FINDING OF NO SIGNIFICANT IMPACT

GREATER SAGE-GROUSE HABITAT RESTORATION PLAN FOR THE CLOVER FLAT AREA

DOI-BLM-ORWA-L050-2016-0006-EA

The Bureau of Land Management, Lakeview District, Lakeview Resource Area (BLM), has analyzed several alternative proposals to improve habitat for Greater Sage-grouse (*Centrocercus urophasianus*) and other sagebrush-obligate wildlife species. The alternatives include removing post-settlement western juniper trees (less than 150 years old) from sagebrush-steppe, aspen, and transitional forest habitats in the Clover Flat area.

An environmental assessment (EA) was prepared that analyzed the potential direct, indirect, and cumulative environmental impacts of three alternatives. The alternatives included: (1) No Action (no sagebrush habitat treatments), (2) Proposed Action (implement a variety of habitat treatment prescriptions, required design features, best management practices, and mitigation measures) and (3) Biomass Removal (implement a variety of habitat treatment prescriptions including biomass removal, required design features, and best management practices). Four other alternatives were considered, but were not analyzed in detail (see Chapter 2 of attached EA).

The Council on Environmental Quality (CEQ) regulations state that the significance of impacts must be determined in terms of both context and intensity (40 CFR 1508.27). The context of the proposed project is the South Warner Project Area. For this reason, the analysis of impacts in the attached Environmental Assessment (EA) is focused appropriately at this scale. The CEQ regulations also include the following ten considerations for evaluating the intensity of impacts:

1) Would any of the alternatives have significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)? ( ) Yes (X) No

Rationale: Based on the analysis contained in the attached EA, none of the alternatives would have either significant beneficial or adverse impacts on the human environment. There are no paleontological resources, prime or unique farmlands, wild horse management areas, wild and scenic rivers, significant caves, designated wilderness areas, wilderness study areas, research natural areas, or hazardous waste sites located in the project area. No impacts would occur to low income or minority populations. Neither adverse nor beneficial impacts are anticipated to land status, geology, or mineral and energy resources (EA, pages 47-48).

Potential beneficial or adverse impacts to greenhouse gas emissions, air quality, soils, biotic crusts, watershed and hydrology, water quality, riparian and aquatic habitat, upland vegetation, noxious weeds and invasive non-native species, special status plants, wildlife habitat, special status animals, livestock grazing, cultural and historic resources, traditional cultural uses, areas of critical environmental concern, areas with wilderness characteristics, recreational opportunities, visual resources, fuels, and fire-fighter safety anticipated by the alternatives have been analyzed in detail within Chapter 4 of the attached EA and found not to be significant.

2) Would any of the alternatives have significant adverse impacts on public health and safety (40 CFR 1508.27(b)(2)? ( ) Yes (X) No

Rationale: None of the alternatives analyzed in detail in the EA would have significant impacts on public health or safety because the project area is not located near a populated urban area. There would also be no impacts to low income or minority populations (page 48). Further, there are no known hazardous waste sites in the project area (page 48). There would be no impacts to ground water drinking sources surrounding the project area (page 60). Potential impacts to surface water quality in the project area have been analyzed in the EA and found not to be significant (pages 21-23 and 60-62). Potential impacts to air quality within and surrounding the project area have been analyzed in the EA and found not to be significant (pages 16-17 and 52-54).

3) Would any of the alternatives have significant adverse impacts on unique geographic characteristics (cultural or historic resources, park lands, prime and unique farmlands, wetlands, wild and scenic rivers, designated wilderness or wilderness study areas, or ecologically critical areas (*ACECs, RNAs, significant caves*)) (40 CFR 1508.27(b)(3)? ( ) Yes (X) No

Rationale: There are no park lands, prime or unique farmlands, wild and scenic rivers, research natural areas, significant caves, designated wilderness areas, or wilderness study areas located in the project area (pages 43-44 and 47-48).

Potential impacts to riparian and wetland habitats, cultural and historic resources, areas of critical environmental concern, and areas with wilderness characteristics have been analyzed in the attached EA and found not to be significant (pages 23, 41-44, 60-61, 80-85).

4) Would any of the alternatives have highly controversial effects (40 CFR 1508.27(b)(4)? ( ) Yes (X) No

Rationale: The BLM has extensive expertise planning, analyzing impacts, and implementing sagebrush habitat restoration projects such as those proposed by the alternatives addressed in the attached EA. The potential beneficial or adverse impacts to greenhouse gas emissions, air quality, soils, biotic crusts, watershed and hydrology, water quality, riparian and aquatic habitat, upland vegetation, noxious weeds and invasive non-native species, special status plants, wildlife habitat, special status animals, livestock grazing, cultural and historic resources, traditional cultural uses, areas of critical environmental concern, areas with wilderness characteristics, recreational opportunities, visual resources, fuels, and fire-fighter safety can be reasonably predicted based on existing science and professional expertise. The attached EA analyzed these impacts (see Chapter 4). The nature of these impacts is not highly controversial, nor is there substantial dispute within the scientific community regarding the nature of these effects. The public, other agencies, and Native American tribes will be provided a 30-day period to review and comment on the analysis. Substantive comments will be reviewed to determine if highly controversial effects, as defined under 40 CFR 1508.27(b)(4), would be likely to occur.

5) Would any of the alternatives have highly uncertain effects or involve unique or unknown risks (40 CFR 1508.27(b)(5)? ( ) Yes (X) No

Rationale: The BLM has extensive expertise planning, analyzing impacts, and implementing sagebrush habitat restoration projects such as those proposed by the alternatives addressed in the attached EA. The potential beneficial or adverse impacts of the alternatives to greenhouse gas emissions, air quality, soils, biotic crusts, watershed and hydrology, water quality, riparian and aquatic habitat, upland vegetation, noxious weeds and invasive non-native species, special status plants, wildlife habitat, special status animals, livestock grazing, cultural and historic resources, traditional cultural uses, areas of critical environmental concern, areas with wilderness characteristics, recreational opportunities, visual resources, fuels, and fire-fighter safety can be reasonably predicted based on existing science and professional expertise. The attached EA analyzed these impacts (see Chapter 4). The nature of these impacts is not highly uncertain nor does it involve unique or unknown risks.

6) Would any of the alternatives establish a precedent for future actions with significant impacts (40 CFR 1508.27(b)(6)? ( ) Yes (X) No

Rationale: The BLM has extensive expertise planning, analyzing impacts, and implementing sagebrush habitat restoration projects such as those proposed in the alternatives addressed in the EA. None of the alternative actions represents a new, precedent-setting wildlife habitat management technique nor would they establish a precedent for future similar actions with potentially significant effects.

7) Are any of the alternatives related to other actions with potentially significant cumulative impacts (40 CFR 1508.27(b)(7)? ( ) Yes (X) No

Rationale: Based on the analysis contained within the Cumulative Effects section (Chapter 4) of the attached EA, none of the alternatives would have significant cumulative effects within the cumulative effects analysis area, even when added to the effects of other past, present, and reasonably foreseeable future actions. To the extent the effects of these types of treatments could have significant cumulative beneficial effects when examined throughout the broader scale of all Greater Sage-Grouse in the Oregon Region, they have already been addressed within the *Oregon Greater Sage-Grouse Proposed Resource Management Plan Amendment and Final Environmental Impact Statement* (BLM 2015).

8) Would any of the alternatives have significant adverse impacts on scientific, cultural, or historic resources, including those listed or eligible for listing on the National Register of Historic Resources (40 CFR 1508.27(b)(8)? ( ) Yes (X) No

Rationale: Potential impacts to cultural and historic resources and traditional cultural use areas have been analyzed in Chapter 4 of the attached EA and found not to be significant (pages 42-43 and 81-83).

9) Would any of the alternatives have significant adverse impacts on threatened or endangered species or their critical habitat (40 CFR 1508.27(b)(9)? ( ) Yes (X) No

Rationale: None of the alternatives analyzed in the attached EA would have significant impacts on Federally-listed threatened or endangered species or their critical habitats as no listed species occur in the project area (pages 24, 26, 30).

10) Would any of the alternatives have effects that threaten to violate Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)? ( ) Yes (X) No

Rationale: The analysis contained in the EA conforms to the requirements of the National Environmental Policy Act. All of the alternatives analyzed in the EA comply with applicable Federal or State environmental laws. No local environmental protection laws are known to exist.

In accordance with the Federal Land Policy and Management Act, the project's Purpose and Need, and alternative actions were reviewed for conformance with current land use plans and other applicable plans and policies. The purpose and need for the action conforms with the applicable goals and management direction contained in the *Lakeview RMP/ROD* (BLM 2003).

The action alternatives also conform with the applicable goals, objectives, and management decisions contained in both the *Lakeview RMP/ROD* and the *Oregon Greater Sage-Grouse Approved RMPA* (BLM 2003, 2015). (see Appendix D).

The Purpose and Need and Proposed Action alternative conforms with the *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon* (ODFW 2005, 2011) and the *Oregon Smoke*

Management Plan (see Appendix D).

Finding

On the basis of the analysis contained in the attached EA, the consideration of intensity factors described above, and all other available information, it is my determination that none of the alternatives analyzed would constitute a major federal action which would have significant adverse or beneficial impacts on the quality of the human environment. Therefore, an Environmental Impact Statement (EIS) is unnecessary and will not be prepared.

__________________________________ ____________________

J. Todd Forbes Date

Field Manager, Lakeview Resource Area

BLM

Greater Sage-Grouse Habitat Restoration Plan for the Clover Flat Area

Environmental Assessment
DOI-BLM-ORWA-L050-2016-0006-EA

Bureau of Land Management
Lakeview District Office
1301 South G Street
Lakeview, Oregon 97630

October 2017

Lakeview District, Lakeview Resource Area

The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

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1. PURPOSE AND NEED FOR ACTION

Introduction

The Clover Flat project area contains approximately 19,625 acres of BLM-administered land and is located to the west of Valley Falls, Oregon (Map 1). The vegetative diversity within the project area has been impacted over the last century due to a combination of factors including: fire exclusion, historic livestock grazing practices, encroachment of western juniper (*Juniperus occidentalis*) into sagebrush-steppe and aspen stands, changes in hydrologic regimes and erosion, and increases in noxious weeds and non-native invasive species. A reduction in vegetative diversity has also occurred, including both a loss of complexity in vegetative communities (reduction of distribution and abundance of community types) and a trend toward more homogenous communities of common vegetation (i.e. expansion of juniper woodlands). The project area contains important Greater Sage-Grouse (*Centrocercus urophasianus*) and winter mule deer (*Odocoileus hemionus*) habitat that is being negatively impacted by juniper expansion.

