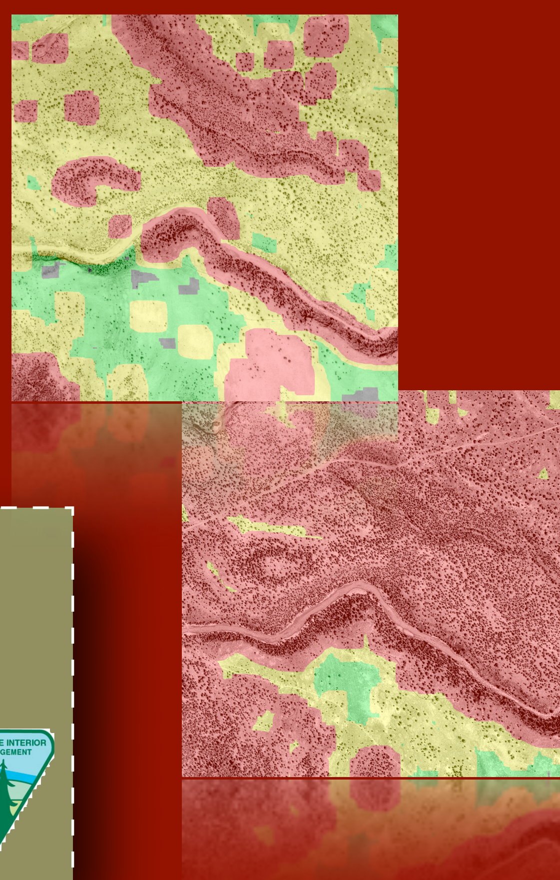
SAGE STEPPE ECOSYSTEM RESTORATION STRATEGY

FINAL ENVIRONMENTAL IMPACT STATEMENT



Modoc National Forest
Alturas Field Office BLM
Modoc County

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Sage Steppe Ecosystem Restoration Strategy

Final Environmental Impact Statement

Modoc, Lassen, Shasta and Siskiyou counties, California and Washoe County, Nevada

Lead Agency: USDA Forest Service

Cooperating Agencies: USDI Bureau of Land Management
Modoc County, California

Responsible Official: Stanley Silva, Forest Supervisor
Modoc National Forest
800 West 12th Street
Alturas CA 96101

For Information Contact: Rob Jeffers, Project Lead
Modoc National Forest
800 West 12th Street
Alturas CA 96101
530-233-8816

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Chapter 1. Purpose of and Need for Action

1.1 Document Structure

The USDA Forest Service (FS) and the USDI Bureau of Land Management (BLM) have prepared this Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action and alternatives. Additional documentation may be found in the project planning record located at the Modoc National Forest, Alturas, California.

The document is organized into five chapters:

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the Restoration Strategy; the purpose of and need for the Restoration Strategy, and the agencies' Proposed Action for achieving that Purpose and Need. This section also details how the FS and BLM informed the public of the proposal and how the public responded. As part of the public response, Significant Issues related to the Proposed Action were identified which were specifically analyzed during the course of this EIS. The results of the analyses of the issues are more fully presented in Chapter 4.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agencies' Proposed Action as well as alternative methods for achieving the purpose and need. These alternatives were developed based upon Significant Issues raised by the public that were within the scope of the proposal's purpose and need. The discussion also includes implementation guidelines. Finally, this chapter provides a summary table of the environmental consequences associated with each alternative. The results of the analyses are more fully presented in Chapter 4.

Chapter 3. Existing Condition: This chapter describes the existing condition of the Analysis Area. The discussions identify the Focus Area for restoration, and describe general elements of the existing condition for key features and Significant Issues. The chapter is organized by environmental component.

Chapter 4. Environmental Consequences: This chapter describes the environmental effects of implementing the Proposed Action and other alternatives. Chapter 4 also provides analysis of each alternative's effects on the Significant Issues. The analysis is organized by Purpose and Need components, Significant Issues, and other environmental components.

Chapter 5. Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.

Appendices: The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

1.2 Background

1.2.1 Agency Interaction and Restoration Strategy

The U.S. Department of Agriculture's Modoc National Forest (FS) and U.S. Department of the Interior's Bureau of Land Management, Alturas Field Office (BLM); and Cooperating Agency, Modoc County, California, are developing a Restoration Strategy and associated environmental impact statement (EIS). The Sage Steppe Ecosystem Restoration Strategy EIS focuses on the restoration of sage steppe ecosystems that have come to be dominated by juniper, as the density of Western juniper has increased over the landscape. The Restoration Strategy will broadly identify appropriate restoration methodologies by ecological conditions; and provide guidelines for design and implementation of effective restoration treatments for restoration areas to be analyzed site specifically over a 50-year horizon.

The Analysis Area covers approximately 6.5 million acres of public and private land (Figure 1). Within the Analysis Area, there is an identified Focus Area (Figure 1) that contains the sage steppe ecosystem and includes all areas that are proposed for restoration treatment. The Focus Area is more than 4 million acres and contains a large percentage of BLM and private lands (Table 1). Restoration projects would occur on National Forest lands and public lands administered by the BLM in parts of Modoc, Lassen, Shasta and Siskiyou Counties, California and in Washoe County, Nevada (Figure 2). Lands other than FS and BLM administered lands are taken in consideration in this analysis to provide contextual information to guide decision-making by the two agencies.

Table 1. Focus Area Ownership and Management

Ownership	Acres	Percentage of Focus Area
US Forest Service	648,246	16%
BLM	1,760,894	44%
Private and other	1,618,316	40%
Total	4,027,456	100%

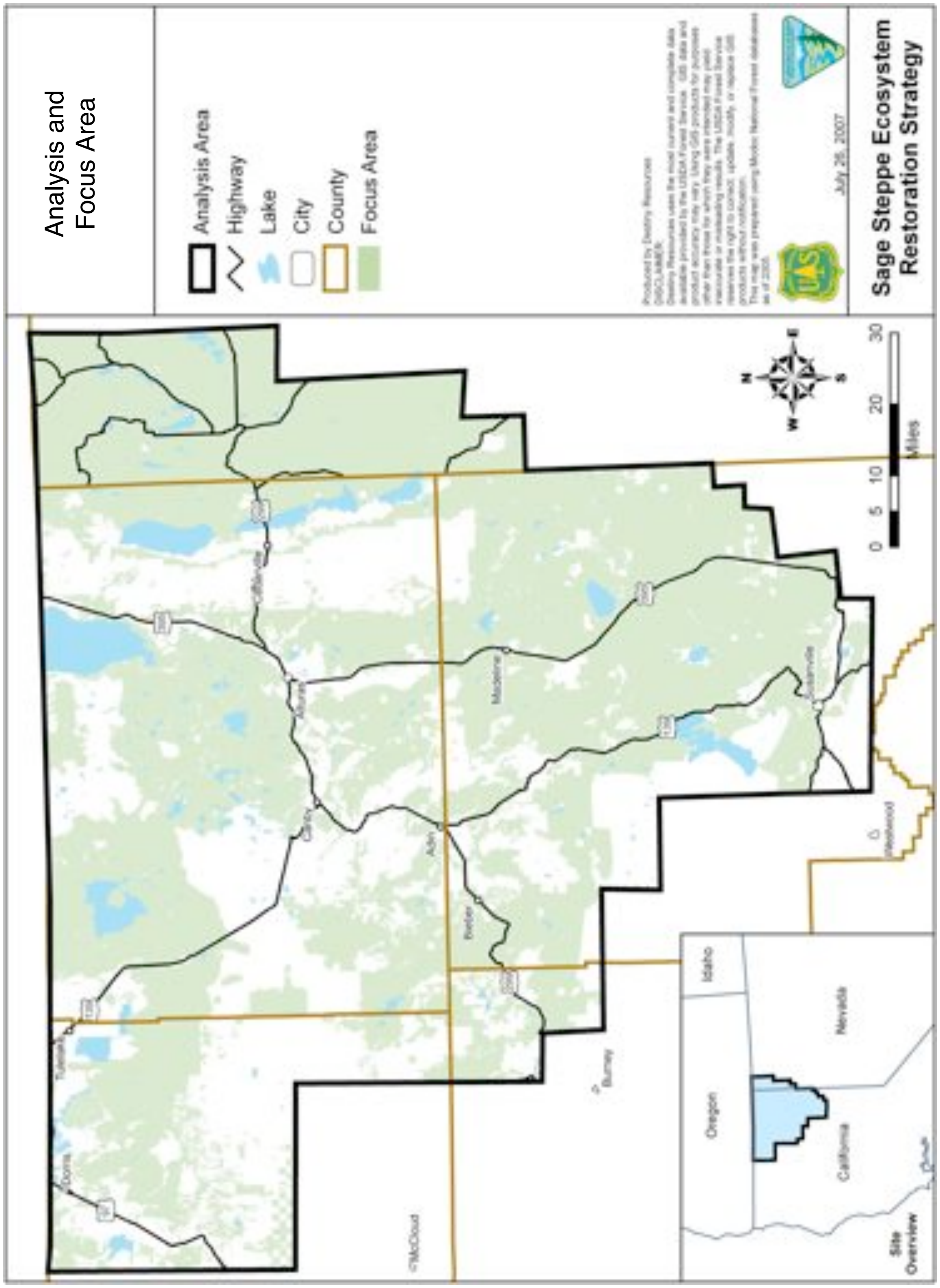

Figure 1. Analysis and Focus Area Location Map

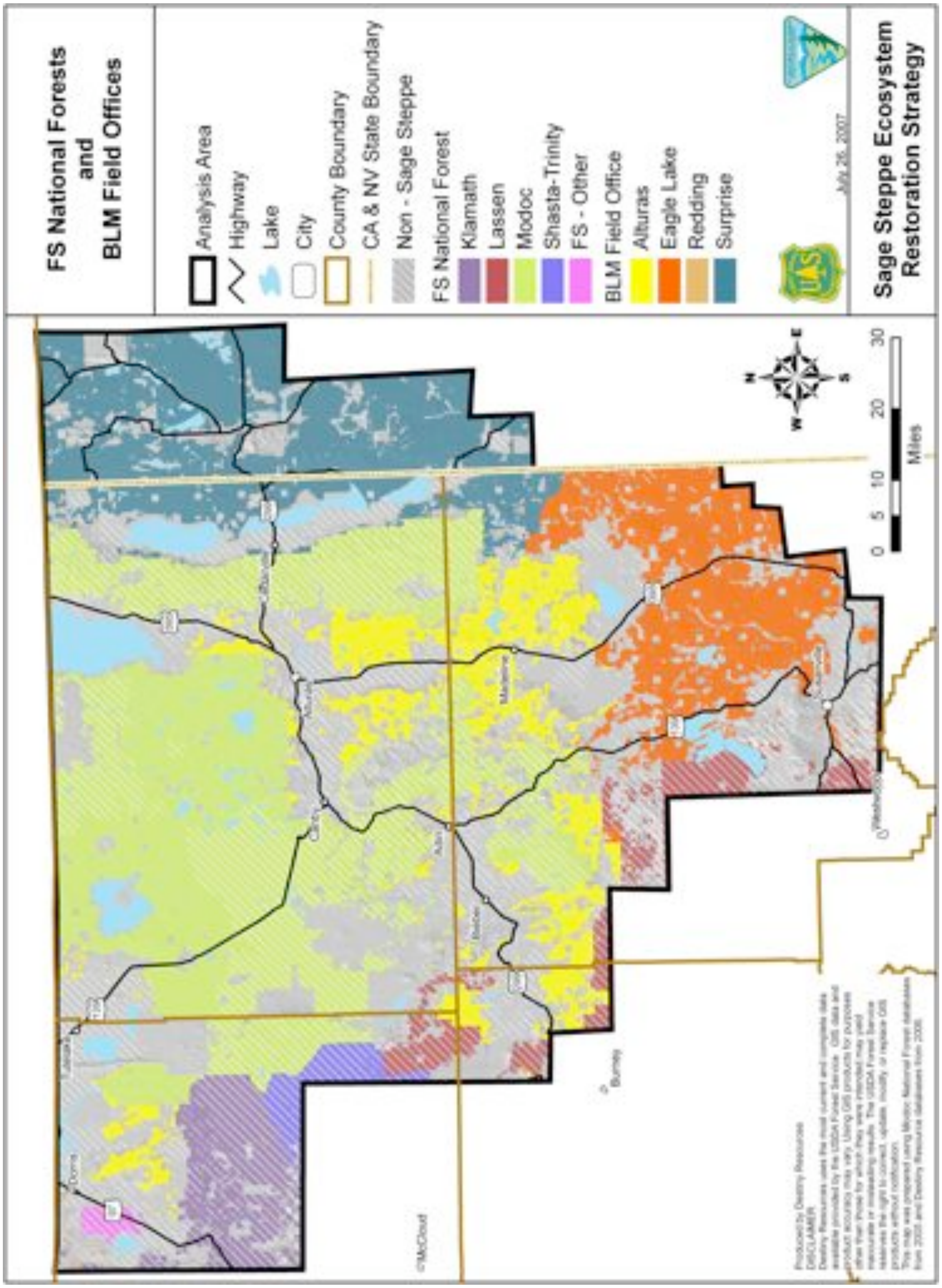

Figure 2. Federal Land Management Agency Lands in the Analysis Area

1.2.2 HISTORICAL CONTEXT - NANDSCAPE CHANGES IN VEGETATION COMPOSITION

Leaves, twigs, and seeds from pack rat middens found in caves, and pollen from pond and lake sediment cores have been used to date the arrival of Western juniper in the region to between 4,800 to 6,600 years ago (Bedwell 1973, Mehringer and Wigand 1984, and Wigand 1987). Throughout the past 5,000 to 6,000 years prior to settlement, Western juniper in the Analysis Area expanded and contracted mostly due to changes in the climate (Miller *et al.* 2005). Scientific literature, relict juniper woodlands, tree ring data, down and dead trees and stumps, and historic surveys support the view of the pre-settlement distribution of Western juniper stands as being generally confined to rocky ridges, and sites where fine fuels were too low to carry fire (Burkhardt and Tisdale 1976, Vasek and Thorne 1977, Holmes *et al.* 1986, Miller and Rose 1995, Waichler *et al.* 2001). However, individual large juniper tress were scattered throughout the sage steppe ecosystem. Western juniper range expansion results from climate change, however, density increases occur within its range.

During the past 100 to 150 years, the density of Western juniper within its range in the Analysis Area has increased dramatically (Figures 3 and 4). The increase in density of Western juniper over the last 150 years has been documented by many scientific studies (Miller and Wigand 1994, Knapp *et al.* 2001, Miller and Tausch 2001, Miller *et al.* 2008).

The increase in density of Western juniper that has been observed in the Analysis Area reflects a pattern of increasing juniper dominated woodlands throughout the Intermountain west (Cottam and Stewart 1940, Burkhardt and Tisdale 1976, Miller and Rose 1995 and 1999, Gedney *et al.* 1999, O'Brien and Woudenberg 1999, Soulé and Knapp 1999, Coppedge *et al.* 2001, Soulé *et al.* 2004, Miller *et al.* 2008). These studies and others have concluded that the increase in sites dominated by Western juniper was primarily due to severe domestic livestock grazing from the late 1800s to the 1930s and the related modification of the fire regime in the sage steppe ecosystem. Post-World War II fire suppression has further modified the fire regimes.

Fire regimes have been modified throughout the Analysis Area primarily due to two major human influences; domestic livestock grazing and wildfire suppression. Grazing began in the late 1800's and increased during first half of the 1900's (Pit River Watershed Alliance 2005). Domestic grazing altered the fire regime by reducing the fine fuels that carried frequent fires in the mountain big sagebrush communities. Studies have documented that fire regimes changed around 1900 (McKelvey and Busse 1996). Several studies have concluded that there were significant declines in fires since the late 1800's in mountain big sagebrush communities in the Intermountain West (Miller and Tausch 2001). Additional studies have found that the decline in fires in the mountain big sagebrush communities occurred with and has a relationship to the increase in density of Western juniper in the late 1800's (Miller and Rose 1999, Miller *et al.* 2001, Miller *et al.* 2008).

Figure 3. The North Fork of the Pit River and eastern Devil's Garden Rim on the XL Ranch in 1906[1]

Figure 4. The North Fork of the Pit River and eastern Devil's Garden Rim on the XL Ranch in 2007.

[1] Modoc National Forest History Archive – Historic Photo Collection: Archive Photo # 62552

Western juniper can adapt readily to changes in climate, which may result in range expansion. However, within the range of Western juniper, fire would keep its density low because fire would kill young juniper trees.

Where Western juniper occurs as scattered trees within the sage steppe ecosystem, wildlife habitat values are generally higher (Miller *et al.* 2005 and Miller *et al.* 2008). However, increased Western juniper density in sagebrush areas was associated with an increase in bare ground and a decrease in ground cover (Knapp and Soulé 1998 and Bunting *et al.* 1999). Closed canopy juniper stands (>20 percent canopy closure) generally have little ground cover and the sagebrush and grassland components gradually decline as canopy cover increases, reducing its habitat value (Miller *et al.* 2005). Another negative result of increasing juniper density is the potential impact to hydrologic conditions. Under closed canopy Western juniper woodlands, the lack of ground cover increases the susceptibility of the site to erosion, sediment yield and loss of soil productivity (Pierson *et al.* 2002).

As the density of juniper has increased on many sites, large portions of the sage steppe ecosystem in the Analysis Area have been converted to predominantly juniper woodlands. This has resulted in a loss of biodiversity on the landscape, diminished habitat values, particularly for sage obligate species; and has contributed to degraded surface hydrologic conditions in many watersheds.

1.3 Purpose and Need for Action

The purpose of this Restoration Strategy is to adopt an approach for juniper management on National Forest System and Bureau of Land Management lands encompassed by the 6.5 million acre Analysis Area, in order to restore the sage steppe ecosystem and associated vegetative communities to desired habitat conditions reflecting ecological processes that existed pre-European settlement. This action is needed because of the loss of the sagebrush ecosystem across the landscape as the density of juniper has altered many sites from sagebrush steppe to juniper woodlands dominated. The cause of this ecological shift is predominately due to anthropogenic changes, and the associated loss of vegetative, habitat, and hydrologic values. The purpose of this Restoration Strategy is to restore sage steppe ecosystems that have become dominated by Western juniper woodlands due to human causes.

More specifically the purpose of this Restoration Strategy is to restore sage steppe ecosystem processes and vegetation conditions that resemble historic mosaics, so that historic fire return intervals in sage steppe ecosystems can be sustained. Additional objectives include; improving watershed function and condition, restoring biodiversity and productivity, managing fuels to conform to the National Fire Plan requirements, and implementing, where appropriate, national renewable energy direction. This Restoration Strategy would restore habitat for sagebrush obligate species, improve hydrologic conditions and enhance the forage base for wildlife and domestic animals.

Miller *et al.* (2008) concludes that "*The lack of active management will potentially result in the continued decline of historic sagebrush communities, structural diversity, understory species, herbaceous production, habitat for sagebrush obligates, and landscape heterogeneity. As a greater proportion of the landscape shifts towards Phase III the risk of larger, intensive wildfires and conversion to annual exotics will increase, as will the cost of treatment, and the potential for desirable outcomes will decrease. Infilling by younger trees also increases the risk for the loss of presettlement trees due to increased fire severity and size resulting from the increase in the abundance and landscape level continuity of fuels*."

1.4 Proposed Action

Federal managers of the FS and the BLM propose to adopt a long-range Restoration Strategy to restore the sage-steppe ecosystem and related species habitat. The Proposed Action is to create an integrated, landscape-scale management Restoration Strategy that restores the sage steppe ecosystem across a 6.5 million acre Analysis Area (Figure 1). This Restoration Strategy focuses on the conditions of the sage steppe ecosystem that is targeted for restoration. Within the Analysis Area, there is an identified Focus Area (Figure 1) that contains the sage steppe ecosystem and includes all areas that are proposed for restoration treatment. Primary methods to be employed for restoration include fire use, mechanical restoration and hand restoration. Using this integrated approach, the federal land managers propose to treat up to 30,000 acres per year across FS and BLM lands. The mix of restoration methods would be about 19 percent of the area restored by mechanical methods; 78 percent using fire; and three percent using hand treatments. This Restoration Strategy is a programmatic, landscape-scale approach to restoration. The treatments would require site-specific environmental analysis to meet the objectives of the proposed Restoration Strategy and obtain federal agency approval prior to implementation.

This EIS may provide the basis for amending or revising FS and BLM respective land management plans, as appropriate. The Modoc National Forest anticipates revising its Forest Land and Resource Management Plan (USDA Forest Service 1991a) in the next several years. The analysis from this EIS will be incorporated into the revision process. The Lassen, Shasta Trinity and Klamath National Forests may use the information contained in this EIS as appropriate. The new Resource Management Plans for the Alturas, Surprise and Eagle Lake Field Offices of the Bureau of Land Management have been designed to accommodate decisions arising from the Restoration Strategy.

1.5 Decision Framework

The lead agencies are the FS, Modoc National Forest and the BLM, Alturas Field Office. Modoc County is a cooperating agency. Partner agencies include Siskiyou and Lassen Counties, California. The responsible officials for this planning effort are the Modoc National Forest,

Forest Supervisor and Alturas Field Office, Field Manager. The responsible officials will use the information from this EIS to guide their decision-making and to coordinate treatment projects across ownerships, as appropriate. As appropriate, this information may also be used to amend, revise, or inform their resource management plans. If utilized to amend the Modoc National Forest Land and Resource Management Plan, this would be a non-significant plan amendment (USDA Forest Service 2008a). Decisions related to this EIS are programmatic and strategic in nature and do not require implementation of projects. Specific decisions to be made, in addition to adoption of a Sage Steppe Ecosystem Restoration Strategy, may include:

1.5.1 Bureau of Land Management

The BLM may amend its respective Resource Management Plans to include components developed in this analysis, including but not limited to:

- Desired Future Conditions
- Design Standards to be incorporated
- Monitoring and Adjustment Approach

1.5.2 US Forest Service

Information from the EIS may be utilized to amend or revise the Modoc National Forest Land and Resource Management Plan, including some or all of the following:

- Desired Future Conditions
- Design Standards to be incorporated
- Monitoring and Adjustment Approach

1.6 Public Involvement

The Sage Steppe Ecosystem Restoration effort began in a series of informal discussions between the Alturas Field Office of the BLM, the Modoc National Forest, and the North Cal-Neva Resource Conservation and Development Council that focused on wildlife habitat loss, accelerating juniper density, soil surface degradation, and forage loss. Resource Concepts, Inc. an engineering and environmental consulting firm from Carson City, Nevada was contracted to develop a concept paper detailing the agencies' concerns, and presenting a strategic approach for future management. The product was entitled, "Western Juniper Management Strategy and Planning Proposal Analysis", and was submitted to the agencies on August 7, 2001.

This concept paper provided the foundation for numerous informal discussions with a wide array of public and private entities, as the problem statement and the strategic approach were refined and developed. Informal discussions were held with approximately 32 agencies, organizations, tribal entities, legislators, and individuals from 2000 to 2004.

Additionally, agency representatives specifically discussed the sage steppe/juniper initiative on 18 separate occasions with the Modoc County Resource Advisory Committee, between December 1, 2001 and August 2, 2004. Agency representatives also discussed the initiative with the BLM's Northeast California/Northwest Nevada Resource Advisory Council on 13 occasions between June 2000 and August 2004. Further, the agencies met with the Modoc-Washoe Experimental Stewardship Steering Committee four times between February of 2003 and June of 2005; and the Modoc County Land Use Committee 17 times from August of 2002 to August of 2005.

In a final effort to refine and further develop the agencies proposed Restoration Strategy prior to distribution of the Notice of Intent, which marked the beginning of the formal scoping period, eight public meetings were held throughout the Analysis Area (Table 2) to solicit public comments.

Table 2. Public Workshop Locations, Dates and Number of Attendees

Meeting Location	Date	Approximate Number of Attendees
Tulelake	August 24, 2004	18
Macdoel	August 25, 2004	12
Bieber	August 31, 2004	30
Fall River Mills	August 31,2004	0
Alturas	September 2, 2004	15
Likely	September 3,2004	2
Cedarville	September 14, 2004	15
Susanville	September 15, 2004	15
	Total	105

The following preliminary considerations were identified from the comments received during those meetings:

- short term impacts on riparian areas
- effects on wildlife habitat
- effects on cultural resources
- long-term potential for the introduction or spread of invasive species

- impacts on rangeland permit holders
- effects on nutrient cycling as a result of various treatment methods

Formal scoping reaches out beyond the decision makers and agencies, and attempts to clarify the issues that have high public interest. The formal scoping process for this effort began with the publishing of the Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) in the Federal Register on July 18, 2005. A Public Scoping Notice was distributed following the NOI and a public notice was published in the Modoc Record on July 28, 2005.

The scoping comment period ended on September 9, 2005. Some comments were received after this date but were still included in the content analysis and scoping report. The scoping report presents the results of a content analysis completed on the comments. Content analysis is a process that identifies specific, separate statements within each submitted letter and categorizes them. These categories are used to help frame the significant public issues for consideration and further refine the Proposed Action and develop alternatives in the EIS. The report also identifies information that may need to be clarified in the EIS.

The formal scoping process generated 23 letters from a variety of groups and individuals. Figure 5 displays the distribution of those letters by group. Those 23 letters contained 284 individual comments. Figure 6 shows the distribution of comments by category.

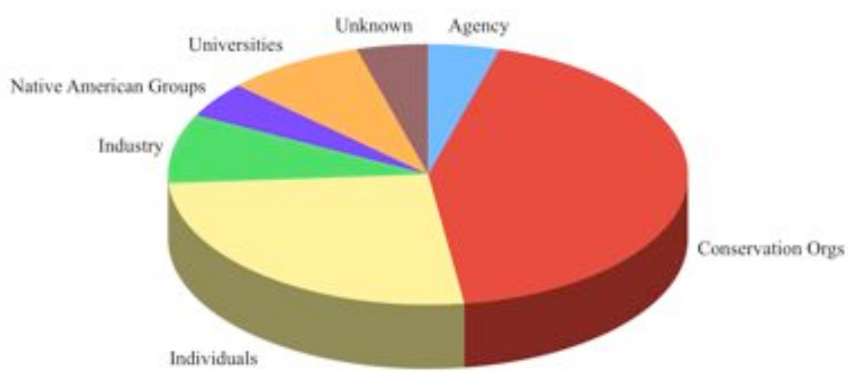

Figure 5. Distribution of Scoping Comments by Type of Organization.

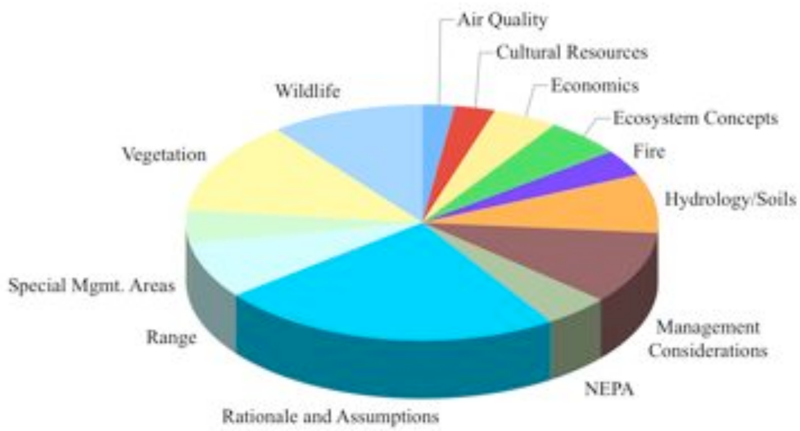

Figure 6. Distribution of Scoping Comments by Comment Category.

1.6.1 DEIS Public Comment

The Notice of Availability (NOI) of the Draft EIS (DEIS) was published in the Federal Register on August 31, 2007. During the comment period nine public meetings, presentations and field trips were offered throughout the Analysis Area (Table 3). A total of 40 people attended the public meetings. In addition several people attended the two field trips.

Table 3. DEIS Public Meeting Locations, Dates and Number of Attendees

Meeting Location	Date	Approximate Number of Attendees
Susanville	September 24, 2007	1
Cedarville	September 25, 2007	4
Sage Steppe Ecosystem Working Group in Alturas	September 26, 2007	13
Bieber	September 26, 2007	3
Resource Advisory Council in Alturas	September 27, 2007	8
Tulelake	September 27, 2007	5
Alturas	September 28, 2007	6
	Total	40

The DEIS public comment period ended on October 15th, 2007. During that 45-day comment period 23 comment letters were received. These comment letters were analyzed using the same method that was used on the scoping comments. Three comment letters were received well after the end of the comment period and therefore were not analyzed. However, in reviewing those letters, it was concluded that the issues raised are substantially encompassed within comments submitted during the comment period and that the response to comments (Appendix A) addresses their issues. Responses to all substantive comments received during the comment period are presented in Appendix A.

Based upon public comments on the DEIS an additional alternative (Alternative J) was added to the Final EIS. Alternative J has been identified by the agencies as the Preferred Alternative.

1.6.2 Comment Categories

The following 13 comment categories were identified in the comments submitted during scoping and on the DEIS, and the analysis of the comments was divided into these categories:

- Rationale and Assumptions
- Management Considerations
- Range
- Vegetation
- Wildlife
- Hydrology and Soils
- Fire
- Air Quality
- Cultural Resources
- Economics
- Ecosystem Concepts
- NEPA
- Special Management Areas

1.6.3 Native American Tribal Consultation

Six federally recognized Tribes have cultural interests in the Sage Steppe Ecosystem Restoration Analysis Area. They are the Alturas Rancheria, the Cedarville Rancheria, the Ft. Bidwell Paiute Tribe, the Klamath Tribes, the Pit River Tribe, and the Susanville Rancheria. Each of the six tribes is a separate sovereign government with its own governing body and elected officials.

The Klamath Tribes have interests in the northern portion of the area. Their interest area is described as lands ceded by the Modoc Indians in the Treaty of 1864. That area is generally north of line from the Medicine Lake Highlands east to the southern tip of Goose Lake. The Pit

River Tribe has interests based on the 100-mile square described in the Indian Claims Commission, Docket 347, 1959. That area is generally south of that Highlands to Goose Lake line and continues east to the crest of the Warner Mountains.

The Warner Mountains are a major north/south divide between the aboriginal territories of two tribal groups. Pit River Indians generally occupy the western portion of the mountains and extend along the Pit River proper. Northern Paiute Indians generally occupy the eastern portion of the mountains and extend into the Great Basin. On the western side of the Warner Mountains are the Alturas Rancheria and the Pit River Tribe. On the eastern side of the Warner Mountains are the Cedarville Rancheria and Ft. Bidwell Paiute Tribe. Each of the six tribes is a separate sovereign government with its own governing body and elected officials.

Additionally the unrecognized Shasta Tribe Inc. and the Shasta Nation Inc. have cultural interests in the project area. Both have interests in the Medicine Lake Highlands.

Tribal consultation with the federally recognized tribes began in March 2003 with informing the Tribes with the status of the Restoration Strategy in face-to-face consultation meetings held between line officers and tribal officials. Line officers traveled to each tribe's preferred meeting location. The consultation continued with more detailed discussions regarding the Tribes issues (Table 4).

The Tribes raised several issues with the Proposed Action. Their issues included effects of the restoration on:

- the integrity of Native American cultural resources
- Native American cultural practices
- gathering of traditional foods
- loss of habitat for culturally important wildlife and plant species
- prescribed fire at a large scale may have adverse impacts to air quality

Table 4. Tribal Consultation Log

Date	Tribe	Type of Contact	Location
March 27, 2003	The Klamath Tribes	BLM Line Officer and Tribal Council	Klamath Falls, Oregon
July 14, 2003	Atwamsini Band of the Pit River Tribe	FS Line Officer and Tribal Council	Big Valley Field Trip
November 4, 2003	Astarawi Band of the Pit River Tribe	Cultural Representatives from FS and Tribe	Raptor Habitat Field Trip
March 15, 2004	Pit River Tribe	FS Line Officer and Tribal Council	Alturas, California
October 4, 2004	Pit River Tribe	FS Line Officer and Tribal Council	Alturas, California
November 11, 2004	Fort Bidwell Paiute Tribe	FS Line Officer and Tribal Council	Fort Bidwell Indian Community Building
January 10, 2005	Pit River Tribe	FS Line Officer and Tribal Council	Alturas, California
January 21, 2005	Pit River Tribe	BLM Line Officer and Tribal Council	XL Ranch
March 2, 2005	The Klamath Tribes	BLM Line Officer and Tribal Council	Chiloquin, Oregon
September 7, 2005	The Klamath Tribes	BLM Line Officer and Tribal Council	Chiloquin, Oregon
September 8, 2005	The Klamath Tribes	Meeting with Perry Chocktoot Jr.	Field Trip
September 16, 2005	Pit River Tribe	BLM Line Officer and Tribal Council	XL Ranch
September 19, 2005	Fort Bidwell Indian Reservation	Phone Call	Phone call to solicit scoping comments
September 19, 2005	Alturas Rancheria	Phone Call	Phone call to solicit scoping comments
September 19, 2005	The Klamath Tribes	Phone Call	Phone call to solicit scoping comments
September 19, 2005	Pit River Tribe	Phone Call	Phone call to solicit scoping comments

Table 4. Tribal Consultation Log (continued)

Date	Tribe	Type of Contact	Location
September 19, 2005	Susanville Rancheria	Phone Call	Phone call to solicit scoping comments
September 19, 2005	Cedarville Rancheria	Phone Call	Phone call to solicit scoping comments
March 1, 2006	Pit River Tribe	FS Line Officer and Tribal Council	Alturas, California
April 20, 2006	Susanville Rancheria	Cultural representatives from FS and Tribe	Susanville Rancheria
June 7, 2006	The Klamath Tribes	BLM Line Officer and Tribal Council	Chiloquin, Oregon
September 6, 2006	Pit River Tribe	FS Line Officer and Tribal Council	Alturas, California
December 6, 2006	Pit River Tribe	FS Line Officer and Tribal Council	Burney, California
March 1, 2007	Pit River Tribe	BLM Line Officer and Tribal Council	Alturas, California
June 14, 2007	Pit River Tribe	BLM Line Officer and Tribal Council	Burney, California
December 12, 2007	Pit River Tribe	BLM Line Officer and Tribal Council	Burney, California

1.7 Significant Issues

The FS and partner agencies separated the issues into two groups: Significant and Non-Significant Issues. Significant Issues were defined as those directly or indirectly caused by implementing the Proposed Action. Non-Significant Issues were identified as those: 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, Forest Plan, RMP, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "*…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…*"

A brief summary of the effects of the alternatives for each Significant Issue is provided below. The effects of the restoration on Significant Issues are analyzed in detail in *Chapter 4 – Environmental Consequences*.

1.7.1 ISSUE 1 – RESTORATION RATE

Issue Statement: *The restoration rate in the Proposed Action will not keep up with juniper expansion to fully meet the purpose and need. The restoration treatments in the Proposed Action would restore 25,000 to 30,000 acres per year. This rate could not restore the existing sage steppe acres that have been encroached upon and keep up with new juniper expansion in a foreseeable time frame.*

Continued Western juniper "expansion" has not been considered quantitatively in this analysis, primarily because the current ecological view of what has happened has been an increase in Western juniper density throughout the Sage Steppe Ecosystem, not an actual expansion to new ecological zones. The Interdisciplinary Team (IDT) discussed this issue at length during alternative development. The IDT structured an alternative that would accelerate the rate of restoration to more fully and completely achieve the restoration objectives (Alternative E). Part of the evaluation of alternatives includes a comparison of the time required to restore the Focus Areas under each alternative. The time required to restore the Focus Area ranges from a low of 33 years for Alternative E to a high of 250 years for Alternative A. Alternatives B and D would require 40 years Alternative J 47 years and Alternative C would require 50 years to complete the restoration of the Focus Area.

1.7.2 ISSUE 2 – PERMANENT ROADS

Issue Statement: *New permanent roads created for restoration treatment activities may cause negative environmental effects such as the spread of noxious weeds, increased OHV use of the area, increased soil erosion, negative impacts to wildlife habitat, and other associated management problems.*

All alternatives except Alternative A (Current Management) would include a Design Standard regarding new and temporary road construction (*Section 2.4.5 Road Management*) that does not allow construction of new permanent roads solely for the purpose of sage steppe restoration. Therefore, noxious weed spread, increased OHV use, soil erosion, and negative impacts to wildlife habitat would not increase due to the construction of new permanent roads for sage steppe restoration. Alternative A (Current Management) does not include this limitation; therefore, it is possible that new roads could be built under Current Management for sage steppe restoration projects. However, at this time, there are no known plans for new road construction associated with sage steppe restoration for the FS or BLM.

1.7.3 ISSUE 3 – UNCERTAIN RESULTS

Issue Statement: *Treatments could result in further degradation of sage steppe biodiversity, and not restoration. There is uncertainty as to whether the most degraded sage steppe areas* *will respond to treatment. Uncertainty must be addressed through adequate monitoring and adjustment through time.*

There is strong scientific support for this restoration approach (Miller *et al.* 2005, Miller *et al.* 2008). However, as in any natural system, there will always be some element of uncertainty regarding some of the restoration results. During alternative development, the IDT considered an alternative that uses a research approach to the implementation of the restoration. This alternative was not fully developed and analyzed for reasons described in Chapter 2 (*Section 2.7.1 Alternative F – Research and Development*). Instead of a separate alternative to address this issue, a Design Standard (*Section 2.4.6 Monitoring and Adjustment Approach*) was developed and is proposed for three of the alternatives. Alternative J (Preferred Alternative) uses a go slower approach initially, similar to Alternative C but with the greater reliance on mechanical treatments, as in Alternative D and E. Alternative J (Preferred Alternative) was added to the FEIS in part to address this issue. This Monitoring and Adjustment Approach will better allow for determination of results of those implementation activities that have less certain outcomes.

Alternatives B, C, D, E and J include this Monitoring and Adjustment Approach. This Design Standard would include monitoring of the results of the restoration activities. Adjustments would be made to the restoration methods based upon the monitoring, and future restoration projects and implementation rates would reflect those adjustments.

1.7.4 Issue 4 – Livestock Grazing Impacts on Restoration Effectiveness

Issue Statement: *Improper timing and intensity of livestock grazing can reduce plant vigor, create bare ground leading to erosion of the top soil, prevent historic fire return intervals due to removal of fine fuels, and retard restoration response after mechanical or fire treatments. The Proposed Action would not be effective in restoring the sage steppe ecosystem if it does not address the impacts of livestock grazing.*

In response to this issue, a Design Standard (*Section 2.4.3 Livestock Grazing Management Practices*) was developed and is proposed for all alternatives, except Alternative A (Current Management). This Design Standard assumes a minimum of two growing seasons of rest following restoration treatment and, monitoring and evaluation of treated areas prior to resuming livestock grazing. The two growing season rest period is considered a minimum amount of rest (Miller *et al.* 2005, EOARC 2007). There are three principle reasons that rest from livestock grazing would be necessary: reestablishment of sage steppe vegetation, creating adequate understory for burning, and preventing establishment of non-native species. Additional rest, more than two growing seasons, would be decided on a site-specific basis, dependent on post treatment monitoring conducted at the project level. The restoration treatments that have already been implemented have shown that a minimum of two growing seasons of post treatment rest is likely to be adequate to achieve restoration goals for most site conditions. It is possible that in some areas, site conditions will require additional rest to achieve restoration goals.

All restoration activities are also subject to current management policies and guidelines regarding livestock grazing. These policies and guidelines have been shown to be effective at improving range condition by insuring proper season, timing and duration of grazing based upon site-specific conditions. In the Analysis Area livestock commonly utilize juniper trees for shade, and where they seek shade, there can be a decrease in herbaceous vegetation and an increase in soil disturbance. During site specific project planning non-old growth juniper distribution will be designed so that following sage steppe restoration treatments, livestock are not attracted to riparian, aspen or old growth juniper stands to meet their shade requirements.

Alternative A has the lowest rate of restoration (5,000 acres per year). Therefore, the potential for any direct impact of livestock grazing on the restoration areas would be lower than any of the other alternatives. Without periodic fire, however, the quality and vigor of plant communities can deteriorate over-time and the likelihood of catastrophic wildland fire increases. Under Alternative A, the shortfall between the rate of sage steppe restoration and the increase in juniper density in the Focus Area is the greatest.

Alternatives B and C propose the largest area to be restored using fire. These areas are especially susceptible to damage from livestock grazing immediately following treatment, preventing or delaying successful restoration. Therefore, the potential direct effects of livestock grazing on areas restored by fire would be the highest of the alternatives. The Design Standard for rest and compliance with existing standards and guidelines, as well as other Design Standards would prevent adverse effects. Alternatives D, E and F propose the least number of acres to be restored using fire.

1.7.5 Issue 5 – Impacts on Livestock Industry

> ***Issue Statement:*** *Implementation of 25,000 to 30,000 acres of restoration per year with anticipated two years of rest following mechanical or fire treatments and a year of rest prior to prescribed fire treatments may have an adverse economic impact on the local livestock industry. Most suitable grazing land in the Analysis Area is being utilized and therefore livestock have little alternative range to use during rest periods. The project may cause ranchers to reduce their herds or adjust their operations, and result in substantial economic impacts on the local economy.*

The IDT developed and evaluated an alternative that reduces the rate of treatment and therefore lessens short-term impacts to the livestock industry (Alternative C). All treatments are designed to result in a long-term increase in sage steppe grass, forb and brush species that would result in a corresponding upward trend in overall range condition over time. However, rest requirements would have short-term consequences to individual livestock operators and short and long-term consequences to the livestock industry. If no alternative pasturage or additional feed sources such as supplemental hay can be found, then the individual livestock operator would have to reduce herd sizes during the duration of the restoration treatments and rest periods on their allotments. It is assumed that grazing lands throughout the Analysis Area are being used at capacity; therefore most livestock operators would likely have to reduce herd sizes.

Alternative A would maintain livestock management at the current level with respect to AUMs rested specifically for sage steppe restoration. Alternative A has the lowest rate of restoration compared with the other alternatives and therefore has the lowest number of AUMs rested per year. Alternative A (Current Management) includes about 1,261 AUMs rested that equals an annual value in cash receipts of about $120,000 per year.

Alternative B would require that 8,000 AUMS be rested per year for most of the implementation of this alternative across the 2.3 million acres of livestock grazing allotments. The short-term impacts to the industry are the second highest of the alternatives in Decades 1 and 2. Some impacts to the livestock industry would occur due to increased costs for feed, moving livestock to other pastures, renting private pastures or loss of income due to smaller herds. These impacts would be short-term to individual ranchers but would be long-term to the livestock industry because they would continue for 40 years. Alternative B would result in an annual reduction in cash receipts in the functional economic area of about $631,000 per year as compared to Current Management.

The direct and indirect effects of Alternative C would be similar to Alternative B. However, the number of required AUMs rested per year would start at nearly 4,000 for the first decade and increase to nearly 8000 for the 3rd, 4th and 5th decades. The short-term impacts to the industry are the second least of the alternatives in Decades 1 and 2. Resting from 4,000 to 8,000 AUMs annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Alternative C would result in an annual reduction in cash receipts in the functional economic area of about $631,000 per year as compared to Current Management.

Alternative D would attempt to have a reduced impact on the livestock industry through shorter rest periods associated with mechanical treatment. The number of AUMs rested per year that would be required would start at about 6,400 for the first decade and increase to over 8,100 for the 3rd and 4th decades. The impacts to the industry would be the third least of the alternatives in Decades 1 and 2. Alternative D would result in the second highest upward trend (same as Alternative B) in range quality based upon acres restored. Alternative D would result in an annual reduction in cash receipts in the functional economic area of about $651,000 per year as compared to Current Management.

Alternative E proposes a higher percentage of mechanical treatment and treats the highest percentage of dense juniper stands. This alternative would require the highest level of annual rest through the first three decades, which could pose a greater impact on the industry in the first three decades. The number of rested AUMs per year that would be required would start at over 8,500 for the first two decades and increase to nearly 10,000 for the 3rd decade. The short-term impacts to the industry are the greatest of all the alternatives in Decades 1 and 2. Alternative E would result in an annual reduction in cash receipts in the functional economic area of about $821,000 per year as compared to Current Management.

Alternative J (Preferred Alternative) would have a reduced impact on the livestock industry through shorter rest periods associated with mechanical treatment and a slower initial restoration rate. The number of AUMs rested per year that would be required would start at about 3,200 for the first decade, increase to 4,500 for the second decade, and increase again to over 8,100 for the 3rd and 4th decades. The impacts to the industry would be the second least of the alternatives in Decades 1 and 2. Resting 3,200 to 8,100 AUMS annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Alternative J (Preferred Alternative) would result in an annual reduction in cash receipts of about $651,000 per year.

1.7.6 Issue 6 – Noxious Weeds and Non-Native Invasive Species

Issue Statement: *Arid landscapes are very vulnerable to invasion by noxious weeds and non-native invasive species following mechanical and prescribed fire treatments. The Proposed Action would increase the risk of this invasion in the Analysis Area.*

The potential effects of the alternatives include the introduction and spread of noxious weeds and pests into the restoration areas and the spread of other invasive non-native species such as cheatgrass and medusahead. These effects may be increased if new roads are built or livestock grazing is resumed before adequate rest. All alternatives, except for Alternative A, propose Design Standards (*Section 2.4 Design Standards*) that would not allow new permanent roads and would require adequate rest from livestock grazing.

The overall risk of the spread of invasive plant species for Alternative A is Moderate. The factors that contribute to this risk rating include the small effect of a low rate of restoration and a small number of total acres to be restored. However, this alternative also has a relatively large effect on the risk of the spread of invasive plant species due to the high percentage of fire use on the areas treated, potentially some new permanent roads and does not use the Monitoring and Adjustment Approach, which would contribute to a moderate to high risk of noxious weed introduction and spread. In combination, these factors would have the effect of a moderate risk of the spread of invasive plant species for Alternative A (Current Management).

The overall risk of the spread of invasive plant species for Alternative B (Proposed Action) is High. The factors that contribute to this risk rating include the effect of a high rate of restoration, a large number of total acres to be restored, high percentage of fire use, and not using the Monitoring and Adjustment Approach. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads. In combination, these factors would have the effect of a High risk of the spread of invasive plant species for Alternative B (Proposed Action).

The overall risk of the spread of invasive plant species for Alternative C is Moderate. The factors that contribute to this risk rating include the effect of a moderate rate of restoration, a large number of total acres to be restored, and high percentage of fire use. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach. In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternative C.

The overall risk of the spread of invasive plant species for Alternatives D, E and J is Moderate. The factors that contribute to this risk rating include the effect of a high rate of restoration, a large number of total acres to be restored, and moderate percentage of fire use. However, these alternatives also have a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach. In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternatives D, E and J.

All alternatives, except Alternative A, would reduce the long-term risk of large, high intensity fires by restoring the mosaic across the ecosystem and reducing the density of juniper. Large, high intensity fires inhibit native grasses and forbs, and increases the opportunity for noxious and non-native plant establishment. Restoring natural fire to the landscape would also reduce the types of fuels that would result in large fires and encourage the growth of fine fuels that carry ground fire. Large, high intensity fires create conditions that favor the spread of noxious weeds. Additionally, the reduction in juniper density would encourage the growth of native herbaceous plants and grasses and provide greater competition to the non-native invasive plants.

1.7.7 Issue 7 – Old Growth Juniper

Issue Statement: *Old growth juniper trees exist in various locations throughout the Focus Area. These trees are a natural component and play an important role in the sage steppe ecosystem and should not be killed due to restoration treatments.*

Alternatives B, C, D, E and J propose a Design Standard (*Section 2.4.4 Old Growth Juniper*) that would require old growth juniper trees to be protected. This feature requires that all juniper trees that exhibit growth forms indicating that the tree was present at or before the mid-1800s would be protected. Therefore, there would be essentially no impact on old growth juniper trees from the Alternatives B, C, D, E and J.

Alternative A (Current Management) does not include the old growth juniper Design Standard and there would be some potential to remove old growth juniper trees. However, during restoration or other restoration activities in Alternative A (Current Management) would cover a relatively small area, minimizing the potential for removal of old growth juniper trees in those areas.

Past firewood cutting policies have had some impact on old growth juniper, however policies to be implemented in the future would protect old growth juniper.

1.7.8 Issue 8 – Juniper Wildlife Habitat

Issue Statement: *Some wildlife species such as migratory birds rely on juniper stringers and clumps. If restoration treatments fragment this habitat it would have an impact on these wildlife species.*

For all alternatives, species occupying juniper woodland habitats would experience habitat losses, and associated local population declines. As grasslands and sage replaces juniper, bird species diversity would decrease. However, there are no species that have been designated as juniper "obligates." Species using these habitats also occupy other habitats and/or may occupy juniper only as it is in an ecotone with other habitats. Within the Focus Area, certain avian species appear to use juniper, at least seasonally, due to its availability, and use as forage and cover habitat. By restoring sage steppe ecosystems through removal of juniper, some mature juniper woodlands that may provide habitat for these species would be reduced in extent. However, large areas of dense juniper would remain in the Focus Area and will provide ecologically functional juniper woodland habitat (Appendix A). The Design Standard for Old Growth Juniper (*Section 2.4.4 Old Growth Juniper*) would require that all action alternatives retain old growth juniper.

1.7.9 Issue 9 – Short-term Impacts to Sage Obligate Species

Issue Statement: *There would be short-term impacts on sage obligate species habitat that could outweigh long-term benefits. This may be particularly true with the widespread use of fire that could reduce the extent of sagebrush habitat in the short term.*

The wildlife analysis of the sage obligate species evaluates both short and long-term impacts of the Proposed Action and alternatives (*Section 4.6.4 Sage Steppe Obligate Species*). That analysis shows that although some of the sage obligate species do experience short-term negative impacts due to implementation of Alternatives B, C, D, E and J, they all have positive or neutral long-term effects.

For Alternative A (Current Management), the restoration rate is unlikely to keep up with sage steppe vegetation maturity and eventual decadence and juniper density increases. Therefore, this alternative provides the lowest level of long-term benefits to sage-obligate wildlife while allowing for continued increases in juniper density to degrade habitats, potentially leading to local extirpation of sage obligate species. Short-term effects could include potential elimination of some sage-obligate species use of restoration sites followed by an increase to various population levels depending on rate and type of vegetative recovery. Long-term effects may include lack of recolonization due to loss of the source population, invasion by exotic plants reducing native habitat quality, and increases in early successional and/or predatory species that would compete with or directly reduce populations.

Alternatives B and C involve the same treatment area and the same proportions of prescribed burn (77 percent) and mechanical treatment (20 percent) but differ in the amount of area treated per decade. Alternative B would treat the total Focus Area over four decades, and Alternative C would require five decades. For Alternative B, mature sage steppe habitat would exist in across 39 percent of the Focus Area by the end of the 5th decade. Alternative C would have 30 percent of the Focus Area in mature sage steppe habitat at this point. The remaining restored areas in Alternative C would continue to mature. The effect of Alternatives B and C would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species however effects would be positive long-term for all except the Sage lizard, which would have a neutral long-term effect.

The effects of Alternatives B and C for pronghorn and mule deer show short-term positive effects to pronghorn and mule deer due to increases in forage from the grasslands created by the restoration treatments. Long-term effects on pronghorn and mule deer show high positive effects due to increases in forage from the grasslands created by the restoration treatments. The effects of Alternative C on sage steppe obligate species would be very similar to Alternative B. The main difference would be a smaller short-term negative effect on sage-grouse due to deferring fire use for the first 20 years in special wildlife habitat areas.

Alternative D would restore the Focus Area over 4 decades. However, this alternative would use mechanical means to restore nearly half of the restoration areas. By the end of the 4th decade, 40 percent of the Analysis Area would provide mature sage-steppe habitat. Alternative E differs from Alternative D only in the restoration rate at which fire use and mechanical treatments are applied. By the end of the 4th decade, 46 percent of the Focus Area would be mature sage steppe vegetation under Alternative E. Alternative J (Preferred Alternative) would use the same treatment mix as Alternative D and E but would proceed more slowly initially. Therefore, by the end of the 5th decade, 35 percent of the Focus Area would be mature sage steppe vegetation under Alternative J (Preferred Alternative).

The effect of Alternatives D, E and J would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species however effects would be positive long-term for all except the Sage lizard, which would have a neutral long-term effect.

The effects of Alternatives D and J for pronghorn and mule deer show short-term positive effects to pronghorn and mule deer due to increases in forage from the grasslands created by the restoration treatments. The effects of Alternative E for pronghorn and mule deer show the highest short-term positive effects to pronghorn and mule deer due to increases in forage from the grasslands created by the restoration treatments. The effects of Alternatives D, E and J on sage steppe obligate species would differ from Alternatives B and C in two important areas. The main difference would be more positive effects on sage-grouse, both from in the short-term (neutral effect) and long-term (high positive effect). These differences in effects on sage-grouse are due to the smaller percentage of fire use and deferring fire use for the first 20 years in special wildlife habitat areas. Another difference between Alternative E and Alternatives B and C would be in the effects on pronghorn and mule deer. Alternative E would have a smaller positive long-term effect (moderate positive) due to the greater percentage of mechanical treatments. However, the short-term effect on pronghorn and mule deer would be more positive due to the amount of forage created in Alternative E due to the higher restoration rate.

1.7.10 Issue 10 – Soil Productivity and Surface Hydrologic Condition

Issue Statement: *The proposed restoration treatments could result in the reduction of vegetative cover in the short term, and result in increased soil erosion, increased sediment delivery to streams and/or soil nutrient loss. Not restoring this ecosystem could also result in increased soil erosion, increased sediment delivery to streams, and/or soil nutrient loss.*

Short-term and long-term effects of the alternatives on watershed condition, which includes soil erosion and increased sediment delivery to streams, was evaluated using a watershed index analysis approach.

It is predicted Alternative A (Current Management) would have the smallest short-term disturbance and erosion potential from restoration activities. Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover, reducing erosion and sediment yield. However, this alternative is predicted to have the smallest increase in long-term ground cover due to the smallest area of restoration so the long-term watershed improvement would be the least.

Alternative B (Proposed Action) would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative B (Proposed Action). In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe that would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the second largest short-term disturbance and erosion potential from restoration activities. Alternative B would have the second greatest positive long-term increase in ground cover due to the area of restoration.

The direct and indirect effects of Alternative C on soil erosion would be very similar to Alternative B due to the same area of mechanical treatment on dense juniper areas. The main differences are that with a slower rate of treatment, potential erosion generated from the treatments would be lower, but long-term ground cover increases would also be lower. Overall the effects of this alternative on soils would be positive although delayed somewhat compared to Alternative B. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative C. In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe that would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the second largest short-term disturbance and the second smallest erosion potential from restoration activities. Alternative C would have the second smallest positive long-term increase in ground cover due to the area of restoration.

Alternative D would have similar effects on erosion and sediment yield as Alternative B. One difference is that this alternative has a higher proportion of mechanical treatments. The only differences in the watershed ranking are that this alternative has a higher short-term disturbance ranking, due to the higher proportion of mechanical treatments. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative D. In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe that would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and second largest erosion potential from restoration activities. Alternative D would have the second greatest positive long-term increase in ground cover due to the area of restoration.

Alternative E would have similar effects on erosion and sediment yield as Alternative B. However, this alternative has a higher proportion of mechanical treatments and a higher rate of treatment. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative E. In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe that would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and erosion potential from restoration activities. Alternative E would have the greatest positive long-term increase in ground cover due to the area of restoration.

Alternative J (Preferred Alternative) would have similar effects on erosion and sediment yield as Alternative B. However, this alternative has a higher proportion of mechanical treatments and a higher rate of treatment. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative J (Preferred Alternative). In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe that would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and third lowest erosion potential from restoration activities. Alternative J (Preferred Alternative) would have the fourth greatest positive long-term increase in ground cover due to the area and rate of restoration.

1.7.11 Issue 11 – Native American Cultural Resources and Activities

Issue Statement: *The short and/or long term vegetative changes created by restoration treatments may have effects on the integrity of Native American cultural resources. These vegetation changes may also have effects on Native American cultural practices and the gathering of traditional foods, such as the loss of habitat for culturally important wildlife and plant species. Native Americans also expressed concern that prescribed fire at a large scale may have adverse impacts to air quality.*

1.7.11.1 Native American Cultural Resources and Activities

Important cultural values in the Analysis Area include Native American prehistoric sites and artifacts, historic sites and structures, and traditional Native American uses. Culturally important wildlife species to Native Americans in the Analysis Area include jackrabbits, yellow-bellied marmots, which the Native Americans referred to as groundhogs, and porcupines. The Native American band name of the Fort Bidwell Tribe is Gidutikad, which they translate as groundhog eaters. This name reflects the importance of that food source to that tribe (Meza pers. Comm. 2008). Native American Tribes indicate that there used to be large rabbit drives with a harvest that provided enough for all people in the Tribes. Tribes believe that the populations of rabbits, groundhogs/marmots and porcupines have declined because of the conversion of sagebrush land to agriculture and other losses of sagebrush habitats.

Important plant species to Native Americans include Epos and juniper. Epos (*Perideridia spp*.) roots are dug for food, generally in the spring, lasting for about a month. Some specific epos fields in the Analysis Area are currently being used. Smaller fields that are used by various Native American families are also present throughout the Analysis Area. Various spiritual and cultural practices use juniper trees or portions of them. Specific juniper stands and/or trees are also used throughout the Analysis Area for Native American spiritual and cultural practices, and juniper berries and leaves are important culturally for a variety of uses. Juniper is also a source of firewood.

Although it is highly likely that Native American cultural sites would be protected for all alternatives with the implementation of specific guidelines, all alternatives would still have a risk of disturbing cultural resources while implementing the proposed activities. The types of risks by restoration method are common to all alternatives and are described in Chapter 4.

All alternatives would maintain over 124,000 acres of dense juniper across the Focus Area on FS and BLM administered lands. As implementation proceeds, the density of juniper would continue to increase in untreated areas. Additionally, treated areas would have new juniper seedlings, as occurred prior to Anglo settlement. Old growth juniper would be preserved through a Design Standard (*Section 2.4.4 Old Growth Juniper*). The area of juniper remaining under all alternatives would be more than adequate to provide for the traditional Native American uses of juniper, including juniper berries, leaves, and firewood.

Alternative A (Current Management) would have a minimal risk of adverse effects to Native American cultural resources due to the relatively small area treated per year. Under Alternative A, the restoration areas are very small compared to the sage steppe Focus Area and they would likely not increase the populations of jackrabbits, groundhogs/marmots or Porcupines. Overall, the restoration treatments would be positive for sage obligate species and negative for juniper woodland species.

Alternative A does not propose any restoration treatments within epos gathering areas. However, the lack of substantial restoration would mean that juniper would continue to increase in density across the area and could lead to reduced epos production due to competition with juniper for nutrients and water.

Alternative B would pose a moderate risk of adverse effects to Native American cultural resources. The BLM and FS are currently working on research to aid in the protection of cultural resources from the potential effects of restoration treatments. The results of those efforts may yield some different approaches that would reduce the risks of adverse effects from sage steppe restoration treatments, particularly given the long timeframe for completion of the activities.

For Alternative B, C, D, E and J, the restoration treatments cover a large area so they would likely create better habitat for sage obligate species within the sage steppe Focus Area. Overall, the restoration treatments would be positive for sage obligate species and negative for juniper woodland species. The effects of the proposed restoration treatments would have a positive effect on population trends of jackrabbits because restoration would increase their food sources, a variety of herbs and shrubs (*Section 3.8.6.1 Jackrabbits*). The effects of the proposed restoration treatments would have a positive effect on population trends of groundhogs/marmots because restoration would increase their food sources, grass, leaves, flowers, fruit, grasshoppers, and bird eggs (*Section 3.8.6.2 Groundhog/Yellow-bellied Marmot*) and would also provide more openings around rock piles. Porcupine populations would likely remain stable following restoration treatments. They are associated with woodlands, although not exclusively, so removal of juniper trees would reduce that habitat component, however their food sources in the spring; leaves, twigs and green plants, would increase. Therefore porcupines would experience a change due to restoration treatments would have negative and positive aspects. Alternatives B, C, D and E would have an overall positive effect on the populations of culturally important animals.

Alternative B would have some risk of damage to epos areas but also have the positive effects of restoring these areas so that increases in juniper density does not further reduce the ability of the area to grow Epos. The treatments in Epos areas would have some short-term impacts but should provide positive long-term effects.

Alternative C would have very similar effects to Alternative B. However, because this alternative has a slower initial rate of restoration, more of the area may be able to be restored under improved approaches for the protection of cultural resources, therefore reducing the risk compared to Alternative B. The effects of Alternative C on Epos gathering areas would be the same as Alternative B. The lower rate of restoration in the first two decades may allow for more thorough consultation, monitoring and adjustments of restoration techniques.

Alternatives D and J would have very similar types of effects as Alternative B. However, because these alternatives have a smaller percentage of fire use and a slower initial rate of restoration, the risk of effects is less. Additionally, more of the area may be able to be restored under improved approaches for the protection of cultural resources, therefore reducing the risk compared to Alternative B. The effects of Alternatives D and J on Epos gathering areas would be the same as Alternative B. The lower rate of restoration in the first two decades may allow for more thorough consultation, monitoring and adjustments of restoration techniques.

Alternative E would have very similar types of effects as Alternative B. However, because this alternative has a smaller percentage of fire use restoration, more of the area may be able to be restored under improved approaches for the protection of cultural resources, therefore, reducing the risk compared to Alternative B. This alternative would have the most positive effect on the populations of culturally important animals due to having the fastest restoration rate. The effects of Alternative E on Epos gathering areas would be essentially the same as Alternative D.

1.7.11.2 Air Quality

The level of emissions generated by Alternative A (Current Management) would be expected to remain within acceptable state and federal standards and result in a negligible probability of impacts. Class 1 airsheds would not be impacted from smoke generated from prescribed fire activities.

Alternative B would have the largest emissions of any of the alternatives, except for Decade 4 in Alternative E. The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Based upon the evaluation criteria, there is a moderate probability that smoke generated from prescribed fires would have significant effects on air quality, however the effects would be short-term (24-hours in duration).

Alternative B is the only alternative that would pose a moderate probability of impacts throughout the entire 40-year implementation period. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the greatest likelihood of delays in the implementation of the fire use restoration.

Alternative C would have the second lowest emissions produced for any of the alternatives during the first two decades. During the last three decades, however, the emissions would match those of Alternative B, and other than a three-year period in Alternative E, are the highest emissions produced by the alternatives. The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Based upon the evaluation criteria, there is a slight to low probability during the first two decades and a moderate probability during the last three decades that smoke generated from prescribed fires would have significant effects on air quality, however the effects would be short-term (24-hours in duration).

Alternative D emissions are the third lowest of the alternatives. The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Based upon the evaluation criteria, there is a slight to low probability during the first two decades and a low probability during the next two decades that smoke generated from prescribed fires would have significant effects on air quality, however the effects would be short-term (24-hours in duration).

Alternative E would generate higher emissions than Alternative D but for a shorter time. The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Based upon the evaluation criteria, there is a low probability during the first two decades and a moderate probability during the next two decades that smoke generated from prescribed fires would have significant effects on air quality, however the effects would be short-term (24-hours in duration).

Alternative J (Preferred Alternative) emissions are the second lowest of the alternatives. The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Based upon the evaluation criteria, there is a slight probability during the first two decades and a low probability during the next three decades that smoke generated from prescribed fires would have significant effects on air quality, however the effects would be short-term (24-hours in duration).

1.7.12 ISSUE 12 – PRESCRIBED FIRE AND WILDLAND FIRE USE IMPLEMENTATION

Issue Statement: *Burning on this scale may not be practical, particularly when environmental consequences and tactical reasonableness, such as smoke emissions and burn windows, are fully weighed.*

Alternative A includes approximately eight project-level prescribed fire projects over approximately 3,900 acres per year. This amount of prescribed fire would be within the combined agencies' (BLM and FS) current capability to complete these projects. Therefore, there would be no additional impact on resources required for Alternative A.

Alternative B would restore 24,300 acres per year with fire use, requiring 49 prescribed fires each year through the first four decades in the planning period. The current capability of FS and BLM resources is approximately 24 prescribed fires each year. Therefore, this alternative would require additional resources to complete the remaining 25 burns annually.

Alternative C would restore approximately 12,150 acres annually with fire use during Decades 1 and 2, requiring 24 prescribed fire projects each year throughout the first 20 years. Beginning in Decade 3 to the end of the planning period, a doubling of treatments would require an estimated 49 prescribed fires per year. The current capability would be adequate during Decades 1 and 2, but would require the use of additional resources outside the Focus Area to accomplish an additional 24 burns per year in Decades 3-5.

Alternative D would restore an estimated 14,400 acres annually with fire use during Decades 1and 2, requiring approximately 29 prescribed fire projects each year throughout the first 20 years. Resources from outside the Analysis Area would be required to complete five fires per year for the first two decades. Beginning in Decade 3 to the end of Decade 4, approximately 41 prescribed fires each year would require additional resources to complete 17 fires per year.

Alternative E would restore an estimated 19,153 acres annually with fire use during Decades 1and 2, requiring approximately 38 prescribed fires each year during the first 20 years. Additional resources from outside the Analysis Area would be required to complete 14 of those prescribed fires per year for the first two decades. Annual prescribed fires on 24,000 acres in Decade 3 would require the implementation of 48 prescribed fires, requiring additional resources to complete 24 fires per year. In Decade 4, there would be approximately 49 annual prescribed burns conducted over the first three years in this decade. These burns would require additional resources to complete 25 fires per year.

Alternative J (Preferred Alternative) would restore an estimated 7,200 acres annually with prescribed fire during Decades 1and 2, requiring approximately 14 prescribed fire projects each year throughout the first 20 years. The level of prescribed burning for the first two decades is within the current agency capability. Beginning in Decade 3 to the end of Decade 5, approximately 41 prescribed fires each year would require additional resources to complete 17 fires per year.

1.7.13 Issue 13 – Local Economics

Issue Statement: *The Proposed Action, with its heavy emphasis on prescribed fire and wildland fire use, has not considered treatment costs and local socio-economics, including opportunities for employment.*

A socio-economic analysis has been completed to compare the alternatives, including treatment costs and local employment opportunities. Alternative E would require the most labor for implementing mechanical treatments and has the potential to result in the most beneficial effects on the regional and local economies. Alternative E has the second highest personnel requirements for implementing prescribed burns. However, Alternative E would have the greatest short-term impact on the livestock sector of the local economy, resulting in an annual loss of nine jobs for the time (two to five years) needed to rest some range allotments. In terms of short-term economic impacts to the livestock sector, Alternatives B and C would have the lowest impacts, followed by Alternatives D and J. For all alternatives, except Alternative A (Current Management), the number of jobs created through mechanical treatment and prescribed fire would offset the job losses from resting AUMs.

Chapter 2. Alternatives, Including the Proposed Action

2.1 Introduction

This chapter describes and compares the alternatives considered for the Sage Steppe Ecosystem Restoration Strategy. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form. The comparison in this chapter can be combined with the issues comparison in Chapter 1 to sharply define the differences between each alternative and provide a clear basis for choice among options by the decision maker and the public. Alternative comparisons are presented both for the design of the alternatives and the environmental, social and economic effects of implementing each alternative.

2.2 Description of Restoration Methods

To meet the purpose and need, there are three different methods that are proposed to achieve sage steppe restoration: mechanical restoration, fire use, and hand restoration. The degree to which each of these methods is used varies between alternatives, as does the rate of restoration. Some of these methods could be used in combination. For example, some restoration areas might benefit from mechanical restoration followed by prescribed fire to reduce the woody debris left after the mechanical treatment.

2.2.1 Mechanical Restoration

Mechanical restoration involves the use of heavy machinery to physically remove Western juniper. There are several different kinds of mechanical restoration approaches and all can achieve similar results on the landscape. Mechanical restoration techniques that have previously been employed in the area, and are expected to be used in implementing the alternatives, include the following:

- Tracked feller-buncher machines. These machines would snip off the juniper trees and put them into a chipper that is pulled behind the feller-buncher. After the chip bin is full, the chips are augured into a tractor-trailer for transportation off site.
- Rubber-tired feller-buncher machines. These machines would cut the juniper trees and transport them to a landing area or pile them for skidding to the landing. Rubber tired skidders can then be used to transport the juniper to the landing areas, as needed. At the landings, the juniper trees are processed into chips and hauled away or limbed and just the boles hauled away, depending on the intended use for the material.

- Trees may be cut by the above methods but left on ground instead of transported off-site.
- The above methods can be combined and tailored specifically for site conditions, availability of machinery, economic conditions, and other factors.

The mechanical methods of restoration could generate slash in quantities that would require treatment. In these cases, the material would be piled and burned to minimize impacts to sagebrush. Mechanical methods have the benefit of minimal impacts to sagebrush because they would not kill them as prescribed fire would.

2.2.2 Fire Use

Fire use includes both the use of prescribed fire and naturally caused fire to achieve restoration objectives. Young Western juniper is not fire-tolerant and therefore, in favorable conditions, fire can be used to remove young juniper from a site. Prescribed fire would be used where enough fuel exists to carry a fire, where a fire can be managed successfully, and where conditions are good for achieving restoration objectives of removing juniper from the site. Naturally caused wildland fires would be allowed to burn to achieve restoration objectives in areas, and under conditions, where the wildland fires can be managed. Following a fire, it is expected that most of the juniper would be dead but as snags would remain standing for up to several decades.

Fire use would also kill sagebrush because, like juniper, it is not fire tolerant. Burned areas also have a greater potential for invasion by non-native plant species than areas restored using mechanical or hand treatment methods. Burned areas would require monitoring and control to prevent spread of invasive species.

2.2.3 Hand Restoration

Hand restoration is the most labor intensive method of restoration and would generally be accomplished by crews with chainsaws cutting down juniper. The trees would then be piled for burning or yarded to areas where trucks or skidders can reach them. This method would be used in the most environmentally sensitive areas or in areas where it is not feasible to use fire or mechanical means.

The benefit of hand restoration is that sensitive areas, such as those that include riparian areas, aspen trees, etc. can be treated with beneficial results. The disposal of the juniper trees and associated slash is a challenge for hand restoration because, once cut down, they cannot be moved easily by hand. This material would generally be piled and burned, or left on site.

2.3 Alternatives Considered in Detail _______________

The FS and BLM developed four alternatives for the Draft EIS, not including the Current Management Alternative. These alternatives included the Proposed Action, and three other alternatives that were developed in response to Significant Issues raised by the public. The Significant Issues are discussed in more detail in Chapter 1. Following review and consideration of the comments on the Draft EIS, an additional alternative (Alternative J). Alternative J (Preferred Alternative) was added to address the concerns that Alternatives D and E would proceed to quickly without adequate time to monitor and adjust, similar to Alternative C. That concern combined with the view of many commentors that Alternative D has a more positive mix of mechanical treatment and fire use. Commentors expressed concerns that Alternative C relied too heavily on fire use and therefore would be difficult to implement, due to both uncertain results and the lack of agency resources to complete the fire use projects. Therefore, Final EIS analyzes six alternatives in detail: the Current Management alternative, the Proposed Action, and three additional alternatives.

The alternatives restore different proportions of the sage steppe ecosystem within the Focus Area (Table 5). The remainder of the dense Western juniper is either on slopes greater than 30 percent, or is lower density. The differences in restoration treatments by treatment type and acres are shown on Table 6. The Western juniper with canopy cover greater than 20 percent in Table 5 is the same category as the dense juniper identified in Table 6. Similarly, the Western juniper with canopy cover between six and 20 percent in Table 5 is the same category as the less juniper identified in Table 6

Table 5. FS and BLM Treatment of Western Juniper by Canopy Cover by Alternative.

Western Juniper canopy cover (%)	Area in the Analysis Area (acres)	Alt. A Treatment Area (acres)	Alts. B & C Treatment Area (acres)	Alts. D, E and J Treatment Area (acres)
1-5	845,100	77,400	388,700	387,900
6-20	900,400	116,100	583,000	581,900
>20	433,300	56,500	282,500	282,500
Total	2,178,800	250,000	1,254,200	1,252,300

Table 6. Acres of FS and BLM Restoration Treatments by Alternative

	Alternative A	Alternative B	Alternative C	Alternatives D, E and J
Mechanical Restoration[1]				
Dense Juniper Areas	32,500 acres	163,700 acres	163,700 acres	163,700 acres
Less Dense Juniper Areas	0 acres	0 acres	0 acres	272,600 acres
Isolated Juniper Areas	16,000 acres	79,000 acres	79,000 acres	79,000 acres
Total Mechanical	48,500 acres	242,700 acres	242,700 acres	515,300 acres
Fire Use[2]				
Inside Wildland Urban Interface (WUI)	16,000 acres	80,100 acres	59,200 acres	34,200 acres
Inside WUI deferred	0 acres	0 acres	20,900 acres	13,700 acres
Outside WUI	177,500 acres	891,600 acres	749,100 acres	540,400 acres
Outside WUI deferred	0 acres	0 acres	142,500 acres	108,900 acres
Total Fire Use	193,500 acres	971,700 acres	971,700 acres	697,200 acres
Hand Treatment[3]	8,000 acres	39,800 acres	39,800 acres	39,800 acres
Total Treatment Acres	250,000 acres	1,254,200 acres	1,254,200 acres	1,252,300 acres

[1]Mechanical Restoration areas have the following characteristics:
- ≤30% slope
- Dense juniper areas have >20% canopy closure and are ≤1 mile from existing roads
- Less dense juniper areas have 6-20% canopy closure and are ≤1 mile from existing roads
- Isolated juniper areas have >20% canopy closure and are greater than 1 mile from existing roads

[2]Fire Use Restoration areas have the following characteristics:
- ≤20% juniper canopy closure
- WUI – Wildland Urban Interface areas
- Deferred – special wildlife areas that are deferred from fire use for the first 20 years

[3]Hand Treatments areas have the following characteristics:
- >20% juniper canopy closure and >30% slope
- Hand treatments are associated with resources such as:
  - Within 100 feet of seasonal drainages
  - Cultural/Archaeological sites if compatible with values present
  - Sensitive habitats

2.3.1 ALTERNATIVE A (CURRENT MANAGEMENT)

Alternative A, the Current Management alternative, would use existing plans to continue to guide management of the Analysis Area. Although there is no explicit BLM or FS policy regarding rest following treatment, it is generally required under Current Management practices. The current rate of restoration would be expected to continue for the next 40-50 years at approximately 5,000 acres per year of restoration within the Focus Area. The mix of restoration methods would be similar to the Proposed Action, with about 19 percent of the area restored by mechanical methods; 78 percent using fire; and three percent using hand treatments. A total of 250,000 acres would be restored over 50 years under this alternative.

2.3.2 ALTERNATIVE B (PROPOSED ACTION)

The Proposed Action (Alternative B) proposes to restore more than 30,000 acres per year for approximately 40 years. It is anticipated that about 19 percent of the area would be restored by mechanical methods; 78 percent would use fire; and three percent would use hand treatments (Figure 7). Mechanical and hand treatments could yield raw material for potential commercial use. A total of over 1.2 million acres would be restored over 40 years (Table 6). The majority of restoration treatments would take place on the Modoc National Forest, and Alturas, Eagle Lake and Surprise Field Offices (Table 7). A relatively small area of restoration would take place on the Klamath National Forest and very small amounts of restoration would take place on the Shasta-Trinity National Forest and Redding Field Office.

The restoration would increase the area of sagebrush and grassland dominated sage steppe habitat over time, and reduce the density of Western juniper in the sage steppe ecosystem. The restoration could create more diverse vegetative conditions potentially leading to an increase in the sagebrush and grassland dependent species populations. The restored areas would be rested from domestic livestock grazing until site-specific objectives are met. For prescribed burning, an additional one year of rest preceding the activities would be generally required to provide the fine fuels necessary to facilitate burn treatments. These rest periods would have an impact to the local livestock industry throughout the life of this project.

A Monitoring and Adjustment Approach would be used to test the effectiveness of different restoration methods and associated vegetative response. Based upon this monitoring, the pace and methods of restoration would be adjusted as appropriate. The approach to restoration in Alternative B would include systematic monitoring of results. Based upon the monitoring, adjustments would be made to the restoration methods, and future restoration projects would reflect those adjustments.

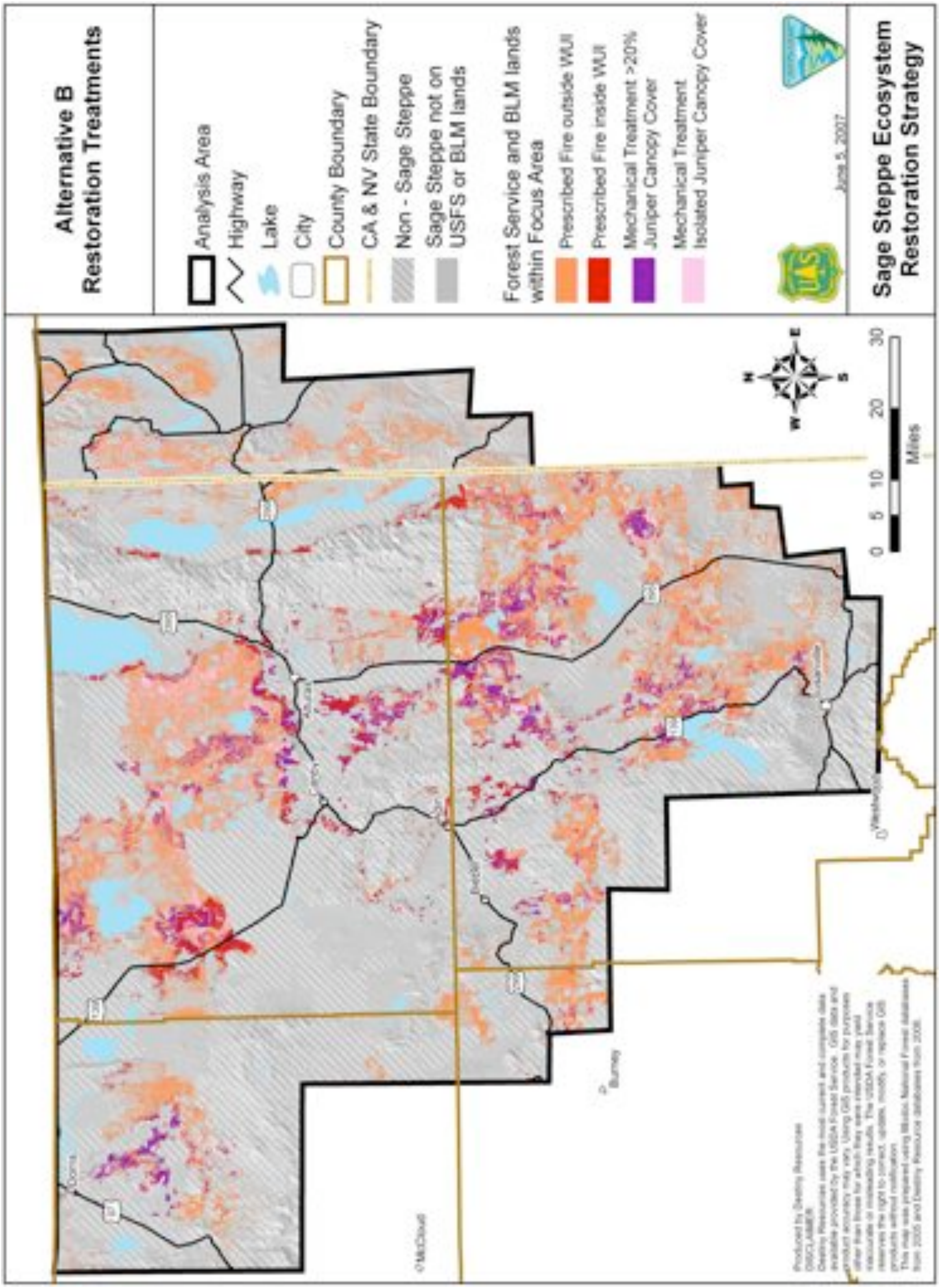

Figure 7. Restoration Treatment Areas for Alternative B (Proposed Action)

Table 7. Alternative B Restoration Treatments by Agency (FS and BLM)[1]

	Klamath National Forest	Modoc National Forest	Shasta-Trinity National Forest	Alturas Field Office	Eagle Lake Field Office	Redding Field Office	Surprise Field Office
Mechanical Restoration							
Dense Juniper Areas	2,770	46,270	20	78,580	28,430	270	7,360
Less Dense Juniper Areas	-	-	-	-	-	-	-
Isolated Juniper Areas	1,060	50,340	-	7,390	6,730	560	12,920
Total Mechanical	3,830	96,610	20	85,970	35,160	830	20,280
Fire Use							
Inside Wildland Urban Interface (WUI)	-	40,150	-	30,010	320	-	9,620
Inside WUI deferred	-	-	-	-	-	-	-
Outside WUI	24,910	266,380	2,420	222,530	207,540	1,570	166,250
Outside WUI deferred	-	-	-	-	-	-	-
Total Fire Use	24,910	306,530	2,420	252,540	207,860	1,570	175,870
Total Treatment Acres[2]	28,740	403,140	2,440	338,510	243,020	2,400	196,150

[1]Please see footnotes for Table 6 for details on treatments.

[2]Total treatment acres do not include hand treatments of 39,800 acres for all agencies total.

2.3.3 Alternative C

Theme – This alternative would proceed more slowly and cautiously with restoration activity than the Proposed Action. A Monitoring and Adjustment Approach would be used to test the effectiveness of different restoration methods and associated vegetative response. Based upon this monitoring, the pace and methods of restoration would be adjusted as appropriate before increasing the restoration rate to match the Proposed Action.

This alternative would restore about 15,000 to 19,000 acres annually for the first two decades, fewer than Alternative B (Proposed Action) because some of the Focus Area within critical sage-grouse, mule deer and pronghorn antelope habitat (Figure 8 and Table 6) would be deferred until the third decade and later. The restoration methods and Focus Area would be the same as those for the Proposed Action. The majority of restoration treatments would take place on the Modoc National Forest, and Alturas, Eagle Lake and Surprise Field Offices (Table 8). A relatively small area of restoration would take place on the Klamath National Forest and very small amounts of restoration would take place on the Shasta-Trinity National Forest and Redding Field Office.

For the first decade, the annual restoration rate would be approximately 50 percent of each restoration method in the Proposed Action. Total area of restoration would be approximately 15,000 acres per year for the first decade. For the second decade, it is assumed that the restoration rate for mechanical methods would equal the Proposed Action, but that the fire use rate would remain at half. The second decade restoration rate would be approximately 19,000 acres per year. Beyond the second decade, the rate of restoration would equal that of the Proposed Action of approximately 30,000 acres per year. This buildup in restoration rates assumes that monitoring has validated implementation of the restoration methods. In 40 years fewer acres would be restored as compared to the Proposed Action. An additional 10 years, or 50 years in total, would be required to complete restoration in all of the Focus Area under this alternative. It is expected that this approach would create greater certainty regarding the results over time. Alternative C would defer a more aggressive restoration rate until such a time as monitoring validates the increased rate.

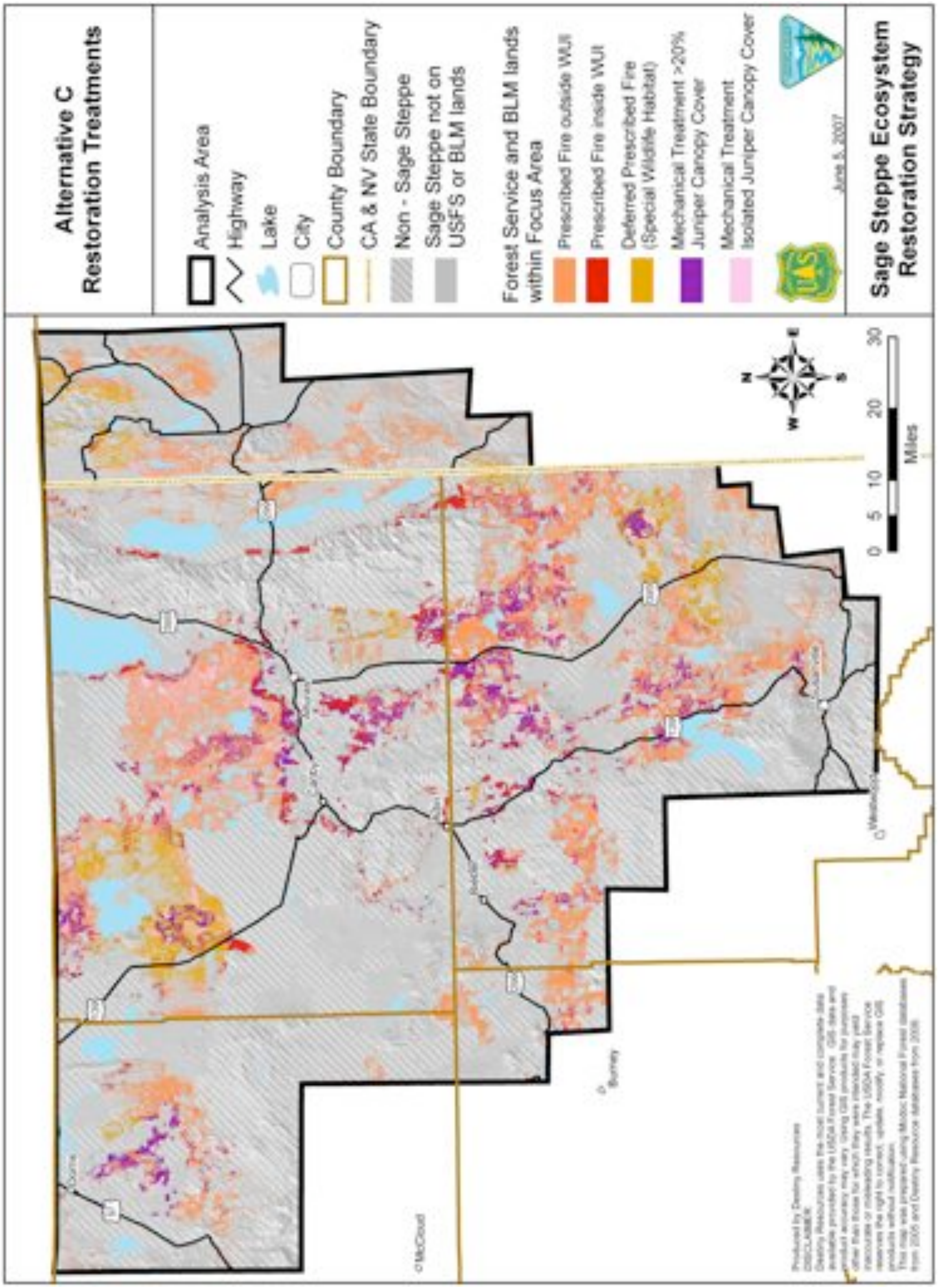

Figure 8. Restoration Treatment Areas for Alternative C

Table 8. Alternative C Restoration Treatments by Agency (FS and BLM)[1]

	Klamath National Forest	Modoc National Forest	Shasta-Trinity National Forest	Alturas Field Office	Eagle Lake Field Office	Redding Field Office	Surprise Field Office
Mechanical Restoration							
Dense Juniper Areas	2,770	46,270	20	78,580	28,430	270	7,360
Less Dense Juniper Areas	-	-	-	-	-	-	-
Isolated Juniper Areas	1,060	50,340	-	7,390	6,730	560	12,920
Total Mechanical	3,830	96,610	20	85,970	35,160	830	20,280
Fire Use							
Inside Wildland Urban Interface (WUI)	-	22,280	-	26,980	320	-	9,620
Inside WUI deferred	-	17,870	-	3,030	-	-	-
Outside WUI	24,910	204,380	2,420	211,010	171,370	1,570	133,440
Outside WUI deferred	-	62,000	-	11,520	36,170	-	32,810
Total Fire Use	24,910	306,530	2,420	252,540	207,860	1,570	175,870
Total Treatment Acres[2]	28,740	403,140	2,440	338,510	243,020	2,400	196,150

[1]Please see footnotes for Table 6 for details on treatments.

[2]Total treatment acres do not include hand treatments of 39,800 acres for all agencies total.

2.3.4 ALTERNATIVE D

Theme – Alternative D emphasizes restoration methods to retain the sagebrush component, have lower risks of invasive species spread due to less area restored with fire, and potentially require less agency resources to implement. This alternative reduces the amount of fire use (from 78 percent to 56 percent) and increases the amount of mechanical restoration (from 19 percent to 41 percent) as compared to the Proposed Action (Figure 9 and Table 6). The majority of restoration treatments would take place on the Modoc National Forest, and Alturas, Eagle Lake and Surprise Field Offices (Table 9). A relatively small area of restoration would take place on the Klamath National Forest and very small amounts of restoration would take place on the Shasta-Trinity National Forest and Redding Field Office.

There are a number of Significant Issues, which include concerns that fire use would not achieve resource and restoration objectives with acceptable results. This alternative reduces the area of fire use and increases the area of mechanical restoration as compared to the Proposed Action. Alternative D restores 28,000 acres per year for the first two decades. The restoration rate then increases to 34,000 acres per year for the third and fourth decades. The differences in the restoration rates is a result of deferring critical sage-grouse, mule deer and pronghorn antelope habitat from restoration with fire use for the first two decades. Alternative D would take approximately 40 years to restore all of the Focus Area. The overall extent of restoration of the Focus Area in the Proposed Action would be similar for this alternative. However, some of the restoration areas that would be burned in the Proposed Action would be mechanically restored in this alternative.

