury levels in the lakes are very low, indicating an insignificant contribution of mercury from mineralized hot springs and leaching. These background levels do not need to be considered in calculations of the effects of deposition from geothermal emissions. (370)

RESPONSE Mercury levels in the lakes are at or below .1 ppb (how much below is unknown). Federal and state standards for protection of aquatic life are .012 ppb. Average mercury levels in fish have been found by the Oregon Health Division to be high in East Lake (.64 ppm). The hot springs contribute some (perhaps most) of this mercury to the lakes, based on USGS analyses of hot-spring water. To assess the potential effects of mercury deposition from geothermal emissions on aquatic life and the food chain (including humans), it is necessary to calculate total mercury levels in the lakes. These totals can be derived only by adding the projected geothermal contributions to the natural background levels.

COMMENT Concern that Cumulative Effects sections for air and water quality overemphasize potential for geothermal effects while ignoring other pollutant sources (natural, recreational, industrial, treatment, fire). The document should say that trace element accumulation from any and all nearby sources is not expected to be a problem but should be monitored over the long term. (371)

RESPONSE The uncertainty in the degree of impacts from geothermal development has been more clearly acknowledged in the Cumulative Effects section, based on the available data and assumptions used in the geothermal EIS (USDA Forest Service 1994). The content of the geothermal portion of this section has been updated to reflect the revised models of metal deposition that have been developed for the geothermal EIS. See the Monitoring program in the

Monument Plan for long-term monitoring intent in NNVM. Effects of the geothermal development are expected to be insignificant to air and water quality within NNVM as long as the modelling assumptions in the geothermal EIS prove to be accurate with respect to geothermal fluid chemistry.

Scenic Quality

Eight respondents addressed the issue of scenic quality, asking for a clearer explanation of how and where the landscape will be changed, especially when viewed from the highway, Paulina Peak, Lava Butte and the lakes. More description of the scenic aspects of facilities and signs was requested by three commentors. Finally, one respondent was concerned about how we would evaluate the beauty (or lack of beauty) of natural processes to the average visitor.

COMMENT Improvements and development at resorts should follow the existing rustic character and architecture. The use of stone and timbers following an alpine setting in all structures should be done both for an economical and aesthetic standpoint. The massive furniture manufactured in LaPine should be considered. (372)

RESPONSE There is a document (working draft) "Deschutes National Forest Recreation Facility Handbook" which was recently designed to outline the architectural guidelines for recreation development on the forest. There is a section specific to the Monument. Site-specific material sources are not within the scope of this programmatic document.

COMMENT Need to know what it will look like! Need integrated spatial articulation to better evaluate and understand actions proposed. How will the existing landscape be changed in terms of scenic quality as viewed from highway, lakes, Paulina Peak, Lava Butte? (373)

RESPONSE The visual quality objective map (VQO-NNVM) for Alternative C-Modified is the result of an integrated analysis and issue synthesis. This map outlines the minimum standards that must be met (in terms of scenery). This document does not describe what any individual project would look like. It does describe (on the VQO map) what standards must be met in order to be consistent with the Plan and not necessitate a plan amendment (see also scenery standards and map legend, as well as Chapter 4 scenery).

COMMENT What is "natural" to the average visitor? Define. Are we allowing natural processes to be emphasized and to occur even if they don't seem natural or beautiful to the visitor? (natural vs. scenic). (374)

RESPONSE The terms "natural ecological succession," "scenic," and "natural appearing" are defined for the purposes of this discussion in Standards and Guidelines for scenery. Providing for high scenic quality in some parts of the Monument and "natural" ecological patterns in other parts is consistent with the intent of Monument legislation. See Chapter 4 and the VQO map for more details.

COMMENT How do you know we can meet the visual quality standard? Especially since we would be exceeding the recommended treatment for partial retention. Need spatial allocation of actions. (375)

RESPONSE Alternative C-Modified assumes a lower level of vegetative treatments. In this alternative, effects of vegetative treatments would be expected to provide for the desired visual condition and to remain within visual standards.

COMMENT How do we implement this plan? (Need a model.) What are our priorities? (376)

RESPONSE Please see the VQO maps in the Standards and Guidelines section. See also Areas of Concern and Opportunity map and text for an explanation of priorities by area.

COMMENT Where and why will we manage vegetation? (377)

RESPONSE The Areas of Concern and Opportunity Map was developed to show where projects might take place. The VQO map shows the standards for visual changes in the vegetation. For more specifics about vegetation management, see the vegetation section of Chapter 4, and Standards and Guidelines.

COMMENT Describe the percentage of change that will occur in each viewshed. Need vegetation management intensity zones. (378)

RESPONSE The Visual Quality Objective (VQO) map shows the minimum standards for how much visual change **can** occur, from individual projects or cumulatively. The standards by which these are measured and the standards themselves are described in the Scenery Standards and Guidelines in the Monument Plan. Specifics about individual viewsheds are in the planning record.