Purpose and Need for Action

The purpose of the proposed action is to remove post-settlement[1] western juniper (juniper) from existing sagebrush communities to improve or restore habitat for the Greater Sage-Grouse (hereafter referred to as sage-grouse) within the project area (Map 1). Sagebrush/sage-grouse habitat in this area has been degraded by the encroachment of juniper. Several recent health assessments completed in the Clover Flat project area identified juniper encroachment as an issue impacting rangeland health conditions (BLM 2015a; 2015e). Juniper expansion, absent fire or active vegetation management, tends to suppress native shrub, grass, and forb species that sage-grouse depend on. Removal of post-settlement juniper would maintain or restore sagebrush steppe habitats. This habitat restoration plan/environmental assessment (EA) would provide guidance for habitat treatment activities on BLM-administered lands in the project area for the next five to 20 years.

The need for the proposed action arises from the fact that the habitats for sage-grouse on BLM-administered lands in the project area are outside the desired range of conditions described in the *Lakeview Resource Management Plan/Record of Decision* (RMP/ROD*;* BLM 2003b, page 23 as maintained) due to the proliferation of post-settlement juniper. The *Lakeview RMP/ROD* places a high priority on the rehabilitation of shrub-steppe vegetation communities at risk due to decline in vegetative diversity and dominance by juniper. The plan also emphasizes the use of prescribed fire and mechanical treatments to regulate woody species dominance and direct vegetation composition toward desired conditions (pages 23 to 24). Priority areas for juniper management have been identified as: quaking aspen (*Populus tremuloides*) groves, riparian areas, sage-grouse breeding and nesting habitats, mule deer winter range, bighorn sheep range,

[1] "Post-settlement" juniper refers to juniper that was established after or near the time of European settlement or less than 150 years old.

and young, invasive juniper sites impacting other resource values (pages 33 to 35). The plan also calls for maintaining or enhancing old-growth or pre-settlement[2] juniper stands (page 34).

In addition, both the United States Fish and Wildlife Service (USFWS 2010, 2013) and the *Oregon Greater Sage-Grouse Approved Resource Management Plan Amendment* (ARMPA; BLM 2015b) identified conifer expansion into sagebrush habitat as a threat to sage-grouse and its habitat. The *Oregon Greater Sage-Grouse ARMPA* recommends removing conifers encroaching into sagebrush habitats, particularly in the vicinity of leks[3] to eliminate potential predator (raptor) perch sites. The plan also recommends treating weeds and invasive plants and re-seeding areas in conjunction with juniper removal as important methods for preserving or restoring sagebrush habitat and mitigating the threat of habitat degradation or loss (pages 1-11, 2-10 to 2-17).

Restoration Plan Objectives

a. Improve nesting, brood rearing and winter habitats for sage-grouse through a reduction of post-settlement juniper. This includes, but is not limited to maintaining big and low sagebrush stands with intact, native understory grasses, maintaining brood rearing habitats around springs, seeps, and meadows, and avoiding activities that would cause the long-term spread of non-native grasses or noxious weeds.
b. Remove juniper and other young conifers to promote the maintenance and health of native sagebrush, grasses, and forbs in sage-grouse habitats along the forest fringe.
c. Maintain or improve health of aspen stands (Map 3) for a variety of wildlife species by reducing post-settlement juniper and reintroducing fire.
d. Maintain pre-settlement (old-growth) juniper stands and individual old-growth trees for wildlife species, especially cavity nesting birds.

Background

The following section contains a summary of the current science regarding juniper expansion within the region.

Juniper in the Pacific Northwest has been expanding at an unprecedented rate (Belsky 1996). Juniper was once confined to rocky ridges and unproductive pumice sands with sparse vegetation and infrequent fires (Eddleman and Miller 1992; West 1984; Miller and Rose 1995; Miller *et al*. 1999a). Juniper has now spread to more productive sagebrush sites with deep, well-drained soils (Miller and Rose 1999). Juniper has also invaded the dry fringes of pine stands and aspen sites where it competes vigorously with other species (Wall *et al*. 2001; Miller and Rose 1999). In one study in the region, three-fourths of the aspen stands sampled had established juniper populations. Twelve percent of the aspen stands had been completely replaced by juniper while

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[2] "Pre-settlement" juniper refers to juniper that was established prior to the time of European settlement or about 150 years old or more.

[3] Lek refers to an area where male sage-grouse congregate and display (or strut) during the breeding season to attract females.

twenty-three percent were dominated by juniper. Seventy percent of these stands had zero recruitment of new aspen (Wall *et al*. 2001).

The expansion of juniper in the region began in the late 1800s (Young and Evans 1981; Eddleman 1987; Miller and Rose 1995) and has been most frequently attributed to the introduction of livestock, reduced role of fire, and optimal climatic conditions during the late 1800s to early 1900s (Tausch *et al*. 1981; West 1984; Miller and Wigand 1994, Soulé *et al.* 2004). Heavy livestock grazing between 1880 and 1930 removed fine fuels that historically carried fire across the landscape, as well as removed competition from other species (Miller *et al*. 1999b). There was also a reduction in human set fires in the nineteenth century (Burkhardt and Tisdale 1976; Miller *et al*. 1994) and wildfire suppression activities began between 1910 and 1930 (Agee 1993). Research supports the importance of the role of fire as a natural disturbance process within sagebrush steppe (*Artemisia* spp.) and juniper ecosystems (Kaufman and Sapsis 1989; Agee 1993; Miller and Svejcar 1994; Miller *et al*. 1995), as well as pine (*Pinus* spp.) forests (Franklin and Dryness 1973).

During the late 1800s until about 1916, winters in southeastern Oregon were milder and precipitation was greater than the current long-term average (Antevs 1938; Graumlich 1987). These conditions promoted vigorous juniper growth (Fritts and Xiangdig 1986; Holmes *et al*. 1986). Juniper's heavy use of available soil moisture allows it to aggressively compete with herbaceous and shrub species used by sage-grouse and numerious other important wildlife species. Watersheds can also be degraded by juniper expansion by reducing total ground cover leading to soil surface erosion (Buckhouse and Gaither 1982; Gaither and Buckhouse 1983).

Juniper occupies over 2.5 million acres of eastern Oregon, southwestern Idaho, and northeastern California (Miller and Wigand 1994), including approximately 400,000 acres of juniper occurring within the Lakeview Resource Area (LRA) (BLM 2003a). Much of this juniper is less than 150 years old and falls in the early to mid-seral stage (Miller *et. al.* 2005).

Miller *et al.* (2005) describes juniper succession into sagebrush-steppe communities in terms of juniper tree dominance, understory (grass, forb, and shrub) presence or absence, and management options. Miller describes three phases of juniper succession and the transition zone where the shrub layer is becoming impacted, thus restricting management options. In Phase 1, juniper trees are present, but grasses, forbs, and shrubs are the dominant vegetation that influences ecological processes (hydrologic, nutrient, and energy cycles) on the site. In Phase 2**,** juniper trees are co-dominant with grasses, forbs, and shrubs and all three vegetation layers influence ecological processes on the site. In the transition stage between Phases 2 and 3**,** juniper trees are co-dominant with grasses and forbs, but the shrub layer is out-competed by juniper and is on the decline. In Phase 3, juniper trees are the dominant vegetative component and the primary plant layer influencing ecological processes on the site. Native shrubs and grasses are sparse, though some invasive non-native species such as cheatgrass (*Bromus tectorum*) or medusahead rye (*Taeniatherum caput-medusae*) can be the dominant grass in the understory.

The BLM recognizes there is some on-going disagreement as to how to best manage western juniper within the sagebrush-steppe environment. One literature review contends there are many inaccuracies with respect to the negative impacts of juniper expansion and positive impacts of juniper treatment activities in the scientific literature, particularly related to general wildlife habitat impacts (Belsky 1996). However, this particular review focused on studies of pinyon-juniper woodlands in the Southwest and southern Great Basin and did not examine studies of western juniper in the northern Great Basin, nor did it examine the impacts of western juniper on Greater Sage-grouse habitat specifically. This EA contains an analysis of potential impacts, both positive and negative, expected from the proposed treatments based on a review of the best available current and regionally applicable scientific literature.

Miller *et al.* (2005) found that the early transitional stages (Phases 1 and 2) of juniper encroachment into the sagebrush-steppe offered the most diversity of wildlife habitats and highest wildlife species diversity and abundance because these phases still contain a healthy, diverse understory of native shrubs, grasses, and forbs. In contrast, closed juniper-dominated stands (Phase 3) offer less diverse wildlife habitats and wildlife species diversity. As canopy closure increases, the native understory shrubs, grasses, and forbs begin to decline and vegetative species and structural diversity decline, causing wildlife habitat and species diversity to decline. Belsky (1996) reported numerous scientific studies found that juniper removal can improve habitat for open, shrub-steppe dependent wildlife species. Holmes *et al*. (2017) noted an increase in nesting pairs of several sagebrush-steppe obligate songbird species following juniper removal from sagebrush habitats in the South Warner Mountains located southeast of the project area. Research related specifically to Greater Sage-grouse shows they tend to avoid aspen, juniper woodlands and savannahs, and riparian areas with trees because they provide perch and nest sites for avian predators (Baruch-Mordo *et al*. 2013, Knick *et al*. 2013). These birds also avoid invasive annual grasslands because they provide no habitat.

Miller *et al.* (2005) found the most effective time to remove young juniper and restore sagebrush-steppe communities (in terms of both cost and desired vegetative response) is during Phases 1 and 2. Once a stand transitions to Phase 3, the understory is not adequate to carry a fire, nor is there an adequate seed source in the soil of desirable native understory plant species. Cheatgrass and other weeds often take over Phase 3 sites when the juniper canopy is removed without additional intensive restoration work to the site, such as seeding with native species (Miller *et al*. 2007).

Juniper phases on BLM-administered lands within the project area are shown on Map 3 and summarized in Table 1-1.