This alternative would also incorporate the Monitoring and Adjustment Approach described in Alternative B. It would not, however, include the reduction in restoration rate specified in Alternative C.

2.3.5 ALTERNATIVE E

Theme – Alternative E differs from the Proposed Action by increasing the restoration rate in order to more fully respond to the purpose and need. This alternative would target mechanical treatment at nearly double the restoration rate of the Proposed Action. Alternative E, similar to Alternative D, would emphasize mechanical restoration methods and less extensive use of fire treatments. Mechanical restoration would retain the sagebrush component. This would have a lower risk of invasive species spread, and would potentially require fewer agency resources to implement.

Overall, this alternative would increase the annual restoration rate over all other alternatives. This alternative would reduce the area of fire use for restoration (from 78 percent to 56 percent) and increase the amount of mechanical restoration (from 19 percent to 41 percent) compared to the Proposed Action. The majority of restoration treatments would take place on the Modoc

National Forest, and Alturas, Eagle Lake and Surprise Field Offices (Table 9). A relatively small area of restoration would take place on the Klamath National Forest and very small amounts of restoration would take place on the Shasta-Trinity National Forest and Redding Field Office.

This alternative would restore 37,000 acres per year for the first two decades, then the restoration rate would increase to approximately 42,000 acres per year for the third decade. The mechanical restoration would be completed by the end of the third decade. About 24,000 acres per year of fire use restoration would continue for three years into the fourth decade. The primary reason that fire use continues after the mechanical restoration would be completed is to decrease the potential for air quality impacts. The other differences in the restoration rates is a result of deferring critical sage-grouse, mule deer and pronghorn antelope habitat from restoration with fire use for the first two decades. Alternative E would take approximately 33 years to restore all of the Focus Area.

This alternative would also incorporate the Monitoring and Adjustment Approach described in Alternative B. It is anticipated that this monitoring will validate the aggressive restoration rate.

2.3.6 Alternative J (Preferred Alternative)

Theme – Alternative J (Preferred Alternative) would proceed more slowly and cautiously with restoration activity than the Proposed Action, similar to Alternative C. As in all alternatives, a Monitoring and Adjustment Approach would be used to test the effectiveness of different restoration methods and associated vegetative response. Based upon this monitoring, the pace and methods of restoration would be adjusted as appropriate before increasing the restoration rate to match Alternative D. Alternative J (Preferred Alternative) would use restoration methods to retain the sagebrush component, have lower risks of invasive species spread due to less area restored with fire, and potentially require less agency resources to implement, similar to Alternative D.

Similar to Alternative D and E, this alternative reduces the area of fire use and increases the area of mechanical restoration as compared to the Proposed Action. This shift in restoration treatments addresses a number of Significant Issues, which include concerns that fire use would not achieve resource and restoration objectives with acceptable results.

Alternative J (Preferred Alternative) would restore about 14,000 to 21,000 acres annually for the first two decades, fewer than Alternative B (Proposed Action) because some of the Focus Area within critical sage-grouse, mule deer and pronghorn antelope habitat (Figure 8 and Table 6) would be deferred until the third and fourth decades. The restoration methods and Focus Area would be the same as those for Alternatives D and E.

The approach to restoration in Alternative J (Preferred Alternative) would include systematic monitoring of results. Based upon the monitoring, adjustments would be made to the restoration methods, and future restoration projects would reflect those adjustments.

For the first decade, the annual restoration rate would be approximately 50 percent of each restoration method in Alternative D. Total area of restoration would be approximately 14,000 acres per year for the first decade. For the second decade, it is assumed that the restoration rate for mechanical methods would equal Alternative D, but that the fire use rate would remain at half. The second decade restoration rate would be approximately 21,000 acres per year. Beyond the second decade, the rate of restoration would equal that of Alternative D of approximately 34,000 acres per year. This buildup in restoration rates assumes that monitoring has validated implementation of the restoration methods. In 40 years fewer acres would be restored as compared to the Proposed Action and Alternative D. An additional seven years, or 47 years in total, would be required to complete restoration in all of the Focus Area under Alternative J (Preferred Alternative). It is expected that this approach would create greater certainty regarding the results over time. Alternative J (Preferred Alternative) would defer a more aggressive restoration rate until such a time as monitoring validates the increased rate.

Table 9. Alternatives D, E and J Restoration Treatments by Agency (FS and BLM)[1]

	Klamath National Forest	Modoc National Forest	Shasta-Trinity National Forest	Alturas Field Office	Eagle Lake Field Office	Redding Field Office	Surprise Field Office
Mechanical Restoration							
Dense Juniper Areas	2,770	46,270	20	78,580	28,430	270	7,360
Less Dense Juniper Areas	10,000	70,350	1,250	102,610	64,430	350	23,610
Isolated Juniper Areas	1,060	50,340	-	7,390	6,730	560	12,920
Total Mechanical	13,830	166,960	1,270	188,580	99,590	1,180	43,890
Fire Use							
Inside Wildland Urban Interface (WUI)	-	13,620	-	12,710	260	-	7,610
Inside WUI deferred	-	11,920	-	1,780	-	-	-
Outside WUI	13,960	161,710	1,030	128,260	118,800	1,230	115,410
Outside WUI deferred	-	48,150	-	7,160	24,360	-	29,230
Total Fire Use	13,960	235,400	1,030	149,910	143,420	1,230	152,250
Total Treatment Acres[2]	27,790	402,360	2,300	338,490	243,010	2,410	196,140

[1]Please see footnotes for Table 6 for details on treatments.

[2]Total treatment acres do not include hand treatments of 39,800 acres for all agencies total.

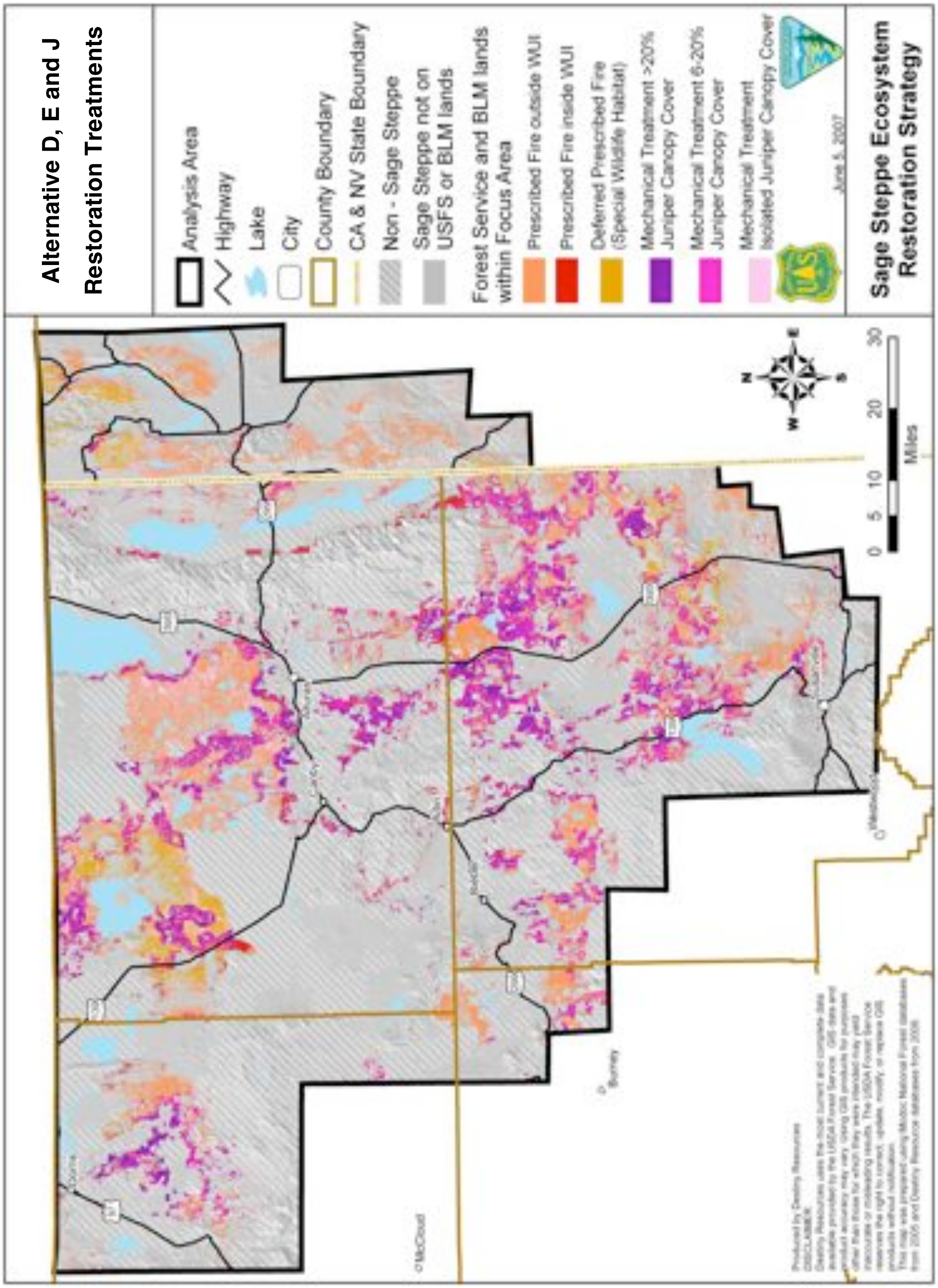

Figure 9. Restoration Treatment Areas for Alternatives D, E and J

2.4 Design Standards

The Proposed Action (Alternative B) and all the alternatives except for the Current Management (Alternative A) would include the following Design Standards as part of the alternatives.

2.4.1 Cultural Resources

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for cultural resources management based upon law, policy, and standards and guidelines. Additionally, these agencies have Programmatic Agreements with the California and Nevada Offices of Historic Preservation. These agreements will be reviewed for potential modifications during site-specific project planning. If those agreements cannot be adequately modified then new agreements would be drafted to guide the identification, treatment and protection of cultural/heritage resources during the implementation period.

2.4.2 Firewood Gathering

Firewood gathering is an important activity for many people in the Analysis Area. Some people rely on firewood as a primary heating source for their houses. In addition, others use it as a recreational activity. The Modoc National Forest and Alturas Field Office will work with firewood gatherers to ensure that firewood gathering areas are available as appropriate during site-specific sage steppe restoration planning.

One of the concerns regarding firewood gathering is that firewood cutters will target old growth juniper because it is more desirable. Firewood cutting policies have been revised, as necessary, to ensure that old growth juniper will not be cut during firewood gathering activities. These firewood cutting policies will include a combination of diameter limits, growth form (see *2.4.5 Old Growth Juniper*), and designated cutting areas to ensure that old growth juniper will not be taken during firewood gathering. It should be noted that just a diameter limit alone will not protect old growth juniper as a 18-inch DBH limit would leave approximately 43 percent of the old growth juniper available for cutting (Miller pers. Comm.). The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

2.4.3 Livestock Grazing Management Practices

Restoration approaches for all alternatives, including the Current Management alternative, involve various restoration treatments to remove juniper over substantial portions of the landscape. Any of these restoration methods, mechanical, fire use or hand restoration, would be designed with the purpose of restoring the sage steppe ecosystem and the associated vegetative communities to mosaics similar to historic conditions.

Rest from livestock grazing following treatment to allow the restorative processes to take place would be essential for these restoration methods to be successful. There are three principle reasons that rest from livestock grazing would be necessary: reestablishment of sage steppe vegetation, creating adequate understory for burning, and preventing establishment of non-native species (Miller *et al.* 2005 and Miller *et al.* 2007). The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become established with adequate crown and root structure. Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science strongly indicate this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where site conditions, the restoration method, and weather dictate.

Rest from livestock grazing would also be required both before and after prescribed fire. In order for fire to carry across a unit of the landscape designated for burning, there must be adequate ground cover of grass and forb species (i.e.: adequate plant height and herbaceous volume). This would most often add one year of pre-fire rest to a restoration area in addition to the required post-fire rest.

Finally, if the plant species desired to accomplish sage-steppe restoration do not get the necessary rest time to become well established, they may not be able to successfully compete against invasive and noxious weed species, precluding achievement of the restoration objectives.

The FS and the BLM will seek all opportunities to minimize the impacts on grazing permittees due to livestock removal to facilitate rest. These efforts would include but not be limited to:

- design of projects to minimize rest on non-treated acres
- use vacant sheep allotments for cattle or sheep/cattle use for displaced livestock
- temporary use of allotments that are vacant for other than resource protection
- holding of permits voluntarily returned or acquired through administrative action for use by displaced livestock
- development of other forms of “forage reserves” or “grassbanks”, both on and off federal and state land

All restoration activities are also subject to current management policies and guidelines regarding livestock grazing. These policies and guidelines have been shown to be effective at improving range condition by insuring proper season, timing and duration of grazing based upon site-specific conditions. In the Analysis Area livestock commonly utilize juniper trees for shade, and where they seek shade, there can be a decrease in herbaceous vegetation and an increase in soil disturbance. During site specific project planning non-old growth juniper distribution will be designed so that following sage steppe restoration treatments, livestock are not attracted to riparian, aspen or old growth juniper stands to meet their shade requirements.

2.4.4 Old Growth Juniper

Old growth Western juniper trees are a natural component and play an important role in the sage steppe ecosystem and would be retained during sage steppe restoration. The intent of this Design Standard is to preserve those trees that were present at or before the mid-1800s for their many social and ecological values. Individual old growth trees in restoration areas would be identified using morphological characteristics (Miller *et al.* 2005). Characteristics of old growth juniper would include:

- Rounded or unsymmetrical tops that may be sparse and contain dead limbs
- Deeply furrowed, fibrous bark on the trunk that is reddish in color
- Branches near the base of the tree that may be very large and covered with fruitcose lichens
- Limited terminal leader growth on branches in the upper 25 percent of the canopy

Restoration areas could become areas where firewood cutters looking for large juniper trees that may be old growth, could find them easier to access. Following treatment, restoration areas may be closed to firewood cutting, or other measures implemented, in order to retain old growth juniper as a natural component of the sage steppe ecosystem.

In the Analysis Area livestock commonly utilize juniper trees for shade, and where they seek shade, there can be a decrease in herbaceous vegetation and an increase in soil disturbance. During site specific project planning non-old growth juniper distribution will be designed so that following sage steppe restoration treatments, livestock are not attracted to riparian, aspen or old growth juniper stands to meet their shade requirements.

2.4.5 Road Management

No new permanent roads would be constructed for the sole purpose of sage steppe restoration. Temporary roads would be used were appropriate and would be decommissioned following use.

2.4.6 Monitoring and Adjustment Approach

Monitoring and Adjustment is a key Design Standard incorporated into each of the action alternatives for the Sage Steppe Ecosystem Restoration Strategy. Monitoring and Adjustment (or Adaptive Management) is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. This process also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a "trial by error" process, but rather emphasizes learning while doing. It does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits.

Monitoring to be conducted under each of the action alternatives must be designed to provide data for the following purposes:

- to evaluate progress toward achieving objectives;
- to increase understanding of resource dynamics via the comparison of predictions against survey data; and
- to enhance and develop models of resource dynamics as needed and appropriate.

The accumulation of understanding and subsequent adaptation of management strategies depends on feeding monitoring and assessment results back into the decision making process. Scientists, managers and stakeholders should collaborate in an interdisciplinary assessment of what is known and what is learned about the system being managed.

Monitoring and Adjustment for the Sage Steppe Ecosystem Restoration Strategy will occur at two levels, at the Programmatic Level and at the Site Specific Level. The two levels of Monitoring and Adjustment are explained below.

2.4.6.1 Programmatic Level Monitoring

The agencies will complete an annual report to provide programmatic monitoring results for the Sage Steppe Ecosystem Restoration Strategy. The programmatic monitoring report will provide information on those items listed below, as well as other information that may be determined necessary.

- Acres within the Focus Area treated by jurisdiction and treatment
- Number of sites monitored, broken down by project name, jurisdiction, along with the name of the individual who collected and summarized the data.
- An estimate of the acres, and treatment type on private lands or other jurisdictions within the Focus Area.

The annual report will also summarize:

- For each site specific analysis area, the percentage of dense juniper remaining in the project area after treatment.
- Compliance with old growth retention standard.

2.4.6.2 Site Specific Level Monitoring

The agencies will develop monitoring plans for site specific treatments that are part of the Sage Steppe Ecosystem Restoration Strategy. Each plan will include site specific objectives and the technique that will be used to monitor progress in meeting those objectives. Monitoring will be conducted to determine, at a minimum:

- The amount of dense juniper to be retained in the project area
- Old growth retention objectives
- Noxious weed objectives
- Desired vegetative cover and composition

To be useful for decision making and evaluation, objectives must be site specific, measurable, achievable, results oriented, and include definite timeframes. Each site specific monitoring plan that is developed will be made available to the public and other stakeholders to review and provide input during the NEPA process.

2.4.6.3 Technical Advisory Committee

A Technical Advisory Committee (TAC) will be established for the purpose of reviewing all monitoring information to determine if treatments or other management actions should be adjusted at the programmatic or site specific levels to better meet restoration objectives.

The TAC will conduct an annual meeting of interested publics and other stakeholders to present the findings and recommendations for the programmatic and site specific levels of monitoring. After receiving input from the public, recommendations for the programmatic and site specific levels of management will be finalized and forwarded to resource specialists and decision makers to consider when initiating future treatment projects.

2.4.6.4 Examples of Adjustments

As displayed above, there are two levels of Monitoring and Adjustment that are part of the Restoration Strategy. Examples for each follow.

- An example of an adjustment that could occur at the programmatic level is reducing the pace of restoration based upon monitoring that shows that the agencies cannot accomplish the rate of restoration for various reasons including; lack of resources, need for additional rest from grazing at many types of restoration sites, and air quality restrictions on prescribed fire implementation.
- An example of an adjustment that could occur at the site specific level is adding an additional growing season of rest from livestock grazing at specific sites that are not achieving restoration objectives for grass and forb cover following the initial two years of rest.

2.4.6.5 Ongoing Projects that Assist Monitoring

There are some ongoing site-specific projects that will aid the Monitoring and Adjustment Approach such as:

- Camp Creek Paired Watershed Study – This project is currently underway in eastern Oregon, and is being run by Oregon State University Extension. The objective is to try to determine if water quantity changes after removal of juniper.

- Oregon State University/Modoc National Forest "Regional Experiment to Evaluate the Effects of Fire and Fire Surrogate Treatments in the Sagebrush Biome". More information on this cooperative research project is available from the Modoc National Forest.

2.5 Site-specific Planning Considerations

This Restoration Strategy is programmatic in nature, therefore site-specific restoration projects are not proposed in this document. Conditions on the ground will be determined during site-specific decision-making and NEPA compliance documentation and will be used to select the most appropriate combination of restoration treatments to achieve sage steppe ecosystem restoration. Site-specific conditions will be determined through existing mapping, site reconnaissance and field surveys, as necessary. The following site-specific factors, and others, will influence the determination of the best restoration treatment options (Miller *et al.* 2007).

- Fuel composition
- Plant composition including:
    - Abundance of desirable species
    - Desirable fire sensitive species
    - Invasive species
    - Juniper woodland type
- Ecological site risk and potential
- Sensitive species
- Overall objectives
- Size of area to be treated
- Liability and adjacency to other plant communities
- Cost and resources
- Social acceptability

Based upon Miller *et al.* (2007), it is anticipated that most restoration sites in the Focus Area, have the capability for native vegetation to become reestablished from existing native seedbanks and native plants following restoration treatments. Site-specific planning would determine if native seeding or planting by the agencies is warranted.

These factors and others will be considered before the selection of the most appropriate restoration treatment methods. An example of the site-specific considerations would be that Wyoming big sagebrush occupies drier sites that Mountain big sagebrush. Wyoming big sagebrush sites therefore would take longer to respond to restoration treatments.

The Restoration Strategy is a landscape level approach that uses the sage steppe ecosystem vegetation mosaic as the desired condition. However, when site-specific projects are being proposed, approved and implemented, they will be designed to meet site-specific objectives. These objectives would be established during the development of the site-specific projects. The process for developing the site-specific objectives would likely include an interdisciplinary team site review, analysis of the existing vegetation, site capability; and expected changes in vegetation species and age class composition (ground cover and shrubs) from restoration activities.

2.6 Sage Steppe Ecosystem Maintenance

This Restoration Strategy presents the first phase of sage steppe restoration of the Focus Area. It is recognized that additional restoration activities and/or maintenance of restored areas may be required over time. Additional programmatic, landscape scale analysis may be undertaken at that time.

2.7 Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods to achieve the purpose and need. Some of these alternatives were outside the scope of restoration of the sage-steppe ecosystem across the landscape, duplicative of the alternatives considered in detail, or determined to have components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

2.7.1 Alternative F – Research and Development

This alternative differs from the Proposed Action by using a research and development approach. This approach would institutionalize a research, development and assessment program that would defer full implementation of restoration until agreed upon research design objectives are met. Forest Service Research Stations and universities would be involved in the design of this approach. It is estimated that less than 5,000 acres of research restoration would be conducted annually during the first decade.

This alternative was dismissed from detailed consideration because agencies have sufficient current science and experience to support the Proposed Action. However, a Monitoring and Adjustment Approach was incorporated into Alternatives B, C, D, E and J. In addition, Alternatives C and J restores sage steppe at a slower rate than the other alternatives for the first two decades specifically to validate restoration treatment effectiveness.

2.7.2 Alternative G - Increased Fire Use

This alternative differs from the Proposed Action by primarily using fire as a restoration method. It is generally perceived by some commentors that fire use would have fewer environmental concerns than mechanical methods. Also, some comments stated that since a component of the purpose and need is to return natural fire regimes back to the landscape, fire use to achieve restoration results should largely be used to accomplish that objective.

This alternative was dismissed from detailed consideration because those areas proposed for mechanical restoration in the Proposed Action do not exhibit the necessary vegetative conditions to effectively carry a fire. Additionally, it is not likely that this alternative could be implemented due to air quality impacts related to fire use at such a scale.

2.7.3 Alternative H – Mechanical Restoration Only

This alternative differs from the Proposed Action by allowing only mechanical and hand restoration. This alternative would respond to the concerns about the impacts of prescribed fire on livestock grazing, wildlife, invasive species and air quality.

This alternative was dismissed from detailed consideration because currently it is not anticipated that the agencies will have the financial resources to accomplish this level of restoration using only mechanical and hand treatments. In addition, this alternative would not restore a fire disturbance regime to the sage steppe ecosystem, one of the objectives in the purpose and need.

2.8 Comparisons of Alternatives

Chapter 1 – Significant Issues provides a summary of the effects of implementing the alternatives on the Significant Issues. Table 10 provides a summary of the other effects that are analyzed as part of this FEIS. Information in Table 10 displays different levels of effects or outputs on various resources distinguished quantitatively or qualitatively among alternatives.

Table 10. Summary Comparisons of Resource Effects by Alternative

Environmental Component	Evaluation Criteria	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative J
Reduction in fire hazard level	Focus Area moved towards Condition Class I	5%	24%	24%	17%	17%	17%
Short term effect on forage base for domesticated animals	Trend in range quality	Minor changes	Reduction	Reduction	Reduction	Reduction	Reduction
Long term effect on forage base for domesticated animals	Trend in range quality	Minor positive trend	Long term improvement	Long term improvement, 2nd lowest rate	Long term improvement, 2nd highest rate	Long term improvement, highest rate	Long term improvement, 2nd lowest rate
Watershed	Trend in overall watershed function	Positive, smallest increase	Positive, 2nd highest	Positive, 2nd smallest	Positive, 2nd highest	Very Positive, highest	Positive, 3rd smallest
Wildlife – Mule Deer	Short and long term population trend	Short Term Low intensity, positive trend Long term Moderate intensity, negative trend	Short Term Low intensity, positive trend Long term High intensity, Postive trend	Short Term Low intensity, positive trend Long term High intensity, Postive trend	Short Term Low intensity, positive trend Long term Moderate intensity, Postive trend	Short Term Moderate intensity, positive trend Long term Moderate intensity, Postive trend	Short Term Low intensity, positive trend Long term Moderate intensity, Postive trend
Wildlife – Pronghorn	Short and long term population trend	Short Term Low intensity, positive trend Long term Moderate intensity, negative trend	Short Term Low intensity, positive trend Long term High intensity, Postive trend	Short Term Lowintensity, positive trend Long term High intensity, Postive trend	Short Term Low intensity, positive trend Long term High intensity, Postive trend	Short Term Moderate intensity, positive trend Long term Moderate intensity, Postive trend	Short Term Low intensity, positive trend Long term Moderate intensity, Postive trend

Table 10. Summary Comparisons of Resource Effects by Alternative (continued)

Environmental Component	Evaluation Criteria	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative J
Visuals – Short term significant adverse effects due to Mechanical and Fire restoration	Percentage of area in Retention or Preservation VQOs (USFS) or Class I and II VRMs (BLM) treated per decade	Negligible	"High" probability VQO Treatments 2.6% VRM Treatments 10.6%	"Moderate" probability VQO Treatments 2.0% VRM Treatments 8.5%	"High" probability VQO Treatments 2.5% VRM Treatments 10.6%	"High" probability VQO Treatments 3.1% VRM Treatments 12.8%	"Moderate" probability VQO Treatments 2.2% VRM Treatments 9.0%
Visuals – long term effect	Trend	Neutral	Neutral to Positive	Neutral to Positive	Neutral to Positive	Neutral to Positive	Neutral to Positive
Recreation – Short term effects	Comparison of intensity of shift from Semi-Primitive Motorized to Roaded Natural	Minor, temporary shift	Temporary shift of areas from Semi-Primitive Motorized to Roaded Natural	Temporary shift of areas from Semi-Primitive Motorized to Roaded Natural but lower intensity than Alternative B due to slower Restoration Rate	Temporary shift from Semi-Primitive Motorized to Roaded Natural, greater reduction in Semi-Primitive Motorized than Alts. B & C due to mechanical restoration	Temporary shift from Semi-Primitive Motorized to Roaded Natural, greater reduction in Semi-Primitive Motorized than Alts .B & C due to mechanical restoration.	Temporary shift from Semi-Primitive Motorized to Roaded Natural, greater reduction in Semi-Primitive Motorized than Alts. B & C due to mechanical restoration
Recreation – Long term effects	Improvement in Mule deer habitat could lead to increase in number of deer tags issued	"Moderarte" Decline in Habitat	"High" Improvement in Habitat	"High " Improvement in Habitat	"Moderate" Improvement in Habitat	"Moderate" Improvement in Habitat	"Moderate" Improvement in Habitat

Chapter 3. Existing Condition

Chapter 3 summarizes the biological, physical, and socio-economic environments of the Analysis Area. The chapter begins by comparing historical data to today's vegetation patterns. Then, the existing condition of each resource as it pertains to the actions proposed is presented.

The existing conditions of the Analysis Area and Focus Area set the baseline for the analysis of the effects of the alternatives on each resource area. Although the Lassen National Forest is included in the Analysis Area there are no acres proposed for restoration treatment on the Lassen National Forest and it is therefore not presented in this chapter. Two other federal agencies, the Shasta-Trinity National Forest and the Redding Field Office, have fewer than 2,500 acres proposed for restoration treatment (Table 4). The less than 2,500 acres of restoration treatments would be less than 0.2 percent of the total restoration treatment area. Due to their very small area and the fact that these areas are within the sage steppe ecosystem adjacent to the other lands, and therefore very similar, the Shasta-Trinity National Forest and the Redding Field Office will not be specifically addressed in the existing condition section. Similarly, the Klamath National Forest has less than 29,000 acres proposed for restoration treatments, which is about two percent of the proposed restoration treatments. Again, due to their small area and the fact that these areas are within the sage steppe ecosystem adjacent to the other lands, and therefore very similar, the Klamath National Forest will not be specifically addressed in the existing condition section.

3.1 Introduction

The Analysis Area is located within the Modoc Plateau Geologic Province that consists of a flat-topped upland area built up of irregular masses of a variety of volcanic materials (Pit River Watershed Alliance 2004). Topography of this area varies but generally consists of wide valley floors between 4,000 and 6,000 feet interrupted by mountains.

The purpose of the Sage Steppe Ecosystem Restoration Strategy is to restore the distribution of vegetation types to a location and extent more similar to that which existed prior to European settlement to benefit sage steppe associated wildlife and other sage steppe ecosystem values. The Analysis Area covers approximately 6.5 million acres located in the counties of Lassen, Modoc, Shasta and Siskiyou in California and Washoe County in Nevada (Figure 1 in *Chapter 1*). This Restoration Strategy focuses on the conditions of the sage steppe ecosystem that is targeted for restoration. Within the Analysis Area, there is an identified Focus Area (Figure 1 in *Chapter 1*) that contains the sage steppe ecosystem and includes all areas that are proposed for restoration treatment.

3.2 Vegetative Conditions

The discussion of the existing vegetative conditions addresses the primary vegetation types that have been affected by an increase in the density of Western juniper in the Focus Area.

3.2.1 Historical Vegetation Patterns

The ecological picture of the pre-European landscape is of a dynamic mosaic of big sagebrush, low sagebrush, grasslands, and juniper. These vegetation types likely existed in a variety of age classes, sizes and mosaics. This type of mosaic was formed and maintained by wildfires and other natural disturbances (Miller *et al.* 2005 and 2008). Juniper can grow in many places throughout the Focus Area, but was eliminated or kept at low density in many of those areas by fire (see also discussion of the disturbance regimes in the sage steppe ecosystem, *Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*).

The increase in density of Western juniper in the Focus Area is part of the expansion of juniper woodlands throughout the Intermountain west (Cottam and Stewart 1940, Burkhardt and Tisdale 1976, Miller and Rose 1995 and 1999, Miller *et al.* 2008, Gedney *et al.* 1999, O'Brien and Woudenberg 1999, Soulé and Knapp 1999, Coppedge *et al.* 2001, Soulé *et al.* 2004). These studies and others have concluded that the increasing density of Western juniper over time was primarily due to the initial severe domestic livestock grazing and the modification of the fire regime in the sage steppe ecosystem combined with warmer and wetter climatic conditions. The results of those factors can be seen in numerous places throughout the Focus Area such as the XL Ranch example (see Figures 3 and 4 in Chapter 1).

The initial arrival of Western juniper in the region can be dated to between 4,800 and 6,600 years ago (Bedwell 1973, Mehringer and Wigand 1984, and Wigand 1987). These dates have been established by studying leaves, twigs, and seeds from pack rat middens found in caves, and pollen from pond and lake sediment cores. Throughout the past 5,000 to 6,000 years prior to settlement, Western juniper in the Analysis Area expanded and contracted mostly due to changes in the climate (Miller *et al.* 2005). Scientific literature, relict juniper woodlands, tree ring data, down and dead trees and stumps, and historic surveys support the view of the pre-settlement distribution of Western juniper stands as being confined to rocky ridges, scattered in micro-sites on low sagebrush flats, and on soils where fine fuels were too low to carry fire (Burkhardt and Tisdale 1976, Vasek and Thorne 1977, Holmes *et al.* 1986, Miller and Rose 1995, Waichler *et al.* 2001). In addition, on the Modoc Plateau and as in Idaho (Miller *et al.* 2008), pre-settlement Western juniper stands occurred on sites that had soil too shallow for pine and fir, but productive enough for juniper to out-compete sagebrush and develop into juniper stands which would survive all but major wildfires.

During the past 100 to 150 years, the density of Western juniper in the Focus Area has increased dramatically. The historic increase of Western juniper over the last 150 years has been documented by many scientific studies (Miller and Wigand 1994, Knapp *et al.* 2001, Miller and

Tausch 2001, Miller *et al.* 2008) including some that have documented the increase within the Focus Area of this Restoration Strategy (*Section 3.2.2 Alteration of Historic Disturbance Regimes*). In a recent study of Western juniper in southeastern Oregon and southwestern Idaho, Johnson (2005) found that about 95 percent of Western juniper trees have been established since 1850. Miller *et al.* (2008) found that the current area occupied by juniper increased between 140 to 625 percent since 1860. The Lifeform analysis in the Focus Area found that the acres of greater than or equal to 21 percent juniper canopy closure increased 150 to 560 percent between 1946 and 1998.

Although western juniper can survive for 1,000 years or longer (Sowder and Mowat 1965), Miller *et al.* (2001 and 2008) estimated 10 percent or less of today's juniper woodlands are comprised of trees that were established prior to 1860. In comparing two FS surveys conducted during 1938 and 1988 across eastern Oregon, Gedney *et al.* (1999) reported a 600 percent increase in density and area during the 50-year period.

3.2.2 Alteration of Historic Disturbance Regimes

3.2.2.1 Livestock Grazing and Wildfire Suppression

Modification of fire regimes in the Focus Area has occurred because of two major human influences; domestic livestock grazing and wildfire suppression. Domestic grazing began in the late 1800's and increased during the first half of the 1900s (Pit River Watershed Alliance 2004). Domestic grazing altered the fire regime by reducing the fine fuels that carried frequent fires in the mountain big sagebrush communities. Studies have documented that fire regimes changed around 1900 (McKelvey and Busse 1996, Riegel *et al.* 2006). Several studies have concluded that there were significant declines in fires since the late 1800s in mountain big sagebrush communities in the Intermountain West (Miller and Tausch 2001). Additional studies have found that the decline in fires in the mountain big sagebrush communities occurred with and has a relationship to the early expansion of Western juniper in the late 1800s (Miller and Rose 1999, Miller *et al.* 2001 and 2008).

3.2.2.2 Alteration in Fire Regime

Fire regimes have changed as the density of the juniper woodlands and decadence in the sagebrush increased due to lack of fire. Fire suppression helped reduce the number and extent of fires. The change in natural fire regime intervals appears to be a long-term consequence of reduction of fine fuels caused by early grazing combined with fire suppression (*Section 3.4.1 Wildfire*) and resulting in increased vegetation density (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*).

3.2.3 Historical and Existing Data Comparison

The scientific literature provides support for the mosaic view of the sage steppe ecosystem within the Focus Area that is described above and how Western juniper has dramatically increased in density. Additional information was used to further define the changes of the ecosystem within the Focus Area. Several different data sources were used to estimate the range and extent of juniper in the Focus Area in 1870. Three main data sources were used to define the extent of juniper before changes in the fire regime altered the sage steppe ecosystem. They are:

- The Second Biennial Report of the California State Board of Forestry for the Years 1887-88 to Governor R.W. Waterman (BIR).
- U.S. General Land Office "Original Exterior Subdivisional Rectangular Surveys" (GLO).
- A set of 1946 black and white aerial photographs on file at the Modoc National Forest Supervisor's Office, History Archives.

Using the information from all three historical sources, it is apparent that in 1870 juniper occurred in stands or as individual trees throughout the Focus Area. A comparison of the 1946 aerial photographs with 1998 aerial photographs was completed to validate the increase in density of juniper in the Focus Area, similar to increases reported in the research literature.

The 1946 aerial photographs were compared to 1998 aerial photographs to determine how the distribution and density of juniper has changed in the Focus Area in the past 50+ years. These comparisons were accomplished using a methodology defined in the *Ecology Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007a).

The results of the juniper canopy cover analysis for the 10 randomly selected matched pairs of 1946 and 1998 aerial photos shows that the most dramatic change occurred in the ≥21 percent canopy class. Within this group of photos, the area of dense juniper increased between 1.5 to 5.6 times between 1946 and 1998. Overall, the area of the dense juniper (≥21 percent canopy class) increased an average of more than three times from 1946 to 1998. The individual results for each site are presented in the *Ecology Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007a). These results confirm the research that juniper has increased dramatically in density throughout the sage steppe ecosystem. Figures 10 and 11 display the differences of juniper density between 1946 and 1998 for one of the matched photograph pairs, which is typical of the results of the comparisons.

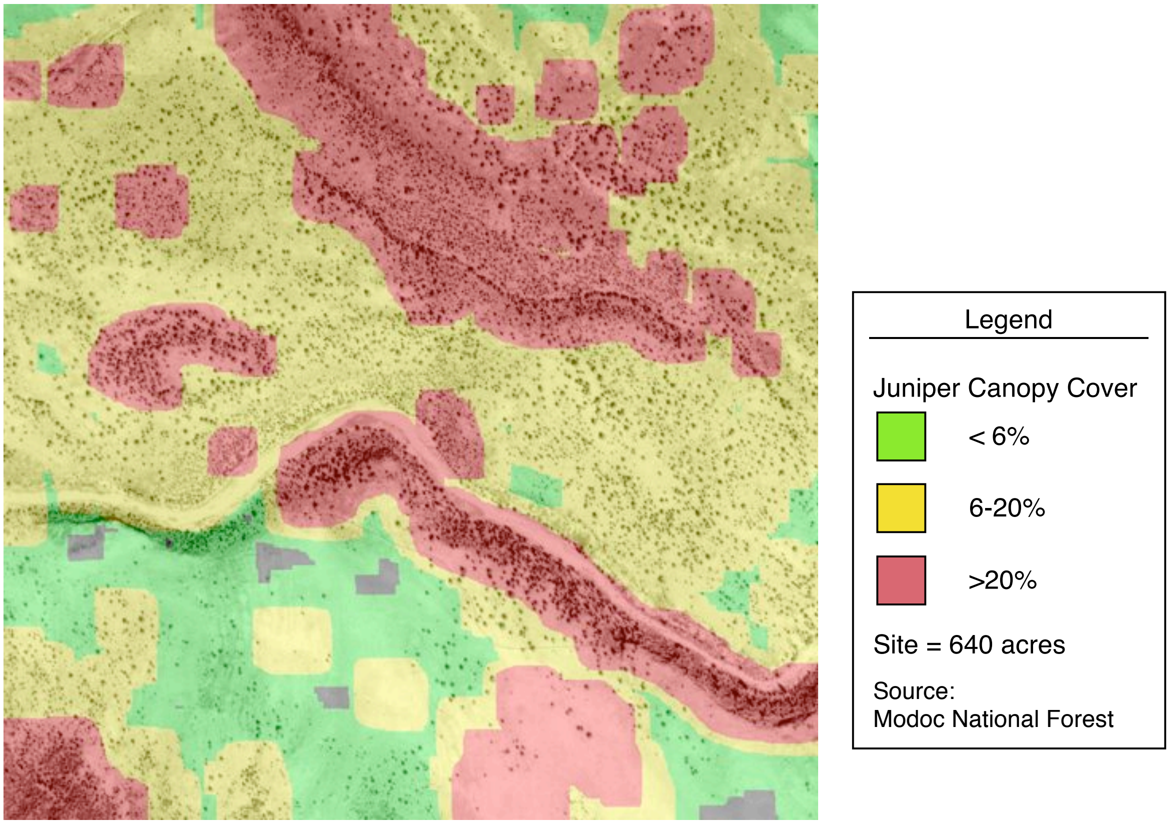

Figure 10. Juniper Density in 1946 at Site BIR_04

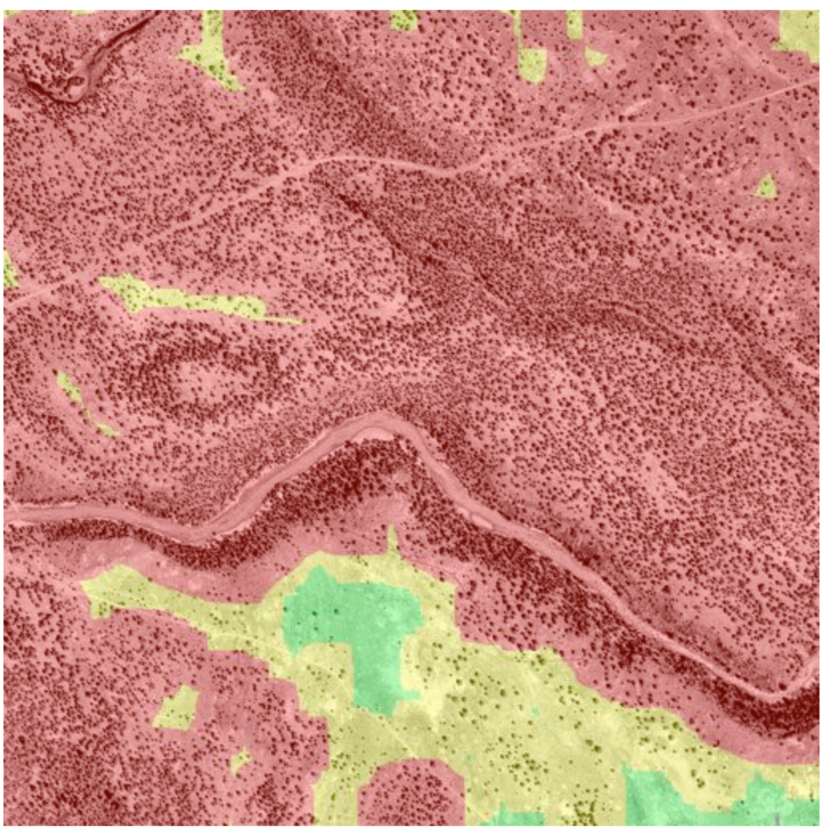

Figure 11. Juniper Density in 1998 at Site BIR_04

3.2.4 EXISTING VEGETATION IN THE SAGE STEPPE FOCUS AREA

Four primary existing vegetation types comprise the sage steppe Focus Area. CALVEG vegetation mapping and classification (USDA Forest Service 1981) was one method used to determine the extent of these vegetation types in the Focus Area. The existing vegetation was typed using dominant vegetation rather than the entire floristic composition. The CALVEG analysis provided an estimate of the four vegetation types in the Focus Area (Table 11), which are also displayed on Figure 12. Additional information on the use of CALVEG is found in the *Ecology Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007a).

Table 11. Primary Existing Vegetation Types in the Sage Steppe Focus Area (CALVEG)

Vegetation Type	Acres in Focus Area
Big Sagebrush	1,744,600 acres
Western Juniper	680,700 acres
Low and Black Sagebrush	150,200 acres
Aspen	15,400 acres

The analysis and mapping using CALVEG was completed at a landscape scale. The results on this scale are not appropriate for site-specific vegetation analysis. For any EIS alternative and the subsequent site-specific projects, site-specific analysis would be need to be completed at the project level.

There is substantial variability within the vegetation types identified in Table 11. These variables include: soils, aspect, slope, rainfall, elevation, vegetation composition, recent natural or human disturbances, presence of non-native invasive species and others. The application of appropriate management techniques depends on site-specific conditions (Miller *et al.* 2007).

One example of the variability in the Focus Area is within the big sagebrush vegetation type. The two main species of big sagebrush that dominate sites in the Focus Area are Mountain big sagebrush and Wyoming big sagebrush. One of the differences between these big sagebrush types is that Wyoming big sagebrush occurs on drier sites than Mountain big sagebrush. These drier sites will take longer to respond to restoration treatments than the wetter Mountain big sagebrush sites.

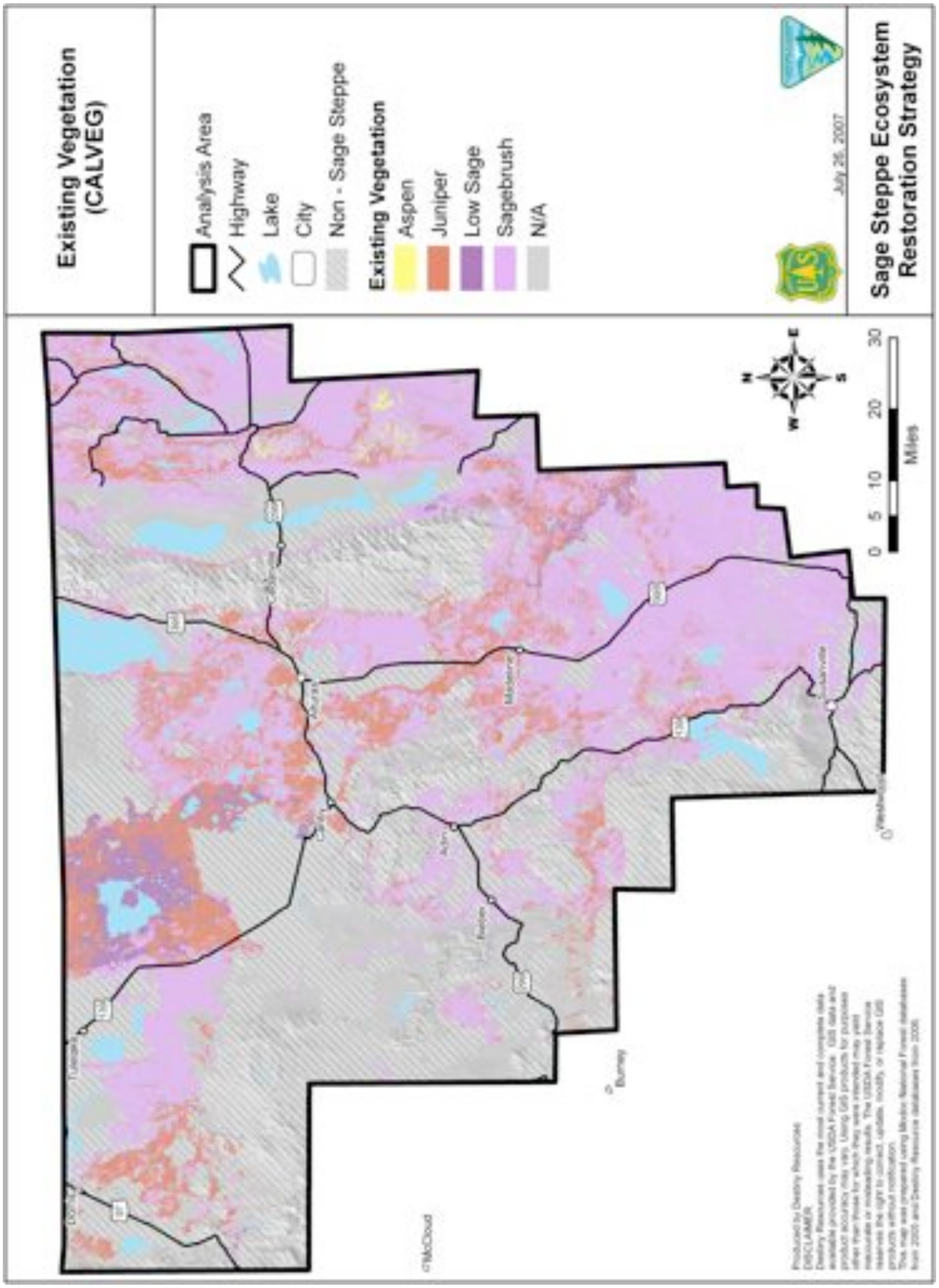

Figure 12. Focus Area Vegetation Types (CALVEG)

3.2.4.1 Big Sagebrush

Big sagebrush (*Artemisia tridentata*) is the dominant ecological community in the Focus Area, covering over 1,744,000 acres as of 1985 (Table 11). Big sagebrush is the most common and widespread sagebrush species in the region and is the dominant species in this vegetation type. The primary big sagebrush varieties found in the Focus Area are Mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) and Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*). Mountain big sagebrush are generally found at higher elevations and moister sites than Wyoming big sagebrush.

Figure 13. Typical Big Sagebrush Community

Big sagebrush often occurs in pure stands but may include other species of sagebrush, rabbitbrush (*Chrysothamus ssp.*), bitterbrush (*Purshia tridentata*) and others. The vegetation of a pristine shrub-steppe ecosystem is dominated by perennial bunchgrasses and widely spaced shrubs (Whisenant 1990). Numerous grass species may accompany the shrubs. The density of the stand may vary from scattered to closely spaced plants with touching crowns (Figure 13). Big sagebrush occurs in the Focus Area in areas where the soil depth is too shallow for pines, but deep enough for the establishment of sagebrush as well as Western juniper. Individual juniper trees are naturally found scattered in this vegetation type (Miller *et al.* 2005 and 2008).

3.2.4.2 Western Juniper

Western juniper occurs naturally as part of the sage steppe ecosystem throughout the Focus Area, as individual trees and juniper woodlands. This species can establish in areas of poor thin soils as well as more productive sites. It occurs at all elevations in the Focus Area. Areas that are considered juniper woodland habitats are characterized as woodlands of open to dense aggregations of Western juniper. There are currently 680,700 acres in the Focus Area that exist as juniper woodland habitat or vegetation type (Table 11).

Western juniper woodlands historically developed on sites with infrequent wildfires, where the trees could become established and could survive fires as mature trees in isolated juniper woodlands that, by circumstance, did not burn or experienced only infrequent wildfires. The lack of wildfire in these locations was the result of various factors, such as rocky rims and clay or alkali flats with little fine fuels. Western juniper also historically occurred on the Modoc Plateau, as in Idaho, on sites where the soils were too shallow for pine or fir but productive enough for juniper to rapidly out-compete sagebrush (Miller *et al.* 2008).

The density of juniper tree canopies determines the composition of the understory and, consequently, the diversity of other plant species that occupy these juniper woodland habitats. Wildlife diversity in juniper woodlands is directly related to the diversity and abundance of understory plant species (Miller *et al.* 2001 and 2008). On sage steppe sites with less than six percent canopy closure, the juniper generally does not have a significant affect on sagebrush and forb and grass vegetation. Sites with approximately 6-20 percent canopy closure are in transition from sagebrush-dominated ecosystems towards Western juniper woodlands. As the canopy closure increases above 20-30 percent, the grasses and shrub understory declines (Miller *et al.* 2001 and 2008) and, in some cases, bare soil prevails (Figure 14) and the site becomes juniper woodland.

Figure 14. Bare Ground under Dense Juniper in the Focus Area

Open habitats of less than 30 percent canopy closure of juniper normally have an understory shrub association of sagebrush and/or bitterbrush with forb and grass cover. However, once the canopy closure exceeds 30 percent, there is a 75 percent reduction in shrub understory (Miller *et al.* 2005 and 2008). Researchers have documented that Western juniper stands in sagebrush areas are associated with an increase in bare ground and a decrease in ground cover (Knapp and Soulé 1996, and Bunting *et al.* 1999). Under closed canopy Western juniper stands, the lack of ground cover on some sites increases the susceptibility of the site to increased erosion, sediment yield and loss of soil productivity (Pierson *et al.* 2002). Similarly, it has been noted by vegetation management specialists in the Focus Area (Aarstad pers. Comm. 2006) that a marked decline in density of sagebrush and forb and grass cover begins on sites with greater than 20 percent juniper canopy closure, particularly on drier sites.

These studies and observations demonstrate how the density of juniper has a direct impact on the balance and diversity of vegetation within the sage steppe ecosystem. The density of juniper cover in the Focus Area was quantified using "LifeForm", in order to get a more current determination than CALVEG of the existing densities of juniper in the Focus Area. "LifeForm" is a software application produced by the Decision Support Science Team of the Pacific Southwest Research Station, USFS. The results of this analysis (Table 12 and Figure 15) provide a more accurate depiction of the juniper canopy cover classes throughout the Focus Area than CALVEG. As shown in these results, in 1998, the Focus Area contained nearly 2.2 million acres with juniper at some measurable density. Within these 2.2 million acres, 680,700 acres are classified by CALVEG as Western juniper woodland vegetation type. The other areas with lower juniper densities are classified by CALVEG as big sagebrush, aspen or low sage (Table 11).

Table 12. Western Juniper Area by Canopy Cover in the Focus Area (Lifeform)

Western Juniper canopy cover (cc)	Acres in the Focus Area	Percent of the Focus Area
1-5% cc	845,100 acres	39%
6-20% cc	900,400 acres	41%
>20% cc	433,300 acres	20%
Total	2,178,800 acres	100%

The Western juniper densities across the Focus Area were classified into three canopy cover classes; areas with juniper canopy cover less than six percent, areas with six to 20 percent canopy cover and areas with greater than 20 percent juniper canopy cover. Juniper most commonly exists in the Focus Area in the six to 20 percent canopy cover class, although only slightly less area is found in the less than six percent canopy cover class. Dense juniper, >20 percent canopy cover, occupies over 433,000 acres, or nearly 20 percent of the Focus Area. Based upon historical information these canopy covers are significantly higher than what existed prior to 1870 and the increase in density of juniper has changed the dynamics and diversity of the sage-steppe ecosystem.

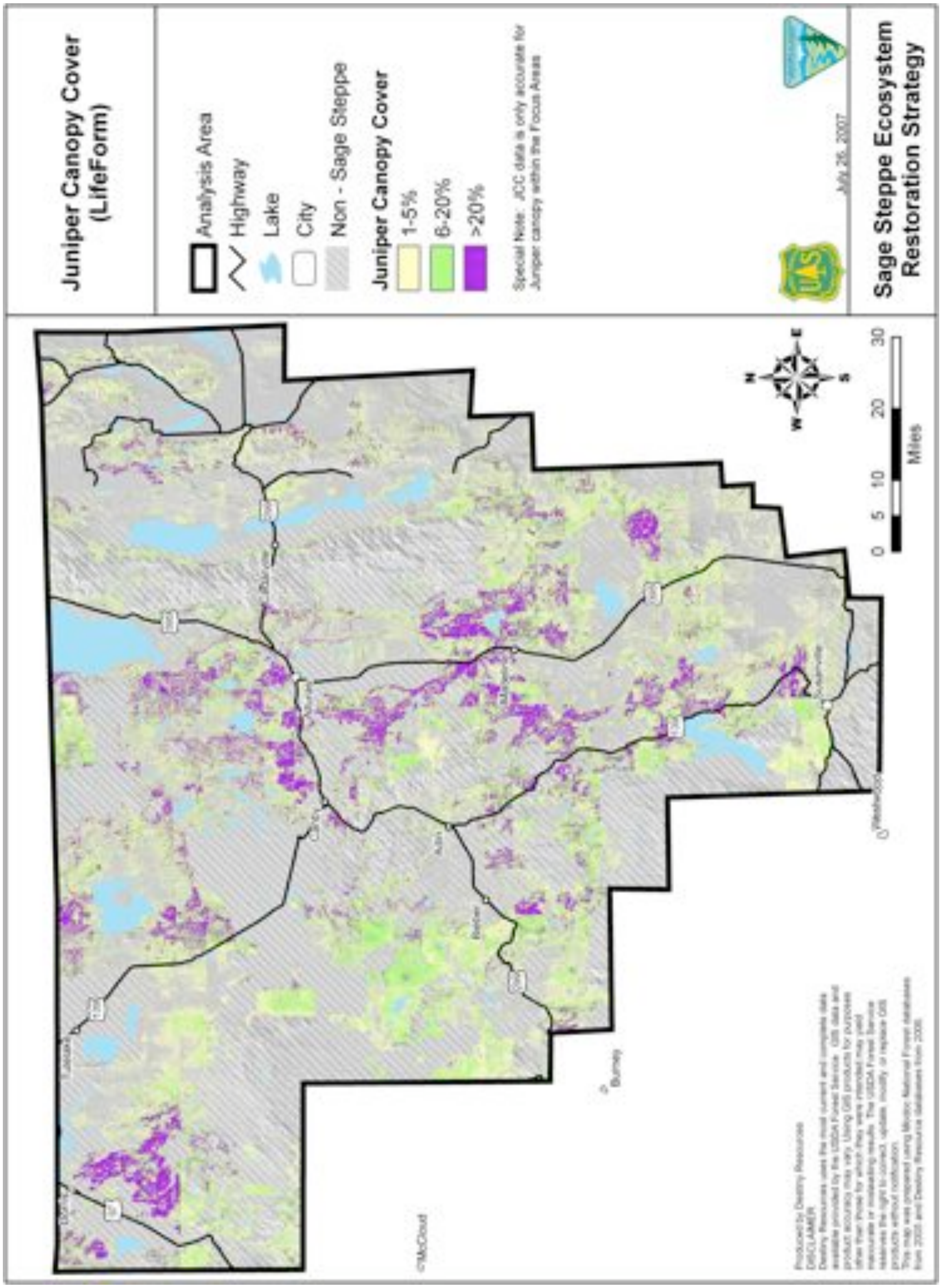

Figure 15. Focus Area Western Juniper Canopy Closure (Lifeform)

3.2.4.3 Low and Black Sagebrush

Low sagebrush and black sagebrush are together the third most dominant vegetation type in the Focus Area. These species grow on shallow soils with a restrictive layer of bedrock or clay pan. Low sagebrush is a wide-ranging species, found throughout the Great Basin (Figure 16). Low sagebrush dominated areas are usually found where the annual precipitation is between eight and 18 inches and between 4,000 to 9,000 feet in elevation (Munz and Keck 1959). Stands are usually found on shallow soils with impaired drainage in the transition zone between the wetter valley floor and open timber on the mountainsides (Hormay and Talbot 1961). Along the eastern flanks of the Sierra Nevada, from Inyo County northward through Modoc and Siskiyou Counties, low sagebrush communities are generally restricted to elevated arid plains.

Figure 16. Typical Low Sagebrush Community.

The low sage vegetation type differs from big sagebrush in that vegetative diversity is much greater and a rich variety of forbs are usually present (Young *et al.* 1977). It may be dominated by one or more species of sage, but is often in association with rabbitbrush, bitterbrush, or big sagebrush. The ground cover of grasses and forbs is typically sparse – between five to 15 percent coverage (Kuchler 1977). Low sagebrush is one of the most palatable sagebrushes for sage-grouse. Western junipers are usually only found in low sagebrush areas as scattered trees, due to the shallow soils and poor drainage.

Black sagebrush stands have similar characteristics. However, black sagebrush are present at higher elevations, ranging from 8,000 to 11,000 feet in elevation (Cheatham and Haller 1975). Black sagebrush is commonly associated with winterfat and Morman-tea. As of 1985, there were approximately 150,000 acres of low and black sagebrush in the Focus Area (Table 11).

3.2.4.4 Aspen Vegetation Type

Aspen communities occur in mesic sites where stands are primarily reproduced from rootstock cloning. They may occur in pure stands or in association with black cottonwood (*Populus trichocarpus*), willow (*Salix spp*.), or coniferous species. Western juniper has been increasing in density in many aspen stands in the Focus Area. There are currently approximately 15,400 acres of aspen or aspen/cottonwood stands in the Focus Area (Table 11).

Aspen are perpetuated by rootstock cloning, but originally come from seeds. Aspen suckering is often facilitated by fire or other disturbances. There is also evidence that aspen can regenerate without disturbance. The desire to sustain an aspen ecosystem lies in the benefits derived from them. Bartos (2001) lists a number of values attributable to the aspen ecosystem that include forage for livestock, habitat for wildlife, water for downstream users, aesthetics, recreational sites, wood fiber, and landscape diversity.

3.2.5 DISTURBANCE REGIMES IN THE SAGE STEPPE ECOSYSTEM

3.2.5.1 Historical Disturbance Regimes

The primary historic disturbance regime for the big sagebrush community was lower intensity understory fires (Miller *et al.* 2008). These types of wildfires occurred at intervals of about 12 to 70 years in the southwestern United States (Wright *et al.* 1979). The historical fires created a mosaic of successional stages across the sage steppe landscape. When fires occurred, sagebrush and scattered young juniper were generally killed setting the successional stage back to grasses and forbs. Sagebrush would reseed from plants on site or wind delivered from plants in other areas, taking up to 30 years to recolonize the site (Brown and Smith 2000).

Through time, Western juniper would have seeded into big sagebrush communities and become established as small-scattered juniper trees. Based upon the sagebrush fire return interval of up to 70 years, the small Western juniper trees would be killed in fires, along with the sagebrush, where they burned. The fire resistance of juniper varies with age. Juniper seedlings, saplings and poles are highly vulnerable to fire (Martin 1978). However, if they are not killed by fire, the juniper trees mature to the point of becoming somewhat fire resistant as they develop a thicker bark layer.

Generally, within the sage steppe ecosystems, the fire return intervals were frequent enough to prevent domination of a site by juniper. Sagebrush would more readily seed-in and develop faster than the juniper. Western juniper woodlands historically developed on sites with infrequent wildfires, where the trees could become established and could survive fires as mature trees in isolated juniper woodlands that, by circumstance, did not burn or experienced only infrequent wildfires. The lack of wildfire in these locations was the result of various factors, such as rocky rims and clay or alkali flats with little fine fuels. Western juniper also historically occurred on the Modoc Plateau, as in Idaho, on sites where the soils were too shallow for pine or fir but productive enough for juniper to rapidly out-compete sagebrush (Miller *et al.* 2008).

Sometimes burn circumstances alone would allow juniper to gain dominance on a big sagebrush site. In these circumstances, the lack of fire would allow the seedlings and saplings to grow into larger trees, increasing their fire resistance. As the juniper becomes denser on a site, the sagebrush understory and ground cover diminish (*Section 3.2.4.2 Western Juniper*). A denser stand of juniper can out-compete sagebrush and much of the understory for water, nutrients and light. This leads to the juniper becoming the dominant species on the site. Then the mature juniper woodland typically lacks sufficient fine fuel biomass and fuel continuity to carry fire under normal conditions to return the site to sagebrush.

The complex and interwoven elements of the sage steppe ecosystem resulted in a range of successional stages across the landscape with a constantly changing mosaic of grasses, different stages of sagebrush with scattered juniper trees and some dense juniper woodlands. Fire was the key disturbance factor that maintained this mosaic in the ecosystem. Burn patterns across the landscape would have been determined by fuel continuity, topography, wind, season of burn and ignition source.

3.2.5.2 Disturbance Regimes from Mid-1800s to Present

Beginning in the 1860s, settlement altered the disturbance regime. The first changes came with livestock grazing in the sage steppe ecosystem, which reduced the understory grass and forb communities. These understory communities provided the fine fuels that could carry more frequent fires. Sagebrush has since become more decadent, as this plant community has reached more mature successional stages. In areas where sagebrush overstories have become denser, the competition for light and moisture combined with grazing has continued to decrease the understory grass and forb communities that provided the fine fuels that could carry wildfire.

Fire suppression, which became effective in the mid 1900s, added to the decline of fire across the landscape, resulting in a reduction of the patchiness of different ecosystem age classes across the landscape as fewer areas were converted to grasses and forbs through fire.

Additionally, since the advent of effective fire suppression and livestock grazing, Western juniper has increased in density on sites previously dominated by mountain big sagebrush, bitterbrush, curl-leaf mountain mahogany, quaking aspen, and riparian communities (Miller and Rose 1995, Wall *et al.* 2001, Miller *et al.* 2000 and 2008). As the density of the juniper woodlands and decadence in the sagebrush increased due to lack of fire, the dynamics of fire across the landscape have changed. The major change has been a shift from more frequent fires of varying intensities to larger, more uniform fires. *Section 3.4.1 Wildfire* provides a more detailed discussion of this topic.

3.2.5.3 Disturbance Regimes in Low and Black Sage

In low and black sagebrush, grass productivity is often limited by adverse soil physical properties; therefore stands generally lack enough fine fuels to carry a fire. In addition to low fine fuel loading, wide shrub spacing makes fire infrequent in low and black sagebrush. On the Modoc plateau, low sagebrush burned less frequently than big sagebrush because of wide shrub spacing in low sagebrush types and possibly because of a less flammable herbaceous composition. Historical fire return intervals are estimated to be around 90 years (Miller and Rose 1999).

3.2.5.4 Disturbance Regimes in Aspen

Generally, fires in young aspen stands are low intensity surface fires unless there is a great deal of fuel on the forest floor. In older stands, particularly those that are breaking up, abundant fuel can lead to higher intensity fires (Peterson and Peterson 1992). The fire return interval for aspen in the Focus Area has a variable frequency, low to moderate and high intensity fire with a fire recurrence interval of 7-120 years.

Fires in aspen generally would have burned in summer and fall when dormant understory vegetation was dry enough to carry fire (Duchesne and Hawkes 2000). Thin barked aspen are vulnerable to even low intensity fire. These fires would have thinned or killed aspen trees and stimulated sprouting of the aspen clones (Brown and Smith 2000). Moderate-intensity fires stimulate the greatest amount of sprouting after fire, contributing to aspen's continued dominance on a site (Parker and Parker 1983). The resulting landscape in pure aspen cover types would have been a mix of fire generated age classes. Where fire thinned the aspen trees, a mixed aged stand would develop.

Miller *et al.* (2001) indicate lack of fire and grazing by ungulates are both key factors in the recent encroachment of western juniper and lack of aspen recruitment in communities throughout the northwestern Great Basin. The herbaceous component and age class distribution of aspen forests have been altered substantially due to grazing (Kay 1997, Bartos and Campbell 1998). Historically, the aspen understory would have been much more lush with grasses and herbaceous vegetation. Grazing likely has altered fire behavior in aspen stands (Bartos 2001) both by altering the species composition, possibly to less flammable species, and by reducing the amount of ground litter which could carry a lower intensity fire. In addition to livestock grazing; deer, elk and beaver that prefer aspen sprouts have had an affect on aspen stand structure and dynamics (Baker *et al.* 1997, White and Feller 2000). These factors combined have created conditions that are more favorable to juniper encroachment into aspen stands.

3.2.6 Noxious Weeds and Non-Native Plants

Noxious or invasive species are now widely recognized worldwide as posing threats to biological diversity, second only to direct habitat loss and fragmentation. Noxious weeds are known to alter ecosystem functions such as nutrient cycles, hydrology, and wildfire frequency, out-compete and exclude native plants and animals, and hybridize with native species. All natural communities are susceptible to invasion by noxious weeds especially following some kind of disturbance. The noxious weeds considered problematic in certain areas, as well as their locations, acreages, and priority for control can change in a short time period (within 2 years) as new noxious weeds are located, acreages of infested lands increase or decrease and management priorities change.

Within the Analysis Area, noxious weed infestations are small and scattered compared to other parts of the west. There are 35 invasive non-native plants infesting the Analysis Area, infesting less than 35,000 acres on federal land (*Botany Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2007b]). Twenty-eight of these plants are officially designated as noxious weeds by the California Department of Food and Agriculture (CDFA). The species of highest priority for treatment are the knapweeds, yellow starthistle, and Dalmation toadflax (USDA Forest Service 2004c).

Noxious weeds with the Analysis Area have been observed in many vegetation types (BLM *et al.* 2000). Riparian areas may be dominated by Canada thistle, spotted knapweed, and perennial pepperweed (USDA Forest Service 2004c). Dry communities are inherently vulnerable to invasion by many species of weeds including knapweeds and yellow starthistle. Approximately 20 percent of the Analysis Area receives less than 14 inches of annual rainfall. The highest risk levels for weed invasion into western juniper communities are in the warmer, lower elevation sites (less than 4,500 feet - Miller *et al.* 2005).

The distribution of native grasses within the Focus Area has been reduced by competition with introduced annual grasses, in particular cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*). Both species rapidly invade disturbed sites. Medusahead, the most widespread noxious weed in the Focus Area, has a low palatability and nutritional value to livestock and wildlife because of its high silica content. Western juniper woodlands at greatest risk of medusahead invasion are primarily on clay soils (Miller *et al.* 2005).

The vegetation of a pristine shrub-steppe ecosystem is dominated by perennial bunchgrasses and widely spaced shrubs (Whisenant 1990). If fires occur frequently, perennials will likely give way to a community dominated by cheatgrass and other annuals (West 1983). Species that are commonly displaced by cheatgrass include big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), bluebunch wheatgrass (*Agropyron spicatum* = *Pseudorogneria spicata*), western wheatgrass (*Agropyron smithii* = *Pascopyrum smithii*), Sandberg bluegrass (*Poa sandbergii* = *Poa secunda*), needle-and-thread grass (*Stipa comata* = *Hesperostipa comata*), and Thurber's needlegrass (*Stipa thurberiana*).

Cheatgrass can persist in unpredictable environments because seed germination is staggered from August until May. Cheatgrass has a compressed phenology and usually dries out and casts seeds by mid-June (West 1983). These dry plants can then provide fuel for wildfires. Cheatgrass seedlings can germinate after the first fall rain in infested areas (West 1983). This allows it to extract higher levels of soil moisture and nutrients than other grasses

Although cheatgrass competes with established perennial grasses for soil moisture, its adaptation and promotion of frequent fires are what gives it the greatest competitive advantage. Cheatgrass is well adapted to fire and often dominates plant communities after fire (Melgoza *et al.* 1990). Once established, cheatgrass-dominated grasslands greatly increase the potential and recurrence of wildfires. In many areas that have been invaded by cheatgrass the natural fire cycle has shortened from every 60-100 years to every three to five years (Devine 1998, Whisenant 1990). Not only are these areas burned more often, the fires are more uniform, with fewer patches of unburned vegetation remaining within the burns (Whisenant 1990). This wildfire cycle significantly reduces the ability of perennial grasses and shrubs to re-establish, and furthers the dominance of cheatgrass.

Most native herbaceous species found on the Modoc Plateau and in the Great Basin are capable of withstanding fire effects unless the fire burns very hot and kills the grass at the crown and roots. Herbivory by livestock and wild horses and burros, if not properly managed, can overuse herbaceous plants, resulting in their removal from the stand. This adverse impact can result in replacement of native perennial herbaceous species with invasive annuals. Off highway vehicle (OHV) use in herbaceous-dominated communities can be negligible; however, constant travel on identical tracks can remove the vegetation, creating opportunities for erosion or for invasive annuals to move into the site.

The persistence of annual grasses (primarily medusahead and cheatgrass) is attributable primarily to the ability of annual plants to produce seed every year, store many years of seed in surface litter and soil, and germinate earlier than the remaining perennial plants. The invasion and dominance of annuals was accelerated by the loss or reduction of native perennial bunchgrass/shrub communities. The experience of BLM technical staff indicates that annuals (primarily medusahead and cheatgrass) will persist, but that it is possible to slow or reduce their spread by applying appropriate grazing management techniques (Dolan pers comm.).

3.2.7 Special Status Plants

Special status plants include: 1) federal endangered, threatened, proposed, and candidate species; 2) state endangered, threatened, and rare species; 3) FS Sensitive and Watch list plants; and BLM Sensitive Species.

A total of 155 special status plants are known to occur within the Analysis Area. The list of special status plants includes one federally listed endangered species; one federally listed threatened species; one federal candidate species; two California-listed endangered species; and 32 CNPS List 1B plants. The *Botany Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007b) summarizes the habitats and known distribution of these species. Many of these special status plants are restricted to specific habitat types and elevations.

3.2.8 Climatic Changes

One of the factors that contributed to the increases in Western juniper density throughout the Focus Area was a wetter and milder period in the late 1800s through the early 1900s (Miller *et al.* 2005 and 2008, Soulé *et al.* 2004). This fluctuation in the climate resulted in a pulse of Western juniper seedling establishment and growth in the late 1800s through the early 1900s. Increased concentrations of CO_2 during the last half of the 20th century have been reported to have contributed to the increased density of Western juniper (Johnson *et al.* 1993, Knapp and Soulé 1996). These changes are part of the ecosystem dynamics that caused increases in Western juniper density in the sage steppe ecosystem.

However, as described in *Section 1.2.2 Historical Context – Landscape Changes in Vegetation Composition*, the increase in sites dominated by Western juniper in the sage steppe ecosystem since the late 1800s, while influenced by the climate of the late 1800s and early 1900s, was primarily due to two major human influences; severe domestic livestock grazing from the late 1800s to the 1930s and the associated changes in the fire regime; and later, through post World War II fire suppression. Prior to the late 1800s, low intensity wildfires carried by fine fuels played a major role in preventing juniper seedlings from becoming mature trees within much of the sage steppe ecosystem. Severe domestic livestock grazing in the late 1800s to the 1930s resulted in a reduction of fine fuels that would have carried these low intensity fires. Post World War II fire suppression further reduced the occurrence of low intensity fires in the sage steppe ecosystem.

More recent climate changes have included warmer temperatures (IPPC 2007) but not an increase in precipitation (CEC 2006a). Warmer temperatures combined with periods of drought have led to some increases in high intensity wildfires in the Analysis Area (JW Associates 2007f). Looking to the future, scientists are developing a range of models to predict future climate changes and their corresponding effects on ecological responses. However, the models acknowledge a high level of uncertainty in the predictions, especially when applied at a finer scale (CCSP 2007, CEC 2006b, Millar *et al.* 2007). Some current models indicate that future climate induced vegetation changes for the Modoc Plateau would include more grassland and fewer juniper woodlands and brushlands (CEC 2006b). Some models indicate that the quantity of fine fuels would decrease if climate change provides less precipitation, and conversely, the quantity of fine fuels would increase if climate change provides more precipitation; and that any potential increases or decreases in temperatures would only change the timing of when fine fuels dry out and become more flammable (Minnich 2006).

A draft report entitled, "*Preliminary review of adaptation options for climate-sensitive ecosystems and resources*" prepared by the US Climate Change Science Program (CCSP), was made available for public review and comment in the Federal Register from 21 August 2007-5 October 2007. "*This draft document is being released solely for the purpose of pre-dissemination peer review under applicable information quality guidelines. This document has not been formally disseminated by NOAA*." (Federal Register: August 21, 2007 (Volume 72, Number 161)). As described in the Federal Register, this document "*reviews the state of knowledge of adaptation options for key, representative ecosystems and resources that may be sensitive to climate variability and change. It is designed to serve resource managers and decision makers interested in using science to inform adaptation to the impacts of climate variability and change*." (Federal Register: August 21, 2007 (Volume 72, Number 161). Due to its draft status, direct quotation of this important document is not possible at time of this writing, however, throughout the draft document there is repeated emphasis on the need for resource managers to design future projects in a collaborative setting including a broad range of stakeholders and incorporating a Monitoring and Adjustment Approach in the face of uncertainty.

A recently published article by Millar *et al.* (2007) reflects the themes found in the CCSP draft document. "*Learning from experience and iteratively incorporating lessons into future plans (adaptive management in its broadest sense) is the lens through which natural resource management must be conducted (Spittlehouse and Stewart 2003, Stephens and Ruth 2005)*" (Millar *et al.* 2007). Millar *et al.* (2007) also state, "*A toolbox approach, from which various treatments and practices can be selected and combined to fit unique situations, will be most* *useful….A toolbox approach, recognizes that strategies may vary based on the spatial and temporal scales of decision-making. Planning at regional scales will often involve acceptance of different levels of uncertainty and risk than appropriate at local scales (Saxon et al. 2005).*" and "*Essential to managing for uncertainty is the imperative to learn-as-you-go.*"

At the national level, the agencies are initiating long-term climate change approaches to ensure that climate change science is integrated into agency policy and direction for ecosystem restoration and management. "*We must recognize that restoration and adaptation are inexorably linked -- adaptation informs restoration. Developing, testing, and applying knowledge and management tools will be the only way we can continue to provide ecosystem goods and services, and protect and enhance their values in a changing climate*." (USDA Forest Service 2007a)

3.3 Livestock Grazing

Agriculture, including ranching operations, ranks as one of the top three economic activities in the Analysis Area. Grazing on public lands is an integral part of many of these ranching operations. Ranchers typically use public lands for three- to six- month periods while their private property, not being used for grazing, is devoted to alfalfa and grass hay production for winter feed. Reductions in public land grazing disrupt the balance for ranchers and will usually reduce the number of livestock a rancher can support. Increases in Western juniper density over the past century have reduced livestock forage availability and has been a factor in a reduction in livestock numbers in the Analysis Area. Currently, it is estimated that the grazing lands throughout the Analysis Area are used to capacity.

3.3.1 Historic Rangeland Use

It is estimated that millions of livestock (sheep and cattle) were trailed from the Upper Sacramento River Valley through the Analysis Area and into Idaho and Montana during the 40 plus years prior to the start of the 20th century. The livestock would often lay over in Surprise Valley for rest and feed enroute, and to serve the burgeoning mining communities in that part of the country (Journal of the Modoc County Historical Society, No. 2-1980, Sheep Drive, Loring White). These trailing herds would often number as high as three to four thousand head of sheep, and cattle herds in the 1,000 to 1,500 head range. During this period, small homestead and ranching operations sprang up in the upper Pit River and Surprise Valley, which ultimately competed for available livestock forage with the large trailing operations. Around the start of the 20th century, sheep became the largest constituent of livestock in the area. Overgrazing prompted settlers to petition the U.S. government to create the Warner Mountains and Modoc Forest Reserves in 1904, which later became the Modoc National Forest in 1908. The transient use had increased to the point of jeopardizing local range allotments and the local livestock economy (Pit River Watershed Alliance 2004). During World Wars I and II, livestock use increased dramatically on public lands. From 1914 to 1920, sheep use was higher due to the demand for wool and mutton to supply the armed forces. Cattle demand increased after World War I.

In addition to sheep and cattle, there was a large horse industry on the public lands from about 1890 until after World War I. Many horses continued to use the range up to the passage of the Taylor Grazing Act in 1934.

Stocking rates were increased somewhat during the period of 1939–1946 in response to the needs of World War II. Many allotments were split into smaller units, numerous sheep allotments were converted to cattle allotments and many range improvements were implemented during this period. These range improvements included the addition of water sources for better livestock distribution and to make upland areas more suitable for grazing. In an effort to correct the overgrazing of the previous decade, the FS conducted a significant number of plantings and seedings. Little attention was given to the use of native seed, and seed mixtures used for reseeding were largely exotic. The seed mix most commonly used included crested wheatgrass (*Agropyron cristatum*), common timothy (*Phleum pretense*) and smooth brome (*Bromus inermis*). It also was common in this period to eradicate riparian vegetation (willows and aspens) in an attempt to maximize forage production.

During 1950–1970, permanent reductions in the number of livestock were made on most allotments in the Modoc and Lassen National Forests. Seasons of use were also reduced during that time and uneconomical allotments were abandoned. Many of these were sheep allotments, because sheep had previously used lands unsuitable for cattle grazing.

The Alturas, Eagle Lake and Surprise Field Offices of the BLM portions of the Analysis Area have been grazed by livestock over the same period of time. Excessive grazing from the late 1800s to the 1930s altered plant composition and productivity of the rangelands. Many of today's problems, including soil losses and vegetation changes, are more a result of earlier grazing practices than current use. Livestock reductions on adjacent National Forest System lands moved livestock onto public domain lands (now BLM administered). Additionally, claims of historical grazing use on public domain lands during the priority years (1929-1934) by applicants for permanent grazing rights were used to establish grazing levels under the Taylor Grazing Act of 1934. BLM lands in this Analysis Area were substantially overstocked by 1938, when the last applications were accepted, and remained so until the adjudication period in the 1960s. Livestock numbers were reduced during this adjudication, and portions of the forage allocations were subsequently redistributed for wildlife use within the Analysis Area.

The increasing density of juniper was a contributing factor in the reductions in livestock numbers on both the National Forest and BLM lands in the 1950s and 1960s. However, the density increases have become an even more significant factor in livestock reductions since the early 1970s (*Section 3.2.2 Alteration of Historic Disturbance Regimes*).

3.3.2 EXISTING CONDITION FOR LIVESTOCK GRAZING

The Modoc National Forest covers 1.6 million acres, a large percentage of the 6.5 million acre Analysis Area. Domestic livestock (cattle and to a minor extent, sheep), wildlife (deer, antelope and elk) and wild horses all utilize the range on the Modoc National Forest. According to the Modoc National Forest LRMP (USDA Forest Service 1991a), the Modoc National Forest currently provides 122,500 AUMs of domestic livestock grazing use, which represents 23 percent of the permitted livestock forage use in the Analysis Area (Table 13). Approximately 63 percent (1 million acres) is rangeland, of which 900,000 acres (90 percent) are suitable for grazing. The 1990 and 2030 goals for AUMs on the Modoc National Forest are 117,400 and 123,700, respectively. As of 2005, there were 77 active allotments (84 in 1991) with one horse permit, nine for sheep, and the remaining for cattle. Additionally, eight deer and five pronghorn herds use the Forest. Their forage requirements are allocated in the Plan as well. After the passage of the Taylor Grazing Act in 1934 and up to the present time, horses continue to be a major use of range in some allotments. The Plan calls for maintaining the wild horse population between 275 and 335 animals within a 258,000-acre wild horse territory.

Table 13. Analysis Area Livestock Grazing Allotments

Landownership	Number of Allotments	AUMs
Modoc National Forest	77	122,500 AUMs
Shasta-Trinity National Forest[1]	1	393 AUMs
Klamath National Forest[2]	12	6,408 AUMs
Alturas Field Office	155	54,015 AUMs
Eagle Lake Field Office	56	52,250 AUMs
Surprise Field Office	49	92,465 AUMs
Totals	350	328,031 AUMs

[1]Less than 0.2% of the restoration treatments are planned on the Shasta-Trinity National Forest. The one allotment listed is only partially within the Analysis Area.

[2]About 2% of the restoration treatments are planned on the Klamath National Forest. The number of allotments include some partial allotments.

When the Modoc National Forest LRMP was implemented in 1991, most of the Forest's permanent rangeland, or 582,000 acres, was in satisfactory ecological condition, meaning the current range condition is '*excellent with a static trend or fair with static or upward trend, with a diversity of herbaceous, shrub, and forest vegetation*'. A total of 342,000 acres were considered to be in unsatisfactory ecological condition, described as livestock grazing conditions in poor to very poor with static or declining trend. The areas in unsatisfactory ecological condition were due to a variety of causes including poor management of livestock, competition of livestock with wildlife and wild horses and extensive increases in juniper density due to historic grazing practices and suppression of naturally occurring fires.

Portions of the Shasta/Trinity, and Klamath National Forests are included in the Analysis Area. Allotments on the Klamath National Forest are mostly on the Goosenest Ranger District.

The Alturas, Eagle Lake and Surprise Field Offices of the BLM comprise 2,746,800 acres of the Analysis Area. Of the 503,045 acres of BLM-administered lands within the boundaries of the Alturas Field Office, 456,909 acres (91 percent) are presently in grazing allotments. Within these allotments, 54,015 AUMs are available for permitted animals and present permits allow for 53,108 active AUMs. All of the BLM-administered lands within the Surprise Field Office area are presently included in grazing allotments. Within these allotments, 92,465 AUMs are available for permitted animals. Of the 1,022,767 acres of BLM-administered lands within the boundaries of the Eagle Lake Field Office, 987,779 (97 percent) are currently in grazing allotments. Within these allotments, 52,250 AUMs are available for permitted animals.

For the Surprise allotments in 2005, roughly 15-20 percent meet all standards for rangeland health while approximately 25 percent do not meet all standards, with recent livestock grazing a primary cause, but with progress being made towards meeting standards. An additional approximate 20 percent do not meet all standards, with recent livestock grazing a primary cause, but no progress is being made towards meeting standards. The balance of the allotments have not been assessed.

BLM and National Forest rangeland is divided into grazing allotments, which are further divided into pastures. Within the allotments, animal movements are controlled through the use of pasture fences, drift fences, locations of water sources and active herding practices. "Rest-rotation" management is being applied, in an approach in which pastures are grazed in one season and ungrazed in one or two subsequent seasons. Livestock are moved in and out of allotments and between pastures by trucks or overland "drives."

Livestock grazing resources that support grazing activities include vegetation as well as components such as water, minerals, and cover. The carrying capacity for grazing animals of a particular given area of rangeland, described in terms of AUMs, consists of the number of animals that can be supported by the range while meeting required standards. The relative composition and quality of forage species, in concert with animal food preferences, contributes to quantification of the carrying capacity (Heady and Child 1994).

3.4 Fire/Fuels

For thousands of years prior to the Euro-American settlement in the 19th century, fire played a major role in the shaping and maintaining of ecosystems across the landscape. Lightning was the major source of ignitions for wildfires. Native Americans also used fire to burn areas for many uses (Pit River Watershed Alliance 2004). The frequency and extent of fires was of such magnitude that dead and down fuels, and fuel ladders, rarely developed sufficiently to support the generation of crown fires. Perennial grasses provided the fine fuels that carried fire across the land. Fires typically were of light to moderate intensities, variable sizes, with relatively consistent fire return intervals.

In the early part of the 20th century, conditions began to change as settlers began grazing cattle and suppressing natural wildfire (*Section 3.2.1 Historical Vegetation Patterns*). These actions interrupted the natural rhythm of fire and fire return intervals (USDA Forest Service 2006). Heavy, unregulated cattle and sheep grazing began in the mid-1800s, affecting the quantity and distribution of the widespread perennial grasses (fine fuels), which had been the principal component carrying wildfire in grasslands. In some places, native perennial grasses were replaced with introduced annuals and weed species. Wildfires began to change in character; they became larger in extent and exhibited more intense and damaging fire intensity, sometimes leading to long-term ecological changes. In recent history, catastrophic fire events have become even more common from late 1990s into 2004 (USDA Forest Service 2006).

Human-caused fires increased with the settlement of lands in northeastern California. The Modoc National Forest found that approximately 23 percent of all fires from 1910 to 1979 were human caused. Fire prevention activities have increased since the mid-1900s, which has reduced the numbers of human caused fires. This reduction is attributed to intensive public education programs (USDA Forest Service 1991a).

In 2000, responding to presidential direction, the federal agencies developed the National Fire Plan (NFP) to address the catastrophic fires that were occurring, reduce wildfire impacts on rural communities, and ensure adequate levels of firefighting resources in the future (USDA Forest Service 2000b). Both the BLM and FS have been implementing the NFP since 2000. One of the NFP top priorities calls for the change of existing fuel levels and providing increased protection of rural communities referred to as "Communities At Risk". These communities are defined within an area called the "Wildland Urban Interface" (WUI). Typically the WUI has flammable vegetation near or in close proximity to improvements (homes, businesses and other structures) at risk of being damage or destroyed by wildfire.

3.4.1 WILDFIRE

The effects that any given fire could have on the land are highly variable because of the factors that determine a fire's severity and extent, including ground fuels, weather, moisture content of the fuels, etc. Severe fires cause greater impacts to the landscape than low intensity ground fires or mixed severity fires. High intensity fires can damage soils, increase sediment delivery to streams, reduce habitat for some plant and wildlife species, and degrade air quality. A high intensity fire, which is much more difficult to control than low intensity fire, may also have a higher monetary cost for suppression, and may present a risk to lives and structures. As the WUI has expanded, so have the risks of these types of losses.

The California Department of Forestry (CDF) and the FS have collaborated to assemble Fire Perimeters data. These data consists of CDF fires 300 acres and greater in size and USFS fires 10 acres and greater throughout California from 1950 to 2002 (Table 14). An examination of these data shows that they are comprised of almost entirely forest fires within the Analysis Area. Therefore, fires on BLM and other fires within the sagebrush and grassland components of the sage steppe are not part of this database. Forest fire data show an apparent trend towards increased average acres burned per year over the last 100 years. This trend would include fires in dense juniper. Even though weather cycles play a role with wet and dry years and even decades, the current fire events are considered to be outside the normal type, extent and intensity of fire. This apparent trend appears to be a long-term consequence of the altered fire regimes caused by early grazing, fire suppression, increased vegetation density (*Section 3.2.2 Alteration of Historic Disturbance Regimes*) and the interruption of the natural fire return intervals.

Table 14. Total Acres Burned and Average Annual Acres Burned by Decade[1]

Decade	Total Acres Burned	Average Acres Burned/Year
1910-1919	69,891	6,989
1920-1929	95,906	9,591
1930-1939	89,606	8,961
1940-1949	124,218	12,422
1950-1959	192,580	19,258
1960-1969	42,706	4,271
1970-1979	184,053	18,405
1980-1989	58,088	5,809
1990-1999	206,690	20,699
2000-2004	113,088	22,618[2]

[1]Data source: http://www.fs.fed.us/r5/rsl/projects/frdb/layers/fire.html. An examination of these data shows that they are comprised of almost entirely forest fires within the Analysis Area.

[2]Note: There are only five years in this period and not the typical ten years in the decade.

3.4.2 Current Vegetative Conditions and Fire

Historically, the vegetation patterns and structures in the Focus Area were heavily influenced by wildfire (*Section 3.2 Vegetative Conditions*). The composition, structure and patterns of grasses, shrubs and forestlands evolved with and were shaped by the frequency and intensity of fires. In turn, climate, weather patterns, and vegetation or cover type determined the frequency of fire on a site. In some of the grassland areas, periodic fires occurred with a return interval of every decade or less. In big sagebrush, the fire return interval varied between 12 to 70 years, depending on species of sagebrush and site conditions (Appendix A). Areas such as the low sagebrush did not have enough productivity to often sustain a fire (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*).

The historical fire patterns of more frequent low to moderate intensity fires maintained juniper at low densities in most of the area with scattered areas of dense juniper woodlands. The landscape would be a variety of age classes and have vegetative diversity.

As the ecosystem continues to change, the types of fires that could occur would likely differ from historical conditions due to changes in the horizontal and vertical vegetative structures in the Analysis Area. Larger, more continuous areas of dense juniper would exhibit more intense fire behavior.

3.4.3 Fire Regimes

Fire regimes are described in terms of frequency and severity, and represent pre-settlement historical fire processes generated for the period from around 1500 to just prior to the mid-1800s. Fire Regimes I and II represent frequent fire return intervals. Fire Regime I represents a frequent, low severity fire in intervals of 0-35+ years. This Fire Regime occurs mostly on forested land. Fire Regime II represents frequent stand replacement fires, also at intervals of 0-35+years. This Fire Regime occurs primarily on grasslands and shrublands. Fire Regimes III, IV, and V have longer fire return intervals and occur on forestlands, shrublands, and grasslands (USDA Forest Service 2002). Table 15 presents the Fire Regime descriptions as developed by Hardy *et al.* (2001) and Schmidt *et al.* (2002).

Currently, four of the five Fire Regimes are found within the Analysis Area and Focus Area (Table 16). This information is based on landscape scale information.

Table 15. Fire Regime Descriptions[1]

Fire Regime	Description
I	0-35 year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced).
II	0-35 year frequency and high (stand replacement) severity greater then 75 percent of the dominant overstory vegetation replaced.
III	35-100+ year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced).
IV	35-100+ year frequency and mixed severity (greater than 75 percent of the dominant overstory vegetation replaced).
V	200+ year frequency and high (stand replacement) severity.