COMMENT Need to address other things besides vegetation in scenic quality: eg. facilities, signing... (379)

RESPONSE The scenic section of Chapter 4 discusses relationships with other resources. See also other Standards and Guidelines.

COMMENT Specific suggestions for improving scenic sections of Plan. (380)

RESPONSE This input was considered in revising the Plan.

Law Enforcement

Adequate enforcement of laws and regulations was a concern of two reviewers. Specific issues included illegal obsidian collection and overnight parking in boat launch areas.

COMMENT Both commercial and all other non-traditional collection of obsidian from the obsidian flow should continue to be prohibited. Durable signs should be erected in the former collecting areas and the rules enforced. (381)

RESPONSE The Forest Service coordinates with state and county law enforcement agencies to provide for public safety and resource protection. The expanded interpretation programs in Alternatives C and C-modified would also help reduce resource damage and conflicts through education and the presence of Forest Service interpreters. There are signs now at the Big Obsidian Flow informing people that collecting is illegal. Additional information, including an obsidian flyer/handout, is distributed at the entrance station. The wording of the Law Enforcement section has also been clarified to reflect updated information.

COMMENT A large sign should be placed in the main Paulina boat launch area that says "No overnight parking for vehicles or trailers." Too often you arrive early in the morning and people have left their boat trailers all night, or there are motor homes, campers, etc. parked in the boat trailer parking area. (382)

RESPONSE In 1994 the Forest Service started a contract agreement with a private corporation (Northwest Land Management of Palo Alto, California) to collect campground fees, provide maintenance, and enforce regulations in the caldera. We anticipate this additional presence will discourage inappropriate overnight parking.

Local Communities

Twelve comments addressed local communities and socio-economic issues. Most concerns fell into three categories: The first was cost of recreational use; people wanted to keep day use free and freeze rates for campsites. Second was the cost of improving facilities; reviewers felt that the proposed facilities and related maintenance may not be affordable at this time. The third issue was the local economy. ODFW said that if deer numbers decrease, hunters' contribution to the local economy will decrease. Another reviewer thought that private enterprise should provide support services in Bend and La Pine for education and research activities in the Monument. One respondent wanted all monies generated from nearby geothermal development to be used only in NNVM.

Some groups and individuals volunteered their services to make the Monument a better place. We received offers to help with design and maintenance of trails and sno-parks, development of interpretive materials, and installation of bat and bird nesting boxes.

COMMENT Hunters contribute major dollars to the Central Oregon economy. Under the proposed alternative, deer population will decrease. (386)

RESPONSE Habitat for deer (and elk) populations will be provided in the Monument. Alternative C-Modified reduces the amount of vegetation treated, thereby keeping more hiding cover for big game animals. Other parts of the Monument, however, will be managed differently to provide habitat for other, non-game species.

COMMENT Alt B is too low-key and would never be accepted by the public. Low visitor numbers would kill the Monument's funding opportunities. (387)

RESPONSE The Forest Service identified C-Modified as its preferred alternative, but did offer a range of options for managers with the different alternatives.

COMMENT Alt C is good for the present economic conditions. (388)

RESPONSE See above response to #387.

COMMENT Want monies generated from geothermal development to be used in NNVM only. (389)

RESPONSE If geothermal power is developed west of the Monument, California Energy, Inc. (the developer) would pay property taxes in Deschutes County on the land and buildings associated with that development. This would ease the property tax burden on all other county residents. In addition to these standard property taxes, a percentage of the profits (called royalties) from geothermal generation of electric energy is returned to the general fund of Deschutes County. The ability to distribute geothermal monies directly to NNVM is beyond the scope of this document.

COMMENT Keep day use free and boat launches free. Don't allow rates to go up on campsites. (390)

RESPONSE This Monument Plan addresses overall planning and development. Campground and day-use fees are outside the scope of this Plan.

COMMENT Education and research should be dispersed, with private enterprise providing support services, such as food and lodging in Bend and LaPine. This would assist the local economy. (391)

RESPONSE The preferred alternative emphasizes interpretation, education and research, while keeping about the same number of campsites. This would mean that any additional visitation to the Monument, for sight-seeing, "ecotourism," or science and research projects, would probably find lodging in nearby communities. We have allowed for moderate increases in day-use, and improved the quality of the interpretive and educational programs to offer more for visitors to do in the Monument. Again, these increases would be absorbed by the visitor service section of the local economies.

COMMENT Volunteering various services (interpretation, trail construction, bird boxes, etc) to help with Monument programs. (392-396)

RESPONSE Thank you for offers of help. The Forest Service welcomes opportunities to work together with partners and volunteers to improve services to visitors and enhance resources.

Special Uses

Six respondents addressed resorts or summer homes. Four people asked for more information on the resorts, specifically, if the facilities would continue to operate and if they would be improved. One respondent asked that no more resorts be licensed at either lake, stating that existing development already taxes the area during the short summer season. Another reviewer wanted the role of the resorts to be clarified and planned as a part of overall development of the caldera. Yet another commentor asked that summer homes meet standards and guidelines similar to the ones for resorts.