Table 1-1. Juniper Phases within BLM-Administered Portions of Clover Flat Project Area

Juniper Phase	**Acres**	**Percent** (%)
No Juniper	5,784	29
Phase 1	10,894	56
Phase 2	2,232	11
Phase 3	715	4
Total	**19,625**	**100.0**

Issues and Concerns

The following represents a summary of concerns BLM has received recently from one member of the public related to juniper treatment in general and the potential use of juniper biomass for jet fuel production specifically:

- General concern was expressed regarding the scale of (juniper) deforestation that is occurring on BLM, Forest Service, private, and state lands in this region of Oregon.

- An opinion was expressed that Federal agencies must prepare an Environmental Impact Statement (EIS) to address the current and foreseeable footprint of deforestation, as well as the new stress that a potential biomass plant would have on fuel demand, air pollution, water pollution, wood hauling, and other impacts.

- A request that BLM identify all areas currently proposed for (juniper) deforestation, which have not yet been treated, as well as other foreseeable projects, presumably for the purposes of cumulative effects analysis.

- A question was expressed as to how BLM would address livestock grazing disturbance and spread of aggressive invasive exotic weeds like cheatgrass or medusahead. A related concern was expressed that, following juniper removal, the understory would be converted to exotic grass monocultures.

- A request that BLM identify where, when, and how old-growth, mature forested habitats would be destroyed.

- A question was expressed as to how deforestation would affect the local micro-climate, watersheds, and habitats for native biota and how BLM would track adverse impacts to native biota.

Those issues or concerns that BLM determined to be applicable (within the scope of the purpose and need) or substantive have been addressed within the development of the restoration plan objectives (above), within the range of alternatives (Chapter II) and/or in the analysis of potential impacts, including potential cumulative effects (Chapter IV), or within the Finding of No Significant Impact (FONSI).

Decision to be Made

The decision to be made is whether or not to implement a sagebrush restoration plan that would reduce the encroachment of post-settlement juniper to maintain or improve sage-grouse habitat on BLM-administered lands within the project area.

Wildfire suppression and rehabilitation, livestock grazing, and weed treatment decisions have already been addressed in the *Lakeview RMP/ROD* (BLM 2003b, as maintained), *Oregon Greater Sage-Grouse ARMPA* and *Record of Decision* (BLM 2015b), and other recent activity plans (BLM 2015d, 2015f, 2015g, 2016a, and 2016b). Though the potential impacts of these other previously-approved actions are addressed in the cumulative impacts section, these previous management decisions remain in effect and will not be re-visited by this project decision.

Decision Factors

The following factors will be considered in making the final agency decision:

1. The degree to which the alternative management actions meet the project purpose and need and habitat restoration plan objectives.

2. The degree to which the alternative management actions conform to the *Lakeview RMP/ROD* (BLM 2003b, as maintained) and the *Oregon Greater Sage-Grouse ARMPA and ROD* (BLM 2015b) (see Appendix D.)

3. The nature and intensity of environmental impacts that would result from project implementation and the expected effectiveness of the proposed treatments and associated mitigation measures.

4. The comparative costs of the vegetation treatments.

2. ALTERNATIVES INCLUDING THE PROPOSED PLAN

Alternatives Analyzed in Detail

The range of alternatives in any NEPA analysis is determined by the purpose and need for action, as defined by the federal agency having the authority to propose and carry out that action. In this EA, the BLM analyzed three alternatives in detail (see Chapter 4) and represent a range of reasonable management actions intended to meet the purpose and need for action described in Chapter 1.

Alternative 1 - No Action

Under this alternative, no juniper treatment for sagebrush habitat restoration would occur. Natural processes (climate, wildfire, succession, etc.) would be the primary means of vegetation change on BLM-administered lands within the project area. However, current livestock grazing, wildfire suppression and rehabilitation, and weed management activities would continue as described under other existing management plans, policies, and decisions (BLM, 2003b, as maintained; 2015d, 2015f, 2015g, 2016a, 2016b, 2016d, 2017).

Management Direction Common to Alternatives 2 and 3

Development of Treatment Prescriptions

Under these alternatives, individual vegetation treatment units were first identified and digitized using recent, one-meter resolution satellite imagery from the National Agricultural Imagery Program (NAIP) stored as digital orthophoto quads (DOQs). BLM staff then visited individual treatment units, took representative ground photographs, and recorded data on field sheets regarding the vegetation present, stand structure and classification, evidence of historic fire, and other resource values.

The BLM ID team developed prescriptions for treatments on an individual unit basis based on the data collected during field inventory and using the handbook developed by Miller *et al.* (2007) as a guide. Post-settlement juniper trees would be treated using a variety of possible prescriptions (Table 2-1). The proposed treatment method was based on the size and density of the juniper trees within a treatment unit.

Table 2-1. Descriptions of Treatment Prescriptions

Method	Description	Typical Area
Cut and Leave	Refers to hand severing post-settlement juniper using chainsaw or loppers at the lowest stump height and leaving on-site.	Areas where juniper trees are less than six feet tall and sparsely distributed across the unit.
Cut, Lop, and Scatter	Refers to hand severing post-settlement juniper using chainsaw or loppers at the lowest stump height, followed by lopping and scattering or lopping and leaving the branches.	Areas where juniper trees are less than six feet tall and sparsely distributed across the unit.
Cut, Pile, Cover, and Burn	Refers to hand severing post-settlement juniper using chainsaw or loppers at the lowest stump height, followed by piling and covering, allowing the trees to cure for at least one summer season, then igniting each pile by hand with a drip torch. Burning under this method is generally carried out when there is sufficient moisture or snow to eliminate or reduce the fire spread away from the pile, thereby maintaining the majority of the shrubs and grasses while eliminating juniper slash.	Areas where juniper are dense across the landscape and greater than six feet tall.
Mechanical Cutting and Biomass Removal	Alternative 3 only; Use of mechanical equipment to cut, yard, chip, and haul juniper material for biomass.	Areas where juniper are dense across the landscape and greater than six feet tall.
No Treatment		Areas with no juniper or containing other resource values where the most appropriate mitigation method is avoidance.

Pre-settlement (old-growth) juniper stands would be maintained by avoidance or enhanced by selective thinning of interspersed post-settlement trees.

Juniper cutting would be conducted in accordance with the timing restrictions identified in the *Oregon Greater Sage-Grouse ARMPA* MD SSS-9, Table 2-3, and MD VEG 4 (BLM 2015b). During cutting activities, all branches would be removed from cut stumps to prevent re-sprouting. In addition, within cut and leave treatment units, all branches higher than four feet above the ground or one foot above average sagebrush heights would be cut to eliminate potential raptor perch sites.

A burn plan would be developed prior to implementing prescribed fire (burn) treatments. The objective would be to burn piles while leaving native shrubs and grasses in-between unburned and intact. Piles would be burned when conditions are favorable to achieving this objective. Favorable burning conditions in the project area generally occur in the winter through early summer when the trees are dry enough to burn well, but there is adequate moisture or snow cover to prevent the fire creeping into the surrounding sagebrush.

Both action alternatives include preventative measures to minimize the risk of noxious weed and invasive annual species (cheatgrass) expansion (see Appendices A and B). In addition, post-treatment of burn sites would include monitoring and treating noxious weeds/invasive non-native species in accordance with the *Integrated Invasive Plant Management Plan* (BLM 2015d) and reseeding any sites with inadequate native grass understory (i.e. Phase 3 juniper sites). Appropriate native or non-native seed mixes would be used (see Appendix C). The most appropriate seeding method (aerial, broadcast, or drill) would be used based on topography and site conditions. New methods and technologies such as seed coating, fertilization, trampling by livestock, or charcoal banding may be used to increase the likelihood of successful germination and establishment of perennial plants.

Required Design Features and Best Management Practices

Management Decisions (MD) SSS-13 and FIRE-16 from the *Oregon Greater Sage-Grouse ARMPA* (BLM 2015b) requires that all authorized actions in sage-grouse habitat include appropriate Required Design Features (RDFs) and Best Management Practices (BMPs). Appendix B lists those RDFs that the ID determined would be appropriate to apply to Alternatives 2 and 3 to mitigate potential adverse impacts to sage-grouse or their habitat.

BMPs are discretionary land and resource management techniques that are designed to maximize beneficial results and minimize negative impacts of management actions. Those BMPs from in the *Lakeview RMP/ROD* (BLM 2003b, as maintained) that the ID team determined would be appropriate to apply to Alternatives 2 and 3, but were not already incorporated into the alternative descriptions, are listed in Appendix A. Those BMPs from the *Oregon Greater Sage-Grouse ARMPA* (BLM 2015b) that the ID determined would be appropriate to apply are listed in Appendix B.

Mitigation Measures

Additional mitigation measures were applied to both alternatives to reduce or eliminate potential impacts to other resource values/uses that were not addressed through the application of required design features or best management practices described above. These included specific measures for cultural resources, special status plants, and livestock grazing.

Cultural Resources and Special Status Plant Species

BLM staff surveyed all proposed treatment units for cultural resources and special status plant species. Based on the survey results, BLM included appropriate mitigation measures into the design features for the action alternatives. Those measures included site protection or avoidance by altering the treatment prescription so that piling and burning did not occur directly on top of a site. If cultural resource or special status species values could not be adequately mitigated within a particular treatment unit, the ID Team recommended the decision-maker eliminate that portion of the unit from treatment.

Livestock Grazing

Areas treated by cut and leave or cut, lop, and scatter treatment methods would not require rest from livestock grazing following treatment. Units with pile burning or seeding treatments would be evaluated by an ID team (see monitoring section) to determine if rest from grazing is needed to meet vegetation recovery objectives. Following treatment and recovery, no increase in livestock grazing preference (forage allocation) would occur.

Implementation

Project implementation would be conducted over a five to 20 year period of time. The amount of implementation that would occur in any given year would likely vary depending upon funding and available staff resources.

Implementation would require some units to be treated by multiple entries over time in consultation with the affected livestock permittee. Those units treated by either cut and leave, or cut, lop, and scatter methods would be entered once for juniper cutting, and again for weed treatments and seeding, if necessary. Those units treated by cut, pile, and cover methods would be entered once to cut and pile the trees, a second time after one to three years to burn the juniper trees/piles, and a third time for weed treatments and seeding, if necessary.