[1]General Technical Report RMRS-GTR-87. 2002. USDA Forest Service.

Table 16. Acres by Fire Regime[1]

Fire Regime	Analysis Area	Focus Area
I	1,451,570 acres	524,309 acres
II	0 acres[2]	0 acres[2]
III	3,049,542 acres	2,406,051 acres
IV	311,832 acres	226,067 acres
V	16,103 acres	185 acres

[1]Data source: http://frap.cdf.ca.gov/data/frapgisdata/select.asp

[2]It is likely that some Fire Regime II is found in the Analysis Area and Focus Area based upon field experience and more site-specific data. The acres in Fire Regime II are likely included in the Fire Regime I acres.

3.4.4 Condition Classes

Condition classes describe the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Several factors may have caused this departure from historical conditions including fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects and disease (introduced or native), or other past and present management activities.

The existing Condition Classes within the Analysis Area and Focus Area (Table 17) show that the majority these areas are in Condition Class 3. This indicates that much of the area has been significantly altered from its historical range and that the risk of losing key ecosystem components is high. The Condition Classes confirm that the Analysis Area and Focus Area are outside of the historical range for fire regime and return interval. The descriptions of Condition Classes are presented in Table 18.

Table 17. Acres by Condition Class[1]

Condition Class	Analysis Area	Focus Area
1	476,878 acres	286,485 acres
2	1,437,678 acres	853,753 acres
3	3,023,148 acres	2,035,211 acres

[1]General Technical Report RMRS-GTR-87. 2002. USDA Forest Service.

Table 18. Condition Class Descriptions[1]

Condition Class	Attributes	Example management options
Condition Class 1	Fire regimes are within or near an historical range. The risk of losing key ecosystem components is low. Fire frequencies have departed from historical frequencies by no more than one return interval. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	Fire regimes have been substantially altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. Vegetation attributes have been substantially altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

[1]General Technical Report RMRS-GTR-87. 2002. USDA Forest Service.

3.5 Air Quality

The Analysis Area air basin is characterized as having "crisp, clean mountain air" (USDA Forest Service 1991a). Air quality of the basin, as recognized under the Federal Clean Air Act standards, is considered to be excellent. However, the Reno area heavily impacts the southern portion of Washoe County air quality conditions, which affects the eastern part of the Analysis Area. The Focus Area is north of the Reno area and in the more open desert terrain found in the northern part of Washoe County. The air quality for this open area is similar to that of Modoc County, which is excellent.

Air quality is measured against various standards that have been determined by State and Federal Agencies. In order to determine that air quality is meeting the applicable standards (attainment), seven recognized pollutants are measured against the standards. The seven pollutants are: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), lead, sulfur dioxide, PM10 and PM2.5. Of these pollutants, five are of major concern in the Focus Area. These include PM10 and PM2.5, O_3, CO, and NO_2. Wildfires, prescribed fires, wood stove and fireplace burning produce smoke that contain both PM10 and PM2.5 particulate matter but of differing levels. Sources of CO are automotive (mobile) and industrial activities (stationary), which are found throughout the Analysis Area. Stationary sources include factories, power plants, and agricultural burning. Mobile sources of pollution include automobiles, trucks, buses, and various types of recreational vehicles. Mobile sources are primarily responsible for the decrease in air quality in Northern California (Center for Economic Development 2005).

PM2.5 and PM10 – Particulate matter measuring over 2.5 or 10 microns in diameter. Concentrations are measured in micrograms per cubic meter at ground level. Sources of PM2.5 or 10 include cars and trucks (especially diesels), fireplaces, smoke from wildfires and prescribed fires, woodstoves, and windblown dust. The increase of respiratory disease, lung damage, and possible death in extreme cases, may likely occur with overexposure to PM2.5 or 10.

CO – Carbon monoxide. Ground level concentrations are measured in parts per million. Sources include all entities that consume fuel by burning. Some examples include all internal combustion engines (i.e. cars, trucks, construction and farming equipment), residential heaters and stoves. Over exposure to CO can cause chest pain in heart patients, headaches, nausea, reduced mental alertness, and even death at very high CO levels.

NO_2 – Nitrogen dioxide. Ground level concentrations are measured in parts per million (See carbon monoxide for sources). Overexposure to NO2 can cause lung damage.

O_3 – Ozone. Concentrations are measured in parts per million. Examples of sources include cars and trucks (especially diesels), industrial sources such as chrome plating, neighborhood businesses, such as dry cleaners and service station, and building materials and products. Overexposure to O3 can cause difficulties with breathing and increased risk of lung damage.

3.5.1 Regulation of Air Quality

The Clean Air Act defines national ambient air quality standards (NAAQS). These standards identify the acceptable levels of pollutants above which the effects are detrimental to public health or welfare (Table 19). The California Air Resources Board (CARB), through its authority, delegates the regulatory and monitoring requirements to the local Air Pollution Control Districts (APCD) for the state. In Nevada, the Nevada Bureau of Air Quality (NBAQ) is the responsible agency for the regulatory and monitoring requirements.

Table 19. Current Federal and State Ambient Air Quality Standards[1]

Pollutant	National Standards	California Standards
Ozone	0.12 ppm (1-hr avg) 0.08 ppm (8-hr avg)	0.09 ppm (1-hr avg)
Carbon Monoxide	9.0 ppm (8-hr avg) 35.0 ppm (1-hr avg)	9.0 ppm (8-hr avg) 20.0 ppm (1-hr avg)
Nitrogen Dioxide	0.053 ppm (annual a.m.)	0.25 ppm (1-hr avg)
Sulfur Dioxide	0.03 ppm (annual a.m.) 0.14 ppm (24-hr avg) 0.5 ppm (3-hr avg)	0.04 ppm (24-hr avg) 0.25 ppm (1-hr avg)
Lead	1.5 µg/m^3 (calendar qtr)	1.5 µg/m^3 (30-day avg)
Particulate Matter (PM10)	50 µg/m^3 (annual a.m.) 150 µg/m^3 (24-hr avg)	20 µg/m^3 (annual a.m.) 50 µg/m^3 (24-hr avg)
Particulate Matter (PM2.5)	15 µg/m^3 (annual a.m.) 65 µg/m^3 (24-hr avg)	12 µg/m^3 (annual a.m.) 65 µg/m^3 (24-hr avg)

[1]Source: California Air Resources Board, www.arb.ca.gov/aqs/aaqs2.pdf, July 9, 2003
ppm = parts per million
a.m. = arithmetic mean
µg/m = micrograms per cubic meter

Federal land management agencies follow the appropriate agricultural burning and smoke management guidelines and reporting processes when using prescribed fire. In addition to applying state and federal guidelines the BLM and FS follow their respective manual direction and requirements. Records are maintained to account for the amount of vegetation fuels burned and these records are submitted on a quarterly basis to the County Air Pollution Control (CAPC).

3.5.2 Class 1 and Class 2 Airsheds

Under the Clean Air Act, three air quality classes were established. Class I airsheds include wilderness exceeding 5,000 acres, and National Parks exceeding 6,000 acres. The Class I airsheds have the most stringent restrictions on the amount of pollution that can be added into the airshed under the provisions of the Prevention of Significant Deterioration program (PSD). Class

I airsheds are the "cleanest" areas and receive special visibility protection. They are allowed very limited increases (increments) in sulfur dioxide and particulate matter concentrations in the ambient air over baseline concentrations (USDA Forest Service Manual 2580.5). Two areas in the Analysis Area are designated as Class I. One is the South Warner Wilderness located in the Modoc National Forest and in the eastern side of the Analysis Area. The other is the Lava Beds Wilderness in the Lava Beds National Monument, located in the northwest corner of the Analysis Area. In the Analysis Area, all areas that are not classified as Class I are designated as Class II, including wildlands and urban areas (National Wildfire Coordination Group 2001).

The Analysis Area air basin is in a remote area. The area experiences little effects from the ozone pollution that typically flows in from urban areas. Therefore, the entire air basin is in an attainment status for state standard levels of ozone. As population centers in the Analysis Area continue to slowly grow, pollution from particulate matter (PM10) could become a more common problem (Center for Economic Development 2005). However, as seen in Figure 17, the most recent period from 2002-2003 does not indicate any days exceeding the allowable level of PM10 particulate matter for this air basin. This can be compared to the period from 1994 to 2001 when during six of the eight years, more than 10 days per year exceeded the state PM10, 24 –hour standards. In 1995 and 1999, 54 and 30 days, respectively, exceeded the standard.

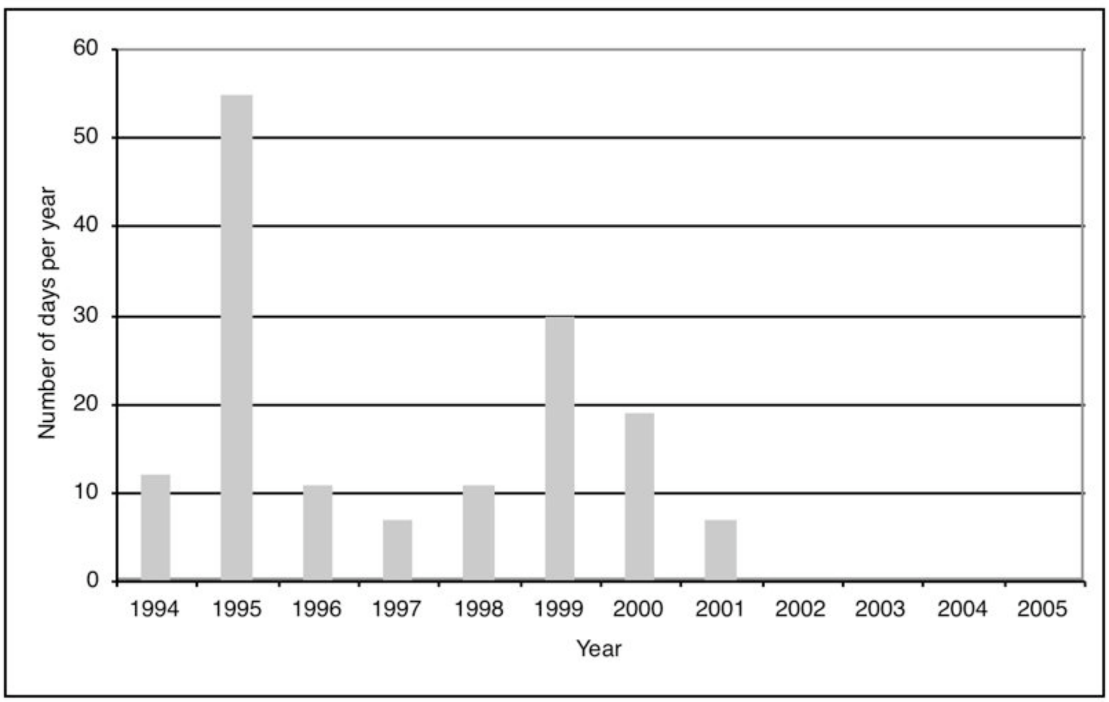

Figure 17. Number of Days Exceeding State PM10 24-hour Standards in the Analysis Area Air Basin

If an air basin exceeds the allowable levels for one or more of the above four pollutants, the state may impose limitations on existing industrial operations and types of new industrial facilities proposed to be built in the area (Center for Economic Development 2005).

3.5.3 AIR QUALITY OF FOCUS AREA

Modoc County typifies the quality of air found in the Northeast Plateau Air Basin and within the Focus Area. As discussed above, its remote location prevents the ozone pollution that typically flows in from urban areas found in the valleys of central California. As a result, the entire basin has reached attainment for state standard levels of ozone. Particulate matter (PM10) is a more common problem for Modoc County. The levels of PM10 found in the county are due in large part to smoke emissions generated by stoves and fireplaces during the winter months. Table 20 presents information on PM10 concentrations in Modoc County from 1993 through 2005. This table shows the Maximum 24 hour concentration and the number of days that State and National 24-hour standards were violated. In 2002 through 2005, the county air quality did not exceed state or federal standards (Table 20).

Table 20. Modoc County PM10 Summary – Maximum 24 hour Concentrations and Days Above State and National 24 hour Standards.[1]

Measure ($\mu g/m^3$)	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Max. 24-Hr. Concentration	0	101.0	78.0	74.0	97.0	62.0	94.0	79.2	66.6	0.0	0.0	0.0	0.0
Max. Annual Geometric Mean	0	25	25	17	18	15	22	17	16	0	0	0.0	0.0
Days Above State 24-Hr. Std.	0	13	54	12	6	12	30	18	6	0	0	0.0	0.0
Days Above Nat'l 24-Hr. Std.	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0

[1]Source: California Air Resources Board, Measurements taken in Alturas at W. 4th Street. PM10 Particulate matter under10 microns in diameter. Ground level concentrations are measured in micrograms per cubic meter.

PM10 pollutants are often generated by residential burning in population centers. However, another source of similar pollution is from the burning of vegetation on BLM and FS lands. Burning occurs from prescribed fire operations such as logging slash disposal, site preparation for reforestation, and livestock grazing improvement projects. Suspended particulate matter (PM10 and PM2.5) can be a major concern when wildfires occur. As with residential burning, prescribed fire and wildfires are seasonal in nature. Winter is the season when smoke is generated from residential stoves and fireplaces. Prescribed burning projects typically occur during the fall and spring periods when burns can be managed under appropriate weather conditions that allow for acceptable smoke dissipation. Wildfires usually occur during the summer and early fall periods. Smoke dissipation from wildfires is unmanageable and dissipates in the direction of wind patterns existing at the time.

Land management activities that use mechanical treatments generate particulate emissions from the use of internal combustion engines. The types of particulate matter include the release of dust, soot and other bits of tiny small solid materials into the air. These sources include the burning of diesel fuel in vehicular equipment and road construction. These pollutants exist when operations are ongoing, which is nearly year-round because access is usually not limited seasonally.

3.6 Soil Resources

3.6.1 Soil Characteristics

Climate, vegetation, geologic parent material, relief, aspect, age of landforms, and disturbance history determine soil characteristics. The Analysis Area has considerable variety in these factors, resulting in considerable variability in soil characteristics. The Analysis Area is composed of three ecological subregions; the Modoc Plateau, Southern Cascades and Northwestern Basin and Range. The Modoc Plateau comprises the majority of the Analysis Area.

3.6.2 Erosional Processes

The climate of much of the lower elevation areas of the Analysis Area is semiarid. Sheet erosion accounts for the highest sediment yields in semiarid environments like the Analysis Area, although accelerated channel erosion can also occur (Leopold 1966). Soils in semiarid areas are particularly susceptible to erosion (Langbein and Schumm 1958). In environments that are more arid, even though vegetative cover is extremely sparse, rainfall occurs too infrequently to cause significant long-term erosion. Conversely, in areas that are more humid, increased vegetative cover successfully protects soils by reducing runoff and erosion. In areas with semiarid conditions, vegetative cover is sparse but rainfall occurs more frequently than in drier climates. These conditions create naturally high erosion rates (Langbein and Schumm 1958). However, although much of the Analysis Area is in a semiarid climate, soil erodibility hazard is generally low to moderate. The lower soil erodibility hazard is partially because slopes in the Analysis Area are predominantly low to moderate. Nearly 85 percent of the Analysis Area has slopes of less than 20 percent (Table 21 and Figure 18). These shallow slopes are an important factor in the low to moderate overall erosion potential.

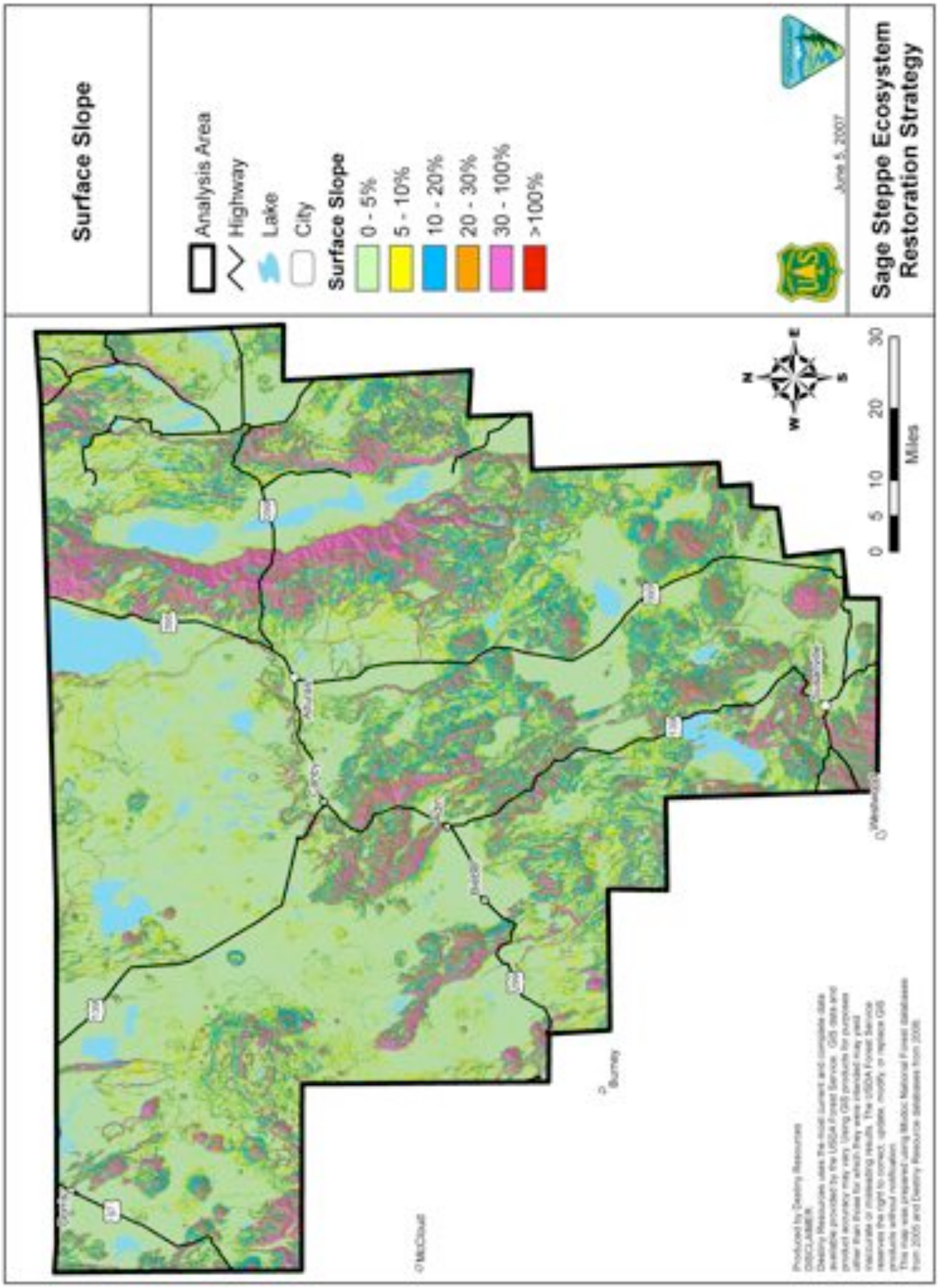

Figure 18. Analysis Area Surface Slope

Table 21. Land Slope of the Analysis Area

Slope (percent)	Area (acres)	Portion of Total Area	Cumulative Area
0-5	3,347,539	51 %	51 %
5-10	1,026,726	16 %	67 %
10-20	1,119,356	17 %	84 %
20-30	554,102	8 %	92 %
30-100	502,946	8 %	100 %
>100	1,157	0 %	100 %
Total	6,551,826		

Vegetative cover also affects soil erodibility. Based on research in areas with comparable conditions, greater vegetative cover generally provides greater stability for soils. Higher elevation forest and herbaceous vegetation with greater groundcover generally provides more stability to underlying soils than lower elevation shrub and herbaceous vegetation with lower groundcover (Pierson *et al.* 1994, Simanton and Emmerich 1994).

Canopy cover and standing biomass are inversely proportional to erosion and are generally regarded as the primary factors influencing erosion (Blackburn *et al.* 1994). The amount and type of vegetation on semiarid rangelands spatially influence the microenvironment, surface soil characteristics, and erosion rates. Shrubs have a stronger influence on the factors that control erosion than grasses do. As a result, shrubs create spatially distributed microsites that function as water collection and sediment deposition areas with extremely low erosion rates. Except during the most extreme rainfall events, these shrub influenced microsites generally do not experience erosion. The majority of the erosion occurs in the spatially distributed spaces between these vegetation types (Blackburn *et al.*1994). The effect of vegetative cover on soil stability is particularly evident after high-intensity rainfall events (Martinez-Mena *et al.* 2000)

3.6.3 Disturbance Processes and Effects on Soil Erosion

The primary historic disturbance process that affected soils and contributed to erosion in the Analysis Area was fire. In general, fire can have serious consequences for soil resources, depending on location and severity. High severity fires tend to significantly reduce the amount of duff (the decomposed organic layer on the surface of the soil below the vegetative groundcover), cause losses in soil nutrients, and heat the soil (Harvey *et al.* 1989, Hungerford *et al.* 1991). Water and sediment yields may increase as more of the forest floor is consumed (Robichaud and Waldrop 1994, Soto *et al.* 1994, Wells *et al.* 1979). If a fire consumes the duff and organic layers of the soil, exposing the mineral soil below, infiltration and water storage capacities of the soil are greatly reduced (Robichaud 1996). This effect increases overland flow and therefore, surface erosion. Therefore, severe fires generally increase runoff and subsequent erosion of soils (McNabb and Swanson 1990).

Intense fires can produce hydrophobic (water-repellent) layers, as volatilized products from the organic matter move from the burning layer to the underlying soil (DeBano *et al.* 1976). Hydrophobicity will dramatically decrease soil infiltration as the water repellent layers form, increasing surface runoff. During formation, volatile organic molecules diffuse down into the soil, where they cool, condense, and form a compound that coats soil particles and fills pore spaces. Fires generally produce more developed hydrophobic layers in coarser textured soils than in fine-grained soils, and in soils with a greater amount of organic matter, higher soil temperatures, and lower moisture content.

Range fires can influence the physical evolution of the land surface in semiarid areas (Bierman and Gillespie 1991). These rapidly moving fires generally heat soil and rocks for only several minutes in most locations. The heating intensity of these fires tends to be spatially heterogeneous, and therefore, the physical effects of these fires vary across the landscape. By removing vegetation and accelerating physical weathering, fire influences soil structure by breaking existing rocks into smaller fragments (Bierman and Gillespie 1991).

3.6.4 Fire Suppression and Vulnerability of Soils to Fire

The susceptibility of soils to the potentially severe effects of intense wildfire varies throughout the Analysis Area. At lower elevations, in dense Western juniper stands for example, soils are at relatively high risk of exposure to unnaturally intense wildfires. In these areas, soils would be affected more than they would have been affected under historic conditions because the vegetation is susceptible to more intense fires than historically.

The most significant factor influencing the extent of soil erosion following wildfire in the Analysis Area is the intensity of rainfall that follows over the first few years. Soil erosion could be significant following a relatively low-intensity fire if heavy precipitation destabilizes the surface and carries eroded sediment downhill. Conversely, soil erosion could be minimal following high intensity fires if the following precipitation is gentle enough to enhance vegetative recovery without destabilizing the soil.

Based on the well-documented effects of wildfires, the areas that are most vulnerable to fire include relatively erodible soils, particularly in areas where the fire risk is higher than it was historically. Fine-grained soils are the types of soils that are less susceptible to erosion. The extent of soil erosion following fires also depends upon the amount of cover left on the site.

3.6.5 Prescribed Fire

In general, the impacts of prescribed burning are significantly less damaging to soil resources than the effects of intense wildfires. Management strategies can improve physical and hydrological soil characteristics by creating mosaic patterns of areas with contrasting hydrological properties (Fitzjohn *et al.* 1998). Mosaic patterns created during prescribed burning may prove effective at reducing runoff and erosion in semiarid watersheds.

Although intense wildfires produce the most dramatic adverse impacts to soil resources, prescribed fires may also produce hot spots with increased potential for surface runoff and erosion. In the Analysis Area, soils are most vulnerable when burned in late fall before the rainy season. Prescribed burns that occur in the spring tend to produce fewer impacts from runoff and sediments because vegetation re-establishes before the rainy season, providing soil surface protection. Significant seasonal and yearly differences in impacts to soils may occur because of differences in precipitation levels and intensities, irrespective of a burn.

3.6.6 Soil Erosion Hazard

Soil K factors represent a relative index of susceptibility to particle detachment and transport by rainfall as compared to bare, cultivated soil. A K factor of one would indicate the same susceptibility as a plowed, unvegetated field. This quantitative measure of soil erodibility and runoff potential is based primarily on the percentage of silt, sand, and organic matter, soil structure, rock fragments, and soil permeability. There are two types of K factors, Kw and Kf. Kw represents the K factor of the whole soil, including rock fragments, and Kf represents the K factor of the fine fraction of the soil. For the purposes of determining the potential erodibility of different soils after disturbance, this analysis uses the Kw factor. By definition, Kw factors range from 0.02 to 0.69 (Wischmeier and Smith 1978). Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. In the Analysis Area, Kw ranges from 0.02 to 0.64, representing the variability in soil conditions over this 6.5-million acre area.

Slopes are the second factor in soil erosion potential with steeper slopes having higher soil instability. Slopes range from less than five percent to over 100 percent in the Analysis Area.

Table 22 presents the criteria for rating the Analysis Area for potential soil erodibility. The ratings of low, moderate and high reflect the relative probability of soil erosion following surface disturbance. Each soil hazard rating provides a relative measure of the potential susceptibility of the landscape to surface erosion if disturbed, rather than a measure of actual soil erosion or sediment delivery. If disturbed, soil erosion could be prevented on even high potential soil erodibility soils with appropriate mitigation measures. In many areas, soil erosion that occurred following disturbances would be redeposited on hillslopes, resulting in no sediment reaching a stream channel.

Table 22. Criteria for Determining Potential Soil Erodibility

Percent Slope	Kw Factor		
	Kw < 0.2	0.2 < Kw < 0.35	Kw > 0.35
0-20	low	low	moderate
21-40	low	moderate	high
40-50	moderate	high	high
>50	severe	severe	severe

Potential soil erodibility in the Analysis Area is predominantly moderate. The high potential erodibility areas correspond with steeper upland slopes (Figure 19). The data show that nearly 70 percent of the Analysis Area is in the Slight to Moderate potential soil erodibility categories (Table 23) and that the Severe category only accounts for two percent of the Analysis Area. The "No Tabular Data" category is comprised mostly of rock outcrops.

Table 23. Analysis Area Potential Soil Erodibility

Erodibility	Area	Percentage of Area
Slight	1,867,210 acres	29 %
Moderate	2,527,017 acres	39 %
High	863,893 acres	13 %
Severe	144,872 acres	2 %
No Tabular Data	1,147,416 acres	18 %
Total	6,550,408 acres	

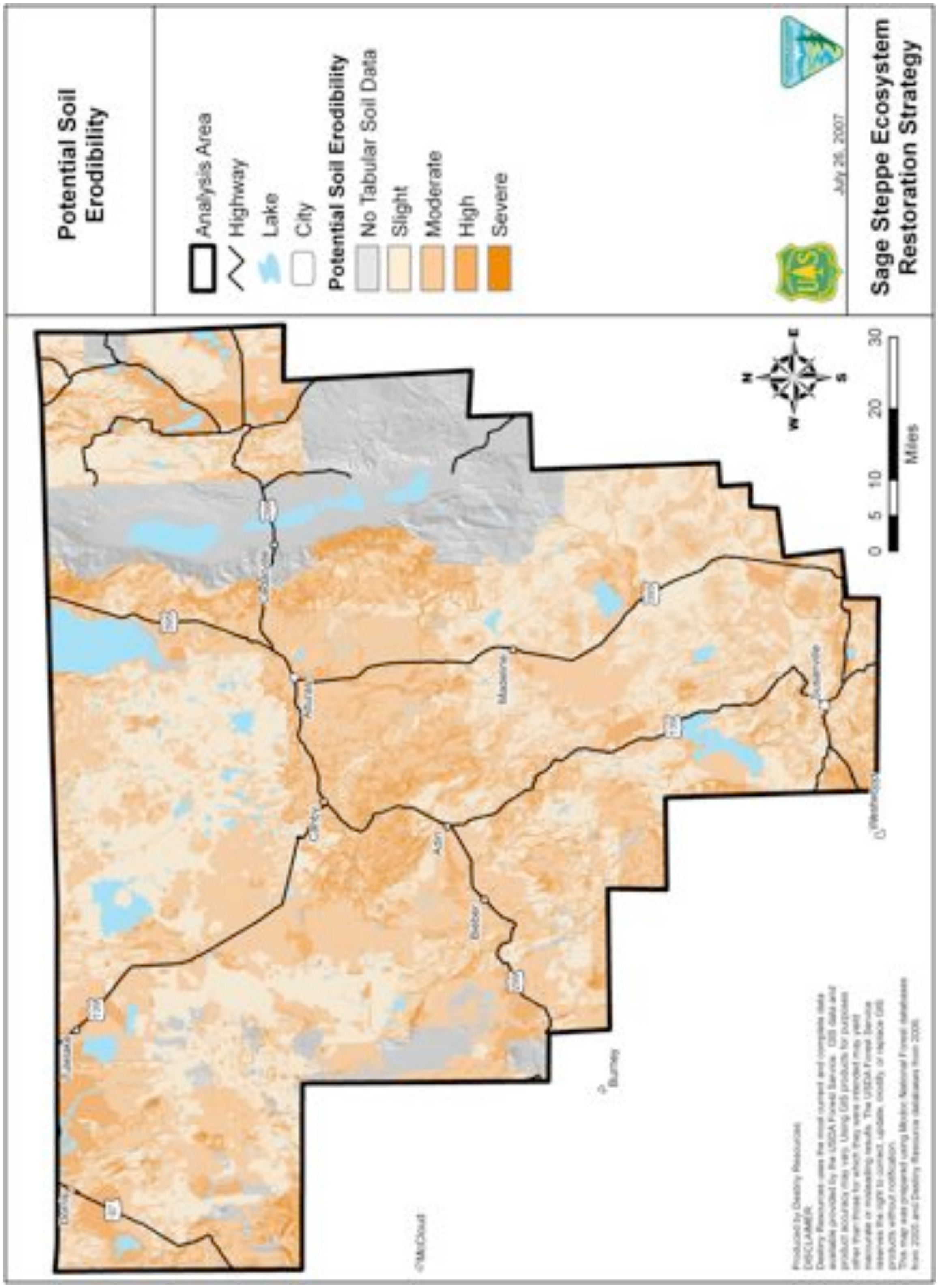

Figure 19. Analysis Area Potential Soil Erodibility

3.6.7 NUTRIENT CYCLING

Nutrient cycling is an important function to understand for the Sage Steppe Ecosystem Restoration Strategy. Restoration activities that result in loss of nutrients from the treatment area could have a negative impact on the ability of the restoration to be successful.

The main plant nutrients in forests and grasslands are generally nitrogen (N) and Phosphorus (P) although site productivity may also be limited by moisture (Austin *et al.* 2004). Nitrogen (N) is an essential plant nutrient but is highly water soluble and therefore can be transported off a site, reducing that location's productivity. In semi-arid environments, nutrient availability can vary widely depending upon the available moisture (Bates *et al.* 2002). In general, nutrients are held in plant tissues, mineralized in the soil, or solublized in soil moisture or ground water. In sage steppe: trees, shrubs, grasses, and other plants tend to increase soil nutrient content beneath them (Charley and West 1977). These resource islands may be transient in nature but show that standing biomass affects the nutrient status of the site (Stubbs and Pyke 2005).

Prescribed fire has been shown to release nutrients (Kauffman *et al.* 1994). Because fire is a natural part of these ecosystems, the plants that occupy a site following fire depend on that nutrient flush to establish. Mechanical removal of juniper is not part of the natural disturbance regime and therefore current research is investigating its affect on nutrients. In the most recent study, juniper removal has been shown to not change the soil nutrient content (Stubbs and Pyke 2005) and was similar to sites that were burned after the initial flush of nutrients. In another study (Bates *et al.* 2002) N increased following juniper cutting. However, these two treatment methods can result in different forms of N being available to plants that would grow after treatment (Stubbs and Pyke 2005). One of the reasons that juniper removal does not affect the soil nutrient content is that juniper has relatively low N and P content in its branches and leaves (Bunderson and Weber 1986). Also, in semi-arid environments, soil mineralization tends to dominate during dry periods (Kramer and Green 1999) and plants receive a flush on nutrients during wet periods (Bunderson and Weber 1986, Stubbs and Pyke 2005).

3.7 Watersheds

The USGS has a standardized system of delineating and classifying watersheds by hydrologic unit code (HUCs). The Analysis Area contains 16 "fourth level" watersheds (or 4th-HUCs). These fourth level watersheds typically range from 500,000 to 1,000,000 acres. Table 24 displays the Analysis Area's 4^{th} level watersheds. These 16 watersheds are part of larger watershed basins that are also displayed in Table 24 and on Figure 20. The watershed basins are used in this document to describe the various watershed characteristics of the Analysis Area.

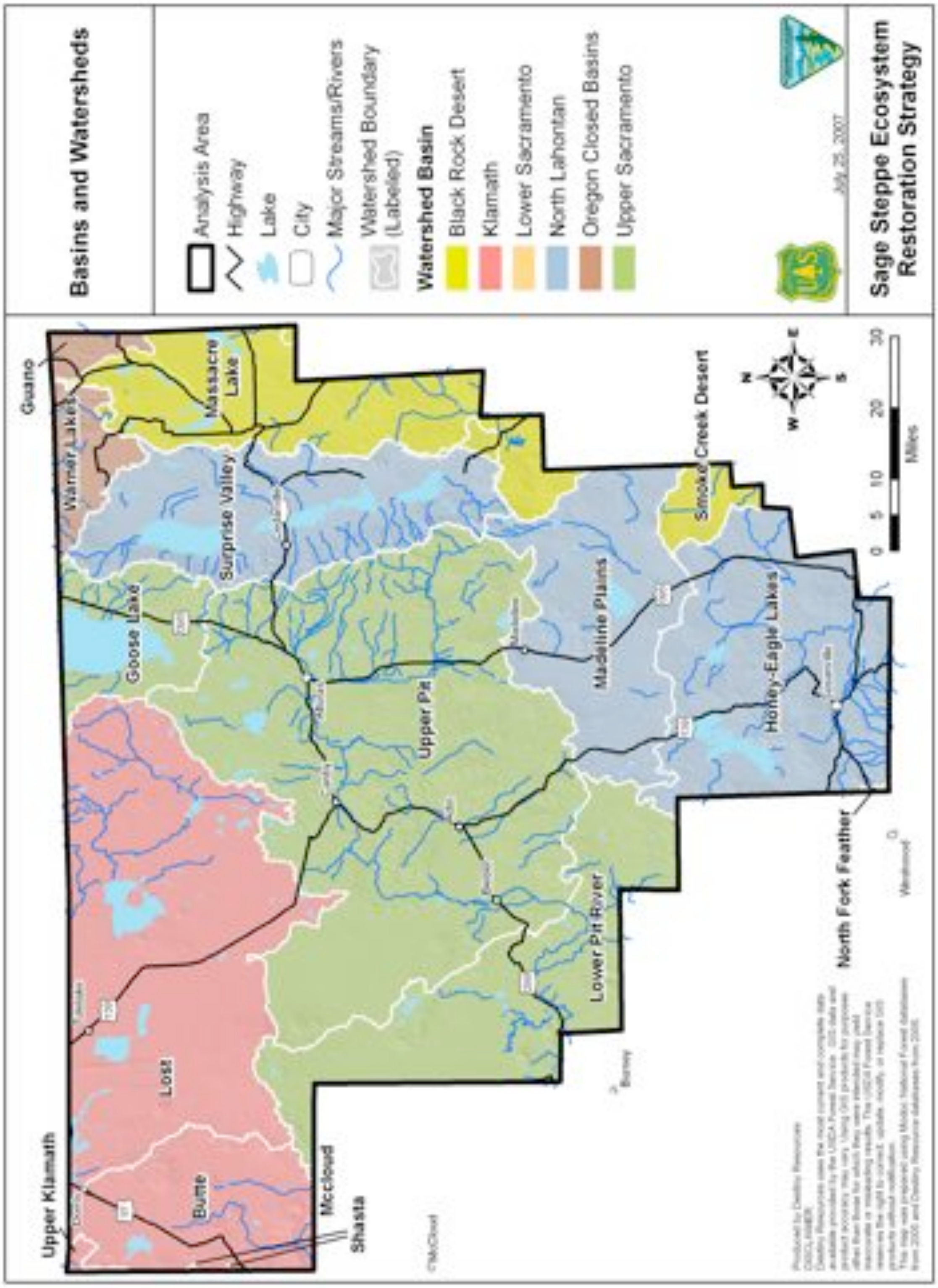

Figure 20. Analysis Area Watersheds and Basins

Table 24. Watersheds and Basins in the Analysis Area

HUC Code	4th Level Watershed	Basin	Watershed Area
16040203	Smoke Creek Desert	Black Rock Desert	72,239 acres
16040204	Massacre Lake	Black Rock Desert	522,906 acres
		Basin Total	595,146 acres
17120007	Warner Lakes	Oregon Closed Basins	113,556 acres
17120008	Guano	Oregon Closed Basins	40,241 acres
		Basin Total	153,798 acres
18010204	Lost	Klamath	1,092,959 acres
18010205	Butte	Klamath	354,904 acres
18010206	Upper Klamath	Klamath	10,706 acres
18010207	Shasta	Klamath	1,537 acres
		Basin Total	1,460,106 acres
18020001	Goose Lake	Upper Sacramento	232,692 acres
18020002	Upper Pit	Upper Sacramento	1,716,791 acres
18020003	Lower Pit	Upper Sacramento	611,207 acres
18020004	McCloud	Upper Sacramento	1,266 acres
		Basin Total	2,561,956 acres
18020121	North Fork Feather	Lower Sacramento	2,008 acres
18020122	East Branch North Fork Feather	Lower Sacramento	113 acres
		Basin Total	2,121 acres
18080001	Surprise Valley	North Lahontan	576,236 acres
18080002	Madeline Plains	North Lahontan	515,525 acres
18080003	Honey-Eagle Lakes	North Lahontan	697,479 acres
		Basin Total	1,789,240 acres

3.7.1 WATER QUALITY

The greatest potential effects from the restoration activities are sediment yield and sedimentation. Therefore, this section will focus on the existing conditions for sediment yield and sedimentation.

3.7.1.1 Sediment Yield

Erosion is the removal of soil particles by wind, water and ice. Sediment yield occurs when soil leaves the site and enters a water body. Sediment yield from forest restoration activities is generally a concern in areas of intense disturbance such as skid trails, landings and roads (Megahan and Kidd 1972). Best Management Practices (BMPs), when properly applied, can be very effective at minimizing erosion from forest harvesting activities (Megahan and Hornbeck 2000).

Road surface erosion and the use of unsurfaced roads is a potentially significant erosion problem especially where roads are hydrologically connected to streams (USDA Forest Service 2001a). The use of unsurfaced roads may cause rutting, increasing the potential for sedimentation to streams. Road surface erosion can be significant where roads are surfaced with native materials, especially if the native materials have a high erosion potential (Walkinshaw and Santi 1996), and where there has been insufficient road drainage planning. Roads that are surfaced with gravel or pavement are generally less susceptible to surface erosion (USDA Forest Service 2001a).

In the Analysis Area, some roads cross over stream channels or are adjacent to them. Due to their proximity, these roads generally have the highest potential to contribute sediment to streams. When streamflow exists, it has easy access to the sediment generated by vehicle traffic.

3.7.1.2 Sedimentation

Sedimentation occurs when the sediment yield is transported to and deposited in a stream. Watershed cumulative effects from sediment are an important concern in managed watersheds (Megahan and Hornbeck 2000). Sediments that reach the stream system can stay in the channel for years and create instream sediment sources that may have impacts at the site and downstream. Riparian vegetation provides a wide variety of benefits to stream systems, including providing shade to control stream temperature, root strength to maintain stream banks, and input of nutrients that form the base of many aquatic food webs (Bisson *et al.* 1987). Riparian areas can also serve as filters for sediment generated upslope. Areas around streams have been designated as special management areas by land management agencies and generally have a management emphasis that prioritizes retention or enhancement of riparian dependent resources. This approach has been shown to be very effective in moderating cumulative watershed effects (Thomas *et al.* 1993).

Roads are the primary contributors of sediments to streams in managed watersheds (Rothacher 1971, Megahan and Kidd 1972, Sullivan and Duncan 1981, Swanson *et al.* 1981, Reid and Dunne 1984, Amaranthus *et al.* 1985, Rice and Lewis 1986, Swift 1988, Bilby *et al.* 1989, and Donald *et al.* 1996). Roads can impact the ecological integrity of a watershed in many ways. Roads can affect a site's productivity by removing and displacing topsoil (USDA Forest Service 2001a). Improperly constructed roads and roads built across unstable or marginally stable areas can fail, potentially resulting in habitat destruction (USDA Forest Service 2001a). Roads built on erodible soils and an improperly planned road drainage network can impair the water quality in nearby streams (USDA Forest Service 2001a). Under-sized culverts or bridges can wash out (USDA Forest Service 2001a) causing erosion and sedimentation.

3.7.2 Water Quantity

There has been interest in increasing water yield by vegetation treatments since early in the 1900s. The first watershed study designed to evaluate water yield increases was the Wagon Wheel Gap watershed study started in 1909. Bosch and Hewlett (1982) found 94 watershed studies that had some water yield component. Several literature reviews of these studies (Baker 1999, Megahan and Hornbeck 2000, MacDonald and Stednick 2003, and Schumann 2005) have been conducted recently due to renewed interest in the potential for increased water yield from landscape restoration treatments. The results of Hibbert's (1967) summary of 39 watershed studies have basically remained unchallenged:

- Reduction of forest cover increases water yield
- Establishment of forest cover on sparsely vegetated land decreases water yield
- Response to treatment is highly variable and, for the most part, unpredictable

One of the basic conclusions is that the higher the precipitation, the larger the water yield increases (Megahan and Hornbeck 2000). Also, the magnitude of water yield increases tends to decline following treatments due to revegetation. The other common finding of these studies is that the level of treatment required to achieve and sustain water yield increases may be in conflict with other resources objectives (Megahan and Hornbeck 2000). In other words, the intensity and extent of vegetation treatments required to generate sustained, increased water yields may not be acceptable within the context of integrated resource management.

3.7.3 Watershed Basin Conditions

The discussion of watershed conditions is divided into basins listed in Table 24. The Lower and Upper Sacramento basins are combined in this discussion.

3.7.3.1 General Watershed Characteristics

Since settlement, the major influences on hydrologic characteristics of the streams in the Analysis Area have been water diversion, grazing, increasing density and maturity of vegetation, and to a lesser extent, road building. Timber harvest and vegetation manipulation can affect hydrologic characteristics by: decreasing the level of evapotranspiration, ground cover, and shading; changing snowmelt dynamics; and increasing groundwater recharge. Fire was the dominant disturbance agent, which has been suppressed since the early part of last century. Disturbance by fire has been replaced by timber harvest and grazing. Grazing can change species composition. Species composition can also be indirectly altered by timber harvest and grazing through a reduction in fire frequency and subsequent change in vegetation (see also *Chapter 3.2 – Vegetation*, for further discussion on historical vegetation and disturbance regimes).

The low gradient of valley floors throughout the Analysis Area is attributed to the deposition of large amounts of volcanic material. Abundant volcanic flows were often channeled into the relatively narrow valleys, which confined the flows. This confinement along with the inherent viscosity of the magma combined to form nearly flat valley floors throughout the Analysis Area. This created streams with generally low gradients in these valley floors, which includes much of their length. These lower gradient stream segments are generally located in the areas where human activity has the greatest potential to introduce sediments into them. When sediment yield is increased, these low gradient streams do not have the sediment transport capacity to move the sediment downstream and maintain their geomorphic conditions. Lower gradient systems tend to widen and become shallower when the sediment yield is increased. Wider and shallower streams usually experience higher water temperatures, higher primary productivity and have less physical habitat for native fish.

3.7.3.2 Black Rock Desert

The Black Rock Desert watershed falls mostly in Nevada. It is located within the Northwestern Basin and Range ecological subregion. It is part of the western extent of the Great Basin Desert. In general, the Black Rock Desert watershed contains few moderately slow rivers and streams. These streams flow in deeply incised canyons with bedrock control at higher elevations to alluvial channels at lower elevations that terminate in basins or lakes.

The State of Nevada's 305(b) report listed Negro Creek, one of the streams in the Black Rock Basin, as fully supporting its beneficial uses. There are also several reservoirs that are mostly used for irrigation. There are no impaired waters listed for the Massacre Lake watershed within the Analysis Area. The California Unified Watershed Assessment (1998) ranked watersheds in this basin as Category II; watersheds with good water quality that, through regular program activities, can be sustained and improved. The Smoke Creek Desert watershed contains Smoke Creek of which 15 miles has been assessed as impaired by the State of California. The causes are listed as habitat alterations and sedimentation/siltation, with the possible causes being agriculture, livestock and rangeland grazing.

3.7.3.3 Oregon Closed Basins

The Oregon Closed Basins watershed occupies a very small portion of the Analysis Area. These watersheds drain north into Oregon where they enter closed basins. In general, the Oregon Closed Basin watershed contains few moderately slow rivers and streams. These streams flow in deeply incised canyons with bedrock control at higher elevations to alluvial channels at lower elevations that terminate in basins or lakes.

There are no impaired waters listed for these watersheds within the Analysis Area. The California Unified Watershed Assessment (1998) ranked watersheds in this basin as Category II; watersheds with good water quality that, through regular program activities, can be sustained and improved. There are several streams that are within these watersheds that are listed as impaired due to temperature in stream sections in Oregon, outside of the Analysis Area.

3.7.3.4 Klamath

The Klamath watershed covers over 1,460,000 acres of the Analysis Area. The Lost watershed is the largest hydrologic unit code (HUC) within the basin. These watersheds drain west to the Klamath River. The basin is located in the Southern Cascades ecological subregion. Streams in these watersheds are slow to moderately rapid rivers and streams. They flow in alluvial or weak bedrock channels westerly to the Klamath River.

The Lost watershed has two water bodies on the California 303(d) list. These water bodies include segments of the Klamath River and Tule Lake. The impairments are listed as ammonia, filling and draining, flow alterations, habitat alterations, nutrients, organic enrichment, pH and temperature. The probable causes for the impairment are listed as several different sources of water diversion and flow alterations, channelization, dam construction, loss of wetlands, nonpoint sources, and natural causes.

The Butte watershed has one water body on the California 303(d) list. The Klamath River is listed as being impaired by nutrients and temperature. The probable causes are nonpoint sources. There are some water bodies on the 303(d) list in the Upper Klamath and Shasta watersheds but they are outside of the Analysis Area.

The California Unified Watershed Assessment (1998) ranked watersheds in this basin as Category I: watersheds that are candidates for increased restoration activities due to impaired water quality or other impaired natural resource goals.

3.7.3.5 Lower and Upper Sacramento

The Lower and Upper Sacramento watersheds were combined in this discussion, primarily because the Lower Sacramento watershed covers such a small area (2,121 acres) and they are both part of the Sacramento River watershed. The Upper Pit River watershed is the largest watershed within the Analysis Area at over 1.7 million acres and has recently been extensively studied. The Pit River Watershed Alliance (2004) contains substantial detailed information on this watershed including hydrology and water quality assessments. Those assessments will not be repeated here but mostly incorporated by reference.

The Upper Pit River Watershed is located in northeastern California at the eastern edge of the Great Basin Province. The North Fork of the Pit River originates at Goose Lake, an enclosed basin except during rare events when it spills over into the Pit River. The North Fork headwaters include a number of tributaries in the Warner Mountains. The South Fork of the Pit River originates from the merging of East Creek and other tributaries. The north and south forks of the Pit River converge in the town of Alturas and then flows in a southwesterly direction into Shasta Lake in Shasta County into the Sacramento River.

The Upper and Lower Sacramento watersheds are located within the Modoc Plateau ecological subregion. Small numbers of slow flowing rivers and small numbers of slow to moderately rapid flowing streams characterize the area. Most of these streams do not flow throughout the summer. Rivers and streams flow in alluvial and bedrock controlled channels to the Sacramento River, or to basins within the Modoc Plateau. Numerous small to very large lakes and reservoirs occur in this area.

The California Unified Watershed Assessment (1998) ranked watersheds in this basin as Category I; watersheds that are candidates for increased restoration activities due to impaired water quality or other impaired natural resource goals. Additionally, the Upper Pit River watershed was listed as a Priority Category I watershed.

In the Goose Lake watershed, Goose Lake is listed as impaired by the State of California. The cause of impairment is listed as sedimentation/siltation and the source is unknown.

The Upper Pit watershed is on the California 303(d) list for nutrients, organic enrichment/low dissolved oxygen, and temperature. California state assessments list eight water bodies as impaired. They include Bayley Reservoir, Big Sage Reservoir, Dorris Reservoir, Pit River, Roberts Reservoir and West Valley Reservoir. The causes for impairment are filling and draining, flow alteration, nutrients, organic enrichment, sedimentation/siltation, water temperature and turbidity. The probable causes that are listed include agriculture related flow modifications, channelization, loss of wetlands, erosion/siltation, habitat modification, riparian habitat loss, nonpoint sources and upstream impoundments.

The Lower Pit watershed contains two water bodies on the 303(d) list within the Analysis Area. Fall River is listed for sedimentation/siltation and the Pit River is listed for organic enrichment/low dissolved oxygen and temperature.

3.7.3.6 North Lahontan

The North Lahontan watershed is the second largest in the Analysis Area at close to 1.8 million acres. It contains three watersheds of basically equal size. It is located within the Northwestern Basin and Range ecological subregion. In general, the North Lahontan watershed contains few moderately slow rivers and streams. These streams flow in deeply incised canyons with bedrock control at higher elevations to alluvial channels at lower elevations that terminate in basins or lakes.

The California Unified Watershed Assessment (1998) ranked the Madeline Plains watershed as a Category II; watersheds with good water quality that, through regular program activities, can be sustained and improved. It ranked the Surprise Valley watershed as Category I; watersheds that are candidates for increased restoration activities due to impaired water quality or other impaired natural resource goals. The Honey-Eagle Lakes watershed was listed as a Priority Category I watershed.

Within the Madeline Plains watershed there are no identified impaired water bodies. In the Surprise Valley watershed Mill Creek is on the 303(d) list for sedimentation/siltation.

In the Honey-Eagle Lakes watershed there are seven water bodies on the 303(d) list. They are Honey Lake, Susan River, Skedaddle Creek, Honey Lake Area Wetlands, Eagle Lake, Pine Creek, and Honey Lake Wildfowl Management Ponds. The impairments are listed as flow alterations, metals, salinity, arsenic, sedimentation/siltation, trace elements, phosphorus, nitrogen and high coliform counts. The 305(b) assessment lists 22 water bodies as impaired.

3.8 Wildlife

The focus of the Sage Steppe Ecosystem Restoration Strategy is on restoration of the sage steppe ecosystem. Data indicates large-scale vegetative changes have occurred during the past 150 years (Eddleman *et al.* 1994, Miller and Rose 1995, Anderson and Inouye 2001, Miller *et al.* 2005, and others). The density of Western juniper woodlands have significantly increased over the 6.5 million acre Analysis Area reducing the open sage steppe habitats that historically dominated this area (*Section 3.2.2 Alteration of Historical Disturbance Regimes*). These changes have, in turn, affected populations of wildlife species, specifically sage steppe "obligates," those species whose habitat requirements are highly dependent upon the sage steppe ecosystem. Conversely, species finding suitable habitat in western juniper woodlands or in combinations of juniper and sage may have benefited by these changes. However, as juniper woodlands have became dominant in areas previously dominated by sagebrush and grasslands, vegetative diversity has decreased, altering faunal diversity (Oregon Dept. of Forestry 2000, and Dobkin and Sauder 2004). These alterations have caused some species populations to decrease to the point that their future viability is threatened.

3.8.1 Primary Habitats

The Analysis Area encompasses 6.5 million acres in northeastern California (Figure 1). Across this area, Western juniper has increased in density from one percent to greater than 35 percent canopy closure (USDA Forest Service 2005) in many locations. Sagebrush habitats and juniper woodlands comprise a large portion of the Focus Area (*Chapter 3 – Existing Vegetation*), therefore the primary focus of this discussion will be on the wildlife species occupying these habitats. Mayer and Laudenslayer (1988) categorize 10 terrestrial and four aquatic habitats that potentially occur within the Analysis Area (Table 25). The discussion will emphasize the wildlife and fish habitats for those species that occur within and adjacent to the sage steppe ecosystem.

Table 25. Primary Habitats in the Analysis Area

Terrestrial	Aquatic
Sagebrush	Lacustrine
Bitterbrush	Riverine
Low Sage	Fresh Emergent Wetland
Juniper woodland	
Eastside Pine	
Jeffery Pine	
White fir	
Pasture/Wet Meadow	
Aspen	
Montane Riparian	Wet Meadow

3.8.1.1 Big Sagebrush

Big sagebrush (*Artemisia tridentata*) is the most common and widespread sagebrush species in the region and is the dominant species in this habitat type. *Section 3.2.4 Existing Vegetation in the Sage Steppe Ecosystem Focus Area* describes its attributes and occurrence in the Analysis and Focus Areas.

Big sagebrush provides food and shelter for many species of birds, small and large mammals, reptiles, amphibians and insects. Sagebrush communities provide habitat for approximately 100 bird species and 70 mammal species (Braun *et al.* 1976), and a variety of reptiles and amphibians. Sagebrush is an essential food source, especially in winter, for several wildlife species and also may provide protective cover.

3.8.1.2 Low Sage

This habitat type differs from big sagebrush in that vegetative diversity is much greater. *Section 3.2.4 Existing Vegetation in the Sage Steppe Ecosystem Focus Area* describes its attributes and occurrence in the Analysis and Focus Areas.

Laudenslayer (1982) lists 28 species of terrestrial vertebrates that find conditions optimum for breeding in typical stands of this habitat type. He lists 37 additional species that find conditions suitable for breeding. These stands tend to lose their snow cover earlier in spring than surrounding habitats, thus they provide an especially important source of new, green forage for pronghorn and mule deer (Verner No date).

Low sagebrush is a more nutritious and palatable forage than big sagebrush. Pronghorn and sage-grouse prefer this sagebrush for winter forage and often wait to migrate until heavy snows force them to move on to less palatable plants, (e.g., big sagebrush). Low sagebrush is important to pronghorn, because pronghorn are adapted to areas with low vegetation that enables a better view of potential predators. Large raptors often hunt in this habitat because it affords a good view of prey and, depending on the site, few obstructions for low-level flight. Low sage often occurs in association with gravels or boulders.

3.8.1.3 Bitterbrush

Bitterbrush is only occasionally found in pure stands and usually occurs as a co-dominant with big sagebrush or rabbitbrush (Mayer and Laudenslayer 1988). The species is highly digestible and provides excellent winter forage for mule deer and pronghorn. Any stands occurring in the Analysis Area would be considered as sagebrush stands.

3.8.1.4 Western Juniper

The Western juniper woodland vegetative community and occurrence is described in *Section 3.2.4 Existing Vegetation in the Sage Steppe Ecosystem Focus Area*. Juniper woodland habitats are characterized as open to dense aggregations of Western juniper. More than 100 wildlife species have been identified within open juniper woodlands. The density of tree canopy determines the composition of the understory and, consequently the diversity of wildlife species that occupy these areas. Wildlife diversity in juniper communities relates strongly to the diversity and abundance of understory plant species (Miller 2001).

Open habitats of less than 30 percent canopy closure usually have an understory shrub association of sagebrush and/or bitterbrush with forb and grass cover, however, canopies exceeding 30 percent closure show a 75 percent reduction in shrub understory (Miller *et al.* 2005). As the canopy closure increases, a cheatgrass understory is common and, in some cases, bare soil prevails. As discussed in *Section 3.2.4 Existing Vegetation in the Sage Steppe Ecosystem Focus Area*, dense juniper (greater than 20 percent canopy cover) occupies nearly 20 percent of the Focus Area (Table 12). These areas would be expected to have a reduction in the diversity of wildlife species as compared to other sites occupied by lower density of juniper.

3.8.1.5 Eastside Pine, Jeffrey Pine and White Fir

It is assumed there is an extremely limited interface of these vegetation types in the Analysis Area. More information about their attributes can be found in the *Wildlife Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007c).

3.8.1.6 Wet Meadow/Pasture

Wet meadows occur where water is near the surface during the growing season and where percolation is slowed by the saturated or impermeable soil pan below. These sites are important in arid environments, providing both drinking water and breeding sites for a number of species. In the Focus Area the greater sandhill crane is wholly dependent upon such sites for breeding and rearing of their young.

The Focus Area contains numerous private in-holdings, many of which are principally natural or cultivated pasturelands. These areas are often a mixture of perennial grasses and legumes grown for the grazing or harvesting for winter forage for livestock. These areas provide foraging for wild ungulates, birds of prey, and other wildlife species.

3.8.1.7 Aspen

Aspen communities occur in mesic sites where stands are primarily perpetuated from the rootstock cloning. *Section 3.2.4 Existing Vegetation in the Sage Steppe Ecosystem* discusses the attributes and occurrence of aspen in the Analysis and Focus Areas. Although no wildlife species are noted as being wholly dependent upon aspen, its occurrence provides a high degree of vegetative and faunal diversity available to a variety of species. It has been hypothesized that ungulates and rodents may help maintain aspen groves through feeding on conifers (Trimble 1989). Western juniper has been increasing in density in many aspen stands in the Focus Area (*Section 3.2.4.4 Aspen Vegetation Type*).

Griffis-Kyle and Beier (2003) found small aspen patches were an important ecosystem component to many species of birds in the Southwest. They conclude, "*From the perspective of conservation and management of forest birds, the lack of area and isolation effects in combination with higher bird abundance and diversity in aspen, demonstrates that even the smallest and most isolated aspen patches contribute to regional vigor of bird populations taken in the context of a larger forest system.*"

3.8.1.8 Montane Riparian

A variable and structurally diverse riparian habitat usually occurs as a narrow grove of deciduous trees with sparse understory along a stream course (Mayer and Laudenslayer 1988).

3.8.1.9 Aquatic

Aquatic habitats are those riverine or lacustrine habitats having permanent water. Aquatic habitats in the Focus Area are limited to small tributaries to the Pit River, Tule Lake Basin, Klamath Lake and Goose Lake; natural shallow lakes; and constructed reservoirs. Aquatic habitats provide habitat for species dependent on water for all or part of their life cycles and as a source of drinking water for many species.

3.8.2 SAGE STEPPE OBLIGATE SPECIES

The term, "*sagebrush obligates*" is defined as species requiring sagebrush vegetation as a major part or all of their life history requirements, specifically within the Great Basin ecosystems. According to Paige and Ritter (1999), at least eight vertebrate species are considered to be sagebrush "*obligates*" (Table 26). Although sagebrush obligates are considered to be dependent upon the sagebrush ecosystem, all are known to use other habitats, either spatially or seasonally. Within these species' life histories, the sagebrush ecosystem may be used in a variety of ways. Vegetative variations that affect use include stand age and/or condition, stand structure, species composition, and stand size. A discussion of each of these species follows.

Table 26. Sage Steppe Obligate Species

Common Name	Scientific Name
Pronghorn	*Antilocapra americana*
Pygmy rabbit	*Brachylagus idahoensis*
Sagebrush vole	*Lemmiscus curtatus*
Greater sage-grouse	*Centrocercus urophasianus*
Brewer's sparrow	*Spizella breweri*
Sage thrasher	*Oreoscoptes montanus*
Sage sparrow	*Amphispiza belli*
Sagebrush lizard	*Sceloporus graciosus graciosus*

3.8.2.1 Pronghorn (*Antilocapra Americana)*

Yoakum (1980) states "*The pronghorn is almost inextricably linked to sagebrush*." Under pristine conditions, extensive sagebrush areas with a low coverage of shrubs provides good visibility for predator escape as well as adequate biomass to meet this species' food requirements. Sagebrush of one kind or another, especially the varieties of big sagebrush, are seemingly essential to its health and continued survival. While small populations of pronghorn persist in areas without sagebrush, it seems the evolutionary processes have left it ideally suited to survival on the sage steppe of the Western United States (Pollock 2000).

The sage steppe of the Great Basin has been categorized as peripheral pronghorn habitat (Yoakum 1968) with population densities in the Great Basin averaging less than 0.4 per square kilometer (1.0 sq. mi.). Pronghorn use Western juniper woodlands very little during winter or spring (Trainer *et al.* 1983), and in summer are found most often in sagebrush or other communities with low vegetation structure (Kindschy *et al.* 1982). This species is adapted to low rolling topography and avoid slopes greater than 30 percent. Where, in circumstances where they are forced to occupy treed habitats, pronghorns adjust by modifying their behavior. Pronghorn habitat ranges from sea level to 11,000 feet. The largest populations, particularly in the Great Basin, are between elevations of 4,000 to 6,000 ft (Yoakum 1974). The highest densities, which reflect the best habitats, occur where precipitation averages 38 centimeters (l0-16 inches) per year.

Surveys conducted in 2003 for pronghorn found that the overall population had reached the lowest point in several decades (Shinn personal communication). Several years of drought have been the main contributor to the depressed populations. Juniper encroachment and increasing noxious weeds and annual exotic grasses is contributing to poor habitat conditions in some areas.

3.8.2.2 Pygmy Rabbit (*Brachylagus idahoensis)*

The historic distribution of the pygmy rabbit included much of the semi-arid, shrub steppe region of the Great Basin and adjacent intermountain zones of the conterminous western United States

(Green and Flinders 1980), within portions of California, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming (USDI Fish and Wildlife Service 2003).

Pygmy rabbits are not distributed continuously across their range. Rather, they are found in areas within their broader distribution in areas of tall, dense clumps of sagebrush and where soils are sufficiently deep and loose to allow burrowing. They are highly dependent on sagebrush for both food and shelter (Bailey 1936, Orr 1940, Green and Flinders 1980, Weiss and Verts 1984, and Washington Dept. of Fish and Wildlife 1995). Pygmy rabbits eat sagebrush throughout the year but in lesser amounts in summer (51 percent) than in winter (99 percent) (Green and Flinders 1980 and Paige and Ritter 1999).

Woody cover and shrub heights are significantly greater in the pygmy rabbit sites. In California, pygmy rabbits are patchily distributed in sagebrush, bitterbrush and pinyon-juniper habitats where it is associated with tall, dense, large-shrub stages of big sagebrush, greasewood, and rabbitbrush (Orr 1940, Laudenslayer 1982, Zeiner *et al.* 1990). Pygmy rabbits may also occur in curlleaf mountain mahogany, low sage, and saltbush-greasewood habitats (Laudenslayer 1982).

Pygmy rabbit surveys have been conducted in recent years in Modoc and Lassen Counties without detecting any animals (Schmidt, Paul Pers. Comm.).

3.8.2.3 Sagebrush Vole (*Lemmiscus curtatus)*

The sagebrush vole occupies a range of habitats Central Washington, southern Alberta, and Manitoba south through eastern Oregon and California to Nevada, Utah, and northeast Colorado where populations are highest in sagebrush, bitterbrush, and low sage habitats.

Sagebrush voles occupy multi-entrance burrows in loose soils beneath shrubs (James and Booth 1954) and are primarily nocturnal. They feed on green herbaceous plants in summer, eat the bark and twigs of sagebrush during winter and use the shredded bark of sagebrush to line their burrows (Paige and Ritter 1999). Overgrazing and agriculture has eliminated this species from much of its original range (O’Farrell 1972) therefore its local abundance is variable.

3.8.2.4 Greater Sage-Grouse (*Centrocercus urophasianus)*

The greater sage-grouse currently ranges from southeastern Alberta and southern Saskatchewan; western North and South Dakota; Colorado, Utah, Nevada, eastern California, eastern Oregon and Washington (Schroeder *et al.* 2004) where populations have been in a continuous decline in western North America (Connelly and Braun 1997) as well as California (Zeiner *et al.* 1990). Population declines on the Modoc plateau have been determined to be the result of habitat reduction, primarily through juniper encroachment (Schmidt, Paul pers. com.); decadence in big sage habitat through wildfire prevention (Miller 2001); reduction in low sage habitat (Schmidt, pers. com.); loss of habitat quality as a result of livestock grazing (Schroeder *et al.* 2000); climatic changes (Miller *et al.* 2005); habitat disturbances (e.g. agriculture development, type conversions) and hunting (Mayer and Laudenslayer 1988). Within the Buffalo-Skeddadle

Population Management Unit (PMU) the sagebrush ecosystem that has the potential to support sage-grouse has declined over the past 100 years.

Approximately 46 percent of potential habitat (mature sagebrush and seedlings present) is dominated by annual grass, annual forbs, bare ground, or 0-9 percent juniper cover. Approximately 19 percent of potential sagebrush habitat has crossed the threshold from sagebrush dominated (mature sagebrush and seedlings not present) to juniper or annual grass dominated communities (Northern California Sage-grouse Working Group 2005).

Concern has been expressed throughout the western United States that sage-grouse populations and habitat quality/quantity have increasingly declined. Eight petitions to list the sage-grouse as a threatened or endangered species have been filed with the U.S. Fish and Wildlife Service (USFWS) between 1999 and 2004. These petitions have contributed to the current attention to the invasion of western juniper into sage steppe habitats.

In response to three of these petitions, the USFWS issued a 12 month finding on January 12, 2005, which stated: "*Although sagebrush habitat continues to be lost and degraded in parts of the greater sage-grouse's range (albeit at a lower rate than historically observed), from what we know of the current range and distribution of the sage-grouse, its numbers are well represented. As a result, we find that the species is not in danger of extinction, nor is it likely to become endangered in the foreseeable future. We are encouraged that sage-grouse and sagebrush conservation efforts will moderate the rate and extent of habitat loss for the species in the future. We strongly encourage the continuation of these efforts.*" (USDI Fish and Wildlife Service 2005).

Three plans have been developed to direct the management of sage-grouse habitat in the Analysis Area. These plans are described below.

3.8.2.4.1 Greater Sage-grouse Conservation Plan for Nevada and Eastern California

In response to the petitions to list, the Governor of Nevada organized a Sage-grouse Conservation Team whose responsibility was to develop a management strategy to prevent listing. Volume II of this plan will include a Washoe-Modoc Sage-grouse Conservation Plan (Sage Grouse Conservation Team 2004).

*3.8.2.4.2 Conservation Strategy for Sage-grouse (*Centrocercus urophasianus*) and Sagebrush Ecosystems Within Devil's Garden/Clear Lake Population Management Unit.*

Areas of the sagebrush ecosystem within the Devil's Garden PMU that have the potential to support sage-grouse (1,140,000 acres) have declined over the past 50 years. A Memorandum of Understanding (MOU) between the BLM, FS, USFWS and WAFWA was signed on August 14, 2000 to undertake conservation planning to improve populations, reverse habitat declines, and demonstrate the commitment of all involved to the long-term conservation of the species (Northern California Sage-grouse Working Group 2006).

3.8.2.4.3 Conservation Strategy for Sage-grouse within the Buffalo – Skedaddle Population Management Unit

Areas of the sagebrush ecosystem within the Buffalo Skeddadle PMU that have the potential to support sage-grouse (1,475,506 acres) have declined over the past 100 years. A Memorandum of Understanding (MOU) between the BLM, FS, USFWS and WAFWA was signed on August 14, 2000 to undertake conservation planning to improve populations, reverse habitat declines, and demonstrate the commitment of all involved to the long-term conservation of the species (Northern California Sage-grouse Working Group 2005).

Habitat conditions necessary for occupancy by this species includes sage stands with mixed shrubs (Klebenow 1969, Trimble 1989), shrub heights of over 16 inches with a grass understory (Gregg *et al.* 1994) with a canopy closure of less than 40 percent (Connelly *et al.* 1991, Gregg *et al.* 1994), small open areas suitable for leks (Connelly *et al.* 1991) and abundant seasonal herbaceous plant growth for brood sustenance (Dunn and Braun 1986).

3.8.2.5 Sage Thrasher (*Oreoscoptes montanus)*

The sage thrasher breeds from extreme southern British Columbia, southward through the western United States to northern Arizona and New Mexico. The winter distribution extends from the southern southwestern states to central Mexico.

Sage thrashers are almost entirely dependent on sagebrush habitat during the breeding season usually nesting in tall dense clumps of sagebrush within areas having some bare ground for foraging (Paige and Ritter 1999). Throughout their range prefer relatively dense stands of tall sagebrush for nesting. Nests are sometimes built in other shrubs associated with sagebrush, including rabbitbrush, antelope-brush, and juniper.

Shrub size is very important for nesting, with the birds requiring sagebrush approximately three feet in height. In the winter, the sage thrasher uses a variety of scrub, brush, and thicker habitats. Bare ground is an important substrate for sage thrashers for foraging (Weins *et al.*1985). They tend to utilize discontinuous patchy habitats surrounded by other types, but the probability of occupancy increases as patch size increases (Knick and Rottenberry 1995).

In North America, the sage thrasher appears to be stable in areas where it has suitable habitat. In areas with extensive loss of sagebrush, the species' numbers have greatly declined and some local populations have been eliminated.

3.8.2.6 Brewer's Sparrow (*Spizella breweri)*

The Brewer's sparrow breeds in the northern Rocky Mountains of the Yukon and British Columbia, and in the Great Basin south to southern California and New Mexico and winters in open desert scrub and cropland within the southern Mojave and Colorado deserts (Zeiner *et al.* 1990). At times it can be found on the wintering grounds in very large flocks.

While it occupies a wide range of shrub dominated habitats over its range, the Brewer's sparrows in the Great Basin are associated closely with sagebrush habitats having abundant scattered shrubs and short grass (Paige and Ritter 1999).

3.8.2.7 Sage Sparrow (*Amphispiza belli)*

The Sage sparrow nests in the foothills and deserts of the American west in sagebrush habitat. Sage sparrows breed from western Wyoming west to central Washington, and as far south as north-central New Mexico in the east and Baja in the west; they also occur in the foothills of the Sierra Nevada Mountains of California. The species nests in parts of California, Idaho, Oregon, Utah, Washington, and Wyoming. In the Great Basin they appear to prefer large continuous stands of sagebrush (Paige and Ritter 1999). They do not normally migrate but populations may move to lower desert areas during the winter months (Zeiner *et al.* 1990).

Weins and Verts (1984) found Sage sparrow territories to vary "*from location to location, from plot to plot in the same location, and from year to year in the same plot*" and that "*this variation was sometimes substantial*." Therefore, determination of population levels for this species can only be achieved on the plot level and is likely to be affected by a variety of factors unrelated to habitat capacity.

High sagebrush cover, large patch size, spatially similar patches, low disturbance and little fragmentations provided the most optimal cover (Knick and Rottenberry 1995). Populations appear to be negatively affected by landscape changes that increase fragmentation of shrublands (Knick and Rottenberry 2000).

3.8.2.8 Sagebrush Lizard (*Sceloporus graciosus graciosus)*

The Sagebrush lizard occupies sagebrush and other shrub habitats throughout western North America. Sagebrush lizards are predominately found in sagebrush cover, but they may also be found in greasewood and other desert shrubs and sometimes on small rocky outcrops. Sagebrush lizards are usually found at higher elevations than Western Fence Lizards and may even utilize juniper-pine woodlands with brushy understory (Storm and Leonard 1995).

Sagebrush lizards prey on insects found in a wide variety of sagebrush habitats, often climbing the shrubs in search of their prey (Paige and Ritter 1999). Records of Sagebrush lizards are widespread throughout the western states wherever any type of sagebrush occurs (Stebbins 1966). The wide variety of habitat use precludes this species from being an indicator of specific sagebrush habitat condition.

3.8.3 BIG GAME SPECIES

3.8.3.1 Mule Deer (*Odocoileus hemionus)*

Mule deer use both sage and western juniper communities as well as aspen stands, particularly in the winter months. Open stands of western juniper with an understory shrub cover of sage, bitterbrush, mountain mahogany and/or winterfat, and a variety of forbs in the spring and early summer provides ideal habitat. Stands of larger trees serve as hiding and escape cover as well as dampening the effects of winter storms while the shrub and forb understory provides forage. Dense canopies of juniper resulting in reduced shrubs and forb understory renders the habitat unsuitable for mule deer except on the edges where adjacency to open areas can provide forage.

Journals of early explorers and settlers indicate that in northeastern California mule deer populations were sparse and that "*prime mule deer ranges present during the early and mid 20th century did not exist*" (Clements and Young 1997). Deer populations in the Analysis Area probably reached their highest levels from the mid 1950's through the mid-1960's, declining by over 50 percent in the mid 1970's (Updike *et al.* 1990)

Mule deer use western juniper woodland communities more frequently during severe winter conditions (Leckenby and Adams 1986), when western juniper provides thermal cover. Miller (2001) states, "(*W)oodlands having 30 percent tree canopy, trees 15 ft in height, and 13 large trees per acre reduced temperature severity, wind, and snow cover during the winter. Deer occupied these woodlands during severe winter conditions*." Leckenby *et al.* (1982) defined optimal thermal cover for mule deer in the juniper zone as "*stands of evergreen or deciduous trees or shrubs, at least 1.5 m tall, with crown closure greater than 75 percent.*" However, Miller *et al.* (2005) indicates that understory vegetation usually declines in Western juniper communities as the canopy cover increases. Therefore, the encroachment of Western juniper into mule deer winter range eventually reduces the forage base available for winter consumption. While Western juniper woodlands provide beneficial thermal cover, increased canopy closure restricts understory forage and detracts from winter range quality (Clements and Young 1997 and Miller *et al.* 2005).

In contrast, big sage and low sage habitats provide a high level of forage but are limited in thermal protection. Studies of nutritional values and foraging preferences of various sage species are extremely variable. Some studies indicate that excess foraging on big sagebrush may be detrimental to mule deer nutritional health (Carpenter *et al.* 1979) while others indicate big sagebrush to be a preferred and nutritious winter forage species (Wambolt 1996). Mule deer prefer big sagebrush communities to western juniper during fawning (Sheehy 1978). Foraging habitat is considered a limiting factor for mule deer in northeastern California, but lands managed by the Eagle Lake Field Office provide important transition or intermediate ranges (California Department of Fish and Game 1998).

Long-term studies show that overall deer numbers have been declining for several decades throughout California. Juniper expansion has caused a major decline in understory vegetation and shrub reproduction and health over a large portion of the Field Office area. High-density juniper is the single most important limiting factor in high-quality deer forage. Without large-scale habitat improvement, the deer population trend is likely to continue downward. BLM and CDFG work together to meet habitat objectives set forth in multiple herd management plans through the region.

3.8.3.2 Rocky Mountain Elk (*Cervus elaphus Canadensis)*

This sub-species of elk is not endemic to northern California but has recently invaded from the north, either from introduced or expanding native populations as habitat suitable for their occupancy in northern California become available. As opposed to mule deer that are primarily browsers, elk are primarily grazers although they utilize browse to a significant degree, especially during the winter.

Tom Ratcliff, FS biologist (retired) reported to the Modoc Record, (Modoc Record, June 12, 1997) that, "*California Fish and Game and Modoc National Forest personnel recently combined sightings data bases and since 1990 over 200 sightings have been made in the county. Elk are being seen more frequently and in larger groups. According to reports, in March 1997, 50 head of bulls, cows and calves were seen in a large group. Several sightings of over 20 head of elk have been recorded in the past five years*." Richard Shinn (pers. comm. 2006) and Robert Schaffer (pers. comm. 2006), California Fish and Game biologists estimate elk numbers in the Focus Area are between 500 and 1,000 animals and either stable or slightly increasing. They do not believe juniper reduction will adversely affect this species as they are currently occupying many areas where juniper cover is minimal to non-existent.

3.8.4 Juniper Woodland Species

Western juniper woodlands provide habitat to a number of wildlife species. In Washington, three large herbivores, 25 bird species and a number of small mammals species were identified to occupy early to late successional juniper woodlands (Miller 2001). None of these species was endemic to this habitat type but used it as available in conjunction with other habitat requirements.

3.8.4.1 Swainson's Hawk (*Buteo swainsonii*)

This species has been listed as threatened under the California Endangered Species Act (CESA). The listing was primarily due to riparian habitat loss and population reductions in the central and southern portion of the state. The species may utilize a variety of habitats but in the Focus Area, sage steppe with scattered western juniper for nest sites appears to be preferred. Swainson's hawk nesting sites are restricted to level terrain (Bosakowski *et al.* 1996) where they forage over open lands and agricultural fields. In Washington, Swainson's hawk nests are often found close to roads and human structures and primarily in areas where the surrounding habitat was dominated by wheat fields (Bechard *et al.* 1990).

3.8.4.2 Ferruginous Hawk (*Buteo regalis*)

Ferruginous hawks are birds of open country. They occur in semiarid grasslands with scattered trees, rocky mounds or outcrops, and shallow canyons that overlook open valleys. They may occur along streams or in agricultural areas in migration. Ferruginous hawks rely primarily upon rodents found in their grassland ecosystems. Prey includes ground squirrels, jackrabbits, pocket gophers, prairie dogs, and kangaroo rats. Other prey includes snakes, lizards, grasshoppers, and crickets.

3.8.4.3 Juniper Titmouse (*Baeolophus ridgwayi*)

The juniper titmouse (*Baeolophus ridgwayi*) is a BLM sensitive species. It is common in a variety of habitats but is found primarily in association with juniper and desert riparian areas. It seems to prefer juniper woodlands rather than riparian woodlands and normally nests in natural cavities or those previously excavated by other species. A study in Wyoming found this species to be associated with senescent trees (Pavlacky and Anderson 2001) indicating a preference for older stands over mid-successional ones. In Arizona, the juniper titmouse was found to utilize pinyon-juniper woodlands with canopy closures of less than 30 percent and densities between 63 and 154 trees per acre (Masters 1979 and LaRue 1994). The juniper titmouse roosts in cavities of trees or snags, nests in natural or human-made cavities (e.g., woodpecker holes or other natural cavities, or nest boxes). It is logical to assume that individual old trees within sage/steppe habitats do not provide adequate habitat to maintain this species. Larger groups of older trees and/or those on an ecotone with other woodland habitats (oaks, pines, etc.) that provide a more complex ecosystem are required.

Little is known about this species in the Focus Area beyond its occurrence in particular habitat types. These habitats are plentiful on lands managed by the Alturas Field Office and the Modoc National Forest.

3.8.4.4 Other Mammals

A few species, such as the pinyon mouse and bushy-tailed woodrat, relate closely to juniper (Miller 2001). At least 28 rodent species inhabit sagebrush-grass communities. Most of these rodent species eat herbaceous vegetation or seeds, but differ in specific habitat preferences. Some species, such as kangaroo rats, are beneficial in terms of seed dispersal and germination (McAdoo *et al.* 1983).

3.8.5 Neotropical Migrants

Summering in North America and wintering in the tropics of Central and South America characterize this group of species. Concerns have recently been addressed at the reduction of habitats, both in North America and in the tropics.

Dobkin and Sauder (2004) list bird species associated with riparian ecosystems found within sage-steppe landscapes. These included 10+ species considered to be neotropical migrants. Sage steppe species considered in the Idaho Partners for Flight Conservation Plan (Ritter 2000) for sage steppe habitats included Swainson’s hawk, sage-grouse, short-eared owl, loggerhead shrike, rock wren, sage thrasher, Brewer’s sparrow, lark sparrow and Sage sparrow. Species considered for juniper and pinyon juniper habitats included ferruginous hawk, gray flycatcher, plumbeous vireo, pinyon jay, Virginia warbler and black-throated gray warbler. It can be assumed that riparian areas, including aspen stands, within sage/steppe ecosystems would increase the opportunity for providing habitat to migrating neotropical migrants.

As the data clearly indicates, junipers have increased dramatically in the Focus Area in the past 100 years, and the arboreal coniferous habitat used by certain neotropical migrants has also increased. While junipers may provide summer nesting habitat for some neotropical migrants, the high density of junipers may have increased use by species preferring juniper woodlands yet may have not actually contributed to increases in populations overall.

The fact that neotropical bird species are continuing to decline indicates that increases in juniper woodland habitat in the Focus Area is not likely contributing to population stability. In fact, data is fairly clear that wintering habitat, contaminants and habitat fragmentation in both eastern and western North American riparian areas is much more likely to be the factors affecting these species (Ritter 2000).

Ritter (2000) indicates that encroachment of juniper on other ecosystems has reduced neotropical migrant habitat in the west and likely has resulted in a shift in the species using these areas. However, Reinkensmeyer (2000) found bird densities highest in old-growth juniper and lowest in grassland sage.

The overlying problem with assessment of neotropical migrants lies in the criteria used to group these bird species, their annual winter migratory habits to South America. As this analysis is based on alterations of habitats, and neotropicals occur in all habitats, some may be enhanced while others are adversely affected. For this reason, an analysis, if attempted, must be assessed on a species/vegetation type basis.

3.8.6 Culturally Important Small Mammals

3.8.6.1 Jackrabbits (*Lepus spp.*)

There are three species of hares (genus *Lepus*) native to California: the Black-tailed, the White-tailed and the Snowshoe hare. The Black-tailed and White-tailed hares are commonly called jackrabbits. Of these, only the Black-tailed jackrabbit (*Lepus californicus*) is a desert dweller, inhabiting all four southwestern deserts. The range of the White-tailed jackrabbit in California is restricted to the east side of the Sierra Nevada and Cascade ranges from Tulare County north to the Oregon border. The Snowshoe hare's range is a long narrow strip from the Oregon border down through the higher elevations of the Klamath, Cascade, and Sierra Nevada ranges as far south as Tuolumne County. There are a few Snowshoe hares in the Warner Mountains in Modoc County. The Snowshoe is seldom seen for it prefers to live in dense fir thickets and in winter is isolated by deep snow. Due to their different ranges, jackrabbits in the sage steppe are assumed to be Black-tailed jackrabbits. It is unlikely that White-tailed or Snowshoe hares would live in the sage steppe.

The Black-tailed jackrabbit is common and is found all over California except in the mountainous areas at elevations above 12,000 feet. They adapt themselves readily to man's use of the land and thrive even in highly developed areas. The Black-tailed jackrabbit prefers to live in valleys and flat, open country. Jackrabbits are strict vegetarians, eating a great variety of herbs and shrubs. In farming areas the Black-tailed jackrabbit may become a serious pest in young orchards and to other agricultural crops.

The Black-tailed jackrabbit is 18 to 25 inches long and is colored buff peppered with black above, and white below. The tail has a black stripe above. The ears are long and brown with black tips. Jackrabbits have many natural enemies. Coyotes, Bobcats, foxes, Horned Owls, hawks and snakes prey on both the young and adults.

3.8.6.2 Groundhog/Yellow-bellied Marmot (*Marmota flaviventris*)

All Tribes in the Analysis Area describe groundhogs as a culturally important wildlife species. Following discussions with the Tribes, groundhogs have been identified as *Marmota flaviventris*, commonly called yellow-bellied marmot in scientific literature. The Native American band name of the Fort Bidwell Tribe is Gidutikad that they translate as groundhog eaters. This name reflects the importance of that food source to that tribe (Meza pers. Comm. 2008).

Marmota flaviventris inhabits a wide range of environments from sea-level prairies in eastern Washington through a variety of montane environments in the Sierras, southern Rockies and southern Cascades (Barash 1974). They prefer boulder fields or large rock talus slopes adjacent to meadow or shrub and grass uplands. This combination of habitats provides grass and forbs for food, and nearby rocks to escape from predators (Darby 2008). They choose to dig burrows under rocks because predators are less likely to see their burrow. Habitat for groundhogs/marmots is commonly found throughout the Focus Area; however, the reduction of grass and shrubs due to increased juniper density in the Focus Area has reduced habitat suitability.

Marmota flaviventris usually weigh between five and 11 pounds when fully grown. Their territory is about six acres around a number of summer burrows. Predators include foxes and coyotes. When a groundhog/marmot sees a predator it whistles to warn all other marmots in the area (giving it the common name the whistle pig). Then it typically hides in a nearby rock pile. They live in colonies. A colony is a group of about 10 to 20. *Marmota flaviventris* are diurnal and omnivores, eating grass, leaves, flowers, fruit, grasshoppers, and bird eggs.

As described above, the Fort Bidwell tribe refers to the local *Marmota flaviventris* as groundhogs. Tribal members refer to *Marmota flaviventris* that is found in Yosemite (California) and Montana as marmots. They indicate that the local groundhog is a little bigger, a little darker in color, with a little bushier tail than the animals they refer to as marmots (Meza pers. Comm. 2008).

3.8.6.3 Porcupine (*Erethizon dorsatumis*)

The North American porcupine (*Erethizon dorsatumis*) a quill-bearing rodent that is heavyset, short-legged, slow-moving, usually solitary, nocturnal, herbivorous, and spends much of its time in trees. The porcupine's barbed quills detach easily and can become painfully embedded in the skin of an attacker. Porcupine quills embedded in an attacker's face may prevent the animal from feeding successfully, causing death from starvation.

The porcupine's range is throughout all the North American desert regions, and the entire west, north to Canada. Although the porcupine is usually regarded as arboreal and found in woodlands, individuals wander widely. The porcupine is primarily nocturnal and may rest by day in hollow trees and logs, crevices in rocky bluffs or underground burrows.

Porcupines are strict vegetarians. In the spring they feed on leaves, twigs and green plants. In winter, they chew through the outer bark of fir, hemlock, aspen and pines trees to eat the tender layer of tissue below. Sometimes, they will completely girdle, and thus kill, trees. They may also gnaw used ax handles, canoe paddles and other items for the salt and oil they contain. The two large, front gnawing teeth continue to grow as long as the porcupine lives.

3.8.7 Threatened and Endangered Species

The U.S. Fish and Wildlife Service, Klamath Falls Office, provided a list of listed, proposed, and candidate species that may occur in Modoc County (USDI Fish and Wildlife Service 2005). The list indicates that there are three vertebrates occurring within the Focus Area boundaries.

3.8.7.1 Modoc Sucker (*Catastomus microps*)

The Modoc sucker (*Catostomus microps*) is federally listed as endangered. The species is found only in a small portion of the upper Pit River drainage in Modoc and Lassen counties and is found in several streams in the Analysis Area, preferring those having still-water pools and a mud substrate (McGinnis 1984). In the Alturas Field Office area, Ash Creek and Rush Creek have Modoc suckers year round. These small creeks are in the Warm Springs/Big Valley watershed near Adin. In the Fall River watershed, there is very little occupied, historical, or potential habitat and there is no designated critical habitat. It is believed that the Modoc sucker does not currently reside in the Fall River planning unit (Reid pers. comm.).

The Modoc sucker requires small partially shaded streams having large muddy-bottomed pools (Moyle and Marciochi 1975). Streams that have been channelized through livestock induced bank disturbance and erosion are unsuitable for this species. Critical habitat for the Modoc sucker includes the Turner Creek and Rush Creek drainages (USDI Fish and Wildlife Service 2001).

3.8.7.2 Lost River Sucker (*Deltistes laxutus*)

The Lost River sucker is listed as endangered under the ESA. The present distribution includes Upper Klamath Lake and its tributaries (Buettner and Scoppettone 1990), Clear Lake Reservoir and its tributaries (Buettner and Scoppettone 1991), Tule Lake and the Lost River up to Anderson-Rose Dam, and the Klamath River downstream to Copco Reservoir (USDI Fish and Wildlife Service 1993). Lost River suckers inhabit lakes but spawn in tributary streams or springs. Lost River suckers spawn near the bottom and when gravel is available.

3.8.7.3 Shortnosed Sucker (*Chasmistes brevirostris*)

The Shortnosed sucker is listed as endangered under the ESA. This species is endemic to deeper lakes in the Klamath Basin, many that have now been drained, and spawning in tributaries. In California, the present distribution of shortnose suckers is similar to that of the Lost River sucker.

3.8.8 FS AND BLM SENSITIVE SPECIES

Forest Service Manual (FSM) 2670.5 defines sensitive species as "*those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers, density, or habitat capability that reduce a species existing distribution.*" In FSM 2670.22, management direction for sensitive species is, in part, to ensure that species do not become threatened or endangered because of Forest Service action, and to maintain viable populations of all native species.

BLM sensitive species are designated by the State Director, per Manual Direction 6840.

3.8.8.1 Northern Goshawk (*Accipiter gentilus*)

Goshawks reproduce in a broad range of vegetative communities, ranging from extensive mature coniferous forest in coastal regions to small patches of aspen and pine in Great Basin shrub-steppe communities. At the landscape or home range scale, goshawks utilize a diverse array of habitat, both in vegetation type and degree of openness (Squires and Reynolds 1997)

Reich *et al.* (2004) rated pinyon-juniper communities in Arizona as poor for goshawk nesting having found no nest sites located within them. However, Drennan and Beier (2003) found most male goshawks appeared to have moved into lower-elevation pinyon juniper forest in the winter months.

3.8.8.2 Golden Eagle (*Aquila chysaetos)*

The golden eagle (*Aquila chrysaetos*) occupies a wide variety of habitats at all elevations throughout its range (Palmer 1988). The species nests primarily on cliffs with commanding views, and occasionally in large trees (Verner and Boss 1980).

Olendorff *et al.* (1981) estimated a wintering population of nearly 50,000 in the western States. In Utah during at least one recent year, the golden eagle population was reported to be increasing, although this may have been a temporary condition resulting from local increases in prey (Harlow and Bloom 1989).