Three comments on grazing showed a full range of opinion (pro, con, and neutral) on the proposal to eliminate grazing within the Monument. One reviewer noted that modification or cancellation of grazing could involve waiting periods, structural improvements, or negotiated measures. One commentor felt that all of the proposed fencing would not be necessary to keep cattle off of lava areas and that it would be expensive to build and maintain--not to mention an eyesore.

Three comments on commercial special-use activities included support for: 1) prohibiting any commercial activity in special forest products (plants, boughs, cones, Christmas trees, and fungi); 2) limiting commercial guide services to preserve the peaceful atmosphere, and 3) allowing some aircraft to fly over the Monument (a total ban could limit fire control, etc.).

We received one comment on utilities and rights-of-way from PGT. This respondent asked us to allow for potential siting of future utility projects on new or expanded corridors.

COMMENT Maintain affordable rates at the lodges. (98)

RESPONSE The rates charged by the owner of the resorts are beyond the scope of this planning document.

COMMENT Support a higher level of occupancy for the resorts provided rates remain reasonable and the low key "get away from it all" experience is maintained. (99)

RESPONSE Standards and Guidelines for the Monument Plan say that resorts will maintain the present "low-key" experience in the caldera. Any expansion must be approved by the Forest Service in conjunction with existing resort/special use requirements, and appropriate NEPA analysis.

COMMENT Clarify the role of Paulina and East Lake Resorts in the overall development of the caldera. (402)

RESPONSE All alternatives proposed in this FEIS call for keeping the present resorts and summer homes in the Monument at their current levels (two resorts and six summer homes.) Improvements and modifications to these facilities are governed by existing Deschutes National Forest and Regional Office guidelines. Standards and guidelines for these special uses are outlined in the plan.

COMMENT Allow the lodges to be upgraded at both lakes..... The two private lodges on the lakes with their services and facilities are very beneficial. I hope you will continue to let them operate. (135, 403)

RESPONSE See above response to #402.

COMMENT No additional resort facilities should be licensed at either lake. Existing development already taxes a short summer season recreational area. (404)

RESPONSE See above response on resort expansion. The preferred alternative proposes to keep just two resorts in the caldera. Any expansion of the existing resorts would require further site-specific analysis.

COMMENT Alt. C does't talk too much about the resort's role in providing public services. Are we going to allow the permitee to improve facilities? It seems like the Forest Service hamstrings these people with piles of red tape. Let's face it, our public are urban-oriented and demand services. (405)

RESPONSE See above responses to resort questions. The resorts provide a quality experience now in a unique recreational setting. The preferred alternative proposes to keep the number and size of resorts at about present levels, but to allow for upgrades in facilities.

COMMENT Summer homes are also a special use, so I suggest they should have to meet Standards and Guidelines similar to the ones for resorts. (407)

RESPONSE Summer homes are governed by special use permits issued by the U.S. Forest Service. They are subject to regulations contained in the Deschutes National Forest guidelines for summer homes and special uses. Alternative C-Modified proposes to continue existing summer home permits, but not allow construction of any new homes.

COMMENT Pacific Gas Transmission Company (PGT) owns and operates the natural gas pipelines on rights-of-way through the Monument just east of Highway 97. PGT believes the intent of Congress when it created the Monument was to recognize the Monument's existing utility corridors as planning corridors within which future utility projects may be accommodated. The DEIS does not address the potential siting of future utility projects on new or expanded rights-of-way within these corridors. (408, 409)

RESPONSE Language has been added to Chapter 3, Special Uses, to address this concern. The Plan Standards and Guidelines for utilities also set criteria for possible future expansion. A site-specific analysis would be needed for any future expansions or adjustments to the existing utulity corridors.

COMMENT The action alternatives would require modification or cancellation of the current grazing permit on the Sugarpine Allotment. This proposal to eliminate grazing would require waiting periods, additional structural improvements and/or negotiated measures. (410)

RESPONSE The preferred alternative proposes to eliminate grazing from the Monument. This would be done in the most efficient and cost-effective manner, using appropriate procedures for phasing out the allotments permit. Specific requirements would be negotiated between the Forest Service and grazing lease-holder.

COMMENT ODFW supports elimination of livestock grazing in the Monument. (411)

RESPONSE This was proposed in the draft EIS, and is part of the Final EIS in Alt. C-Modified.

COMMENT Do not agree with C, because it eliminates all grazing from the Monument. (412)

RESPONSE Increasing recreational use of the Monument and protection of other resource values lead the Forest Service to propose eliminating grazing from the Monument. There are other places on the Fort Rock District where grazing is more appropriate and can be accommodated without conflicts with other uses and resources.