Monitoring

An ID Team would monitor treated sites to determine whether prescribed pile burn sites are likely to undergo natural recovery by native species, be at risk of noxious weed/cheatgrass invasion, or need post-burn seeding treatment. The ID Team would monitor pile burn/seeded sites to determine if vegetation recovery objectives have been met. The ID Team could consider requiring rest from grazing for an area if adequate vegetation recovery has not occurred or newly established seedlings have not developed an adequate root system to withstand a pull test[4].

[4] A pull test refers to pulling on the upper parts of a rooted plant to determine if the upper parts of the plant will break before the entire plant is uprooted from the soil. This method simulates ungulate grazing and is a good indicator of plant susceptibility to grazing pressure.

Alternative 2 - Proposed Action

About 8,201 acres of the 19,265-acre project area would be treated under this alternative. Treatment prescriptions proposed in this alternative include various hand (chainsaw) cutting methods including: cut and leave; cut, lop, and scatter; cut, pile, cover, and burn as described in the preceding section. Additional mitigation measures were applied to this alternative to further reduce or eliminate potential impacts to mule deer thermal cover, visual resources, wilderness characteristics, and recreation use. These included:

a) Hand (chainsaw) cutting methods only would be utilized. No mechanical (machine cutting) method would be used.
b) All units containing wilderness characteristics would be treated collectively at the same time (season/year) and treatments would be completed within 2-3 years to minimize displacing and/or effecting users seeking primitive recreation opportunities and to lessen short-term impacts to visual resources.
c) Within units with wilderness characteristics or visual corridors, stumps would be cut no more than 4 inches above ground surface (dirt or rock)
d) Material would be piled and burned on top of stumps to the extent possible, particularly within units with wilderness characteristics or visual corridors.
e) Cutting along the edges of unit boundaries would be feathered, dithered, or undulated across the project area.
f) Cut and leave treatment prescription within units with wilderness characteristics and visual corridors would be avoided. The cut, lop, and scatter prescription would be used on a very limited basis in units where cut, pile, cover, and burn treatments are not feasible. If cut and leave treatments are deemed necessary within units with wilderness characteristics or visual corridors, ensure all branches/materials are cut lower than 1 foot above the ground, even in tall sagebrush areas.
g) Within units with wilderness characteristics and visual corridors, the cut, pile, cover, and burn treatment prescription would be favored (in areas where trees are dense enough to make burn piles).
h) In the cut, pile, cover, and burn treatment units, the objective of the prescribed burning portion of the treatment would be to consume a minimum of 85% of the material in each pile. Within units with wilderness characteristics and visual corridors, the objective of the prescribed burning portion of the treatment would be to consume a minimum of 95% of the material in each pile.
i) Within units with wilderness characteristics or visual corridors, all old-growth trees and 50-70% of the groupings of mature trees would be retained where necessary to provide adequate screening and mimic the natural formation, shape, and arrangement of vegetation within each unit (generally cutting most trees less than 10 feet in height). Retention trees would be left in areas where pre-settlement trees would have been historically located (drainages, canyons, cliffs, rocky outcrops, peaks/hilltops, escarpments, and ridges).
j) A few scattered, mature trees would be retained on open slopes and flats, along main roads and key observation viewpoints, sparsely treed areas and valley bottoms across the project area for primitive recreation purposes (wind block, thermal/shade cover, and esthetics).

k) Implementation monitoring and adaptive management would be used along with recreation staff knowledge, to ensure leave trees are sufficient to meet wilderness characteristics, visual quality, and recreation needs.
l) Within units with wilderness characteristics, broadcast seeding methods would be emphasized.

As a result of the mitigation measures described above, the treatment methods within many units (3,128 acres; Map 5) were modified or further refined to thin, rather than completely remove juniper. Treatment in these thinned units would consist of cutting 30 to 50% of the invasive, post-settlement juniper. Treatment in these areas would focus on cutting most young, small juniper, while leaving some large, mature juniper, and all pre-settlement (old-growth) junipers to provide vegetative screening on the landscape. Examples of what these thinning treatments would look like in areas of different juniper densities (low, medium, and high) are shown in Maps A-C of Appendix E. Acre estimates for each treatment prescription are shown in Table 2-2.

Table 2-2. Treatment Prescriptions for Alternative 2

Prescription	Acres	Percent (%)
Cut and leave	435	2.2
Cut, lop, and scatter	2,807	14.3
Cut, pile, cover, and burn	1,813	9.2
Cut, move pile, cover, and burn	18	0.1
Thin and leave	230	1.2
Thin, lop, and scatter	210	1
Thin, pile, cover, and burn	2,688	13.7
No treatment	11,448	58.3

Alternative 3 - Biomass Removal

The BLM has a memorandum of understanding (MOU) (BLM-OR931-1408) with the Western Juniper Utilization Group and the U.S. Forest Service intended to promote "economic opportunities related to western juniper (utilization) from rangeland restoration and fuels reduction projects"… under this MOU, BLM has agreed to ensure that its NEPA documents "include an analysis of product removal when juniper is cut as part of restoration or hazardous fuel reduction treatments" (BLM 2014a). In accordance with this policy, a biomass removal alternative was developed.

Under this alternative, approximately 8,251 acres of the project area would be treated using hand (chainsaw) methods including: cut and leave; cut, lop, and scatter; and cut, pile, and burn treatments similar to Alternative 2. Mechanical equipment (i.e. Temco, excavator, skidder, wood chipper, and dump trucks) would be used in denser units within 0.25 miles of existing main roads to cut/fall, bunch, and yard biomass material. Material would be chipped on-site at designated yarding areas and then hauled to a biomass facility via trucks. The additional costs (primarily for chipping and hauling to a biomass facility) of this alternative would be paid by the benefitting party. Due to existing management decisions within the *Lakeview RMP/ROD* (BLM 2003b, as maintained), biomass removal would not occur within perennial riparian areas or Red Knoll ACEC. In addition, biomass activities would be limited to slopes less than 30% and would not remove pre-settlement (old-growth) juniper (see Appendix A). However, no wilderness character, visual quality, recreation, or mule deer mitigation measures would be employed in the project area under this alternative. Biomass recovery treatments would occur within approximately 240 acres of the project area (Table 2-3). An additional ten acres would be needed for temporary landings (Map 6).

Table 2-3. Treatment Prescriptions for Alternative 3

Prescription	**Acres**	**Percent** (%)
Cut and leave	807	4.1
Cut, lop, and scatter	2,798	14.3
Cut, pile, cover, and burn	4,646	23.7
Biomass removal	250	1.2
No treatment	11,119	56.7

Areas containing low density or young juniper (Phase 1) or located further than 0.25 mile from existing roads would be treated using other methods, as it would not be economically viable to use mechanical equipment to either cut or remove juniper from those areas (Table 4-3).

Alternatives Considered but Eliminated from Detailed Analysis

Cutting All Juniper in the Project Area

This alternative would consist of cutting, piling, and burning all junipers within the project area, including pre-settlement or old growth stands and areas containing cultural sites. This alternative was not analyzed in detail because it is not consistent with the management direction contained in the *Lakeview RMP/ROD* or the *Oregon Greater Sage-Grouse ARMPA* (BLM 2003b, as maintained; 2015b), and would have unavoidable or unacceptable impacts to cultural resources.

Cutting All Juniper in the Project Area Except Pre-Settlement Trees

This alternative would consist of cutting, piling, and burning all junipers within the project area, excluding pre-settlement or old-growth stands. This alternative was not analyzed in detail because the additional benefits to sage-grouse would be minimal and the impacts to other resources, especially cultural resources, would be more substantial when compared to other alternatives.

Broadcast Burning Only

This alternative would use large-scale broadcast burning to kill and remove juniper from the project area. Utilizing this method would impact much more shrub habitat compared to other alternatives. It would likely be less effective at removing juniper and would be much less selective, removing both pre-settlement and post-settlement trees. It would also cause a much higher risk of invasion by noxious weeds and invasive grasses following burning and would not conform with the most recent, applicable prescribed burning management direction contained in the *Oregon Greater Sage-Grouse ARMPA* (BLM 2015b).

Biomass Removal Only

This alternative would consist of conducting biomass removal across the entire project area. This alternative would require construction/creation of additional temporary access roads or the use of rubber-tired dump trucks for off-road hauling of biomass out of un-roaded treatment areas. This alternative was not analyzed in detail because the topography in portions of the project area is too steep for safe truck operation, it would likely result in significant negative impacts to native vegetation, and would not conform with applicable land use plans (BLM 2003b, as maintained; 2015b).

3. AFFECTED ENVIRONMENT

Introduction

This chapter describes the current conditions for each of the relevant resource values, uses, or issues found in the project area.

Regional Climate

The project area is located in the semiarid rain-shadow region east of the Cascade Mountains and is characterized by cool temperatures, light precipitation, and moderate winds. This area has both maritime and continental climate patterns, with most of the weather patterns moving inland on cyclonic low pressure fronts off the Pacific Coast. The majority of precipitation falls as snow, with higher elevations receiving greater depths. Annual precipitation across the region ranges from 11 to 21 inches. Elevations within the project area range from 4,500 feet to 6,400 feet with the average elevation around 5,700 feet. Eighty-three percent of the project area lies at elevations above 5,500 feet.

Temperature also varies widely, both seasonally and by elevation. Summer highs can exceed 100 degrees Fahrenheit in the lower elevations and winter lows below zero degrees Fahrenheit can occur at all elevations. Freezing temperatures can occur any time of the year, especially at higher elevations. Higher elevation areas have a progressively shorter growing season, especially above the 6,000 foot elevation.

Greenhouse Gas Emissions, Carbon Sequestration, and Climate

Though most climate scientists agree that average global temperatures have generally been rising over the past century, there is substantial regional variation. Mote (2003) studied climate across the Pacific Northwest and though he found that temperatures have increased over the last century, the rates differed by climatic zone. The central zone, which included eastern Oregon, experienced an average annual temperature increase of 1.5 degrees Fahrenheit during this timeframe. This study noted that the 1990s were the warmest decade of the 20th century. However, average global temperature anomalies actually leveled off between 1998 and 2013 before rising further in 2014-2015 (NOAA 2016).