The golden eagle is not a listed species or a candidate species for listing under ESA. However, it is considered a species of special concern and it receives federal protection under the Eagle Protection Act, primarily because of similarity of appearance to bald eagles, and under provisions of the Migratory Bird Treaty Act (Littell 1992).

3.8.8.3 Burrowing Owl (*Athene cunicularia*)

This species is designated as a Sensitive Species by the FS and BLM, and is a species of special concern by the California Department of Fish and Game. Burrowing owls utilize the sage steppe areas of the Great Basin, specifically nesting in those areas that have lower shrub volumes but where scattered shrubs provide perching sites (Green and Anthony 1989). Nesting most often occurs in abandoned rodent or badger burrows (Dechant *et al.* 1999). In Oregon, owls used badger burrows in recently burned areas that were previously unused and it can be assumed that vegetation shifts to dense stands of taller woody shrubs would preclude burrowing owl occupancy.

3.8.8.4 Greater Sandhill Crane (*Grus Canadensis tabida)*

Littlefield (1989) observed that in California the largest number of nesting sandhill cranes was in Modoc County with 64 nesting pairs. Nesting areas are comprised of wetlands and meadows, usually within sage steppe and western juniper habitat types. Nest sites are located on mesic sites having surrounding vegetation of grasses and sedge (Littlefield 1989).

While sandhill cranes do not use upland areas of sage or western juniper, activities in these areas that affect adjacent wetlands may be detrimental to successful reproduction.

3.8.8.5 Bats

At least nine bat species may be found foraging within sagebrush habitats but these are closely associated with caves, rock crevices, and water sources (McAdoo *et al.* 2004). Rock outcrops, canyon cliffs, trees, and mineshafts provide a high amount of suitable habitat for roosting and maternity habitats.

3.8.8.6 Fisheries

There are a number of permanent streams in the Focus Area that can support fish populations. There are no populations of anadromous fish within the Analysis Area. In the Goose Lake watershed, only a small stretch of Willow and Lassen Creeks provides suitable aquatic habitat. These small stream sections provide spawning habitat for Goose Lake sucker, Goose Lake tui chub, pit sculpin, speckled dace, Goose lake lamprey, and Goose Lake redband trout. Most of these species use these creeks for spawning (California Department of Fish and Game 1992 and Moyle 1996).

3.8.8.6.1 Goose Lake Sucker

The Goose Lake sucker (*Catostomus occidentalis lacusanserinus*) is restricted to the Goose Lake basin and has been reported to spawn in the streams that are tributary to Goose Lake including Willow, Lassen, Branch, and Corral creeks of Modoc County.

3.8.8.6.2 Goose Lake Tui Chub

The Goose Lake Tui Chub (*Gila bicolor thalassina*) is confined to the Goose Lake basin of Oregon and California. In addition to Goose Lake itself, the chub also occurs in low-elevation sections of streams that are tributaries to the lake. The California Department of Fish and Game reported that when the lake was dry in late June of 1994, chubs were abundant in a small portion of lower Willow and Lassen creeks (Moyle *et al.* 1995).

3.8.8.6.3 Goose Lake Lamprey

The Goose Lake lamprey (*Lampetra tridentata ssp.*) is endemic to Goose Lake and its tributaries. The streams most important for spawning and as habitat for the ammocoetes have not been identified with certainty although collections have been made in Willow, Lassen and Cold (tributary to Lassen Creek) creeks in Modoc County (Moyle *et al.* 1995).

3.8.8.6.4 Redband Trout

Redband trout (*Oncorhynchus mykiss ssp*.) occupy Willow and Lassen Creeks and their tributaries in Modoc County and may continue to spawn in these creeks in the headwaters where enough gravel and spring flows support spawning runs from Goose Lake (Moyle *et al.* 1995 and Moyle 1996).

3.8.8.7 Western pond turtle (*Emys marmorata*)

A single aquatic reptile, the western pond turtle, may occur within the Focus Area although it is limited in habitat due to impacts on nesting habitat from agricultural practices and livestock. They are present in ponds and slow stream environments, especially in the Lower Pit River.

3.8.8.8 Great Basin spadefoot (*Spea intermontana)*

Nearly completely terrestrial, this species only requires temporary rain pools or pools in ephemeral streams in which to breed. They are found in drier habitats than most amphibians, usually in dry grasslands and open woodlands. They need loose soil for burrowing, or access to rodent burrows, to shelter in during the day. They escape dry conditions by retreating into underground refuges such as small mammal burrows or by burrowing into the soil (Corkran and Thoms 1996).

3.8.8.9 Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles have been recently removed from protection under the Endangered Species Act (ESA) but are listed as endangered under the California Endangered Species Act (CESA).

The historic breeding range included all of California except the southern deserts. Over 100 breeding pairs of bald eagles were discovered in 1993, primarily in the Klamath-Tule Lake Basin and Pit River drainage of northern California. Wintering birds range throughout California and concentrate near reservoirs and lakes where prey is abundant. Streams supporting anadromous fish are used by wintering eagles in the Central Valley to a lesser extent. Perch sites and night roosts are important habitat elements for the bald eagle. Such sites are usually in a large, sturdy tree with open branchwork. In a study in the Great Basin in Oregon, no records could be located regarding bald eagle using juniper for a nesting structure.

As many as 1,000 eagles make the adjacent Klamath Basin the largest wintering area for the species in the lower 48 states. Wintering waterfowl populations can be two million or more and the scavenging eagles primarily eat waterfowl that have succumbed to avian cholera, a disease that does not often affect the eagles. Bald eagles may use lakes within the Analysis Area but are primarily restricted to these and other bodies of water.

3.8.9 Management Indicator Species (MIS)

For the Modoc National Forest, there are three categories of MIS, covering 32 species of wildlife and fish (USDA Forest Service 1991b). MIS for the Modoc National Forest include the following: federally listed species, FS sensitive species, harvest species, and ecological indicator species (USDA Forest Service 1991a page 3-37). The federally listed and FS sensitive species were based on the lists current for 1991. Over the past fifteen years, there have been changes to the status of the species covered under the Modoc National Forest MIS list. For example, recently the bald eagle was delisted and is now a FS and BLM sensitive species. A forest-wide MIS report has been completed and summarizes the current information about the forest-scale population distributions and relationships to habitat of the MIS listed within the Modoc National Forest (USDA Forest Service 2007b).

The Modoc National Forest LRMP (USDA Forest Service 1991b) requires a combination of species monitoring and habitat status depending on the MIS. Appendix E of the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS (USDA Forest Service 2001b) as adopted by the 2004 SNFPA Record of Decision (USDA Forest Service 2004a) amended the direction for species monitoring. The requirements for habitat monitoring are still found in the Modoc National Forest LRMP (USDA Forest Service 1991a, Chapter 5, pages 5-1 to 5-22). Table 27 displays the Modoc National Forest MIS and their current monitoring requirements.

The monitoring program for harvest species (i.e. species that are hunted, fished, or trapped) has been designed to be implemented in cooperation with CDFG. This direction is consistent with both the 1982 Planning rule to monitor forest-level MIS population trends in cooperation with state fish and wildlife agencies to the extent practicable (36 CFR 219.9(a)(6)) as well as Modoc LRMP direction.

The Modoc National Forest MIS report consists of species accounts for each MIS. The species accounts are based on the best current information on life history, habitat relationships, suitable habitat, and changes in distribution information for each MIS. Species distribution information is discussed at a variety of spatial scales, including the range of the species, State (i.e., California), Province (e.g., Sierra Nevada), and Forest. This information is discussed in terms of the current amount of habitat and the current species distribution from a forest perspective. For each MIS, the timeframe for the changes in distribution as well as trend in habitat is the adoption of the Forest Plan to the present. The current quantity of habitat present on the Modoc National Forest has been delineated for each species based on GIS models, which incorporate changes in habitat since the Modoc LRMP was finalized.

Two species do not have detailed species accounts prepared for the Modoc National Forest MIS report: California bighorn sheep and peregrine falcon. Neither of these species is known to occupy the Modoc National Forest; therefore, the preparation of a summarized account was appropriate.

Table 27. Monitoring Requirements for the MIS on the Modoc National Forest

MIS	MIS Monitoring Requirements	
	Habitat[1]	Population[2]
American Marten	Vegetation mapping, down log & snag transects	Bioregional - status & change in geographic distribution
Bald Eagle	Vegetation surveys, Habitat capability analyses	Recovery Plan
Bighorn Sheep	N/A - Extirpated	N/A – Extirpated
Blue/Sooty Grouse	Vegetation mapping	Distribution population
Brook Trout	Stream/lake habitat surveys	Distribution population
Brown Trout	Stream/lake habitat surveys	Distribution population
Canada Goose	Livestock utilization measurements	Distribution population
Golden Eagle	Habitat utilization assessment	Distribution population
Goose Lake Redband Trout	Stream surveys, Photo points	Distribution / relative abundance
Greater Sandhill Crane	Livestock utilization measurements	Distribution population
Hairy Woodpecker	Snag, down log transects; vegetation mapping	Distribution population
Largemouth Bass	Stream/lake habitat surveys	Distribution population
Lost River Sucker	Stream surveys, Photo points	Recovery Plan
Mallard	Livestock utilization measurements	Distribution population
Modoc Sucker	Stream surveys, Channel profiles, Photo points	Population sampling
Mule Deer	Vegetation sampling and mapping	Distribution population
Northern Goshawk	Ground surveys and vegetation measurement	Bioregional - status & change
Osprey	Habitat utilization assessment	Distribution population
Peregrine Falcon	Ground surveys during and after reintroduction efforts	Distribution population
Pileated Woodpecker	Snag transects, down log transects, vegetation mapping	Distribution population
Prairie Falcon	Habitat utilization assessment	Distribution population
Pronghorn	Habitat surveys including ecological condition (e.g. vegetation mapping, condition and trend, etc.)	Distribution population
Rainbow Trout	Stream/lake habitat surveys	Distribution population
Red-breasted Sapsucker	Vegetation sampling, photo points	Distribution population
Red-naped Sapsucker	Vegetation sampling, photo points	Distribution[3]
Sage-grouse	Habitat surveys including ecological condition (e.g. vegetation mapping, condition and trend, etc.)	Distribution population
Shortnose Sucker	Stream surveys, Photo points	Recovery Plan
Spotted Owl, Northern	Vegetation mapping / analysis	Recovery Plan
Swainson's Hawk	Habitat utilization assessment	Distribution / relative abundance
Western Gray Squirrel	Vegetation mapping	Distribution population
Willow Flycatcher	Vegetation sampling, photo points	Bioregional status and change
Yellow Warbler	Vegetation sampling, photo points	Distribution population

[1]Modoc National Forest FLRMP (USDA Forest Service 1991a)

[2]Sierra Nevada Forest Plan Amendment, Appendix E

[3]Monitoring requirements are in essence the same as the "Distribution population" data.

Twelve species are identified as "*MIS whose habitat would be either directly or indirectly affected*" by the Sage Steppe Restoration Strategy. These species are addressed below or in the following sections:

- *Section 3.8.2 – Sage Steppe Obligate Species*: Pronghorn and Greater sage-grouse.
- *Section 3.8.3 – Big Game Species*: Mule deer.
- *Section 3.8.4 – Juniper Woodland Species*: Swainson's hawk.
- *Section 3.8.7 – Threatened and Endangered Species*: shortnose sucker, Lost River sucker, Modoc sucker.
- *Section 3.8.8 – FS and BLM Sensitive Species*: Greater sandhill crane, Golden eagle, and Northern goshawk and Goose Lake redband trout.

3.8.10 State Listed Species

A review of species listed by the State of California indicates the Swainson's hawk (*Buteo swainsonii*) and greater sandhill crane (*Grus Canadensis tabida*), both listed as Threatened Species, reside in the Analysis Area. See *Section 3.8.4.1 Swainson's Hawk* and *Section 3.8 8.4 Greater Sandhill Crane* for the existing conditions of these species.

3.8.11 Other Focus Area Species

3.8.11.1 Predatory Mammals

There are a number of predatory mammals that use the sage steppe habitats. These are dependent on shrub cover; a variety of smaller vertebrates as prey, and a source of available water. Diverse habitats that provide a variety of vegetative conditions conducive to rodent occupancy are normally optimum for these species. These predatory species include (but are not limited to): long-tailed weasel, striped skunk, American badger, coyote and bobcat. In areas of high mule deer populations the mountain lion is also present.

3.8.11.2 Birds

Range maps published by Grenfell and Laudenslayer (1983) indicate 166 birds potentially reside in the Focus Area either as permanent residents and/or winter or summer residents. Surveys conducted in Great Basin sage types by the High Desert Ecological Research institute cataloged 25 upland and 12 riparian bird species closely associated with shrub-steppe habitats. Of these, all of the upland species and nine of the riparian species were dependent upon shrub or ground vegetation for nesting and/or foraging. Generally, bird populations in sage steppe habitats have declined (Dobkin and Sauder 2004).

The density of sagebrush cover has important influences on habitat use by many bird species. Of 17 birds studied in eastern Washington, seven species had a positive relationship to sagebrush cover, two were inversely related, and eight were not related (Vander Haegan *et al.* 2000).

American robins, mountain bluebirds, cedar waxwings, Steller's jays, and scrub jays readily consume the berries. During the winter, Townsend's Solitaires and robins may consume more than 200 berries per day (Miller 2001).

3.8.11.3 Amphibians

3.8.11.3.1 Cascade frog (Rana cascada)

There are no records in the Focus Area (Jennings and Hayes 1994).

3.8.11.3.2 Northern leopard frog (Rana pipiens)

Considered extinct in the Focus Area (Jennings and Hayes 1994, Jennings pers. Comm. 2006).

3.8.11.3.3 Spotted frog (Rana pretiosa)

One verified record in the eastern Warner Mountains. Likely extinct in Focus Area (Jennings and Hayes 1994, Jennings pers. Comm. 2006).

3.9 Socioeconomics

Economic effects are associated with several of the Significant Issues for this Restoration Strategy. Modoc County has one of the highest poverty rates in northern California, and the Modoc County General Plan (1988) has called for greater economic diversification. Economics is also highly relevant to this Restoration Strategy. Grazing is a foundation of the agriculturally based economy, and grazing income could be reduced by the proposed activities. However, jobs added to accomplish juniper removal could have a positive economic effect.

Data sources used in depicting existing conditions come from a variety of sources for various time periods. Most of the economic and demographic data depict conditions from 1990 to 2004. However, other important sources of data such as the Modoc County General Plan (1988) depict economic activity from earlier time periods (1950 until 1980). As a result of these different data sources, a single range of years was not used for reporting and analyzing data.

The Analysis Area includes portions of Siskiyou, Shasta, Lassen and Washoe Counties, in addition to all of Modoc County. Although the economic impacts of treatments in the counties are similar with respect to acre for acre economic effects, the economic diversity of Siskiyou, Shasta, Lassen and Washoe Counties is greater; therefore the focus of local economics for the Sage Steppe Ecosystem Restoration Strategy will be on Modoc County.

3.9.1 Summary of the Social and Economic History

This section focuses on the social and economic history of European settlers. The Native American economies were integrated with the European settlers soon after they arrived. For a discussion of the social history of the Native American Tribes in the Analysis Area, see *Section 3.10 Cultural Resources*.

By 1864, the first permanent European settlement was established by James Townsend in Surprise Valley near what is now the area south of Cedarville. The town of Surprise Valley, later named Cedarville, was established in 1867. In 1870, Presley, Carlos, and Jim Dorris settled the town of Dorris Bridge, later to become the City of Alturas. At about the same time, settlers established homes in the area of modern Adin. Modoc County was officially made a county in 1874, and by 1880 there were about 4,400 people in Modoc County (Pit River Watershed Alliance 2004). The population tended to concentrate in Surprise Valley and along the Pit River. Surprise Valley was, at this time, the most populous area of the county. In addition to Alturas, several towns had been established, including Canby, Eagleville, Likely, Adin, Lake City, and Cedarville. Several lumber mills were operating in the county (Pit River Watershed Alliance 2004).

The predominant economic activity was agriculture (mostly grazing). The timber production business was also an important element of the economy. The period of 1880 to 1910 saw steady expansion of the population (by 1910 the population was about 6,200). The population concentrated in existing town areas. The exception was the High Grade mining district, which saw substantial expansion across the Warner Mountains at the north end of the county, but only for a brief period. Railroad service was established in 1908, four years after electrical service. Some exports occurred, but production was local-service oriented.

World War I had a substantial effect on the local economy and population. Many people left the county and most of the small lumber mills shut down. Following the end of the war, renewed economic activity occurred. Population increased to about 5,400 in 1920 and to 8,000 in 1930. New mills were being built, including the Pickering Lumber Company in western Alturas around 1925. At the time, the Pickering Mill was considered to be the largest of its kind in the world. The Great Depression had a substantial dampening effect on the local economy and the mill was never finished.

By 1940, economic recovery was taking place in Modoc County. There were nine active mills that produced over 107 million board feet of lumber in 1940. One-tenth of the county population (and one-third of all adult males) was employed in the lumber mills. Agriculture was the other major economic activity in the county, and was dominated by livestock production including sheep, beef cattle, dairy cows, and horses. By 1940, only 42 percent of the population lived in rural areas. An increased export economy created more non-agricultural jobs in the county. Farming operations were changing from subsistence crops to income producing livestock and export crops.

The company-owned lumber camps were all in upland areas, and with the exception of Big Lakes, were all located on the western edge of the Devils Garden. The largest, Tionesta, in 1940, was the second-largest town in the county, with more than 700 residents. The other company lumber towns were Long-Bell Camp Number 1, and Big Lakes, all in reality semi-permanent logging camps. Alturas had almost doubled in size between 1912 and 1940. Growth resulted because of the increasing functions of a county seat and the fact that the town was by far the best retail center in the county. Pavement of the major highways through the county had benefited Alturas in two ways. More retail trade was coming from outlying areas at the expense of the rural market centers, and the beginnings of regional highway traffic through the county permitted Alturas to cater to tourists passing through the scenic volcanic lands. The town had continued to grow on the north side of the North Fork of the Pit River. Main Street was now a part of the U.S. Highway 395, and new stores and service stations were located on this regional thoroughfare north of the old business district.

In 1940, Alturas was described as containing 654 dwellings with no home worth more than $10,000.00, but with only 32 worth less than $1,000.00. There were more than 100 retail establishments and shops, adequate high schools and elementary schools, a library, five churches, fraternal halls, theater, three hotels, county hospital, and various government offices. The town had a modern sewer system, waterworks, paved streets, and sidewalks. Gradual expansion of the population and the economy, plus the revival of the transit role in the economy by railroads and regional motorists, had made Alturas the most important town center in Modoc County (Pit River Watershed Alliance 2004).

Modoc County went through a period of economic stagnation from 1950 through 1980. In 1950, there were 3,738 employees in all sectors, and in 1980 there were 2,925 employees. Timber harvest steadily decreased during the late 1970's and 1980's. In contrast, agricultural production varied from year to year from 1976 to 1984, but increased overall. The greatest increase in value occurred in 1979 and 1980. According to the Modoc County General Plan (1988) variations in production are related to variations in the value of agricultural products. Production of vegetables had nearly tripled and livestock had doubled. The Socioeconomic Specialist Report contains detailed information as to the employment by decade and sector, as well as the timber harvest by year from 1978-1983 and 2003 and 2004, and the gross value of agricultural products from 1976–2004.

There are substantially less agriculture, mining, manufacturing, and transportation jobs in 2000 as compared to 1950. Government and finance jobs show substantial increases during the same time period. This mirrors an economic change that has occurred throughout many rural counties in California.

3.9.2 Sense of Place

Modoc County has the lowest population density among the California counties in the Analysis Area. It is located several hours drive from other population centers such as Redding, Klamath Falls, and Reno. Modoc County has a sense of place based upon American Indians that have historically occupied and live in the area, and based on a well-developed ranching culture. For example, the Surprise Valley Chamber of Commerce features an annual Basque Barbeque and Squirrel Roundup. Modoc County is also distinct in the amount of undeveloped lands and a slow rate of population growth. Public lands in Modoc County offer abundant opportunities for hunting and viewing wildlife, and for solitary recreation experiences. The Alturas Chamber of Commerce refers to this area, as "*where the West still lives*", and the Surprise Valley Chamber of Commerce refer to Surprise Valley as an area where "*the pavement ends and the west begins*." Modoc County is home to several communities that are heavily dependent on resource management activities. For example, there is a biomass plant and sawmill in Bieber, and the Big Valley Sustained Yield Unit legislation was passed to help support communities such as Bieber. The goal of the Sage Steppe Ecosystem Restoration Strategy is consistent with the customs and culture of the Analysis Area.

3.9.3 Economic Conditions in Modoc County

3.9.3.1 Population Trends

The population of Modoc County has remained nearly constant during the last 15 years. In 1990 the population was 9,600 and in 2004 the population was 9650. Annual changes in population ranged from -2.8 percent to +2.1 percent. The population in the city of Alturas has decreased slightly since 1990. In 1990, the population was 3,190 and in 2004 it was 2,840. Annual changes in population have ranged from -3.6 percent to +1.4 percent. The *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007d) provides detailed annual tables for the years 1990 through 2004 for Modoc County and the city of Alturas.

3.9.3.2 Age Distribution

The age distribution from 1990 through 2004 shows a couple of notable trends (see *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2007d] for detailed tables). In the 20 to 39 year old age group, there has been a decrease from about 2,450 persons in 1990 to 1,983 individuals in 2004. It is likely that as youth complete high school and or other forms of training, they leave the area in search of employment. In contrast, the number of persons in the 50 to 59 year old age group has increased by more than 50 percent since 1990. The increase in the 50-59 year old age group mirrors a regional trend in northern California of retirees migrating from urban areas to rural areas. This is reflected in income data showing that 26 percent of total personal income in Modoc County is from transfer payments (welfare, social security, disability, etc.) which is twice as high as the proportion of transfer payment income for California as a whole.

3.9.3.3 Race and Ethnicity

The majority of the population in Modoc County is Caucasian (approximately 80 percent), followed by Hispanic, and American Indians. During the last 15 years, the number of Caucasians has decreased by about 10 percent. In contrast the number of Hispanics has increased by about 70 percent to comprise about 12 percent of the population and the number of Asians in the county has doubled. The rate of increase in the Hispanic population in Modoc County is less than the rate of increase for California as a whole. It is important to note that the percentage increases for minority populations are large in part due to the fact that the population base in 1990 was a low number for both Hispanics and Asians, in comparison to the Caucasian population. The number of Blacks has slightly decreased slightly and the number of American Indians has slightly increased. For California as a whole about 47 percent of the population is Caucasian, and about 32 percent are Hispanic. A detailed table about race and ethnicity from 1990 to 2004 is found in the *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007d).

3.9.3.4 Unemployment Trends

Unemployment records (based on people not working who were able, available and actively seeking work between ages of 16 and 65 years old) from 1990 until 2003 show that unemployment has ranged from 7.6 percent to 13.5 percent. Unemployment was highest in 1993 and lowest in 2002. Unemployment reached its peak during 1993, at a time when the entire state was in a recession. Unemployment in 2002 was 7.6 percent, during which time unemployment for the state of California was 6.7 percent (see *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2007d]).

3.9.3.5 Income Trends

Total personal income for Modoc County has steadily increased between 1990 and 2002. Total personal income is defined by the U.S. Department of Commerce as having five components. Earnings by place of work refer to the total income earned from jobs located in a given county. Dividends, interest, and rent are various types of returns on investments and include payments or royalties received from patents, copyrights, and rights to natural resources. Personal contributions for social insurance are always negative and refer to payments made by the self-employed, and other individuals to programs such as Social Security and Medicare. Adjustments by place of residence are made so that total personal income reveals income by place of residence instead of place of work. This is helpful when analyzing the number of individuals that actually work in a given county, not counting commuters. A positive resident adjustment indicates people live within the county, but work outside it. A negative residence adjustment indicates people work in the county, but live outside it. Transfer payments are income for work not immediately performed, such as Social Security, Medicare, or Medicaid payments. Among the different components of income, transfer payments showed the greatest percent increase since 1990. This reflects the aging of the County's population, and retirees' income from programs such as social security and disability. In 1990, the total personal income for Modoc County was $146,940, 000. In 2002, this figure increased to $223,836,000. In 2002, Modoc County's total personal income ranked 22nd (last) among the counties in Northern California. Further details are found in the *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007d).

Modoc County ranks 12th in per capita income when compared to the 22 counties in northern California. In 1990 per capita income (inflation adjusted) was $21,529 and it had risen to

$24,053 in 2002. Real income showed a large increase (about eight percent) in 1993, and a large decrease in 2000 (- 11 percent). Annual details can be found in the *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007d).

3.9.3.6 Poverty Rate

The poverty rate is determined by a set of money income thresholds that vary by family size and composition. In 1989, the Census Bureau defined the poverty level for a household of two individuals, regardless of age, as $8,076 per year, and for 1999 as $10,865 per year. The average poverty rate in Modoc County in 1999 was 21.5 percent, above the statewide average of 14.2 percent. This was the highest poverty rate among all the northern California counties in 1999 (Center for Economic Development 2005), and fifth highest statewide. From 1989 until 1999 the County experienced a 43 percent increase in poverty, while the City of Alturas experienced an increase of 95 percent (from 13.9 percent to 27.1 percent). The high poverty rate combined with an average per capita income for Northern California indicate that there is a larger income disparity in Modoc County than the other 22 counties in this region of California.

3.9.3.7 Business and Industry Sectors

The business and industry sectors in Modoc County include: agriculture and mining; construction; manufacturing; transportation and public utilities; wholesale trade; retail trade; finance, insurance and real estate; services; government; and tourism. The *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007d) provides detailed statistics from 1990 and 2002 and descriptions of each of these sectors.

In Modoc County the government and public administration sector accounted for the largest number of employees (1,300) in 2002, followed by the Agriculture and Mining sector with 746 employees. Earnings by industry in 2002 show a similar pattern with the Government and public administration sector first and the agriculture and mining sector, second. Over the 12-year period for which data are reported, agricultural earnings show some fluctuation in earnings, probably due to variation in crop and beef prices and the costs of production. In all years, the government and public administration sector ranked first in earnings. In most years, agriculture ranked second in earnings. In all years, agriculture ranked at least third in earnings.

Several conclusions can be drawn from this information. Only the government sectors have seen earnings steadily increasing, presumably due to the fact that many government entities usually give regular cost of living wage adjustments to their employees. Earnings in the construction and finance sectors doubled, possibly due to increased demand for new houses generated by retirees moving into the County. Earnings in agriculture stayed relatively constant, with a slight increase in real income in between 1990 and 2002.

3.9.3.8 Taxable Sales

Taxable sales are reported since they are an indicator of a county’s fiscal health, and are indirectly related to economic conditions. Taxable sales do not necessarily reflect business establishments’ total gross income, only the proportion that is taxable. Since 1994 taxable retail sales have grown steadily, from about $35 million dollars to $45 million dollars in 2003. This growth pattern (28 percent increase) is less than the growth in taxable sales experienced by the other California counties in the Analysis Area. Growth in taxable sales grew at 71 percent over a nine-year period for Shasta County, followed by 48 percent for Siskiyou County, followed by 43 percent for Lassen County. When examining taxable sales on a per capita basis, Modoc County is fourth ($4663 per person) relative to the other California counties in the Analysis Area. Shasta County taxable sales on a per capita basis are about three times as high as Modoc County, at $13,714 per person. Modoc County's fiscal health is lower than the other three counties in California portion of the Analysis Area (see *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2007d] for detailed information).

3.9.4 Economic Conditions in Lassen County

The population of Lassen County increased from 1990 to 2004 by from 27,000 to 34,850 people, or about 29 percent. A significant portion the population increase is attributed to construction of the prison in Susanville, which accounts for about 4,000 people. In 2004, the largest age group was the 20-29 year old age group, which represents about 20 percent of the County's population. Since 1990, the number of people between the ages of 50-59 years old increased by 4.4 percent. Approximately 70 percent of Lassen county residents classified themselves as Caucasian in 2004. Hispanics were the next largest group, comprising about 15 percent of the County's population. In 2002, the government and public administration sector of the economy represented about 43 percent of the County's employment (5,612 employees), followed by the services sector, at about 20 percent (2,400 employees). Similarly, earnings by industry show that the government and public administration sector accounted for 62 percent of Lassen County earnings in 2002. Between 2001 and 2002 tourism earnings increased 30 percent in Lassen County, as compared to five percent in California as a whole. The poverty rate for Lassen County was 14 percent in 1999, a decrease of about four percentage points since 1989. The per capita income of Lassen County was $19,174 for 2002, which ranks second last in California. The High Desert Prison in Susanville has a negative effect since incarcerated individuals are presumably included in the County population. Total personal income for Lassen County was $643,788,000 in 2002.

3.9.5 Economic Conditions in Siskiyou County

The population of Siskiyou County increased from 1990 to 2004 from 43,300 to 44,850 people, or about 3.5 percent. Population density was 7.1 persons per square mile. In 2004 the largest age group was the 50-59 year old age group, which represented about 17 percent of the County's population. Since 1990, the number of people between the ages of 50-59 years old increased by about 75 percent. Approximately 82 percent of Siskiyou county residents classified themselves as Caucasian in 2004. Hispanics were the next largest group, comprising about eight percent of the County's population. In 2002, the services sector of the economy represent the largest proportion of the County's employment (5,522 employees), closely followed by the government and public administration sector (4,499 employees). Retail trade and tourism section provided nearly equal amounts employment (2760 and 2,598 employees, respectively). Earnings by industry show a slightly different pattern with the government and public administration sector showing the highest earnings, closely followed by the services sector, followed by the transportation and public utilities sector. Between 2001 and 2002 tourism earnings increased 10 percent in Siskiyou County, as compared to five percent in California as a whole. The poverty rate for Siskiyou County was 18.6 percent in 1999, an increase of about four percentage points since 1989. The per capita income of Siskiyou County was $23,874 for 2002, which ranked second last in California. Total personal income, adjusted for inflation for Siskiyou County was $1,055,973 in 2002.

3.9.6 Economic Conditions in Shasta County

The population of Shasta County increased from 1990 to 2004 from 145,300 to 175,700 people, or about 20 percent. Population density was 46.4 persons per square mile. In 2004 the largest age group was the 20-29 year old age group, which represented about 14 percent of the County's population. Since 1990, the number of people between the ages of 20-29 years old increased by about 35 percent. Approximately 83 percent of Lassen county residents classified themselves as Caucasian in 2004. Hispanics were the next largest group, comprising about 11 percent of the County's population, followed by Native Americans. In 2002, the services sector of the economy represent the largest proportion of the County's employment (29,634 employees), followed by the government and public administration sector (14,444 employees). Earnings by industry show a similar pattern with the government and public administration sector showing the highest earnings, followed by the services sector. Between 2001 and 2002 tourism earnings increased 12 percent in Shasta County, as compared to five percent in California as a whole. The poverty rate for Shasta County was 15.5 percent in 1999, an increase of about two percentage points since 1989. The per capita income of Shasta County was $26,532 for 2002, which ranks eighth in the northern California counties. Total personal income, adjusted for inflation for Shasta County was $4,557,804 in 2002.

3.9.7 Economic Conditions in Washoe County, Nevada

Washoe County borders northeastern California and includes Reno and the surrounding communities. In 2005, the total population of Washoe County was estimated at 389,872 people. Almost one-third of the population (31 percent) fell in the 45 to 59 years old category. Population density was 53.5 persons per square mile, in large part due to the population of the Reno-Sparks area. Population density where project activities would occur would be much lower. Eighty-eight percent of the population was Caucasian, and about 19 percent was Latino. Unemployment for the County was five percent, and the poverty level in 1999 was about ten percent. In terms of employment by industry sector, the arts, entertainment, and recreation sector accounted for the largest proportion of employment (34,406 employees) at 20 percent. The education, health, and social services sector is second, and accounted for about 16 percent of employment (27,041 employees). Retail trade was third, accounting for about 12 percent of employment (20,323 employees). The agriculture sector was last, and accounted for 0.8 percent of the County's total employment. The median, per capita income was about $45,000.

3.9.8 SUMMARY OF ECONOMIC CONDITIONS IN THE ANALYSIS AREA

Over a 15-year period for which there are readily available economic and demographic data, there has not been much economic or demographic expansion in the California counties comprising the Analysis Area, particularly in Modoc County. In Modoc County the population over a 15-year period has remained nearly constant. The number of employees in the government and public administration sector remained constant, while the number of employees in the agriculture and mining sector decreased by about 50 employees. Lassen County showed a substantial increase in population (about three percent per year), in large part due to construction of the High Desert Prison. The population of Shasta County grew at the next fastest rate, at an average of about two percent per year. In 1999, poverty levels in the four California counties ranged from 14.1 percent to 21.5 percent, with Modoc County having the highest poverty level, which has implications for analysis of environmental justice. Per capita incomes were similar across Siskiyou, Shasta, and Modoc counties, with Lassen County having the lowest per capita income at $19,174. Lassen County shows a much lower per capita income due to the number of prison inmates included in the county's population who make little or no income. For all four California counties, the government and public administration industry sector consistently ranks first or second in terms of numbers of employees and in earnings. For Modoc County, agriculture typically has ranked second in earnings and number of employees; this is not the case for the other three counties where retail and service industry sectors play a larger role. In terms of population density, Modoc County had the lowest among the California counties with 2.45 people per square mile, while Shasta County had the highest with 46.4 people per square mile. The implication of these differences in population density are that Modoc County has a "*sense of place*" that is based more in a rural culture and an agriculturally dependent economy than Shasta County.

The Modoc County General Plan (1988) specifically mentioned wildlife related tourism as a possible means of diversifying the local economy. Improving deer habitat and subsequently deer population levels may help address this desire for increased wildlife related tourism. Historically, deer hunting was a popular activity in Modoc County, drawing many hunters from outside the area. However, deer herds began to decrease, largely due to increasing juniper density and subsequent forage reductions. From 1987 until 1997 the number of deer tags issued for the Modoc County area decreased dramatically because of deer herd population decreases (Loft 1998). In 1997 only 28% of the number of deer tags in 1987 were issued to hunters due to reductions in deer herds. As a result, mule deer hunting related expenditures in Modoc County decreased from about $5.4 million dollars per year to about $540,000 per year. During the same time period statewide demand in nature study and wildlife viewing increased (California Department of Parks 2004). All of these factors result in a large disparity between the demand for deer hunting recreation and the supply of those opportunities in Modoc County.

Nature study, including wildlife viewing is one of the few activities monitored by California Department of Parks and Recreation (2004) that has steadily increased since 1987. Also, the 2000 NVUM survey showed that wildlife viewing is a popular activity on the Modoc National Forest. Finally, there is strong interest in diversifying the economy by improving wildlife related recreation.

Washoe County has a different economy structure than the counties in the California portion of the Analysis Area. This is largely due to the fact that Reno and surrounding communities are located in Washoe County. For Washoe County the amusement and recreation industry sector generates the most employment and earnings. Unemployment, as reported in the 2000 Census, was low at five percent, as was the poverty level at about ten percent. A common trend in all counties was a large proportion of the population in the 50 to 59 year old category. This suggests over time that a larger proportion of income will come into the counties as transfer payments, as opposed to earned income. It also suggests that housing and industries that service the needs of the elderly may be in much greater demand in 10-15 years.

3.9.9 ENVIRONMENTAL JUSTICE

Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*," requires each federal agency, whenever practicable and appropriate, shall collect, maintain, and analyze information assessing and comparing environmental and human health risks borne by populations identified by race, national origin, or income. To the extent practical and appropriate, Federal agencies shall use this information to determine whether their programs, policies, and activities have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Evaluating environmental justice is part of the NEPA process and constitutes the civil rights impact analysis.

The USDA provides direction to its agencies, including the FS, for incorporating environmental justice considerations into their programs and activities in compliance with Executive Order 12898. The following provisions are pertinent to this Restoration Strategy.

USDA agencies are to ensure to the greatest extent practicable, minority and low-income populations do not experience disproportionately high and adverse effects from USDA programs and activities. USDA agencies also should identify and use opportunities to reach out to such populations and promote USDA programs and activities that positively affect their health and environment.

Continual evaluation of the effect of USDA programs and activities on the environment and health of minority and low-income populations is an important component of environmental justice. USDA agencies shall review and revise as necessary agency decision-making processes to ensure incorporation and full consideration the effects that agency decisions may have on minority and low-income populations.

USDA agencies shall, whenever practicable and appropriate, collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fishing, hunting or trapping for subsistence. Agencies shall communicate with the public the risks of these consumption patterns, including publishing guidance reflecting information available concerning methods for evaluating the human health risks association with the consumption of pollutant-bearing fish or wildlife (USDA, Departmental Regulation Number 5600-002, December 15, 1997).

Relative to California, most racial groups are under represented in the California counties comprising the Analysis Area. However, in all four California counties, American Indians are over represented. Statewide, 0.5 percent of Californians are American Indians. In the California counties in the Analysis Area, the proportion of residents that are American Indians range from three to 4.4 percent.

All four California counties are below the poverty line, and Modoc County ranks in the top five most impoverished counties, as measured by individuals below the poverty line.

3.10 Cultural Resources

The cultural resources affected environment includes a geologically and geographically complex area, with a long prehistoric sequence. The area supported linguistically and ethnographically diverse Native American peoples, and witnessed important historic events. Since the Analysis Area incorporates a number of environmental zones, cultural provinces, and ethnographic territories, any future cultural studies could provide archaeologists a unique opportunity to quantify archaeological feature variability and artifact-midden assemblage variability.

3.10.1 Environmental Context

The Sage Steppe Ecosystem Restoration Strategy would affect a vast tract of land within northeast California and northwest Nevada. The Modoc Plateau dominates much of the Analysis Area, except for the Basin and Range Province that characterizes the eastern portion of the Analysis Area in northwestern Nevada, and the Cascade Range and the northernmost Sierra Nevada within the western and southern-most portions of the Analysis Area. The Modoc Plateau supports a seasonally abundant and complex set of resources that were extremely important to the prehistoric occupants of the region.

This area generally contained an abundance of locally available basalt and obsidian, especially within the Warner Mountains. These materials were used to produce an immense variety of ground and flaked stone tools by the Native American occupants of this area. This raw material was also available at numerous additional locales, including the Red Rock and High Rock areas to the south and east of the Warners, the Medicine Lake Highlands northeast of McCloud and near the western portion of the Analysis Area, and the Tuscan formation further west and southwest.

3.10.2 Prehistoric Context

Human occupation of the Analysis Area began approximately 12,000 years ago, and has been divided into six separate periods, each with distinctive life ways and land use patterns. The initial occupation, the Early Holocene period (ca. +7,000 BP), is characterized by highly mobile people who traveled from one valley to another gathering food. The Post-Mazama period (ca. 7000-5000 BP), signals the first significant use of upland zones of the Analysis Area, as well as increasing settlement activity near prominent sources of water. The Early Archaic period (5000-3500 BP), is marked by major increases in archaeological visibility with artifacts and sites dating to this time occurring in a wide range of geographic contexts. Obsidian and basalt quarry production begin to accelerate during this period. This trend continues through the Middle Archaic period (3500-1500 BP), which represents both within the Analysis Area and throughout California somewhat of a "golden age" recognized by the appearance of large, semi-sedentary villages, as well as elaborations in material culture, house construction, obsidian and basalt production, and ceremonial and settlement activity directed at the hunting of large game.

The transition from the Middle to the Late Archaic period (1300-600 BP) produced major changes in assemblage structure, subsistence, and settlement practices. At about 1000 B.P. large-scale obsidian quarry production collapsed, many of the previously occupied villages were abandoned, and subsistence activities were increasingly directed at a few key root crops. Drought, population-resource imbalances, and chronic warfare have all been cited as potential causes for these dramatic changes. The final phase of prehistoric occupation, the Terminal Prehistoric period (600 BP-Contact), is marked by the arrival of Numic-speaking groups into much of the Great Basin portion of the Analysis Area. Settlements had a "stand alone" domestic quality, as might be expected by a series of dispersed, short-term occupations by small family units. There is also continuing evidence of conflict associated with the arrival of new peoples.

The types of Native American sites already known to be present, or which are likely present but remain undiscovered, within the Sage Steppe Ecosystem Restoration Strategy Analysis Area include:

- Large village sites located along the margins of all permanent streams, particularly at confluences, and other natural surface water sources (springs, seeps). Additional large village sites have been documented along smaller stream courses, especially where streams merge, and particularly at the interface between major ecotones.

- Simple and complex surface scatters of lithic artifacts without associated buried cultural deposits, resulting from short-term occupation and/or specialized economic activities.
- Caves and rock overhangs, frequently associated with the margins of valleys or meadows, often containing varied quantities of surface-occurring as well as buried cultural material.
- Cairns and rock alignments, including hunting blinds, sleeping circles, and other rock features, containing various quantities of associated portable cultural material.
- Petroglyphs, often in the form of cupped boulders but including figures, chevrons and a complex variety of circles, lines and other components, in some cases associated with village sites or encampments and elsewhere. Less frequent, but also present, are pictographs-painted forms of rock art.
- Bedrock food processing (milling) stations, including mortar holes and metate slicks.
- Trails often associated with migratory game animals.
- Mortuary sites, often but not exclusively associated with large village complexes.
- Quarries at natural outcrops of obsidian and basalt, where, for centuries in some cases, recovery and primary reduction have littered the surface with "blanks", partially formed artifacts, cores and waste flakes.
- Isolated artifacts and artifact fragments.

Primary habitation sites, numerous examples of which have been documented as containing structural and other features, are considered the most significant prehisotic types. Smaller, less utilized sites (e.g., lithic scatters, food processing stations) have also yielded obsidian artifacts and debitage, which is of particular interest to regional research since obsidian hydration dating and sourcing techniques can be utilized to establish relative chronologies and patterns of trade and exchange. Sites containing human burials or evidence of cremation have traditionally been important to archaeology as well as Native Americans. Prehistoric rock art, rock stacks, cairns, and rock alignments have become increasingly important to both archaeologists and Native Americans, not only for research value but also for traditional cultural value.

3.10.3 Ethnographic Context

Ethnographic groups occupying this region at the time of initial contact with Euro-American populations (circa. A.D. 1850) include the Modoc, Pit River, Northern Paiute, and Maidu.

3.10.3.1 Klamath and Modoc

Modoc territory centered on Lower Klamath, Tule, and Clear Lakes and Lost River, which flows between Clear and Tule Lakes (Kroeber 1925, Ray 1963, Merriam and Talbot 1974). In the pre-contact period the Modoc Indians lived on both sides of what is now the California-Oregon border and immediately east of the Cascade Range.

The Modoc engaged in far-ranging economic pursuits including fishing, hunting, gathering (especially camas bulbs), digging for epos, the root crop that played the largest role in the Modoc economy (Ray 1963). Hunting activities revolved mainly around deer and elk. Groups usually returned to their winter village sites by December.

Permanent winter villages were established in the river valleys, such as Lost River Valley, and along the Lower Klamath and Tule lakes. Winter settlements varied in size, but some were rather large (ca. 100 people) and were continually occupied (Stern 1998). Social life was most elaborate in the winter villages, where family groups congregated after an extended period of hunting, fishing and gathering.

3.10.3.1.1 Ethnohistory

The South Emigrant Trail (or Applegate Trail) ran through Modoc territory, and in the 1850s the tribe became increasingly engaged in hostilities with the settlers and miners who entered the area. In 1864, the Modoc and Klamath signed a treaty that assigned reserve lands for both tribes in Klamath territory, with no land in traditional Modoc territory. The Modoc War, was an armed conflict between the Modoc Tribe and the United States Army in southern Oregon and northern California from 1872–1873. After the Modoc War, the remainder of the Modoc Tribe were sent to Oklahoma. In 1909, the Modoc were allowed to return to the Klamath Reservation, if they so desired. Some returned many years later to join the members of the tribe who had been allowed to remain at the Klamath agency (Murray 1959, Ray 1963, Thompson 1971, and Powers 1976). By the time ethnographic efforts were pursued in the late nineteenth and early twentieth centuries, the Modoc had been effectively separated from their traditional lands. Many had spent most of their lives in Oklahoma, where the opportunities for passing on cultural information, especially about the traditional landscape, were greatly restricted (Voegelin 1942). Consequently, there is relatively less detailed information regarding Modoc lifeways and sites than is available for other tribes, who were able to maintain intimate knowledge of their aboriginal territory through continuous residence.

3.10.4 The Pit River: Achumawi (Ajumawi) and Atsugewi

The Pit River Indians have traditionally inhabited a vast area of northeastern California that encompasses the mountainous Pit River drainage, from southern Goose Lake all the way to Big Bend, in Shasta County.

Pit River people on the west side of the Analysis Area lived near the easternmost limits of salmon and acorns, which made up part of their subsistence economy. The eastern bands focused their subsistence efforts on the many fish in the local streams. They also hunted deer in the Warner Mountains, and on the plains north of the Pit River (Kniffen 1928). The tribes also gathered tubers and other roots and hunted waterfowl.

Traditionally, the Pit River bands established permanent winter settlements in protected valleys, building substantial dwellings against the severe winter weather. Later, family groups may have remained in the uplands during mild winters to be near caches of roots (Delacorte 2002, and Foster-Curley 2006). The basic structure usually served as a multi-family home, where all shared a central fire (Voegelin 1942, and Garth 1953). Summer shelters at gathering camps typically were brush windbreaks (Kroeber 1925). The village was the basic political unit.

3.10.4.1 Ethnohistory

The Pit River bands, like the Modoc, experienced considerable conflict with the miners and settlers who invaded their lands in the 1850s. By 1859, many tribal members had been placed on a multi-tribal reservation in Round Valley, in northern Mendocino County. By 1863, many of the Pit River people had escaped from Round Valley and returned to their traditional homes. As more and more of their ancestral hunting and fishing grounds were overrun by settlers, they turned to settler's cattle for a source of meat. This led to a series of retaliatory raids on native villages by the U.S. Army. These conflicts resulted in the Northern Paiutes joining the Pit River bands in a battle against the U.S. Army on September 26 and 27, 1867 called the Battle of Infernal Caverns. Several men were killed on both sides, until the Indians finally escaped during the night through a system of underground passages in the basalt.

As the population of settlers grew and the native population and resources dwindled, the Pit River peoples became dependent on settlers for jobs (Gates 1983). Many of these people have continued to reside in their traditional homeland and maintain an intimate knowledge of their lands.

3.10.5 Northern Paiute

The Northern Paiute occupied a vast territory. There were 22 bands of which five used the Analysis Area. These bands inhabited the arid western Great Basin and were the neighbors of the Maidu, Washoe, Modoc, Pit River, and Shoshone.

Northern Paiute bands foraged throughout their home territory. Settlement and subsistence patterns were closely tuned to fluctuations in the seasonal availability and distribution of food resources. These included fishing, hunting, and collecting a wide variety of seeds, nuts and berries. Supplies of these foods were stored for use during the winter months when resources were limited. The lands of the Northern Paiute is uniformly desert. The Honey Lake Paiute had a relatively more productive base with lakes and tributary streams; the other bands lived in a more typically arid Basin environment.

Winter villages were established in favored locations where fuel and water were available. Such a settlement might have only three houses (ca. 15 persons), but a large one might have a population of up to 50 persons (Fowler and Liljeblad 1986). Winter houses were made of a conical pole framework built around a shallow depression and covered with mats. The basic political and social groups within these bands were independent family units.

3.10.5.1 Ethnohistory

By 1849, many emigrants were flooding west by overland routes into California. One of these was the Applegate-Lassen Trail, which crossed the Surprise area by the 1840s. In 1859, gold and silver were discovered in Northern Paiute territory. The encroachment by the settlers met with violent resistance including mounted war parties. Despite the conflicts, a fair number of Indians survived and remained in or near their home territories. Consequently, considerable information has been retained regarding their traditional culture and territory.

3.10.6 Maidu (Mountain Maidu)

The Mountain Maidu concentrated in a series of large, flat-floored valleys occurring in the high (between 1,200 and 1,600 meters above sea level) mountain environment. These well-watered areas offered a rich diversity of flora and fauna (Dixon 1905, Riddell 1978). Village sites were chosen near a stream or spring, and generally located in sheltered, open coves, where an enemy could not easily approach unseen and a knoll afforded good drainage (Powers 1976). Maidu territory encompassed both arid Great Basin environments of sagebrush and alkali flats in the Honey Lake vicinity, as well as the more lush meadows, sloughs, and tributaries of the Susan River and Willow Creek (Riddell 1978). Maidu subsistence activities focused on the rich fish and waterfowl resources in the marshes and the plentiful game, such as deer and bear. Women's activities focused on gathering and processing vegetal foods. The Maidu also produced their own tools, most significantly baskets. For this important functional and artistic ability, skill at basket making afforded a woman status.

Three types of structures served as homes for the Maidu. A semi-subterranean structure was used during winter months (Dixon 1905, Voegelin 1942, and Riddell 1978). A major village also had a larger version of this lodge used as a ceremonial or assembly house and owned by the chief. In summer, the Maidu used simple shade pole shelters (Riddell 1978). Each village or community of villages had a chief who was chosen with the aid of a shaman and who acted as an advisor. Seasonal celebrations were held in honor of the Maidu resources.

3.10.6.1 Ethnohistoric and Historical Context

The Mountain Maidu were relatively unaffected by Euro-Americans until 1850 when settlement of the Honey Lake Valley began. Conflicts between the Maidu and Euro-Americans quickly escalated as settlers and their livestock overtook the meadows that sustained Maidu habitation and subsistence. Hostilities diminished by the 1870s, and the surviving Maidu were able to reside on their traditional lands and avoid confrontations with Euro-Americans. As a result, the Maidu have been able to maintain traditional practices within their historical homelands. Today, many descendants of the Honey Lake Maidu live in and around the town of Susanville and on the Susanville Ranchería (also home to many Paiute people).

3.10.7 Historic Context

Historic overviews and the results of previous archaeological and historical research throughout the Analysis Area document the presence of a wide range of historic site and feature types and complexes generally associated with European settlement, including the following:

- Historic railroad alignments.
- Two-track historic trails/wagon roads, some now-paved or graded and graveled.
- Water distribution systems, including small and large ditch, canal and channel systems, and levees, dams and reservoirs dating to historic time periods.
- Occupation sites/homesteads, and associated features such as refuse disposal areas, privy pits, barns, sheds, and where associated with early and on-going settlement, substantial historic buildings.
- Commercial undertakings of various types, including mines, electrical transmission, quarry.
- Refuse disposal sites associated with early communities.
- Historic townsites, and government constructed settlements (e.g., Fort Bidwell, facilities at Herlong).
- Historic residence and ranch features, including standing structures, structural remnants, fences, stock ponds, corrals, graves and family cemeteries, kilns, cairns, wells, and developed springs.
- Logging sites and camps, and associated features such as skid trails, loading and landing sites, and cut stumps.
- Blazed trees and Aspen tree carvings.

A variety of functions have typically been assigned to these historic site and component types, including ranching, transportation, homesteading, public land entry, military presence and activities, rural electrification and communication, refuse disposal, and mining.

3.10.7.1 Transportation

Transportation throughout the region has been based largely on geography. As migration began to swell in the early 1840s, passes were found through the mountains, opening emigrant trails in their wake (Howard 1998). The United States government conducted surveys of the West, using the Corps of Topographical Engineers branch of the Army. Some of these surveys were intended to seek routes for railroads. The first routes tended to be ridge routes (such as modern Interstate 80), which could be more easily followed than canyon routes. Stage routes through canyon trails (such as State Route 49 along the North Fork of the Yuba River through Downieville) came later, during the Gold Rush, when the money could be raised to carve stable roadbeds out of canyon walls. The majority of trails into the west occurred between Yosemite and Mount Lassen, where passes through the mountains ranged between 6,000 and 9,000 feet, lower than those to the north and south.

Pioneer trails sometimes became wagon roads for the tide of immigrants crossing the lower Cascades into northern California and Oregon. The establishment of military forts and outposts throughout the region led to the emergence of connecting routes, creating a tighter network of interconnected travel. With use came improvement, and improvement often included hospitality, such as inns and way stations. After the Civil War ended, railroad construction to the west began in earnest (Myrick 1962, Beck and Haase 1974, and Howard 1998).

Railroads developed in this rugged terrain later than in the valley and easier mountain passes to the south. Most were constructed in response to the freighting markets offered by timber and mining companies, as well as agricultural operations. Railroads dominated regional transportation until the post-World War II period, when cheap oil and gas, a booming economy, and a nationwide growth in automobile traffic led to the construction of highways and roads (Myrick 1962, Garate 1982, and Kautz Environmental Consultants, Inc. 1995).

Construction of transportation routes has also created right-of-way corridors for telegraph and other communication and energy-transmission lines, as well as pipelines carrying gas and water. Also, parallel alignments of roads and railroads often occur. In addition to routing, transportation corridors often include maintenance sites, toll-collection locations, and other types of facilities. This enhances the importance of transportation routes, both historic and modern.

3.10.7.2 Mining

Mining has been important in the land use and settlement of the region. Both precious and non-precious natural materials have led to short-term use of industrial boom town sites and to permanent settlement. Mining also spurred the construction of improved transportation systems and spurred the growth of regional logging operations. Mining sites can be found throughout the Analysis Area; where certain natural resources are located. These resources include such minerals as gold, obsidian and pumice.

Unlike agriculture, mining was never the principal economic component of the region. While there has been scattered gold mining in some areas, there were two centers of gold mining; Hayden Hill and Highgrade. The largest mining operations centered on the extraction of sand and gravel (Kautz Environmental Consultants, Inc. 1995).

3.10.7.3 Agriculture and Ranching

The Analysis Area's economy is dominated primarily by cattle ranching, but also includes substantial sheep ranching. Ranchers use open range for their summer feed.

The earliest agricultural operations by necessity occurred along natural drainages and in river valleys, where fertile alluvial soils and a constant supply of water were available. As population and demand grew, so did the economic feasibility of irrigation projects, which led to the spread of ranching and farming throughout the area.

Early cattle grazing did not flourish, for a variety of causes. While cattle came into the region possibly as early as 1846 over the Applegate Trail, most emigrant cattle died along the way or arrived in poor condition. Sheep grazing had the largest impact on driving public land-use management, even though most of the ranchers in the Analysis Area had cattle, especially in the Eagle Lake management area. Sheepherders from Nevada and the Sacramento Valley began to use the region by the 1870s, when many Basque sheep herders and their flocks reached northward from southern California. Most were itinerant shepherds who by right of law could use the public lands, which by then were already carefully divided by consensus among the resident ranchers.

By the 1870s, sheep ranchers had established the annual practice of moving their herds from the mountains and foothills to desert winter ranges. Following the northern trail, they drove their flocks from California into Nevada in increasing numbers. By 1880, 150,000 head were driven through the Home Camp and Tuledad regions alone.

By the later 1890s, sheep by the millions were being trailed through the Focus Area. Migrant Basques sheepherders have become famous for their tree carvings throughout the high-elevation grazing lands of California and Nevada. These carvings, known as arborglyphs, are often found in groves of quaking aspen trees between 5,000 and 10,000 feet above sea level. The carvings include names, dates, and cartoon drawings of human forms and other objects. The earliest known carvings in the northern Sierra date to the 1880s, although most date after 1900. It is likely that carvings were made earlier but, given the short life span of aspens, have vanished from the alpine landscape (Camacho and Kingston 1977, Claytor and Beasley 1979, and Maniery 1986).

Sheep grazing resulted in severe negative soil and vegetation impacts. Cattle ranchers lobbied the federal government to control the practice. Restricted grazing rights first led to an increase and then a dramatic decline in sheep, especially after enactment of the Taylor Grazing Act in 1934.

Government incentives greatly encouraged agricultural development in the region. With the offer of free land in exchange for the development of a homestead, settlers established operations. Many of these first ranchers established their ranches and farms to supply foodstuffs to mining communities. Others acted as subsistence farmers, simply striving to meet their government homesteading requirements to ‘prove up’ their land claims. Along with these farms, large grazing operations for sheep and cattle also spread across the public lands, altering the landscape in the nineteenth century. In the 1920s and 1930s, it led to the development of extensive irrigation systems to water an arid land.

During World War II, most farm workers remained on the farm to ensure the nation’s continuous food supply. Changes that began to unfold at that time, though, included increasing mechanization. By the dawn of the post-war era, cheap oil and gas led to increasing ownership and use of vehicles and improved roads.

After World War II, concerns about grazing on public lands increased. In the 1960s, the BLM issued grazing permits on millions of acres of public land reducing the number of cattle. Another major change came in the 1960s, when grazing allotments were fenced, ending the free range. Immediately ranchers were faced with reducing herd size. In 1974, the Natural Resources Defense Council sued the Department of the Interior to require environmental impact studies of the effects of grazing on public land. In response to this and other pressures, the BLM again cut the grazing herd size, leading to reductions in the number of head of cattle that ranchers were able to graze (Cox 2002). The combination of the reduced availability of public land for grazing and increasing suburban development has led to a decline in ranching.

The Eagle Lake Land and Irrigation Company started a short-lived irrigation system in the Honey Lake Valley in 1892, including a pumping station and canals. By the dawn of the twentieth century, the federal government stepped in, creating massive irrigation projects. The project's completion in 1912 ended up draining Tule Lake and turning the lakebed into farmland. That same year, the first irrigation canals and reservoir in the Upper Pit River Valley got underway (Kautz Environmental Consultants, Inc. 1995).

3.10.7.4 Military Development

The United States military has had a major impact on the development of this region, perhaps more so than on the rest of California. The federal government wished to provide as safe an environment as possible to encourage settlement and clearly establish the west coast as a part of the United States. In 1848, the US Army created the Pacific Division, which included what is today California, Nevada, Oregon, and Idaho (Utley 1969). This division was responsible for the protection of settlements (including mining towns) and emigrant trails. The major Army fortifications in the northern California were Fort Jones in Scott Valley (1852, outside the Analysis Area), Fort Crook in the Fall River Valley (1857), and Fort Bidwell in Surprise Valley (1866).

By the 1860s, amidst reallocation of military funding to the Civil War forces, the Pacific Division struggled to maintain its fortifications. With the end of the war and a refocus upon their primary task, the Division was faced with an increasingly armed and resistant Native American population fighting to maintain their freedom and traditional ways of life. After the Native Americans had been subdued and largely relocated, the military no longer had a purpose in the region and withdrew (Castillo 1998).

The military did have some presence in the region in the twentieth century. There was limited training during World War II near Goose Lake, but relatively little other activity. In 1933, the Army acquired dried portions of Honey Lake and used it for training pilots; in 1942, it was annexed to the Sierra Ordnance Depot for arms storage during the war. During this time, Japanese-Americans were relocated to the Tule Lake Relocation Camp.

3.10.7.5 Urbanization

While the Analysis Area is one of the most rural regions of California and Nevada, there are still communities that have exhibited urban patterns of development. These patterns include the development of a community center, where citizens in the surrounding areas can meet more than just their basic needs. Urban centers provide larger churches, high schools, government offices, specialized medical and dental attention, and other secondary resources beyond simply food and dry goods.

During the formative years of towns, particularity in short-term mining and logging-oriented economies, it was not unusual for the population to be predominately male. As towns became more permanent, women and children moved in, changing the demographic makeup to a family oriented society. Consequently, institutional facilities and community service-oriented establishments developed. These included cemeteries, churches, schools, social halls, fraternal organizations, governmental agencies, fire stations and sheriff or police stations. Finally, parks, gardens, sports fields and city-operated landfills, sewer and water systems developed.

Occupation of the South Fork of the Pit River Valley began with cattle operations in 1868, while the Madeline Plains became the site of cattle, sheep, and horse ranches. In 1869, ranchers from the Klamath Basin, encouraged by the relocation of the Modoc Indians, moved south into the Tule Lake region. By the 1880s, ranches and homesteads were well established in all of these regions.

Just as development today follows transportation corridors, towns and homesteads grew along old wagon roads and railroad lines. The Nevada-California-Oregon (NCO) railway started a construction boom between 1910 and 1914 when several depots were built along the NCO railway. Train transportation also aided the arrival of a whole new generation of homesteaders on the Madeline Plains between 1910 and 1918 (Kautz Environmental Consultants, Inc. 1995).

Settlement has always been the catalyst for urban development. Settlement in the Analysis Area has been encouraged through state and federal government incentives. Public Land Entry claims led to the establishment of homesteads, many of which disappeared while others thrived, sometimes even growing into urban centers. More than half the population of the Analysis Area today lives in two small areas-the Honey Lake Plain and the Upper Pit River Valley Basin. Susanville is the largest settlement, with the other areas each having a smaller urban pattern.

3.10.7.6 Logging

Timber has been a mainstay of the region, especially around the heavily timbered portions of Sierra, Lassen and Plumas counties. Individuals and small companies were the first to begin logging private lands. As private land became increasingly logged-over, the federal government began setting aside millions of acres of woodland to create forest reserves, which eventually became the National Forests in the early twentieth century (PAR Environmental Services 1988).

The market continued to grow with new mining rushes, railroad projects, and the establishment of towns and other settlements. Mining operations and associated camps, for instance, required lumber for flumes, wing dams and ditches, rockers, sluices, tunnels, and mills.

Logging operations changed with technological evolution. The first loggers used horses and oxen with skids to haul logs to small milling sites, and then shipped the lumber by wagon to market. Perhaps the first innovation in regional logging came from a desire to facilitate the difficult task of skidding logs over the ground. By the late 1880s major innovations in equipment fueled with steam led to changes in the logging industry. Steam-driven tractors, massive machines with three wheels each up to seven feet in diameter chugged along mountain roads, spewing smoke and scattering livestock. Another major innovation was a steam-powered machine equipped with a spool for hauling logs, a Dolbeer donkey. The Dolbeer donkey was commonplace in the region after 1890, tackling the more strenuous skidding hauls (Berry 1917).

The use of the railroad for transporting logs between the sawmill and the market began around 1900 with the Boca and Loyalton railroad in the Eagle Lake Field Office and quickly expanded, reaching a heyday in the 1920s and 1930s. Railroads were vital to the development of the timber economy and were often constructed with the logging companies as their main clientele. By the 1930s, technology shifted again to tractor-skidding and truck-logging, occasionally supplemented by railroads to deliver the timber to market. With improved transportation, more-distant markets proved far more profitable. By the 1940s, trucks hauled the wood to the often far away mills. By the mid-twentieth century, regional logging produced timber for all markets, even international ones (Kautz Environmental Consultants, Inc. 1995).

3.10.7.7 Electrical Development

Electrical development took two forms: generation and transmission. Generation of power includes building and operating the massive dams, powerhouses, pipelines, flumes, tunnels, forebays and the like to create electrical power using water. Major hydroelectric systems within the project harness water from the Pit and Feather rivers and their tributaries. Once the power is harnessed, long ribbons of towers and wires transmit that power across the mountains and into the valleys for dispersal to the customers.

By the early twentieth century, electrical power was becoming increasingly in demand in California. All major hydroelectric developments in the Analysis Area have been on the Pit River and its tributaries. Smaller hydroelectric generation operations have also been constructed for localized use, both private and public. Today the efficiency of the larger operations has led to the abandonment of most small generation plants, since it is cheaper to buy power in most cases than to maintain generation facilities.

High-voltage transmission lines also cross through the Analysis Area, carrying hydroelectricity generated on the Columbia River to the major markets in California. These lines have become part of the major transmission facilities in the western United States. They cross through the Analysis Area on rights-of-way over both public and private lands.

3.10.7.8 Resource Management

Resource management pertains to government agency management of and protection of natural and cultural resources. The first steps toward resource protection and reserving land came from the creation of the national forest service system, managed by the United States Department of Agriculture, Forest Service. The FS has actively constructed roads, telephone and communication lines, lookout towers, ranger stations, and public recreational facilities, and has implemented extensive forest-management practices, such as reforestation.

Public lands outside the forest reserves are managed by the Bureau of Land Management, which maintains and supports a myriad of public activities on the land. The most frequent uses are for recreation and grazing, followed by mining.

State agencies, including the California Department of Forestry and Fire Protection and the State Department of Fish and Game, also are heavily involved in the region. The CDF, which began operations in 1919, provides fire-protection services and forest management, such as underbrush removal and reforestation. CDF maintains camps, firebreaks, guard stations, and other facilities throughout the California portion of the Analysis Area. Fish and Game activities include the monitoring of game and operation of fisheries, such as hatcheries and restocking sites. They also manage ecological reserves and numerous wildlife areas on both state and federal lands.

The Depression-era Civilian Conservation Corps (CCC), made significant contributions to the Analysis Area throughout the 1930s and 1940s. More than 20 CCC camps were built and manned during this period. The CCC had a few basic goals; to aid in fire prevention, firebreak construction, fire detection, and general improvements. Fire detection included lookouts and stations throughout California. Improvements included roads and bridges, communication lines, administrative headquarters, and fire-fighting bases (Thornton 2002). Many of the roads, steel and wooden lookout structures, workstations, and field offices currently used by the FS and National Park Service were constructed by the CCC.

3.10.7.9 Tourism

Recreational opportunities have been recognized in the Analysis Area for at least 150 years. By the 1850s, resorts were developing around the high mountain lakes in the southern portion of the Eagle Lake management area.

Recreation has included hunting, fishing, camping, equestrian use, water and snow sports, hiking, visits to hot springs, and climbing. The reservoirs created by hydroelectric system development provided recreational fishing, boating and camping opportunities for summer visitors, as well as local residents. Eagle Lake, one of the few natural lakes in the area, is prized for Eagle Lake trout and water-based recreation.

As transportation systems developed, increasing numbers of tourists could conveniently reach the high-mountain lakes and valleys for summer recreation. Today the Analysis Area's economy is increasingly reliant on recreation and tourism. Today burgeoning populations in both California and Nevada seeking escape from urban life increasingly use the region.

3.10.8 CULTURALLY SIGNIFICANT CURRENT USES FOR NATIVE AMERICANS

Six federally recognized Tribes have cultural interests in the Sage Steppe Ecosystem Restoration Analysis Area (see *Section 1.6.3 Native American Tribal Consultation*). Current uses by Native American Tribes have been summarized here based upon recent consultations concerning juniper restoration activities. Many other current uses likely exist but these will be used as the focus of the analysis of the effects of the proposed restoration activities on Native American cultural resources.

3.10.8.1 Food Supply

3.10.8.1.1 Epos

Epos (*Perideridia spp*.) roots are dug for food generally in the spring, lasting for about a month. There are some specific epos fields in the Analysis Area that are currently being used. Smaller fields that are used by various families are also present throughout the Analysis Area.

3.10.8.1.2 Groundhogs/Marmots and Porcupines

Groundhogs/marmots and porcupines are culturally important to some of the tribes because they traditionally provided an easy food source.

3.10.8.1.3 Rabbits

There used to be large rabbit (jackrabbit) drives with a harvest that provided enough for all people in the tribe. The tribes believe that the populations have declined because of conversion of sagebrush lands to agriculture and other losses of sagebrush habitat.

3.10.8.2 Other Uses

3.10.8.2.1 Firewood

Firewood is an important current use by Native Americans, as well as non-Native Americans, of the juniper trees in the Analysis Area.

3.10.8.2.2 Juniper berries and leaves

Juniper berries and leaves are important culturally for a variety of uses for Native Americans.

3.10.8.2.3 Native American Spiritual and Cultural Practices

Various spiritual and cultural practices utilize juniper trees or portions of them. Specific juniper stands and/or trees are also used throughout the Analysis Area for spiritual and cultural practices.

3.11 Scenic Resources

3.11.1 FS Visual Quality Objectives

Visual quality objectives (VQOs) are standards for managing visual resources and combine the factors of variety class, viewer sensitivity levels, and viewing distance to form a category. Landscapes with high scenic value are considered those with the greatest visual variety in terms of landforms, vegetation, and water bodies. Three variety classes describe the Modoc National Forest (USDA Forest Service 1991a). Variety Class A represents nine percent of the Forest and is considered a distinctive landscape with varied water, landforms, and vegetation. Variety class B represents 38 percent of the Modoc National Forest and is considered a common landscape with moderate slopes, rounded ridges, and broad valleys. Variety Class C represents 53 percent of the Modoc National Forest is considered a minimal landscape of one species vegetation and little variation in the landscape size, texture or color.

Viewer sensitivity refers to landscapes that are readily viewable, and often are seen from regular travel routes (such as Highway 139) and recreation areas. Viewing distance is categorized as foreground, middleground, and background views. The foreground refers to viewing distances of up to 0.5 miles. The middleground refers to distances between three to five miles. Background distance refers to distances of 3-5 miles to up to 15 miles. Objects viewed in the background distance zone are barely distinguishable such that their texture and form are no longer apparent.

These factors are combined into a determination of VQO standards. Table 28 displays the area for each VQO on National Forest lands for the Analysis Area. They are also shown on Figure 21. The five VQOs are described below.

Table 28. VQO Classes on National Forest Lands within the Analysis Area.

VQO Class	Acres
Preservation	84,301
Retention	151,661
Partial Retention	448,308
Modification	1,398,667
Maximum Modification	64,611

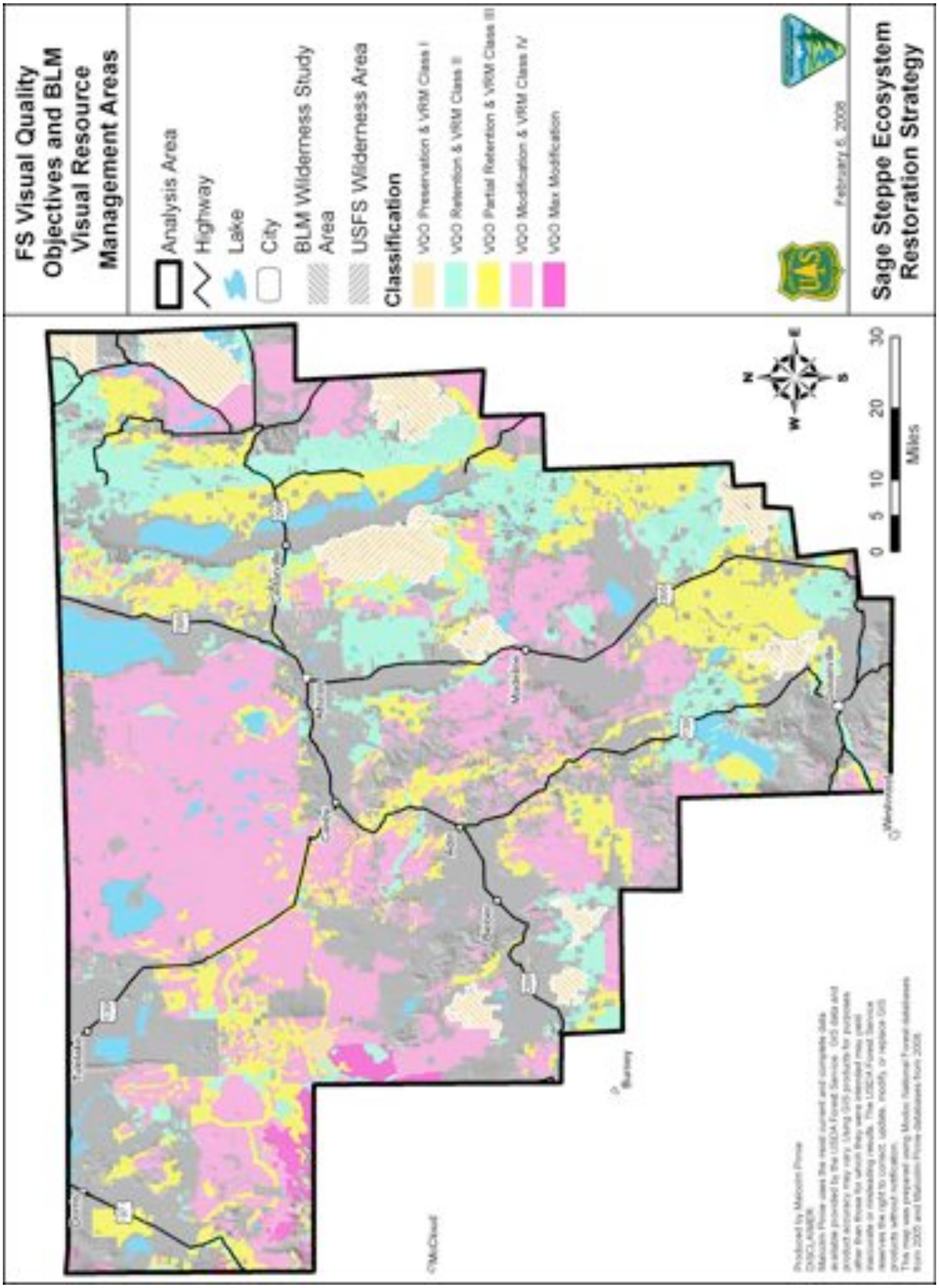

Figure 21. Visual Quality Objectives and Visual Resource Management Areas

- **Preservation (P)** – Only ecological changes are permitted. Most management activities are prohibited. Trails, trail bridges, and other trail-related improvements are designed and located to be visually unobtrusive. Areas designated with a Preservation VQO include the South Warner Mountains wilderness area, the Burnt Lava Flow Virgin area; Glass Mountain, the Medicine Lake Lava Flow, and the Devils Garden Natural area. The segment of Willow Creek proposed as a Wild and Scenic River also falls within this VQO. Wildland fire is consistent with this VQO. There are approximately 84,000 acres in this VQO category.
- **Retention (R)** – Management activities result in a natural appearing landscape. Activities may occur but are not visually evident to the casual observer. Activities repeat form, line, color, and texture found frequently in the characteristic landscape. Changes in the qualities of size, amount, intensity, direction, and pattern should not be evident. Reducing contrast in form, line, color, and texture to meet retention should be accomplished during operation or immediately thereafter. There are lands designated with a Retention VQO along highway 139 and west of 139 in between Canby and Adin, on lands north of the South Warner wilderness, and on the east and west sides of Lava Beds National Monument. There are about 152,000 acres on National Forest lands in this VQO category.
- **Partial Retention (PR)** – Management activities remain visually subordinate to the characteristic landscape. Activities and structures may repeat form, line, color, or texture common in the characteristic landscape. Activities and structures may also introduce form, line, color or texture, which are found infrequently or not at all in the characteristic landscape. Reducing contrast in form, line, color, and texture to meet partial retention should be accomplished as soon as possible after project completion or within the first year. Partial retention areas are located along Highway 139 from Canby to Tulelake, on the east side of Clear Lake Reservoir, and on lands north of the South Warner wilderness and southeast of Goose Lake. There are about 448,000 acres in this VQO category on National Forest lands in the Analysis Area.
- **Modification (M)** – Management activities may dominate the original landscape. However, activities or vegetative and land form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Reducing form, line, color, and texture contrast to meet modification should be accomplished in the first year. Most of the Modoc National Forest lands have a VQO of Modification. These tend to be areas not in close proximity to water bodies or recreation features. There are about 1,400,000 acres in this VQO category.
- **Maximum Modification (MM)** - Management activities of vegetative and land form alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the

surrounding area or character type. When viewed as foreground or middleground they may not appear to borrow from naturally established form, line, color or texture. Alterations may also be out of scale or contain detail that is incongruent with natural occurrences as seen in foreground or middleground. Reducing form, line, color, and texture contrast to meet maximum modification should be accomplished within five years. There are about 65,000 acres of MM on National Forest lands in the Analysis Area.

3.11.2 Modoc National Forest Visually Significant Resources

Most of the Analysis Area is located in the Modoc Plateau ecological subregion. This subregion is a combination of fault block mountains and ridges, interspersed with volcanoes, cinder cones, and lava flows. Vegetation is a mix of sagebrush and western juniper at lower elevations, and mixed conifer (Jeffrey Pine, White fir, Ponderosa pine) at higher elevations. On the northwest portion of the Modoc National Forest there are mixed conifer stands interspersed with various volcanic features, and several areas offer high levels of visual variety including the Burnt Lava Flow Virgin Area, Glass Mountain, and Medicine Lake Glass Flow. The North and South Forks of the Pit River meander across the Analysis Area and join near Alturas. There are numerous small to very large reservoirs throughout the Analysis Area that provide visual variety, such as Medicine Lake, Clear Lake, and Big Sage Reservoir, all on National Forest lands. On the eastern side of the Modoc National Forest, the Warner Mountains rise to about 9,800 feet and offer views of coniferous forests, aspen stands, rock outcrops, and numerous streams.

Highways 299, 139, and 395 bisect FS and BLM lands in the Analysis Area and portions of each are designated as scenic byways. The National Scenic Byways (NSB) program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or All-American Roads based on their archaeological, cultural, historic, natural, recreational, and scenic qualities.

Lava Beds National Monument, administered by the National Park Service, offers outstanding opportunities to view cinder cones, lava flows, and lava tubes. The monument is located in the northwest portion of the Analysis Area and has National Forest lands on three sides.

3.11.3 BLM Visual Resource Management System

The BLM uses a Visual Resource Management (VRM) system to inventory visual resources, to establish levels of management by assigning visual resource class objectives, and to evaluate visual impacts. The VRM system recognizes that areas vary in their scenic value and importance to the public, and that different levels of management are needed to protect areas with high value as compared to areas with low or no value. Once areas are inventoried, and their public importance (visual sensitivity) is determined, visual resource class objectives are assigned. Definitions of visual resource classes are provided below.

- **Class I:** To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention
- **Class II:** To retain the existing character of the landscape. The level of change to the characteristic landscape should be low
- **Class III:** To partially retain the existing character of the landscape. The level of change to the characteristic landscape can be moderate.
- **Class IV:** To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

The BLM has assigned and mapped visual resource classes for the Alturas, Eagle Lake and Surprise Field Offices. Figure 20 shows visual resource classes for the Alturas Field Office. North of Alturas, Highway 395 has a Class 2 visual resource objective on both sides of the highway. South of Alturas, Highway 395 has a Class 2 objective on the east side of the highway and Class 3 on the west side to the Tule Mountain Wilderness Study Area (WSA). South of the Tule Mountain WSA, the visual resource objective is Class 4 on both sides of Highway 395. All four WSAs have a visual resource objective of Class I. For the Surprise Field Office, the majority of lands are classified as Class 3 or 4. The South Warner Contiguous WSA is classified as Class 1.

3.11.4 BLM Visually Significant Resources

Table 29 displays VRM classes across all BLM lands in the Analysis Area. The majority of the lands are in VRM class four, which allows for changes in the characteristic landscape that attract the attention of the viewer (BLM VRM manual 8410). Class I which does not allow for changes that could attract the attention of a viewer consists of 460,085 acres. About 60 percent of the BLM lands are found in the Class IV Objective. A description of VRM classes by Field Office, as well as important scenic resources, is presented in the next section.

Table 29. Area in VRM Classes on BLM lands in the Analysis Area.

BLM Field Office	Class I[1] (acres)	Class II (acres)	Class III (acres)	Class IV (acres)
Alturas	56,648	157,177	104,006	185,214
Eagle Lake	380,359	171,218	265,832	45,129
Surprise	183,581	313,902	164,884	143,853
Totals	620,588	642,297	534,722	374,196

[1]All WSAs will be Class I until ruled on by Congress.

3.11.5 Alturas Field Office Visual Resources

The results of the VRM inventory process performed for the Alturas Field Office lands are shown in Table 29. About 11 percent of the area is in Class I, and about 37 percent is in Class IV. About 52 percent of the lands administered by the Alturas Field Office are in VRM Classes III and IV, suggesting they can tolerate some modifications to the characteristic landscape while still meeting visual management objectives.

The visual landscapes in the Alturas Field Office area are varied and diverse; ranging from dense forests of white fir and pines, to open grasslands/sagebrush steppes, to deep volcanic canyons. Lava fields with oaks and redbud vegetation provide fall color in some areas and contain cinder cone landforms. Alturas Field Office lands include four WSAs composed primarily of volcanic features of cinder cones and plateaus. These areas include geologic visual resources and riparian areas. In addition, these WSAs support dense juniper forests, mountain mahogany-covered slopes, and pine and white fir topped highlands. A vista overlook west of Fall River Mills provides excellent views of the Winters Toll Road, the military road to Fort Crook, old Highway 299 (proclaimed as the Yellowstone Cutoff in 1929), and Pit River Falls. However, large expanses of juniper have been removed from the landscape on private lands in recent years without considerations for visual or other resource values. Many of these removal projects are visible from U.S. Highway 395, State Route 299, and local country roads—and often substantially alter the visual character of the landscape.

3.11.6 Eagle Lake Field Office Visual Resources

The results of the visual resource inventory performed for the RMP are shown in Table 29. More than 40 percent of the area is in Class I, and only five percent is in Class IV. Classes II and III account for 51 percent together. About 84 percent of the Eagle Lake Field Office is within the Analysis Area.

The Eagle Lake Field Office is located at the junction of three geographic provinces. The more than two million acres of the Field Office are located where the northwestern edge of the Great Basin intersects the northern end of the Sierra Nevada Mountains and the southeastern side of the Cascade Range, with a subregion called the Modoc Plateau comprising much of the Cascade portion of the area. Throughout the Field Office area, vegetation is mostly high desert species dominated by shrubs and grasses. However, areas of pines and aspens are located at the higher elevations—mainly on the western side of the office's jurisdiction.

The most dominant Great Basin features of the Field Office area includes the expansive Honey Lake Valley; the Smoke Creek Desert on the eastern side of the Field Office jurisdiction; various small, shallow lakes that dry out in summer; and the expansive Madeline Plains, a Pleistocene lake bed now covered with shrubs and grasses. Eagle Lake, a closed basin lake with no outlet—unlike other lakes in the area, contains a healthy fishery and is a major recreational attraction because of its high scenic quality and excellent Eagle Lake rainbow trout fishery.

Above these valleys are numerous fault block ridges, conical volcanic mountains of various sizes and eroded calderas reaching up to the mid 7,500-foot elevation above base elevations of 4,000 to 5,000 feet. Most rock is of volcanic origin; however, the Fort Sage Mountains in the southeast side of the Field Office are a striking mixture of lower slopes made up of rounded, granular, light-colored, decomposed granite with volcanic peaks rising up to the east nearly 8,000 feet and over 4000 feet of vertical relief above the 4,000-foot base elevation of Honey Lake Valley. The Skedaddle Mountains are the most striking of the desert mountains, with deeply incised canyons and vertical cliff faces. Dry Valley Rim, with over 1,500 feet of vertical relief, is a striking escarpment that extends over 20 miles north to south. The higher peaks of Shinn Mountain, Spanish Springs Peak, and Observation Peak ring the upper Smoke Creek watershed. Lower Smoke Creek cuts between Dry Valley Rim's northern end and the steep slopes of Burro Mountain. Twin Peaks and the Buffalo Creek canyons comprise the northeastern end of the jurisdiction and contain rugged canyons and desert mountains. Antelope Mountain and Shaffer Mountain form the north side of the northwest end of Honey Lake Valley, where most of Lassen County's population is located.

Three stream courses on the eastern side of the Field Office area where perennial flows eventually empty into Great Basin desert lakes and playas that provide high visual interest. The Susan River Canyon provides scenic interest as it cuts through the Sierra/Cascade interface, slicing through mostly volcanic rock but also exposing granite in some areas. The Susan River flows year-round and sustains a rich riparian habitat, including thick cottonwood groves and many species of shrubs. The canyon also contains the historic Fernley and Lassen Railway grade, with 11 steel railroad bridges and two tunnels, now the route of the scenic Bizz Johnson National Recreation Trail.

Willow Creek north of Belfast is a mixture of two very different canyon segments. The 3.5 miles of the upper canyon is a small, narrow, wooded canyon with scattered conifers and thick riparian vegetation located between Tunnison Mountain to the north and wooded hills to the south. The three miles of lower canyon cuts through a flat volcanic tableland in a desert setting. Flows are low, but sufficient to sustain riparian growth—mostly grasses and some shrubs.

Upper Smoke Creek is a small stream that originates from a spring and proceeds to gradually cut a shallow but deepening canyon in its 13-mile run to Smoke Creek Reservoir in the middle of its course. Below the private reservoir, the creek cuts between the Twin Peaks and Burro Mountain areas to the east and north of the creek—and the Cherry Mountain and Dry Valley Rim areas to the west and south of the creek—before spreading out on the Smoke Creek Desert Playa, where the creek dries up. After 100 years of overgrazing that heavily affected the vegetation along the creek, the riparian area is improving along the creek's length.

The National Historic Nobles Emigrant Trail passes through the lower canyon. The largely undisturbed setting adds substantially to the historic context of experiencing the trail in this area. An historic military patrol route also passes along the volcanic tablelands adjacent to upper Smoke Creek. The largely undisturbed setting here also adds substantially to the historic context of experiencing the trail in this area.

The landscape is largely natural appearing, with most human-made features associated with the development around the Honey Lake Valley; along the Highway 395 corridor between Reno, Nevada and Susanville, California; and, to a far lesser extent, around smaller communities where residential properties and farming and ranching occur. One 345-KV powerline with a high, rusted brown Corten steel "H" type double tower configuration extends along portions of Highway 395 between Alturas and Reno, with various segments also located away from the highway. Other smaller single wooden pole power lines and phone lines parallel Highway 395 and portions of other state and county roads.

Main highways considered as scenic corridors by Lassen County are Highways 36, 44, 139, and 395. These routes carry the most traffic through BLM lands, particularly Highways 395 and 139. The highest traffic volume of any road through BLM land is on Highway 395. Visual sensitivity is considered high along all of these roads because of high traffic volumes. Lassen County Road A-1 around Eagle Lake is also considered a scenic highway by the county.

Proposals for wind energy development in the Eagle Lake Field Office area provide the greatest potential to affect existing visual quality. Construction of a second powerline parallel to the existing powerline would impact visual quality but would not be as significant if it followed the current line rather than along a new alignment. Proposals by cell phone tower installation companies to construct 200-foot tall cell phone towers at five- to seven-mile intervals along Highway 395 has the potential to significantly alter the current landscape experienced by Highway 395 travelers.

3.11.7 Surprise Field Office Visual Resources

The results of the visual resource inventory performed for the RMP are shown in Table 29. About 23 percent of the area is in Class I, and 18 percent is in Class IV. Classes II and III account for 59 percent together. About 66 percent of the Surprise Field Office is within the Analysis Area.

The visual landscapes in the Surprise Field Office are varied and diverse, ranging from the Surprise Valley and the Warner Mountains to the west, to open grasslands/sagebrush basins, to forest-covered higher elevations. The Barrel Springs and Buckhorn Back-Country Byways and the National Historic Applegate-Lassen Emigrant Trail in the Field Office area rely on the visual setting as a key component of the recreation opportunity experience associated with these attractions.

3.12 Recreation

3.12.1 Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a tool that is used by resource managers in the FS and BLM to plan for and manage a range of recreation opportunities. ROS responds to the fundamental concept that recreationists have diverse tastes and preferences; therefore, a diversity of opportunities should be provided. Managers provide for recreation opportunities by altering physical, social, and management attributes of settings where recreation activities occur. Visitors select settings with the attributes that fit their individual interests. While specific ROS categories vary by federal management agencies, all agencies employ the concept of identifying recreation opportunities along a spectrum from no development, little interaction with other visitors, and low on-site management presence to highly developed recreation facilities, high levels of interactions with other visitors, and a high level of on-site management. ROS categories used in this discussion include primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban. Descriptions of each of the ROS categories follow.

- **Primitive** – The primitive ROS area is generally on a setting of at least 5,000 acres and three miles away from all roads and trails with motorized use (or has sufficient spatial or topographic characteristics to allow a sense of solitude). Access is via non-motorized trails or cross country. The social setting provides for less than six parties encountered per day on trails, and less than three parties visible from campsites. Typical activities include hiking, horseback riding, fishing, hunting, and camping. Visitor capacity is 0.5 recreation visitor days (RVD)/acre/year. There is a very high chance of solitude and an unmodified natural or natural-appearing environment.

- **Semiprimitive Nonmotorized** – These areas include settings that are generally at least 2,500 acres in size, and are between ½ and three miles from all roads, railroads, or trails with motorized use. The area is closed to motorized travel. Access is via non-motorized trails or non-motorized primitive roads or cross-country. Access roads have a maintenance level 1, the lowest possible rating. There is a low contact frequency with other visitors. The social setting provides for 6-15 parties encountered per day on trails, and six or less parties visible from campsites. Visitor capacity is 1.0 RVD/acre/year. On-site management controls are present but subtle. Interpretation is through self-discovery with some use of maps, brochures, and guidebooks. Typical activities include hiking, horseback riding, fishing, hunting, and camping.

- **Semiprimitive Motorized** – This ROS is characterized by a setting that allows motorized use, is generally at least 2,500 acres in size, and is at least ½ mile from roads or trails with motorized use. Access is via roads maintained at level 1 or 2. The social setting provides for low to moderate levels of contact with other visitors. Visitor capacity is 1.5 RVDs/acre/year. On-site management controls are present but subtle. Interpretation is through very limited on-site facilities along with use of maps, brochures, and guidebooks. Typical activities include off-highway vehicle (OHV) touring, snowmobiling, hiking, cross-country skiing, canoeing, hunting, and fishing.
- **Roaded Natural** – A setting in an area that is within ½ mile of roads and trails open to motorized use. Access is primarily via conventional motorized use on roads. Contact frequency with other users may be low to moderate on trails and moderate to high on roads. The social setting provides for moderate to high frequency of contacts on roads and low to moderate frequency on trails away from roads. Visitor capacity is 2.5 RVD's/acre/year. On-site management controls are noticeable but harmonize with the natural environment. Typical activities include but are not limited to hiking, cross-country skiing, downhill skiing, power boating, snowmobiling, OHV touring, trailer camping, hunting, and fishing.
- **Rural** – The setting is a natural environment substantially modified to the point that developments are dominant to the sensitive travel route observer. The social setting provides for moderate to high visitor contact. Visitor capacity is estimated at 75 RVDs/acre/year. Visitor controls and regulations are obvious and law enforcement is visible. Interpretation may be through more complex wayside exhibits including small, lighted structures. Typical activities or facilities include but are not limited to camping, fishing information center, convenience stores, resorts, marinas, and downhill ski areas.
- **Urban** – The setting is an urbanized environment with dominant structures, traffic lights, and paved streets. Sights and sounds of people predominate.