COMMENT The FS has proposed we build 8 miles of fence along these areas to ensure that cattle do not enter the Monument. There are a few areas that might need some fencing, but it would be a poor idea to run 8 miles of fence along a lava flow. It is not necessary for control of the cattle, would be expensive to build and maintain, and would result in long-term visual blight. (413)

RESPONSE See above response to #410.

COMMENT I believe it important to absolutely prohibit ANY commercial activity in special forest products within the Monument, including perennials, succulents, boughs, cones, Christmas trees, and all wild fungi (edible, medicinal, and sacred). (414)

RESPONSE Alt. C-Modified also proposes to eliminate any commercial activities within the Monument that do not specifically further the goals of protecting and enhancing Monument

resources. The Forest Service feels that commercial harvest, in general, is not compatible with Monument goals and values. However, some exceptions may be allowed, such as a small contract to remove down and dead firewood, or a fishing guide taking a party of visitors on the lakes. See the Standards and Guidelines section of the Plan for more details.

COMMENT Concerned with commercial and guide service, winter and summer. This could become overpowering vey quickly. (415)

RESPONSE Monument Plan Standards and Guidelines give the Forest Service the flexibility to limit or control the number of special use permits issued to guides. The purpose of these services is to provide a quality recreational experience, in keeping with Monument values.

COMMENT Disagree with total ban on aircraft in MSP-9. The FS should have to abide by the same ban which would limit fire control, etc. A limit on numbers OK. (416)

RESPONSE The FAA has a limit on aircraft, requesting them to maintain an altitude of at least 2,000 feet over national parks and monuments. This regulation is consistent with Monument management goals, because it ensures a peaceful recreational experience for visitors, especially in the caldera. This FAA requirement does not apply to fire-fighting efforts or emergency landings. Since this is already an applicable regulation in place, the standard, which would be redundant, has been eliminated.

Lands

The privately-owned property between the lakes concerned one reviewer, who asked for more information. Deschutes County wanted to ensure close coordination with the Monument Plan when they review land-use applications on surrounding properties and update ordinances for private and state-owned lands within NNVM. A third commentor on this issue, the Oregon Division of State Lands, was concerned that their regulatory and proprietary responsibilities were not adequately addressed.

There were additional concerns about the North and South Paulina Roadless Areas, which became part of the Monument under the 1990 legislation, and the proposed Mokst Butte Research Natural Area.

COMMENT There is a block of privately-owned property located between Paulina and East Lakes. Why has this land been excluded from public ownership? Will this land be commercially developed in the future? (418)

RESPONSE Negotiations are ongoing to bring parcels of land in private ownership within the Monument under federal management. This includes the private land (158 acres) in the caldera, currently owned by LPP Resources Limited Partnerhip. This land was privately owned at the time the area became a national monument.

COMMENT Lands within NNVM (and covered by Deschutes County ordinances) are zoned and designated Forest Use and Open Space and Conservation. As county ordinances are periodically updated, there needs to be close coordination between the Forest Service and Deschutes County planners regarding these zones. (417)

RESPONSE Coordination with both state and county governments is an ongoing priority for the Forest Service.

COMMENT Within NNVM, the Division of State Lands owns over 500 surface acres, as well as additional mineral rights. It appears the proposed Plan severely limits the economic uses of this land. We propose that representatives of the Division of State Lands and the Deschutes National Forest begin discussion of the possibility of a Forest Service /DSL land exchange. (463)

RESPONSE Regarding state lands within the Monument, a number of options are possible, including a land exchange, or an agreement on appropriate uses of this land. The Forest Service is interested in pursuing the possibilites of a land exchange, or other arrangements that could meet Monument objectives. In addition, Attachment B to a DSL letter to the Monument Planning team (March 22, 1994), has been entered into the planning record for future reference concerning these lands.

COMMENT Much of the proposed "treatment" of lodgepole pine is to occur within existing roadless areas. (452)

RESPONSE Alternative C-Modified proposes to stay out of the roadless areas as much as possible. See discussions in Chapter 4, the Monument Standards and Guidelines, and the Record of Decision.

COMMENT The north Paulina and south Paulina roadless areas are virtually ignored in the Plan. (453)

RESPONSE A new section on the roadless areas has been added to Chapter 3 and Chapter 4. Roadless areas are also specifically addressed in Standards and Guidelines..

COMMENT The Monument legislation supersedes the Forest LMP's management direction direction for all lands within the Monument, so the Mokst Butte proposed Research Natural Area is not required, but is included in all alternatives. The proposed RNA extends across the full width of the Monument, which would require locating any trail (or road) connection between Lava Lands and the Lava Cast Forest area outside of the Monument. There should be a reevaluation of the RNA's proposed boundaries to support the Monument, not act as a barrier. (454)

RESPONSE The Forest Service is checking on appropriate uses in an RNA. It could be that a trail skirting the edge of the RNA is appropriate and compatible with Research Natural Area

goals and objectives. Another possibility is to plan any interpretive trails so they do go outside the Monument. A boundary adjustment is also a possibility. All of these options are being considered. The Forest Service's preferred alternative, C-Modified, does not call for any new roads near the RNA.