While many factors are known to have an effect on temperature (i.e. long-lived greenhouse gases, ozone, aerosols, water vapor, aviation contrails, surface albedo, and solar irradiance), not all have been studied at the same level of detail (Forster *et al.* 2007, Taylor 2009). Greenhouse gas levels represent one factor that has been widely studied in recent years. Forster *et al.* (2007) reviewed scientific information on atmospheric constituents and radiative forcing and concluded that human-caused increases in greenhouse gas emissions since 1750 are extremely likely (95% confidence level) to have exerted a "substantial" warming influence on climate. Based on its own review of available science, the National Oceanic and Atmospheric Administration (NOAA) estimates that 50% or more of the recent global warming is likely due to greenhouse gas increases caused by humans (NOAA 2010, 2016). This implies that up to 50% of the recent global warming trend may be attributed to other causes, including natural fluctuations.

There is still debate and uncertainty as to the timing and magnitude of temperature change and its potential effect on future regional and global precipitation and weather patterns. Predictions of future climate conditions are based on outputs from broad-scale computer modeling studies. These predictions vary greatly depending upon which model is used and the data and assumptions that are plugged into the model. BLM has completed two regional environmental impact statements (EISs) which summarized the science regarding climatic trends, predictive modelling study results, and sources of uncertainty in the Pacific Northwest (BLM 2010a, 2015c). These analyses are hereby incorporated by reference in their entirety. One summary states that the climate in Oregon in future decades is predicted to generally be warmer, but not significantly wetter (BLM 2010a, page 169). The other summary states that eastern Oregon is predicted to become warmer and effectively drier over time (BLM 2015c, page 3-162). While such modelling efforts may help predict future climatic conditions, the results are somewhat inconsistent, and the validity of the results cannot be tested in real time.

The U.S. Geological Service (USGS 2008) reviewed the applicable science on greenhouse gas emissions and concluded that it is beyond the scope of existing science to identify any specific source of greenhouse gas emissions or sequestration (storage) and designate it as the cause of specific climate impacts at any specific location. The Council on Environmental Quality (CEQ

2014) has also noted that it is difficult to attribute specific climate impacts to individual projects and recommends using greenhouse gas emissions and changes in carbon sequestration/storage as proxies for assessing potential impacts to climate.

The most common greenhouse gases include (in descending order of atmospheric composition): water vapor, carbon dioxide, methane, and nitrous oxide. Of the four, water vapor is the most abundant and important, representing over 90% of all greenhouse gases present in the atmosphere (Forster *et al.* 2007; Taylor 2009). Methane and nitrous oxide emissions represent a very small percentage of all greenhouse gases in the U.S. and have declined between 1990 and 2007 (USEPA 2009a). None of the alternatives analyzed would have any measureable effect on atmospheric water vapor, nitrous oxide, or methane, and therefore, these specific gasses will not be discussed or analyzed further. For these reasons, BLM will focus its analysis on quantifying potential changes in carbon dioxide emissions and carbon sequestration processes that may result from the alternative actions (see Chapter 4).

Air Quality

South-central Oregon can experience very strong nighttime inversions that break up with daytime solar heating. In the wintertime, arctic air masses frequently move over the area valleys. Temperatures can remain below freezing for several weeks at a time. Winter nights are commonly clear and cool in the valleys. Under these conditions, inversions and air stagnation can occur for many days in a row over valleys in Lake County.

The two major factors affecting air quality in south-central Oregon are the use of wood burning stoves for home heating in the winter months and wildfire and prescribed burning activities throughout the burning season. In the project area there are no air quality restriction areas (Class 1 air sheds, non-attainment areas, or special protection areas).

Windblown particulate matter on federally-administered lands originates from several sources including road dust, wildfire, and prescribed burning. Although smoke from fire is a natural part of the ecosystem, it can potentially affect human health because of particulate matter concentrations and is, therefore, an issue of concern.

Air quality is a sensitive issue in Lake County primarily because of the town of Lakeview's recent efforts to avoid a designation as nonattainment area for the fine particulate matter 2.5 ($PM_{2.5}$)[5] standard. $PM_{2.5}$ is can be emitted into the air as a solid or liquid particle and its chemical form is stable. It occurs in soot from diesel engines, fuel combustion products from residential fireplaces and woodstoves, and smoke from pile and forest burning.

Potential air quality consequences are important for the preservation of high quality visual values for the region. National Ambient Air Quality Standards (NAAQS) were established by the 1963 Clean Air Act and subsequent amendments to protect the public health and welfare from adverse

[5] Particles which pass through a size-selective inlet with a 50% efficiency cut-off at 2.5 μm aerodynamic diameter. $PM_{2,5}$ corresponds to the "high-risk respirable convention" as defined in ISO 7708:1995, 7.1. $PM_{2.5}$ in the atmosphere is composed of a complex mixture of particles: sulfate, nitrate, and ammonium; particle-bound water; elemental carbon; organic carbon representing a variety of organic compounds; and crustal material.

impacts associated with the presence of pollutants in the ambient air. In December 2012, the U.S. Environmental Protection Agency (EPA) strengthened the annual $PM_{2.5}$ standard by lowering the level from 15 mg/m^3 (milligrams per cubic meter) to 12 mg/m^3 and retained the daily (24 hour) $PM_{2.5}$ standard of 35 mg/m^3 (NAAQS and 71 FR 61144). Areas in violation of the $PM_{2.5}$ standard (based on the most recent three years of monitoring data) are designated as "nonattainment areas" by the EPA.

Fuel reduction projects using prescribed fire are also a common source of pollutants that can contribute to reduced air quality. To comply with air quality standards and minimize impacts, the Lakeview Resource Area reports to the Oregon Department of Forestry (ODF) an estimate of the fuel tonnage consumed for each proposed project. Burn days are selected in coordination with the ODF Smoke Management staff to minimize the probability of sending smoke into sensitive areas (OAR 629-048-0001).

Soils and Microbiotic Crusts

Biological soil crusts (BSCs) such as mosses, lichens, micro fungi, cyanobacteria and algae play a role in a functioning ecosystem and are one of at least 12 potential indicators used in evaluating upland watershed function. In addition to providing biological diversity, BSCs contribute to soil stability through increased resistance to erosion and nutrient cycling (Belnap *et al.* 2001). Lichen species diversity is poorly known in the Pacific Northwest (Root *et al*. 2011). Further, identification of BSCs at the species level is not practical for fieldwork, as it is very difficult and may require laboratory culturing (Belnap *et al.* 2001).

Soil information was summarized from the soil survey for South Lake County (NRCS 1991), as well as digital soil data on file at the Lakeview District BLM Office. This data is incorporated herein by reference in its entirety.

The project area is comprised of 40 soil complexes broken up by topographic features and slope (Table 3-1 and Map 4). Most soils on the project area are very rocky, cobbly, loams in texture with high shrink-swell potential. Approximately, 45% of the project area is composed of the Booth soil complexes, which are found on hillsides, mountainsides, and benches. These soil complexes are moderately deep and well-drained, and support predominantly low sagebrush vegetation types. These soil complexes have slow permeability, high shrink-swell potential, and increased erosion potential due to shallow soil depth and location on slopes.

Approximately 22% of the project area is comprised of Booth complex, 2 to 15 percent slopes. These soils are formed from basalt have a moderate hazard of erosion and a high shrink-swell potential. These soils are well drained with slow permeability and support plant communities dominated by low sagebrush, bitterbrush, Idaho fescue, and bluebunch wheatgrass. About half of this (11% of the project area) is characterized as Booth Complex, 2 to 15 percent slopes, eroded. This soil type is located primarily in the southern portion of the project area where Phase 2 and 3 juniper stands are common.

Table 3-1. Soil Complexes in the Project Area

Map#	Soil Complex Name	Acres	Percent
133E	LASERE VERY STONY LOAM, 5 TO 30 PERCENT SLOPES	2,393	12%
44C	CHEWAUCAN VERY COBBLY SILTY CLAY LOAM, 2 TO 15 PERCENT SLOPES	2,346	12%
16C	BOOTH COMPLEX, 2 TO 15 PERCENT SLOPES, ERODED	2,252	11%
12C	BOOTH VERY STONY LOAM, 2 TO 15 PERCENT SLOPES	1,999	10%
22F	BOOTH-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SOUTH SLOPES	1,911	10%
12E	BOOTH VERY STONY LOAM, 15 TO 30 PERCENT SLOPES	1,612	8%
222F	REDCANYON-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SOUTH SLOPES	878	4%
21F	BOOTH-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT NORTH SLOPES	810	4%
153C	MCCONNEL VERY GRAVELLY SANDY LOAM, 2 TO 15 PERCENT SLOPES	704	4%
221F	REDCANYON-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT NORTH SLOPES	671	3%
234F	ROCK OUTCROP-XEROLLS COMPLEX, WARM, 20 TO 50 PERCENT SLOPES	602	3%
145C	LORELLA GRAVELLY SANDY LOAM, LOW PRECIPITATION, 2 TO 15 PERCENT SLOPES	574	3%
117F	ITCA-BULLUMP COMPLEX, 30 TO 50 PERCENT NORTH SLOPES	472	2%
189B	OXWALL GRAVELLY LOAM, 0 TO 5 PERCENT SLOPES	436	2%
40B	CALIMUS SILT LOAM, 0 TO 5 PERCENT SLOPES	329	2%
25F	BOOTH-ROCK OUTCROP ASSOCIATION, 30 TO 50 PERCENT SLOPES	323	2%
240F	ROYST-NUSS-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SOUTH SLOPES	203	1%
114B	ICENE-MESMAN-REESE COMPLEX, 0 TO 5 PERCENT SLOPES	175	1%
132C	LASERE LOAM, 2 TO 15 PERCENT SLOPES	170	1%
156B	MCCONNEL GRAVELLY SANDY LOAM, SODIC SUBSTRATUM, 0 TO 5 PERCENT SLOPES	166	1%
148F	LORELLA-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SOUTH SLOPES	111	1%
95C	FORDNEY GRAVELLY LOAMY SAND, 5 TO 15 PERCENT SLOPES	105	1%
272C	WINTERIM-BOOTH COMPLEX, 0 TO 15 PERCENT SLOPES	62	0.3%
162B	MESMAN FINE SANDY LOAM, 0 TO 5 PERCENT SLOPES	55	0.3%
134F	LASERE VERY STONY LOAM, 30 TO 50 PERCENT SOUTH SLOPES	52	0.3%
269E	WINTERIM VERY GRAVELLY LOAM, 15 TO 40 PERCENT NORTH SLOPES	42	0.2%
59F	DEPPY-RUBBLE LAND COMPLEX, 30 TO 50 PERCENT SLOPES	26	0.1%
146G	LORELLA-ITCA COMPLEX, 30 TO 70 PERCENT SLOPES	23	0.1%
163B	MESMAN FINE SANDY LOAM, MILDLY ALKALINE, 0 TO 5 PERCENT SLOPES	23	0.1%
239F	ROYST-NUSS-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT NORTH SLOPES	22	0.1%
95B	FORDNEY GRAVELLY LOAMY SAND, 0 TO 5 PERCENT SLOPES	21	0.1%