An ROS inventory was conducted on the Modoc National Forest in 1980 (USDA Forest Service 1991a, Appendix K) and specific FS ROS designations are summarized in Table 30. Roaded Natural ROS designation covers 61 percent of the Modoc National Forest. Semi-Primitive Non-Motorized is the next most common designation, covering 27 percent of their lands. The remaining lands are primarily Semi-Primitive Motorized, with only one percent designated as Rural. No areas are designated as Primitive.

Table 30. Recreation Opportunity Spectrum for Modoc National Forest and BLM Field Offices

Designation	Modoc National Forest (acres)[1]	Alturas Field Office (acres)	Eagle Lake Field Office (acres)	Surprise Field Office (acres)
Primitive	0	46,784	237,953	0
Semi-Primitive Non-Motorized	446,686	64,972	NA	448,394
Semi-Primitive Motorized	181,983	283,949	NA	636,820
Backcountry[2]	NA	NA	675,335	NA
Roaded Natural	1,009,179	107,340	109,479	127,038
Rural	16,544	0	0	6,952
Total	1,654,392	503,045	1,022,767	1,219,204

[1]acres are estimated from information in Modoc National Forest LRMP

[2]The Backcountry ROS designation was created by the Eagle Lake Field Office by combining the Semi-Primitive Non-Motorized and the Semi-Primitive Motorized.

ROS designations from the Final RMPs for the three BLM Field Offices (USDI Bureau of Land Management 2007a, 2007b and 2007c) are also shown on Table 30. The largest allocation on the Alturas and Surprise Field Offices is the Semi-primitive Motorized, with 56 percent and 52 percent, respectively of their lands in this designation. The Alturas Field Office's next largest designation is Roaded Natural, with 21 percent. The Eagle Lake Field Office has the largest area in the Analysis Area designated as Primitive. The Surprise Field Office has 37 percent of its area in the Semi-Primitive Non-Motorized category. Eagle Lake Field Office has a majority in the Backcountry class (66 percent).

3.12.2 Recreation on Modoc National Forest lands

3.12.2.1 Overview of Existing Activity Participation and Use Levels

Major recreation activities in the Analysis Area include fishing, viewing natural features, driving for pleasure on roads, picnicking and other activities at day use areas, viewing wildlife, OHV travel, and hiking or walking (Table 31). Fishing activities occur primarily along reservoirs. Viewing natural features and driving for pleasure on roads generally occurs on major travel routes such as Highways 139, the Modoc Volcanic Scenic Byway, Highway 299, the Volcanic Legacy Scenic Byway, and Highway 395.

Table 31. Recreation Activity Participation and Primary Activity for the Modoc National Forest[1]

Recreation Activity	Percent participation[2]	Percent who said it was their primary activity
Fishing- all types	48	40
Viewing natural features such as scenery, flowers, etc on NFS lands	75	35
Driving for pleasure on roads	37	22
General/other- relaxing, hanging out, escaping noise and heat, etc,	67	8
Camping in developed sites (family or group)	8	5
Picnicking and family day gatherings in developed sites (family or group)	18	5
Viewing wildlife, birds, fish, etc on NFS lands[3]	30	5
Hunting- all types	2	2
Backpacking, camping in unroaded areas	3	1
Visiting historic and prehistoric sites/area	4	1
Off-highway vehicle travel (4-wheelers, dirt bikes, etc)	12	1
Hiking or walking	15	1
Gathering mushrooms, berries, firewood, or other natural products	2	1
Primitive camping	5	<1
Resorts, cabins and other accommodations on FS managed lands	1	<1
Visiting a nature center, nature trail or VIS	2	<1
Nature Study	3	<1
Snowmobile travel	1	<1
Motorized water travel (boats, ski sleds, etc)	2	<1
Other motorized land/air activities (plane, other)	0	<1
Horseback riding	1	<1
Bicycling, including mountain bikes	1	<1
Non-motorized water travel (canoe, raft, etc.)	2	<1
Downhill skiing or snowboarding	0	<1
Cross-country skiing, snow shoeing	0	<1
Other non-motorized activities (swimming, games and sports)	4	<1

[1]Source: Modoc National Forest National Visitor Use Monitoring Results Report, August, 2001

[2]multiple responses permitted, responses do not sum to 100 percent.

[3]First version of survey form used October through March had these two viewing categories combined as viewing scenery

The Pacific Flyway, providing excellent opportunities to view waterfowl, crosses the Modoc National Forest. Waterfowl viewing occurs at the Modoc National Wildlife Refuge, and along other reservoirs and at wetlands on the Devils Garden Ranger District (USDA Forest Service 2005). OHV travel on the Forest is minor (Berner personal communication 2005). There are no designated OHV staging areas, and only one route, the Modoc Backcountry Discovery Trail, is designated for OHV use. There are hiking and walking trails throughout the Forest, but most of the trails are in the South Warner Wilderness. There is an interpretive trail (Cedar Creek trail) located between Cedarville and Alturas off Highway 299, and the High Grade National Recreation Trail traverses a saddle on the west side of Mt. Vida.

Deer hunting, traditionally a popular activity is currently widely dispersed, in part due to low deer herd numbers that have characterized the Analysis Area during the last decade. As deer populations have declined, so have the number of deer hunting tags issued by California Department of Fish and Game. Some of the popular deer hunting areas on the Modoc National Forest have included Stone Coal Mountain, Knox Mountain, Boyd Hill, and Hunter's Ridge (Landoski pers. comm. 2005). Deer hunting in the Stone Coal Mountain area may overlap with the Big Canyon inventoried roadless area. Hunting in the Knox Mountain area may overlap with the Knox Mountain inventoried roadless area. Popular areas on BLM lands have included Bayley Reservoir and Nelson Corral Reservoir (Schmidt pers. comm. 2005). These two BLM areas do not correspond with any BLM wilderness study areas.

Recreation use for the Modoc National Forest as a whole for calendar year 2000 was estimated at 146,155 national forest visits +/- 23.1 percent. Use was lower than on the Lassen National Forest. There were an estimated 175,206 site visits, an average of 1.1 site visits per national forest visit. Included in the site visit estimate are 5,160 Wilderness visits.

The study findings indicated most recreation use on the Modoc was local, day use, and that most visitors surveyed were satisfied with their national forest visitor experience for the trip during which they completed a survey. Table 31 shows all activities that survey respondents indicated they had participated in, and their primary activities. These included; viewing scenery (75 percent), general relaxation (67 percent), fishing (48 percent), driving for pleasure on roads (37 percent), and viewing wildlife (30 percent).

Information on the types of areas people visit on the Modoc National Forest will help guide impact analysis so that highly visited areas can either be avoided or can have mitigation measures developed (i.e., avoid vegetation treatment actions during peak use times). Table 32 summarizes visitor use of facilities and special areas.

Table 32. Most Frequently Mentioned Categories for Visitor Use of Facilities and Specially Designated Areas, Modoc National Forest[1]

Facility/ Area Type	Percent who said they used (national forest visits)
Forest roads	76
Picnic Area	34
Boat launch	26
Scenic byway	19
Designated Wilderness	14
Developed campground	14
Hiking, biking, or horseback trails	14
Swimming area	13
Developed fishing site/ dock	6

[1]Source: Modoc National Forest National Visitor Use Monitoring Results Report, August, 2001

The category "Forest roads" received the highest proportion of responses (76 percent), followed by "picnic areas" (34 percent), followed by "boat launches" (26 percent). About one out of five survey respondents mentioned use of scenic byways. One implication of the results is as juniper treatment projects are implemented more information will be needed about what "Forest roads" are popular for recreation use to avoid affecting recreation use along those roads. Another implication is that picnic areas, boat launches, and scenic byways are also relatively popular for recreation. Attention to potential impacts to these other important recreation areas will need to be considered when assessing effects of proposed juniper treatments.

3.12.2.2 Prominent Recreation Features

There are 36 designated recreation sites listed on the "Modoc Country" map, which is cooperatively produced by the BLM Alturas Field Office and the Modoc National Forest. Prominent recreation features on the Modoc National Forest include:

- The California Backcountry Discovery Trail,
- Highways 395, 299, and 139, of which portions are designated scenic byways.
- The South Warner Wilderness
- Volcanic Legacy Scenic Byway
- The Emigrant Trails Scenic Byway
- Modoc Volcanic Scenic Byway

- 19 Inventoried Roadless Areas

The South Warner Wilderness, located about 15 miles southeast of Alturas, offers outstanding opportunities for solitary type recreation experiences. This area received about 5,000 visits in 2000, and about 80 percent of that reported use was equestrian, with the remainder being hiking or walking (Berner pers. comm. 2005). The Volcanic Legacy Scenic Byway is a 120-mile drive that traverses Tule Lake National Wildlife Refuge, Lava Beds National Monument, and portions of the Klamath, Shasta-Trinity, and Modoc National Forests. The Emigrant Trails Scenic Byway route starts in the northeast corner of Modoc County on US Hwy 395 at New Pine Creek to Canby, California. At Canby, the route turns northwest along State Hwy 139 to Tulelake, where it connects with the existing Modoc Volcanic Scenic Byway, which is part of the Volcanic Legacy All American Road.

The 19 inventoried roadless areas (IRA's), total 201,600 acres. On the Modoc National Forest, IRA's are divided into two types: areas where road construction or reconstruction is allowed, and areas where road construction or reconstruction is not allowed. Both types of IRAs are distributed across the forest. There are no IRA's on the Modoc National Forest that have been recommended for wilderness designation (Keller pers. comm. 2005). The Mt. Vida and Mt. Bidwell IRAs are within ten miles of recreation facilities such as Lily Lake and may receive intermittent, low recreation use. The Knox Mountain and Big Canyon IRA's may receive some hunting use. However, other than these areas it is likely there is very low or no recreation use in the other IRA's on the Modoc National Forest. However, there is hunting throughout these IRAs. Most of the IRAs do not have recreation facilities nearby or trails that allow access, and most of the IRAs are in rugged terrain. These IRAs are described individually in the *Recreation Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007e).

3.12.2.3 Other Recreation Opportunities

The Cedar Creek Interpretive trail, which is readily accessible from Highway 299 is three miles in length, and offers opportunities to understand the vegetation zones on the Forest. Other areas that offer interpretive and viewing areas on the Modoc National Forest include:

- Various fire lookouts
- Devil's Garden
- Doublehead
- Dismal Swamp
- Fandango Pass
- Glass Mountain
- High Grade Mining District
- Medicine Lake Highlands
- Modoc War Fortifications

The forest is home to more than 300 wildlife species, and wildlife viewing has been identified as a frequently engaged in activity. A proposal is currently being developed for a birding trail. Popular wildlife viewing areas include:

- Big Sage Reservoir
- Blue Lake
- Fandango Pass and Valley
- Dismal Swamp
- Henski Reservoir
- Big Valley Loop
- Antelope Prairie Loop
- Doris Loop
- Beaver Creek Loop

Private, noncommercial firewood cutting is also viewed as a recreation activity on the forest. The Forest makes maps available of areas open or closed to firewood cutting. Firewood permits for personal firewood cutting are required. Permit sales for the last five years have ranged between 529 (Fiscal Year 2004) and 704 in Fiscal Year 2000.

3.12.2.4 Planned Capital Improvements (Modoc National Forest)

The Forest has a five-year recreation strategy plan (USDA Forest Service 2004b). The plan describes strategic goals and objectives, and priority investments. An OHV Route Designation process has started. A recreation Facilities Master Plan is also under development. There are many existing facilities in need of upgrading. Redesign and reconstruction will also be considered at the Forest's currently existing 36 developed recreation sites to accommodate larger group sizes and meet accessibility standards.

3.12.3 Recreation on BLM Lands

3.12.3.1 Special Designations

The BLM has several types of designations and regulatory requirements that help focus management on recreation activities that require special attention due to the high numbers of users and/or due to the potential to impact natural and cultural resources. These designations and requirements are briefly described below.

3.12.3.1.1 Off-Highway Vehicle Route Designation

Off-highway vehicles (OHVs) include motorcycles, all-terrain vehicles (ATVs), and four-wheel drive vehicles. BLM administered lands have been generally open to OHV use, however, under the Final RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) OHV use would be limited to designated or authorized roads and trails. Heritage or cultural resources, soil losses on trail systems, and fish and wildlife resources are monitored to determine if there are impacts from OHV use. The current designations for OHV use areas on BLM-administered lands are as follows.

- **Open areas** – allow for all types of vehicle use, at all times, anywhere in the area.
- **Limited areas** – are restricted at certain times, in certain areas, or to certain vehicle use. Examples include seasonal limitations, requirements to use only existing roads and trails, and requirements to use only designated roads and trails.
- **Closed areas** – are areas where OHV use is prohibited.

3.12.3.1.2 Special Recreation Management Areas

Special Recreation Management Areas (SRMAs) are areas that warrant special management attention. In these areas, the mixture of resources and recreation activities related to those resources require focused management efforts in order to protect unique resources, provide for visitor safety, and resolve conflicts among users. SRMAs also can provide facilities and interpretive services in support of visitor use to better meet visitor needs and enhance visitor understanding and enjoyment of an area. SRMAs are proposed for all three northern California BLM Field Offices. The BLM-administered lands not designated as SRMAs are called extensive recreation management areas.

3.12.3.1.3 Special Recreation Permits

Special recreation permits are authorizations that allow for recreational use of the public lands and related waters. They are issued as a means to manage visitor use, protect natural and cultural resources, provide for the health and safety of visitors, and provide a mechanism to accommodate commercial recreational uses. These permits are required for the following types of uses: commercial competitive, organized groups/events, and individual or group use in special areas. Examples of events requiring special recreation permits include: motorcycle races, endurance horseback rides, and birddog trials.

3.12.3.2 Prominent Recreation Features and Activities

The BLM lands have less developed recreation sites compared to national forest lands in the Analysis Area. The types of recreation activities that occur are similar to activities occurring on national forest lands. Major recreational activities on BLM lands in northeastern California include general sightseeing, driving for pleasure, scenery and wildlife viewing, hiking, backpacking, photography, hunting, fishing, camping, picnicking, rock hounding, cross-country skiing, horseback riding, mountain biking, OHV use, boating and other water sports at the larger reservoirs and lakes. However, a major difference between recreation on FS and BLM lands in the Analysis Area is there is less recreation use associated with water-based facilities on BLM lands, and generally more dispersed recreation uses.

3.12.3.2.1 Recreation on Eagle Lake Field Office Lands

On lands administered by the Eagle Lake Field Office there are three Special Recreation Management Areas (SMRA's), including the Bizz Johnson Trail and Susan River, Eagle Lake, and Fort Sage (Table 33). The Bizz Johnson trail is 24.5 miles in length and follows an old railroad alignment. Eagle Lake supports fishing and water sports, while the Fort Sage SMRA is primarily used for OHV recreation. Table 34 shows that within the Eagle Lake Basin the majority of use is along the lake shoreline (13,525 visits).

Table 33. Recreation Management Areas in the Eagle Lake Field Office Area[1]

Recreation Management Area	Acres
Eagle Lake Basin (SRMA)	34,320
Bizz Johnson Trail (SRMA)	2,756
Fort Sage (SRMA)	28,494
Extensive recreation management area	957,197
Total	1,022,767

[1]Source: BLM draft RMP for Field Offices in northeastern California

Table 34. Visits to Locations within the Eagle Lake Basin (1995–2003)[1]

Location	Fiscal Year[2]								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
North Eagle Lake campground	2,488	1,470	2,206	2,754	2,293	1,974	2,033	1,748	3,418
Rocky Point East	6,507	6,307	6,832	4,368	6,546	5,801	6,114	6,193	5,840
Rocky Point West	720	995	1,310	610	1,726	1,672	2,283	1,186	1,045
Highway 139									
Shoreline use areas	10,250	8,425	11,648	12,556	14,602	23,375	19,612	14,168	13,525
Dispersed use areas	5,973	4,768	6,055	8,013	9,374	8,343	9,177	7,984	10,314
Total Visits[3]	25,938	21,965	28,051	28,301	34,541	41,165	39,219	31,279	34,142

[1]All use on BLM-administered land outside the designated use areas listed above. Source: BLM draft RMP for Field Offices in northeastern California

[2]Fiscal year represents October 1 through September 30.

[3]A visit is one person visiting an area for any portion of a single day.

The Skedaddle Mountains are popular for hiking because of the rugged and dramatic canyons and ridges, Dry Valley Rim has spectacular vistas across Smoke Creek Desert, and Twin Peaks offers a commanding view of surrounding lands. The abandoned Modoc Line Railroad Grade, with 85 miles of track removed in 2003, has excellent potential for conversion to a rail trail. Lassen and Modoc Counties have passed resolutions of support for rails-to-trails conversion of the Modoc Line to preserve the linear ROW resource and to utilize the corridor for trail uses. Dirt roads afford many mountain biking opportunities, including loop rides. Shaffer Mountain Summit Road offers a challenging ride, Burro Mountain Loop provides a good desert loop. Numerous other loops rides are also available on existing dirt roads. However, there are few single-track trails currently on lands administered by the Eagle Lake Field Office.

Hunting for a variety of upland game birds, rabbits, waterfowl, antelope and deer are the most widespread recreation activities that occur throughout the Eagle Lake Field Office area. Most hunting begins in August and extends through fall, and into early winter for chukar and waterfowl. Hunting for dove and quail also occurs. A short sage-grouse season (one weekend and a one-bird limit) continues to offer a highly sought after game bird hunting experience. A small amount of waterfowl hunting occurs on small reservoirs and along rivers and creeks. Hunting for cottontail and jackrabbits is also popular.

Big game species hunted are pronghorn antelope, mule deer, and black-tailed deer. State wildlife agencies in both California and Nevada regulate deer and antelope hunting tags, and are regulated by quotas per hunting zone. Although demand is very high, hunter numbers are relatively low compared to other types of hunting. Archery, rifle (regular season), and muzzleloader hunting seasons occur for antelope and deer.

In California, the Eagle Lake Field Office contains most of two highly sought hunting zones: X5a (115 deer tags were issued out of 730 first-choice applications received in 2002) and X5b (160 deer tags were issued out of 2,567 first-choice applications received in 2002). In Nevada, the Eagle Lake Field Office contains most of Zone 015 (50 deer tags were sold with a five to one chance of drawing a tag in 2000).

Hunters have expressed concern that areas for non-motorized hunting opportunities are shrinking as more and more hunters use quads and technology increases the amount of terrain capable of being traversed by those vehicles. Support appears to be growing for designation of hunt areas where vehicle entry would be limited either seasonally during the hunt or year-round to provide core non-motorized areas for hunting and other non-motorized activities, such as hiking, horseback riding, and wildlife viewing.

Recreational shooting is popular throughout the Eagle Lake Field Office Area. Target shooting commonly occurs in Antelope Pit along Highway 139, approximately six miles north of Susanville; in a gravel pit near the mouth of Rice Canyon about six miles east of Susanville; along Byers Pass Road; and in various gravel pits and open areas around the perimeter of Honey Lake Valley.

Lake or reservoir fishing occurs in Eagle Lake and in area reservoirs. Stream fishing from BLM-administered land occurs in the segment of Willow Creek through the Tunnison Mountain WSA and, to a limited extent, in Upper and Lower Smoke Creek.

Camping using recreational vehicles (motor homes) in association with hunting, hiking, and sightseeing is popular throughout the Field Office area. Campers concentrate where the hunting is good, or nearby where shade or water is available. Popular camping locations are Ramhorn Springs Campground, and Upper Smoke Creek Basin, while Lower Smoke Creek Road, Buckhorn Road, Buffalo Ranch and North Fork Buffalo Creek Roads, Horse Lake Road, and East Skedaddle Roads provide camping areas for self-contained vehicles. Other site-specific activities include petroglyph viewing at the Belfast Petroglyph site and at Upper Smoke Creek.

3.12.3.3 Recreation on Surprise Field Office Lands

One of the main recreation sites for the Surprise Field Office is Fee Reservoir, which has seven semi-primitive campsites, vault toilets, and no drinking water. Also popular is the Surprise Valley/Barrel Springs backcountry byway, a 93-mile driving tour across BLM lands in California and Nevada. Other prominent recreation features for the Surprise Field Office include:

- Buckhorn Backcountry Byway
- High Rock Canyon
- Stevens Camp

3.12.3.4 Recreation on Alturas Field Office Lands

The Alturas Field Office maintains a developed campground along the Pit River located near Fall River Mills, California. The campground offers sites with tables and fire rings under large pine, ash and oak trees. Two primitive camping areas are located at Dry Creek Station, near Likely, California and Cinder Cone, south of Fall River Mills, California.

Three mountain bike trails are managed by this Field Office including the Devils Garden, Likely Challenge, and Woodland Jurassic trails. The trails offer opportunities for a variety of skill levels. Two designated national scenic byways bisect Alturas Field Office lands: portions of the Volcanic Legacy Scenic Byway, and the Emigrant Trails Scenic Byway. Given the considerable means of access, dispersed recreation opportunities exist throughout the entire planning area. The National Historic Applegate and Lassen Emigrant Trails, as well as the Pacific Crest Trail, bisect the Alturas Field Office lands and provide opportunities for hiking. There are also two areas popular for cross-country skiing including the Nelson Corral High Country trails, and the Dead Horse loop area. Neither of these areas have facilities.

The Alturas Field Office also includes public lands in four highly sought after mule deer hunting zones: X5b (southeast of Madeline); X3b (Warner Mountains); X3a (Nelson Corral Reservoir/Likely Mountain); X2 (Devil’s Garden); and portions of western Zones X1 and X4. Demand for antelope and deer tags in these zones far exceeds the available supply. Those hunters who draw a tag highly value their opportunity to hunt in these zones that extend into and, in some cases, are entirely within the Alturas Field Office jurisdiction, as are the Likely Tables, which has the largest wintering population of antelope in California.

Extensive wildlife viewing opportunities exist, in part due to the area's proximity to the Lower Klamath and Tulelake National Wildlife Refuges, and large tracts of agricultural lands. In addition, two locations are included in the California Wildlife Viewing Guide. These include Kelly Reservoir, and Beaver Creek. Wildlife attracts numerous visitors to designated viewing locations throughout the Field Office area. Riparian corridors, such as Beaver Creek, are important for migratory, neotropical birds and other species dependent on riparian habitat.

Recreational shooting is a popular activity on Alturas Field Office lands, two of the primary areas being Portuguese Flat and the Day Cinder Pit.

3.12.4 Wilderness Study Areas

In 1976, Congress directed the BLM to inventory its lands for wilderness characteristics. Attributes that were used in the inventory were:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable
- Has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition,
- Have outstanding opportunities for solitude, or a primitive or unconfined type of recreation in at least part of the area.
- May also contain ecological, geological, other features of scientific, scenic, or historical value.

The BLM is required by Congress to manage each WSA consistent with the direction provided in Section 603(c) of FLMPA. In general, BLM is required to maintain the wilderness characteristics of each WSA until Congress decides whether it should either be designated as wilderness or should be released for other purposes.

While many activities are allowed within WSAs, some have specific restrictions. For example, recreation vehicle use off existing travel routes and issuing new mineral leases, are not allowed. New road construction is permitted to develop existing, valid mining claim, or if an existing right of way (for some other purpose) exists. New, temporary road construction may be permitted for fire suppression activities. However, generally new road construction for other forms of resource management is not encouraged (Brink pers. comm. 2005). Most primitive recreation activities are allowed and are encouraged. Use levels for these WSA's are probably very low, and of a similar magnitude as use of the South Warner Wilderness area. The BLM has ten wilderness study areas in the Analysis Area, listed below and shown on Figure 22.

- Pit River Canyon WSA
- Tule Mountain WSA
- South Warner Contiguous WSA
- Massacre Rim WSA
- Timbered Crater WSA
- Tunnison Mountain WSA
- Wall Canyon WSA
- Sheldon Contiguous WSA
- Lava WSA
- Portions of the Buffalo Hills, Twin Peaks and Five Springs WSAs are also in the Analysis area.

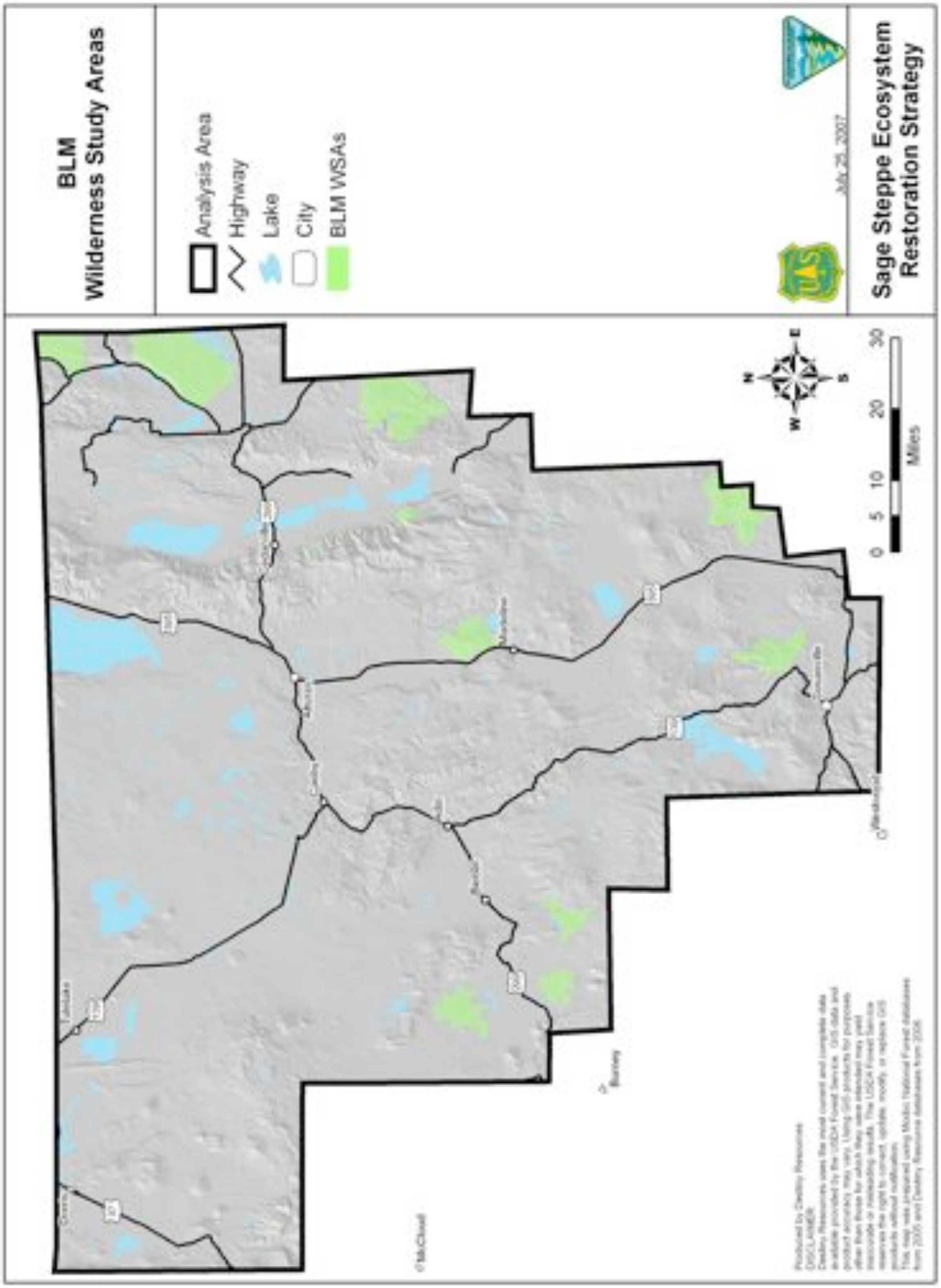

Figure 22. BLM Wilderness Study Areas

Chapter 4. Environmental Consequences

4.1 Introduction

Chapter 4 discusses the impacts to the environment in terms of direct, indirect, and cumulative effects to each resource. These effects are defined in 40 CFR 1508.7 and 1508.8 and are described in the summaries below. In addition, a general description of the activities that affect each resource or issue is included.

The effects presented in this chapter are based upon the programmatic Sage Steppe Ecosystem Restoration Strategy. No specific projects would be implemented as a result of this decision. Site-specific decisions to implement this Restoration Strategy would require additional NEPA compliance, with site-specific restoration projects identified and effects of those projects disclosed. Therefore, the effects presented here do not contain site-specific analysis.

4.1.1 Direct and Indirect Effects

Direct effects are defined as effects caused by the action and occurring at the same time and place. Indirect effects are defined as effects caused by the action but occurring later in time or further removed in distance. The restoration activities that would be completed by the FS and BLM would potentially generate direct and indirect effects and are described in Chapter 2 (*Section 2.3 Alternatives Considered in Detail*), presented in Table 5.

4.1.2 Cumulative Effects

Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions. These actions are separate from, and not included in, the proposed activities that result in direct and indirect effects. Actions that are included in the cumulative effects analysis varies by resource area because of differing areas of influence both in time and space for different resources. The past, present, and reasonably foreseeable actions that are considered in the analysis for each resource vary depending upon if they have been judged to have an effect on the outcome of the analysis. The ongoing and future activities that are planned or known in the Analysis Area are described below.

There are several ongoing or foreseeable future sage steppe restoration projects within or near the Analysis Area that are proposed or anticipated by other federal agencies, and private landowners (Tables 34 and 35). The need to include these actions in the individual resource analysis is dependent on the cumulative effects area and duration of effects for each resource. The landowners or managers that are responsible for these actions include other federal agencies, including the National Park Service and the Bureau of Reclamation, private landowners, and

Native American Tribes. Native Tribes currently have approximately 500 acres of restoration treatments planned.

Table 35. Acres of Other Federal Agency Restoration Treatments by Alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Mechanical Restoration[2]					
Dense Juniper Areas	0	400	400	400	400
Less Dense Juniper Areas	0	0	0	7,300	7,300
Isolated Juniper Areas	0	200	200	200	200
Total Mechanical	0	600	600	7,900	7,900
Fire Use[2]					
Inside Wildland Urban Interface (WUI)	0	1,300	1,300	1,100	1,100
Inside WUI deferred	0	0	0	0	0
Outside WUI	0	32,300	31,500	24,600	24,600
Outside WUI deferred	0	0	800	500	500
Total Fire Use	0	33,600	33,600	26,200	26,200
Total Treatment Acres	0	34,200	34,200	34,100	34,100

[1]Mechanical Restoration areas have the following characteristics

≤30% slope
Dense juniper areas have >20% canopy closure and are ≤1 mile from existing roads
Less dense juniper areas have 6-20% canopy closure and are ≤1 mile from existing roads
Isolated juniper areas have >20% canopy closure and are greater than 1 mile from existing roads

[2]Prescribed fire Restoration areas have the following characteristics

≤20% juniper canopy closure
Deferred – special wildlife areas that are deferred from prescribed fire for the first 20 years

There are several ongoing or foreseeable types of future actions in the Analysis Area that are not specifically designed for sage steppe ecosystem restoration but may contribute to cumulative effects. These include livestock grazing, road construction and use, firewood gathering and forest management throughout the Analysis Area. These actions will be briefly introduced below and will be discussed under the cumulative effect sections in this chapter where applicable.

The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

Table 36. Acres of Private Lands Restoration Treatments by Alternative

	Alt. A	Alts. B & C	Alts. D & E
Mechanical Restoration[1]			
Dense Juniper Areas	128,900	128,900	128,900
Less Dense Juniper Areas	345,800	345,800	345,800
Isolated Juniper Areas	11,500	11,500	11,500
Total Mechanical	486,200	486,200	486,200
Fire Use[2, 3]			
Inside Wildland Urban Interface (WUI)	0	47,800	42,800
Outside WUI	0	8,500	6,500
Total Fire Use	0	56,300	49,300
Total Treatment Acres	486,200	542,500	535,500

[1]Mechanical Restoration areas have the following characteristics

≤30% slope
Dense juniper areas have >20% canopy closure and are ≤1 mile from existing roads
Less dense juniper areas have 6-20% canopy closure and are ≤1 mile from existing roads
Isolated juniper areas have >20% canopy closure and are greater than 1 mile from existing roads

[2]Prescribed fire Restoration areas have the following characteristics

≤20% juniper canopy closure
Deferred – special wildlife areas that are deferred from prescribed fire for the first 20 years

[3]Within ½ mile from FS and BLM WUIs for prescribed fire

New permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands.

Firewood gathering would occur at various locations in the Focus Area and would likely remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits.

Forest management, primarily by the FS, is expected to continue at its current level but would be outside of the Focus Area. Some resources could have cumulative effects due to forest management.

4.2 Vegetation

The intent of the Purpose and Need for this Restoration Strategy is ecological restoration: to restore the vegetation structure and composition, and ecological functioning of sage steppe ecosystem in northeast California and northwest Nevada. Therefore, the vegetation section covers the resource components that are essential to this project. The vegetation section provides the basis for other resource analyses that are based upon the changes in vegetation that are presented in this section.

4.2.1 Sage Steppe Ecosystem Mosaic

The density of Western juniper in the Focus Area has increased an average of more than three times from 1946 to 1998 (Appendix B). Increases in the density of Western juniper over the last 150 years have been documented by many scientific studies (Miller and Wigand 1994, Knapp *et al.* 2001, Miller and Tausch 2001). In a recent study of Western juniper in southeastern Oregon and southwestern Idaho, Johnson (2005) found that about 95% of western juniper trees have been established since 1850. The density of Western juniper in the Focus Area is part of the expansion of juniper woodlands throughout the Intermountain west (Burkhardt and Tisdale 1976; Coppedge *et al.* 2001; Cottam and Stewart 1940; Gedney *et al.* 1999; Miller and Rose 1995, 1999; O'Brien and Woudenberg 1999; Soulé and Knapp 1999; Soulé *et al.* 2004). These studies and others have concluded that the increases in the density of Western juniper were primarily due to the combination of the following two factors:

- Severe domestic livestock grazing from the late 1800s to the 1930s (*Section 3.3.1 Historic Rangeland Use*)
- Modification of the fire regime from more frequent fires of varying intensities to less frequent larger, intense fires (*Section 3.2.5.2 Disturbance Regimes from Mid-1800s to Present* and *Section 3.4.1 Wildfire*)

The Sage Steppe Ecosystem Restoration Strategy has the purpose of restoring the landscape to a sage steppe ecosystem that functions similarly to the pre-1870s landscape mosaic, including similar vegetation mosaics and species composition. The pre-1870s landscape mosaic was a constantly changing mosaic of grasses, different stages of sagebrush with scattered juniper trees, and some dense juniper woodlands. Frequent fires of varying intensities were the key disturbance factor that maintained that mosaic in the sage steppe ecosystem. An ecological analysis was completed that provides an estimate of the desired dense juniper woodland component for the sage steppe ecosystem to approximate the pre-1870s landscape mosaic. That analysis (Appendix B) estimates that approximately 75,300 acres of dense juniper on FS and BLM lands within the Focus Area would approximate the pre-1870s landscape mosaic. Dense juniper stands currently occupy approximately 433,300 acres in the Focus Area (Table 11). The less dense (6-20 percent canopy cover) juniper stands also occupy a larger area than pre-1870s landscape mosaic. The ecological analysis results show that the less dense juniper stands increased in area by 31 percent between 1946 and 1998 (Appendix B). The less dense juniper stands currently occupy approximately 900,000 acres in the Focus Area (Table 11), while the pre-1870s landscape mosaic would have contained less than 600,000 acres.

There are important resource concerns regarding the increase in juniper density. These concerns include: increased soil erosion due to lack of ground cover; decreased species diversity due to reduced amount of sagebrush, grasses and forbs with corresponding reductions in wildlife habitat suitability; reduction in low intensity fires which sustained the sage steppe ecosystem; and increased potential for severe fires which can cause greater habitat loss and soil damage than low intensity fires.

4.2.1.1 Methodology

The primary measurements of progress towards satisfying the Purpose and Need are the amount and rate of restoration activity, and the amount of area where juniper density has been reduced to its pre-1870s landscape mosaic function within the sage steppe ecosystem. The changes in the sage steppe ecosystem composition will be analyzed by evaluating changes in area (acres) of dense juniper, and the rate of restoration.

4.2.1.2 Effects Common to All Alternatives

All restoration activities are subject to current management policies and guidelines regarding livestock grazing. These policies and guidelines have been shown to be effective at improving range condition by insuring proper season, timing and duration of grazing based upon site-specific conditions. In the Analysis Area, livestock commonly utilize juniper trees for shade, and where they seek shade, there can be a decrease in herbaceous vegetation and an increase in soil disturbance. During site specific project planning non-old growth juniper distribution would be designed so that following sage steppe restoration treatments, livestock are not attracted to riparian, aspen or old growth juniper stands to meet their shade requirements.

4.2.1.3 Alternative A (Current Management)

4.2.1.3.1 Direct and Indirect Effects

Alternative A would reduce the amount of dense juniper on FS and BLM managed lands in the Focus Area by 56,500 acres over a period of 50 years (Table 4 and Figure 23), leaving 376,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2 Vegetation*). Therefore, the sage steppe ecosystem under Alternative A would have about 300,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative A would leave the majority of the existing dense juniper and therefore would make little progress towards restoring the pre-1870s landscape mosaic.

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 56,000 acres that would be mechanically or hand treated would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 56,000 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 193,500 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). Therefore, the restored areas would be comprised of mostly grasslands (78 percent) compared to sagebrush (22 percent). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative A is 250 years, the most of all alternatives (Table 37).

4.2.1.3.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area.

Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). Grazing could reduce the success of the restoration by not allowing native plants to become established, trampling new seedlings, etc. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative A include an additional 486,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 730,000 acres. Dense western juniper would occupy substantially more than pre-1870s landscape mosaic within the Focus Area (Appendix B). The result would be that the cumulative effect of Alternative A would be to restore portions of the Focus Area to the pre-1870s landscape mosaic. However, most of the Focus Area would remain similar to its current condition, with increasing juniper density and decreasing sagebrush and grass.

4.2.1.4 Alternative B (Proposed Action)

4.2.1.4.1 Direct and Indirect Effects

Alternative B would reduce the amount of dense juniper on FS and BLM managed lands in the Focus Area by 282,500 acres over a period of 40 years (Figure 23), leaving 150,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2. Vegetation*). Therefore, the sage steppe ecosystem under Alternative B would have about 75,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative B would make substantial progress towards restoring the pre-1870s landscape mosaic by removing 282,500 acres of the existing dense juniper (Table 4).

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 282,500 acres that would be mechanically or hand treated (Table 5) would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 282,500 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 971,000 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). Therefore, the restored areas would be comprised of mostly grasslands (78 percent) compared to sagebrush (22 percent). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative B is 40 years, the same as Alternative D, less than Alternatives A, C and J and more than Alternative E (Table 37).

4.2.1.4.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area.

Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative B include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternative B would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.2.1.5 Alternative C

4.2.1.5.1 Direct and Indirect Effects

Alternative C would reduce the amount of dense juniper on FS and BLM managed lands in the Focus Area by 282,500 acres over a period of 50 years (Figure 23), leaving 150,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2 Vegetation*). Therefore, the sage steppe ecosystem under Alternative C would have about 75,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative C would make substantial progress towards restoring the pre-1870s landscape mosaic by removing

282,500 acres of the existing dense juniper (Table 4). The main differences between Alternatives B and C would be the lower rate of restoration due to deferring fire use treatments in special wildlife areas for the first 20 years, and the use of the Monitoring and Adjustment Approach to reduce the risk of uncertainty of treatment results for Alternative C. The restoration for this alternative would be accomplished over 50 years rather than the 40 years of the Proposed Action. Therefore, the reduction in the juniper woodlands would be more gradual.

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 282,500 acres that would be mechanically or hand treated (Table 5) would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 282,500 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 971,000 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). Therefore, the restored areas would be comprised of mostly grasslands (78 percent) compared to sagebrush (22 percent). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative C is 50 years, less than Alternative A but more than all other alternatives (Table 37).

4.2.1.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative C include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternative C would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.2.1.6 Alternative D

4.2.1.6.1 Direct and Indirect Effects

Alternative D would reduce the amount of dense juniper on FS and BLM managed lands in the Focus Area by 282,500 acres over a period of 40 years (Figure 23), leaving 150,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2 Vegetation*). Therefore, the sage steppe ecosystem under Alternative D would have about 75,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative D would make substantial progress towards restoring the pre-1870s landscape mosaic by removing 282,500 acres of the existing dense juniper (Table 4). The effects of Alternative D on the reduction of dense juniper would be essentially the same as Alternative B, because the treatment type and rate would be the same in dense juniper.

The 555,100 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 697,200 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 555,100 acres that would be mechanically or hand treated (Table 5) would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 555,100 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 697,200 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade. Alternative D would have higher proportion of mechanical treatment than Alternatives B and C. Therefore, Alternative D would result in larger areas of sagebrush and smaller areas of grasslands as compared to Alternatives B and C.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative D is 40 years, the same as Alternative B, less than Alternatives A, C and J and more than Alternative E (Table 37).

4.2.1.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of

Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternative D would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.2.1.7 Alternative E

4.2.1.7.1 Direct and Indirect Effects

Alternative E would reduce the amount of dense juniper on FS and BLM managed lands in the Focus Area by 282,500 acres over a period of 33 years (Figure 23), leaving 150,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2 Vegetation*). Therefore the sage steppe ecosystem under Alternative E would have about 75,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative E would make substantial progress towards restoring the pre-1870s landscape mosaic by removing 282,500 acres of the existing dense juniper (Table 4). The effects of Alternative E on the reduction of dense juniper would be similar to Alternative B, except that the restoration would occur seven years sooner.

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 555,100 acres that would be mechanically or hand treated (Table 5) would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 555,100 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The 697,200 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). Therefore, the restored areas would be comprised of mostly grasslands (56 percent) compared to sagebrush (44 percent). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade. The effects of Alternative E on dense juniper and the overall vegetative composition of the sage steppe ecosystem would be similar to Alternative D. Alternative E would have a higher proportion of mechanical treatment than Alternatives B and C. Therefore, Alternative E would result in larger areas of sagebrush and smaller areas of grasslands compared to Alternatives B and C. The other difference between Alternative E and Alternative B is the use of a monitoring and evaluation approach under Alternative E.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative E is 33 years, the shortest time of any of the alternatives (Table 37).

4.2.1.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative E include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternative E would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.2.1.8 Alternative J (Preferred Alternative)

4.2.1.8.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would reduce the amount of dense juniper (>20 percent canopy cover) on FS and BLM managed lands in the Focus Area by 282,500 acres over a period of 47 years (Figure 23), leaving 150,800 acres of dense juniper remaining in the Focus Area. The pre-1870s landscape mosaic on FS and BLM land is estimated to have contained 75,300 acres of dense juniper stands in the Focus Area (*Section 4.2 Vegetation*). Therefore, the sage steppe ecosystem under Alternative J (Preferred Alternative) would have about 75,000 acres of dense juniper more than the pre-1870s landscape mosaic. Alternative J (Preferred Alternative) would make substantial progress towards restoring the pre-1870s landscape mosaic by removing 282,500 acres of the existing dense juniper (Table 4). The effects of Alternative J (Preferred Alternative) on the reduction of dense juniper would be essentially the same as Alternative D, because the treatment type and rate would be the same in dense juniper.

The restored areas would be changed from sage steppe areas with greater than six percent juniper to grassland and sagebrush dominated sage steppe areas. The 555,100 acres that would be mechanically or hand treated (Table 5) would be restored to sagebrush in the short-term (5-10 years) where sagebrush is an existing component of those stands. The 555,100 acres restored to sagebrush would be added to the nearly 1.9 million acres of existing sagebrush (Table 10). The

697,200 acres that would be restored by fire use would be converted from less dense juniper/sagebrush to mostly grasslands. In the long-term (>20 years) sagebrush will reestablish in these areas. Natural or prescribed fires would burn over the landscape and move juniper woodlands and sagebrush areas back to grasslands as natural disturbance regimes become more established.

Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites following fire. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007). After the second decade, the sage steppe grasslands would have sagebrush established. The percentage of sagebrush cover and age class in the restored areas would continue to increase after the second decade. Alternative J (Preferred Alternative) would have higher proportion of mechanical treatment than Alternatives B and C. Therefore, Alternative J (Preferred Alternative) would result in larger areas of sagebrush and smaller areas of grasslands as compared to Alternatives B and C.

The number of years required to complete restoration of the Focus Area is used to display how effective this alternative would be at restoring the sage steppe ecosystem. The time required to restore the Focus Area for Alternative J (Preferred Alternative) is 47 years, less than Alternatives A and C, and more than Alternatives B, D and E (Table 37).

4.2.1.8.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

When livestock grazing is returned to the restored sage steppe sites there are some potential cumulative effects. Existing standards and guidelines require the assessment of site conditions and establishment of goals that may require variable utilization rates depending on the conditions of sites. These standards and guidelines require monitoring for plant vigor, natural reseeding, perennial expansion, and litter that would manage the livestock grazing to achieve restoration objectives. Livestock grazing would be managed to maintain an upward trend in restoration areas to achieve the sage steppe restoration objectives.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments. Cutting of old growth juniper is prohibited under current FS and BLM firewood permits. The restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*).

Forest management will occur outside of the Focus Area and will therefore not have an effect on vegetation within the Focus Area. Within the sage steppe ecosystem there are inclusions of Eastside pine. Eastside pines would be treated to restore the resiliency of those ecosystem to catastrophic wildfire. Those management actions would be directed at ecosystem restoration and would be a positive cumulative effect on the sage steppe ecosystem.

The cumulative effects of Alternative J (Preferred Alternative) include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternative J (Preferred Alternative) would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

Table 37. Comparison of Number of Years to Restore Focus Area[1]

	Years
Alternative A	250
Alternative B	40
Alternative C	50
Alternative D	40
Alternative E	33
Alternative J	47

[1]The years to restore the Focus Area shown in the table is the amount of time needed to treat the more than 1.2 million acres identified in Table 6. A substantial amount of area would remain untreated in the Focus Area.

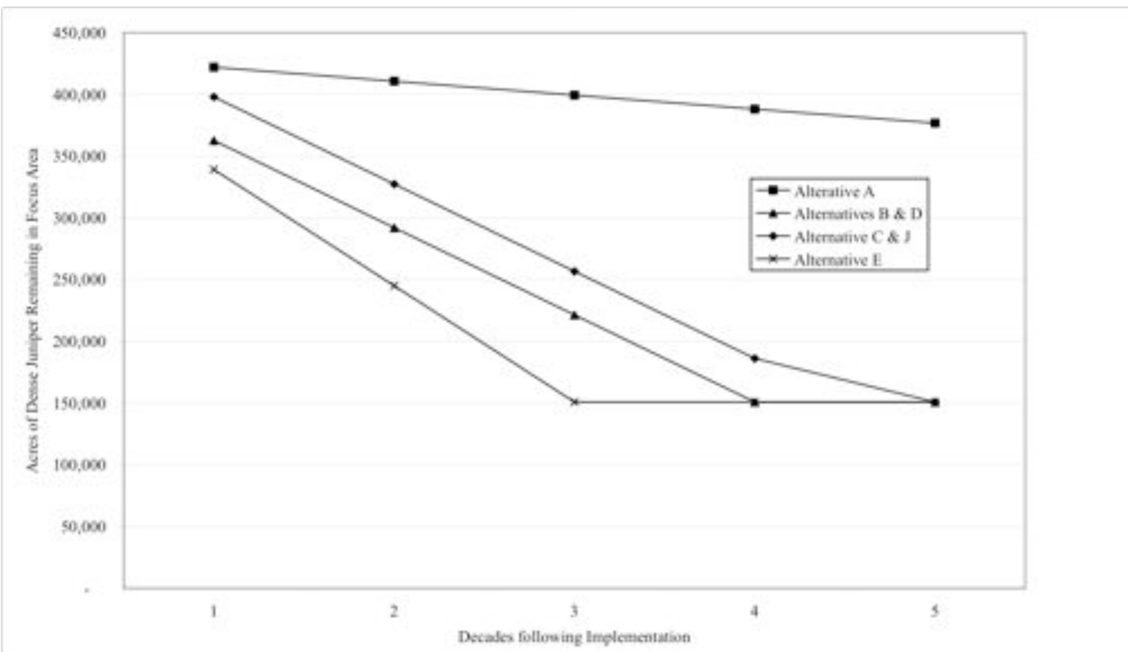

Figure 23. Acres of Dense Juniper Stands Remaining at the Conclusion of Each Decade of Restoration Treatments[1]

[1]Dense juniper stands are defined as >20 percent canopy closure.

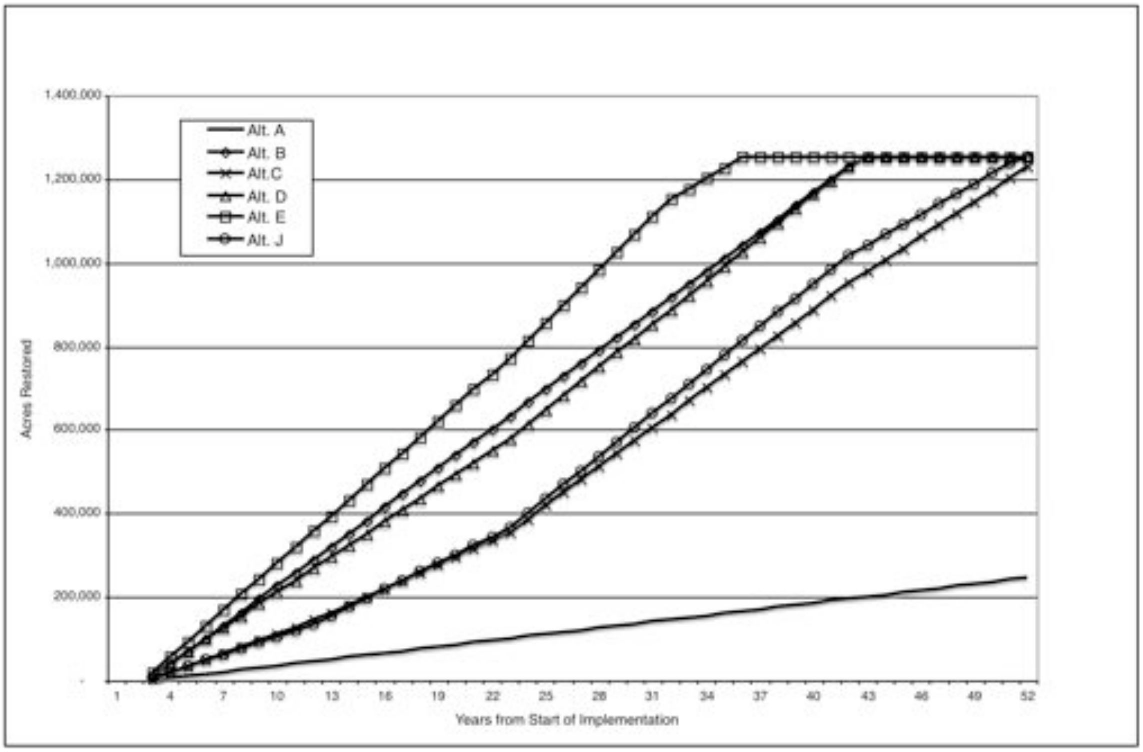

Figure 24. Sage Steppe Ecosystem Acres Restored by Alternative

4.2.2 Noxious Weeds

The disturbances created by restoration treatments could provide conditions suitable for the invasion of noxious weeds and invasive non-native plants. If restoration areas are invaded by noxious weeds and invasive non-native plants, the native plants would have a more difficult time out competing the non-natives and re-establishing themselves as the dominant vegetation. Changes in fire regimes as a result of noxious weed infestations may result in further expansion and dominance of noxious weeds in the restoration areas. The restoration goals would not be achieved if noxious weeds and invasive non-native plants dominate restoration areas.

The level of disturbance and the potential for noxious weeds and invasive non-native plants to invade treatment areas would vary based upon the conditions at various restoration sites. The rate at which noxious weeds and invasive non-native plants invade treated areas would be dependent on several factors, including:

- treatment methods, the level of soil disturbance and how well disturbed soils are rehabilitated following treatments
- amount of remaining canopy cover, level of shade at the soil level and duff depth
- initial species composition
- regeneration rate of native forbs, shrubs and trees

- the presence or absence of noxious weed and invasive non-native plants or seed banks within or adjacent to the restoration area
- fire history and precipitation levels of the area prior to and following treatments are additional factors that would influence introduction and spread
- biological characteristics of noxious weeds

Methods to control noxious weeds and invasive non-native species do not vary by alternative. Site-specific environmental analysis would occur prior to restoration projects, and site-specific strategies would be applied to reduce weed infestation to the greatest extent possible. Under all alternatives, weed surveys, mapping, and risk analysis completed at the project level would increase the knowledge base and the ability to minimize introduction and spread. The priority would be on surveying for the early detection of invasive species in order to contain and control them in riparian areas, in threatened, endangered, proposed, candidate, and sensitive species habitat, and in areas where there is a high potential for rapid rate of spread. Some recent studies (EORAC 2007) provide additional information on specific treatment approaches to minimize noxious weed occurrence and spread for specific situations.

4.2.2.1 Restoration Risks

4.2.2.1.1 Fire Use

One of the methods used to achieve restoration is reintroducing fire into areas dominated by Western juniper to remove the juniper and allow the release of native sagebrush, as would have occurred under natural fire regimes. Fire use exposes mineral soil, reduces shade, and creates a flush of nutrients. Weeds take advantage of these conditions, which can result in a reduction of native plant establishment and recovery after a fire. The ecosystem response to fire use depends on factors such as the fire history of the area, season of burning (spring, summer or fall), fire size, fire intensity, and the composition of the existing plant community (including weeds) at the time of the fire.

The majority of invasive or noxious weed species of concern share the ability to survive fire and colonize burned areas quickly. Cheatgrass establishes from seed stored in the soil and transported after fire. It is a strong competitor in the postfire environment, where it takes advantage of resources available and produces abundant seed crops. Once established, cheatgrass responds rapidly to woodland fires and shifts the seasonality of fire to the more active growing period of native perennials (Whisenant 1990). Repeated fires can simplify vegetation into a homogenous landscape dominated by exotic annuals (Young and Evans 1981, Young 1991).

4.2.2.1.2 Mechanical Treatment

Mechanical restoration involves using machinery to physically remove the Western juniper from the restoration area. The soil disturbance associated with mechanized restoration treatments could create an environment susceptible to the spread of cheatgrass or colonization by other noxious weeds or invasive species. Often weeds are introduced through the movement of contaminated equipment (carrying invasive plant seeds) across uncontaminated lands. Soil surface disturbance may also disrupt native seed banks, providing an opportunity for non-native species to establish colonies in areas dominated by native species. However, mechanical restoration would only remove the tree layer, so the majority of grasses and forbs would remain. The persistent tillers and extensive root systems of perennial grasses and other species would not be eliminated. The persisting root competition would help to protect the area from colonization by invasive plant species.

4.2.2.1.3 Hand Treatment

The localized disturbance caused by hand restoration would be highly likely to be recolonized by surrounding vegetation. Hand restoration creates minimal surface disturbance in localized, relatively small treatment areas.

4.2.2.2 Noxious Weeds Management Direction

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for noxious weeds through management directives, standards, and guidelines.

Goals for noxious weeds from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Reduce impacts of Forest pests to tolerable levels through integrated pest management

Goals for noxious weeds from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- Minimize introduction and establishment of new noxious weed species. In areas where noxious weeds are established, maintain areas where infestations have been controlled. Institute measures to substantially decrease the area and density of infestation where weeds have not passed an ecological threshold for site rehabilitation (e.g., cheatgrass and medusahead).

4.2.2.3 Methodology

The following factors were considered in determining the potential direct, indirect, and cumulative effects from restoration activities on noxious weeds and non-native invasive species within the Analysis Area:

- Likelihood that standards and guidelines would isolate existing infestations, pathway access, and potential vectors, using:
  1. Disturbance type, timing, frequency, intensity, and severity
  2. Response characteristics of existing weed species to various types of disturbance
  3. Characteristics of vegetation communities susceptible to weed invasion

Table 38 shows the risk rankings that were used in determining the potential direct, indirect, and cumulative effects from restoration activities on the potential for the introduction and spread of noxious weeds and invasive species within the Focus Area.

Table 38. Noxious Weed Risk Ratings for Alternative Effects Evaluation

Risk Ranking	Alternative Indicators
Low	Low Number of Total Acres Restored Low Rate of Restoration Lower percentage of Fire use Monitoring & Adjustment Approach Used No New Permanent Roads
Moderate	Moderate Number of Total Acres Restored Moderate Rate of Restoration Moderate percentage of Fire use Some New Permanent Roads
High	Large Number of Total Acres Restored High Rate of Restoration Higher percentage of Fire use Monitoring & Adjustment Approach Not Used Many New Permanent Roads

4.2.2.4 Alternative A (Current Management)

4.2.2.4.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative A (Current Management) is Moderate (Table 39). The factors that contribute to this risk rating include the small effect of a low rate of restoration and a small number of total acres to be restored. However, this alternative also has a relatively large effect on the risk of the spread of invasive plant species due to the high percentage of fire use on the areas treated, potentially some new permanent roads and does not use the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*), which would contribute to a moderate to high risk of noxious weed introduction and spread. In combination, these factors would have the effect of a moderate risk of the spread of invasive plant species for Alternative A (Current Management).

In the long-term, Alternative A (Current Management) has the greatest area of the alternatives at risk for large, intense wildland fires as unnatural fuel loading conditions would remain high, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants. This alternative would have the greatest risk of the spread of noxious weeds from these types of fires.

4.2.2.4.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 50 years, an estimated 250,000 acres would be restored under Alternative A (Current Management). Additional sage steppe restoration would occur on about 486,000 acres of private lands. A total of 734,000 acres would be restored. The cumulative effects of these restoration activities in combination with other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

4.2.2.5 Alternative B (Proposed Action)

4.2.2.5.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative B (Proposed Action) is High (Table 39). The factors that contribute to this risk rating include the effect of a high rate of restoration, a large number of total acres to be restored, high percentage of fire use, and not using the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*). However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads. In combination, these factors would have the effect of a High risk of the spread of invasive plant species for Alternative B (Proposed Action).

In the long-term, Alternative B has a lower area than Alternative A at risk for large, intense wildland fires due to unnatural fuel loading conditions, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants.

4.2.2.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 40 years, an estimated 1,254,200 acres would be restored under Alternative B (Proposed Action). Additional sage steppe restoration would occur on about 34,000 acres of other federal lands and 542,000 acres of private lands. A total of 1,830,900 acres would be restored. The cumulative effects of these restoration activities in combination with the other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

4.2.2.6 Alternative C

4.2.2.6.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative C is Moderate (Table 39). The factors that contribute to this risk rating include the effect of a moderate rate of restoration, a large number of total acres to be restored, and high percentage of fire use. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*). In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternative C.

In the long-term, Alternative C has a lower area than Alternative A (Current Management) at risk for large, intense wildland fires due to unnatural fuel loading conditions, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants.

4.2.2.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 50 years, an estimated 1,254,200 acres would be restored under Alternative C. Additional sage steppe restoration would occur on about 34,000 acres of other federal lands and 542,000 acres of private lands. A total of 1,830,900 acres would be restored. The cumulative effects of these restoration activities in combination with other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

4.2.2.7 Alternative D

4.2.2.7.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative D is Moderate (Table 39). The factors that contribute to this risk rating include the effect of a high rate of restoration, a large number of total acres to be restored, and moderate percentage of fire use. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*). In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternative D.

In the long-term, Alternative D has a lower area than Alternative A (Current Management) at risk for large, intense wildland fires due to unnatural fuel loading conditions, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants.

4.2.2.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 40 years, an estimated 1,252,300 acres would be restored under Alternative D. Additional sage steppe restoration would occur on about 34,000 acres of other federal lands and 535,000 acres of private lands. A total of 1,821,900 acres would be restored. The cumulative effects of these restoration activities in combination with other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

4.2.2.8 Alternative E

4.2.2.8.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative E is Moderate (Table 39). The factors that contribute to this risk rating include the effect of a high rate of restoration, a large number of total acres to be restored, and moderate percentage of fire use. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*). In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternative E.

In the long-term, Alternative E has a lower area than Alternative A (Current Management) at risk for large, intense wildland fires due to unnatural fuel loading conditions, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants.

4.2.2.8.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock*

Grazing Management Practices) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 33 years, an estimated 1,252,300 acres would be restored under Alternative E. Additional sage steppe restoration would occur on about 34,000 acres of other federal lands and 535,000 acres of private lands. A total of 1,821,900 acres would be restored. The cumulative effects of these restoration activities in combination with other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

4.2.2.9 Alternative J (Preferred Alternative)

4.2.2.9.1 Direct and Indirect Effects

The overall risk of the spread of invasive plant species for Alternative J (Preferred Alternative) is Moderate (Table 39). The factors that contribute to this risk rating include the effect of a moderate rate of restoration, a large number of total acres to be restored, and moderate percentage of fire use. However, this alternative also has a relatively small effect on the risk of the spread of invasive plant species due to no new permanent roads, and would use the Monitoring and Adjustment Approach (*Section 2.4.6 Monitoring and Adjustment Approach*). In combination, these factors would have the effect of a Moderate risk of the spread of invasive plant species for Alternative J (Preferred Alternative).

In the long-term, Alternative J (Preferred Alternative) has a lower area than Alternative A (Current Management) at risk for large, intense wildland fires due to unnatural fuel loading conditions, along with the risk of high fire intensity and severity. This type of fire presents opportunities for the expansion of noxious weeds and invasive plants.

4.2.2.9.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing would continue throughout the Focus Area and effects from herbivory and trampling will continue (USDA Forest Service 2005). Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*) that has had the effect of creating more favorable conditions for non-natives and noxious weeds. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

No new permanent roads would be built in this alternative and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads that would be used for restoration of sage steppe ecosystem could create pathways for the introduction of noxious weeds and non-natives. The small amount of new roads that are expected to be built would not increase pathways in the Focus Area.

Firewood gathering may introduce non-native and noxious weeds through the use of contaminated vehicles, etc. However, firewood gathering would occur in relatively small areas compared to the restoration treatments and restoration areas may be closed to firewood cutting following restoration treatments, or other measures implemented to retain old growth juniper (see *2.4.5 Old Growth Juniper*). Therefore, firewood gathering would not have a cumulative effect on the spread of non-native or noxious weeds.

Forest management that would occur within the Focus Area would be limited in extent and would have standards to minimize the spread of noxious weeds and non-native plants. Therefore, forest management would not have a cumulative effect on noxious weeds and non-native plants within the Focus Area.

Over 47 years, an estimated 1,252,300 acres would be restored under Alternative J (Preferred Alternative). Additional sage steppe restoration would occur on about 34,000 acres of other federal lands and 535,000 acres of private lands. A total of 1,821,900 acres would be restored. The cumulative effects of these restoration activities in combination with other cumulative effects would not be expected to result in a substantial increase in noxious weed and invasive non-native species infestations.

Table 39. Risk of spread of Noxious Weeds and Invasive Non-Native Plants by Alternative

Risk Factor	Alternative A (Current Management)	Alternative B (Proposed Action)	Alternative C	Alternatives D and E	Alternative J
Area of Disturbance	Low	High	High	High	High
Percentage of fire use of treated area	Moderate	High	High	Moderate	Moderate
Use of a Monitoring & Adjustment Approach	High	Low	Low	Low	Low
Rate of restoration	Low	High	Moderate	High	Moderate
Building new roads	Moderate	Low	Low	Low	Low
Overall Rating	Moderate	High	Moderate	Moderate	Moderate
Long-term risk due to increased fire risk and continued increase in juniper density	High	Lower than Alternative A	Lower than Alternative A	Lower than Alternative A	Lower than Alternative A

4.2.3 OLD GROWTH JUNIPER

Old growth juniper trees would be protected during restoration activities. A specific Design Standard for the identification and protection of old growth juniper trees is part of Alternatives B, C, D, E and J (*Section 2.4.4 Old Growth Juniper*). This feature requires that all juniper trees that exhibit growth forms indicating that the tree was present at or before the mid-1800s would be protected. Therefore, there would be essentially no impact on old growth juniper trees in those alternatives.

Alternative A (Current Management) does not include the old growth juniper Design Standard and there would be some potential to remove old growth juniper trees. However, restoration in Alternative A (Current Management) would cover a relatively small area, minimizing the potential for removal of old growth juniper trees. The intent of the restoration is to reduce juniper density that has increased since the mid-1880's. Therefore, old growth juniper trees are not the target of this restoration effort and would not be targeted under Alternative A. Past firewood cutting policies have had some impact on old growth juniper, however policies to be implemented in the future would protect old growth juniper. Therefore, there would be minimal impact to old growth juniper trees under Alternative A.

Past firewood cutting policies have had some impact on old growth juniper, however policies to be implemented in the future would protect old growth juniper.

4.2.4 Special Status Plants

4.2.4.1 Introduction

The Proposed Action and alternatives have the potential of affecting individuals or populations of special status plant species. Special status plants are species that have been designated by the FS or BLM as sensitive and have specific management direction. These species have the potential to be impacted during restoration activities by direct destruction of the plants themselves or indirectly through changes in their habitat. This section will discuss the effects on these species.

4.2.4.2 Special Status Plants Management Direction

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for special status plants through management directives, standards, and guidelines.

Goals for special status plants from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Protect habitat for sensitive species sufficient for eventual delisting

Goals for special status plants from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- Manage public lands to maintain, restore, or enhance populations and habitats of special status plants. Priority for management intervention would be: (1) federal endangered or threatened species, (2) federal proposed species, (3) federal candidate species, (4) State listed species, (5) BLM 'sensitive' species, (6) BLM 'special interest' species.

4.2.4.3 Special Status Plants Effects Analysis

The following factors were considered in determining the potential direct, indirect, and cumulative effects from project activities on special status plant species that occur in the Focus Area:

- Likelihood that FS and BLM Standards and Guidelines would protect known special status plant populations or critical habitat, including:
  1. Distribution of the species
  2. Habitat quality
  3. Disturbance type, timing, and duration
  4. Reproductive viability

Compliance with existing standards and guidelines, species guidance documents, pre-project surveys, biological assessments and biological evaluations all would serve to reduce the impacts that proposed site-specific projects could have on special status species. Overall, direct effects may initially have a negative impact on a small portion of special status plant occurrences and habitat, but would not contribute to a downward trend in reproductive viability.

For all alternatives, it would be highly likely that the restoration activities would be implemented with no substantial effects to known special status plant populations or critical habitat because of the implementation of the programs and plans listed above. A more detailed effects analysis is presented in the *Botany Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007b). A Biological Evaluation (BE) was completed for all Forest Sensitive Plant Species (USDA Forest Service 2008b). For all alternatives and all species that occur in sage steppe habitats, the BE reached a determination of effects of "may impact individuals or habitat, but will not likely contribute towards Federal listing or loss of viability to populations or species".

The cumulative effects of the alternatives would include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing.

Roads could have an impact on special status plant habitat. No new permanent roads are proposed for Alternatives B, C, D, E and J, and no new roads are expected to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects, however the amount of new roads is expected to be minimal.

Firewood gathering would have some risk of impacts to special status plants, however it would occur at relatively small areas compared to the restoration treatments. Forest management that would occur inside the Focus Area would be required to survey for and avoid special status plants. Therefore, forest management would not have a cumulative effect on special status plants within the Focus Area.

The alternatives, in combination with other sage steppe restoration projects on other federal and private lands, would have no additional cumulative effect to known special status plant populations or critical habitat because of the implementation of the programs and plans listed above.

4.3 Fire/Fuels and Air Quality

4.3.1 Fire/Fuels

The change in fire regimes is the primary reason why Western juniper has increased in density throughout the Focus Area. This Restoration Strategy has a goal of restoring historic disturbance regimes, including fire, to the landscape. Prescribed fire and wildland fire use would be used as a restoration method designed to change key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Prescribed fire would be used where enough fuel exists to carry a fire, the fire can be managed successfully and conditions are good for achieving restoration objectives of removing juniper from the site. Following a prescribed fire, it is expected that most of the juniper would be dead but would remain standing for up to several decades. Prescribed fire would also kill sagebrush because, like juniper, it is not fire tolerant. Sagebrush would need a seed source to reproduce in the burned area. Natural seeding and reestablishment of sagebrush would likely take more than 20 years (Nelle *et al.* 2000) for most restoration sites. Grasses and forbs would resprout or reproduce from seed and would likely dominate the site in the first two decades following treatment (EOARC 2007).

4.3.1.1 Methodology for Analysis

The measure to determine how well the alternatives meet the Purpose and Need is changes in Condition Classes. Condition classes describe the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure (*Section 3.4.4 Condition Classes*). Condition class degradation, increasing from Class 1 to 2 or Class 2 to 3, would increase the fire hazard level and departure from historical fire regimes. Condition class improvement, decreasing from Class 2 to 1 or Class 3 to 2, would reduce the fire hazard level and move areas closer to historical fire regimes.

The technical definitions for Condition Classes are presented in the *Fire/Fuels Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007f). The majority of the Focus Area is currently in Condition Class 3 (Table 12) that means these areas are classified as having fire regimes and vegetation characteristics that have been significantly altered from their historical range. The types of vegetative changes are described in *Section 3.2 Vegetative Conditions* and the changes in fire regimes are described in *Section 3.4 Fire/Fuels*.

It is likely that the area restored that is currently in Condition Class 2 would be changed to Condition Class 1. However, areas existing in Condition Class 3 may be reduced to Condition Class 1 or 2 depending on conditions on-site, efficiency of the burn, and the expertise of the staff. The Condition Class changes would be caused by alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure through the use of fire use.

This analysis uses only fire use treatments and does not include areas that are treated by mechanical means. Mechanical treatment typically does not mimic natural wildfire or have the same effect on Condition Class as would a wildfire or prescribed burn. This is because mechanical treatment does not treat groundcover vegetation or shrubs, although it does reduce the number of tree stems per acre. Mechanical treatment does have the potential of moving treated areas towards Condition Class 1. The effects of mechanical treatment upon Condition Class reduction would be evaluated as part of the monitoring process.

4.3.1.2 Alternative A (Current Management)

4.3.1.2.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative A (Current Management) progress throughout the planning period, over 176,000 acres would be moved toward Condition Class 1 through fire use. A total of five percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of the alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1. Alternative A would not substantially change the existing conditions in the Focus Area due to the small amount of acres treated with fire use (Table 40).

4.3.1.2.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

The effects of Alternative A in combination with past, present and future foreseeable effects would be a continuation in the degradation of the Analysis Area’s Condition Classes. The total estimated area of fire use treatment (193,500 acres) would not be sufficient to offset the continuing increase in juniper density, therefore the Condition Classes within the Focus Area will continue to be mostly outside of historical fire return intervals and have an increased fire hazard from large, intense wildfires due to their condition.

4.3.1.3 Alternative B (Proposed Action)

4.3.1.3.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative B progress throughout the planning period, over 880,000 acres would be moved toward Condition Class 1 through fire use. A total of 24 percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of the alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1.

Another effect of this alternative is that as implementation progresses, the historical fire regimes would become more established. Although the risk of large wildfires would still exist, over time the expected fire intensity would be less than that under current conditions, resulting in less severe ecological damage from wildland fire.

Large wildfires would also contribute to the continued alteration of vegetation across the landscape. Planned treatments and wildfires would increase the diversity of vegetative patterns across the landscape of differing densities, structural stages, and successional stages.

4.3.1.3.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

Alternative B (Proposed Action), in combination with fire use on 56,300 acres of private lands and 33,600 acres of other governmental lands, would restore 1,061,600 acres with fire use. The result would be that the cumulative effect of Alternative B would be historical fire regimes would return over large portions of the Focus Area and the fire hazard from large, intense wildfires would be reduced.

4.3.1.4 Alternative C

4.3.1.4.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative C progress throughout the planning period, over 880,000 acres would be moved toward Condition Class 1 through fire use. A total of 24 percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1.

Another effect of this alternative is that as implementation progresses, the historical fire regimes would become more established. Although the risk of large wildfires would still exist, over time the expected fire intensity would be less than that under current conditions, resulting in less severe ecological damage from wildland fire. Because fewer acres would be treated during the first two decades, the Condition Classes would not change as rapidly as Alternative B. A substantial return to natural fire return intervals would be delayed until at least the third decade. The impact from large wildfires would continue, with a gradual lessening of size and fire intensity, and associated fire behavior, over time. Less severe ecological damage would occur beginning with the third decade.

Large wildfires would also contribute to the continued alteration of vegetation across the landscape. Planned treatments and wildfires would increase the diversity of vegetative patterns across the landscape of differing densities, structural stages, and successional stages.

4.3.1.4.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

Alternative C, in combination with fire use on 56,300 acres of private lands and 33,600 acres of other governmental lands, would restore 1,061,600 acres with fire use. The result would be that the cumulative effect of Alternative C would be historical fire regimes would return over large portions of the Focus Area and the fire hazard from large, intense wildfires would be reduced.

4.3.1.5 Alternative D

4.3.1.5.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative D progress throughout the planning period, over 634,000 acres would be moved toward Condition Class 1 through fire use. A total of 17 percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1.

Another effect of this alternative is that as implementation progresses, the historical fire regimes would become more established. Although the risk of large wildfires would still exist, over time the expected fire intensity would be less than that under current conditions, resulting in less severe ecological damage from wildland fire. Compared to Alternative B, the fewer number of acres treated with fire use in the first two decades in Alternative D would delay substantial change in Condition Classes until the third decade. The return of historical fire regimes intervals would be delayed until at least the third decade. Large wildfires would continue, with a gradual lessening of size and intensity, and associated fire behavior and ecological damage beginning with the third decade.

Large wildfires would also contribute to the continued alteration of vegetation across the landscape. Planned treatments and wildfires would increase the diversity of vegetative patterns across the landscape of differing densities, structural stages, and successional stages.

4.3.1.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward

Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

Alternative D, in combination with fire use on 49,300 acres of private lands and 26,200 acres of other governmental lands, would restore 772,700 acres with fire use. The result would be that the cumulative effect of Alternative D would be historical fire regimes would return over large portions of the Focus Area in the third decade along with the reduction in fire hazard from large, intense wildfires.

4.3.1.6 Alternative E

4.3.1.6.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative E progress throughout the planning period, over 634,000 acres would be moved toward Condition Class 1 through fire use. A total of 17 percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1.

Although, Alternative E has a similar percentage a fire use, which would reduce Condition Class changes, it has an accelerated treatment rate that would result in similar effects on Condition Classes to Alternative B. Large wildfires would also contribute to the continued alteration of vegetation across the landscape. Planned treatments and wildfires would increase the diversity of vegetative patterns across the landscape of differing densities, structural stages, and successional stages.

4.3.1.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

Alternative E, in combination with fire use on 49,300 acres of private lands and 26,200 acres of other governmental lands, would restore 772,700 acres with fire use. The result would be that the cumulative effect of Alternative E would be historical fire regimes would return over large portions of the Focus Area in the second decade along with the reduction in fire hazard from large, intense wildfires.

4.3.1.7 Alternative J (Preferred Alternative)

4.3.1.7.1 Direct and Indirect Effects

Fire use restoration treatments throughout the Focus Area would reduce juniper density and create grasslands as described in *Section 4.2.1 Sage Steppe Ecosystem Mosaic* and vegetative mosaics similar to those that existed historically, as described in *Section 3.2.1 Historical Vegetation Patterns*. As treatments under Alternative J (Preferred Alternative) progress throughout the planning period, over 634,000 acres would be moved toward Condition Class 1 through fire use. A total of 17 percent of the Focus Area would be reduced in Condition Class. Table 40 presents a comparison of alternatives and the progress they make toward bringing the Focus Area closer to Condition Class 1.

Another effect of this alternative is that as implementation progresses, the historical fire regimes would become more established. Although the risk of large wildfires would still exist, over time the expected fire intensity would be less than that under current conditions, resulting in less severe ecological damage from wildland fire. Compared to Alternative B, the fewer number of acres treated with fire use in the first two decades in Alternative J (Preferred Alternative) would delay substantial change in Condition Classes until the third decade. The return of historical fire regimes intervals would be delayed until at least the third decade. Large wildfires would continue, with a gradual lessening of size and intensity, and associated fire behavior and ecological damage beginning with the third decade.

Large wildfires would also contribute to the continued alteration of vegetation across the landscape. Planned treatments and wildfires would increase the diversity of vegetative patterns across the landscape of differing densities, structural stages, and successional stages.

4.3.1.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) including reestablishing historic fire regimes.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would remove mature juniper trees in those areas and also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward Condition Class 1, however it would occur at relatively small areas compared to the restoration treatments.

Forest management that would occur within the Focus Area would treat fuels as part of those activities, moving some of those areas into Condition Class 1. Therefore, forest management could have some positive cumulative effect on Condition Classes within the Focus Area.

Alternative D, in combination with fire use on 49,300 acres of private lands and 26,200 acres of other governmental lands, would restore 772,700 acres with fire use. The result would be that the cumulative effect of Alternative D would be historical fire regimes would return over large portions of the Focus Area in the third decade along with the reduction in fire hazard from large, intense wildfires.

Table 40. Cumulative Area of Condition Classes 2 and 3 that are Moved Towards Condition Class 1 due to Prescribed Burning, by Alternative

	Alternative A	Alternatives B and C	Alternatives D, E and J
Condition Class 2	52,245 acres	262,400 acres	188,200 acres
Condition Class 3	123,840 acres	621,900 acres	446,200 acres
Percentage of Focus Area in Condition Class 2 and 3 moved toward Condition Class 1	5 %	24 %	17 %

4.3.2 PRESCRIBED FIRE AND WILDLAND FIRE USE IMPLEMENTATION

The amount of prescribed burning in the Proposed Action is a substantial increase over the current amount that the FS and BLM complete. The environmental consequences of prescribed fire are addressed throughout this chapter in *Section 4.2 Vegetation, Section 4.5 Watershed and Soil Resources* and *Section 4.6 Wildlife*. Smoke emissions from prescribed fire are addressed in *Section 4.3.3 Air Quality*. This section will address the tactical reasonableness in terms of resources currently available and additional resources needed within the burn window to accomplish the prescribed burning program.

4.3.2.1 Methodology for Analysis

The following criteria are used in the effects analysis for evaluating and comparing each alternative.

- Agency capability to accomplish the amount of proposed prescribed fires, based on the resources needed for each alternative compared to the existing agency capability of 24 burns per year.

The following assumptions were used to determine the capability to accomplish the prescribed fire activities:

- The average prescribed fire size each agency can accomplish in a single day would be approximately 500 acres.
- There are 20 burn days available in the fall period and 60 days in the spring, for a total of 80 prospective burning days. However, it was assumed that constraints such as burn day conditions being outside of acceptable conditions, access in the spring period, and other factors, result in only half of the 80 days being considered available. This leaves 40 available days in which each agency would be able to conduct burning activities. Each agency has the capability of executing two projects per week. At a rate of four burns per week a total of 24 prescribed fires can be accomplished during the available days in the year.
- Wildfires and the use of natural wildfires that would occur in Wildfire Use Areas are not considered in analyzing the proposed levels of prescribed burning under each alternative. However, wildfires could accomplish some of the goals of the prescribed burning proposed in those areas.

4.3.2.2 Alternative A (Current Management)

4.3.2.2.1 Direct and Indirect Effects

The current planned management activities include approximately eight project-level prescribed fire projects over approximately 3,900 acres per year (Table 41). This amount of prescribed fire would be within the combined agencies' (BLM and FS) current capability (Figure 25) to complete these projects. Therefore, there would be no additional impact on resources required for Alternative A.

4.3.2.2.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

4.3.2.3 Alternative B (Proposed Action)

4.3.2.3.1 Direct and Indirect Effects

Alternative B would restore 24,300 acres per year with prescribed fire, requiring 49 prescribed fires each year through the first four decades in the planning period (Table 41). The current capability of FS and BLM resources is approximately 24 prescribed fires each year. Therefore, this alternative would require additional resources to complete the remaining 25 burns annually (Figure 25).

4.3.2.3.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

4.3.2.4 Alternative C

4.3.2.4.1 Direct and Indirect Effects

Alternative C would restore approximately 12,150 acres annually with prescribed fire during Decades 1 and 2, requiring 24 prescribed fire projects each year throughout the first 20 years (Table 41). Beginning in Decade 3 to the end of the planning period, a doubling of treatments would require an estimated 49 prescribed fires per year. The current capability would be adequate during Decades 1 and 2, but would require the use of additional resources outside the Focus Area to accomplish an additional 24 burns per year in Decades 3-5 (Figure 25).

4.3.2.4.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

4.3.2.5 Alternative D

4.3.2.5.1 Direct and Indirect Effects

Alternative D would restore an estimated 14,400 acres annually with prescribed fire during Decades 1and 2, requiring approximately 29 prescribed fire projects each year throughout the first 20 years (Table 41). Resources from outside the Analysis Area would be required to complete five fires per year for the first two decades (Figure 25). Beginning in Decade 3 to the end of Decade 4, approximately 41 prescribed fires each year would require additional resources to complete 17 fires per year (Figure 25).

4.3.2.5.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

4.3.2.6 Alternative E

4.3.2.6.1 Direct and Indirect Effects

Alternative E would restore an estimated 19,153 acres annually with prescribed fire during Decades 1and 2, requiring approximately 38 prescribed fires each year during the first 20 years (Table 41). Additional resources from outside the Analysis Area would be required to complete 14 of those prescribed fires per year for the first two decades (Figure 25). Annual prescribed fires on 24,000 acres in Decade 3 would require the implementation of 48 prescribed fires, requiring additional resources to complete 24 fires per year (Figure 25). In Decade 4, there would be approximately 49 annual prescribed burns conducted over the first three years in this decade. These burns would require additional resources to complete 25 fires per year (Figure 25).

4.3.2.6.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

4.3.2.7 Alternative J (Preferred Alternative)

4.3.2.7.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would restore an estimated 7,200 acres annually with prescribed fire during Decades 1and 2, requiring approximately 14 prescribed fire projects each year throughout the first 20 years (Table 41). The level of prescribed burning for the first two decades is within the current agency capability (Figure 25). Beginning in Decade 3 to the end of Decade 5, approximately 41 prescribed fires each year would require additional resources to complete 17 fires per year (Figure 25).

4.3.2.7.2 Cumulative Effects

The past, present and future foreseeable effects include the demands on prescribed burning for other projects associated with sage steppe restoration or forest management throughout the Analysis Area. For the FS, the other prescribed fires would be associated with forest management projects and are currently at a relatively low level and therefore, would have only a small cumulative effect. The BLM is currently conducting prescribed fires for sage steppe restoration as part of their existing program, which would become part of this Restoration Strategy and therefore, would not experience additional cumulative impacts. Prescribed burning on private lands would be minimal and would not use FS or BLM crews, and therefore, would not have a cumulative impact. The cumulative effects of this alternative in combination with the other agency demands on prescribed burning are essentially the same as the direct effects of this alternative.

Table 41. Annual Acres of Prescribed Fire and Number of Burns Per Year to Accomplish Treatment by Alternative for Each Decade

	Alt. A		Alt. B		Alt. C		Alt. D		Alt. E		Alt. J	
Decade	# of Burns	Annual Acres Treated	# of Burns	Annual Acres Treated	# of Burns	Annual Acres Treated	# of Burns	Annual Acres Treated	# of Burns	Annual Acres Treated	# of Burns	Annual Acres Treated
1	8	3,900	49	24,300	24	12,150	29	14,400	38	19,200	14	7,200
2	8	3,900	49	24,300	24	12,150	29	14,400	38	19,200	14	7,200
3	8	3,900	49	24,300	49	24,300	41	20,500	48	24,000	41	20,500
4	8	3,900	49	24,300	49	24,300	41	20,500	49	24,700	41	20,500
5	8	3,900	-	-	49	24,300	-	-	-	-	41	20,500

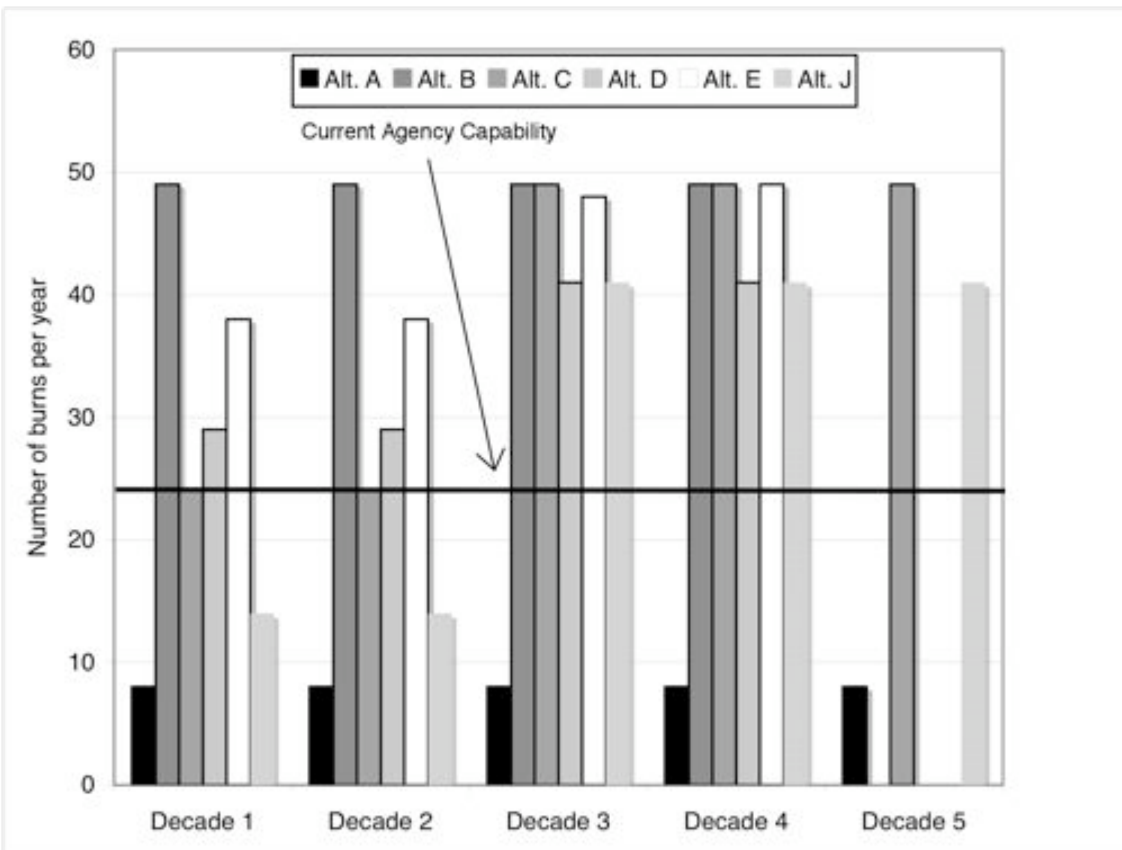

Figure 25. Comparison of Number of Burns per Year to Current Agencies' Capability.[1]

[1]The number of burns in Alternative E in Decade 4 would only occur for three years and the number of burns in Alternative J (Preferred Alternative) in Decade 5 would occur for seven years.

4.3.3 AIR QUALITY

Maintaining the existing high air quality standards is important in the Analysis Area. Impacts to air quality affect all populations, especially the young and elderly and those with respiratory health problems. Several of the naturally occurring and planned activities have the potential to affect air quality. Wildfires are a source of temporary and unscheduled increases in pollutants, particularly emissions of particulate matter, measured as PM10 (particles less than 10 microns in size). Prescribed fires can cause short-term air quality degradation from smoke emissions. The use of heavy equipment, vehicles and gravel roads can produce dust and vehicle emissions. Dust created by driving on gravel roads results in short-term, localized decreases in air quality. Sources of air pollutants related to the proposed restoration activities include smoke from wildland fire, wildland fire use (WFU), prescribed burning, vehicular and equipment emissions, and dust from the use of unsurfaced roads. Dust, and vehicle and equipment exhaust emissions would have minimal effects on air quality, because these types of emissions usually settle quickly and remain relatively close to their origin, resulting in only localized effects. The greatest potential impact on air quality is smoke from wildland fires, WFU, and prescribed burning. Wildland fires would burn at a greater intensity than prescribed fires and therefore create greater potential for degrading air quality. However, wildland fires are sporadic in nature and unpredictable, and are therefore not part of this analysis. Therefore, the air quality and human health effects of smoke generated from prescribed fires are the focus of this analysis.

A project level smoke management plan would be developed for each prescribed fire operation and included with a project prescribed fire plan. A daily burn permit would be required and authorized only by the local Air Quality Management District following approval of these plans. Burning would be conducted only on days meeting both smoke management and prescribed fire requirements.

The execution of prescribed fires would occur on days that have fair to excellent smoke dispersion that would protect Class 1 airsheds and other smoke sensitive areas. In contrast to the prescribed fire plan, a wildland fire use incident must be located within an approved Wildland Fire Use area that is contained within an approved Wildland Fire Implementation Plan (WFIP). Contained within this WFIP are the acceptable standards, requirements, and conditions under which a naturally occurring incident may be implemented. In both cases, the principal objective is to use fire incidents to meet specific resource management objectives. By implementing the plan requirements, the negative effects from smoke can be reduced. However, this approach would not eliminate the risk of smoke impacts from prescribed fire and/or wildland fire use projects. Unanticipated smoke intrusions can be caused by unforeseen weather changes and equipment failures.