COMMENT Why is Mokst Butte RNA not identified as non-motorized? (455)

RESPONSE This has been corrected in the maps. There <u>are</u> limits on motorized activities in RNA's.

COMMENT The action alternatives appear to down-play the significance of three areas: the Wild and Scenic River Areas, RNA, and BEMA's (Bald Eagle Management Areas). These special areas seem to get overlooked in the newly-formulated "Zones." Although it is stated in the draft that "All alternatives maintain the unique scenic values of Paulina Creek," and that "An RNA is included in all alternatives," only Map D shows a potential Wild and Scenic River Corridor or the potential RNA. (456, 457)

RESPONSE All action alternatives include maintaining the outstanding and remarkable values of the section of Paulina Creek within the Monument and Special Management Areas. This is accomplished through Standards and Guidelines concerning water quality, riparian protection, and recreation. It could become a Wild and Scenic River, if a Forest Service suitability study recommends it. Meanwhile, its outstandingly remarkable values will be protected in the Monument Plan. All alternatives similarly include the proposed 1250-acre Mokst Butte Research Natural Area near Lava Cast Forest. It is identified as a separate entity (Area 12) on the Areas of Concern and Opportunities Map. Alternative A proposes one BEMA; Alternative B proposes three; and Alternatives C and C-modified propose two. Standards and Guidelines also specifically address BEMA's.

Cumulative Effects

Some people felt that the document was too general to adequately assess cumulative effects. ODFW was concerned that thinning vegetation outside the Monument and managing for open stands of old-growth ponderosa pine within NNVM would reduce stand densities too much and degrade wildlife habitat over a vast area.

The potential negative effects of geothermal development are over-emphasized in the document, according to one reviewer. A second commentor wanted geothermal development recognized as a potential good neighbor, while a third was concerned that bats and birds will be poisoned by holding ponds.

COMMENT Concern that accumulation of some trace metals in animals and plant tissues, and eventually into the food chain, is not just a geothermal issue. Should be addressed for all sources (including recreational and industrial). (355, 371)

RESPONSE See Monitoring Program in Plan. Monitoring to be done would not focus just on geothermal emissions.

COMMENT Please consider the cumulative effects of pollutants through the life of the geothermal project. (356)

RESPONSE Cumulative effects of geothermal emissions are covered generally in the FEIS in Chapter 4. Cumulative effects are analyzed in depth in the Newberry Pilot Project FEIS, published in the summer of 1994. Based on that analysis, geothermal emissions are not expected to result in significant adverse effects on Monument resources. Monitoring will be done to track and evaluate effects. In the event of unexpected adverse differences from those projected in the geothermal FEIS, steps to correct the problem will be taken. See Monitoring program in this Plan and in the Record of Decision for the geothermal project.

COMMENT Development of the geothermal resource should be recognized as a potential good neighbor. Geothermal played a role in the designation of the Monument, and has considerable mention in the legislation. There is little discussion of geothermal in the DEIS, and when it is mentioned, it is usually as a source of potential negative impacts to the Monument. (419)

RESPONSE Geothermal resources are an interesting and potentially influential aspect of the Monument's ecosystems, both in biophysical and human/social terms. Geothermal interests did play an important part in development of the Monument legislation, and the language in the Act acknowledges the potential for geothermal development in several different ways. This is recognized and discussed in Chapter 1 of the FEIS, as well as in the Standards and Guidelines and management goals of the Monument Plan. Chapter 3 describes the interest in geothermal energy and the potential for development adjacent to the Monument. The section on geothermal energy has been updated to reflect the Record of Decision authorizing the Newberry Geothermal Pilot Project.

COMMENT I'm concerned that bats and birds will be poisoned by geothermal holding ponds. (420)

RESPONSE Cumulative effects of geothermal emissions are covered in the geothermal project FEIS, published in the summer of 1994. See also response to #356.

COMMENT Although it proposes some significant developments and is called a "Comprehensive Management Plan," the Newberry Plan presents such a general picture as to make it difficut to even provide meaningful comment on the Plan. The basic planning element of cumulative effects cannot be assessed or understood without there being more specificy in the Plan. (421)

RESPONSE This Plan is a programmatic document, setting broad direction and guidelines for the future of Newberry National Volcanic Monument. As such, it functions much as a "Constitution" to guide managment in the future. It also outlines areas where any development (trails, day use areas, buildings, etc.) would occur. The Areas of Concern and Opportunity Map and accompanying text was developed to respond to public concerns for more specificity and detail. After this Plan there will another level of planning -- site-specific analyses of projects that are consistent with the broad direction of this Plan.