Map#	Soil Complex Name	Acres	Percent
271E	WINTERIM VERY GRAVELLY LOAM, SLUMP, 2 TO 30 PERCENT SLOPES	15	0.1%
125A	LAKEVIEW SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	13	0.1%
57A	DEGARMO-WELCH COMPLEX, 0 TO 2 PERCENT SLOPES	10	0.05%
38F	BULLUMP-LORELLA ASSOCIATION, 30 TO 50 PERCENT SLOPES	7	0.03%
168F	MOUND VERY BOULDERY LOAM, SLUMP, 30 TO 50 PERCENT NORTH SLOPES	5	0.02%
164C	MESMAN-ALS COMPLEX, 0 TO 15 PERCENT SLOPES	2	0.01%
127A	LAKEVIEW SILTY CLAY LOAM, LOW PRECIPITATION, 0 TO 2 PERCENT SLOPES	0	0.001%
53A	CRUMP-BORAVALL COMPLEX, DRAINED, 0 TO 1 PERCENT SLOPES	0	0.0004%
W	WATER	11	0.1%

The second most abundant soil complex in the project area (12%) is the Lasere very stony loam, 5 to 30 percent slopes. This soil is formed from basalt is moderately deep and well drained with slow permeability. These soils have a moderate to severe erosion hazard and a high shrink swell potential. Lasere very stony loam soils support plant communities dominated by low sagebrush and bluebunch wheatgrass.

The third largest soil complex in the project area is the Chewaucan, very cobbly-silty clay loam, 2 to 15 percent slopes. This soil is characterized by its lacustrine deposits formed from basalt. It is a well-drained soil with moderate permeability and a slight to moderate erosion potential. This soil supports a vegetation community dominated by bluebunch wheatgrass, Idaho fescue, and antelope bitterbrush.

Slopes in the project area range from 0 to over 40 percent. Soils exhibit low infiltration rates, high runoff potential, and varying degrees of resistance to erosion. Forty eight percent (48%) of the project area is rated as having “slight” erosion potential, indicating that erosion is unlikely under normal climatic conditions. Twenty one percent (21%) is rated “moderate” erosion potential indicating that some erosion is likely and that erosion-control measures may be needed. Twenty eight percent (28%) of the project area is rated as having “severe” erosion potential indicating that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised. The remaining 3% is not rated for erosion hazard due to either being rock outcrop or water.

Watershed and Hydrology

The project area is located almost entirely within the Lower Chewaucan River 5th field watershed, with the southeastern tip of the area located within the Crooked Creek 5th Field watershed**.** Willow Creek, crossing through the southern third of the project area for three miles, is the primary stream in the project area, although much of it is intermittent and often dry in the summer and fall. The lower reach of Willow Creek was historically entrenched; however, a new floodplain equipped with a healthy component of both woody and herbaceous riparian vegetation has established that is capable of attenuating high flows and storing base flows. Coyote Creek is a large, intermittent stream that flows several months of the year and is tributary to Willow Creek. Pine Creek is an intermittent stream that flows off the national forest across about a 0.25 mile of the southwest portion of the project area before draining into Willow Creek. Moss Creek is a small, narrow perennial stream that flows in and out of the project area along the western edge of the project area for about one mile and eventually drains into the Chewaucan River.

Streams within the project area respond both geomorphically and hydrologically to the climate, particularly to the amount of precipitation, the form it comes in, and timing of snowmelt. Normal spring runoff typically occurs from March through June and usually produces the highest flows during this time period. The higher elevations (mostly National Forest lands) are a major source of flow for both base flow and spring runoff. The low elevation areas (mostly BLM-administered lands) contribute more towards spring runoff and have less influence on base flow.

Base flows are estimated to have decreased a small amount as compared to historic conditions. Encroachment of conifers/junipers and interception by roads can create conditions for less base flow, but increased peak flows (USFS 1992). High flows can cause additional scour potential to streams and drainages that can add to erosion. Peak flow estimates were simulated for Willow Creek and Moss Creek using the Oregon Water Resources Department *Peak Discharge Estimation Mapping Tool* (Tables 3-2 and 3-3).

Table 3-2. Willow Creek Peak Flow Estimates

Willow Creek--Peak Flow Estimates			
Return Period (Years)	**Peak Flow (cfs)**	**95% Confidence (Lower Limit)**	**95% Confidence (Upper Limit)**
2	319	118	863
5	581	265	1280
10	798	387	1650
20	1040	518	2080
25	1120	549	2290
50	1390	680	2850
100	1690	799	3570
500	2480	1040	5910

Table 3-3. Moss Creek Peak Flow Estimates

Moss Creek--Peak Flow Estimates			
Return Period (Years)	**Peak Flow (cfs)**	**95% Confidence (Lower Limit)**	**95% Confidence (Upper Limit)**
2	76.6	28.4	207
5	130	59.3	287
10	174	84.3	360
20	222	110	446
25	238	116	488
50	291	141	600
100	348	164	740
500	494	205	1190

Water Quality, Riparian and Aquatic Habitat, and Special Status Aquatic Species

The primary streams in the Clover Flat project area are Willow Creek, Coyote Creek, Pine Creek, and Moss Creek. Only Moss and Willow Creek contain perennial water. However, much of Willow Creek specifically within the project area is intermittent, and is often dry in the summer and fall. The perennial portion is very limited in linear extent (e.g. 100 yards) on BLM-administered lands. While these streams may provide livestock water during portions of the year, none of these streams provide drinking water for human consumption. Ranches surrounding the project area rely on private groundwater wells for drinking water.

Willow Creek

Past disturbances in the area, including cattle grazing and road construction, are thought to have led to degraded fish habitat, riparian, and water quality conditions throughout much of Willow Creek. Photos points established in 1979 show a lack of riparian vegetation and unstable stream channel conditions, including channel down-cutting and actively eroding streambanks. Degraded stream conditions led to the construction of riparian exclosure fences in the late 1970s and early 1980s. With the exception of small water gaps, all BLM-administered portions of Willow Creek were excluded from livestock grazing from the early 1980s to the present. This resulted in a substantial increase in riparian vegetation, greater vertical and lateral stream channel stability, increased streambank stability, decreased erosion and subsequent instream fine sediment deposition, and general improvement of fish habitat conditions.

Proper Functioning Condition (PFC) inventories were completed on 2.65 miles of Willow Creek, on BLM-administered lands in 1996 (BLM 1996b, 1999). At that time, 0.6 mile were determined to be at PFC, 1.15 miles were Functional at Risk with an Upward Trend, and 0.9 mile were considered Non-Functional. Those stream reaches were re-surveyed in 2012, at which time all 2.65 miles were determined to be in PFC (BLM 2012a).

Due to riparian habitat improvements and exclosure fencing maintenance issues, the grazing management of one short reach of Willow Creek was changed to a riparian pasture, grazed in conjunction with the South Pasture, in a recent grazing decision (BLM 2016b).

Based on the 2012 State of Oregon's 303(d) stream listing information (ODEQ 2012), Willow Creek, from the mouth to the headwaters, does not meet state standards for temperature. No current water quality data exists for Willow Creek. However, the improved stream channel and riparian conditions described above, and minimal grazing on most of the BLM-administered portions of the creek is likely contributing to improved stream shading and water quality.

Coyote Creek

Coyote Creek is a large, intermittent stream that flows several months of the year and is tributary to Willow Creek. No formal surveys exist for Coyote Creek and it is not known to provide habitat for any fish or aquatic amphibian species. A 2016 field visit found a vertically and laterally stable channel, with dimensions, pattern, and profile appropriate for its landscape setting. There is no excessive erosion or deposition. The stream banks contain little riparian vegetation due to its intermittent nature. Coyote Creek is very well-armored with rock throughout the BLM-administered portions of the creek, and the stream substrate is large, dominated by cobble to boulder size material.

Pine Creek and Tributaries

Pine Creek is an intermittent channel that flows from southwest to northeast across the southwest portion of the project area before draining into Willow Creek. The BLM-administered portion of Pine Creek upstream (south) of the County Road 2-10 (0.15 mile) was assessed and determined to be at PFC in 2012 (BLM 2012b). The previous PFC assessment, completed in 1997, assessed this stream segment to be non-functional (BLM 1997b). An exclosure was constructed in 2007 to exclude livestock grazing and improve riparian conditions. Excluding livestock from this area for the last seven years was successful in improving riparian conditions.

The BLM-administered segment of Pine Creek north of County Road 2-10 (0.15 mile of stream) was assessed for PFC in 2012 and determined to be Functioning at Risk with no apparent trend. Indicators for not meeting PFC were riparian vegetation that lacked vigor or a diverse age class of riparian plant species. A number or raw and actively eroding banks were observed and were not actively re-vegetating. High utilization of riparian vegetation and active hoof action were observed (BLM 2012b). A ten-acre exclosure was constructed in the spring of 2015 to eliminate livestock grazing on Pine Creek downstream of the county road (BLM 2014b). This management change is expected to lead to the creek reaching PFC in the foreseeable future.

Unnamed Tributary 1 to Pine Creek, approximately 0.5 miles in length, and approximately one acre of freshwater emergent wetland located in the NW ¼ of the SW ¼ of Section 7, have recently been assessed as Functional at Risk with an Upward Trend. Unnamed Tributary 2 to Pine Creek (approximately 0.25 mile) was recently assessed and determined to be Functional at Risk with an Upward Trend (BLM 2015i). Notes of the field visits in April of 2015 indicated that the existing, sandy soils in this area are susceptible to slight disturbances. Recovery is slow and riparian vegetation is the only stabilizing component for the head cuts and soil conditions. These tributaries are within a riparian pasture currently rested from livestock grazing. Head cuts within the meadow and stream reaches continue to put the stream and associated riparian systems at risk of further instability.