4.3.3.1 Methodology for Analysis

This evaluation of air quality uses the estimated smoke emissions generated from prescribed fire because they have the greatest potential impact (USDI Bureau of Land Management 2006a) of the proposed activities. The predicted smoke emissions, by themselves, cannot be translated into effects on human health and air quality because the site-specific projects have not been planned. Therefore, the emission sources and quantities cannot be placed on the ground and given a time of occurrence. In all alternatives, the use of approved prescribed burn, wildland fire use, and smoke management plans in combination with the application of regulatory control through the permitting process would be applied on each site-specific project. There are several analysis assumptions that are listed in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007g).

For this analysis, the following qualitative impact levels are used to analyze effects on human health and air quality. The determination of what impact level applies to each alternative was based upon the estimated emissions of total PM10 and PM2.5, the duration of the burning window, the size of the Focus Area in relation to the amount of burning, the direction of prevailing winds in combination with the topographic orientation of the Analysis Area and professional judgment based upon past experiences with prescribed fires.

- ***Negligible*****:** Air quality would not change, or expected changes would be at or below the level of detection. Air quality effects would be considered none to slight. Air quality standards and guidelines would maintain air quality within acceptable limits.
- ***Slight Probability***: There would be a slight probability that air quality would measurably change, but the changes would be small and remain local. Air quality standards and guidelines would maintain air quality within acceptable limits. The potential would exist for an occasional short-term degradation of acceptable emissions standards lasting less than 24-hours.
- ***Low Probability*****:** There would be a low probability that air quality would be expected to measurably change. Air quality effects would be local and less than 24-hours in duration. Air quality standards and guidelines would likely be successful in maintaining air quality within acceptable limits.
- ***Moderate Probability*****:** There would be a moderate probability that air quality would measurably change. Air quality effects would be substantial in the short-term (24-hours in duration), a result of multiple prescribed burn and wildland fire use projects occurring simultaneously. Air quality impacts would be noticeable regionally. The success of air quality standards and guidelines in maintaining air quality within acceptable limits in the short-term would be uncertain.

- ***High Probability*****:** There would be a high probability that air quality would measurably change. Air quality effects would be substantial in the short-term (24-hours in duration), a result of multiple prescribed burn and wildland fire use projects occurring simultaneously. Air quality impacts would be noticeable regionally. The success of air quality standards and guidelines in maintaining air quality within acceptable limits in the short-term would be uncertain. It is highly likely that the level of prescribed burning proposed would not be able to be accomplished because of adverse air quality impacts.

4.3.3.2 Alternative A (Current Management)

4.3.3.2.1 Direct and Indirect Effects

Alternative A would use prescribed fire on 3,900 acres by conducting eight burns per year (Table 41). The total PM10 and PM2.5 emissions would be approximately 240 and 192 tons, respectively. Table 42 provides a comparison of PM10 and PM2.5 emissions between alternatives. The impacts to air quality would be temporary with some short-term degradation. Air quality changes would be at or below detection levels resulting in negligible impacts from prescribed fire smoke emissions.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Design Standards would be required and are expected to be successful. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a negligible probability that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the five decades.

Alternative A is the only alternative that would pose a negligible probability of impacts throughout the entire 50-year implementation period. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the smallest likelihood of delays in the implementation of the prescribed fire restoration.

4.3.3.2.2 Cumulative Effects

The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a negligible probability that major impacts on air quality would result from the cumulative burning activities.

4.3.3.3 Alternative B (Proposed Action)

4.3.3.3.1 Direct and Indirect Effects

Alternative B would restore 24,300 acres per year with prescribed fire across the four million acre Focus Area. In order to accomplish that rate of prescribed fire, 49 individual burns would be conducted annually that would have to fit into the 80-day burning window. These prescribed burns would produce an estimated annual total of 1,506 tons of PM10 and 1,205 tons of PM2.5 emissions throughout each of the first four decades in the planning period (Table 42). These are the largest emissions of any of the alternatives, except for Decade 4 in Alternative E.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a moderate probability that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the first four decades.

Alternative B is the only alternative that would pose a moderate probability of impacts throughout the entire 40-year implementation period. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the greatest likelihood of delays in the implementation of the prescribed fire restoration.

4.3.3.3.2 Cumulative Effects

The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

An additional 89,900 acres of restoration by prescribed fire is expected to be completed on other federal and private lands under Alternative B for a total of over one million acres of restoration by prescribed fire. Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a moderate probability that major impacts on air quality would result from the cumulative burning activities.

4.3.3.4 Alternative C

4.3.3.4.1 Direct and Indirect Effects

Alternative C would restore 12,150 acres per year with prescribed fire by conducting 24 burns annually for the first two decades (Table 41). During Decades 3-5, annual treatment would increase to 24,300 acres per year, requiring 49 burns per year (Table 41) that would have to fit into the 80-day burning window. The prescribed burns would produce an estimated annual total of 753 tons of PM10 and 602 tons of PM2.5 emissions during the first two decades. These are the second lowest emissions produced for any of the alternatives during a single decade. During the last three decades, however, the prescribed burns would produce 1,506 tons of PM10 and 1,205 tons of PM 2.5 emissions throughout the last three decades in the planning period (Table 42). These emissions match those of Alternative B, and other than a three-year period in Alternative E, are the highest emissions produced by the alternatives. A total of 971,700 acres would be treated by prescribed fire by the end of the planning period.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a slight to low probability during the first two decades and a moderate probability during the last three decades that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the last three decades.

Implementation of Alternative C would be able to stay on schedule during the first two decades, due to the low probability of impacts. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the third greatest likelihood of delays in the implementation of the prescribed fire restoration based upon the final three decades.

4.3.3.4.2 Cumulative Effects

The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

An additional 89,900 acres of restoration by prescribed fire is expected to be completed on other federal and private lands under Alternative C for a total of over one million acres of restoration by prescribed fire. Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a slight to low probability during the first two decades and a moderate probability in the final three decades that major impacts on air quality would result from the cumulative burning activities.

4.3.3.5 Alternative D

4.3.3.5.1 Direct and Indirect Effects

Alternative D would restore 14,400 acres per year with prescribed fire by completing 29 burns annually for the first two decades (Table 41). During Decades 3 and 4, annual treatment would increase to 20,500 acres, requiring 41 burns each year (Table 41) that would have to fit into the 80-day burning window. The prescribed burns would produce an estimated annual total of 891 tons of PM10 and 713 tons of PM2.5 emissions during the first two decades, and 1,271 tons of PM10 and 1,017 tons of PM2.5 of emissions throughout the last three decades in the planning period (Table 42). The emissions are the third lowest of the alternatives. A total of 697,200 acres would be treated by prescribed fire by the end of the planning period.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a slight to low probability during the first two decades and a low probability during the next two decades that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the last three decades.

Implementation of Alternative D would be able to stay on schedule during the first two decades, due to the low probability of impacts. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the second smallest likelihood of delays in the implementation of the prescribed fire restoration.

4.3.3.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

An additional 75,500 acres of restoration by prescribed fire is expected to be completed on other federal and private lands under Alternative D for a total of approximately 772,000 acres of restoration by prescribed fire. Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a slight to low probability during the first two decades and a low probability in the next two decades that major impacts on air quality would result from the cumulative burning activities.

4.3.3.6 Alternative E

4.3.3.6.1 Direct and Indirect Effects

Alternative E would restore 19,200 acres annually with prescribed fire by completing 38 burns per year (Table 41). This restoration would produce an estimated annual 1,187 tons of PM10 and 950 tons of PM2.5 emissions during Decades 1 and 2 (Table 41). In Decade 3, the annual prescribed burn treatment would increase to 24,000 acres and 48 burns per year that would have to fit into the 80-day burning window. This activity would generate an estimated 1,488 tons of PM10 and 1,190 tons of PM2.5 of emissions (Table 42). In Decade 4 the annual restoration by fire would again increase to 24,700 acres and 49 burns per year, but this activity would only occur for the first three years of this decade. No prescribed fire activity is planned past year 33, which is the implementation period of this alternative. At the end of the implementation period, 697,200 acres would be treated by prescribed fire.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a low probability during the first two decades and a moderate probability during the next two decades that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the last three decades.

Implementation of Alternative E would be able to stay on schedule during the first two decades, due to the low probability of impacts. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the third smallest likelihood of delays in the implementation of the prescribed fire restoration.

4.3.3.6.2 Cumulative Effects

The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

An additional 75,500 acres of restoration by prescribed fire is expected to be completed on other federal and private lands under Alternative E for a total of approximately 772,000 acres of restoration by prescribed fire. Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a low probability during the first two decades and a moderate probability in the next two decades that major impacts on air quality would result from the cumulative burning activities.

4.3.3.7 Alternative J (Preferred Alternative)

4.3.3.7.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would restore 7,200 acres per year with prescribed fire by completing 14 burns annually for the first two decades (Table 41). During Decades 3, 4 and 5, annual treatment would increase to 20,500 acres, requiring 41 burns each year (Table 41) that would have to fit into the 80-day burning window. The prescribed burns would produce an estimated annual total of 445 tons of PM10 and 356 tons of PM2.5 emissions during the first two decades, and 1,271 tons of PM10 and 1,017 tons of PM2.5 of emissions throughout the last three decades in the planning period (Table 42). The emissions are the second lowest of the alternatives. A total of 697,200 acres would be treated by prescribed fire by the end of the planning period.

The direct effects of the prescribed fires would be an increase the amount of smoke in the air during burning. Smoke would remain in the airshed for a relatively short time, generally not more then a few days. Smoke production would be dispersed, because although simultaneous events would be occurring on a single day, they would be required to be far enough apart to maximize dispersion. Visual impairment and impact upon Class 1 airsheds would be mitigated through implementation of standards and guidelines for each agency and requirements of regulatory agencies. Therefore, Class 1 areas would not be impacted by smoke. Based upon the evaluation criteria, there is a slight probability during the first two decades and a low probability during the next three decades that smoke generated from prescribed fires would have substantial effects on air quality (Table 43), however the effects would be short-term (24-hours in duration).

The indirect effect on air quality would be an increase in the likelihood that the annual volume of emissions may place the airshed outside of its current air quality attainment status during the last three decades.

Implementation of Alternative J (Preferred Alternative) would be able to stay on schedule during the first two decades, due to the slight probability of impacts. Because of how potential air quality impacts are controlled through the regulatory process, adverse impacts would not be allowed to occur. Instead, the regulatory process would impose restrictions that have the potential to reduce the proposed rate of prescribed burning, which would slow down the rate of restoration. This alternative would have the second smallest likelihood of delays in the implementation of the prescribed fire restoration.

4.3.3.7.2 Cumulative Effects

The past, present and future foreseeable effects include smoke generated from prescribed fires associated with other forest management throughout the Analysis Area and smoke generated from private land activities.

Forest management will continue throughout the Analysis Area and if those management activities involve prescribed fire, they would have the potential for the cumulative effect of reducing the amount of annual burning that would be accomplished under this alternative. The ability to accomplish the proposed rate of prescribed burning would be impacted by smoke transported from other burning activities on adjacent forests and resource management areas. The cumulative impact of smoke drift from these outside sources would increase the probability that restoration activities in the Focus Area would be delayed. The APCD permitting process would regulate the amount of burning in the area, thus reducing or eliminating foreseeable smoke related problems to sensitive areas from the Proposed Action.

An additional 75,500 acres of restoration by prescribed fire is expected to be completed on other federal and private lands under Alternative J (Preferred Alternative) for a total of approximately 772,000 acres of restoration by prescribed fire. Prescribed burning on other federal and private lands would contribute to the cumulative effects on air quality and may cause delays in the implementation of the alternative. These activities, along with those proposed on FS and BLM managed lands, would require burn permits before conducting prescribed fires. There is a slight probability during the first two decades and a low probability in the next three decades that major impacts on air quality would result from the cumulative burning activities.

Table 42. Total Estimated Tons of PM10 and PM2.5 Emissions by Decade by Alternative

	Alternatve A		Alternatve B		Alternatve C		Alternatve D		Alternatve E		Alternatve J	
Decade	PM10 (Tons)	PM2.5 (Tons)	PM10 (Tons)	PM2.5 (Tons)	PM10 (Tons)	PM2.5 (Tons)	PM10 (Tons)	PM2.5 (Tons)	PM10 (Tons)	PM2.5 (Tons)	PM10 (Tons)	PM2.5 (Tons)
1	240	192	1,506	1,205	753	602	891	713	1,187	950	445	356
2	240	192	1,506	1,205	753	602	891	713	1,187	950	445	356
3	240	192	1,506	1,205	1,506	1,205	1,271	1,017	1,488	1,190	1,271	1,017
4	240	192	1,506	1,205	1,506	1,205	1,271	1,017	1,532	1,226	1,271	1,017
5	240	192	-	-	1,506	1,205	-	-	-	-	1,271	1,017

Table 43. Probability of Impacts from Prescribed Burning on Human Health and Air Quality Values from Restoration Treatments by Alternative

Decade	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E[1]	Alternative J[1]
1	Negligible	Moderate Probability	Slight to Low Probability	Slight to Low Probability	Low Probability	Slight Probability
2	Negligible	Moderate Probability	Slight to Low Probability	Slight to Low Probability	Low Probability	Slight Probability
3	Negligible	Moderate Probability	Moderate Probability	Low Probability	Moderate Probability	Low Probability
4	Negligible	Moderate Probability	Moderate Probability	Low Probability	Moderate Probability	Low Probability
5	Negligible	-	Moderate Probability	-	-	Low Probability

[1]For Alternative E the impacts would only occur in the first three years of Decade 4 and Alternative J (Preferred Alternative) would occur in the first seven years of decade 5.

4.4 Livestock Grazing

4.4.1 Forage for Domestic Animals

The Sage Steppe Ecosystem Restoration Strategy has the purpose of restoring the landscape to a sage steppe ecosystem that functions similarly to the pre-1870s landscape mosaic, including similar vegetation mosaics and species composition. The pre-1870s landscape mosaic was a constantly changing mosaic of grasses, different stages of sagebrush with scattered juniper trees, and some dense juniper woodlands. The existing dense and less dense juniper woodland components of the sage steppe ecosystem occupy a larger area in the Focus Area than they did in the 1870s (*Section 4.2.1 Sage Steppe Ecosystem Mosaic*). Increases in the density of juniper are associated with decreases in the ground cover consisting of shrubs, grasses and forbs (*Section 4.4.1.1 Methodology for Analysis*). Density increases of Western juniper over the past century have reduced livestock forage availability and has been a contributing factor to previous reductions in livestock numbers in the Analysis Area (JW Associates 2007h).

Agriculture, including ranching operations, ranks as one of the top three economic activities in the Analysis Area. Grazing on public lands is an integral part of many of these ranching operations. Ranchers typically use public lands for three- to six-month periods while their base (private) property, not being used for grazing, is devoted to alfalfa and grass hay production for winter feed. For example, ranchers who have grazing allotments on the Modoc National Forest depend on approximately 15 percent of their total annual forage requirement from National Forest lands (JW Associates 2007h). Reductions in public land grazing disrupt this ranch/public land balance and will generally result in a decrease in the number of livestock a given ranch operation can support. Grazing lands throughout Modoc County are currently at capacity.

4.4.1.1 Methodology for Analysis

The basic methodology for the analysis of the effects of the alternatives was to assess the range condition trends qualitatively and compare those trends between alternatives. The quality of range condition is also compared between alternatives based upon short-term impacts and long-term improvement in the condition of the rangeland component of the sage steppe ecosystem expected to occur by mechanical and fire use restoration treatment methods. The restoration activities would change juniper dominated areas to grassland and sagebrush dominated sage steppe areas (*Section 4.2.1 Sage Steppe Ecosystem Mosaic*). Larger areas of grassland and sagebrush dominated sage steppe would provide higher quality range conditions for livestock grazing.

4.4.1.2 Management Direction for Livestock Grazing

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for livestock grazing through management directives, standards, and guidelines.

Goals for livestock grazing from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Maintain the wild horse herd populations between 275 and 335 animals.
- Balance permitted grazing and forage capacity by 2000 with grazing systems that complement other resource needs.
- Coordinate livestock grazing resource planning opportunities with BLM, SCS and individuals to achieve goals.

Goals for livestock grazing from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- Livestock grazing will be maintained as a recognized and economically viable use of public lands. Authorized use will be such that rangeland health standards are met and maintained, and the needs of other resources and resource users are adequately addressed.
- Treatments will effectively reduce juniper density while leaving sufficient herbaceous material to provide watershed protection as well as forage and cover for wildlife and other resource needs.

4.4.1.3 Alternative A (Current Management)

4.4.1.3.1 Direct and Indirect Effects

Livestock grazing would continue at the current level in accordance with applicable land management plan direction (Figure 24). Alternative A (Current Management) would result in only minor long-term changes in the current trend of overall range condition and desirable sage-steppe plant species. With the greatest shortfall between the rate of sage steppe restoration and rate of juniper density increases occurring in this alternative, and without periodic disturbance, be it mechanical or by fire, increases in juniper density would likely continue. A closed juniper canopy limits establishment of desirable plant species and could result in a continued reduction in forage base, over time.

4.4.1.3.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions. However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative A include an additional 486,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 730,000 acres. The cumulative effect of sage steppe restoration projects would contribute toward a more positive range condition trend.

4.4.1.4 Alternative B (Proposed Action)

4.4.1.4.1 Direct and Indirect Effects

Alternative B would result in an upward trend in range quality based upon acres restored (Figure 24). The short-term impacts (less than five years) from restoration activities would be a reduction of range conditions due to fire use, in particular. However, grasses would quickly reestablish and would dominate those restored areas (EOARC 2007). The restoration treatments would result in a long-term (greater than 10 years) upward trend in range condition due to the change from juniper dominated areas to grassland and sagebrush dominated sage steppe areas. Over 40 years, an estimated 1,254,200 acres of sage steppe ecosystem would be restored under Alternative B, resulting in long-term improvement in range conditions.

4.4.1.4.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions. However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative B include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. The cumulative effects of restoration activities would be long-term improvement of range condition across a large area.

4.4.1.5 Alternative C

4.4.1.5.1 Direct and Indirect Effects

Alternative C would result in an upward trend in range quality based upon acres restored (Figure 24). The short-term impacts (less than five years) from restoration activities would be a reduction of range conditions due to fire use, in particular. However, grasses would quickly reestablish and would dominate those restored areas (EOARC 2007). The restoration treatments would result in a long-term (greater than 10 years) upward trend in range condition due to the change from juniper dominated areas to grassland and sagebrush dominated sage steppe areas.

The direct and indirect effects of Alternative C would be similar to Alternative B, because they treat the same area with the same treatment methods. However, Alternative C would achieve the restoration at a slower rate than Alternative B, resulting in an additional 10 years needed to restore the Focus Area. Alternative C has the second lowest rate of restoration (Figure 24).

4.4.1.5.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions. However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative C include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. The cumulative effects of restoration activities would be long-term improvement of range condition across a large area.

4.4.1.6 Alternative D

4.4.1.6.1 Direct and Indirect Effects

Alternative D would result in an upward trend in range quality based upon acres restored (Figure 24). The short-term impacts (less than five years) from restoration activities would be a reduction of range conditions due to fire use, in particular. However, grasses would quickly reestablish and would dominate those restored areas (EOARC 2007). The restoration treatments would result in a long-term (greater than 10 years) upward trend in range condition due to the change from juniper-dominated areas to grassland and sagebrush dominated sage steppe areas.

The direct and indirect effects of Alternative D would be similar to Alternative B, because they treat a similar area within the same time (40 years). However, Alternative D proposes a higher percentage of mechanical treatment than Alternatives B and C that would result in more sagebrush and less grassland. Alternative D has the second highest rate of restoration (Figure 24). The restoration would create a long-term improvement in range condition.

4.4.1.6.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions. However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. The cumulative effects of restoration activities would be long-term improvement of range condition across a large area.

4.4.1.7 Alternative E

4.4.1.7.1 Direct and Indirect Effects

Alternative E would result in an upward trend in range quality based upon acres restored (Figure 24). The short-term impacts (less than five years) from restoration activities would be a reduction of range conditions due to fire use, in particular. However, grasses would quickly reestablish and would dominate those restored areas (EOARC 2007). The restoration treatments would result in a long-term (greater than 10 years) upward trend in range condition due to the change from juniper-dominated areas to grassland and sagebrush dominated sage steppe areas.

The direct and indirect effects of Alternative E would be similar to Alternative D, because they treat the same area with the same treatment methods. However, Alternative E proposes a higher treatment rate than all of the other alternatives, including Alternative D (Figure 24). The restoration would create a long-term improvement in range condition.

4.4.1.7.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions. However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative E include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. The cumulative effects of restoration activities would be long-term improvement of range condition across a large area.

4.4.1.8 Alternative J (Preferred Alternative)

4.4.1.8.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would result in an upward trend in range quality based upon acres restored (Figure 24). The short-term impacts (less than five years) from restoration activities would be a reduction of range conditions due to fire use, in particular. However, grasses would quickly reestablish and would dominate those restored areas (EOARC 2007). The restoration treatments would result in a long-term (greater than 10 years) upward trend in range condition due to the change from juniper-dominated areas to grassland and sagebrush dominated sage steppe areas.

The direct and indirect effects of Alternative J (Preferred Alternative) would be similar to Alternative C, because they treat a similar area within a similar period (47 to 50 years). However, Alternative J (Preferred Alternative) proposes a higher percentage of mechanical treatment than Alternatives B and C that would result in more sagebrush and less grassland. The restoration would create a long-term improvement in range condition.

4.4.1.8.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, firewood gathering and forest management throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Temporary roads may reduce forage during their use, however this loss of forage would be minor, and would occur during restoration treatment and therefore would be during the livestock rest period. Some new roads could be built on private lands to support restoration projects.

Firewood gathering would occur at various locations in the Focus Area. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush. There would be some increased forage in these areas however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and if those projects improve range conditions, those actions would contribute toward an increase in range conditions.

However, forest management projects generally do not have a goal of increasing range conditions, therefore forest management projects would have a minor effect on range conditions.

The cumulative effects of Alternative J (Preferred Alternative) include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. The cumulative effects of restoration activities would be long-term improvement of range condition across a large area.

4.4.2 IMPACTS ON LIVESTOCK INDUSTRY

Livestock grazing has changed fire regimes throughout the Focus Area through the reduction of fine fuels (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. There are two principle reasons that rest from livestock grazing would be necessary to achieve sage steppe ecosystem restoration goals: reestablishment of sage steppe vegetation, including the prevention of non-native weed species; and creating adequate understory for fire use. The first and foremost need for rest from grazing is to ensure that newly established grass and forb species can become vigorous with adequate crown and root structure. Increased densities and ground cover of native grasses and forbs will minimize any occurrence of cheatgrass and other invasive non-natives (EORAC 2007). Rest will be required following any treatment until site-specific objectives have been met. In this ecosystem, experience and the science suggest this to be a minimum of two growing seasons. Rest for longer periods may be required in situations where specific site conditions, or monitoring indicate a longer period of rest is necessary to achieve site-specific restoration objectives.

All restoration treatments are designed to result in an increase in sage steppe grass, forb and brush species that would result in a corresponding upward trend in overall range condition over time (*Section 4.4.1 Forage for Domestic Animals*). However, as described, restoration treatments would require resting from livestock grazing. These rest requirements would have consequences to the livestock operators. They may be faced with the need to find alternative feed and forage sources for whatever portion of their allotment is involved in the treatment and required rest period. There may be instances where an individual livestock operator can locate alternative pasturage or additional feed sources such as supplemental hay, but these require an additional expense to the rancher. If no alternative pasturage or additional feed sources such as supplemental hay can be found, then the individual livestock operator would have to reduce herd sizes during the duration of the rest and restoration treatments. It is assumed that grazing lands throughout Modoc County are being used at capacity; therefore most livestock operators would likely have to reduce herd sizes.

4.4.2.1 Methodology for Analysis

Rest from livestock grazing is an important component in this restoration effort. A comparison of the total number of animal unit months (AUMs) rested per year by alternative and the reduction in sales was completed to evaluate the impacts on the livestock industry.

4.4.2.2 Alternative A (Current Management)

Livestock management would continue at essentially the current level in accordance with applicable land management plan direction. Alternative A has the lowest rate of restoration compared with the other alternatives and therefore has the lowest number of AUMs rested per year (Figure 26). Alternative A (Current Management) includes about 1,261 AUMs rested that equals an annual value in cash receipts of about $120,000 per year (*Section 4.7 Socioeconomics*).

4.4.2.2.1 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative A include an additional 486,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 730,000 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

4.4.2.3 Alternative B (Proposed Action)

4.4.2.3.1 Direct and Indirect Effects

Alternative B (Proposed Action) would have nearly 8,000 AUMs rested per year for most of the duration of this alternative (Figure 26). The short-term impacts to the industry are the second most of the alternatives in Decades 1 and 2 (Figure 26). Resting 8,000 AUMs[1] annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Some impacts to the livestock industry would occur due to increased costs for feed, moving livestock to other pastures, renting private pastures or loss of income due to smaller herds. These impacts would be short-term (less than five years) to individual ranchers but would be long-term (greater than 10 years) to the livestock industry because they would continue for 40 years. Alternative B would result in an annual reduction in cash receipts of about $631,000 per year (*Section 4.7 Socioeconomics*).

[1] Note that the AUMs rested for each alternative used in the Socioeconomics analysis is the difference between Current Management (Alternative A) and the alternative, which results in lower numbers of AUMs rested compared to this analysis which uses the total number of rested AUMs.

4.4.2.3.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative B include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

4.4.2.4 Alternative C

4.4.2.4.1 Direct and Indirect Effects

The direct and indirect effects of Alternative C would be similar to Alternative B. However, the number of required AUMs rested per year would start at nearly 4,000 for the first decade and increase to nearly 8000 for the 3rd, 4th and 5th decades (Figure 26). The short-term impacts to the industry are the second least of the alternatives in Decades 1 and 2 (Figure 26). Resting 4,000 to 8,000 AUMS annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Alternative C would result in an annual reduction in cash receipts of about $631,000 per year (*Section 4.7 Socioeconomics*).

4.4.2.4.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative C include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

4.4.2.5 Alternative D

4.4.2.5.1 Direct and Indirect Effects

This alternative would have a reduced impact on the livestock industry through shorter rest periods associated with mechanical treatment. The number of AUMs rested per year that would be required would start at about 6,400 for the first decade and increase to over 8,100 for the 3rd and 4th decades (Figure 26). The impacts to the industry would be the third least of the alternatives in Decades 1 and 2 (Figure 26). Resting 6,400 to 8,100 AUMS annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area.

Alternative D would result in an annual reduction in cash receipts of about $651,000 per year (*Section 4.7 Socioeconomics*).

4.4.2.5.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

4.4.2.6 Alternative E

4.4.2.6.1 Direct and Indirect Effects

Alternative E proposes a higher percentage of mechanical treatment and treats the highest percentage of dense juniper stands. This alternative would require the highest level of annual rest through the first three decades, which could pose a greater impact on the industry in the first three decades.

The number of rested AUMs per year that would be required would start at over 8,500 for the first two decades and increase to nearly 10,000 for the 3rd decade (Figure 26). The short-term impacts to the industry are the greatest of the alternatives in Decades 1 and 2 (Figure 26). Resting 8,500 to nearly 10,000 AUMS annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Alternative E would result in an annual reduction in cash receipts of about $821,000 per year (*Section 4.7 Socioeconomics*). Other impacts to the livestock industry would be similar to that of Alternative D.

4.4.2.6.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative E include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

4.4.2.7 Alternative J (Preferred Alternative)

4.4.2.7.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would have a reduced impact on the livestock industry through shorter rest periods associated with mechanical treatment. The number of AUMs rested per year that would be required would start at about 3,200 for the first decade, increase to 4,500 for the second decade, and increase again to over 8,100 for the 3rd and 4th decades (Figure 26). The impacts to the industry would be the second least of the alternatives in Decades 1 and 2 (Figure 26). Resting 3,200 to 8,100 AUMS annually would be necessary over the 2.3 million acres of livestock grazing allotments within the Focus Area. Alternative J (Preferred Alternative) would result in an annual reduction in cash receipts of about $651,000 per year (*Section 4.7 Socioeconomics*).

4.4.2.7.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from forest management and other sage steppe restoration projects throughout the Analysis Area. Forest management will continue inside of the Analysis Area and those projects might involve actions that would require rest from livestock grazing that would add to the number AUMs rested.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. These sage steppe restoration projects would potentially need to be rested during restoration and would therefore would contribute to the cumulative effect on the livestock industry.

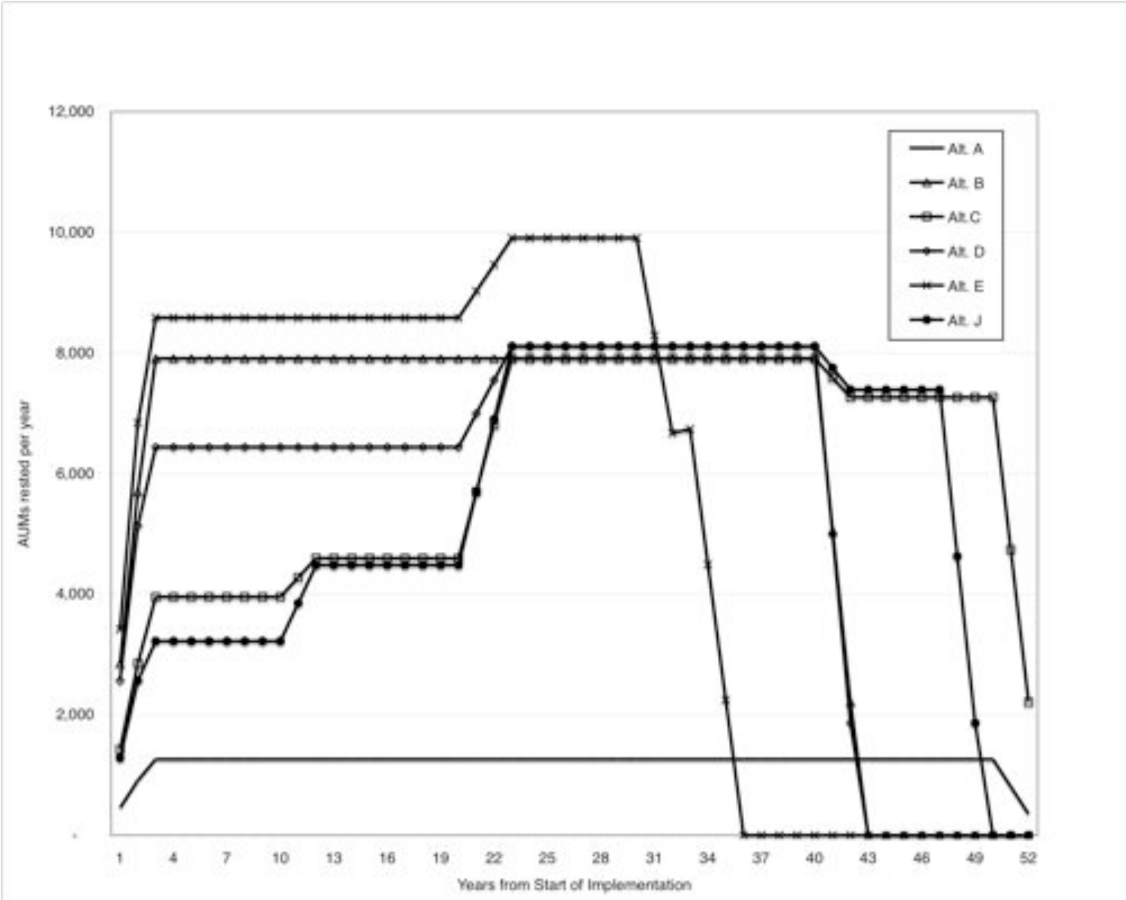

Figure 26. Alternative Comparison of Rested AUMs per Year

4.5 Watershed and Soil Resources

4.5.1 WATERSHED

One of the effects of the current condition of the sage steppe ecosystem is a reduction in hydrologic values due to reduction of ground cover and increases in erosion (*Section 3.6 Soil Resources*) caused by increased juniper density. Restoration treatments have been shown to increase ground cover, reduce runoff, increase infiltration capacity, and dramatically reduce sediment yield compared to untreated areas (EOARC 2007). There are concerns about the short-term potential impacts of the restoration treatments on increasing erosion and sediment yield. One of the objectives of this project is to improve watershed function and condition. This analysis combines several factors into a watershed function and condition trend analysis that considers both short-term impacts for the treatments and long-term changes in watershed function (*Section 4.5.1.2 Methodology for Analysis*).

4.5.1.1 Management Direction for Watershed

The primary regulation that governs the impacts of management activities on water resources is the Clean Water Act (CWA). The CWA requires each state to adopt water quality standards that protect the public health and welfare and enhance water quality. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of surface waters in the U.S.

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide additional management direction through management directives, standards, and guidelines for watershed resources.

Watershed goals from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Use Best Management Practices (BMPs) to meet water quality objectives
- In second- or third-order watersheds, limit cumulative impacts to protect stream channel conditions and water quality.
- Rehabilitate degraded watershed areas impairing water quality.
- Ensure Forest activities will not adversely affect groundwater quality.

Watershed goals from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- Ensure that hydrologic function in streams, wetlands, springs, and uplands is natural and proper; state water quality standards are achieved, and the needs of beneficial uses are met.

4.5.1.1.1 State Regulation

The states of California and Nevada are required to develop water quality standards to protect surface waters under the CWA. In Nevada, the Bureau of Water Quality Planning (BWQP), which is part of the Nevada Division of Environmental Protection, is responsible for water quality including developing standards for surface waters. The statutory authority is from NRS 445A.010 through 445A.730.

In California the State Water Resources Control Board (SWRCB) regulates water quality. The state has been divided in to nine basins that have created basin plans. The basin plans set standards to protect all waters in those regions and prescribes programs to implement these standards. The standards consist of the designated beneficial uses of the waters, narrative and numeric objectives to protect these uses, and the State's Antidegradation Policy.

4.5.1.2 Methodology for Analysis

The basic methodology to analyze the effects of the alternatives on watersheds will be to assess watershed condition trends qualitatively and compare those trends between alternatives. Watershed condition trends will be evaluated based upon the following four factors:

- **Short-term disturbances from restoration treatments** – This criterion addresses the concern that "*proposed restoration treatments could result in the reduction of vegetative cover in the short-term, and result in increased soil erosion*." This factor was evaluated by comparing alternatives by the total amount of mechanical restoration treatment. Mechanical treatments would have a higher potential for ground disturbance that could potentially generate increased erosion and sediment yield from the restoration treatments. The percentage of mechanical restoration within each watershed was used as the comparison measure. Prescribed fire would have short-term impacts of reducing ground cover.
- **Long-term conditions of ground cover** – This criterion addresses the concern that "*Not restoring this ecosystem could also result in increased soil erosion and increased sediment delivery to streams*." This factor was evaluated by calculating the total restored area by alternative that has been scaled to account for the amount of time required to complete the restoration. Alternatives D, E and J were given a 22 percent upgrade in their scores to account for their using 22 percent more mechanical restoration treatments. Mechanical treatments would retain some of the existing ground cover and therefore would maintain a higher percentage of ground cover following treatments.
- **Erosion predictions from the Soils analysis** – This criterion addresses the concern that "*proposed restoration treatments could result in the reduction of vegetative cover in the short-term, and result in increased soil erosion*." The erosion predictions from the soils analysis were incorporated into this analysis to compare the alternatives on the amount of erosion that would potentially be available for sediment transport. In addition, this factor includes comparing alternatives by the amount of dense (>20 percent) juniper canopy cover areas that would be restored in the first decade. These areas would have some of the greatest concerns for potentially generating increased erosion from the restoration treatments because of the combination of lower amount of ground cover and mechanical restoration treatment.
- **Potential changes in stream function** – This criterion addresses the concern that "*proposed restoration treatments could result in … increased sediment delivery to streams."* The assumption is that greater restoration would lead to better stream function through reduced sediment yield and peak runoff. Watersheds were also rated as in *"poor*" condition if they currently contain impaired stream reaches, or "*good*" condition if watersheds currently contain no impaired stream reaches. Poor condition watersheds would be assumed to benefit more from restoration and improvement in watershed conditions, than good condition watersheds. The amount of total restoration activity in each of those watersheds was calculated, and the following matrix (Table 44) was used to assign values to changes in stream function. The results were scaled to account for the time required to complete restoration.

Table 44. Ratings Used to Evaluate Potential Changes in Stream Function

Watershed Function Rating	Percentage of Watershed Restored		
	>9 percent	>19 percent	>29 percent
Good	5	10	15
Poor	10	20	30

These four factors were assembled into a matrix showing an alternative comparison of composite watershed trends using the listed criteria. The values for long-term ground cover and stream function are considered positive and added to the rating, and the values for short-term disturbances and erosion are considered negative and subtracted from the rating. Ratings for each watershed were added together to obtain a value for the basin. The basin values for each criterion are directly comparable. Therefore, if one basin has a short-term disturbances rating of 50 it would have twice the short-term disturbances than a basin with a rating of 25. As described below in *4.5.1.3 Watershed Effects Common to All Alternatives*, the short-term disturbances and erosion would not result in adverse effects to water quality because of the application of Best management practices (BMPs) and thresholds of concern (TOCs). Therefore, the watershed scores do not determine or estimate compliance with water quality regulations. The BMPs and TOCs may limit restoration activities within specific watersheds until they recover sufficiently from the short-term disturbances. The magnitudes of the watershed scores are also comparable between criteria. For example, a long-term ground cover value of 100 would provide twice the benefit to a watershed than an erosion rating of 50 would have an associated risk. The detailed results are presented in the *Watershed Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007i) and the summary tables are presented in Appendix C.

4.5.1.3 Watershed Effects Common to All Alternatives

BMPs have been developed by both the FS (USDA Forest Service 2000c) and BLM for the types of activities that are proposed for the sage steppe restoration treatments. There is an agreement between the FS and the SWRCB that the FS will use BMPs to comply with the Federal Water Pollution Control Act. The BLM has a similar agreement with the State of California. The implementation of BMPs includes a monitoring and evaluation feedback loop that would determine the effectiveness of the BMPs.

In addition to BMPs, both the FS and BLM use a threshold of concern (TOC) evaluation to determine if the amount and type of activities within a watershed would reach or exceed a predetermined threshold effect level. If the proposed restoration activities are predicted to exceed the TOC within a watershed, the activities proposed for those watersheds would have to be modified by changing the type or extent of the activity, in order to comply with management direction for site-specific restoration projects. The TOCs would limit the amount of restoration treatments within specific watersheds until hydrologic recovery allows additional restoration treatments.

Restoration areas that are identified as dense juniper and proposed for mechanical treatment are mostly located on slight to moderate potential soil erodibility areas (see *4.5.2 Soil Resources*). Severe potential erodibility occurs on less than one percent of the proposed treatment areas in dense juniper. These severe potential erodibility areas would be evaluated on a site-specific basis to determine which BMPs would be required. High potential erodibility occurs on about seven percent of the proposed treatment areas in dense juniper (see *4.5.2 Soil Resources*). These high potential erodibility areas would also be evaluated on a site-specific basis to determine if any additional BMPs would be required. BMPs such as Soil Disturbing Treatments on the Contour (Practice 5-1) and Erosion Prevention and Control Measures During Timber Sale Operations (Practice 1-13) would ensure minimal soil erosion and sediment yield from those areas with more potential for soil erosion.

Specific measures that would be considered during the site specific implementation of restoration projects in order to minimize watershed effects includes;

- Buffer zones around steams and other water bodies where no treatment will take place.
- Grazing exclusion zones in riparian area to protect critical habitat and water quality.
- Staging of restoration treatments, especially in watersheds where water bodies are already impaired, to mitigate cumulative impacts that may result.

The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of the alternatives. There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments. The following effects analysis focuses on watershed trends due to the restoration activities. These trends include both short and long term effects. For this analysis short-term effects would be one to five years and long-term effects would be longer than five years.

4.5.1.4 Alternative A (Current Management)

4.5.1.4.1 Direct and Indirect Effects

The direct effects of Alternative A (Current Management) would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

It is predicted that this alternative would have the smallest short-term disturbance and erosion potential from restoration activities due to the smallest area (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have the smallest increase in long-term ground cover due to the smallest area of restoration (Table 45). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative A. Because of the small area of restoration treatment over the large Focus Area, TOCs should not limit restoration implementation within watersheds.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the smallest increase in stream function trends of the alternatives due to the small area that would be restored.

Black Rock Desert Basin

Smoke Creek Desert watershed has a small positive total watershed trend, due to long-term ground cover having a small positive effect. The restoration activities would cover over five percent of the Smoke Creek Desert watershed. The extent of the restoration activities combined with the small positive watershed trend would have a small positive effect on the trend for this watershed (Table 46).

Massacre Lake watershed has a low positive overall trend due to low increases in ground cover and stream function. The restoration activities would only cover just over three percent of the Massacre Lake watershed. The small extent of the restoration activities combined with the low positive watershed trend would have no change in the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have low positive overall trends due to low positive effect on increases in ground cover and stream function. The restoration activities would only cover slightly over three percent of these watersheds. The small extent of the restoration activities combined with the low positive watershed trend would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a small positive watershed trend, due to a small positive effect of long-term ground cover. The restoration activities would cover nearly five percent of the Lost watershed.

The extent of the restoration activities combined with the small positive watershed trend would have a small positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Butte, Upper Klamath and Shasta watersheds all have near zero or low positive overall trends. These low trend scores are due to no or low positive effects from increases in ground cover, and stream function. Restoration treatments cover around two percent or less of these three watersheds. The small extent of the restoration activities combined with the low positive watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

All the watersheds in the Upper Sacramento Basin have near zero or small positive overall scores due to zero or small positive effect in ground cover and stream function. Restoration treatments cover around three percent or less of these watersheds. The small extent of the restoration activities combined with the near zero or small positive watershed trend scores would have no or little change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall scores due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Honey-Eagle Lakes and Madeline Plains watersheds both have small positive trends, due to small effects on long-term ground cover. The restoration treatments would cover nearly three percent in Honey-Eagle Lakes and over six percent in Madeline Plains. The extent of the restoration activities combined with the small positive watershed trend would have a small positive effect on the trends for these watersheds (Table 46) due to the restoration treatments.

Surprise Valley watershed has a low positive overall trend, due to low effects from increases in long-term ground cover and stream function. Restoration treatments in the Surprise Valley watershed cover nearly four percent of the watershed. The small extent of the restoration activities combined with the low positive watershed trend would have no change in the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.4.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management*

Practices) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

New permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no adverse effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects*) would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative A.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for some watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative A would be no change to a small positive change in trends for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive for some watersheds.

4.5.1.5 Alternative B (Proposed Action)

4.5.1.5.1 Direct and Indirect Effects

The direct effects of Alternative B (Proposed Action) would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

This alternative would have a short-term disturbance that is higher than Alternative A, similar to Alternative C and less than Alternatives D and E (Table 45 and Figure 27). Erosion potential is rated as higher than Alternatives A and C, similar to Alternative D and less than Alternative E (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have an increase in long-term ground cover that is higher than Alternatives A and C, similar to Alternative D and less than Alternative E (Table 45 and Figure 27). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative B. Because of the large area of restoration treatment over the Focus Area, TOCs could limit restoration implementation within watersheds that have a large percentage of the watershed area proposed for restoration.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the second highest increase in stream function trends of the alternatives (Table 46).

Black Rock Desert Basin

Smoke Creek Desert watershed has a high positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect. The restoration activities would cover over 27 percent of the Smoke Creek Desert watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trend for this watershed (Table 46). The 27 percent of the Smoke Creek Desert watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40-year implementation period in order to stay below TOCs.

Massacre Lake watershed has a moderate positive overall trend due to moderate increases in ground cover. The restoration activities would cover slightly over 16 percent of the Massacre Lake watershed. The large extent of the restoration activities combined with the positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have moderate positive overall trends due to moderate positive effects on increases in ground cover. The restoration activities would cover more than 18 and 15 percent of Warner Lakes and Guano watersheds, respectively. The large extent of the restoration activities combined with the moderate positive watershed trends would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a high positive trend, due to a moderate positive effect of long-term ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 23 percent of the Lost watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments. The 23 percent of the Lost watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40 year implementation period in order to stay below TOCs.

The Butte watershed has a small positive trend, due to a small positive effect of long-term ground cover and stream function. The restoration activities would cover nearly 11 percent of the Butte watershed. The extent of the restoration activities combined with the small positive watershed trend scores would have a small positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Upper Klamath and Shasta watersheds have near zero positive overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around seven percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

The Upper Pit and Lower Pit watersheds have moderate positive overall trends due to moderate positive effects on ground cover and small positive effects from stream function. Restoration treatments cover between 14 and 18 percent of these two watersheds. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

The Goose Lake and McCloud watersheds have near zero overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around six percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall trends due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The small extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Madeline Plains watershed has a high positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect. The restoration activities would cover 30 percent of the Madeline Plains watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trends for this watershed (Table 46). The 30 percent of the Madeline Plains watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40 year implementation period in order to stay below TOCs.

Honey-Eagle Lakes watershed has a high positive overall trend due to moderate positive effects on increases in ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 19 percent of Honey-Eagle Lakes watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Surprise Valley watershed has a moderate positive overall trend due to moderate positive effects on increases in ground cover. The restoration activities would cover 13 percent of Surprise Valley watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects*) would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative B.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative B would be a moderate to high positive trend for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive.

4.5.1.6 Alternative C

4.5.1.6.1 Direct and Indirect Effects

The direct and indirect effects of Alternative C on watersheds would be very similar to Alternative B. The main differences are that with a slower rate of treatment, potential erosion generated from the treatments would be lower, but long-term improvements in ground cover and stream function would also be lower. The direct effects of Alternative C would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

This alternative would have a short-term disturbance that is higher than Alternative A, similar to Alternative B and less than Alternatives D and E (Table 45 and Figure 27). Erosion potential would be higher than Alternative A, and less than Alternatives B, D and E (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative would have an increase in long-term ground cover that is higher than Alternative A, similar to Alternatives B and D and less than Alternative E (Table 45 and Figure 27). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative C. Because of the large area of restoration treatment over the Focus Area, TOCs could limit restoration implementation within watersheds that have a large percentage of the watershed area proposed for restoration.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the second smallest increase in stream function trends of the alternatives (Table 46).

Black Rock Desert Basin

Smoke Creek Desert watershed has a high positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect. The restoration activities would cover over 27 percent of the Smoke Creek Desert watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trend for this watershed (Table 46). The 27 percent of the Smoke Creek Desert watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 50-year implementation period in order to stay below TOCs.

Massacre Lake watershed has a moderate positive overall trend due to moderate increases in ground cover. The restoration activities would cover slightly over 16 percent of the Massacre Lake watershed. The large extent of the restoration activities combined with the positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have moderate positive overall trends due to moderate positive effects on increases in ground cover. The restoration activities would cover more than 18 and 15 percent of Warner Lakes and Guano watersheds, respectively. The large extent of the restoration activities combined with the moderate positive watershed trends would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a moderate positive trend, due to a moderate positive effect of long-term ground cover and stream function. The restoration activities would cover more than 23 percent of the Lost watershed. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments. The 23 percent of the Lost watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 50-year implementation period in order to stay below TOCs.

The Butte watershed has a small positive trend, due to a small positive effect of long-term ground cover and stream function. The restoration activities would cover nearly 11 percent of the Butte watershed. The extent of the restoration activities combined with the small positive watershed trend scores would have a small positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Upper Klamath and Shasta watersheds have near zero positive overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around seven percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

The Upper Pit watershed has a moderate positive overall trend due to moderate positive effects on ground cover and small positive effects from stream function. Restoration treatments cover 18 percent of this watershed. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for the Upper Pit watershed (Table 46) due to the restoration treatments.

The Lower Pit watershed has a moderate positive overall trend due to small positive effects on ground cover and stream function, combined with very low effects from short-term disturbances and erosion. Restoration treatments cover 14 percent of this watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for the Lower Pit watershed (Table 46) due to the restoration treatments.

The Goose Lake and McCloud watersheds have near zero overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around six percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall trends due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The small extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Madeline Plains watershed has a moderate positive total watershed trend, due to long-term ground cover and stream function having a moderate positive effect. The restoration activities would cover 30 percent of the Madeline Plains watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a moderate positive effect on the trends for this watershed (Table 46). The 30 percent of the Madeline Plains watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 50-year implementation period in order to stay below TOCs.

Honey-Eagle Lakes watershed has a high positive overall trend due to moderate positive effects on increases in ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 19 percent of Honey-Eagle Lakes watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Surprise Valley watershed has a moderate positive overall trend due to small positive effects on increases in ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover 13 percent of Surprise Valley watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative C.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative C would be a moderate positive trend for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive.

4.5.1.7 Alternative D

4.5.1.7.1 Direct and Indirect Effects

The direct effects of Alternative D would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

This alternative would have the highest short-term disturbance, the same as Alternative E (Table 45 and Figure 27). Erosion potential is higher than Alternatives A and C, similar to Alternative D and less than Alternative E (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have an increase in long-term ground cover that is higher than Alternatives A and C, similar to Alternative B and less than Alternative E (Table 45 and Figure 27). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative D. Because of the large area of restoration treatment over the Focus Area, TOCs could limit restoration implementation within watersheds that have a large percentage of the watershed area proposed for restoration.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the second highest increase in stream function trends of the alternatives (Table 46).

Black Rock Desert Basin

Smoke Creek Desert watershed has a high positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect. The restoration activities would cover over 27 percent of the Smoke Creek Desert watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trend for this watershed (Table 46). The 27 percent of the Smoke Creek Desert watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40-year implementation period in order to stay below TOCs.

Massacre Lake watershed has a moderate positive overall trend due to moderate increases in ground cover. The restoration activities would cover slightly over 16 percent of the Massacre Lake watershed. The large extent of the restoration activities combined with the positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have moderate positive overall trends due to moderate positive effects on increases in ground cover. The restoration activities would cover more than 18 and 15 percent of Warner Lakes and Guano watersheds, respectively. The large extent of the restoration activities combined with the moderate positive watershed trends would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a high positive trend, due to a moderate positive effect of long-term ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 23 percent of the Lost watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments. The 23 percent of the Lost watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40 year implementation period in order to stay below TOCs.

The Butte watershed has a small positive trend, due to a small positive effect of long-term ground cover and stream function. The restoration activities would cover nearly 11 percent of the Butte watershed. The extent of the restoration activities combined with the small positive watershed trend scores would have a small positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Upper Klamath and Shasta watersheds have near zero positive overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around seven percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

The Upper Pit and Lower Pit watersheds have moderate positive overall trends due to moderate positive effects on ground cover and small positive effects from stream function. Restoration treatments cover between 14 and 18 percent of these two watersheds. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

The Goose Lake and McCloud watersheds have near zero overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around six percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall trends due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The small extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Madeline Plains watershed has a moderate positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect, combined with a moderate effect on short-term disturbances. The restoration activities would cover 30 percent of the Madeline Plains watershed. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the trends for this watershed (Table 46). The 30 percent of the Madeline Plains watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40 year implementation period in order to stay below TOCs.

Honey-Eagle Lakes watershed has a high positive overall trend due to moderate positive effects on increases in ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 19 percent of Honey-Eagle Lakes watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Surprise Valley watershed has a moderate positive overall trend due to moderate positive effects on increases in ground cover. The restoration activities would cover 13 percent of Surprise Valley watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and

BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative D.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative D would be a moderate to high positive trend for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive.

4.5.1.8 Alternative E

4.5.1.8.1 Direct and Indirect Effects

The direct effects of Alternative E would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

This alternative would have the highest short-term disturbance, the same as Alternative D (Table 45 and Figure 27). Erosion potential is higher than all alternatives (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have an increase in long-term ground cover that is higher than all alternatives (Table 45 and Figure 27). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative E. Because of the large area of restoration treatment over the Focus Area, TOCs could limit restoration implementation within watersheds that have a large percentage of the watershed area proposed for restoration.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the second highest increase in stream function trends of the alternatives (Table 46).

<u>Black Rock Desert Basin</u>

Smoke Creek Desert watershed has a very high positive total watershed trend, due to long-term ground cover and stream function having a high positive effect, combined with low effects from short-term disturbances and erosion. The restoration activities would cover over 27 percent of the

Smoke Creek Desert watershed. The large extent of the restoration activities combined with the very high positive watershed trend would have a very high positive effect on the trend for this watershed (Table 46). The 27 percent of the Smoke Creek Desert watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 33-year implementation period in order to stay below TOCs.

Massacre Lake watershed has a high positive overall trend due to moderate increases in ground cover, combined with low effects from short-term disturbances and erosion. The restoration activities would cover slightly over 16 percent of the Massacre Lake watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have high positive overall trends due to moderate positive effects on increases in ground cover, combined with low effects from short-term disturbances and erosion. The restoration activities would cover more than 18 and 15 percent of Warner Lakes and Guano watersheds, respectively. The large extent of the restoration activities combined with the high positive watershed trends would have a high positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a very high positive trend, due to a high positive effect of long-term ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 23 percent of the Lost watershed. The large extent of the restoration activities combined with the very high positive watershed trend would have a very high positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments. The 23 percent of the Lost watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 33-year implementation period in order to stay below TOCs.

The Butte watershed has a moderate positive trend, due to moderate positive effects of long-term ground cover and stream function. The restoration activities would cover nearly 11 percent of the Butte watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Upper Klamath and Shasta watersheds have near zero positive overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around seven percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

The Upper Pit watershed has a moderate positive overall trend due to moderate positive effects on ground cover and stream function. Restoration treatments cover 18 percent of this watershed. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for the Upper Pit watershed (Table 46) due to the restoration treatments.

The Lower Pit watershed has a high positive overall trend due to moderate positive effects on ground cover and stream function, combined with very low effects from short-term disturbances and erosion. Restoration treatments cover 14 percent of this watershed. The extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for the Lower Pit watershed (Table 46) due to the restoration treatments.

The Goose Lake and McCloud watersheds have near zero overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around six percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall trends due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The small extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Madeline Plains watershed has a high positive total watershed trend, due to long-term ground cover having a very high positive effect and stream function having a moderate positive effect. The restoration activities would cover 30 percent of the Madeline Plains watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trends for this watershed (Table 46). The 30 percent of the Madeline Plains watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40 year implementation period in order to stay below TOCs.

Honey-Eagle Lakes watershed has a very high positive overall trend due to high positive effects on increases in ground cover and stream function, combined with low effects from short-term disturbances and erosion. The restoration activities would cover more than 19 percent of Honey-Eagle Lakes watershed. The large extent of the restoration activities combined with the very high positive watershed trend would have a very high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Surprise Valley watershed has a high positive overall trend due to moderate positive effects on increases in ground cover and stream function. The restoration activities would cover 13 percent of Surprise Valley watershed. The extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.8.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative E.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative E would be a high to very high positive trend for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive.

4.5.1.9 Alternative J (Preferred Alternative)

4.5.1.9.1 Direct and Indirect Effects

The direct effects of Alternative J (Preferred Alternative) would be ground disturbance that could result in increases in erosion and consequent increases in sediment yield. The indirect effects would include short-term erosion and sediment yield increases due to ground disturbance and prescribed fires. The areas that would be the most sensitive to increases in erosion and sediment yield are areas with steeper slopes and where more erodible soils area located close to streams. These potential effects would be short-term disturbances because vegetation would cover bare soil quickly after treatment and reduce the erosion potential (Ford and Johnson 2006, EOARC 2007).

This alternative would have the highest short-term disturbance, the same as Alternatives D and E (Table 45 and Figure 28). Erosion potential is higher than Alternatives A and C, similar to Alternatives B and D, and less than Alternative E (Table 45 and Figure 27). Long-term ground cover would increase as restored areas revegetate to sage steppe in areas with existing dense juniper cover. This effect would be positive for watersheds as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have an increase in long-term ground cover that is higher than Alternatives A and C, similar to Alternatives B and D, and less than Alternative E (Table 45 and Figure 27). The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse effects to water quality from soil erosion and sediment yield due to the implementation of Alternative J (Preferred Alternative). Because of the large area of restoration treatment over the Focus Area, TOCs could limit restoration implementation within watersheds that have a large percentage of the watershed area proposed for restoration.

Some of the streams in the Analysis Area are impaired by excess sediment and runoff that cause physical stream channel changes that result in decreased fish habitat and increased water temperatures. Restoration would be expected to create a positive trend for stream function in areas where restoration activities achieve their goals of a diverse sage steppe ecosystem. The positive trends would be the result of smaller, less intense wildfires, increases in ground cover, reduction in bare soil and a consequent reduction in sediment reaching streams. This alternative would have the fourth highest increase in stream function trends of the alternatives (Table 46).

<u>Black Rock Desert Basin</u>

Smoke Creek Desert watershed has a high positive total watershed trend, due to long-term ground cover having and stream function having moderate positive effects. The restoration activities would cover over 27 percent of the Smoke Creek Desert watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the trend for this watershed (Table 46). The 27 percent of the Smoke Creek Desert watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 40-year implementation period in order to stay below TOCs.

Massacre Lake watershed has a moderate positive overall trend due to moderate increases in ground cover. The restoration activities would cover slightly over 16 percent of the Massacre Lake watershed. The large extent of the restoration activities combined with the positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Oregon Closed Basins

Warner Lakes and Guano watersheds both have moderate positive overall trends due to moderate positive effects on increases in ground cover. The restoration activities would cover more than 18 and 15 percent of Warner Lakes and Guano watersheds, respectively. The large extent of the restoration activities combined with the moderate positive watershed trends would have a moderate positive effect on the overall trend for these watersheds (Table 46) due to the restoration treatments.

Klamath Basin

Lost watershed has a high positive trend, due to a moderate positive effect of long-term ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 23 percent of the Lost watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments. The 23 percent of the Lost watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 47 year implementation period in order to stay below TOCs.

The Butte watershed has a small positive trend, due to a small positive effect of long-term ground cover and stream function. The restoration activities would cover nearly 11 percent of the Butte watershed. The extent of the restoration activities combined with the small positive watershed trend scores would have a small positive effect in the overall trend for this watershed (Table 46) due to the restoration treatments.

Upper Klamath and Shasta watersheds have near zero positive overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around seven percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Upper Sacramento Basin

The Upper Pit watershed has a small positive overall trend due to moderate positive effects on ground cover and stream function. Restoration treatments cover 14 of the Upper Pit watershed. The extent of the restoration activities combined with the small positive watershed trend would have a small positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

The Lower Pit watershed has a moderate positive overall trend due to moderate positive effects on ground cover and the extent of restoration activities covering 18 of the watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

The Goose Lake and McCloud watersheds have near zero overall trends. These low trend scores are due to no or small positive effects from increases in ground cover. Restoration treatments cover around six percent or less of these two watersheds. The small extent of the restoration activities combined with the low positive watershed trend scores would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

Lower Sacramento Basin

Both of the watersheds in the Lower Sacramento Basin have near zero or very small positive overall trends due to no effect in ground cover and stream function. Restoration treatments cover less than one percent of these watersheds. The small extent of the restoration activities combined with no effect on watershed trends would have no change in the overall trend for these watersheds (Table 46) due to the restoration treatments.

North Lahontan Basin

Madeline Plains watershed has a moderate positive total watershed trend, due to long-term ground cover having a high positive effect and stream function having a moderate positive effect, combined with a moderate effect on short-term disturbances. The restoration activities would cover 30 percent of the Madeline Plains watershed. The large extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the trends for this watershed (Table 46). The 30 percent of the Madeline Plains watershed proposed for treatment would likely exceed TOCs if they are implemented during one decade, therefore, these restoration treatments would need to be staged throughout the 47 year implementation period in order to stay below TOCs.

Honey-Eagle Lakes watershed has a high positive overall trend due to moderate positive effects on increases in ground cover and stream function, combined with very low effects from short-term disturbances and erosion. The restoration activities would cover more than 19 percent of Honey-Eagle Lakes watershed. The large extent of the restoration activities combined with the high positive watershed trend would have a high positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

Surprise Valley watershed has a moderate positive overall trend due to small positive effects on increases in ground cover. The restoration activities would cover 13 percent of Surprise Valley watershed. The extent of the restoration activities combined with the moderate positive watershed trend would have a moderate positive effect on the overall trend for this watershed (Table 46) due to the restoration treatments.

4.5.1.9.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to positive watershed trends.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no effect on watersheds from roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to water quality from soil erosion and sediment yield due to the implementation of Alternative J (Preferred Alternative).

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover and stream function increase. The cumulative effect of Alternative J (Preferred Alternative) would be a small to high positive trend for watersheds in the Analysis Area, because the effects of erosion and sediment yield would not be adverse and watershed condition trends would be positive.

Table 45. Watershed Analysis Summary of Indexed Watershed Scores by Alternative

	Short-term disturbances	Long-term ground cover	Erosion	Stream function	Composite Score
Alternative A	-13	+45	-12	+26	+46
Alternative B	-40	+169	-33	+100	+196
Alternative C	-40	+138	-16	+78	+160
Alternative D	-80	+169	-33	+100	+192
Alternative E	-80	+225	-42	+130	+282
Alternative J	-80	+158	-30	+93	+176

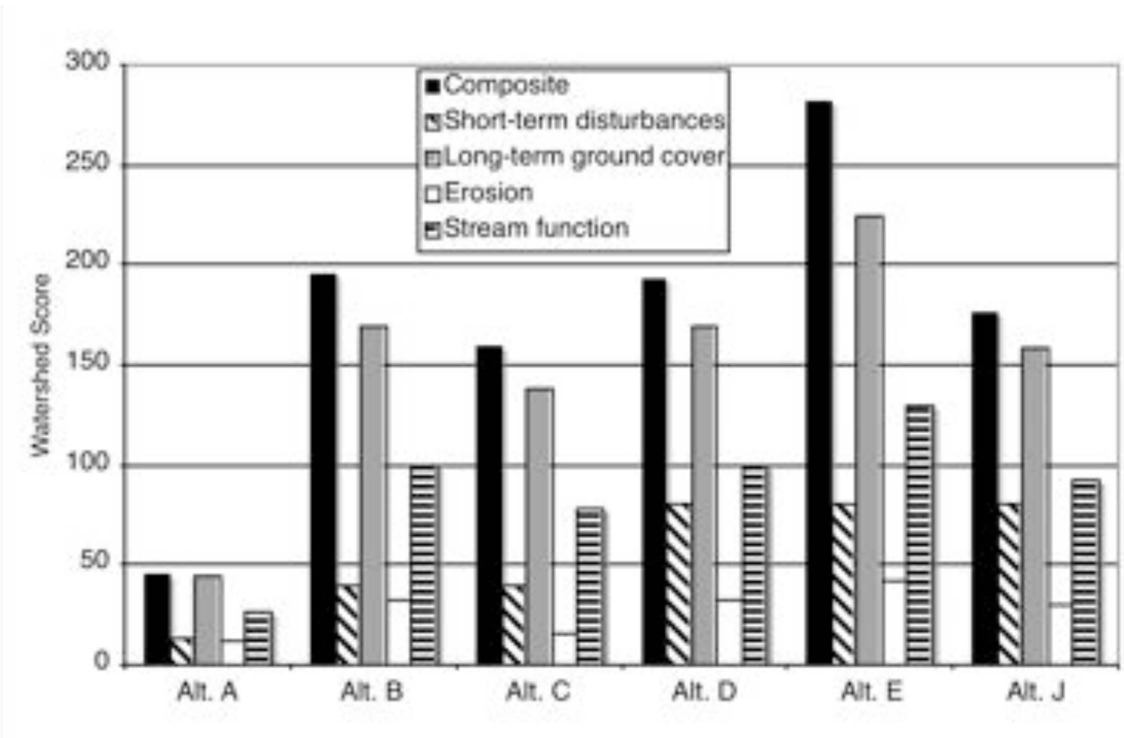

Figure 27. Watershed Scores by Alternative and Factor

Table 46. Watershed Alternative Trend Summary

Watershed Name	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative J
Smoke Creek Desert	Small positive trend	High positive trend	High positive trend	High positive trend	Very high positive trend	High positive trend
Massacre Lake	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
Warner Lakes	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
Guano	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
Lost	Small positive trend	High positive trend	Moderate positive trend	High positive trend	Very high positive trend	High positive trend
Butte	No change	Small positive trend	Small positive trend	Small positive trend	Moderate positive trend	Small positive trend
Upper Klamath	No change	No change	No change	No change	No change	No change
Shasta	No change	No change	No change	No change	No change	No change
Goose Lake	No change	No change	No change	No change	No change	No change
Upper Pit	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	Moderate positive trend	Small positive trend
Lower Pit	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
McCloud	No change	No change	No change	No change	No change	No change
North Fork Feather	No change	No change	No change	No change	No change	No change
East Branch North Fork Feather	No change	No change	No change	No change	No change	No change
Surprise Valley	No change	Moderate positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
Madeline Plains	Small positive trend	High positive trend	Moderate positive trend	Moderate positive trend	High positive trend	Moderate positive trend
Honey-Eagle Lakes	Small positive trend	High positive trend	High positive trend	High positive trend	Very high positive trend	High positive trend
Analysis Area	No to Small Change	Moderate to High Positive Trend	Moderate Positive Trend	Moderate to High Positive Trend	High to Very High Positive Trend	Small to High Positive Trend

4.5.2 Soil Resources

4.5.2.1 Management Direction

The primary regulation that governs impacts on soil and water resources is the Clean Water Act. The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide additional management direction through management directives, standards, and guidelines for soil resources.

Soil resources goals from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Maintain natural nutrient balance to ensure long-term soil productivity
- Restore areas of soil degradation
- Accurately assess the capabilities, suitabilities, and limitations of soils for better management decisions and recommendations

Soil resources goals from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- The long-term health and productivity of soils would be preserved. This means that there would be no net loss of soil mass or productivity.

4.5.2.2 Soil Productivity and Surface Hydrologic Condition

A scientific literature review of the nutrients dynamics in juniper woodlands and sagebrush was conducted to evaluate potential soil nutrient loss from the site for mechanical treatment. Prescribed fire does not remove nutrients from the site and therefore was not evaluated. Nutrients could be also lost from the site through increased soil erosion and increased sediment delivery to streams, which is analyzed above in *Section 4.5.1 Watershed*.

Some of the nutrients that are present in juniper trees would be removed from the site under many of the mechanical restoration methods. The loss of nutrients would be greatest with the use of feller-bunchers used with on-site chippers because they leave few leaves and branches on the site. However, recent research has shown either no change in nutrients following juniper removal (Stubbs and Pyke 2005) or actually increases in Nitrogen (Bates *et al.* 2002). These results are partly because juniper trees have low nutrient content and soil mineralization dominates during dry periods in this environment. The result is that the vast majority of nutrient (N and P) stock remains on site after juniper removal. Therefore, the nutrient stock of sites that experience juniper removal would not be adversely affected.

4.5.2.3 Methodology for Analysis

The amount of shrub and other ground cover is inversely proportional to erosion (Blackburn and Pierson 1994). Therefore, the extent of sagebrush, other shrub cover, and grass and forb cover is an indicator of higher ground cover, and juniper canopy cover of >20 percent is an indicator of lower ground cover. Potential soil erodibility (*Section 3.6.6 Soil Erosion Hazard*) is used to quantify potential erosion. Restoration treatment of juniper with canopy cover >20 percent combined with high and severe potential soil erodibility is used to identify areas that would have a high risk of soil erosion.

4.5.2.4 Soil Resources Effects Common to All Alternatives

All alternatives would disturb soils through the use of fire use, mechanical, and hand treatment restoration. There is a potential for soil loss when using fire use because of the loss of ground cover and increased erodibility due to temporary loss of ground cover. Mechanical treatments use wheeled or tracked vehicles that create various degrees of soil disturbance. Hand treatments, largely delivered by people on foot, would not likely accelerate soil erosion.

Soil disturbance would be of greatest concern in locations where the potential for soil erosion is high. Soil erosion is of most concern where the eroded solids are transported off the site to a stream where they contribute to increased sediment yield. Soil erosion that does not leave the site would not be lost and therefore would not reduce the productivity of the site. Increased soil erosion potential due to ground disturbances from restoration treatments would be short-term because vegetation would cover bare soil quickly after treatment and reduce the potential for further erosion (EOARC 2007).

BMPs have been developed by both the FS (USDA Forest Service 2000c) and BLM for the types of activities that are proposed for the sage steppe restoration treatments. There is an agreement between the FS and the SWRCB that the FS will use BMPs to comply with the Federal Water Pollution Control Act. The BLM has a similar agreement with the State of California. The implementation of BMPs includes a monitoring and evaluation feedback loop that would determine the effectiveness of the BMPs.

Restoration areas that are identified as dense juniper and proposed for mechanical treatment are mostly located on slight to moderate potential soil erodibility areas (Figure 28). Severe potential erodibility occurs on less than one percent of the proposed treatment areas in dense juniper. These severe potential erodibility areas would be evaluated on a site-specific basis to determine which BMPs would be required. High potential erodibility occurs on about seven percent of the proposed treatment areas in dense juniper (Figure 28). These high potential erodibility areas would also be evaluated on a site-specific basis to determine if any additional BMPs would be required. BMPs such as Soil Disturbing Treatments on the Contour (Practice 5-1) and Erosion Prevention and Control Measures During Timber Sale Operations (Practice 1-13) would ensure minimal soil erosion and sediment yield from those areas with more potential for soil erosion.

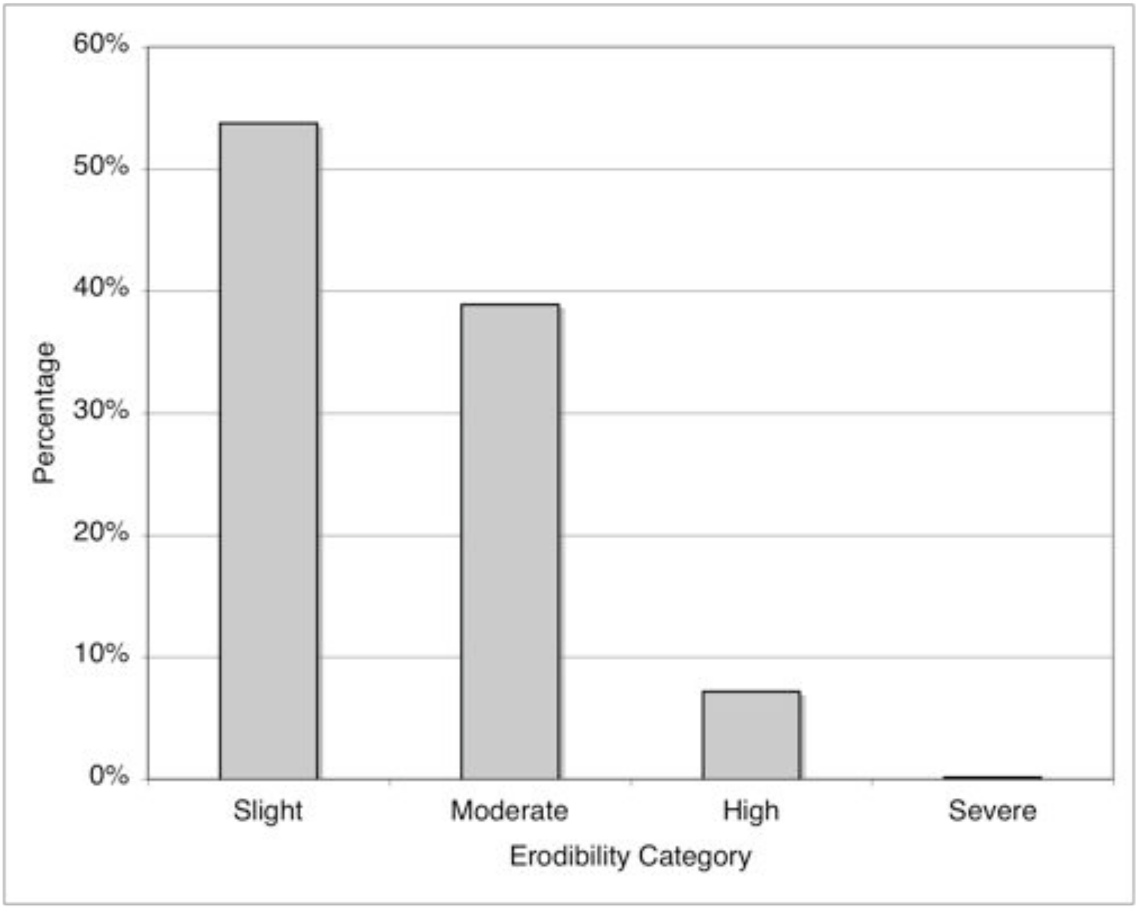

Figure 28. Percentage of Mechanical Treatments in Dense Juniper by Potential Erodibility

4.5.2.5 Alternative A (Current Management)

4.5.2.5.1 Direct and Indirect Effects

Alternative A (Current Management) would cause soil disturbance from 193,500 acres of fire use, 48,500 acres of mechanical and 8,000 acres of hand treatment restoration over 50 years. These treatment areas would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative A (Current Management). There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative is predicted to have the smallest increase in long-term ground cover due to the smallest area of restoration (Table 45).

4.5.2.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

New permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative A.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative A would be no change to a small positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.2.6 Alternative B (Proposed Action)

4.5.2.6.1 Direct and Indirect Effects

Alternative B (Proposed Action) would cause soil disturbance from 971,700 acres of fire use, 242,700 acres of mechanical and 39,800 acres of hand treatment restoration over 40 years. The restoration treatment areas would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative B (Proposed Action). There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the second largest short-term disturbance and erosion potential from restoration activities (Table 45). Alternative B would have the second greatest positive long-term increase in ground cover due to the area of restoration (Table 45).

4.5.2.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative B.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative B would be a moderate to high positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.2.7 Alternative C

4.5.2.7.1 Direct and Indirect Effects

The direct and indirect effects of Alternative C on soil erosion would be very similar to Alternative B due to the same area of mechanical treatment on dense juniper areas (Table 45). The main differences are that with a slower rate of treatment, potential erosion generated from the treatments would be lower, but long-term ground cover increases would also be lower. Overall the effects of this alternative on soils would be positive although delayed somewhat compared to Alternative B. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative C. There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the second largest short-term disturbance and the second smallest erosion potential from restoration activities (Table 45). Alternative C would have the second smallest positive long-term increase in ground cover due to the area of restoration (Table 45).

4.5.2.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands.

The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative C.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative C would be a moderate positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.2.8 Alternative D

4.5.2.8.1 Direct and Indirect Effects

Alternative D would cause soil disturbance from 697,200 acres of fire use, 515,300 acres of mechanical and 39,800 acres of hand treatment restoration over 40 years. The restoration treatment areas would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative D. There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and second largest erosion potential from restoration activities (Table 45). Alternative D would have the second greatest positive long-term increase in ground cover due to the area of restoration (Table 45).

4.5.2.8.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative D.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative D would be a moderate to high positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.2.9 Alternative E

4.5.2.9.1 Direct and Indirect Effects

Alternative E would cause soil disturbance from 697,200 acres of fire use, 515,300 acres of mechanical and 39,800 acres of hand treatment restoration over 33 years. The restoration treatment areas would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative E. There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and erosion potential from restoration activities (Table 45). Alternative E would have the greatest positive long-term increase in ground cover due to the area of restoration (Table 45).

4.5.2.9.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative E.

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative E would be high to very high positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.2.10 Alternative J (Preferred Alternative)

4.5.2.10.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would cause soil disturbance from 697,200 acres of fire use, 515,300 acres of mechanical and 39,800 acres of hand treatment restoration over 47 years. The restoration treatment areas would have increased erosion potential following treatment until ground cover becomes established. The use of BMPs by the FS and BLM would result in no adverse effects to water quality from soil erosion due to the implementation of Alternative J (Preferred Alternative). There may be instances where minor increases in soil erosion and sediment yield occur, however, they will be corrected quickly due to the BMP monitoring and adjustment required during the implementation of restoration treatments.

In the long-term (greater than five years), ground cover would increase in areas currently covered by dense juniper that are restored to sage steppe (EOARC 2007). This effect would reduce potential soil erosion as the increase in ground cover would reduce erosion and sediment yield. This alternative would have the largest short-term disturbance and third lowest erosion potential from restoration activities (Table 45). Alternative J (Preferred Alternative) would have the fourth greatest positive long-term increase in ground cover due to the area and rate of restoration (Table 45).

4.5.2.10.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, other restoration activities, and forest management throughout the Analysis Area.

Livestock grazing will be managed by the FS and BLM to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Those practices would promote increased ground cover and other changes that would contribute to a reduction in soil erosion.

No new permanent roads will be constructed for this project, and others are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. The use of temporary roads would occur on FS and BLM managed lands for sage steppe restoration. These roads would involve minimal ground disturbance and would be reclaimed following use (one to three years). Decommissioning of existing permanent roads would also occur on federal lands where appropriate. Some new permanent and temporary roads may be constructed on private lands. The cumulative effect would be little to no increase in permanent roads and therefore little to no increase in soils erosion associated with new roads.

Forest management will continue in some of the watersheds proposed for sage steppe restoration treatments. Forest management may have cumulative effects in those situations where short-term increases in erosion are expected to occur in the same watershed and within the same timeframe as the restoration treatments in this alternative. TOCs and BMPs, such as Cumulative Off-Site Watershed Effects (Practice 7-8), would take into account the cumulative effects from forest management and therefore, there would be no adverse cumulative effect from forest management activities.

The effects of this alternative in combination with the other restoration activities on other federal and private lands (*Section 4.1.2 Cumulative Effects)* would be an increase in the short-term effects and long-term benefits. The use of BMPs in combination with TOCs by the FS and BLM would result in no adverse cumulative effects to soil erosion and sediment yield due to the implementation of Alternative J (Preferred Alternative).

All watershed trend factors (Figure 27) would increase and the overall cumulative effects would be positive for most watersheds as the long-term ground cover increases. The cumulative effect of Alternative J (Preferred Alternative) would be a moderate to high positive trend for watersheds (*Section 4.5.1 Watershed*) in the Analysis Area, because the effects of erosion and sediment yield would not be adverse.

4.5.3 Floodplains

Executive Order No. 11988 requires federal agencies to disclose their effects on floodplains. No restoration activities are planned for floodplains and the BMPs and site-specific environmental disclosures would ensure that the restoration projects would have no effect on floodplains. Therefore, the restoration activities would not have any effects on floodplains and the alternatives would comply with Executive Order No. 11988.

4.5.4 Wetlands

Executive Order No. 11990 requires federal agencies to disclose their effects on wetlands. Wetland areas are rich ecological features in this semi-arid landscape. They generally contain high quality and unique habitats compared to the surrounding sage steppe ecosystem. Wetlands would be protected through several different measures including; BMPs, special status plants and special wildlife habitat protection measures, in addition to existing management direction for both the FS and BLM that protects wetlands. Wetlands would be identified and protected during restoration activities. Therefore, the restoration activities would not have any effects on wetlands and the alternatives would comply with Executive Order No. 11990.

4.6 Wildlife

The Sage Steppe Ecosystem Restoration Strategy has been initiated to reverse the trend of juniper density increases. Juniper woodlands or areas of denser juniper would become a smaller portion of the landscape resulting in a corresponding decrease in species populations utilizing juniper woodlands. Grasslands and sagebrush dominated sage steppe would become a larger portion of the landscape resulting in a potential increase in sage/steppe obligate species populations. Initially, newly treated habitats may not provide suitable habitat for either group, thus effects must be measured over the long-term. It has been generally accepted that habitat restoration of the sage steppe ecosystem is a necessary process to avoid continued habitat reduction of some sage obligate species, particularly sage-grouse (Wisdom *et al.* 2002).

All wildlife species utilize their habitats in a different manner. Even those that have been designated as "sage steppe obligates" have differing habitat preferences within that ecosystem. Many of those differences are related to vegetative diversity, diversity in plant species present, condition of stand and age of stand. In a natural occurring sage/steppe ecosystem, populations of various wildlife species would assume a level corresponding to the availability of habitat present in the ecosystem, assuming that predation and competition remain constant. That is to say, they would not all maximize their populations simultaneously but population levels would increase or decrease over time as the sage steppe mosaic changes.

4.6.1 Management Direction for Wildlife

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for wildlife through management directives, standards, and guidelines.

Goals for wildlife from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- **Diversity** - Provide vegetative diversity to maintain viable populations and other resource objectives, including scenic quality, wildlife, and reduced wildfire loss.

Goals for wildlife from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- **Ungulates** - Manage BLM lands to restore, maintain, and enhance habitats for, and populations of, ungulate species.
- **Sagebrush Ecosystems and Sagebrush-Obligate Species -** Restore, enhance, and maintain sagebrush ecosystems capable of supporting sagebrush-obligate species such that forage, water, vegetative structure, as well as security and thermal cover, are adequately provided for wildlife on BLM-administered lands.

4.6.2 Methodology for Analysis

The methodology presented here applies to all wildlife species that have population trends predicted in subsequent wildlife sections.

Quantifiable effects on wildlife at a programmatic level are determined through projections of population trends of those wildlife species positively or negatively affected by reductions in the juniper woodland component. Overall, sage obligate species would benefit from an increase in vegetative diversity in the existing sage steppe ecosystem. However, the effects on individuals in this group may vary relative to restoration activities and changes in vegetative diversity site specifically over time. Additionally, the effects on one species may manifest themselves at a completely different time period than that of another. As an example, some species may react positively to initial burning, achieving optimum population levels in the early stages of recovery, but declining as the vegetation matures. Others may require mature stands to reach optimum population levels; declining or even disappearing from newly treated areas and increasing as the vegetation matures.

Therefore, evaluation criteria and the analysis of the effects of the proposed restoration activities and alternatives on wildlife resources is based on:

- Review of technical and scientific literature regarding affected species and/or species groups and their habitats. A separate data analysis and list of references for each species and/or species group was developed as an appendix
- Review of the current Modoc National Forest LRMP (USDA Forest Service 1991a), the BLM's Northeastern California and Northwestern Nevada Standards for Rangeland Health and Guidelines for Livestock Grazing Management (USDI Bureau of Land Management 1999) and specific BLM Resource Management Plans
- Review of available data regarding the potential effects of alternative activities to meet the restoration objective
- Review of available GIS data on the Focus Area as provided by the Modoc NF and the BLM
- Assessment of estimated area (in acres) of treated habitats, the types of treatments to be applied, and the time frame treatments would be applied
- Effects of on-going and future resource management strategies (e.g. grazing, biomass conversion) on the wildlife resource
- Professional judgment of the author and of agency biologists involved with the project

Because one of the goals of this project is to restore habitats necessary to maintain population viability of sagebrush obligate wildlife species, site-specific implementation of those restoration projects would apply the most appropriate treatment for restoration of the sage steppe ecosystem and associated wildlife habitat. This analysis only assesses potential population trends as a result of treatments based on life history data of these species and the habitat conditions necessary to improve and/or maintain these populations. Changes in population levels will be estimated at the project level when site-specific factors can be applied to the analysis.

4.6.2.1 Population Trend Methodology

At the programmatic level, effects to actual populations of a given wildlife species cannot be quantified, since the actions proposed are at a programmatic scale as described above. Therefore, effects were analyzed considering potential short (less than 10 years) and long-term (greater than 10 years) trends for species groups to be assessed. Effects on these species or species groups were rated as long-term (LT) and short-term (ST); positive (+), negative (-) or neutral (0) trends; and estimated intensity, high (H), moderate (M) or low (L). Ratings are based on available literature regarding species, their habitats, potential effects of treatments, and personal knowledge of the author and selected biological researchers. These ratings, with a brief narrative of the effects, are presented in the tables associated with each alternative.

Using the above as a criterion, tables were developed using available data on effects to the target wildlife species (TES, MIS, sage obligates, and selected species occupying juniper woodlands). Available data regarding life history requirements, vegetative diversity requirements, sage steppe successional requirements, and adaptability to varying conditions were considered and applied as appropriate. These data are included in the reference section of the *Wildlife Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007c).

4.6.3 Wildlife Effects Common to All Alternatives

Miller (2001) has indicated that there is a reduction of biotic diversity in areas where juniper has recently become the dominant species. This is especially true of the vertebrate group termed "sage obligates," species that require sage for part or all of their life history requirements. Dobkin and Sauder (2004) documented declines in both species numbers and abundance in dense juniper areas. Diversity in the condition of vegetation to be restored is an important factor with regard to the effects on biota overall. Sage stands currently used by sage-grouse will likely continue to be used after mechanical treatment (Connelly *et al.* 2000a) but may be abandoned following fire (Connelly *et al.* 2000b).

The mountain big sagebrush type that dominates the Focus Area is generally found on moister sites and following fire treatments will re-establish more rapidly than Wyoming big sagebrush sites, especially at higher elevations. Due to the longer time for sagebrush re-establishment, and the drier conditions, there is higher risk of non-native invasive species establishing in burn areas in Wyoming big sagebrush sites versus mountain big sage sites.

A well developed perennial grass and forb layer usually characterizes a mountain big sagebrush community. This cover type, often the most preferred sagebrush type by sage-grouse during nesting (Gregg 1991), can provide excellent nesting cover, and an abundance of succulent forbs. The growing season is longer than the other two big sagebrush types, providing succulent forbs later into the summer. Fire applied to mountain big sage sites should be performed in a manner which promotes patchiness, and in mosaic patterns across the landscape.

Shrub cover, density, and height are determined by site factors (soils, climate, etc.), species of sagebrush and past history of disturbance. Fire is a part of sagebrush ecosystems. Canopy cover varies after each fire. Variability is a range of little sagebrush cover to sagebrush dominating the site. The effects of different restoration treatments (mechanical and prescribed fire) on sage obligate species vary depending on a number of site-specific variables. However, little published data indicates discernible differences between sagebrush restoration methods in restoring sage habitats and usually lump these methods together based upon effects on wildlife.

Slater (2003) found female sage-grouse fidelity was high in areas recently burned if they had used it previously. As would be expected, response to fire by bird populations utilizing sage steppe habitats was strongly related to the size, frequency, patchiness and severity of the burned areas (Knick *et al.* 2005). Prescribed fire applied to mountain big sagebrush types with juniper that is adjacent to occupied sagebrush sites without juniper will promote good brood rearing habitat and would likely contribute to increase population of sage-grouse.

Recovery of sage steppe following treatments can be moderate to very slow. Nelle *et al.* (2000) found "*Burning created a long-term negative impact on (sage-grouse) nesting habitat because sagebrush required over 20 years of post burn growth for…canopy cover to become sufficient for nesting*." Wambolt *et al.* (2001) found (in burned sagebrush habitats) that herbaceous plant responses were minimal while shrubs were lost for many years. Kerely and Anderson (1995) found that sage thrashers (that nest exclusively in mature shrubs) may be excluded until the sage begins to recover and a canopy is established. Winter and Best (1985) found burning "not to be beneficial" to Sage sparrow nesting habitat. McGee (1982) found an initial decrease in small mammal species composition in area burned in the spring but a large increase in densities of individuals within three years.

EOARC (2007) showed that restoration rates in areas having mechanical treatments varied depending on the season in which they were applied and site conditions, and Hedrick *et al.* (1966) determined effects were best on ranges that were in poor condition. Following burning, sagebrush does not resprout from roots but requires a seed source. Sagebrush seeds are small and easily carried long distances by wind.

The effects of burning sagebrush on sage obligate species have been studied in a number of areas with a variety of results. This is particularly true of sage-grouse where the majority of the studies conclude that burning in nesting/breeding habitat may be more detrimental than positive and, in some cases, may be devastating (Connelly *et al.* 2000b). However, none of these studies was directed at the comparisons of juniper domination of historical sage steppe habitats and the determination to restore these areas to sage steppe.

Alternatives B through J show only slight differences to wildlife biota. Initially, burning will dramatically alter the vegetation, resulting in reduced population levels or avoidance of the area by many species. However, recovery may be greatest in burned areas as juniper reproduction will be reduced as well as mature trees removed. Mechanical treatments are more likely to effectively reduce juniper overstory and allow for increases in shrub species. Data indicates that for some species, and particularly for sage-grouse nesting/breeding habitat, responses would be more positive from mechanical treatments (Northern California Sage-grouse Working Group 2005, USDI Bureau of Land Management 2002, Horney 2006).

Overall, the restoration treatments would reduce available habitats for species occupying juniper woodlands while increasing habitats for those occupying sage steppe habitats. These changes will be tempered by current occupancy levels, current vegetative diversity, regeneration potential, and spatial factors.

4.6.4 Sage Steppe Obligate Species

Reinkensmeyer (2000) found that bird species associated with sage ecosystems would decline in any transition from mountain sagebrush communities to juniper woodlands. Thus, in the long-term, sage steppe obligate species will be enhanced though the use of prescribed burns over approximately 697,000 to 972,000 acres in the Focus Area.