COMMENT Concern that black bark stands outside NNVM, and managing for open, old growth ponderosa pine within NNVM would reduce dense stand conditions (songbird habitat, hiding cover) over a very large area. (422)

RESPONSE Alternative C-modified was developed to respond to public comments about the amount of vegetation management, especially in the first decade. Alternative C in the draft proposed to treat about 5200 acres (lodgepole and ponderosa pine) in the first ten years. Alternative C-Modified proposes about one-fourth of that (1300 - 1600 acres over the ten year span). This would increase the number of acres available for hiding cover and (some) songbird habitat.

NEPA/Legal Issues

Nine commentors felt the document needed improvement in order to meet its legal obligations. Some were unhappy with the range and variety of alternatives. Their concerns included not enough access for ATV's, misinterpretation of "natural ecological succession," and extremes in the number of acres of vegetation treated. One commentor wanted the Newberry plan to reflect its status as part of the National Parks and Monuments system.

Some reviewers thought the draft was too vague for a programmatic document and should contain more information. The plan lacks a meaningful section on ecology, according to one respondent. Another requested trail plans for different uses, map publishing plans, user education plans, and trailhead plans. Yet another advised that we will need another public comment period once we add in management areas spatially.

The U.S. Environmental Protection Agency (EPA) found "no significant statutory or jurisdictional issues of concern." Other commentors had specific legal concerns about missing or inaccurate documentation: The U. S. Dept. of Interior's Office of Environmental Affairs noted that the Special Management Areas (including the Transferal and Transferal Adjacent Areas) are not part of the Monument and as such fall under different management criteria. Another reviewer thought that we needed to better address the special relationship between the Secretary of Interior and the Secretary of Agriculture with regard to the implementation of the Geothermal Steam Act of 1970. A Biological Evaluation for chemical treatment of East Lake has not been completed, and the Environmental Assessment for this activity is out of date, according to another commentor.

Range of alternatives

COMMENT As we understand it, the NEPA process requires that public land managers and planners develop a full range of alternative in regards to significant issues in the draft. It appears that your draft alternatives do provide a wide range of choices for all forms of recreation except one (ATV's). (423)

RESPONSE Alternatives A and D in both the draft and final include ATV access or use in parts of the Monument. Of the four alternatives in the draft, two did provide for ATV access or use.

Alternative A provided for access to East Lake Resort and a pass-through corridor in the Transition Zone. Alternative D provided for off-road ATV use anywhere in the Monument except for existing summer closures (i.e., the caldera), and in accordance with current Deschutes National Forest policy.

COMMENT It appears the only alternatives considered were at the extremes. Alternative A and D are minimal in their treatment while B and C are extreme in the number of acres treated. There needs to be a number of treated acres somewhere in the middle of the extremes. (424)

RESPONSE Alternative C-Modified was developed to respond to this and similar comments about vegetation management.

COMMENT There is not a reasonable range of alternatives here, and none of the alternatives comply with the Act's requirement of allowing natural ecological succession to continue to the maximum extent practical. (425)

RESPONSE Alternative D (No Action) would plan no vegetation activities except where needed for human health and safety, such as the removal of a hazard tree in a campground. Alternative C-Modified proposes minimal vegetation treatments in the North and South Paulina Roadless Areas (32,000 acres). Alternative C-Modified assumes treatment of 400 - 1600 acres in the first decade. This is about 2 percent of the Monument's total area. On a yearly average, this would amount to two-tenths of one percent of the Monument's area, leaving 99.8 percent to natural ecological succession.

Need more documentation

COMMENT The Environmental Assessment under which chub control has taken place was written in the mid-to-late 1970's and does not cover special status species. I would strongly recommend that NEPA documentation for this activity be updated, or the activity be suspended until NEPA documentation is completed. (426)

RESPONSE New NEPA analysis and documentation of effects is planned before chub control is done again.

COMMENT I would like to see more specific trail plans for particular sports, map publishing plans, user education plans, trailhead plans. (427)

RESPONSE We would like to provide this information, and may be able to in the future, but for this document, we had to focus on our limited time, money and personnel on the environmental annlysis required by the National Evironmental Policy Act, and the Monument legislation.

COMMENT Need another comment period once you throw in management areas spatially.... not specific enough in the preliminary draft. (428)

RESPONSE The Areas of Concern and Opportunity Map provides more specific information about where activities might occur. It does not establish allocations or management areas. We have tried to respond to most of comments we heard about the draft, and have produced a new alternative to address public concerns. There is an appeal period after the Record of Decision is signed for people with strong objections.

COMMENT We wish to emphasize that the "Plan" is far too programmatic and not near specific enough as to exactly what is planned to happen within the Monument. (429)

RESPONSE This Plan is a programmatic document, setting broad direction and guidelines for the future of Newberry National Volcanic Monument. It does not make site-specific descions about exactly where and what will be done. Rather, it functions much as a "Constitution" to guide managment in the future. It also outlines general areas where any development (trails, day use areas, buildings, etc.) would occur. The Areas of Concern and Opportunity Map was developed to respond to public concerns for more specificity and detail. After this Plan there will another level of planning -- site-specific analyses of projects that are consistent with the broad direction of this Plan.