Moss Creek

PFC site inventories were completed in 1997 on Moss Creek (BLM 1997c). The lower reach of the creek was found to be in PFC within the Moss Creek Pasture. There was some excessive deposition in the system and it was noted that this reach was still sensitive to disturbance. The upper, steeper gradient reach, was rated as Functional at Risk with an upward trend. Notes taken from the review indicated good plant cover was present, but the reach still needed to develop a full floodplain. Since 1997, juniper cutting and improved grazing management on Moss Creek has resulted in improved stream channel and riparian conditions. The creek is now very well vegetated with native riparian vegetation, and appears to be in balance with its landscape setting, exhibiting neither excessive erosion nor deposition. Although no recent survey has been completed, Moss Creek is thought to be at PFC within the project area.

Lentic Wetlands and Riparian Areas

There are an estimated 65 to 70 acres of lentic wetland/riparian habitat on BLM-administered lands within the project area. Over 60 acres were reassessed in 2014-2015 and determined to be in PFC (BLM 2014c; 2015j). The remaining lentic riparian acres have not been assessed using the PFC process, but field reconnaissance and professional judgement has led to the determination that they are generally functioning appropriately, with the exception of: 1) the meadow associated with the unnamed Tributary 2 to Pine Creek discussed above; it was determined to be Functioning at Risk with an Upward Trend in 2015; and 2) one small (under one acre) unnamed spring tributary to Green Creek (at T35S, R19E, Section 34, SE ¼ of NE ¼) was found in 2016 to have some erosion and vegetation (grazing and juniper encroachment) issues.

PFC assessments, stream surveys, and photo monitoring (all on file at the Lakeview Resource Area office), and field reconnaissance generally indicate improving trends in riparian conditions throughout the project area. Photos points established in the 1970s, 1980s and 1990s that were retaken in 2012 show increases in native riparian vegetation, including willows, sedges, and rushes, as well as stream channel narrowing and deepening, and increases in streambank stability.

Aquatic and Special Status Species[6]

On BLM-administered lands, Moss Creek is small, narrow, and provides very limited habitat for aquatic species. Willow Creek provides some limited habitat for Redband Trout (*Oncorhynchus mykiss*), a BLM Sensitive Species (BLM 2008c), and Speckled Dace (*Rhinichthys osculus*). There could be some limited habitat for locally common aquatic amphibians or reptiles such as turtles or frogs, but no surveys have been conducted to date for these species. No other fish or aquatic amphibian or reptile habitat exists specifically in the project area.

Upland Vegetation

Sagebrush-Steppe

Based on vegetation data collected during the 2015 juniper inventory, the dominant vegetation community in the project area is low sagebrush-bunchgrass. Some basin big sagebrush and Wyoming big sagebrush (*Artemisia tridentata* Nutt. *subsp. Wyomingensis*) stands exist within the project area, but these are limited to the lower elevations on the north and east sides of the project area and make up a small amount of the total area (less than 1,000 acres) (Table 3-4).

A small amount of BLM-administered rangelands contain vegetation associated with riparian areas or wetlands along Coyote Creek, Moss Creek, and Willow Creek (see *Riparian and Wetland* section). Other shrub communities that occupy smaller percentages of the project area include silver sagebrush, mountain mahogany, and antelope bitterbrush.

The most common native grasses found in the understory include bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg's bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Elymus elymoides*). These grass species are often found growing together, but one or two are usually the dominant species at a given site depending on soils, topography, and previous disturbance. In low sagebrush communities, the dominant grasses are Sandberg's bluegrass, bottlebrush squirreltail, and Idaho fescue. In mountain big sagebrush communities the dominant grasses are bluebunch wheatgrass, Idaho fescue, bottlebrush squirreltail, and Sandberg's bluegrass.

Within juniper/low sagebrush communities the dominant grasses are Idaho fescue, and bottlebrush squirreltail. Within juniper/mountain big sagebrush communities the dominant grasses are Thurber's needlegrass (*Achnatherum thurberianum*), bottlebrush squirreltail and bluebunch wheatgrass. Portions of the project area are dominated by non-native invasive grasses (see *Noxious Weeds and Invasive Non-Native Species* section).

[6] Special Status Species include species which are Federally listed, proposed for listing, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those listed by the State of Oregon in a category such as threatened or endangered; and those designated by the Oregon BLM State Director as Bureau Sensitive (BLM 2008c).

Table 3-4. Dominant Vegetation Communities within the Project Area

Shrub Dominated Communities	**Acres**
Low sagebrush *Artemisia arbuscula* Nutt. ssp. *arbuscula*	18,214
Basin big sagebrush *Artemisia tridentata* Nutt. ssp. *tridentata*	295
Mountain sagebrush *Artemisia tridentata* Nutt. ssp. *vaseyana* (Rydb.) Beetle	150
Wyoming big sagebrush *Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle and Young	1,215
Klamath plum *Prunus subcordata* Benth.	41
Yellow rabbitbrush *Chrysothamnus viscidiflorus* (Hook.) Nutt. ssp. *viscidiflorus* var. *viscidiflorus*	145
Antelope bitterbrush *Purshia tridentata* (Pursh) DC.	103
Willow *Salix* sp.	36
No shrub	9
Grass Dominated Communities	
Cheatgrass *Bromus tectorum* L.	784
Bottlebrush squirreltail *Elymus elymoides* (Raf.)	230
Idaho fescue *Festuca idahoensis* Elmer	309
Sandberg bluegrass *Poa secunda* J. Presl	1,456
Bluebunch wheatgrass *Pseudoroegneria spicata* (Pursh) Á. Löve ssp. *spicata*	915
Medusahead *Taeniatherum caput-medusae* (L.) Nevski	631
North Africa grass *Ventenata dubia* (Leers) Coss.	271
Small fescue *Vulpia microstachys* (Nutt.) Munro	41
Unknown (includes private or other ownerships)	14,959

Forest and Woodlands

The BLM-administered portion of the forest fringe is dominated by mixed pine and white fir. These forest types occupy a very small percentage of the project area administered by the BLM (approximately 1,200 acres). While these stands have been classified as commercial forest stands, they are not suitable for intensive management for forest products and have no "allowable sale quantity" specified in the land use plan (BLM 2003b, page 33, as maintained). In addition, there are four small patches of aspen (*Populus tremuloides*) scattered across the project area totaling approximately four acres.

Under pre-settlement conditions, periodic wildfires typically killed most juniper saplings in sagebrush-steppe communities. As a result, western juniper was generally limited to rock outcrops or rocky table lands with light grasses and other low fuel levels incapable of carrying hot ground fires. Today these fire-protected sites contain trees greater than 150 years old (old-growth). Within the project area, fire exclusion, loss of fine fuels, and fire suppression over the last 150 years have allowed juniper densities to increase, as well as allowed invasion into other plant communities. The science regarding juniper encroachment within the region is discussed in detail within the *Background* section of Chapter 1. Within the project area, juniper has encroached into about 13,840 acres of BLM-administered lands, most of which is sagebrush-steppe habitat. Approximately 10,894 acres of Phase 1 juniper, 2,232 acres of Phase 2 juniper, and 715 acres of Phase 3 juniper exist within the project area (Table 1-1). This expansion has resulted in changes in vegetation community structure and diversity, degraded watershed function, and negative impacts to sage-grouse habitat.

Special Status Plant Species and Habitat

There are no Federally-listed, Proposed, or Candidate Threatened or Endangered plant species, or any associated designated critical habitat within the Lakeview Resource Area.

Botanical surveys were completed during the 2010 and 2011 field seasons within the project area. Long-flowered snowberry (*Symphoricarpos longiflorus*), also known as desert snowberry, is a BLM sensitive plant found on approximately 15 acres bordering the northeast corner of the project area. This deciduous perennial shrub grows in California, Baja, Nevada, Utah, Colorado, New Mexico, and western Texas, but has a limited distribution in Oregon (Oregon Department of Agriculture 2016, USFS 2005).

In Oregon, it grows in Harney, Lake, and Malheur Counties. Habitat is described as open, rocky slopes and washes in sagebrush and pinyon-juniper zones, sometimes extending upwards into the ponderosa pine zone at elevations of 4,000 to 8,000 feet. Once established, long-flowered snowberry is very persistent. Globally, this plant is ranked as a category G5, demonstrably widespread, abundant, and secure. The State of Oregon ranks this plant as a category S2, imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with only six to 20 occurrences (Oregon Natural Heritage Plan 2003).

Noxious Weeds and Invasive Non-Native Species

Noxious weed and non-native invasive annual grass species have been known to persist in the project area for decades. During the 2015 field season, the entire project area was surveyed for noxious weeds and non-native invasive plant species. Due to the large amounts of cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicas*) scattered across the project area, accurate net infestations of these two species are unknown; however they are abundant throughout the entire project area. Aside from cheatgrass and Japanese brome, of the 19,625-acre project area, about 7,330 acres are considered infested with noxious weeds or non-native invasive plant species. The species of most concern are Medusahead rye (*Taeniatherum caput-medusa* (L.) Nevski), North Africa grass (*Ventenata dubia* (Leers) Coss.), and Mediterranean sage (*Salvia aethiopis L*.). Other noxious weeds known to exist within the project area include bull (*Cirsium vulgare*) and Canada thistles (*C. arvense* (L.) Scop.).

Medusahead, North Africa grass, cheatgrass and Japanese brome are all aggressive non-native invasive winter annual grass species. These grass species currently infesting millions of acres of private and public rangelands in the Western United States. Winter annual grass species usually germinate in the fall, develop a vigorous root system through the winter, and then resume active foliar growth in early spring. By establishing a strong root system these species rob the native perennial grasses and shrubs of limited soil moisture, thus gaining a competitive advantage. Depending on the phenology of the grasses, high silica content found in the stems and other plant parts make these species less palatable to wildlife and livestock, especially medusahead and North Africa grass. The large amount of silica within medusahead is known to result in a buildup of deep thatch layers. These layers have the ability to prevent other plant seeds from reaching the soil, preventing germination and establishment of root systems. Both medusahead and North Africa grass seeds area able to germinate in the thatch and the seedlings then send their roots down into the soil.