Wildland fire use, wildfire or prescribed burning, is generally considered to initially degrade sage-grouse nesting/breeding habitat. Many researchers caution against the use of fire at this time in sage-grouse habitats (Connelly *et al.* 2000b, Nelle *et al.* 2000, Fischer *et al.* 1996) and suppression of wildfire is a key element in most sage-grouse habitat management strategies. The conservation strategies for both the Buffalo-Skeddadle and Devil's Garden/Clear Lake Population Management Units (Northern California Sage-grouse Working Group 2005 and Horney 2006) specify a high priority be placed on suppression of wildfire in sagebrush and juniper communities at this time and are extremely cautious on the use of prescribed burning to restore sage-grouse habitat until enough habitat is restored through mechanical juniper removal. Therefore, at this time, prescribed burns in sage-grouse habitat in the Buffalo Skeedaddle Population Management Unit should be limited to less than 123 acres (Northern California Sage-grouse Working Group 2005). The Greater Sage-Grouse Conservation Plan for Nevada and Eastern California states that "*Wildfire pre-suppression treatments and fire control in limited seasonal sagebrush habitats and existing high quality habitats that support healthy sage-grouse populations are high priority conservation actions*."

4.6.4.1 Alternative A (Current Management)

4.6.4.1.1 Direct and Indirect Effects

Under Alternative A, it would take 250 years to treat the Focus Area. As a result of the low rate of treatment per decade, this alternative provides the lowest level of long-term benefits to sage-obligate wildlife, while potentially allowing for continued increases in juniper density that would degrade sage habitats. Ultimately, this alternative could lead to local extirpation of some sage obligate species (Wisdom *et al.* 2002). Depending on the location, existing vegetative condition, and timing of treatments, effects on wildlife species would be variable. Direct effects include potential elimination of the use of some restoration sites by sage-obligate species, followed by an increase to various population levels depending on rate and type of vegetative recovery. Long-term effects may include lack of recolonization due to loss of the source population, invasion by exotic plants reducing native habitat quality, and increases in early successional and/or predatory species that would compete with, or directly reduce, populations.

This alternative would continue to be governed by standards and guidelines in the Modoc National Forest Land and Resource Management Plan (USDA Forest Service 1991a) and the Northeastern California and Northwestern Nevada Standards for Rangeland Health and Guidelines for Livestock Grazing Management (USDI Bureau of Land Management 1999). However, the potential exists for the continued decline and potential extirpation of several sage-obligate species, specifically sage-grouse and pronghorn. The effects of Alternative A on sage steppe obligate species are displayed in Table 47.

Table 47. Effects of Alternative A (Current Management) on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative A
Brewer's sparrow	Variety of shrub habitats	ST/LT: 0	Utilizes a wide variety of shrub habitats.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST:M- LT:M-	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers Continued levels of treatments in occupied habitats could increase habitat quality but may not be aggressive enough to reverse continued declines in certain populations and continued habitat loss through decadence or juniper encroachment are likely to exceed gains.
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:L+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST/LT:L-	Lack of restoration will not achieve large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST/LT:L-	Prescribed burning will reduce habitat until sage steppe vegetation recovers. It uses a variety of habitats but depends on certain height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	ST:L- LT: 0	Species will be temporarily reduced in burned areas. While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	sagebrush areas with a low coverage of shrubs	ST:L+ LT:M-	Burning will result in increased forage locally. Positive effects of burning may not keep up with habitat decline. Increasing juniper woodland and decadent sage will reduce this species use of the habitat.

4.6.4.2 Alternative B (Proposed Action)

4.6.4.2.1 Direct and Indirect Effects

Alternatives B and C involve the same treatment area and the same percentages of prescribed burn (77 percent) and mechanical treatment (20 percent) but differ in the restoration rate (acres treated per decade). Alternative B would treat the total area (1,254,200 acres) in four decades at a rate of 31,355 acres per decade.

The effect of Alternative B would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species (Table 48) however effects would be positive long-term for all except the Sagebrush lizard, which would have a neutral long-term effect.

In addition, no mechanical treatment would occur in juniper areas of six to 20 percent canopy closure. The effects would vary depending upon the density and species of the shrub layer beneath the canopy. Species occupying juniper woodlands would likely use these areas, especially where canopy closure approached 20 percent. However, the prescribed burning of these areas would continue in a ratio equivalent to their occurrence in the Focus Area.

Table 48. Effects of Alternative B on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative B
Brewer's sparrow	Variety of shrub habitats	ST: 0 LT: M+	Utilizes a wide variety of shrub habitats. Would benefit from abundant scattered shrubs and short grass.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST:M- LT:M+	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers Treatments in occupied habitats and adjacent habitats will increase habitat quality. However, as 77 percent of these treatments will be through prescribed burning, negative effects could reduce positive effects.
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:M+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST: L- LT: M+	Restoration will disrupt habitat. Restoration will improve habitat of large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST: L- LT: M+	Prescribed burning will reduce habitat until sage steppe vegetation recovers. Would provide more of desirable height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	ST:L- LT: 0	Species will be temporarily reduced in burned areas. While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	sagebrush areas with a low coverage of shrubs	ST:L+ LT:H+	Burning will result in increased forage locally. High levels of burning will result in increase forage production over the Focus Area. Reductions in juniper will promote preferred habitat conditions.

4.6.4.3 Alternative C

4.6.4.3.1 Direct and Indirect Effects

Alternative C involves the same area and percentage of prescribed burn (77 percent) and mechanical treatment (20 percent) as Alternative B but has a slower restoration rate. This alternative would treat the total area (1,254,200 acres) in five decades at a rate of 15,678 acres per year or 12.5 percent the first decade, 19,355 acres per year or 15.5 percent in the 2nd decade, 25 percent in each of the 3rd and 4th decades and the remaining 22 percent in the 5th decade.

The effect of Alternative C would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species (Table 49) however effects would be positive long-term for all except the Sagebrush lizard, which would have a neutral long-term effect. The effects of Alternative C on sage steppe obligate species would be very similar to Alternative B. The main difference would be a smaller short-term negative effect on sage-grouse due to deferring fire use for the first 20 years in special wildlife habitat areas.

In addition, no mechanical treatment would occur in juniper areas of six to 20 percent canopy closure. The effects would vary depending upon the density and species of the shrub layer beneath the canopy. Species occupying juniper woodlands would likely use these areas, especially where canopy closure approached 20 percent. However, the prescribed burning of these areas would continue in a ratio equivalent to their occurrence in the Focus Area.

Table 49. Effects of Alternative C on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative C
Brewer's sparrow	Variety of shrub habitats	ST: 0 LT: M+	Utilizes a wide variety of shrub habitats. Would benefit from abundant scattered shrubs and short grass.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST:L- LT:M+	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers. However, initial levels of treatments are reduced in comparison to Alternatives B, D & E. Increasing levels of treatments in occupied habitats and adjacent habitats will increase habitat quality. However, as 77 percent of these treatments will be through prescribed burning, negative effects could reduce positive effects (Connelley *et al.* 2000).
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:M+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST: L- LT: M+	Restoration will disrupt habitat. Restoration will improve habitat of large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST: L- LT: M+	Prescribed burning will reduce habitat until sage steppe vegetation recovers. Would provide more of desirable height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	ST:L- LT: 0	Species will be temporarily reduced in burned areas. While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	sagebrush areas with a low coverage of shrubs	ST:L+ LT:H+	Burning will result in increased forage locally. High levels of burning will result in increase forage production over the Focus Area. Reductions in juniper will promote preferred habitat conditions.

4.6.4.4 Alternative D

4.6.4.4.1 Direct and Indirect Effects

Alternative D would restore 28,243 acres per year for the first two decades and then the restoration rate would increase to 34,373 acres per year for the third and fourth decades. Nearly half of those areas would have been treated by mechanical restoration.

The effect of Alternative D would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species (Table 50) however effects would be positive long-term for all except the Sagebrush lizard, which would have a neutral long-term effect. The effects of Alternative D on sage steppe obligate species would differ from Alternatives B and C in two important areas. The main difference would be more positive effects on sage-grouse, both from in the short-term (neutral effect) and long-term (high positive effect). These differences in effects on sage-grouse are due to the smaller percentage of fire use and deferring fire use for the first 20 years in special wildlife habitat areas. Alternative D would have a smaller positive effect (moderate positive) due to the greater percentage of mechanical treatments.

Depending on the location, existing vegetative condition and timing of treatments, actual effects on wildlife species would be variable. Immediate effects would include potential elimination of sage-obligate species use of treated sites followed by an increase to a variety of levels.

Table 50. Effects of Alternative D on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative D
Brewer's sparrow	Variety of shrub habitats	ST: 0 LT: M+	Utilizes a wide variety of shrub habitats. Would benefit from abundant scattered shrubs and short grass.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST: 0 LT:H+	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers. However, critical sage-grouse habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Treatments in occupied habitats and adjacent habitats will increase habitat quality. Increased use of mechanical treatments (42 percent) will result in greater protection of existing populations and allow for more rapid increases to adjacent habitats.
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:M+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST: L- LT: M+	Restoration will disrupt habitat. Restoration will improve habitat of large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST: L- LT: M+	Prescribed burning will reduce habitat until sage steppe vegetation recovers. Would provide more of desirable height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	LT/ST: 0	While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	sagebrush areas with a low coverage of shrubs	ST:L+ ST:M+	Burning will result in increased forage locally. However, critical pronghorn habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species. Reductions in juniper will promote preferred habitat conditions.

4.6.4.5 Alternative E

4.6.4.5.1 Direct and Indirect Effects

Alternative E differs from Alternative D only in the rate at which fire use and mechanical treatments are applied. This alternative would restore 37,657 acres per year for the first two decades, and then the restoration rate would increase to complete treatment by the end of the third year of the fourth decade. Almost half of the restoration would be completed by mechanical means.

The effect of Alternative E would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species (Table 51) however effects would be positive long-term for all except the Sagebrush lizard, which would have a neutral long-term effect.

The effects of Alternative E on sage steppe obligate species would differ from Alternatives B and C in two important areas. The main difference would be more positive long-term (high positive effect) effects on sage-grouse (Table 51). This difference in long-term effects on sage-grouse are due to the smaller percentage of fire use and deferring fire use for the first 20 years in special wildlife habitat areas. Alternative E would have a smaller positive long-term effect (moderate positive) due to the greater percentage of mechanical treatments.

Table 51. Effects of Alternative E on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative E
Brewer's sparrow	Variety of shrub habitats	ST: 0 LT: M+	Utilizes a wide variety of shrub habitats. Would benefit from abundant scattered shrubs and short grass.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST: L- LT:H+	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers. Treatments in occupied habitats and adjacent habitats will increase habitat quality. Increased use of mechanical treatments (42 percent) will result in greater protection of existing populations and allow for more rapid increases to adjacent habitats.
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:M+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST: L- LT: M+	Restoration will disrupt habitat. Restoration will improve habitat of large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST: L- LT: M+	Prescribed burning will reduce habitat until sage steppe vegetation recovers. Would provide more of desirable height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	LT/ST: 0	While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	Sagebrush areas with a low coverage of shrubs	ST:M+ ST:M+	Burning will result in increased forage locally. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species. Reductions in juniper will promote preferred habitat conditions.

4.6.4.6 Alternative J (Preferred Alternative)

4.6.4.6.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would restore 14,121 acres per year for the first decade, 21,060 acres per year for the second decade, and then the restoration rate would increase to 34,373 acres per year for the third and fourth decades. The restoration rate would then drop to 24,278 acres per year for the remaining seven years. Nearly half of those areas would have been treated by mechanical restoration.

The effect of Alternative J (Preferred Alternative) would be to create a positive trend for sage steppe obligate species and a negative trend for juniper woodland species. Short-term effects would be negative for some sage steppe obligate species (Table 52) however effects would be positive long-term for all except the Sagebrush lizard, which would have a neutral long-term effect. The effects of Alternative J (Preferred Alternative) on sage steppe obligate species would differ from Alternatives B and C in two important areas. The main difference would be more positive effects on sage-grouse, both from in the short-term (neutral effect) and long-term (high positive effect). These differences in effects on sage-grouse are due to the smaller percentage of fire use and deferring fire use for the first 20 years in special wildlife habitat areas. Alternative J (Preferred Alternative) would have a smaller positive effect (moderate positive) due to the greater percentage of mechanical treatments.

Depending on the location, existing vegetative condition and timing of treatments, actual effects on wildlife species would be variable. Immediate effects would include potential elimination of sage-obligate species use of treated sites followed by an increase to a variety of levels. The effects of Alternative J (Preferred Alternative) are displayed in Table 53.

4.6.4.7 Cumulative Effects – Sage Steppe Obligate Species

The past, present and future foreseeable effects for sage steppe obligate species include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of increasing habitats of species occupying sage steppe habitats.

Table 52. Effects of Alternative J (Preferred Alternative) on Sage Steppe Obligate Species

Species	Habitat	Effect	Effects of Alternative D
Brewer's sparrow	Variety of shrub habitats	ST: 0 LT: M+	Utilizes a wide variety of shrub habitats. Would benefit from abundant scattered shrubs and short grass.
Greater sage-grouse	Multiple-aged sagebrush stands with mixed species composition (Klebenow 1969,Trimble 1989, etc.)	ST: 0 LT:H+	Prescribed burning will reduce habitat capacity until sage steppe vegetation recovers. However, critical sage-grouse habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Treatments in occupied habitats and adjacent habitats will increase habitat quality. Increased use of mechanical treatments (42 percent) will result in greater protection of existing populations and allow for more rapid increases to adjacent habitats.
Pygmy rabbit	Tall dense sagebrush with loose soil	ST/LT:M+	Habitat capacity will be slightly increased. Unknown long-term as there is little indication of a relict population base to occupy restored habitats.
Sage sparrow	Large continuous stands of sagebrush	ST: L- LT: M+	Restoration will disrupt habitat. Restoration will improve habitat of large continuous stands of sagebrush.
Sage thrasher	Variety of habitats	ST: L- LT: M+	Prescribed burning will reduce habitat until sage steppe vegetation recovers. Would provide more of desirable height of sagebrush for nesting.
Sagebrush lizard	Sage areas; widely distributed in several habitats throughout its range.	LT/ST: 0	While usually found in sage habitats, this species utilizes a wide variety of types, including juniper woodland, and does not appear to be restricted by vegetative composition to any degree.
Sagebrush vole	Sagebrush, bitterbrush and low sage.	ST/LT: L+	Restoration would increase food source.
Pronghorn	sagebrush areas with a low coverage of shrubs	ST:L+ ST:M+	Burning will result in increased forage locally. However, critical pronghorn habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species. Reductions in juniper will promote preferred habitat conditions.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be positive to sage steppe obligate species because of the restoration of more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.6.5 Big Game Species

4.6.5.1 Alternative A (Current Management)

4.6.5.1.1 Direct and Indirect Effects

Under Alternative A, it would take 250 years to treat the Focus Area. As a result of the low rate of treatment per decade, this alternative provides the lowest level of long-term benefits to big game, while potentially allowing for continued increases in juniper density that would degrade sage habitats. Direct effects include potential elimination of the use of some restoration sites by sage-obligate species, followed by an increase to various population levels depending on rate and type of vegetative recovery. Long-term effects may include lack of recolonization due to loss of the source population, invasion by exotic plants reducing native habitat quality, and increases in early successional and/or predatory species that would compete with, or directly reduce, populations. The potential exists for the continued decline and potential extirpation of pronghorn. The effects of Alternative A on big game species are displayed in Table 53.

Table 53. Effects of Alternative A on Big Game

Species	Effect	Effects of Alternative A
Mule deer	ST:L+	Burning will result in increased forage locally.
	LT:M-	Positive effects of burning may not keep up with habitat decline, especially decadence of preferred forage species such as bitterbrush.
Rocky Mountain elk	ST:L+	Burning will result in increased forage locally.
	LT:M-	Positive effects of burning may not keep up with habitat decline.

4.6.5.2 Alternative B (Proposed Action)

4.6.5.2.1 Direct and Indirect Effects

Alternatives B and C involve the same treatment area and the same percentages of prescribed burn (77 percent) and mechanical treatment (20 percent) but differ in the restoration rate (acres treated per decade). Alternative B would treat the total area (1,254,200 acres) in four decades at a rate of 31,355 acres per decade.

The effects of Alternative B for mule deer and elk show short-term positive effects due to increases in forage from the grasslands created by the restoration treatments (Table 54). Long-term effects on mule deer and elk show high positive effects due to increases in forage from the grasslands created by the restoration treatments.

Table 54. Effects of Alternative B on Big Game

Species	Effect	Effects of Alternative B
Mule deer	ST:L+	Burning will result in increased forage locally.
	LT:H+	High levels of burning will result in increase forage production over the Focus Area. Reductions in juniper not likely to affect use by mule deer
Rocky Mountain elk	ST:L+	Burning will result in increased forage locally.
	LT:H+	High levels of burning will result in increase forage production over the Focus Area.

4.6.5.3 Alternative C

4.6.5.3.1 Direct and Indirect Effects

Alternative C involves the same area and percentage of prescribed burn (77 percent) and mechanical treatment (20 percent) as Alternative B but has a slower restoration rate. This alternative would treat the total area (1,254,200 acres) in five decades at a rate of 15,678 acres per year or 12.5 percent the first decade, 19,355 acres per year or 15.5 percent in the 2nd decade, 25 percent in each of the 3rd and 4th decades and the remaining 22 percent in the 5th decade.

The effects of Alternative C for mule deer and elk show short-term positive effects due to increases in forage from the grasslands created by the restoration treatments (Table 55). Long-term effects on mule deer and elk show high positive effects due to increases in forage from the grasslands created by the restoration treatments.

Table 55. Effects of Alternative C on Big Game

Species	Effect	Effects of Alternative C
Mule deer	ST:L+	Burning will result in increased forage locally.
	LT:H+	High levels of burning will result in increase forage production over the Focus Area. Reductions in juniper not likely to affect use by mule deer
Rocky Mountain elk	ST:L+	Burning will result in increased forage locally.
	LT:H+	High levels of burning will result in increase forage production over the Focus Area.

4.6.5.4 Alternative D

4.6.5.4.1 Direct and Indirect Effects

Alternative D would restore 28,243 acres per year for the first two decades and then the restoration rate would increase to 34,373 acres per year for the third and fourth decades. Nearly half of those areas would have been treated by mechanical restoration.

The effects of Alternative D for big game show short-term positive effects to mule deer and elk due to increases in forage from the grasslands created by the restoration treatments (Table 56). Long-term effects on big game show moderate positive effects due to increases in forage from the grasslands created by the restoration treatments. The difference between this alternative and Alternatives B and C would be in the long-term effects on pronghorn and mule deer. Alternative D would have a smaller positive effect (moderate positive) due to the greater percentage of mechanical treatments. Fire use would potentially create forage as some forage species are fire stimulated.

Table 56. Effects of Alternative D on Big Game

Species	Effect	Effects of Alternative D
Mule deer	ST:L+ LT:M+	Burning will result in increased forage locally. However, critical mule deer habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases, as many forage species are fire-stimulated. Reductions in juniper not likely to affect use by mule deer.
Rocky Mountain elk	ST:L+ ST:M+	Burning will result in increased forage locally. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species.

4.6.5.5 Alternative E

4.6.5.5.1 Direct and Indirect Effects

Alternative E differs from Alternative D only in the rate at which fire use and mechanical treatments are applied. This alternative would restore 37,657 acres per year for the first two decades, and then the restoration rate would increase to complete treatment by the end of the third year of the fourth decade. Almost half of the restoration would be completed by mechanical means.

The effects of Alternative E for big game show the highest short-term positive effects to mule deer and elk due to increases in forage from the grasslands created by the restoration treatments (Table 57). Long-term effects on pronghorn and mule deer show moderate positive effects due to increases in forage from the grasslands created by the restoration treatments. The difference between this alternative and Alternatives B and C would be in the effects on pronghorn and mule deer. Alternative E would have a smaller positive long-term effect (moderate positive) due to the greater percentage of mechanical treatments. Fire use would potentially create forage as some forage species are fire stimulated. However, the short-term effect on pronghorn and mule deer would be more positive due to the amount of forage created in Alternative E due to the higher restoration rate.

Table 57. Effects of Alternative E on Big Game

Species	Effect	Effects of Alternative E
Mule deer	ST:M+ LT:M+	Burning will result in increased forage locally. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases, as many forage species are fire-stimulated. Reductions in juniper not likely to affect use by mule deer.
Rocky Mountain elk	ST:M+ ST:M+	Burning will result in increased forage locally. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species.

4.6.5.6 Alternative J (Preferred Alternative)

4.6.5.6.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would restore 14,121 acres per year for the first decade, 21,060 acres per year for the second decade, and then the restoration rate would increase to 34,373 acres per year for the third and fourth decades. The restoration rate would then drop to 24,278 acres per year for the remaining seven years. Nearly half of those areas would have been treated by mechanical restoration.

The effects of Alternative J (Preferred Alternative) for big game show short-term positive effects to mule deer and elk due to increases in forage from the grasslands created by the restoration treatments (Table 58). Long-term effects on big game show moderate positive effects due to increases in forage from the grasslands created by the restoration treatments. The difference between this alternative and Alternatives B and C would be in the long-term effects on pronghorn and mule deer. Alternative J (Preferred Alternative) would have a smaller positive effect (moderate positive) due to the greater percentage of mechanical treatments and a slower initial restoration rate. Fire use would potentially create forage as some forage species are fire stimulated.

Table 58. Effects of Alternative J on Big Game

Species	Effect	Effects of Alternative D
Mule deer	ST:L+ LT:M+	Burning will result in increased forage locally. However, critical mule deer habitat will be deferred from treatment by fire use for the first two decades preventing any detrimental effects to existing populations. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated. Reductions in juniper not likely to affect use by mule deer.
Rocky Mountain elk	ST:L+ ST:M+	Burning will result in increased forage locally. Higher levels of mechanical treatments (42 percent) will result in reduced forage increases as many forage species are fire-stimulated and limit burning of decadent sage steppe habitats that are less favorable to this species.

4.6.5.7 Cumulative Effects – Big Game Species

The past, present and future foreseeable effects for big game species include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines.

Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of increasing habitats of species occupying sage steppe habitats.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be positive to big game species because of the restoration of more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.6.6 Juniper Woodland Species

Western juniper woodlands provide habitat to a number of wildlife species. In Washington, three large herbivores, 25 bird species and a number of small mammals species were identified to occupy early to late successional juniper woodlands (Miller 2001). None of these species was endemic to this habitat type but used it as available in conjunction with other habitat requirements. Bird species diversity appears to be greater in juniper and lower in grassland and sage steppe habitats (Reinkensmeyer 2000, Sieg 1991).

4.6.6.1 Direct and Indirect Effects – Juniper Woodland Species

For all alternatives, species occupying juniper woodland habitats would experience habitat losses, and associated local population declines. As grasslands and sage replaces juniper, bird species diversity would decrease. However, there are no species that have been designated as juniper "obligates." Species using these habitats also occupy other habitats and/or may occupy juniper only as it is in an ecotone with other habitats. Within the Focus Area, certain avian species appear to use juniper, at least seasonally, due to its availability, and use as forage and cover habitat. These species include the ferruginous hawk, gray flycatcher, plumbeous vireo, pinyon jay, western tanager, Townsend's solitare, mountain bluebird, Virginia warbler, black-throated gray warbler, gray warbler, juniper titmouse, chipping sparrow, and dark-eyed junco (Woolley and Heath 2006). By restoring sage steppe ecosystems through removal of juniper, some mature juniper woodlands that may provide habitat for these species would be reduced in extent. However, large areas of dense juniper will remain in the Focus Area and will provide ecologically functional juniper woodland habitat (Appendix B). The Design Standard for Old Growth Juniper (*Section 2.4.4 Old Growth Juniper*) would require that Alternatives B, C, D and E retain old growth juniper.

The effects of all of the alternatives on three species that use juniper woodlands would be a low positive effect for ferruginous hawk and Swainson's hawk (Table 59) and a low negative effect on Juniper titmouse.

Table 59. Effects Common to All Alternatives for Three Juniper Woodland Species

Species	Habitat	Effect	Effects of All Alternatives
Ferruginous hawk	Open country; grasslands	ST/LT: L+	Old-growth junipers suitable for nest sites to be preserved (See Chapter 2); forage base and availability will be increased.
Juniper titmouse	Juniper, pinyon/juniper woodlands	ST: L- LT: L-	Species will lose habitat from restoration treatments. Effects will increase in proportion to acres treated. Long-term objectives reduce juniper. However, enough dense juniper woodland habitat will remain to maintain viability of this species
Swainson's hawk	Nests in junipers	ST/LT: L+	Old-growth junipers suitable for nest sites to be preserved (See Chapter 2); forage base and availability will be increased.

4.6.6.2 Cumulative Effects – Juniper Woodland Species

The past, present and future foreseeable effects for juniper woodland species include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of increasing habitats of species occupying sage steppe habitats.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be generally negative to juniper woodland species because the restoration of more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic would decrease the amount of dense juniper.

4.6.7 Neotropical Migrants

4.6.7.1 Direct and Indirect Effects – Neotropical Migrants

The direct and indirect effects of the alternatives would reduce the amount of juniper within the Focus Area. The increase in juniper density in the Focus Area over the past 100 years has increased the arboreal coniferous habitat used by certain neotropical migrants. While juniper may provide summer nesting habitat for some neotropical migrants, the increase in density of juniper may not have actually contributed to increases in overall populations. There are few studies that indicate the loss of breeding habitat as the primary effect to this species group. Most data reflects factors dealing with changes in winter habitats, migratory issues, predation and pesticides.

The fact that neotropical bird species are continuing to decline indicates that increases in juniper woodland habitat in the Focus Area is not likely contributing to population stability. In fact, data is fairly clear that wintering habitat, contaminants and habitat fragmentation in both eastern and western North American riparian areas is much more likely to be the factors affecting these species (Ritter 2000).

Ritter (2000) indicates that encroachment of juniper on other ecosystems has reduced neotropical migrant habitat in the west and likely has resulted in a shift in the species utilizing these areas. However, Reinkensmeyer (2000) found bird densities highest in old-growth juniper and lowest in grassland sage.

Neotropical migrants occur in all habitats, therefore some may be enhanced while others adversely affected. Old growth juniper and riparian areas would be retained as part of this Restoration Strategy. The direct and indirect effects of the alternatives would neither increase or decrease neotropical migrant populations as a group because their populations do not appear to be dependent on the amount of juniper in the Focus Area.

4.6.7.2 Cumulative Effects – Neotropical Migrants

The past, present and future foreseeable effects for neotropical migrants include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of increasing habitats of species occupying sage steppe habitats.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be generally neutral to neotropical migrants because their populations do not appear to be dependent on the amount of juniper in the Focus Area.

4.6.8 Culturally Important Small Mammals

Culturally important wildlife species include jackrabbits, groundhogs/marmots and porcupines. As discussed in *Section 3.10.8 Culturally Significant Current Uses for Native Americans*, there used to be large rabbit drives with a harvest that provided enough for all people in the tribe, and all Tribes in the Analysis Area describe groundhogs/marmots as culturally important wildlife species. Tribes believe that the populations of jackrabbits, groundhogs/marmots and porcupines have declined because of the conversion of sagebrush land to agriculture and other losses of sagebrush habitats.

4.6.8.1 Direct and Indirect Effects – Culturally Important Small Mammals

4.6.8.1.1 Alternative A (Current Management)

Under Alternative A, the restoration areas are very small compared to the sage steppe Focus Area and they would likely not increase the populations of jackrabbits, groundhogs/marmots or porcupines. Overall, the restoration treatments would be positive for sage obligate species and negative for juniper woodland species.

4.6.8.1.2 Alternatives B - Proposed Action, C, D, E and J

The restoration treatments cover a large area so they would likely create better habitat for sage obligate species within the sage steppe Focus Area. Overall, the restoration treatments would be positive for sage obligate species and negative for juniper woodland species. The effects of the proposed restoration treatments would have a positive effect on population trends of jackrabbits because restoration would increase their food sources, a variety of herbs and shrubs (*Section 3.8.6.1 Jackrabbits*). The effects of the proposed restoration treatments would have a positive effect on population trends of groundhogs/marmots because restoration would increase their food sources, grass, leaves, flowers, fruit, grasshoppers, and bird eggs (*Section 3.8.6.2 Gourndhog/Yellow-bellied Marmot*) and would also provide more openings around rock piles. Porcupine populations would likely remain stable following restoration treatments. They are associated with woodlands, although not exclusively, so removal of juniper trees would reduce that habitat component, however their food sources in the spring; leaves, twigs and green plants, would increase. Therefore porcupines would experience a change due to restoration treatments would have negative and positive aspects. Alternatives B, C, D, E and J would have an overall positive effect on the populations of culturally important animals.

4.6.8.2 Cumulative Effects – Culturally Important Small Mammals

The past, present and future foreseeable effects for culturally important small mammals include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of increasing habitats of species occupying sage steppe habitats.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be generally positive to culturally important small mammals species because of the restoration of more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

4.6.9 Threatened and Endangered Species

There are no federally listed species, under the Endangered Species Act (ESA), that use the sage steppe community per se, therefore there would be no effects to federally listed species. However, due to requirements of ESA, those species provided in the USFWS list will be addressed for all alternatives. FS/BLM sensitive species that are known to occupy the vegetative types to be affected will also be addressed for all alternatives. State of California listed species will be considered as sensitive species.

A programmatic biological opinion was issued by the US Fish and Wildlife Service regarding the Modoc National Forest grazing program on the Lost River, Modoc, and shortnose suckers in 1996 (Yamagiwa 2006). The requirements in this opinion would be part of site-specific implementation.

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for threatened and endangered species through management directives, standards, and guidelines.

Goals for threatened and endangered species from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- **Wildlife and Fish -** Attain recovery goals for state and federal threatened and endangered species

Goals for threatened and endangered species from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- **Federally Listed Species** – Manage BLM-administered lands to restore, enhance, or maintain habitats and populations of federally-listed endangered or threatened species. Management is equally applicable to federal candidate species or those proposed for listing.

Effects of all alternatives on Modoc, Lost River and shortnose suckers would be neutral because current management plans and the Programmatic Biological Opinion issued by the USFWS would protect the habitats of these fish (Table 60).

Table 60. Effects Common to All Alternatives on ESA Listed Species

Species	Habitat	Effect	Effects of All Alternatives
Modoc, Lost river and shortnose suckers (E)	Streams within the focus Area	ST/LT: 0	Forest plan/BLM standards guidelines, and the Programmatic Biological Opinion issued by the USFWS in 1996 on these species protect their habitats from degradation.

4.6.10 Sensitive Species

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for sensitive species through management directives, standards, and guidelines.

Current direction from the Forest Service for sensitive species has been outlined in the Forest Service Manual (FSM) (USFS 1991a), the Modoc National Forest Final Land and Resource Management Plan (LRMP) (USFS 1991b), and Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement (USFS 2004). Direction for sensitive species for the Modoc National Forest that apply to this Restoration Strategy include:

> "*Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions ... As part of the National Environmental Policy Act process, review programs and activities, through the biological evaluation, to determine their potential effect on sensitive species*." Direction further states that Forests are to "*Avoid or minimize impacts to species, whose viability has been identified as a concern*".

Goals for sensitive species from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

> *"Manage BLM-administered lands to restore, enhance, or maintain habitats and populations of state-listed and BLM 'sensitive' species and prevent the need for future listing by the federal government under the Endangered Species Act."*

The effects of the alternatives on sensitive species are presented in Table 61 for FS sensitive species and in Table 62 and Table 63 for BLM sensitive species and Table 64 for FS and BLM species (bald eagle). Some of the sensitive species are discussed above under sage obligate and juniper woodland dependent species. A Biological Evaluation (BE) was completed for all Forest Service Sensitive Species (USDA Forest Service 2008b). For all alternatives and all FS sensitive species the BE reached a determination of effects of "may impact individuals, but not likely to cause a trend to Federal listing or a loss of viability".

Table 61. Effects Common to All Alternatives on Forest Sensitive Species[5]

Species	Habitat	Effect	Effects of All Alternatives
Northern goshawk	Coniferous forests; aspen groves	ST/LT: 0	Forest plan guidelines protect known nest locations. Aspen groves containing goshawks will be avoided.
Greater sandhill crane	Shallow marshes/grasslands	ST:L- LT: 0	Mechanical and prescribed burning activities near nesting marshes during the spring months could prevent or inhibit breeding activity. Forest plan/BLM standards guidelines protect aquatic habitats from degradation
Great Basin spadefoot	Grasslands and seasonal ponds	ST/LT: 0	Retention and protection of ponds and grassland burrowing mammals preclude adverse affects to this species.
Western pond turtle	Ponds with emergent and submergent vegetation	ST/LT: 0	Forest plan/BLM standards guidelines protect aquatic habitats from degradation.
Goose Lake sucker, GL tui chub, GL lamprey and GL redband trout	Tributaries to Goose Lake within the project area.	ST/LT: 0	Forest plan/BLM standards guidelines protect aquatic habitats from degradation.

Table 62. Effects Common to All Alternatives on BLM Sensitive Species[5]

Species	Habitat	Effect	Effects of All Alternatives
17 species of bats	Various	ST/LT: 0	No analysis feasible at programmatic level. Effects likely minimal as old growth trees are retained (see Chapter 2).
Ferruginous hawk	Open country; grasslands		See *Section 3.8.4.2 Ferruginous Hawk*
Greater sandhill crane	Shallow wetlands/grasslands		See Table 61
Golden eagle	Indicator of habitat condition more than habitat type.	ST: 0 LT:L+	Nest locations in cliff faces and rocky outcrops will not be affected. There will be an increase in the available forage.

Table 63. Effects of Alternatives on BLM Sensitive Species[5]

Species	Habitat	Effect	Effects of Alternative A
Burrowing owl	Open country; grasslands	ST:L+	Individuals could be temporarily displaced by treatments but would readily reoccupy treated areas. Welch (2002) found this species only to inhabit recently burned sagebrush sites in Idaho.
		LT:L-	Species generally located in grassland and open shrub/grassland habitats. As sage matures, this species leaves.
Species	**Habitat**	**Effect**	**Effects of Alternatives B, C, D and E**
Burrowing owl	Open country; grasslands	ST:M+	Individuals could be temporarily displaced by treatments but would readily reoccupy treated areas. Welch (2002) found this species only to inhabit recently burned sagebrush sites in Idaho.
		LT:M-	Species generally located in grassland and open shrub/grassland habitats. As sage matures, this species leaves.

Table 64. Effects Common to All Alternatives on Bald Eagle

Species	Habitat	Effect	Effects of All Alternatives
Bald eagle (T)	Lakes, rivers; large trees	ST/LT: 0	Forest plan/BLM standards guidelines protect aquatic habitats. Nesting or roosting trees in riparian and/or ponderosa pine habitats will not be subject to treatment.

4.6.11 Management Indicator Species (MIS)

The Modoc National Forest LRMP (USDA Forest Service 1991a) provides management direction for MIS through management directives, standards, and guidelines.

Goals for MIS from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Meet habitat or population objectives for Management Indicator Species.

MIS species are analyzed above under *Section 4.6.4 Sage Steppe Obligate Species, Section 4.6.5 Big Game Species, Section 4.6.6 Juniper Woodland Species, Section 4.6.9 Threatened and Endangered Species, Section 4.6.10 Sensitive Species,* and *4.6.12 Aquatic Species*.

4.6.12 Aquatic Species

It is assumed that protection to aquatic communities would be implemented as per the Modoc National Forest Land and Resource Management Plan (USDA Forest Service 1991a) and the BLM Standards for Rangeland Health (USDI Bureau of Land Management 1999). Therefore, no analysis of effects on this group will be conducted. Species requiring aquatic and riparian habitats would not be adversely affected by any of the proposed alternatives.

4.6.13 WILDLIFE CUMULATIVE EFFECTS

The past, present and future foreseeable effects for wildlife include continued livestock grazing, impacts from roads, firewood gathering, forest management and other restoration projects throughout the Analysis Area.

Livestock grazing has changed wildlife habitat throughout the Focus Area through the reduction of fine fuels and altered fire regimes (*Section 3.2.5 Disturbance Regimes in the Sage Steppe Ecosystem*). The FS and BLM will actively manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines. Therefore, sage steppe habitat restoration combined with management of livestock grazing would result in cumulative effects of reducing available habitats for species occupying juniper woodlands while increasing habitats of species occupying sage steppe habitats.

No new permanent roads would be built for Alternatives B, C, D, E and J or are planned to be built by the FS and BLM for other projects. For Alternative A, new permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. The cumulative effects from private roads would be restricted mainly to private lands and the roads are not expected to cover extensive areas. Therefore, the cumulative effects of new roads on private lands is expected to be minor.

Firewood gathering would occur at various locations in the Focus Area and would remove mature juniper trees in those areas. Firewood gathering would also increase fine fuels and ground cover because the slash is left on site. Firewood gathering would likely move some areas toward the pre-1870s landscape mosaic conditions by removing juniper and opening up the areas for sagebrush, however it would occur in relatively small areas compared to the restoration treatments.

Forest management will continue inside of the Analysis Area and would have an effect on wildlife habitat for species that inhabit the Focus Area if they utilize habitat within the forest and sage steppe. These cumulative effects would be addressed at the time of site-specific planning and implementation of both forest management and sage steppe ecosystem restoration projects.

The cumulative effects include the direct and indirect effects discussed previously along with activities on private land of over 486,000 acres of mechanical treatments and between 535,500 to 542,000 acres of fire use for Alternatives B through J. Additional activities on other federal lands include between 600 to 7,900 acres of mechanical treatments and approximately 34,000 acres of fire use. Dense western juniper stands would occupy more area than pre-1870s landscape mosaic within the Focus Area (Appendix B) however the ecosystem would begin to function more similar to the pre-1870s landscape mosaic. The result would be that the cumulative effect of Alternatives B, C, D, E and J would be to restore more than 1.8 million acres of the Focus Area to the pre-1870s landscape mosaic.

Cumulative effects would be lowest in Alternative A due to the reduced levels of vegetative disturbance. As levels of disturbance are nearly equal in Alternatives B, C, D, E and J, cumulative effects are nearly equal in space but may differ in time due to varying levels of treatment/decade. Alternatives B and C have 77 percent burning while Alternatives D, E and J are reduced to 55 percent burning. Removal of shrubs through burning may result in extending recovery periods for sage and other shrub cover (Wambolt *et al.* 2001) and for sage obligate wildlife species (Knick *et al.* 2005, Nelle *et al.* 2000, Peterson and Best 1987) but may allow for increases in herbaceous species (Pyle and Crawford 1996). Mechanical treatment could open canopies and provide for more rapid expansion of shrubs (Hedrick *et al.* 1966) but would not be as productive for increases in herbaceous cover and could result in more damage to soils and cover through biomass removal activities.

4.7 Socioeconomics

4.7.1 Regional Economics

The Sage Steppe Ecosystem Restoration Strategy requires that restoration areas be rested from livestock grazing for a minimum of two years for mechanical treatments and three years for fire use (*Section 2.4.3 Livestock Grazing Management Practices*). During those rest periods, grazing permitees will need to find other forage for their livestock or reduce their herds. There are essentially no unused grazing lands available within the Analysis Area (*Section 3.3 Livestock Grazing*). This section evaluates the economic impacts of reducing livestock herds on the grazing industry due to this Restoration Strategy.

4.7.1.1 Methodology for Analysis

IMPLAN is an input-output model used to estimate economic effects of resource actions on federal lands. It has been used widely in estimating impacts for programmatic and project level planning projects. The IMPLAN Pro input-output model allows Analysis Area construction from a sub-county, county, state, or United States level. Use of county level data enables an analyst to build models to any spatial scale: single county, multi-county, state, or entire United States. All IMPLAN data files are available from the Ecosystem Management Coordination, Planning Analysis Group (PAG) in Ft. Collins, CO.

IMPLAN was used to assess the impact of resting AUMs on the agricultural economy for a three county economic area that includes Modoc County in California, and Lake and Klamath counties in Oregon. This three county area (“Regional Model”) was chosen for analysis following guidelines in the Economic Impact Technical Guide (Alward *et al.* 2006) published by the IMPLAN group in the USDA Forest Service, Washington office. The user's guide indicates that the functional economic area (FEA) must be large enough to represent a semi- self-sufficient economy. Stated another way, the FEA should include the area where people, live, work, and shop. For livestock operations in Modoc County, there are purchases of farm equipment that are typically made in Lake or Klamath counties (Curtis pers. comm. 2006). Farm equipment is typically included as a "line item" in livestock operations budgets (University of California Cooperative Extension, Lassen County, 1997). Analysis of impacts was conducted with assumptions that are documented in the *Socioeconomics Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2007c).

In addition to the Regional Model, a single county IMPLAN model was developed to analyze impacts on Modoc County (*Section 4.7.2 Local Economics*). Analysis of impacts through IMPLAN was conducted with the following assumptions.

- IMPLAN county level data from 2003 (the most recent available) were used, detailing the relationship between cattle ranching operations, sales, and purchases.
- Cattle inventory and sales data were taken from the National Agricultural Statistics Service database for the years 2003 through 2006. Statewide production and sales records were combined with county inventories to provide an estimate of county level livestock sales under current management. These estimates were validated with County Agricultural Commissioners data on livestock sales for the respective counties.
- Reductions in public lands AUMs are assumed to lead to a proportional reduction in livestock inventory and sales. Ranchers would not find alternate sources of pasture or feed.
- Other changes in external variables that affect livestock operation viability such as cost of fuel, cost of winter feed, and selling prices of livestock, were considered fixed for all alternatives.
- The FS and BLM range programs are assumed to remain unchanged following project implementation. Therefore, any possible economic impact from increased FS or BLM range program salaries or personnel was not evaluated.
- Beef cattle and sheep operations would be affected by resting AUMs. Other livestock sectors, including dairy operations, would remain unaffected.
- Contract or temporary labor would be used by federal agencies to complete project activities that require additional labor. No additional permanent full-time employees would be hired by federal agencies.

4.7.1.2 Summary of Regional Impacts on Livestock Industry

The impacts of the alternatives on federal lands grazing and the analysis of the alternatives in the Regional Model are presented in Table 65. Grazing AUMs that would be subject to rest vary from 6,648 under Alternatives B and C to 8,649 under Alternative E in the highest treatment years of each alternative. The rested AUMs associated with Alternative A are considered a baseline from which to compare the alternative effects of Alternatives B through E. Alternative A is current management and therefore the economic effects of this alternative are currently part of the economy.

According to the 2004 crop report for Modoc County, livestock sales in 2004 for beef cattle were approximately $17.1 million. The rest of AUMs in any year is assumed to reduce sales by an amount proportional to the total AUMs available. There are approximately 180,078 AUMs on FS and BLM lands in Modoc County. Therefore, estimated sales are reduced from about $631,000 for Alternatives B and C to $821,000 for Alternative E compared to Current Management.

Employment in the region would be affected by resting AUMs; about 11 jobs would be lost in the short-term under Alternatives B and C, with as many as 15 short-term job losses under Alternative E. Jobs in the ranching industry would be most directly impacted (six to eight jobs, depending upon alternative). Income losses in the region would vary from about $128,000 to $167,000 per year. Ranching businesses would be affected by reductions of $33,000 (Alternatives B and C) to $43,000 (Alternative E), but the support industry for ranching (feed, fuel, trucking, veterinarian services, etc.) would experience additional income losses, ranging from $76,000 to $99,000 per year.

4.7.1.3 Alternative A (Current Management)

The economic values associated with Alternative A are considered a baseline from which to compare the alternative effects of Alternatives B through E. Alternative A is Current Management and therefore the economic effects of this alternative are currently part of the economy. The economic effects of Alternative A are presented here for context.

Alternative A (Current Management) includes about 1,261 AUMs rested that equals an annual value in cash receipts of about $120,000 per year. Current value of total labor income is estimated to be about $24,000 annually, equaling an estimated loss of one direct job due to the rested AUMs.

4.7.1.4 Alternative B (Proposed Action)

For Alternative B, a maximum of 6,648 AUMs would need to be rested annually over the 2.3 million acres of livestock grazing allotments within the Analysis Area (*Section 4.4 Livestock Grazing*). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term (two to three years) for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Alternative B would result in an annual reduction in cash receipts of about $631,000 per year (Table 65), as compared to Current Management. About six direct jobs would be lost due to the rested AUMs. Loss of direct labor income would be about $33,000 (Table 62).

4.7.1.5 Alternative C

For Alternative C, a maximum of 6,648 AUMs would need to be rested annually over the 2.3 million acres of livestock grazing allotments within the Analysis Area (*Section 4.4 Livestock Grazing*). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term (two to three years) for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Alternative C would result in an annual reduction in cash receipts of about $631,000 per year (Table 65), as compared to Current Management. About six direct jobs would be lost due to the rested AUMs. Loss of direct labor income would be about $33,000 (Table 65).

4.7.1.6 Alternative D

For Alternative D, a maximum of 6,852 AUMs would need to be rested annually over the 2.3 million acres of livestock grazing allotments within the Analysis Area (*Section 4.4 Livestock Grazing*). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term (two to three years) for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Alternative D would result in an annual reduction in cash receipts of about $651,000 per year (Table 65), as compared to Current Management. About seven direct jobs would be lost due to the rested AUMs. Loss of direct labor income would be about $34,000 (Table 65).

4.7.1.7 Alternative E

For Alternative E, a maximum of 8,649 AUMs would need to be rested annually over the 2.3 million acres of livestock grazing allotments within the Analysis Area (*Section 4.4 Livestock Grazing*). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term (two to three years) for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Alternative E would result in an annual reduction in cash receipts of about $821,000 per year (Table 65), as compared to Current Management. About eight direct jobs would be lost due to the rested AUMs. Loss of direct labor income would be about $43,000 (Table 65).

4.7.1.8 Alternative J (Preferred Alternative)

For Alternative J (Preferred Alternative), a maximum of 6,852 AUMs would need to be rested annually over the 2.3 million acres of livestock grazing allotments within the Analysis Area (*Section 4.4 Livestock Grazing*). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term (two to three years) for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Alternative J (Preferred Alternative) would result in an annual reduction in cash receipts of about $651,000 per year (Table 65), as compared to Current Management. About seven direct jobs would be lost due to the rested AUMs. Loss of direct labor income would be about $34,000 (Table 65).

Table 65. Changes in Receipts, Annual Employment, and Income from Rest of AUMs Compared to Current Management in the Three-County Region (Modoc, CA, Lake and Klamath, OR).[1]

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Maximum Rested AUMs in Analysis Area (rested AUMs per year)[2]	6,648	6,648	6,852	8,649	6,852
Average Rested AUMs in Analysis Area (rested AUMs per year)[3]	5,089	4,951	4,583	4,583	4,583
Total Cash Receipts (1000s dollars)	-$631	-$631	-$651	-$821	-$651
Employment (jobs)					
Direct	-6	-6	-7	-8	-7
Indirect	-4	-4	-4	-5	-4
Induced	-1	-1	-1	-1	-1
Total employment	-11	-11	-12	-15	-12
Income (1000s dollars)					
Direct	-$33	-$33	-$34	-$43	-$34
Indirect	-$76	-$76	-$78	-$99	-$78
Induced	-$20	-$20	-$20	-$26	-$20
Total Income	-$128	-$128	-$132	-$167	-$132

[1]Changes in AUMs are based upon changes from Alternative A (Current Management). The rested AUMs are located within the Analysis Area but the economic impact is evaluated based upon the three-county area (*Section 4.7.1.1 Methodology of Analysis*). Note: Numbers may not sum precisely due to rounding.

[2]Maximum is the largest amount of reduced AUMs in any year of treatment period.

[3]Average is the straight-line average AUM reduction over 50 years, regardless of the actual length of treatment period.

4.7.1.9 Cumulative Effects on Regional Economy

The regional economy accumulates all of the economic factors, including this Restoration Strategy. The economic impacts would be most dramatic for individual permitees that are forced to reduce their herds for two to three years. However, the cumulative effects of increased juniper density have included reductions in AUMs for some of the same permitees (*Section 4.4 Livestock Grazing*). If the restoration does not occur then continued density increases could produce further reductions in AUMs that would not be temporary. If permitees are forced out of business by reductions in AUMs long-term, that would have a more dramatic economic impact than short-term impacts associated with a more positive range condition trend.

4.7.2 LOCAL ECONOMICS

This section evaluates the economic effects of the Sage Steppe Ecosystem Restoration Strategy on the local economy, which is defined here as Modoc County. This analysis compares the adverse economic effects from reduced grazing to the positive economic effects of increased employment for implementation of the fire use and mechanical restoration treatments.

4.7.2.1 Methodology for Analysis

Local economics impacts were evaluated using the demand on FS and BLM personnel for prescribed fire implementation and the local ability to meet demand for mechanical restoration. Resources needed to accomplish the mechanical restoration treatments proposed in the alternatives were estimated based on conversations with Brad Seaburg and Dave Allen (local biomass operators), and Sean Curtis (Modoc County Resource Analyst) regarding the amount of workers and time needed. Resources needed to accomplish the prescribed burning treatments proposed in the alternatives were based on conversations with Dave McMasters (Modoc National Forest).

In addition to the demand for local resources, the local impacts from rested AUMs were evaluated for Modoc County. A single county IMPLAN model was developed to analyze impacts on Modoc County from rested AUMs. The regional economic effects on the livestock industry are evaluated above in *Section 4.7 Socioeconomics*.

4.7.2.2 Analysis Assumptions

The following assumptions were used to estimate local impacts to economics.

- Mechanical restoration of 20 acres per day would require five people per day on-site, two feller-buncher operators, two skidder operators, and a supervisor. This average is subject to wide variation as a result of the size and shape of the treatment units, the amount of biomass material on-site, topography, and skid distance to the chip truck (Seaburg pers. comm. 2006). In addition to these resources, three chip truck drivers would be needed to haul chips to the biomass plant. The total personnel resource commitment, on-site on a daily basis is eight people (Seaburg pers. comm. 2006).

- The operating season for mechanical restoration is typically about May 1 through October 31, or 180 days (Seaburg pers. comm. 2006).
- Local industry reports that on the average, sites have 10 bone dry tons per acre of biomass available for chipping (Seaburg pers. comm. 2006). For this analysis, restoration areas with different densities of juniper and accessibility were adjusted by the factors in Table 66.

Table 66. Factors Used to Adjust Available Biomass Based upon Density and Road Access.

Juniper Category	Adjustment Factor[1]
Dense juniper areas (>20% canopy closure and <1 mile from existing roads)	1.45
Less dense juniper areas (6-20% canopy closure and <1 mile from existing roads)	0.83
Isolated juniper areas (>20% canopy closure and greater than 1 mile from existing roads)	1.14

[1]The Adjustment Factors are multiplied by the number of acres in each category to adjust the values based upon Gedney *et al*. (1999) and Maxwell and Ward (1980).

- This analysis does not specify the source of labor or whether the labor would come from existing biomass operations or new operations.
- The average prescribed fire size each agency can accomplish in a single day would be approximately 500 acres (Savage pers. comm. 2006).
- Each agency has the capability of executing two (2) prescribed fire projects per week. For planning purposes of this analysis, it is assumed that approximately six weeks are available during which burning would occur. Therefore, at a rate of four burns per week, a total of 24 prescribed fires could be accomplished during the available days in the year with the current agency capability. Additional resources would be required to complete more than 24 burns in one year (JW Associates 2008f).
- There are 20 burn days available in the fall period and 60 days in the spring. However, constraints such as burn day conditions being outside of prescription values, site access in the spring period, only 50 percent of the 80 days are considered available. Therefore, it is assumed there are 40 available days in which BLM and FS could conduct burning activities (JW Associates 2008f).
- Typical staffing for prescribed burns would be two overhead team bosses, a 13-person firing crew, a 20-person hand crew, and a 5-person engine crew. Specific salaries for temporary employees would depend on the level of experience and FS and BLM funding.

The following are provided only for current information on the biomass industry in the Analysis Area.

- A biomass plant typically requires about 8,000 bone dry tons of forest residue per megawatt (MW) of power generated for one year. A 25 MW plant, which is a typical size in northern California, would require 200,000 bone dry tons of forest residue per year (Seaburg pers. comm. 2006).
- Within the Analysis Area, there are currently three biomass plants in operation located near Bieber, Litchfield and Burney.

4.7.2.3 Alternative A (Current Management)

The economic values associated with Alternative A are considered a baseline from which to compare the alternative effects of Alternatives B through J. Alternative A is Current Management and therefore the economic effects of this alternative are currently part of the economy. The economic effects of Alternative A are presented here for context.

It is estimated that mechanical restoration presently generates more than 3,200 tons of available bone dry tons of biomass per year (Table 66). Prescribed burning currently consists of an average of eight burns treating about 3,900 acres annually for a total cost of about $96,000 per year.

Alternative A (Current Management) rests 1,261 AUMs that results in an annual value in cash receipts of about $96,000 per year in Modoc County. Current loss of total labor income associated with the rested AUMs is estimated to be about $21,000 annually in Modoc County, resulting in the estimated loss of one direct job.

4.7.2.4 Alternative B (Proposed Action)

4.7.2.4.1 Direct Effects

Under Alternative B about 242,700 acres of different density would be subject to mechanical treatment, the largest among alternatives (Table 6). Alternative B would take 40 years to implement (Table 37), which would result in the production of an average of 16,300 tons per year. The production of available biomass is estimated at over 655,000 available bone dry tons (Table 67) more than Alternative A (Current Management). Alternative B would require an additional 12-14 seasonal employees to be involved in the on-site portion of mechanical treatment, including several personnel that would drive chip trucks to and from biomass plants (Table 68). Laborers are assumed to be trained forest and conservation technicians; the average annual salary for this occupation in Modoc County in 2006 was $30,646, for a total cost of $15,323 per person for six months[2]. Additionally, there would continue to be available forest residue biomass from private sources.

The largest number of acres (971,700) would be restored with prescribed fire under Alternative B (Proposed Action). Alternative B would require an additional 1,640 person days, at a cost of $492,000 per year for prescribed burning (Table 69). Alternative B would likely require

[2] California Employment Development Department, "Occupational Employment Statistics (OES) Employment and Wages by Occupation," Excel spreadsheet for Northern Mountains Region, July 2006 (accessed at http://www.labormarketinfo.edd.ca.gov/cgi/career/?PageID=3&SubID=152 on February 19, 2007)

additional labor resources for mechanical treatment and prescribed burning. In particular, the number of burns required to implement this alternative (41 burns) would require additional resources. As the number of burns per year increases, it is likely burning conditions may become more complex requiring more workers per burn than is typical or more numerous burns needed to accomplish the objective of burning 500 acres per day.

Some of the additional workers required for mechanical restoration and prescribed burning would come from outside Modoc County. These individuals would earn and spend some of their wages in the County, resulting in a long-term, beneficial effect during the 40 years required for project implementation. Regardless of whether employees are added to the economy or come from the existing labor force, there would be indirect, beneficial effects, both short and long-term. These effects include income, and sales generated from expending portions of that income in the region. Employment would likely be generated from the existing labor pool under Alternative B and would help sustain the existing economy.

Over 87,000 acres of grazing allotments would need to be rested annually (Figure 26) over the 2.3 million acres of range allotments within the Analysis Area (*Livestock Grazing Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008h]). Some impacts to the livestock industry would occur due to reduced income associated with reduced herd size. These impacts would be short-term for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

In 2002 in Modoc County, the agricultural and mining sector employed 746 employees, which represents multiple industries, including forestry. Under Alternative B, total annual livestock sales for Modoc County would be reduced by $505,000 compared to Current Management (Alternative A) resulting in a reduction in employment of seven jobs per year, with up to three in the ranching industry (Table 69). Loss of total income from rested AUM in Modoc County, which would affect other businesses and industries beyond ranchers, would be $109,000 per year. In the context of the current economy in Modoc County, seven employees represents about one percent of the total employees in the agriculture and mining industry sector, or fewer than three percent of livestock operations jobs (primary and secondary).

4.7.2.4.2 Cumulative Effects

The past, present and future foreseeable effects include forest management throughout the Analysis Area. Forest management would potentially require prescribed fire and mechanical treatments that would add to the positive economic impacts from this project. The details of these projects are not currently known.

The effects of adding mechanical treatments anticipated on private and other federal lands to Alternative B (Proposed Action) would be a positive cumulative effect in terms of local resources required to complete mechanical restoration. The total acres treated would increase by nearly 500,000 acres, increasing the amount of workers needed. Workers may need to come from outside the local area, and at a minimum, a proportion of their incomes would be spent within the local area, therefore benefiting the local economy.

The cumulative effects of the economic impacts of the prescribed burning program would be similar to the direct and indirect effects because proportionally little additional burning would occur on private lands. There would be a positive cumulative effect to the local economy.

During project implementation, AUMs rested would not be available for grazing which would have adverse economic impacts.

4.7.2.5 Alternative C

4.7.2.5.1 Direct Effects

Under Alternative C about 242,700 acres of different density would be subject to mechanical treatment, the largest among alternatives (Table 6). Alternative C would take 50 years to implement (Table 37), which would result in the production of an average of 30,520 tons per year. The production of available biomass is estimated at over 655,000 bone dry tons (Table 67) more than Alternative A (Current Management). Effects of Alternative C would be of the same type as Alternative B for mechanical treatment, but this alternative would require fewer additional workers, estimated at 8-12 seasonal workers, for project implementation (Table 68). For prescribed burning, there would be an additional 640 person days, at a cost of $192,000 per year (Table 69). Some of the additional workers required for mechanical restoration and prescribed burning would come from outside Modoc County. These individuals would earn and spend some of their wages in Modoc County, resulting in a long-term, beneficial effect during the 50 years required for project implementation.

The AUMs that would need to be rested annually would vary from over 43,000 to a maximum of 87,000 acres (Figure 26) over the 2.3 million acres of range allotments within the Analysis Area (*Livestock Grazing Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008h]). Impacts to the livestock industry would occur due to reduced income associated with reduced herd sizes. These impacts would be short-term for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Under Alternative C, annual livestock sales in Modoc County would be reduced by $505,000, as compared to current management (Table 69). Direct employment losses would be three jobs per year and direct labor income would be reduced by $19,000 (Table 69). Total labor income, which would affect businesses and industries beyond ranchers, would be reduced $109,000.

4.7.2.5.2 Cumulative Effects

The past, present and future foreseeable effects include forest management throughout the Analysis Area. Forest management would potentially require prescribed fire and mechanical treatments that would add to the positive economic impacts from this project. The details of these projects are not currently known.

The effects of adding mechanical treatments anticipated on private and other federal lands to Alternative C would be a positive cumulative effect in terms of local resources required to complete mechanical restoration. The total acres treated would increase by nearly 500,000 acres, increasing the amount of workers needed. Workers may need to come from outside the local area, and at a minimum, a proportion of their incomes would be spent within the local area, therefore benefiting the local economy.

The cumulative effects of the economic impacts of the prescribed burning program would be similar to the direct and indirect effects because proportionally little additional burning would occur on private lands. There still would be a positive cumulative effect to the local economy.

During project implementation, AUMs rested would not be available for grazing which would have adverse economic impacts.

4.7.2.6 Alternative D

4.7.2.6.1 Direct Effects

Under Alternative D about 515,300 acres of different density would be subject to mechanical treatment, the largest among alternatives (Table 6). Alternative D would take 40 years to implement (Table 37), which would result in the production of an average of 30,520 tons per year. The production of available biomass is estimated at over 1.2 million available bone dry tons (Table 67) more than Alternative A (Current Management). Alternative D would require an additional 22 seasonal employees to be involved in the on-site portion of mechanical treatment (Table 68). In the context of the current economy in Modoc County, 22 employees represent about three percent of the total employees in the agriculture and mining industry sector.

Alternative D would require an average of 28 additional days of prescribed fire (Table 69). Averaging personnel requirements and costs across all four decades results in 1,120 person days per year at a cost of $336,000.

The grazing allotments that would need to be rested annually would vary from over 70,000 to a maximum of 90,000 acres (Figure 26) over the 2.3 million acres of range allotments within the Analysis Area (*Livestock Grazing Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008h]). Impacts to the livestock industry would occur due to reduced income associated with reduced herd sizes. These impacts would be short-term for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Under Alternative D, annual livestock sales would be reduced in Modoc County by $521,000 (Table 69). Direct income would be reduced by $20,000, resulting in the loss of three direct jobs. Total income would be reduced by $112,000 resulting in the loss of seven total jobs (Table 69).

4.7.2.6.2 Cumulative Effects

The past, present and future foreseeable effects include forest management throughout the Analysis Area. Forest management would potentially require prescribed fire and mechanical treatments that would add to the positive economic impacts from this project. The details of these projects are not currently known.

The effects of adding mechanical treatments anticipated on private and other federal lands to Alternative D would be a positive cumulative effect in terms of local resources required to complete mechanical restoration. The total acres treated would increase by nearly 500,000 acres, increasing the amount of workers needed. Workers may need to come from outside the local area, and at a minimum, a proportion of their incomes would be spent within the local area, therefore benefiting the local economy.

The cumulative effects of the economic impacts of the prescribed burning program would be similar to the direct and indirect effects because proportionally little additional burning would occur on private lands. There still would be a positive cumulative effect to the local economy.

During project implementation, AUMs rested would not be available for grazing which would have adverse economic impacts.

4.7.2.7 Alternative E

4.7.2.7.1 Direct Effects

Under Alternative E about 515,300 acres of different density would be subject to mechanical treatment, the largest among alternatives (Table 6). Alternative D would take 33 years to implement (Table 37), which would result in the production of an average of nearly 37,000 tons per year. The production of available biomass is estimated at over 1.2 million available bone dry tons (Table 67) more than Alternative A (Current Management). Alternative E would require an additional 37 seasonal employees to be involved in the on-site portion of mechanical treatment (Table 68). In the context of the current economy in Modoc County, 37 employees represent about five percent of the total employees in the agriculture and mining industry sector. In 2002 in Modoc County, this sector employed 746 employees, representing multiple industries, including forestry.

Alternative E would require an average of 35 additional days of prescribed fire (Table 69). Averaging personnel requirements and costs results in 1,400 person days per year at a cost of $420,000.

The grazing allotments that would need to be rested annually would vary from over 94,000 to a maximum of 109,000 acres (Figure 26) over the 2.3 million acres of range allotments within the Analysis Area (*Livestock Grazing Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008h]). Impacts to the livestock industry would occur due to reduced income associated with reduced herd sizes. These impacts would be short-term for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Under Alternative E, annual livestock sales in Modoc County would be reduced by $657,000, (Table 69). Direct income would be reduced by $25,000, resulting in the loss of four direct jobs. Total income would be reduced by $142,000 resulting in the loss of nine total jobs (Table 69).

4.7.2.7.2 Cumulative Effects

The past, present and future foreseeable effects include forest management throughout the Analysis Area. Forest management would potentially require prescribed fire and mechanical treatments that would add to the positive economic impacts from this project. The details of these projects are not currently known.

The effects of adding mechanical treatments anticipated on private and other federal lands to Alternative E would be a positive cumulative effect in terms of local resources required to complete mechanical restoration. The total acres treated would increase by nearly 500,000 acres, increasing the amount of workers needed. Workers may need to come from outside the local area, and at a minimum, a proportion of their incomes would be spent within the local area, therefore benefiting the local economy.

The cumulative effects of the economic impacts of the prescribed burning program would be similar to the direct and indirect effects because proportionally little additional burning would occur on private lands. There still would be a positive cumulative effect to the local economy.

During project implementation, AUMs rested would not be available for grazing which would have adverse economic impacts.

4.7.2.8 Alternative J (Preferred Alternative)

4.7.2.8.1 Direct Effects

Under Alternative J (Preferred Alternative) about 515,300 acres of different density would be subject to mechanical treatment, the largest among alternatives (Table 6). Alternative J would take 47 years to implement (Table 37), which would result in the production of an average of nearly 26,000 tons per year. The production of available biomass is estimated at over 1.2 million available bone dry tons (Table 67) more than Alternative A (Current Management). Alternative J (Preferred Alternative) would require an additional 19 seasonal employees to be involved in the on-site portion of mechanical treatment (Table 68). In the context of the current economy in Modoc County, 19 employees represent about three percent of the total employees in the agriculture and mining industry sector.

Alternative J (Preferred Alternative) would require an average of 20 additional days of prescribed fire (Table 69). Averaging personnel requirements and costs across all five decades results in 800 person days per year at a cost of $260,000.

The grazing allotments that would need to be rested annually would vary from over 35,000 to a maximum of 90,000 acres (Figure 26) over the 2.3 million acres of range allotments within the Analysis Area (*Livestock Grazing Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008h]). Impacts to the livestock industry would occur due to reduced income associated with reduced herd sizes. These impacts would be short-term for individual ranchers but would be an adverse impact to the grazing industry for the duration of the restoration activities.

Under Alternative J (Preferred Alternative), annual livestock sales would be reduced in Modoc County by $521,000 (Table 69). Direct income would be reduced by $20,000, resulting in the loss of three direct jobs. Total income would be reduced by $112,000 resulting in the loss of seven total jobs (Table 69).

4.7.2.8.2 Cumulative Effects

The past, present and future foreseeable effects include forest management throughout the Analysis Area. Forest management would potentially require prescribed fire and mechanical treatments that would add to the positive economic impacts from this project. The details of these projects are not currently known.

The effects of adding mechanical treatments anticipated on private and other federal lands to Alternative J (Preferred Alternative) would be a positive cumulative effect in terms of local resources required to complete mechanical restoration. The total acres treated would increase by nearly 500,000 acres, increasing the amount of workers needed. Workers may need to come from outside the local area, and at a minimum, a proportion of their incomes would be spent within the local area, therefore benefiting the local economy.

The cumulative effects of the economic impacts of the prescribed burning program would be similar to the direct and indirect effects because proportionally little additional burning would occur on private lands. There still would be a positive cumulative effect to the local economy.

During project implementation, AUMs rested would not be available for grazing which would have adverse economic impacts.

Table 67. Commercially Available Biomass by Alternative (available bone dry tons)

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Increase over Alternative A (Current Management) in Decade 1	171,958	69,638	313,369	428,720	140,343
Increase over Alternative A (Current Management) in Decade 2	171,958	171,958	313,369	428,720	313,369
Increase over Alternative A (Current Management) in Decade 3	171,958	171,958	313,369	428,720	313,369
Increase over Alternative A (Current Management) in Decade 4	171,958	171,958	313,369	0	313,369
Increase over Alternative A (Current Management) in Decade 5	0	69,638	0	0	140,343
Increase in biomass produced over the five decades of implementation compared to Alternative A (Current Management)[1]	655,150	655,150	1,220,795	1,220,795	1,220,795
Biomass produced by Alternative A (Current Management)	163,413	163,413	163,413	163,413	163,413
Total Biomass over five decades	818,563	818,563	1,384,208	1,384,208	1,384,208

[1]Alternatives B and D complete restoration at the end of Decade 4, Alternative E completes mechanical restoration at the end of Decade 3 and Alternative J completes mechanical restoration at the end of year 47. Alternative A continues to produce 32,683 tons of biomass per decade. Therefore, the above table shows a smaller increase in biomass produced over the five decades than would be found by adding the total increase for each decade. For example, in Alternative B, total increase in biomass produced from Decade 1 to Decade 4 is 687,833 tons. However, the increase in biomass over the five-decade period is 655,150 tons because Alternative A produces 32,683 tons in Decade 5.

Table 68. Additional Resources Needed Annually for Mechanical Restoration Compared to Current Management[1]

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Person days	2,742	2,087	4,223	6,847	3,861
Local workers needed per year (six month period of employment)	12-14	8-12	22	37	19
Labor costs (1000s dollars)[2]	$230	$175	$355	$575	$327

[1]Analysis of alternatives assumes workers will work a 6-month season

[2]Costs do not include costs for biological or cultural resource surveys, or costs associated with contract administration if contractor resources are used.

Table 69. Additional Annual Personnel Resources and Costs for Prescribed Burning Compared to Current Management

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Number of worker days required[1]	1,640	640	1,120	1,400	800
Local workers needed per year[2]	12	5	8	10	6
Labor Costs (1000's dollars)[3]	$492	$192	$336	$420	$260

[1]Personnel and costs estimates based on a conversation with Dave McMasters, Modoc National Forest Fire specialist.

[2]Jobs would be temporary, seasonal jobs for the estimated 40 working day duration of the burning program each year.

[3]Costs do not include costs for biological or cultural resource surveys, or costs associated with contract administration if contractor resources are used.

Table 70. Changes in Receipts, Annual Employment, and Income as a Result of Rest of AUMs Compared to Current Management in Modoc County.[1]

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Maximum Rested AUMs in Modoc County (rested AUMs per year)[2]	5,318	5,318	5,481	6,919	5,481
Average Rested AUMs in Modoc County (rested AUMs per year)[3]	4,072	3,961	3,667	3,667	3,667
Total Cash Receipts (1000s dollars)	-$505	-$505	-$521	-$657	-$521
Employment (jobs)					
Direct	-3	-3	-3	-4	-3
Indirect	-3	-3	-3	-4	-3
Induced	-1	-1	-1	-1	-1
Total employment	-7	-7	-7	-9	-7
Income (1,000s dollars)					
Direct	-$19	-19	-$20	-$25	-$20
Indirect	-$80	-$80	-$83	-$105	-$83
Induced	-$10	-$10	-$10	-$12	-$10
Total Income	-$109	-$109	-$112	-$142	-$112

[1]Changes in AUMs are based upon changes from Alternative A (Current Management). The rested AUMs are located within Modoc County. Note: Numbers may not sum precisely due to rounding.

[2]Maximum is the largest amount of reduced AUMs in any year of treatment period.

[3]Average is the straight-line average AUM reduction over 50 years, regardless of the actual length of treatment period.

4.7.3 Environmental Justice

Environmental justice is a required analysis per USDA guidelines established for Executive Order 12898. Environmental justice was analyzed by examining and comparing the Analysis Area ethnic minority and income data with those for the states of California and Nevada. It was further analyzed by alternative, by determining job opportunities available and potential health risks associated with prescribed burning and mechanical treatment for each alternative. The civil rights impact analysis resulting in the following statement of impacts.

4.7.3.1 Alternative A (Current Management)

Effects on environmental justice are changes in job opportunities for and smoke related health effects to minority and low-income populations. Alternative A would not require additional personnel resources for prescribed burning and mechanical restoration, locally, or from outside the Analysis Area. As a result, Alternative A would not have a beneficial or an adverse impact on environmental justice based on providing additional income or job opportunities to an area that has disproportionately low income.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be negligible for Alternative A.

4.7.3.2 Alternative B (Proposed Action)

Alternative B would have a beneficial effect on job opportunities for minorities and low-income individuals in the Analysis Area. Mechanical treatment jobs would be conservation or forestry technician jobs, and each job would pay an estimated $15,323 during a six-month period of employment, for an annual payroll of $230,000, over current management. The prescribed burning jobs would be similar jobs but would be temporary, seasonal jobs for the estimated 40-woring day duration of the prescribed burning program each year. The annual payroll for these jobs would be $492,000.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be moderate for the four decades of implementation of Alternative B.

4.7.3.3 Alternative C

Alternative C would have a beneficial effect on job opportunities for minorities and low-income individuals in the Analysis Area. Mechanical treatment jobs would be conservation or forestry technician jobs, and each job would pay an estimated $15,323 during a six-month period of employment, for an annual payroll of $175,000, over current management. The prescribed burning jobs would be similar jobs but would be temporary, seasonal jobs for the estimated 40-woring day duration of the prescribed burning program each year. The annual payroll for these jobs would be $192,000.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be slight to low for the first two decades and moderate for the last three decades of implementation of Alternative C.

4.7.3.4 Alternative D

Alternative D would require additional labor resources for mechanical treatment and prescribed burning. Therefore, Alternative D would have a beneficial effect on job opportunities for minorities and low-income individuals in the Analysis Area. Mechanical treatment jobs would be conservation or forestry technician jobs, and each job would pay an estimated $15,323 during a six-month period of employment, for an annual payroll of $355,000, over current management. The prescribed burning jobs would be similar jobs but would be temporary, seasonal jobs for the estimated 40-woring day duration of the prescribed burning program each year. The annual payroll for these jobs would be $336,000.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be slight to low for the first two decades and low for the last two decades of implementation of Alternative D.

4.7.3.5 Alternative E

Alternative E would require additional labor resources for mechanical treatment and prescribed burning. Therefore, Alternative E would have a beneficial effect on job opportunities for minorities and low-income individuals in the Analysis Area. Mechanical treatment jobs would be conservation or forestry technician jobs, and each job would pay an estimated $15,323 during a six-month period of employment, for an annual payroll of $575,000, over current management. The prescribed burning jobs would be similar jobs but would be temporary, seasonal jobs for the estimated 40-woring day duration of the prescribed burning program each year. The annual payroll for these jobs would be $420,000.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be low for the first two decades and moderate for the 3rd decade and three years of the 4th decade of implementation of Alternative E.

4.7.3.6 Alternative J (Preferred Alternative)

Alternative J (Preferred Alternative) would require additional labor resources for mechanical treatment and prescribed burning. Therefore, Alternative J (Preferred Alternative) would have a beneficial effect on job opportunities for minorities and low-income individuals in the Analysis Area. Mechanical treatment jobs would be conservation or forestry technician jobs, and each job would pay an estimated $15,323 during a six-month period of employment, for an annual payroll of $327,000, over current management. The prescribed burning jobs would be similar jobs but would be temporary, seasonal jobs for the estimated 40-woring day duration of the prescribed burning program each year. The annual payroll for these jobs would be $260,000.

The prescribed burning would occur throughout the Focus Area and therefore, would not represent a disproportionate air quality health risk on minority or low-income populations. The health risk would be the same as the general population as described in the *Air Quality Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* (JW Associates 2008g). The health risk to minority or low-income populations from the prescribed burning proposed would be slight to low for the first two decades and low for the last three decades of implementation of Alternative J (Preferred Alternative).

4.7.4 Mule Deer Hunting Opportunities

Changes in opportunities for mule deer hunting were evaluated because deer hunting has been an important part of the local economy and has been declining due to reductions in mule deer populations (*Wildlife Specialist Report for the Sage Steppe Ecosystem Restoration Strategy* [JW Associates 2008c]). Tags are determined by California State Wildlife Commission based upon population levels. Opportunities for mule deer hunting were based on the potential for increasing mule deer populations by alternative.

Under Alternative A (Current Management), mule deer habitat and hunting opportunities in the Analysis Area would decline or remain stable. Without substantial efforts to improve mule deer populations through habitat improvement, deer populations would remain stable, or decline.

Alternatives B, C, D, E and J would restore approximately 1,300,000 acres after 33 to 50 years. If mule deer populations increase as a result of this habitat improvement and increase in forage quality, hunting opportunities for mule deer could increase if the California State Wildlife Commission increases the number of tags.

4.7.5 Summary Comparison of Alternatives

Table 71 shows a comparison of the effects of the alternatives on economics. Alternative E would require the most labor for implementing mechanical treatments and has the potential to result in the most beneficial effects on the regional and local economies. Alternative E has the second highest personnel requirements for implementing prescribed burns. However, Alternative E would have the greatest short-term impact on the livestock sector of the local economy, resulting in an annual loss of nine jobs for the time (two to five years) needed to rest some range allotments. In terms of short-term economic impacts to the livestock sector, Alternatives B and C would have the lowest impacts, followed by Alternatives D and J. For all alternatives, except Alternative A (Current Management), the number of jobs created through mechanical treatment and prescribed fire would offset the job losses from resting AUMs.

Table 71. Comparison of Alternative Effects on Annual Local Economics Compared to Current Management.

	Alt. B	Alt. C	Alt. D	Alt. E	Alt. J
Annual Effects due to Mechanical Treatments Compared to Current Management					
Labor required to achieve mechanical treatment (jobs)[1]	12-14 jobs	8-12 jobs	22 jobs	37 jobs	19 jobs
Long-term salary costs for mechanical treatment	$230,000	$175,000	$355,000	$575,000	$327,000
Annual Effects due to Prescribed Fire Treatments Compared to Current Management					
Labor required to achieve prescribed burning (jobs)[2]	12 jobs	5 jobs	8 jobs	10 jobs	6 jobs
Annual salary costs for prescribed burning	$492,000	$192,000	$336,000	$420,000	$260,000
Annual Effects in Modoc County due to Resting of AUMs[3] Compared to Current Management					
Short-term job loss in ranching and related industries (total employment)	-7 jobs	-7 jobs	-7 jobs	-9 jobs	-7 jobs
Short-term loss in livestock sales	-$505,000	-$505,000	-$521,000	-$657,000	-$521,000
Net Annual Effect	$217,000	-$138,000	$170,000	$338,000	$66,000

[1]Jobs would be conservation or forestry technician jobs, and would pay $15,323 during a six-month period of employment.

[2]Jobs would be temporary, seasonal jobs for the estimated 40-working day duration of the burning program each year.

[3]Annual effects to the three county area due to resting of AUMs are presented in Table 65.

4.8 Cultural Resources

4.8.1 Management Direction for Cultural Resources

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for cultural resources through management directives, standards, and guidelines.

Goals for cultural resources from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Protect and manage cultural resources as a non-renewable resource.
- Complete an inventory and evaluation of the Forest's cultural resources by 2050.
- Provide information for public education and enjoyment of the Forest's cultural resources.
- Protect access and use of sites and locations important to traditional Native American religious and cultural practices.

Goals for cultural resources from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- **Preservation and Protection** – Cultural and paleontological resources would be preserved and protected to ensure their availability for appropriate uses by present and future generations in accordance with existing laws, regulations, and executive orders.
- **Survey and Inventory** – Imminent threats to cultural resources from human-caused or natural deterioration would be substantially reduced or eliminated. Potential future conflicts with other land uses would be reduced through identification of priority geographic areas for future inventory of cultural resources.
- **Education and Interpretation** – Public interest, understanding, appreciation, and sensitivity toward cultural and paleontological resources, and Native American issues, would be encouraged and accommodated.
- **Native American Consultation** – Provision would be made for Native American use of traditional cultural properties and culturally significant economic resources. Areas that fulfill defined criteria would be nominated as traditional cultural properties (TCP).

4.8.2 Methodology for Analysis

The following criteria are used to evaluate the potential effects of the Proposed Action and alternatives on Cultural Resources.

- Potential human health impacts from smoke resulting from prescribed fires.
- Effects on culturally important wildlife and botanical species.
- Comparative risks to cultural sites for each restoration treatment, including not being able to control prescribed fires, risk of damage from machines, and risk of discovery by vandals.

Potential human health impacts from smoke resulting from prescribed fires are analyzed in *Section 4.3.3 Air Quality*. Culturally important wildlife species are analyzed in *Section 4.6.8 Culturally Important Small Mammals*. Culturally important botanical species include epos (*Perideridia spp*.) and Western juniper. *Section 3.10.8 Culturally Significant Current Uses for Native Americans* describes that there are some specific epos gathering areas in the Analysis Area. Smaller fields that are used by various families are also present throughout the Analysis Area. Different parts of the juniper trees, including berries and leaves are important for various spiritual and cultural practices.

4.8.3 Cultural Resources Effects Common to All Alternatives

4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act

Important cultural values in the Analysis Area include prehistoric sites and artifacts, historic sites and structures, and traditional Native American uses. It is highly likely that cultural sites would be protected for all alternatives with the implementation of specific guidelines. Protection would come through conventional methods outlined by compliance with the National Historic Preservation Act that include but are not limited to:

- The identification of cultural resources through the inventory of project areas
- Consultation with the appropriate Native American Tribe
- Background literature and previous research review
- Avoidance of cultural resources where appropriate.

There do exist Programmatic Agreements with the California and Nevada Offices of Historic Preservation and Native American groups within the Analysis Area. These agreements will be reviewed for their potential for modification and use during this project. If those agreements cannot be adequately modified then new agreements would be drafted to guide the identification, treatment and protection of cultural/heritage resources during the implementation period.

These cultural resources guidelines would establish a system of evaluation and approval that would allow restoration of the sage steppe ecosystem while preserving cultural values.

4.8.3.2 Preservation of the Traditional Uses of Juniper

Section 4.2 Vegetation provides an analysis of the remaining juniper component in the Focus Area following implementation of the alternatives. All alternatives would maintain over 124,700 acres of dense juniper across the Focus Area. As implementation proceeds, the density of juniper would continue to increase in untreated areas. Additionally, treated areas would have juniper seeding in, as occurred under historical conditions. Old growth juniper would be preserved through a Design Standard (*Section 2.4.4 Old Growth Juniper*). *Section 4.2 Vegetation* provides an in-depth discussion regarding goals for juniper across the landscape based upon historical information. The area of juniper remaining under all alternatives would be more than adequate to provide for the traditional uses of juniper, including juniper berries, leaves, and firewood.

4.8.3.3 Restoration Risks

All alternatives have a risk of disturbing cultural resources due to proposed activities. The types of effects by restoration method and possible avoidance are common to all alternatives. These effects are described below.

4.8.3.3.1 Prescribed Fire

The risks of using prescribed fire for restoration include damage to cultural sites from the fire, fires that get out of control and increase in intensity, and damage from starting, managing and suppressing fires. Prescribed burn impacts to archaeological sites vary in nature, and are affected by topography, fuel load and the extent of the archaeological site. At prehistoric sites, impacts can be devastating: the thermal heating can result in fracture and explosion of artifacts as well as the resetting of the hydration rind. In the Great Basin, obsidian hydration is an important analytical tool for assessing a site's chronological attributes and can provide pertinent information regarding hunter-gatherer mobility, subsistence and settlement patterns, exchange and a host of other relevant issues. For cultural resource management purposes this dating method can be used to evaluate a site's significance and potential eligibility for the NRHP. It is has been shown that moderate to high intensity fires can negatively affect the hydration rind on an artifact, causing a vague to unreadable diffusion front (Origer 1986). Under the right circumstances, i.e. light to moderate fuel loads that burn off quickly before reaching the critical temperature, there would be little impact to flaked and ground stone artifacts (Halford 1999). Fire can also have destructive effects to historic resources such as buildings and barbed wire fences.

4.8.3.3.2 Mechanical Restoration

Studies completed in coniferous forests have shown that the duff layer tends to protect cultural deposits. The concern in juniper harvesting is that while most soil types within conifer stands tends to have a large “0” (organic) horizon that duff layer is often lacking within dense juniper stands. Therefore, there is a greater concern regarding impacts from mechanical harvesting equipment to cultural deposits that are within or on top of bare, clay soils.

In harvesting operations where heavy equipment is the principle means of harvesting timber, all types of cultural resources can be damaged or destroyed. Archaeological remains are particularly susceptible to damage or destruction if the heavy equipment disturbs the surface soil layers, since it is within these layers that such resources are typically found. In one study, (Emerson 1998) researchers discovered that subsurface disturbance within sites was highly varied, and depended in large part on where equipment was driven. Obviously the areas that were directly trafficked by machinery were likely to sustain the most damage.

The most direct effect of mechanical treatments would be the crushing and breaking of surface artifacts, however similar effects could also occur to subsurface deposits as a result of compaction. Oliver *et al.* (1994) notes that different tractor logging systems affect soil differently: tractors with treads compact soil less than tractors with rubber tires. Dispersion and mixing of cultural soils and destruction of features could occur as a result of dragging logs through sites, as well as driving through them.

4.8.3.3.3 Avoidance of Cultural Sites

Because of the risks to archaeological sites and objects from restoration treatments described above, the most widely used technique has been to flag and avoid those areas. There are some unintended potential adverse impacts to the flag and avoid approach. One of these impacts is that an "island" is created in an otherwise open area, inviting public land users to investigate. This could lead to collection of artifacts, illegal excavations, and other "looting" related problems. Another impact could be related to the lack of shade in treated areas, making such islands a favored resting area for livestock and deer during hot weather creating concentrated ground disturbance. There could be a higher fuel load in uncut islands that could burn lead to wildfire burning through a site.

4.8.4 ALTERNATIVE A (CURRENT MANAGEMENT)

4.8.4.1 Direct and Indirect Effects

4.8.4.1.1 Epos Gathering Areas

Alternative A does not propose any restoration treatments within epos gathering areas. Therefore, there would be no adverse direct effects on the epos gathering areas from restoration treatments. However, the lack of substantial restoration would mean that juniper would continue to increase in density across the area and could lead to reduced epos production due to competition with juniper for nutrients and water.

4.8.4.1.2 Restoration Risks

The specific risks of using prescribed fire and mechanical treatments for restoration are similar to those described under *Effects Common to All Alternatives*. Alternative A proposes to use a mix of 73 percent fire use and 23 percent mechanical restoration treatments. The relatively small area (5,000 acres) treated per year makes this alternative have a minimal risk of adverse effects to cultural resources from the restoration treatments.

4.8.4.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1*

Cultural Site and Value Preservation – National Historic Preservation Act would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative A combined with the other federal, private and other activities would be a minimal risk to adverse effects on cultural resources. The measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

4.8.5 Alternative B (Proposed Action)

4.8.5.1 Direct and Indirect Effects

4.8.5.1.1 Epos Gathering Areas

There would be approximately 46,800 acres of mechanical treatment and 124,500 acres of fire use treatment within the identified epos areas (*Section 3.10.8 Culturally Significant Current Uses for Native Americans)* should Alternative B be implemented. These treatments have some risks of damage to epos areas but also have the positive effects of restoring these areas so that increases in juniper density does not further reduce the ability of the area to grow Epos. If the consultation and other aspects of implementation described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* are followed then the treatments in Epos areas would have some short-term impacts but would have positive long-term effects.

4.8.5.1.2 Restoration Risks

The specific risks of using prescribed fire and mechanical treatments for restoration are similar to those described under *Effects Common to All Alternatives*. Alternative B would restore more than 1.2 million acres so the risks would be spread over a large area. The extent of the proposed activities would pose a moderate risk of adverse effects. Monitoring of restoration activities and application of the measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be required to ensure that these effects are acceptable.

The BLM and FS are currently working on research to aid in the protection of cultural resources from the potential effects described in Alternative A. The results of those efforts may yield some different approaches that would reduce the risks of adverse effects from this alternative, particularly given the long timeframe for completion of the activities.

4.8.5.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative B combined with the other federal, private and other activities would be a moderate risk to adverse effects on cultural resources. The measures described in

Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act would be adequate to ensure that the cumulative effects are not significant.

4.8.6 Alternative C

4.8.6.1 Direct and Indirect Effects

Alternative C would have very similar direct and indirect effects to Alternative B. They would be somewhat less than Alternative B due to the slower restoration rate.

4.8.6.1.1 Epos Gathering Areas

The effects of Alternative C on Epos gathering areas would be essentially the same as Alternative A. The lower rate of restoration in the first two decades may allow more for thorough consultation, monitoring and adjustments of avoidance techniques. If the consultation and other aspects of implementation described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* are followed then the treatments in Epos areas would have some short-term impacts but would have positive long-term effects.

4.8.6.1.2 Restoration Risks

The risks of using prescribed fire and mechanical treatments for restoration would be the same as those described for Alternative B, in the short-term. However, because this alternative has a slower initial rate of restoration, more of the area may be able to be restored under improved approaches for the protection of cultural resources therefore reducing the risk compared to Alternative B. Monitoring of restoration activities and application of the measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be required to ensure that these effects are acceptable.

4.8.6.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative C combined with the other federal, private and other activities would be a moderate risk to adverse effects on cultural resources. Alternative C would have very similar cumulative effects to Alternative B. They would be somewhat less than Alternative B due to the slower restoration rate. The measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

4.8.7 Alternative D

4.8.7.1 Direct and Indirect Effects

Alternative D would have very similar direct and indirect effects to Alternative B.

4.8.7.1.1 Epos Gathering Areas

There would be approximately 68,500 acres of mechanical treatment and 102,900 acres of prescribed fire treatment within the identified Epos areas. These treatments have some risks of damage to epos areas but also have the positive effects of restoring these areas so that increases in juniper density does not further reduce the ability of the area to grow Epos. If the consultation and other aspects of implementation described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* are followed then the treatments in Epos areas would have some short-term impacts but would have positive long-term effects.

4.8.7.1.2 Restoration Risks

The risks of using prescribed fire and mechanical treatments for restoration would be the same as those described for Alternative B, in the short-term. However, because this alternative has a smaller percentage of prescribed fire and a slower initial rate of restoration, the effects may be less. Additionally, more of the area may be able to be restored under improved approaches for the protection of cultural resources (see *Alternative B* discussion) therefore reducing the risk compared to Alternative B. Monitoring of restoration activities and application of the measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be required to ensure that these effects are acceptable.

4.8.7.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative D combined with the other federal, private and other activities would be a moderate risk to adverse effects on cultural resources. Alternative D would have very similar cumulative effects to Alternative B. The measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

4.8.8 Alternative E

4.8.8.1 Direct and Indirect Effects

4.8.8.1.1 Epos Gathering Areas

The effects of Alternative E on Epos gathering areas would be essentially the same as Alternative D. The higher rate of restoration and larger area restored would make consultation, etc. under this alternative essential to the success of this alternative. If the consultation and other aspects of implementation described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* are followed then the treatments in Epos areas would have some short-term impacts but would have positive long-term effects.

4.8.8.1.2 Restoration Risks

The risks of using prescribed fire and mechanical treatments for restoration would be the same as those described for Alternative B, in the short-term. However, because this alternative has a smaller percentage of prescribed fire restoration, more of the area may be able to be restored under improved approaches for the protection of cultural resources (see *Alternative B* discussion) therefore reducing the risk compared to Alternative B. Monitoring of restoration activities and application of the measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be required to ensure that these effects are acceptable.

4.8.8.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative E combined with the other federal, private and other activities would be a moderate risk to adverse effects on cultural resources. Alternative E would have very similar cumulative effects to Alternative B. They would be somewhat more than Alternative B due to the faster restoration rate. The measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

4.8.9 Alternative J (Preferred Alternative)

4.8.9.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would have very similar direct and indirect effects to Alternative B.