COMMENT Chapter One needs to address the special relationship between the Secretary of Interior and the Secretary of Agriculture with regard to implementation of the Geothermal Steam Act of 1970. (430)

RESPONSE The Monument legislation (PL 101-522) speaks to the Geothermal Steam Act, specifically in regard to the Monument. This is covered in Section 2 b and c; Section 3 a, b and d; Section 4 a, b and c; and Section 8 c. This Plan's relationship to other agencies and authorities is covered in Chapter 1 of the FEIS.

COMMENT It needs to be made clear throughout the document that the special management areas (including the Transferal and Transferal Adjacent Areas) are not part of the Monument and as such fall under different management criteria. (431)

RESPONSE This has been clarified in Chapter 1.

General

COMMENT This is not a recreation monument or a vegetation monument. The Act requires the Forest Service to caretake and display a unique and special spot, and a Comprehensive Management Plan that accomplishes that mission should be prepared. (432)

RESPONSE The information in the FEIS has been revised, updated, and clarified, and Alt. C-Modified has been added to keep the elements that were strong in the draft. The preferred alternative attempts to strike a balance between increasing recreational use, and protecting unique and precious resources. Alternative C-Modified encourages natural ecological processes in large

areas of the Monument, restores old growth ponderosa pine stands, provides for both developed and dispersed recreation, offers wildlife protection, and provides an extensive interpretive program to foster enjoyment, understanding and respect for this unique and special place.

COMMENT By sitting down with reasonable parties, we (the ATV community) have been able to address the REAL issus and have proposed solutions that will benefit everyone.....We believe the final outcome will make everyone winners. We would challenge you to seek the same openness and spirit of cooperation. (433)

RESPONSE We maintained an open public participation process throughout the planning for this national monument. All Advisory Council meetings are open to the public, and an ATV representative presented a proposal at one Advisory Council meeting. We went to area high schools to get the opinions of young people. We have published a number of newsletters informing people about the issues. We have held at least seven open houses in Central Oregon to listen to peoples' concerns, and meet them face to face. We realize our decisions will not always be popular with everyone.

COMMENT Cut the page enhancers in half and speak to the facts. The document is too long. (434)

RESPONSE The Forest Service, by law, is required to do a thorough analysis of all the issues relevant to this special place, and to present that analysis to the public and to decision makers. This often means lengthy explanations. Whenever feasible we have tried to summarize results of our analysis, without losing meaning.

Miscellaneous

COMMENT The Plan is notably deficient in lacking a meaningful section on ecology and ecological processes. (448)

RESPONSE As part of the corrections and additions between draft and final, an ecological overview of the Monument has been included at the beginning of Chapter 3. The wildlife biologist on the ID team has a master's degree in ecology. The Forest ID team also consulted with the regional ecologist Bill Hopkins for more in-depth ecological insight. The vegetation section of Chapter 4 has been revised to include more information on ecological processes.

COMMENT The Plan appears to be a thoughtful, judicious mix which will preserve the Monument, up-grade the conditions of the lodgepole and ponderosa, improve accessibility but limit the impact of cars and ATVs. (435)

RESPONSE The intent of the Plan is to balance recreational access with resource protection.

COMMENT The goal of the Monument in the first place was to showcase and protect the natural features. Intensive recreation was NOT a goal. (436)

RESPONSE Alternative A highlighted "intensive recreation." It was not identified as the preferred alternative in either draft or final, but did provide a range of reasonable alternatives. Monument legislation speaks to enhancing a number of its resources: including recreation, ecology, botany, fish and wildlife, cultural, scenic, and scientific.

COMMENT Alt. C is acceptable, A is preferred. (437)

RESPONSE Alt. C-Modified includes some features of Alt. A

COMMENT Needs to be more like B. (438)

RESPONSE Alt. B includes various features that would protect and enhance wildlife and dispersed recreation. Some of the these features have been included in Alt. C-Modified.

COMMENT The Plan seems to focus on the right things: educational programs that develop stewardship of this area through time. (439)

RESPONSE Thank you! That is the hope and intent for the Monument Plan.

COMMENT The research and development for the concerns of all resources from human desires -- to land and wildlife, was outstanding..... "A balanced, realistic, fundable, middle-of-the-road alternative which preserves future alternatives and options." (440, 442)

RESPONSE Thank you. The preferred alternative attempts to strike a balance between increasing recreational use, and protecting unique and precious resources.

COMMENT Please no expresso stands. (441)

RESPONSE Commercial developments, including retail sales, are limited by Monument Standards and Guidelines.