4.8.9.1.1 Epos Gathering Areas

There would be approximately 68,500 acres of mechanical treatment and 102,900 acres of prescribed fire treatment within the identified Epos areas. These treatments have some risks of damage to epos areas but also have the positive effects of restoring these areas so that increases in juniper density does not further reduce the ability of the area to grow Epos. If the consultation and other aspects of implementation described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* are followed then the treatments in Epos areas would have some short-term impacts but would have positive long-term effects.

4.8.9.1.2 Restoration Risks

The risks of using prescribed fire and mechanical treatments for restoration would be the same as those described for Alternative B, in the short-term. However, because this alternative has a smaller percentage of prescribed fire and a slower initial rate of restoration, the risk may be less. Additionally, more of the area may be able to be restored under improved approaches for the protection of cultural resources (see *Alternative B* discussion) therefore reducing the risk compared to Alternative B. Monitoring of restoration activities and application of the measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be required to ensure that these effects are acceptable.

4.8.9.2 Cumulative Effects

The past, present and future foreseeable effects include continued livestock grazing, impacts from roads, firewood gathering and forest management throughout the Analysis Area. All of these management activities would be subject to measures similar to those described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

The effects of Alternative J (Preferred Alternative) combined with the other federal, private and other activities would be a moderate risk to adverse effects on cultural resources. Alternative J (Preferred Alternative) would have very similar cumulative effects to Alternative B. The measures described in *Section 4.8.3.1 Cultural Site and Value Preservation – National Historic Preservation Act* would be adequate to ensure that the cumulative effects are not significant.

4.9 Scenic Resources

4.9.1 INTRODUCTION

Scenic resources are not identified in the Purpose and Need for this project. Public scoping did not identify any issues for scenic resources. However, this project would change the scenic character of portions of the landscape. Management direction for both the FS and BLM requires evaluations of changes in scenic quality; therefore, scenic resources are evaluated based upon management direction for both agencies.

Moving areas from being juniper-dominated to sagebrush and grassland, and the restoration treatments, would have some visual effects on the landscape. The sage steppe vegetation type currently exists and is a natural part of the landscape. The changes would be in the proportions of the landscape that are dominated by juniper and sagebrush. Figures 3 and 4 show a photographic comparison of a typical sage steppe location in 1906 compared to the same site in 2007. The restoration treatments would create sage steppe landscapes similar to the 1906 view of the XL Ranch. In all areas of restoration treatment, the scenic landscape would be changed.

Visual effects are caused by physical alterations that show up visually as contrasts between the existing characteristic landscape, and modifications to that landscape by land management related activities. The types of activities that commonly cause visual effects include road building and removal of vegetation. "Contrast", in visual terms, means changes in the major visual elements; form, line, color, and texture. Visual contrast may be seen in modification of landforms, vegetative patterns, and structures.

The changes caused by restoration treatments may be noticeable to visually sensitive viewers, or may be noticeable to viewers (both residents and visitors) in visually sensitive areas. Visually sensitive viewers are likely to include visitors that come to the Analysis Area to view scenery and have come to expect views of increasing juniper. In a randomly sampled population of northern Californians (study group called non-residents) and a separately sampled population of residents living within northeastern California, northwestern Washoe County, Nevada and Klamath Falls, Oregon, researchers found that "*Over 82 percent of non-residents and 68 percent of residents agreed that maintaining the natural undeveloped appearance and vistas of the northeastern California and northwestern Nevada region was extremely important*" (Tierney and Rosegard 2002).

On BLM lands, visually sensitive areas are areas with high levels of recreation use, high levels of public interest, and areas with special designations, such as a wilderness area or wilderness study area (BLM VRM manual 8410). Similarly, on FS managed lands, concern levels are "*a measure of public importance placed on landscapes viewed from travelways and use areas*" (Scenery Management System Handbook, 1994:98).

The Analysis Area does have visually sensitive areas (*Section 3.11 Scenic Resources*), and areas with high concern levels. These tend to be areas that offer views of outstanding scenery, such as from Highway 395 looking east toward the Warner Mountains, and the Modoc Volcanic Scenic Byway, located west of Alturas. However, substantial portions of the travel routes within the Analysis Area do not offer views of outstanding scenic resources, or areas with special designations. For example, there are portions of Highway 395 in Lassen County that bisect areas where juniper encroachment has occurred, and there is little visual variety in terms of water features, topographic relief, or unique landforms. These BLM lands tend to have visual resource management objectives that allow for some degree of landscape modification. There are also many portions of the Modoc National Forest located north and west of Alturas with visual objectives that allow for modification (see Figure 18).

4.9.2 Management Direction for Visual Quality

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for scenic resources through management directives, standards, and guidelines.

Goals for scenic resources from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Maintain or improve the scenic attractiveness of the Forest as seen from major public use areas. Manage visual resources to meet or exceed adopted visual quality objectives (VQOs).
- Rehabilitate areas not meeting VQOs.

Goals for scenic resources from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- Events, management activities, and development of all kinds occurring on public lands administered by the BLM will remain consistent with established visual resource management class objectives.

4.9.3 Methodology for Analysis

Most analysis tools for visual effects rely on determining whether visual objectives for an area can be met. These tools assume that the desired condition is variable within the existing characteristic landscape. The degree of allowable alterations to the existing landscape depends on the type of visual objective described below. However, implementation of the Sage Steppe Ecosystem Restoration Strategy would change the desired visual character of some areas from the existing visual character of juniper-dominated vegetation to the desired visual character of sagebrush and grassland mosaic with scattered juniper trees and woodlands.

On FS managed lands, visual effects were analyzed in the context of Visual Quality Objectives (VQOs). On BLM lands, effects were analyzed using the Visual Resource Management (VRM) approach. Both the BLM and FS visual management systems assess scenic values through a process based on visual variety class, distance zones, and viewer sensitivity. Both systems involve determining impacts in terms of whether or not visual quality management objectives can be met.

The BLM's VRM system explicitly uses a contrast rating system to assess visual impacts by noting via trained observers the degree of change in the existing characteristic landscape that is created by a management action. The FS, however, is less explicit in specifying how contrasts with the characteristic landscape should be measured. For situations where Visual Quality Objectives cannot be met, the FS explicitly mentions particular time frames for attainment of objectives; the BLM's VMS does not specify timeframes.

Long-term changes in visual quality as a result of this Restoration Strategy would be acceptable within the VQO and VRM systems, because the characteristic landscape that would be created is natural and part of the expectations of people viewing the landscape. Restored areas would blend into existing adjacent sagebrush and grassland areas, as well as adjacent juniper woodlands within a few years of the treatments.

The short-term impacts (smoke, vehicles, large trucks and machines) for both fire use and mechanical treatments would have negative scenic impacts if they are clearly noticeable within the sensitive viewsheds.

For this analysis, the following qualitative impact levels are used to analyze short-term effects on scenic quality. The determination of what impact level applies to each alternative was based upon; the combined impacts of prescribed burning and mechanical treatments within FS Preservation and Retention VQOs, and BLM Class I and II VRM classes; the percentage of restoration treatments that would need to occur within those classes in the same decade; and professional judgment based upon past experiences with the VQO and VMS.

- ***Negligible*****:** Scenic quality would not change. Restoration treatments within FS Preservation and Retention VQOs, and BLM Class I and II VRM classes would cover a small area so that scenic impacts are not expected.
- ***Low Probability***: There would be a low probability that scenic quality would be impacted. The scenic changes would cover a small area of the FS Preservation and Retention VQOs, and BLM Class I and II VRM classes and would not be noticed by most people.
- ***Moderate Probability*****:** There would be a moderate probability that scenic quality would be impacted. The scenic changes would be moderate, cover a moderate area of the FS Preservation and Retention VQOs, and BLM Class I and II VRM classes, and be noticeable by most people.
- ***High Probability*****:** There would be a high probability that scenic quality would be impacted. The scenic changes would be dramatic, cover a large area of the FS Preservation and Retention VQOs, and BLM Class I and II VRM classes, and be very evident to anyone that views the area.

4.9.3.1 Analysis Assumptions

The following assumptions were used to determine short-term (less than 10 years) impacts to scenic resources based on comparing restored landscapes to existing landscapes.

- There would be no visual effects resulting from mechanical treatments when viewed from background distances (distances greater than five miles). This is because background items such as trees and sagebrush are barely discernible to the naked eye at those distances.
- Effects from mechanical treatment would persist for up to 10 years, until the effects of the restoration treatments are not noticeable.
- Prescribed fire effects would be evident viewed from foreground, and middleground distances. Effects would only occur during project implementation, which is assumed to include the flaming and smoldering phases of prescribed burns.

4.9.4 Scenic Resources Effects Common to all Alternatives

As mentioned, the desired landscape condition for the sage steppe restoration area is not the characteristic landscape that currently exists. Therefore, one of the project's objectives is to change the characteristic landscape to one that more closely resembles what existed more than 100 years ago. In areas with high densities of juniper, this would increase visual variety across the landscape, resulting in neutral or positive long-term effect. Management activities and changes to the character of the landscape may be evident in visually sensitive areas. Vegetation left in pockets, stringers and feathered edges could reduce impacts to visual resources. However, as discussed below, much of the Analysis Area has visual quality objectives/visual resource management classes that allow for some modification of the characteristic landscape. There would be no mechanical restoration in Wilderness Study Areas (WSAs) on BLM lands. These areas are classified as VRM Class 1.

4.9.5 Alternative A (Current Management)

4.9.5.1 Direct and Indirect Effects

The restoration treatments would likely be widely distributed across the landscape, minimizing impacts to scenic resources. Alternative A would result in some short-term scenic impacts but would have negligible impacts to scenic resources. This conclusion is based on the relatively small amount of restoration treatments within FS Preservation and Retention VQOs, and BLM Class I and II VRM classes and consequent scenic impacts across the large Analysis Area.

As recreation use increases throughout the Analysis Area, it is likely there would be an in increase in the number of areas considered visually sensitive. Areas likely to become more visually sensitive areas include designated National Scenic Byways which include portions of Highway 395, Highway 139, and Highway 299, as well as travel routes adjacent to BLM WSAs. Existing visually sensitive areas include recreation areas such as Eagle Lake and the South Warner Wilderness. Areas that already are considered visually sensitive would experience increased visitation as a result of population growth within the Analysis Area. As visual sensitivity increases throughout the Analysis Area, there may be a need to update VQOs or VRM classes. Treatment activities would then need to be reviewed, and potentially changed, to be consistent with the new VQO or VRM classes.

4.9.5.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

New permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects.

New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative A include an additional 486,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 730,000 acres. The effects of Alternative A (Current Management) combined with the effects of restoration treatments on other lands would result in some short-term scenic impacts but would have negligible impacts. The restoration treatments would have a neutral or positive long-term scenic impact.

4.9.6 Alternative B (Proposed Action)

4.9.6.1 Direct Effects

Direct effects of Alternative B (Proposed Action) would include short-term impacts on views of the landscape during project implementation. For mechanical and hand treatments the degree of contrast between treated areas and the characteristic landscape would be most evident in areas viewed in the foreground (½ mile or less), and areas where there are dense juniper stands. This effect would be more noticeable in areas with at least moderate slopes (greater than 20 percent).

The combined area with restoration treatments within FS Preservation and Retention VQOs would total 10 percent of those areas (Table 72). The combined area with restoration treatments within BLM Class I and II VRM classes would total 42 percent of those areas (Table 73). The restoration would occur over 40 years; therefore nearly three percent per decade within FS Preservation and Retention VQOs and more than 10 percent per decade within BLM Class I and II VRM classes would be treated (Table 74). The result of the rate of treatment, treatment type, and percentage of area per decade within the visually sensitive areas would combine to have a high probability that scenic quality would be impacted.

Other direct effects include views of prescribed burning activities, in particular smoke emissions. Emissions may appear as a point source (single plume) or as a dispersed cloud. Effects of burning would persist for the duration of the burn, including flaming and smoldering portions. Within visually sensitive areas, most burning activities would occur on BLM/Alturas Field Office lands and Modoc National Forest lands. Depending on smoke dispersion, this could result in concentrated effects of smoke emissions in one portion of the Analysis Area, while other areas would experience highly dispersed impacts.

4.9.6.2 Indirect Effects

Indirect effects would include changes in views of scenic resources that persist for relatively long periods of time. During implementation of restoration treatments some visitors would experience scenic impacts when views are from short distances (½ mile or less) in visually sensitive areas. Views from scenic byways or viewpoints could be improved. Some areas along Highways 139, 299, and 395 could benefit from treatments depending on the size of the treatment, the distance of the view of the treatment, and whether scenic quality (increased visual variety) would be improved by the treatment. However, due to the recovery time (up to 10 years) and the number of acres subject to mechanical treatment, this activity would result in substantial impacts to scenic resources in the short-term.

4.9.6.3 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative B include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. If treatments on private and other federal lands are implemented during the short-term impact period, there would be cumulative scenic impacts. Alternative B would have a high probability that scenic quality would have short-term cumulative effects on scenic resources.

4.9.7 ALTERNATIVE C

4.9.7.1 Direct Effects

Direct effects would be similar to Alternative B (Proposed Action), but the area of those effects would be lower in the first two decades of treatment. Direct effects of Alternative C would include short-term impacts on views of the landscape during project implementation. For mechanical and hand treatments the degree of contrast between treated areas and the characteristic landscape would be most evident in areas viewed in the foreground (½ mile or less), and areas where there are dense juniper stands. This effect would be more noticeable in areas with at least moderate slopes (greater than 20 percent).

The combined area with restoration treatments within FS Preservation and Retention VQOs would total 10 percent of those areas (Table 72). The combined area with restoration treatments within BLM Class I and II VRM classes would total 42 percent of those areas (Table 73). The restoration would occur over 50 years, therefore about two percent per decade within FS Preservation and Retention VQOs and about eight percent per decade within BLM Class I and II VRM classes would be treated (Table 74). The result of the rate of treatment, treatment type, and percentage of area per decade within the visually sensitive areas would combine to have a moderate probability that scenic quality would be impacted.

Other direct effects include views of prescribed burning activities, in particular smoke emissions. Emissions may appear as a point source (single plume) or as a dispersed cloud. Effects of burning would persist for the duration of the burn, including flaming and smoldering portions. Within visually sensitive areas, most burning activities would occur on BLM/Alturas Field Office lands and Modoc National Forest lands. Depending on smoke dispersion, this could result in concentrated effects of smoke emissions in one portion of the Analysis Area, while other areas would experience highly dispersed impacts.

4.9.7.2 Indirect Effects

Indirect effects would be of the same type as for Alternative B (the Proposed Action), but the area of those effects would be lower early in the project as a result of the lower treatment rate in the first two decades. However, due to the time required for restoration to a sage steppe ecosystem on sites experiencing mechanical treatment and the relatively large number of acres being treated, there would still be substantial impacts to scenic resources in the short-term.

4.9.7.3 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative C include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. If treatments on private and other federal lands are implemented during the short-term impact period, there would be cumulative scenic impacts. Alternative C would have a moderate probability that scenic quality would have short-term cumulative effects on scenic resources.

4.9.8 ALTERNATIVE D

4.9.8.1 Direct Effects

Effects of Alternative D would be similar to Alternative B (Proposed Action), however mechanical treatments would cover twice the area in visually sensitive areas as Alternative B. Direct effects of Alternative D would include short-term impacts on views of the landscape during project implementation. For mechanical and hand treatments the degree of contrast between treated areas and the characteristic landscape would be most evident in areas viewed in the foreground (½ mile or less), and areas where there are dense juniper stands. This effect would be more noticeable in areas with at least moderate slopes (greater than 20 percent).

The combined area with restoration treatments within FS Preservation and Retention VQOs would total 10 percent of those areas (Table 72). The combined area with restoration treatments within BLM Class I and II VRM classes would total 42 percent of those areas (Table 73). The restoration would occur over 40 years; therefore nearly three percent per decade within FS Preservation and Retention VQOs and more than 10 percent per decade within BLM Class I and II VRM classes would be treated (Table 74). The result of the rate of treatment, treatment type, and percentage of area per decade within the visually sensitive areas would combine to have a high probability that scenic quality would be impacted.

Other direct effects include views of prescribed burning activities, in particular smoke emissions. Emissions may appear as a point source (single plume) or as a dispersed cloud. Effects of burning would persist for the duration of the burn, including flaming and smoldering portions. Within visually sensitive areas, most burning activities would occur on BLM/Alturas Field Office lands and Modoc National Forest lands. Depending on smoke dispersion, this could result in concentrated effects of smoke emissions in one portion of the Analysis Area, while other areas would experience highly dispersed impacts.

4.9.8.2 Indirect Effects

Compared to Alternatives B and C, the landscape would have a different appearance over a greater number of acres at any point in time due to higher percentage of mechanical treatments. This would result in more dramatic short-term effects on scenic resources.

4.9.8.3 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. If treatments on private and other federal lands are done at the same times and in adjacent areas to Focus Area lands, there would be substantial short-term cumulative impacts. The cumulative effects of Alternative D would be similar to Alternative B with the main difference being a larger proportion of mechanical treatment compared to fire use. Alternative D would have a high probability that scenic quality would have short-term cumulative effects on scenic resources.

4.9.9 Alternative E

4.9.9.1 Direct Effects

Effects of Alternative E would be similar to Alternatives B (Proposed Action) and D, however mechanical treatments would cover twice the area in visually sensitive areas as Alternative B and the rate of restoration would be more than both Alternative B and D. Direct effects of Alternative E would include short-term impacts on views of the landscape during project implementation. For mechanical and hand treatments the degree of contrast between treated areas and the characteristic landscape would be most evident in areas viewed in the foreground (½ mile or less), and areas where there are dense juniper stands. This effect would be more noticeable in areas with at least moderate slopes (greater than 20 percent).

The combined area with restoration treatments within FS Preservation and Retention VQOs would total 10 percent of those areas (Table 72). The combined area with restoration treatments within BLM Class I and II VRM classes would total 42 percent of those areas (Table 73). The restoration would occur over 33 years, therefore more than three percent per decade within FS Preservation and Retention VQOs and more than 12 percent per decade within BLM Class I and II VRM classes would be treated (Table 74). The result of the rate of treatment, treatment type, and percentage of area per decade within the visually sensitive areas would combine to have a high probability that scenic quality would be impacted. Effects of Alternative E in terms of immediate appearance of the treated areas would have the greatest effect of all alternatives.

Other direct effects include views of prescribed burning activities, in particular smoke emissions. Emissions may appear as a point source (single plume) or as a dispersed cloud. Effects of burning would persist for the duration of the burn, including flaming and smoldering portions. Within visually sensitive areas, most burning activities would occur on BLM/Alturas Field Office lands and Modoc National Forest lands. Depending on smoke dispersion, this could result in concentrated effects of smoke emissions in one portion of the Analysis Area, while other areas would experience highly dispersed impacts.

4.9.9.2 Indirect Effects

The indirect effects of Alternative E would be similar to Alternative D but would proceed at a faster rate and therefore this alternative would have greater effects short-term. However, the effects would be present over the landscape for the shortest duration (33 years) of any of the alternatives.

4.9.9.3 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative E include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. If treatments on private and other federal lands are done at the same times and in adjacent areas to Analysis Area lands, there would be substantial short-term cumulative impacts. The cumulative effects of Alternative E would be similar to Alternatives B and D however mechanical treatments would cover twice the area in visually sensitive areas as Alternative B and the rate of restoration would be more than both Alternative B and D. Alternative E would have a high probability that scenic quality would have short-term cumulative effects on scenic resources.

4.9.10 ALTERNATIVE J (PREFERRED ALTERNATIVE)

4.9.10.1 Direct Effects

Effects of Alternative J (Preferred Alternative) would be similar to Alternative B (Proposed Action), however mechanical treatments would cover twice the area in visually sensitive areas as Alternative B. Direct effects of Alternative J (Preferred Alternative) would include short-term impacts on views of the landscape during project implementation. For mechanical and hand treatments the degree of contrast between treated areas and the characteristic landscape would be most evident in areas viewed in the foreground (½ mile or less), and areas where there are dense juniper stands. This effect would be more noticeable in areas with at least moderate slopes (greater than 20 percent).

The combined area with restoration treatments within FS Preservation and Retention VQOs would total 10 percent of those areas (Table 72). The combined area with restoration treatments within BLM Class I and II VRM classes would total 42 percent of those areas (Table 73). The restoration would occur over 47 years, therefore about two percent per decade within FS Preservation and Retention VQOs and nine percent per decade within BLM Class I and II VRM classes would be treated (Table 74). The result of the rate of treatment, treatment type, and percentage of area per decade within the visually sensitive areas would combine to have a moderate probability that scenic quality would be impacted.

Other direct effects include views of prescribed burning activities, in particular smoke emissions. Emissions may appear as a point source (single plume) or as a dispersed cloud. Effects of burning would persist for the duration of the burn, including flaming and smoldering portions. Within visually sensitive areas, most burning activities would occur on BLM/Alturas Field Office lands and Modoc National Forest lands. Depending on smoke dispersion, this could result in concentrated effects of smoke emissions in one portion of the Analysis Area, while other areas would experience highly dispersed impacts.

4.9.10.2 Indirect Effects

Compared to Alternatives B and C, the landscape would have a different appearance over a greater number of acres at any point in time due to higher percentage of mechanical treatments. This would result in more dramatic short-term effects on scenic resources.

4.9.10.3 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management, and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would fit into the public's expectations for the character of those lands and therefore would no have a cumulative effect on visual quality.

Forest management will continue inside of the Analysis Area. Within the Focus Area, most forest management activities would likely be management of Eastside pine. Those activities would fit into the scenic character of the Focus Area as long as they comply with existing standards and guidelines. Therefore, forest management activities would not have a cumulative effect on scenic quality within the Focus Area.

The cumulative effects of Alternative J (Preferred Alternative) include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. If treatments on private and other federal lands are done at the same times and in adjacent areas to Focus Area lands, there would be substantial short-term cumulative impacts. The cumulative effects of Alternative J (Preferred Alternative) would be similar to Alternative D with the main difference being a longer time period for implementation of the restoration activities. Alternative J (Preferred Alternative) would have a high probability that scenic quality would have short-term cumulative effects on scenic resources.

Table 72. Treatment Area and Percentage of Area for VQO Categories Preservation and Retention.

Restoration Treatment	Preservation Treatment Area (acres)	Percentage of Preservation with Treatments	Retention Treatment Area (acres)	Percentage of Retention with Treatments	Combined Percentage
Alternatives B & C Mechanical	165	0.2%	2,851	1.9%	2.1%
Alternatives B & C Fire	499	0.6%	11,432	7.5%	8.1%
Alternatives D, E & J Mechanical	165	0.2%	6,692	4.4%	4.6%
Alternatives D, E & J Fire	499	0.6%	7,490	4.9%	5.5%

Table 73. Treatment Area and Percentage of Area for VRM Classes I and II.

Restoration Treatment	Class I Treatment Area (acres)	Percentage of Class I with Treatments	Class II Treatment Area (acres)	Percentage of Class II with Treatments	Combined Percentage
Alternatives B & C Mechanical[1]	0	0.0%	51,325	5.2%	5.2%
Alternatives B & C Fire	91,555	14.8%	218,784	22.3%	37.1%
Alternatives D, E & J Mechanical[1]	0	0.0%	120,818	12.3%	12.3%
Alternatives D, E & J Fire	90,605	14.6%	150,241	15.3%	29.9%

[1]All Class I areas are within WSAs and would not be treated with mechanical methods.

Table 74. VQO Preservation and Retention, and VRM Classes I and II Treatment Area per Decade[1]

Alternative	VQO Preservation and Retention (% of area per decade)	VRM Class I and II (% of area per decade)	VQO and VRM Combined Percentage (% of area per decade)
Alternative B	2.6%	10.6%	13.2%
Alternative C	2.0%	8.5%	10.5%
Alternative D	2.5%	10.6%	13.1%
Alternative E	3.1%	12.8%	15.9%
Alternative J	2.2%	9.0%	11.2%

[1]Treatment area includes both mechanical and fire use.

4.9.11 Scenic Resources Compliance with Existing Plans and Other Regulatory Direction

Alternative A, Current Management, would be consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs. The small number of acres restored in Alternative A would allow treatments within visually sensitive areas to be avoided entirely.

Alternatives B, D and E would have a high likelihood of being inconsistent with the Alturas, Eagle Lake and Surprise RMPs due to the large treatments areas in VRM Class I and II and the timing of those treatments (Table 73). Alternatives C and J would have a moderate likelihood of being inconsistent with the Alturas, Eagle Lake and Surprise RMPs due to the amount of treatment areas in VRM Class I and II and the timing of those treatments (Table 73). Site-specific design, careful restoration treatment locations and/or avoidance of visually sensitive areas would be required to reduce the likelihood on being inconsistent with the Alturas, Eagle Lake and Surprise RMPs.

Alternatives B, C, D, E and J would have a low likelihood of being inconsistent with the Modoc National Forest LRMP due to the small treatments areas in VQO categories of Preservation and Retention (Table 72). With the use of site-specific design, restoration treatment locations and/or avoidance of visually sensitive areas, restoration treatments on the Modoc National Forest will likely be consistent with the Modoc National Forest LRMP.

4.10 Recreation

4.10.1 MANAGEMENT DIRECTION FOR RECREATION

The Modoc National Forest LRMP (USDA Forest Service 1991a) and the BLM Northeastern California Field Offices RMPs (USDI Bureau of Land Management 2007a, 2007b and 2007c) provide management direction for recreation through management directives, standards, and guidelines.

Goals for recreation from the Modoc National Forest LRMP that apply to this Restoration Strategy include:

- Operate and manage Medicine Lake and Blue Lake campgrounds as featured campgrounds. Operate other developed sites at standard levels.
- Manage for a full spectrum of trail opportunities and ensure proper signing of National Recreational Trails.
- Provide a broad spectrum of recreational opportunities that offer an experience level commensurate with the Recreational Opportunity Spectrum (ROS) zone in which the activity takes place.

Goals for recreation from the BLM Northeastern California Field Offices RMPs that apply to this Restoration Strategy include:

- The BLM Northeastern California Field Offices would provide and enhance a variety of developed and undeveloped public recreational opportunities. Increasing demand for quality, resource-dependent recreational activities would be fulfilled while protecting ecosystems, natural and cultural resources, and scenic values.

4.10.2 METHODOLOGY FOR ANALYSIS

For both FS and BLM managed lands in the Analysis Area, analysis of potential impacts to recreation are assessed by estimating any long-term (greater than one recreation season) changes in recreation use levels, changes in recreation areas or facilities, and any changes to ROS designations. Existing use information for the Modoc National Forest was taken from the 2001 National Visitor Use Monitoring (NVUM) report, described in more detail below. Existing use information for the Eagle Lake Field Office was taken from the BLM's Northeastern California Draft Resource Management Plan (2006). Information on the ROS designations was taken from the Modoc National Forest Land and Resource Management Plan (1991), and the BLM's Northeastern California Draft Resource Management Plans (2006).

Information on Modoc National Forest visitor use levels and activity participation periodically are collected as part of the NVUM project. The effort involves implementing a detailed visitor sampling regime, administering visitor questionnaires to forest visitors, and counting cars with electronic traffic counters. FS Strategic and Annual Performance Plans require measuring trends in user satisfaction and use levels to be able to improve public service, and the NVUM program was developed for this purpose. NVUM methods and data analysis are explained in detail in USDA Forest Service 2001c.

Effects of sage steppe restoration treatments to recreation resources would be substantial if there would be any of the following:

- Change of any ROS setting for more than one year
- Loss of recreation access to developed or dispersed sites for more than one year
- Loss of roadless character in Inventoried Roadless Areas (IRAs)

4.10.2.1 Analysis Assumptions

The following assumptions are used in the recreation analysis.

- Hand treatments would either have no effect or a negligible effect on recreation resources due to the low number of acres that would be treated annually.
- Mechanical treatments produce greater amounts of noise, traffic, and dust per acre treated than prescribed burning. Mechanical treatments would therefore have greater impacts to recreation resources than prescribed burning.
- 20 years population growth, recreation demand from surrounding areas and other social forces would increase the use of some recreation resources and change the use of others.
- To the extent possible, roads that provide access to developed recreation sites for safety concerns would be used minimally. If necessary to use them for treatment activities, these roads would be avoided during weekends.

- Restoration areas used by mule deer hunters would not be treated from 30 days before and during the hunting season.

4.10.3 Recreation Effects Common to All Alternatives

There would be no mechanical restoration activities in Inventoried Roadless Areas (IRAs) or Wilderness Study Areas (WSAs). Some prescribed fire and hand restoration treatments would occur in IRAs. Generally, there would be no hand treatments within WSAs. No new roads would be constructed in IRAs or WSAs. Therefore, there would not be any impacts to the roadless character of any IRA's. These areas would continue to be managed for the characteristics that resulted in their roadless designations.

There would be no new permanent roads constructed in all alternatives except for Alternative A. The miles of new permanent roads that could be constructed under Alternative A is not known but is assumed to be few because of the small number of acres treated and no current plans for new permanent roads. Adverse impacts from increased OHV use of new roads would not occur in any alternatives except Alternative A. Alternative A would cause some increases in OHV use in direct proportion to the miles of new road, however the management of those roads would minimize any negative effects.

Direct effects from all alternatives would include increased noise, dust, and traffic along roads used to access units during mechanical treatment or prescribed burning. Since the majority of the acres treated would involve prescribed burning, the effects of increased noise, dust and traffic along roads would be short-term. However, these effects would only temporarily alter recreation settings. Effects would be most noticeable in areas where the ROS setting is SPM; these settings would be temporarily shifted to a RN type of setting, during the duration of treatment activities. Due to the short-term nature of these effects, substantial impacts would not occur.

Direct effects would also include the sights and possibly smells of smoke associated with prescribed burning that would also be temporary. Finally, if treatments occur in areas where there are dispersed undesignated recreation sites, such as those associated with deer hunting, there may be temporary loss of recreation use. Examples of such areas might include: areas popular for deer hunting around Stone Coal Mountain, Knox Mountain, Boyd Hill, and Hunter's Ridge. If treatments of these dispersed use areas are timed to avoid the big game hunting seasons, there would not be substantial impacts.

Indirect effects for all alternatives would include changes in views from scenic byways or viewpoints where recreation use is concentrated and improved hunting opportunities for big game due to improved habitat. Effects to views from scenic byways or viewpoints would be both adverse and beneficial (*Section 4.9 Scenic Resources*).

As recreation use increases throughout the Analysis Area, it is likely there would be a shift in ROS designations with some Semi-Primitive Motorized (SPM) settings shifting to a Roaded

Natural (RN) setting designations. This expected shift is based on an anticipated change in the number of encounters with other recreationists and the recreation visitor days (RVDs) per acre (the result of population growth and increased visitation to the Analysis Area), improvements in recreation facilities, and greater evidence of management presence at recreation sites.

4.10.4 Alternative A (Current Management)

4.10.4.1 Direct and Indirect Effects

Alternative A would cause a minimal or no loss of access to recreation areas. Because of the large extent of the Focus Area, there would be many opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative A would not have substantial effects on recreation.

4.10.4.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

New permanent roads are unlikely to be constructed by the FS or BLM, because there are no current projects under planning or implementation that would require construction of new permanent roads. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative A include an additional 486,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 730,000 acres. If treatments on other federal lands follow the same approach as currently used on FS and BLM restoration treatments there would not be substantial impacts; ROS settings would not be permanently altered, nor would access to developed or dispersed recreation sites be permanently altered, and there would be no substantial impacts.

4.10.5 ALTERNATIVE B (PROPOSED ACTION)

4.10.5.1 Direct and Indirect Effects

Alternative B would cause a minimal or no loss of access to recreation areas. Because of the large extent of the Focus Area, there would be opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative B would not have substantial effects on recreation.

4.10.5.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative B include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. Restoration treatments on other federal and private lands would increase the extent of the short-term effects of the restoration treatments. The increased short-term effects include: noise, traffic and dust causing potential changes in ROS settings; access restrictions to recreation areas; and altered views. These effects would be short-term and would have some positive long-term effects and therefore would not have substantial cumulative effects on recreation in the Analysis Area. Cumulative effects of Alternative B would be similar to Alternatives C, D and E. There would not be substantial impacts to recreation resources.

4.10.6 ALTERNATIVE C

4.10.6.1 Direct and Indirect Effects

Alternative C would cause a minimal or no loss of access to recreation areas. Direct and indirect effects would be the same type as Alternative B (the Proposed Action), but the areas subject to those effects (number of recreation areas that would be affected at a given point in time) would be lower as a result of a lower treatment rate. As a result, at any given time there may be a less substantial shift from SPM settings to RN settings, and access restricted to a fewer numbers of recreation areas. However, impacts to recreation resources would not be substantial because the adverse effects would be short-term and positive effects would be long-term. Because of the large extent of the Focus Area, there would be opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative C would not have substantial effects on recreation.

4.10.6.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative C include an additional 576,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,830,900 acres. Restoration treatments on other federal and private lands would increase the extent of the short-term effects of the restoration treatments. The increased short-term effects include: noise, traffic and dust causing potential changes in ROS settings; access restrictions to recreation areas; and altered views. These effects would be short-term and would have some positive long-term effects and therefore would not have substantial cumulative effects on recreation in the Analysis Area. Cumulative effects of Alternative C would be similar to Alternatives B, D, E and J. There would not be substantial impacts to recreation resources.

4.10.7 ALTERNATIVE D

4.10.7.1 Direct and Indirect Effects

Alternative D would cause a minimal or no loss of access to recreation areas. Effects to recreation resources would be similar to Alternative B (the Proposed Action). The reduction in prescribed burning treatments would reduce the amount of smoke and associated impacts experienced by visitors to the Analysis Area. The magnitude of the effects associated with mechanical treatments would increase. Increased use of mechanical treatments may result in greater reductions in the SPM type settings, and may result in greater (but temporary) loss of access to certain recreation sites. Visitors would experience more traffic on Forest/BLM roads compared to Alternatives B and C. However, impacts to recreation resources would not be substantial because the adverse effects would be short-term and positive effects would be long-term. Because of the large extent of the Focus Area, there would be opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative D would not have substantial effects on recreation.

4.10.7.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative D include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Restoration treatments on other federal and private lands would increase the extent of the short-term effects of the restoration treatments. The increased short-term effects include: noise, traffic and dust causing potential changes in ROS settings; access restrictions to recreation areas; and altered views. These effects would be short-term and would have some positive long-term effects and therefore would not have substantial cumulative effects on recreation in the Analysis Area. Cumulative effects of Alternative D would be similar to Alternatives B, C, E and J. There would not be substantial impacts to recreation resources.

4.10.8 ALTERNATIVE E

4.10.8.1 Direct and Indirect Effects

Alternative E would cause a minimal or no loss of access to recreation areas. The magnitude of the effects on ROS designations, and access to recreation sites would be the greater for Alternative E than for Alternative D, due to the greater restoration rate for mechanical treatments. The effects would be the greatest among all the alternatives, as a result of the shorter time period for treatment. Under this alternative there is a greater likelihood of recreation impacts for longer periods of time as compared to the other alternatives. However, impacts to recreation resources would not be substantial because the adverse effects would be short-term and positive effects would be long-term. Because of the large extent of the Focus Area, there would be opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative E would not have substantial effects on recreation.

4.10.8.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative E include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Restoration treatments on other federal and private lands would increase the extent of the short-term effects of the restoration treatments. The increased short-term effects include: noise, traffic and dust causing potential changes in ROS settings; access restrictions to recreation areas; and altered views. These effects would be short-term and would have some positive long-term effects and therefore would not have substantial cumulative effects on recreation in the Analysis Area. Cumulative effects of Alternative E would be similar to Alternatives B, C, D and J. There would not be substantial impacts to recreation resources.

4.10.9 Alternative J (Preferred Alternative)

4.10.9.1 Direct and Indirect Effects

Alternative J (Preferred Alternative) would cause minimal or no loss of access to recreation areas. Effects to recreation resources would be similar to Alternative B (the Proposed Action). The reduction in prescribed burning treatments would reduce the amount of smoke and associated impacts experienced by visitors to the Analysis Area. The magnitude of the effects associated with mechanical treatments would increase. Increased use of mechanical treatments may result in greater reductions in the SPM type settings, and may result in greater (but temporary) loss of access to certain recreation sites. Visitors would experience more traffic on Forest/BLM roads compared to Alternatives B and C. However, impacts to recreation resources would not be substantial because the adverse effects would be short-term and positive effects would be long-term. Because of the large extent of the Focus Area, there would be opportunities to direct restoration activities to areas that are not disturbed by restoration treatments, any potential road closures or recreation site closures that would be required. Therefore, Alternative J (Preferred Alternative) would not have substantial effects on recreation.

4.10.9.2 Cumulative Effects

The past, present and future foreseeable effects include impacts from roads, forest management and other restoration activities throughout the Analysis Area.

No new permanent roads are currently planned for sage steppe restoration and no new permanent roads are expected to be built by the FS and BLM for other projects. Some new roads could be built on private lands to support restoration projects. New roads on private lands would likely not be open to the public and therefore would not increase access.

Forest management will continue inside of the Analysis Area. Forest management inside the Focus Area would likely include management of Eastside pine. The FS is the agency that would propose and implement forest management projects within the Analysis Area. If forest management projects would have the potential to change recreation use within the Focus Area, the FS would be responsible for planning that would reduce any potential impacts to acceptable levels.

The cumulative effects of Alternative J (Preferred Alternative) include an additional 569,000 acres of the Focus Area that are expected to be restored on other federal (Table 35) and private lands (Table 36), resulting in a total restored area of more than 1,821,900 acres. Restoration treatments on other federal and private lands would increase the extent of the short-term effects of the restoration treatments. The increased short-term effects include: noise, traffic and dust causing potential changes in ROS settings; access restrictions to recreation areas; and altered views. These effects would be short-term and would have some positive long-term effects and therefore would not have substantial cumulative effects on recreation in the Analysis Area. Cumulative effects of Alternative J (Preferred Alternative) would be similar to Alternatives B, C, D and E. There would not be substantial impacts to recreation resources.

4.11 Compliance with Existing Plans and Other Regulatory Direction

All alternatives would follow applicable Federal and State laws and related regulations that govern the management of National Forest and BLM lands. The alternatives would all be consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise

RMPs. Resource specific details that can be determined for the Sage Steppe Ecosystem Restoration Strategy are described below. Consistency with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs will be achieved during site-specific implementation of sage steppe restoration projects.

4.11.1 Noxious Weeds

Sage steppe restoration treatments would increase the risk of noxious weed introduction and spread. However, site-specific design of restoration projects would prevent or minimize the negative effects. The long-term effects of reducing fire risk and intensity and reducing density of the juniper canopy cover would advance vegetation resources toward their desired conditions. All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction, with respect to noxious weeds.

4.11.2 Air Quality

Smoke Management Plans and Prescribe Burn Plans for site-specific projects would implement state and federal regulatory direction. The determination for compliance with state and federal air quality attainment standards would be assessed at the time of site-specific project planning. All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction, with respect to air quality.

4.11.3 Fire/Fuels

All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction. This includes but is not limited to the National Fire Plan, Forest Land and Resource Management Plans, Resource Management Area Plans, Manual Direction, Standards and Guides. Smoke Management Plans and Prescribe Fire Plans for site-specific projects would include federal and state regulatory direction of the federal Clean Air Act of 1990, the California Air Resources Board, and the Nevada Bureau of Air Pollution Control.

4.11.4 Livestock Grazing

The FS and BLM will manage livestock grazing to achieve restoration objectives (*Section 4.4 Livestock Grazing*) using rest periods (*Section 2.4.3 Livestock Grazing Management Practices*) and compliance with existing standards and guidelines that would determine the timing, duration, and intensity of grazing. Sage steppe restoration efforts would result in long-term improvements of rangeland health since it would result in restoration of sage-steppe ecosystem vegetation.

Grazing Management Practices would be incorporated into all of the alternatives to prevent or minimize negative effects. All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction, with respect to livestock grazing.

4.11.5 WATERSHED AND SOIL RESOURCES

All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction. The increases in long-term ground cover and the use of BMPs to minimize soil erosion are consistent with the goals of those plans. The amount of short-term disturbances and erosion would be minimal due to implementation of BMPs. The positive trends in long-term ground cover and stream function are consistent with the direction of those plans, with respect to watershed and soil resources.

4.11.6 WILDLIFE

The National Forest Management Act (NFMA) and its implementing regulations require that land management plans provide for diversity of plant and animal communities in order to meet overall multiple-use objectives. According to NFMA, diversity is based on the suitability and capability of the specific land area. Maintenance of plant and animal community diversity is based upon an ecosystem approach. In an ecosystem approach, the management plans will provide a framework for maintaining and restoring ecosystem conditions necessary to conserve most species. Where the FS determines that the ecosystem approach does not provide an adequate framework for maintaining and restoring conditions to support specific federally listed threatened or endangered species, species of concern, and species of interest, the plan will include additional provisions for these species.

The Modoc National Forest LRMP goals would be met with this Restoration Strategy. Implementation of this Restoration Strategy further refines broad goals of the Modoc National Forest LRMP and serves to meet the requirements of the NFMA. This Restoration Strategy also supports the goals of the BLM Northeastern California Field Offices RMPs.

The Restoration Strategy supports the goals of the Endangered Species Act (ESA) and the California Endangered Species Act (CESA) through protection of species that are currently listed as threatened or endangered and to prevent other species from declining to the point where listing may be necessary. The project provides for vegetative management and increases in species populations where viability has been determined to be an issue. It is designed to meet the purpose of Section 2(b) of ESA that states, "*The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved*…"

4.11.7 Cultural Resources

All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction, with respect to cultural resources. The risks of adverse effects from restoration treatments would be minimized through monitoring of restoration activities and application of the measures described in *Section 4.8.3 Cultural Resources Effects Common to All Alternatives*.

4.11.8 Scenic Resources

Alternative A, Current Management, would be consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs. The small number of acres restored in Alternative A would allow treatments within visually sensitive areas to be avoided entirely.

Alternatives B, D, E and J would have a high likelihood of being inconsistent with the Alturas, Eagle Lake and Surprise RMPs due to the large treatments areas in VRM Class I and II (Table 71). Alternative C would have a moderate likelihood of being inconsistent with the Alturas, Eagle Lake and Surprise RMPs due to the moderate amount of treatment areas in VRM Class I and II (Table 71). Site-specific design, careful restoration treatment locations and/or avoidance of visually sensitive areas would be required to reduce the likelihood on being inconsistent with the Alturas, Eagle Lake and Surprise RMPs.

Alternatives B, C, D, E and J would have a low likelihood of being inconsistent with the Modoc National Forest LRMP due to the small treatments areas in VQO categories of Preservation and Retention (Table 70). With the use of site-specific design, restoration treatment locations and/or avoidance of visually sensitive areas, restoration treatments on the Modoc National Forest will likely be consistent with the Modoc National Forest LRMP.

4.11.9 Recreation

All of the alternatives are consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs, and state and other federal regulatory direction, with respect to recreation.

4.12 Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

4.12.1 VEGETATION

The short-term impacts to the sage steppe vegetation include removal of juniper trees and disturbance of sagebrush and other sage steppe vegetation during restoration treatments. The long-term productivity of the sage steppe ecosystem would be more similar to the pre-1870s sage steppe ecosystem mosaic.

4.12.2 AIR QUALITY

The short-term impact on air quality caused by potential smoke generation from prescribed fire projects under all alternatives would be temporary and lasting less then five days. Mechanical treatments causing temporary short-term impacts from dust and exhaust emissions would last less than an hour. There would be no long-term impacts upon air quality from any of the proposed alternatives. The long-term effects from fire use and mechanical treatments would reduce the magnitude of negative impacts from smoke generated from large wildfires.

4.12.3 LIVESTOCK GRAZING

Restoration treatments would result in long-term gains in forage productivity. These gains will vary by alternative and will likely be affected by climate variations and other external factors. Short-term loss of available forage will occur in all alternatives, the amount depending on acreage treated per year.

4.12.4 SOIL RESOURCES

The soil resource would have some short-term effects due to soil disturbance and potential erosion associated with the restoration activities. Erosion and effects from mechanical treatment and fire use activities that may be detrimental to the soil resource would be minimized through use of on-site project burn plan design and BMPs. Soil protection measures would maintain critical soil parameters and nutrients, ensuring long-term productivity. The long-term productivity of the soil resource would improve following restoration treatments due to reduced soil erosion.

4.12.5 WATERSHED

Short-term effects of the proposed restoration activities could include a small change in total sediment yields should heavy rain periods immediately follow completion of site-specific project activities. Where increased sediment yields result, they would decline with the vegetative recovery of the site, likely five to 10 years. These effects are negligible and would not affect long-term productivity.

4.12.6 SOCIOECONOMICS

Short-term impacts to the livestock industry and the local livestock producers would occur. The long-term productivity of the local livestock producers would be improved by restoration. The long-term impacts to the livestock industry would last through the 30-50 year restoration treatment period.

4.12.7 WILDLIFE

Short-term habitat impacts from the restoration activities would occur for some sage steppe obligate species. Long-term productivity for sage steppe obligate species would improve following restoration. Juniper dependent species would have short-term and long-term impacts from the restoration. Since there would not be declines in existing suitable habitats for special status species and management indicator species, there would be no potential impacts to the maintenance and/or enhancement of long-term productivity for those wildlife resources.

The short-term use and long-term productivity of fisheries, fish habitat, and riparian ecosystems would not be impacted by the mechanical treatment and fire use activities in the alternatives.

4.12.8 SCENIC RESOURCES

In the short-term (less than 10 years) changes to scenic resources would be evident, and would contrast with the characteristic landscape. The long-term productivity (more than 10 years) of scenic resources would not be affected. Long-term, the characteristic landscape would change, but the scenic quality of restored areas after recovery from restoration would approach the desired landscape.

4.12.9 CULTURAL RESOURCES

None of the short-term effects to cultural resources from restoration activities would result in a loss of long-term productivity of those resources. All effects to cultural resources would be short-term and consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs.

4.12.10 RECREATION

None of the short-term effects to recreation resources from restoration activities such as noise, dust and traffic would result in a loss of long-term productivity of those resources to support future recreation use. All effects to recreation resources would be short-term and consistent with the Modoc National Forest LRMP and the Alturas, Eagle Lake and Surprise RMPs.

4.13 Unavoidable Adverse Effects

4.13.1 Vegetation

Unavoidable adverse effects from the restoration treatments include short-term disturbance of sagebrush and associated vegetation due to mechanical and fire use treatments.

4.13.2 Air Quality

Prescribed fire would have local unavoidable adverse effects on air quality but they would be temporary, lasting from one to five days. Mechanical treatments would cause a local, temporary unavoidable adverse impact lasting a few hours. Control measures would be implemented as appropriate through state and federal air quality regulations.

4.13.3 Livestock Grazing

The short-term loss of forage productivity will result in the unavoidable rest or deferment of livestock grazing. This will vary by alternative and by the acreage treated each year by treatment type.

4.13.4 Soil Resources

Unavoidable adverse effects from the restoration treatments include soil disturbance and associated erosion due to mechanical and fire use treatments. These effects would be minimized through the use of BMPs.

4.13.5 Watershed

None of the proposed activities would result in an adverse impact on water quality.

4.13.6 Wildlife

There are no unavoidable adverse effects related to wildlife resources, fish habitat and riparian ecosystems for the alternatives considered in this EIS.

4.13.7 Scenic Resources

Restoration activities associated with the alternatives would result in unavoidable adverse short-term effects to scenic resources in some portions of the Analysis Area. Long-term, the characteristic landscape would change, but the scenic quality of restored areas after recovery from restoration would approach the desired landscape.

4.13.8 Cultural Resources

There would be no unavoidable adverse effects to cultural resources. Impacts to cultural resources would be avoided in order to comply with management direction and laws.

4.13.9 Recreation

None of the restoration activities associated with the alternatives would result in unavoidable adverse effects to recreation resources. All impacts to recreation resources would be short-term.

4.14 Irreversible or Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

4.14.1 Vegetation

None of the proposed fire use or mechanical treatments would result in irreversible effects to vegetation. Removal of some of the juniper woodlands would be an irretrievable commitment of vegetation resources.

4.14.2 Air Quality

None of the proposed prescribed fire or mechanical treatments would result in irreversible and irretrievable effects to air quality.

4.14.3 Livestock Grazing

There are no irreversible commitments of livestock grazing resources. AUMs that are rested during restoration activities would be an irretrievable loss of livestock grazing resources.

4.14.4 Soil Resources

Any soil lost to erosion would be considered an irreversible or irretrievable commitment of the soil resource. BMPs would be used to minimize soil productivity losses from restoration treatments.

4.14.5 WATERSHED

None of the proposed fire use and mechanical treatments by themselves would result in irreversible or irretrievable effects to watersheds.

4.14.6 WILDLIFE

There would be no irreversible commitments of wildlife, fish and riparian resources resulting from fire use and mechanical restoration treatments. Wildlife species that depend upon juniper woodland habitats for part of their habitat requirements may experience decreases in populations, which would be an irretrievable effect to wildlife

4.14.7 SCENIC RESOURCES

Restoration activities associated with the alternatives would result in an irretrievable commitment of scenic resources. Irretrievable commitments of scenic resources would occur due to removal of juniper woodlands and the time required for ecosystem effects to become visually indiscernible. However, there would not be any irreversible commitments of scenic resources. Long-term, the characteristic landscape would change, but the scenic quality of restored areas after recovery from restoration would approach the desired landscape.

4.14.8 CULTURAL RESOURCES

None of the proposed prescribed fire or mechanical treatments would result in irreversible or irretrievable effects to cultural resources.

4.14.9 RECREATION

None of the restoration activities associated with the alternatives would result in an irreversible commitment of resources used for recreation. Site-specific project actions could result in temporary restrictions to dispersed and developed recreation sites within the Analysis Area, resulting in irretrievable effects to recreation during those restrictions.

4.15 Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." The Proposed Action and alternatives have been assessed regarding their consistency with the Modoc National Forest LRMP and the BLM Northeastern California Field Offices RMPs for all alternatives in the resource areas in this chapter. The following lists disclose other environmental laws, etc. that would apply to implementation of this Restoration Strategy.

4.15.1 WATERSHED

The Clean Water Act (CWA) requires federal agencies to comply with all federal, state and interstate, and local authorities in the control and abatement of water pollution. These authorities and their policies include the Environmental Protection and Water Quality Control Boards/Commission for the states of California and Nevada, and the USFWS. All alternatives would comply with these authorities.

4.15.2 AIR QUALITY

The federal Clean Air Act and applicable California and Nevada Air Quality Regulations require federal agencies to comply with all applicable laws and regulatory requirements in the control and abatement of smoke generated by the prescribed fire projects under all alternatives. All alternatives would comply with these authorities and related requirements.

4.15.3 WILDLIFE

There would be no potential conflicts of the alternatives with plans, policies, and objectives of the Endangered Species Act (ESA) or the Migratory Bird Treaty Act. The Modoc National Forest and the BLM Northeastern California Field Offices would work cooperatively with federal, state, local, and tribal agencies in implementing the activities associated with the reduction of western juniper and enhancement of sage steppe vegetation in the protection of threatened, endangered, or proposed species and management indicator species.

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Chapter 5. Consultation and Coordination

5.1 Preparers and Contributors

The FS consulted the following individuals, Federal, State, and local agencies, tribes and non-FS persons during the development of this EIS:

5.1.1 ID Team Members:

5.1.1.1 Board Representative Team

Curt Aarstad – BLM Alturas Field Office
Edith Asrow – Modoc National Forest
Sean Curtis – Modoc County
Rob Jeffers – Modoc National Forest, Project Lead

5.1.1.2 Analysis Team

The Analysis Team were employees or associated with JW Associates Inc. who was contracted to the Modoc National Forest to complete the analysis.
John Baas – Socio-Economics, Recreation, Visuals
Dean Carrier – Wildlife
Julie Etra – Range
Sean Jensen – Archaeology
Kris Kuyper – Botany
Jennifer McCollum – GIS
Brad Piehl – Hydrology, Soils, Project Manager
Tim Pfannenstiel - GIS
Lynn Sprague – Facilitator, Public Involvement, Range
Bob Solari – Air Quality, Fire/Fuels
Jessica Wald – Public Involvement, Technical Writing

5.1.1.3 Agency Technical Review Team

Penni Borghi – BLM Surprise Field Office, Cultural
Michael Dolan – BLM Alturas Field Office, Botany
Cheryl Foster-Curley – BLM Alturas Field Office, Cultural
Gerry Gates – Modoc National Forest, Cultural and Historic
Robert Haggard – Modoc National Forest, Planning
Jami Ludwig – BLM Alturas Field Office, Hydrology and Soils
Dan Meza – Modoc National Forest, Tribal
Sean Redar – Modoc National Forest, GIS

Albert Savage – BLM Alturas Field Office, Fire/Fuels and Air Quality
Paul Schmidt – BLM Alturas Field Office, Wildlife
Claude Singleton – BLM Alturas Field Office, Visuals, Recreation and Historic
Celia Yamagiwa – Modoc National Forest, GIS
Marty Yamagiwa – Modoc National Forest, Wildlife

5.1.2 Federal, State, and Local Agencies:

California State Historic Preservation Office
USDI National Park Service
USDI United States Fish and Wildlife Service

5.1.3 Tribes:

Alturas Rancheria
Cedarville Rancheria
Fort Bidwell Paiute Tribe
Pit River Tribe
Susanville Rancheria
The Klamath Tribes

5.1.4 Monitoring and Adjustment Consultants:

Steve Light – Adaptive Strategies Inc.
Ernie Niemi – ECONorthwest

5.2 Distribution of the Environmental Impact Statement

This final environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, the following Federal, State and local governments, Tribal governments and members, Legislators and Groups and Individuals (Tables 71 through 76) have been sent a hard copy or compact disk of the document, or made aware of the availability of the document. The document is available on the world wide web at:

http://www.fs.fed.us/r5/modoc/projects/sagebrush-restoration-web/juniperstrategy.shtml

Table 75. Federal Agency Distribution List

Agency Name	Name/Title	City	State
Director, Planning and Review, Advisory Council on Historic Preservation		Washington	DC
Division Administrator, Federal Highway Administration		Sacramento	CA
Deputy Director, USDA APHIS PPD/EAD		Riverdale	MD
Environmental Protection Agency, Region 9	EIS Review Coordinator	San Francisco	CA
Federal Aviation Administration, Western-Pacific Region, Regional Administrator		Lawndale	CA
NOAA Office of Policy and Strategic Planning, NEPA Coordinator		Washington	DC
SW Div., Naval Facilities	Mitchell A. Perdue	San Diego	CA
U.S. Coast Guard, Environmental Management		Washington	DC
U.S. Department of Energy, Director Office of NEPA Policy and Compliance	Director, Office of Environmental Policy and Compliance	Washington	DC
USDA-FS, Klamath National Forest	Dan Blessing	Yreka	CA
USDA-FS, Goosenest Ranger District	Laura Allen	Macdoel	CA
USDA-FS, Lassen National Forest	Laurie Tippin, Forest Supervisor	Susanville	CA
USDA-FS, Lassen National Forest	Dave Evans	Susanville	CA
USDA-FS, Shasta Trinity National Forest	Sharon Heywood, Forest Supervisor	Redding	CA
USDA-FS, Winema National Forest	Larry Swan	Klamath Falls	OR
USDA National Agricultural Library Head	Acquisitions and Serials Branch 10301		
USDA National Agricultural Library		Beltsville	MD
USDA Natural Resource Conservation Service	Marc Horney	Yreka	CA
USDI- Fish and Wildlife Service	Div. of Enronmental Coord.	Washington	DC
USDI- Fish and Wildlife Service	Rick Hardy	Klamath Falls	OR
USDI- Fish and Wildlife Service	Kevin Kritz	Reno	NV
USDI- Fish and Wildlife Service	John Beckstread	Tulelake	CA
USDI- Bureau of Land Management, Alturas Field Office	Tim Burke	Alturas	CA

Table 75. Federal Agency Distribution List (continued)

Agency Name	Name/Title	City	State
USDI- Bureau of Land Management, California State Office	Paul Roush	Arcata	CA
USDI- Bureau of Land Management, Eagle Lake Field Office	Dayne Barron	Susanville	CA
USDI- Bureau of Land Management, Surprise Field Office	Shane DeForest	Cedarville	CA
USDI- Bureau of Reclamation, Klamath Basin Area	Karl Wirkus	Klamath Falls	OR
USDI- Bureau of Reclamation	James Sculin	Sacramento	CA
USDI- Bureau of Reclamation	Laura Alan	Klamath Falls	OR
USDI- Fish and Wildlife Service	Steve Clay	Alturas	CA
USDI- Lava Beds National Monument		Tulelake	CA
USDA- Natural Resource Conservation Service	National Environmental Coordinator	Washington	DC
USDA- Natural Resource Conservation Service	Matt Dreschsel	Alturas	CA
USDA- Natural Resource Conservation Service	Kate O'Donnel	Klamath Falls	OR
USDA-Natural Resource Conservation Service	Gene Kelley	Tulelake	CA
USDA-Natural Resource Conservation Service	Randi Paris	Yreka	CA
USDA-Natural Resource Conservation Service	Eric Simmen	Yreka	CA
USDA-Natural Resource Conservation Service	Ken Weaver	Susanville	CA
USDA-Natural Resource Conservation Service	Larry Flournoy	Alturas	CA
USDI- National Marine Fisheries Service, Southwest Region	Habitat Conservation Division	Long Beach	CA
USDI- Office of Environmental Policy and Compliance		Washington	DC
U.S. Army Engineer, South Pacific CESPD-CMP		San Francisco	CA

Table 76. State Agency Distribution List

Agency Name	Name/Title	City	State
CA Department of Fish and Game		Sacramento	CA
CA Department of Fish and Game	Don Koch	Redding	CA
CA Department of Fish and Game	Jim Nelson	Redding	CA
CA Department of Fish and Game	Richard Shinn	Alturas	CA
CA Department of Food and Agriculture		Sacramento	CA
CA Department of Food and Agriculture		Redding	CA
CA Department of Forestry		Sacramento	CA
CA Department of Forestry		Bieber	CA
CA Department of Forestry	Barney Ward	Susanville	CA
CA Department of Forestry	Brad Lutz	Susanville	CA
CA Office of Historic Preservation	Stephen Mikesell	Sacramento	CA
CA Office of Historic Preservation	Dwight Dutschke	Sacramento	CA
CA Regional Water Quality Control Board		Sacramento	CA
CA Regional Water Quality Control Board-Central Valley		Redding	CA
CA Regional Water Quality Control Board-North Coast		Santa Rosa	CA
CA Regional Water Quality Control Board- Lahontan		South Lake Tahoe	CA
Eastern Oregon Agricultural Research Station	Rick Miller	Corvallis	OR
Nevada Dept. of Wildlife	John Gebhardt	Reno	NV
Nevada Dept. Of Wildlife	Roy Leach	Fallon	NV
Nevada State Historic Preservation Officer	Alice Baldrica	Carson City	NV
State Clearinghouse	Director	Sacramento	CA

Table 77. Tribal Governments and Tribal Members Distribution List

Tribal Governments Name	Name/Title	City	State
Alturas Rancheria	Wendy DelRosa	Alturas	CA
Alturas Rancheria	Craig Marcus	Alturas	CA
Alturas Rancheria	Vi Riley	Alturas	CA
Cedarville Rancheria	Melinda Dollarhide	Alturas	CA
Cedarville Rancheria	Duanna Knighton	Alturas	CA
Cedarville Rancheria	Marisha Noneo	Alturas	CA
Coalition to Save Mt. Shasta and Medicine Lake	Floyd Buckskin	Fall River Mills	CA
Confederated Band of Shasta and Upper Klamath Indians	Sami Jo Pohlman	Macdoel	CA
Confederated Band of Shasta and Upper Klamath Indians	Howard Wynant	Macdoel	CA
Fort Bidwell Reservation	Todd DeGarmo	Fort Bidwell	CA
Fort Bidwell Reservation	Paula Sam	Fort Bidwell	CA
Ft. Bidwell Community Council	Loyette Meza	Fort Bidwell	CA
Hammawi Band	Chas Gonzales	Alturas	CA
Hammawi Band	Susan Alvarez	Hat Creek	CA
Hauuawi Band	Susan Alvarez	Hat Creek	CA
Hewise Band	Olivia Forrest Davis	Eagle	ID
Hewisedawi Band	Raymond Lee Alvarez	Alturas	CA
Pit River Tribe	Robert Boyce	Burney	CA
Pit River Tribe	Sharon Elmore	Burney	CA
Pit River Tribe	Jessica Jim	Burney	CA
Pit River Tribe	Marie Orozco-Cue	Burney	CA
Pit River Tribe Natural Resources	Chris Pirosko	Burney	CA
Pit River Tribe, EPA	Michelle Berditschevsky	Burney	CA
Strong Family Health Center	Belinda Brown	Alturas	CA
Susanville Indian Rancheria	Tim Keesey	Susanville	CA
Susanville Indian Rancheria	Melany Johnson	Susanville	CA
Susanville Indian Rancheria	Ena Trau	Susanville	CA
Susanville Rancheria	Stacy Dixon	Susanville	CA
Susanville Rancheria	Jim MacKay	Susanville	CA
The Klamath Tribe	Rick Ward	Chiloquin	OR
The Klamath Tribes	Perry Chocktoot	Chiloquin	OR

Table 77. Tribal Governments and Tribal Members Distribution List (continued)

Tribal Governments Name	Name/Title	City	State
The Klamath Tribes	Allen Foreman	Chiloquin	OR
The Klamath Tribes	Don Gentry	Chloquin	OR
The Klamath Tribes	Elwood Miller	Chiloquin	OR
The Klamath Tribes	Gerald Skelton	Chiloquin	OR
The Klamath Tribes	Joseph Kirk	Chiloquin	OR
The Shasta Tribe	Mary Carpelan	Yreka	CA
The Shasta Tribe, Inc	Roy Hall, Jr.	Ft. Jones	CA
The Shasta Tribe, Inc	Donald E. Boat	Murphy	OR

Table 78. Other Agency Distribution List

Agency Name	Name/Title	City	State
Lassen County Board of Supervisors	Brian Dahle	Susanville	CA
Lassen County Coop. Ext. Service	David Lile	Susanville	CA
Lassen County Dept. of Agriculture	Ken Smith	Susanville	CA
Lassen County Planning Department	Joe Bertotti	Susanville	CA
Modoc County Agriculture Commission	Joe Morreo	Alturas	CA
Modoc County Board of Supervisors	Mike Dunn	Alturas	CA
Modoc County Coop. Ext. Service	Don Lancaster	Alturas	CA
Modoc County Department of Agriculture		Tulelake	CA
Modoc County Fish and Game Commission		Alturas	CA
Modoc County Land Use Committee	Sean Curtis	Alturas	CA
Modoc County Planning Department		Alturas	CA
Siskiyou County Board of Supervisors	Jim Cook	Yreka	CA

Table 79. Legislators Distribution List

Agency Name	Name/Title	City	State
CA Assembly Rick Keene	Clifford Wagner		
CA Assembly Doug LaMalfa	David Reade	Redding	CA
CA Senate Sam Aanestad		Nevada City	CA
CA Senate Dave Cox	Kevin Bassett	Quincy	CA
Congressman John Doolittle	James Stacer	Granite Bay	CA
Congressman Wally Herger	Dave Muerer	Redding	CA
Senator Barbara Boxer	Stacey Smith	Sacramento	CA
Senator Diane Feinstein	Michael Walker	Washington	D.C.
US House of Representatives- Dean Heller	Katie Pace	Reno	NV
US Senate- Harry Reid	Matthew Tuma	Reno	NV
US Senate- John Ensign	Kevin Kirkeby	Reno	NV

Table 80. Groups Distribution List

Group Name	Name/Title	City	State
Big Valley Chamber of Commerce	Josefa Jolurton	Bieber	CA
Big Valley Chamber of Commerce	Jim Kilcrease	Bieber	CA
BLM Alturas Field Office Grazing Permittees		Various	
BLM Eagle Lake Field Office Grazing Permittees		Various	
BLM Surprise Field Office Grazing Permittees		Various	
Blue Mtns. Biodiversity Project	Karen Coulter	Fossil	OR
CA Native Plant Society	Dave DuBose	Redding	CA
CA. Native Plant Society	Vivian Parker	Kelsey	CA
Calif. Wild Heritage Campaign	Pamela Flick	Sacramento	CA
California Cattlemens Assn.	Justin Oldfield	Sacramento	CA
California Indian Basketweavers		Woodland	CA
California Wilderness Coalition	Ryan Henson	Redding	CA
California Wilderness Coalition	Brent Schoradt	Oakland	CA
California Wildlife Federation		Sacramento	CA
Center for Biological Diversity	Sonya Diehn	Tucson	AZ
Central Modoc RCD	Carol Sharp	Alturas	CA
Central Modoc RCD		Alturas	CA
Continental Resource Solutions, Inc.	Glenn A. Zane	Redding	CA
Cooperative Sagebrush Steppe Restoration Initiative	Thomas Esgate, Project Director	Adin	CA
Defenders of Wildlife	Kim Delfino	Sacramento	CA
Double D Ventures, LLC	Diana McDonald	Pilot Point	TX
FSEEE	James Johnston	Eugene	OR
FSEEE	Forrest Fleischman	Eugene	OR
Klamath Forest Alliance	Kimberly Baker	Orleans	CA
Klamath Forest Alliance	Regina Chichizola	Somes Bar	CA
Klamath Forest Alliance	Kyle Haines	Klamath Falls	OR
Lassen Co. Cattlemen Assn.		Susanville	CA
Lassen Co. Farm Bureau	Bob Pyle	Susanville	CA
Lassen Co. Fish and Game Commission	Bob Roe	Forest Falls	CA

Table 80. Groups Distribution List (continued)

Group Name	Name/Title	City	State
Lava Beds-Butte Valley Resource Cons.	Bryan Vogt	Tulelake	CA
Lava Beds-Butte Valley Resource Conservation District	Theresa Wright	Tulelake	CA
Likely Land and Livestock/Modoc County RAC	Bill Flournoy	Likely	CA
Modoc Co. Cattlemen Assn.		Alturas	CA
Modoc County RAC	Willy Hagge	Alturas	CA
Modoc County RAC	Rich Hamel	Likely	CA
Modoc County RAC	June Roberts	Alturas	CA
Modoc County RAC	Dixie Server	Alturas	CA
Modoc County RAC	Randy Wise	Alturas	CA
Modoc County RAC	Paul Bailey	Alturas	CA
Modoc County RAC	Karen McGarva	Likely	CA
Modoc County RAC	Tom Carpenter	New Pine Crk.	OR
Modoc County RAC	Jim Cavasso	Alturas	CA
Modoc County RAC	Pam Couch	Alturas	CA
Modoc County RAC	Delbert Craig	Tulelake	CA
Modoc County RAC	John Fogerty	Alturas	CA
Modoc County RAC and NE Cal/NW Nevada RAC	Alan Cain	Alturas	CA
Modoc County RAC and NE Cal/NW Nevada RAC	Mike Dunn	Alturas	CA
Modoc Foresters, Inc	Lloyd Northrup	Alturas	CA
Modoc Independent News	Ray and Barbara March	Cedarville	CA
Modoc National Forest Grazing Permittees		Various	
Mt. Lassen Chapter, CA Native Plant Society	Woody Elliot	Chico	CA
Mule Deer Foundationn	Executive Director	Reno	NV
Natural Resources Defence Council	Amy Mall	Washington	DC
Natural Resources Defense Council		San Francisco	CA
NE Cal/NW Nevada RAC	John Erquiaga	Lake City	CA
NE Cal/NW Nevada RAC	Tim Garrod	Doyle	CA
NE Cal/NW Nevada RAC	Nancy Huffman	Tulelake	CA
NE Cal/NW Nevada RAC	John H.Razzeto	Trinity Center	CA
NE Cal/NW Nevada RAC	Todd Swickard	Standish	CA

Table 80. Groups Distribution List (continued)

Group Name	Name/Title	City	State
NE Cal/NW Nevada RAC	Skip Willmore	Burney	CA
NE Cal/NW Nevada RAC	Ken McGarva	Likely	CA
NE Cal/NW Nevada RAC	Martin Balding	Susanville	CA
NE Cal/NW Nevada RAC	Frank Bayham	Chico	CA
NE Cal/NW Nevada RAC	Dr. Rosalee Bradley	Janesville	CA
NE Cal/NW Nevada RAC	Gale G. Dupree	Loyalton	CA
NE Cal/NW Nevada RAC	Pete Neely	Chester	CA
NE Calf./NW Nevada RAC	Dr. Henricus Jansen	Chico	CA
Nevada Native Plant Society	Ann Pinzl	Reno	NV
North Cal-Neva RC&D	Mark Steffek	Alturas	CA
North Washoe Cattlemens Assn.	Jesse Harris	Eagleville	CA
Northwest Great Basin Association	Sophie Sheppard	Cedarville	CA
Ore-Cal RC&D	Jim Vancurra	Doris	CA
Oregon Natural Desert Assoc.		Bend	OR
Organized Sportsman of Lassen County	Wayne Jambois	Susanville	CA
Reach, Inc	Toby Loetscher	Klamath Falls	OR
Renegy	Scott Higginson	Tempe	AZ
Resource Concepts, Inc	Sheila Anderson	Carson City	NV
Resource Concepts, Inc	Rex Cleary	Carson City	NV
Rocky Mtn. Elk Foundation	Mike Ford	Yreka	CA
Sierra Club	Toiyabe Chapter	Reno	NV
Sierra Club- Shasta Group	Gordon Johnson	Palo Cedro	CA
Sierra Nevada Forest Protection Campaign	David G. Graves	Sacramento	CA
Sierra Nevada Forest Protection Campaign	Craig Thomas	Sacramento	CA
The Larch Company	Andy Kerr	Ashland	OR
The Sagebrush Sea Campaign	Mark Salvo	Chandler	AZ
TSS Consultants	Tad Mason	Rancho Cordova	CA
University of Nevada, Dept. of Biology	Dr. Peter Brussard	Reno	NV
USA Systems, Inc	Gerald Kooyers	Riggins	ID
Vulcan Power Co.	Steve Munson	Bend	OR

Table 80. Groups Distribution List (continued)

Group Name	Name/Title	City	State
Western Watersheds	Michael Connor, Ph.D	Reseda	CA
Western Watersheds Project	Katie Fite	Boise	ID
Williams Ranch	Alena Caldwell	Canby	CA

Table 81. Individuals Distribution List

Name	City	State
Kenneth P.Able	McArthur	CA
Lucky Ackley	Tulelake	CA
Aaron Albaugh	Adin	CA
Mike Alosi	Susanville	CA
Bob Allen	Burney	CA
David Allen	Redding	CA
Michelle Barker	Cedarville	CA
Keith Bryan	Bieber	CA
Dan Byrne	Tulelake	CA
Mike Byrne	Tulelake	CA
Jacky Collins	Fallon	NV
Paul and Marilyn Davis	Alturas	CA
William L. Diukuer	Bakersfield	CA
Kenny Earl	Susanville	CA
Ted Enderlein	Alturas	CA
Mal Evett		
Erika Forrest	Davis Creek	CA
Clarke Gardner	Davis Creek	CA
Reed Gardner	Davis Creek	CA
Roger Griopy	Bieber	CA
Dan Heinz	Reno	NV
Joe Hemphill	Tulelake	CA
F. Hopping	Adin	CA
Terry Hunt	McArthur	CA

Table 81. Individuals Distribution List (continued)

Name/Title	City	State
Randy Huod	Bieber	CA
Diana L.Jankowski	Alturas	CA
Thad Johnson	Malin	OR
Jim Johnston	Bieber	CA
Stephen Kennedy	McKinleyville	CA
Bob Kramer	Bieber	CA
Karen Kramer	Bieber	CA
Brad Kottinger	Reno	NV
Wayne Langston	Susanville	CA
Ronald Lanner	Placerville	CA
Don Lindsey	Lookout	CA
Theordore Martinez	Alturas	CA
Rod McArther	McArther	CA
Michael McCourt	Susanville	CA
Shane McGarva	Likely	CA
Lynn Mello	Adin	CA
Gary Mickelson	Lake City	CA
Paul Moore	Cottonwood	CA
Dick O'Sullivan	Paynes Creek	CA
Buck Parks	Adin	CA
Jerry Parks	Adin	CA
Lala Parrish	Alturas	CA
Kirsten Petersen	Adin	CA
Bill Phillips	Susanville	CA
Joe Picotte	Alturas	CA
B. Sachau	Florham Park	NJ
Jerry and Judy Scanlan	Malin	OR
Sydney Smith	Cedarville	CA
Marvin and Alice Sevy	Keno	OR
Todd Sloat	McArthur	CA

Table 81. Individuals Distribution List (continued)

Name/Title	City	State
Sharmie Stevenson	Adin	CA
James H.Swinehart	Cedarville	CA
Julie Rectin	Adin	CA
Jeff Richardson	Bend	OR
Wilma M.Rudderham	Cedarville	CA
Stacey Urroz	Alturas	CA
Hans Van Ness	Alturas	CA
John Veverka	Alturas	CA
Warren Weber	Alturas	CA
Terry Williams	Cedarville	CA
Gary Wright	Tulelake	CA

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Glossary

A

Adaptive Management—Adaptive management is a systematic, interdisciplinary process for continually improving management policies and practices by learning from the outcomes of operational programs through monitoring.

Affected Environment—The physical and human-related environment that is sensitive to changes resulting from the proposed actions.

Air Quality—Refers to standards for various classes of land as designated by the Clean Air Act, P.L. 88-206:Jan., 1988.

Airshed—A geographic area that, due to topography, meteorology, and climate, shares the same air.

Allotment—A grazing allotment is a parcel of federal land that is managed under one permit to be used by livestock under certain conditions.

Alternative—A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project that reflects identified public and management concerns for the Analysis Area.

Analysis Area—The Analysis Area is on National Forest lands and public lands administered by the BLM in parts of Modoc, Lassen, Shasta and Siskiyou counties, California and in Washoe County, Nevada. The Analysis Area covers approximately 6.5 million acres of public and private land.

Animal Unit Month (AUM)—The amount of forage required by one animal unit (AU) for one month is called an Animal Unit Month (AUM). One animal unit is defined as a 1,000 lb. beef cow with or without a nursing calf with a daily requirement of 26 lb. of dry matter forage.

B

Background—That part of a scene, landscape, etc., which is furthest from the viewer, usually from 3 miles to infinity from the observer.

Basal Area—The area of the cross section of a tree stem near the base, generally at breast height and inclusive of bark.

Best Management Practices (BMPs)—Practices determined by the state to be the most effective and practical means of preventing or reducing the amount of water pollution generated by nonpoint sources to meet water quality goals.

Big Game—Those species of large mammals normally managed as a sport hunting resource.

Big Game Summer Range—A range, usually at higher elevation, used by deer and elk during the summer. Summer ranges are usually much more extensive than winter ranges.

Big Game Winter Range—A range, usually at lower elevation, used by migratory deer and elk during the winter months; more clearly defined and smaller than summer ranges.

Biological Diversity (Biodiversity)—The relative distribution and abundance of different plant and animal communities and species within an area.

Biological Evaluation—A documented USFS review of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Board Foot (bf)—The amount of wood equivalent to 1 foot by 1-inch thick.

Broadcast Burn—Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of a fuel hazard or as a silvicultural treatment or both.

Browse—Twigs, leaves, and young shoots of trees and shrubs on which animals feed.

C

Canopy—The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees.

Cavity—The excavated hollow in trees by birds or other natural phenomena; used for roosting and reproduction by many birds and mammals.

Cavity Excavator—An animal that constructs cavities in trees for nesting or roosting.

Chipping—The reduction of woody residue by a portable chipper to chips that are left to decay on the forest floor.

Classified Road—A road that is constructed or maintained for long-term highway vehicle use. Classified roads may be public, private, or forest development.

Code of Federal Regulations (CFR)—The listing of various regulations pertaining to management and administration of the National Forests.

Compaction—The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Compartments—A geographic area delineated by a subwatershed drainage for management planning purposes.

Condition Class—A grouping of timber stands into size-age-stocking classes for Forest planning.

Conifer—Any of a group of needle and cone-bearing evergreen trees.

Council on Environmental Quality (CEQ)—An advisory council to the President, established by NEPA. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover—Vegetation used by wildlife for protection from predators or to escape the adverse effects of weather.

Cover complexity—Cover complexity is a qualitative rating of the combinations of different types of cover in one habitat unit. Greater cover complexity would be expected to yield greater fish abundance.

Cultural Resources—The remains of sites, structures, or objects used by humans in the past-historic or prehistoric.

Cumulative Effect—The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor, but collectively significant, actions taking place over a period of time.

Cumulative Effects Area (CEA)—The area that is used for assessing cumulative impacts (see above).

D

Decision Area—The geographic area defining the scope of this document and the alternatives proposed by it.

Decommissioning—Some of the roads are discussed in terms of "decommissioning." This term is used to refer to a specific type of road closure. On a decommissioned road, access would be controlled by means of a moderately sized berm or "tank trap" impassable to vehicles but capable of being easily bulldozed to permit vehicle passage if the road is recommissioned in the future. For all decommissioned roads, water bars are installed, the road bed is seeded, all culverts are removed, and self-maintaining cross-road drainage is provided.

Developed Recreation—Recreation dependent on facilities provided to enhance recreation opportunities in concentrated use areas. Examples are ski areas, resorts, and campgrounds.

Diameter at Breast Height (dbh)—The diameter of a tree measured 4 ft, 6 inches above the ground.

Dispersed Recreation—Recreation that occurs outside of developed recreation sites requiring few, if any, facilities or other improvements and includes such activities as hunting, hiking, viewing scenery, and cross-country skiing.

Displacement of Soil—The movement of the forest floor (litter, duff, and humus layers) and surface soils from one place to another by mechanical forces such as a blade used in piling and windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation is not considered displacement.

Duff—An organic surface soil layer below the litter layer in which the original form of plant and animal matter cannot be identified with the unaided eye.

E

Ecosystem—Any community of organisms along with its environment, forming an interacting system.

Ecotone—The boundary or transition zone between adjacent plant communities.

Edge—Where plant communities meet or where successional stage or vegetation conditions within the plant community come together.

Effects (or impacts)—Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.

Endangered Species—Any plant or animal species that is in danger of extinction throughout all or a significant portion of its range (Endangered Species Act of 1973).

Endemic—Native to or confined to a certain region.

Environment—The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental Assessment (EA)—A concise public document which serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a finding of No Significant Impact, (b) aid an agency's compliance with NEPA when no EIS is necessary, or (c) facilitate preparation of an EIS when necessary.

Environmental Impact Statement (EIS)—A detailed summary prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and the effects analyzed.

Epidemic—The populations of plants, animals and diseases that build-up, often rapidly, to highly abnormal and generally injurious levels.

Erosion—The detachment and transport of individual soil particles by wind, water, or gravity.

F

Fauna—Animals, including lesser forms such as insects, mites, etc.

Fire Regime Condition Class—A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation.

Floodplain—The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Flora—Plants

Focus Area—Within the Analysis Area, there is an identified Focus Area that contains the sage steppe ecosystem and includes all areas that are proposed for restoration treatment.

Forage—All browse and non-woody plants that are available to livestock or game animals and used for grazing or harvested for feeding.

Forage Areas—Vegetated areas with less than 60 percent combined canopy closure of tree and tall shrub (greater than 7 feet in height).

Forb—An herbaceous plant that is not a graminod.

Foreground—That part of a scene, landscape, etc., that is nearest to the viewer, and in which detail is evident, usually ¼ to ½ mile from the observer.

Fuel Treatment—Manipulation or reduction of natural or activity fuels (generated by a management activity such as slash left from logging) to reduce fire hazard.

Fuels—Combustible materials present in the forest that potentially contribute a significant fire hazard.

G

Growing Season—That part of the year when temperatures and moisture are favorable for vegetation growth.

H

Habitat—The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

Habitat Type—An aggregation of all land areas potentially capable of producing similar plant communities at climax stage.

Hiding Cover—Vegetation capable of hiding 90 percent of a standing adult deer or elk at 200 feet or less. Includes some shrub stands and all forested stand conditions with adequate tree stem density or shrub layer to hide animals. In some cases, topographic features also can provide hiding cover.

I

Immediate Foreground—The part of the foreground that is extremely critical for visual detail, usually within 400 feet of the observer.

Indicator Species—See Management Indicator Species.

Indirect Effects—Secondary effects that occur in locations other than the initial action or significantly later in time.

Interdisciplinary (ID) Team—A group of professional specialists with expertise in different resources that collaborate to develop and evaluate management alternatives.

Interdisciplinary Approach—Utilization of one or more individuals representing areas of knowledge and skills focusing on the same task, problem, or subject. Team member interaction provides needed insight to all stages of the process.

Intermittent Stream—A stream that runs water in most months, but does not run water during the dry season of most years.

Invertebrates—Animals having no backbone such as earthworms, insects, and lesser animals.

Irretrievable—Applies to losses of production, harvest, or a commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports (recreation) site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible—Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Issue—A subject or question of public discussion or interest to be addressed or discussed in the planning process.

L

Land Allocation—The assignment of a management emphasis to particular land areas with the purpose of achieving goals and objectives. Land allocation decisions are documented in environmental analysis documents such as the Idaho Panhandle National Forests' Final EIS and Forest Land and Resource Management Plans.

Landtype—A unit of land with similar designated soil, vegetation, geology, topography, climate, and drainage. The basis for mapping units in the land systems inventory.

Limiting Factor—The environmental influence that exceeds the tolerance limit of an animal to restrict it in its activities, functions, or geographic range.

Litter—An organic surface soil layer usually composed of identifiable leaves, branches, or other vegetative material, and animal remains.

M

Management Area—Geographic areas, not necessarily contiguous, that have common management direction, consistent with the Forest Plan allocations.

Management Direction—A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Management Indicator Species—A species selected because its welfare is presumed to be an indicator of the welfare of other species sharing similar habitat requirements. A species of fish, wildlife, or plants that reflect ecological changes caused by land management activities.

Management Prescriptions—A set of land and resource management policies that, as expressed through Standards and Guidelines, creates the Desired Future Condition over time.

Middleground—The part of a scene or landscape that hits between the foreground and background zones.

Mitigation—Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impacts of a management practice.

Model—A formalized expression of a theory to describe, analyze, or understand a particular concept.

Monitoring and Evaluation—The evaluation, on a sample basis, of Forest Plan management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

Mortality—In forestry, trees in a stand that die of natural causes.

Mulching—Covering the surface of the soil with natural (e.g., litter) or deliberately applied organic materials (e.g., straw, wood chips, foliage).

N

National Environmental Policy Act (NEPA) Process—An interdisciplinary process that concentrates decisionmaking around issues, concerns, alternatives, and the effects of alternatives on the environment.

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 the preparation of regulations to guide that development.

Natural Regeneration—Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

Noxious Weed—A plant species that is highly injurious or destructive and has a great potential for economic impact.

O

Obliteration—Obliteration of an existing road would involve removal of all culverts, establishing permanent drainages, and recontouring of the road surface.

Old Growth Habitat—Habitat for certain wildlife that is characterized by mature coniferous forest stands with large snags and decaying logs.

Optimum Habitat—The amounts and arrangement of cover and forage that results in the greatest level of production that is consistent with other resource requirements.

P

Particulates—Small particles suspended in the air and generally considered pollutants.

Pathogen—A specific causative agent of disease, such as a virus.

Peak Flow—The greatest flow attained during the melting of the winter snowpack.

Perennial Streams—Streams that flow continuously throughout the year.

Pioneer Species—A plant capable of invading a bare site (newly exposed soil surface) and persisting there until replaced by another species or community as succession progresses.

Plant Community—An assembly of plants living together.

Preferred Alternative—The alternative recommended for implementation in the EIS (40 CFR 1502.14).

Prescribed Burning—The application of fire to fuels in either a natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

Prescription—Management practices selected and scheduled for application on a designated area to attain specific goals and objectives.

Public Road—A road open to public travel that is under the jurisdiction of and maintained by a public authority such as states, counties, and local communities.

R

Range of Alternatives—An alternative is one way of managing the National Forest, expressed as management emphasis leading to a unique set of goods and services being available to the public. A range of alternatives is several different ways of managing the Forest, offering many different levels of goods and services.

RARE II—The acronym for the second Roadless Area Review and Evaluation conducted by the Forest Service in 1979 that resulted in an inventory of roadless areas considered for potential wilderness designation.

Recreation Opportunity Spectrum (ROS)—A system for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given area might be able to provide. It is used for planning and managing the recreation resource and recognizes recreation activity, setting, and experience opportunities.

Rehabilitation—To return environments into good health.

Research Natural Area—An area in as near a natural condition as possible, that exemplifies typical or unique vegetation and associated biotic, soil, geological, and aquatic features. The area is set aside to preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and general public use is not allowed.

Restricted Road—A National Forest road or segment that is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be specified. The closure is legal when the Forest Supervisor has issued and posted an order in accordance with 36 CFR 261.

Riparian—Pertaining to areas of land directly influenced by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream sides, lake borders, or marshes are typical riparian areas. Riparian vegetation borders watercourses, lakes, or swamps; it requires a high water table.

Road—A vehicle travel way of over 50 inches wide.

Road Maintenance—The upkeep of the entire Forest Development Transportation Facility including surface and shoulders, parking and side areas, structures, and any traffic control devices as are necessary for its safe and efficient utilization.

Roadless Area—A National Forest System area that is larger than 5,000 acres or, if smaller than 5,000 acres, is contiguous to a designated wilderness or primitive area; contains no roads, and has been inventoried by the Forest Service for possible inclusion into the wilderness preservation system.

S

Sage Steppe Obligate - Species requiring sagebrush vegetation as a major part or all of their life history requirements, specifically within the Great Basin ecosystems.

Scoping—The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignment.

Sediment—Any material carried in suspension by water that will ultimately settle to the bottom. Sediment has two main sources—from the channel itself and from upslope areas.

Seedlings and Saplings—Non-commercial size young trees.

Sensitive Species—Those species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density or habitat capability that would reduce a species' existing distribution.

Series—A group of habitat types having the same climax tree species.

Site Productivity—Production capability of specific areas of land.

Slash—The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning of trees.

Snag—A standing dead tree usually without merchantable value for timber products, but may have characteristics of benefit to some cavity nesting wildlife species.

Special Use Permit—A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.

Stand—A community of trees or other vegetation uniform in composition, constitution, spatial arrangement, or condition to be distinguishable from other adjacent communities.

Stand Replacing Fire—A fire that consumes an entire stand of trees. These fires are generally quite hot and can burn hundreds of acres.

Stream Order—It is often convenient to classify streams within a drainage basin by systematically defining the network of branches. Each nonbranching channel segment (smallest size) is designated a *first-order stream*. A stream which receives only first-order segments is termed a *second-order stream*, and so on. The order of a particular drainage basin is determined by the order of the principle or largest segment.

Succession—The progressive changes in plant communities toward climax habitat.

Successional Stage—A stage or recognizable condition of a plant community which occurs during its development from the bare ground to climax habitat.

T

Talus—The loose accumulation of fragmented rock material on slopes, such as at the base of a cliff.

Thermal Cover—Vegetative cover used by animals to modify the adverse affects of weather.

Thinning—Cutting in even-aged stands to redistribute growth potential or benefit the quality of the residual stand.

Threatened Species—Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tiering—Refers to the coverage of general matters in broader EISs or EAs with subsequent other related statements in the EAs incorporated, by reference. The discussions contained in the previous document are incorporated, solely for issues specific to the statement subsequently prepared.

U

Unclassified Road—A road that is not constructed, maintained, or intended for long-term highway use, such as roads constructed for temporary access and other remnants of short-term use roads associated with fire suppression, timber harvest, and oil, gas, or mineral activities, as well as travel ways resulting from off-road vehicle use.

Understory—Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Ungulate—A mammal having hoofs, i.e., deer, elk, and moose.

Unroaded Area – An area that does not contain classified roads.

V

Vertebrates—Animals having a backbone, or a spinal column, including mammals, fishes, birds, reptiles, and amphibians.

Viable Population—A population that has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population on the planning area.

Viewshed—Subunits of the landscape where the scene is contained by topography similar to a watershed.

Visual Condition Class (VCC)—A measure of the level of disturbance to the visual resource, expressed in acres. The visual condition classes are used as indicators to measure the existing conditions and effects of alternatives.

Visual Quality Objective (VQO)— A US Forest Service system of indicating the potential expectations of the visual resource by considering the frequency an area is viewed and the type of landscape.

Visual Resource Management (VRM)— A BLM system to inventory visual resources, to establish levels of management by assigning visual resource class objectives, and to evaluate visual impacts.

Visual Resource—The composite of landforms, water features, vegetative patterns, and cultural features which create the visual environment.

W

Water Yield—The measured output of the forest's streams.

Watershed—Entire area that contributes water to a drainage system or stream.

Wetlands—Areas that are inundated by surface or ground water with a frequency sufficient to 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, wet meadows, river overflows, mud flats, and natural ponds.

Wilderness—All lands included in the National Wilderness Preservation System by public law; generally defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation.

Wilderness Study Areas (WSAs)—Lands that are being evaluated to determine their ability to be included in the National Wilderness Preservation System.

Wildfire—Any wildfire not designated and managed as a prescribed fire with an approved prescription.

Wildland Fire Use—Naturally caused wildfires that are allowed to burn within controlled areas to achieve natural resource objectives.

Wildlife Diversity—The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features.