COMMENT Alt. A and C are too anthropocentric as they will allow for more damaging human impact. B seems more reasonable; less human input on the forest in general. "Don't harm the environment in any way." (443)

RESPONSE The preferred alternative attempts to strike a balance between increasing recreational use, and protecting unique and precious resources. Monument legislation speaks to enhancing a number of its attributes, including recreational opportunities for people. Other resources to be protected and enhanced include: ecology, botany, fish and wildlife, cultural, scenic, and scientific resources.

COMMENT Will Alt. C provide the greatest good for the greatest number in the long run? Alternative A sounded best at first - could it be given stronger emphasis in Alt. C? (444)

RESPONSE See above response to #443. Elements of Alt. A (Monument Trail, low key vegetation management) have been included in Alt. C-Modified.

COMMENT Alt. A is good because it will create more jobs, but it would be worse because it would tear up the mountains and we don't have that many good volcanoes like that left. (445)

RESPONSE See above response to #443.

COMMENT The index is off. (446)

RESPONSE The index has been revised.

COMMENT Radio contact should be required for all staff and volunteers. (447)

RESPONE Budget constraints do not allow all personnel to have a radio.

COMMENT Put together a ground-based team to look at each site for whatever purpose: signage, interpretation, campgrounds, etc. That would be sufficient. (449)

RESPONSE Development of a comprehensive management plan, including architectural themes and signing standards is required by the Monument legislation. This Plan sets broad guidelines for the future and outlines the general direction and level of development for the Monument. Site-specific analysis such as you propose are next.

COMMENT How are the "opportunities" listed in the chapters going to be addressed in the final? They should be addressed in more detail. Give the "in order to..." for each opportunity. (450)

RESPONSE The Monument legislation identified a number of specific issues that must be addressed in this Plan. The Forest Service interdisciplinary team that put together the Plan, using public comment and legislative direction, developed some opportunities that would flow naturally from these issues, We believe they are all consistent with Monument legislation. Some of the opportunities are incorporated in the design of the alternatives; some are identified as part of the desired future condition; some have become part of management goals and objectives; and some are in included in management direction such as Standards and Guidelines.

The Activity Schedule in the Plan gives a general idea of priorities. Realistically, not all the opportunities listed can be pursued. There is simply not enough time and money. But we feel it is important to save these "good ideas" for the future.

COMMENT Concern that the plan will be too restrictive and dictate what we will do. "The volcano is already telling us what the resource can bear -- let the resource tell us what is appropriate at each site," rather than you (Forest Service) telling us what standards to conform to. (451)

RESPONSE This Plan is a programmatic document, setting broad direction and guidelines for the future of Newberry National Volcanic Monument. As such, it functions much as a "Constitution" to guide management in the future. It also outlines areas where any development (trails, day use areas, buildings, etc.) would occur. See also response to #449.

COMMENT The Forest Service also received numerous comments that were specific to the document, suggesting better wording, and pointing out such things as misspellings, and missing information on maps. In addition to the public comments outlined above, the DEIS also received an internal (Forest Service) review.

RESPONSE The draft EIS has been revised, updated, and in many places, language has been clarified or added to respond to comments.

Thanks to everyone who took time to respond to the DEIS, and for your interest in Newberry National Volcanic Monument.

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Acronyms

ACHP	Advisory Council on Historic Preservation
AHPA	Archaeological and Historical Preservation Act
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
ATV	All terrain vehicle
BEMA	Bald Eagle Management Area
BLM	Bureau of Land Management
BMP	Best Management Practice
BOF	Big obsidian flow
BOPU	Botrychium pumicola (pumice grapefern)
BP	Before present
CEQ	Council on Environmental Quality
CFS	Cubic feet per second
CO	Carbon monoxide
DBH	Diameter at breast height
DEIS	Draft environmental impact statement
DEQ	Department of Environmental Quality
DFC	Desired future condition
DNF	Deschutes National Forest
EIS	Environmental impact statement
FEIS	Final environmental impact statement
FSM	Forest service manual
IDT	Interdisciplinary team
KGRA	Known geothermal resource area
MOA	Memorandum of agreement
NAGPRA	Native American Graves Protection and Repatriation Act
N/A	Not applicable
NEPA	National Environmental Policy Act of 1969
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NNVM	Newberry National Volcanic Monument
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
PAOT	People at one time
PETS	Proposed, endangered, threatened and sensitive species
PM_{10}	Particulates in the air with a diameter of 10 microns or less
R	Rural (ROS category)
RN	Roaded Natural (ROS category)
RNA	Research Natural Area
RNNM	Roaded Natural Nonmotorized (ROS category)
ROS	Recreation Opportunity Spectrum
RVD	Recreation visitor day
SCORP	State Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Officer
SPM	Semiprimitive Motorized (ROS category)
SPNM	Semiprimitive Nonmotorized (ROS category)
S&G	Standard and guideline
T&E	Threatened and endangered
TES	Threatened, endangered, or sensitive species
TPA	Trees per acre
USFWS	United States Fish and Wildlife Service
VOC	Volatile organic compounds
VQO	Visual quality objective
W&S	Wild and scenic

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