North Africa grass is a newly identified invasive species within the Lakeview Resource Area that is quickly spreading and invading rangelands. Specialists suspect the species has actually been within the resource area for at least the past ten years; however the identification was confirmed within the past five years. Medusahead has been established for at least 30 years within the project area, possibly much longer. Currently 402 sites of medusahead are documented in the project area. These sites range from small, single plant locations to a 995-acre infestation. However, the majority of the documented invasive plant sites are less than a tenth of an acre. The Clover Flat area has the largest amount of medusahead documented in the Lakeview Resource Area.

Research has been conducted regarding sagebrush/sage-grouse habitat and it's resistance to cheatgrass (and other invasive annual grasses) over a typical temperature/precipitation gradient in the cold desert. Annual grass dominated ecological sites occur along a continuum that includes Wyoming big sagebrush on warm and dry sites, to mountain big sagebrush on cool and moist sites, to mountain big sagebrush and root sprouting shrubs on cold and moist sites (FIAT 2014). Resistance to invasive annual grasses depends on environmental factors and ecosystem attributes and is a function of (1) the invasive species' physiological and life history requirements for establishment, growth, and reproduction, and (2) interactions with the native perennial plant community. The occurrence and persistence of invasive annual grasses in sagebrush habitats is strongly influenced by interactions with the native perennial plant community. Winter annual grass species can germinate from early fall through early spring, exhibit root elongation at low soil temperatures, and have higher nutrient uptake and growth rates than most native species (Mack and Pyke 1983; Arredondo *et al*. 1998; James *et al*. 2011).

Soil types play a key role in the current and future potential invasive annual grass infestation within the project area. The areas with the most resistance to invasive annual grasses have cool to cold soil temperatures and relatively moist soil regimes. Areas with the lowest potential resistance occur within warm, dry soils. Many of the cooler soils are located in elevations over 6,000 feet and are resistant to annual grass infestations. South facing slopes are known for having warm, dry soils and have low resistance to annual grass infestation.

Several attempts have been made to control the large infestations of medusahead on the BLM and private lands in the project area in recent years. In 2003, the Red Knoll-Clover Flat Restoration Project (BLM 2004b) was initiated to restore areas invaded by medusahead within in the Chewaucan Watershed. This restoration project used an integrated treatment approach consisting of prescribed burning, seeding, and herbicide applications (glyphosate). The private landowners have also been involved with the annual grass control efforts on the adjacent property. The initial monitoring of the project showed minimal success, however more recent monitoring has showed a huge reduction in annual grasses and successful plantings of native and favorable non-native species where the plan was initiated.

In 2015, the Lakeview Resource Area completed an *Integrated Invasive Plant Management Plan* (IPM) (BLM 2015d) which allows additional herbicides to be used to control non-native invasive plants. This plan has allowed for more selective herbicide applications to be performed across about 12,281 (6,001 acres in 2015 and 6,280 acres in 2016; BLM 2015f, 2016a) acres of annual grass infested areas within the project area. These areas are currently being monitored and evaluated for post-application seeding, if needed.

The majority of the Canada thistle has been documented in riparian areas. The bull thistle is located in small, isolated infestations usually within disturbed areas such as livestock watering areas. The Mediterranean sage infestations are extensive through the Juniper Creek riparian system, and scattered across the project area in small isolated infestations. These infestations are currently being managed through the Lakeview IPM plan (BLM 2015d).

Terrestrial Wildlife Species and Habitats

Big Game Species and Habitats

The project area falls within the Oregon Department of Fish and Wildlife's (ODFW) Interstate Big Game Habitat Management Unit (HMU). There are approximately 11,996 acres of BLM-administered big game winter range within the project area. The area contains habitat capable of supporting mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), and elk (*Cervus elaphus*).

Mule deer are mostly browsers and require sagebrush and bitterbrush throughout the year. They rely heavily on forbs during the spring and fall green-up periods. The area provides year-round habitat for mule deer, including fawning habitat. The mule deer population is relatively stable within the HMU, but is about 50% below ODFW's current management objectives (ODFW 2003a). Juniper has expanded into several thousand acres of these shrub habitats and is changing the vegetative composition and vegetation species diversity of the habitat. Juniper does provide thermal cover; however, these juniper stands result in reduced deer food sources within the area.

Potential elk winter range habitat occurs within the project area. However, elk are not currently present in the area (ODFW 2003b). Elk are mostly grazers and prefer sagebrush–grasslands for foraging and timber, including juniper woodlands, for security cover.

Pronghorn antelope are mostly browsers and range across the project area. Populations are currently stable to increasing within the HMU. Miller *et al.* (2005) reported that pronghorn antelope rarely use juniper woodlands, as they prefer more open shrub-steppe communities or shrublands with only scattered juniper trees.

Bighorn sheep (*Ovis canadensis*) are grazers and prefer open, sagebrush–grassland habitats that provide forage and cover, as well as, provide ability to see and escape from predators. These areas generally occur on or near steep slopes. Bighorn sheep habitat does occur within the northern portion of the project area, and occasional visitors may occur from the east (ODFW 2003c). However, the suitability of this habitat is limited by fragmentation, being divided by a main highway from a larger block of better habitat east of the project area.

Habitat quantity and quality do not appear to be limiting big game population size or health within the HMU. There are currently 195 Animal Unit Months[7] (AUMs) allocated for mule deer and pronghorn antelope, and five AUMs for other wildlife species within the area (BLM 2003b, pages A-36, as maintained). Based on previous consultation with ODFW biologists, these forage allocations are adequate to support big-game wildlife population targets within the area.

Small Mammals and Habitats

Small mammal species expected to occur in the project area include black-tailed jackrabbit (*Lepus californicus*), mountain cottontail (*Sylvilagus nuttallii*), coyote (*Canis latrans*), ground squirrels (*Spermophilus spp.*), chipmunks (*Tamias spp.*), yellow-bellied marmot (*Marmota flaviventris*), northern flying squirrel (*Glaucomys sabrinus*), bobcat (*Lynx rufus*), American badger (*Taxidea taxus*), spotted skunk (*Spilogale gracilis*), striped skunk (*Mephitis mephitis*), woodrats (*Neotoma spp*.), and other common shrub-steppe mammal species. These species use a variety of habitat types and some are habitat generalists.

Nongame Birds and Habitats

Many of the bird species present in the project area are classified as "migratory birds" protected under the *Migratory Bird Treaty Act of 1918* (MBTA; 16 U.S.C. § 703-712) regardless of their status as common or rare. Common migratory species observed or expected to occur in the area, based on species range and habitat, include the American Robin (*Turdus migratorius*), Dark-eyed Junco (*Junco hyemalis*), Mourning Dove (*Zenaida macroura*), Townsend's Solitaire (*Myadestes townsendi*), Great Horned Owl (*Bubo virginianus*), Barn Owl (*Tyto alba*), Prairie Falcon (*Falco mexicanus*), Common Raven (*Corvus corax*), and the Mountain Bluebird (*Sialia currucoides*). Other bird species suspected or have potential to occur within the area include the Pinyon Jay (*Gymnorhinus cyanocephalus*), Short-eared Owl (*Asio flammeus*), Red-tailed Hawk (*Buteo jamaicensis*), Northern Harrier (*Circus cyaneus*), Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), American Kestrel (*Falco sparverius*), various waterfowl and shorebirds (in riparian areas), and other common shrub-steppe bird species.

[7] An AUM is the amount of forage needed for a mother cow and her calf for one month.

Four bird species that depend on old-growth or mature juniper woodlands that may potentially occur in the project area include: Pinyon Jay (*Gymnorhinus cyanocephalus*), Gray Flycatcher (*Empidonax wrightii*), Ash-throated Flycatcher (*Myiarchus cinerascens*), Juniper Titmouse (*Baeolophus ridgwayi*), and Chipping Sparrow (*Spizella passerine*).

Upland Reptiles and Habitats

There are many reptile species that likely occur within the project area, including western fence lizard (*Sceloporus occidentalis*), sagebrush lizard (*Sceloporus graciosus*), gopher snake (*Pituophis catenifer*), western rattlesnake (*Crotalus viridus*), pygmy short-horned lizard (*Phrynosoma douglasii*), and other common shrub-steppe reptile species. Reptiles generally prefer open canopy habitats for sunning and would likely avoid dense stands of juniper. Of these species, the western fence lizard and gopher snake are known to climb trees for foraging and to escape from predators. The western fence lizard commonly uses juniper logs in old-growth stands; however, rock outcrops and other habitat characteristics seem to impact the abundance and diversity of reptiles more than the presence or absence of juniper (Miller 2001).

Special Status Species and Species with Special Management Designations

There are no Federally-listed, Proposed, or Candidate Threatened or Endangered wildlife species regularly occupying the project area. There is no designated critical habitat within the project area.

Table 3-5 contains a list of Special Status Species and species with special management designations or habitat that are known or may potentially occur in the project area. Special management designation lists include BLM Strategic Species, Species of Concern[8], Birds of Conservation Concern[9], Birds of Management Concern[10], and Focal Species[11]. Species with negligible or no identified impacts or that likely do not occur within the project area will not be discussed further. Common names for avian species have been standardized and are used throughout this document from the American Birding Association (2016) *Checklist of Birds*.

[8] Species of Concern (SOC) is an informal term used by the USFWS, referring to species that are declining or appear to be in need of conservation.
[9] Birds of Conservation Concern (BCC) are identified by the USFWS as those which, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973 (USFWS 2008). Species considered include nongame birds, gamebirds without hunting seasons, ESA candidate, proposed endangered or threatened, and recently delisted species.
[10] Birds of Management Concern (BMC) are species, subspecies, populations, or geographic segments of populations that warrant management or conservation attention as determined by the USFWS. They must be either a high priority gamebird, on the BCC list, a federally threatened or endangered species, or overly abundant leading to management conflicts.
[11] Focal Species are a subset of BMC which: 1) have high conservation need, 2) are representative of a broader group of species sharing the same or similar conservation needs, 3) act as a potential unifier for partnerships, and/or 4) have a high likelihood that factors affecting status can be realistically addressed. Focal species are used to increase accountability and to measure success in achieving bird conservation.

Table 3-5. Special Status Species and Species with Special Management Designations or Habitat

Species	Habitat Summary	Special Status	BLM Strategic Species	Species of Concern	Birds of Conservation Concern	Birds of Management Concern	Focal Species	Alt. 1 - No Action	Alt. 2 –Prop. Action	Alt. 3 - Biomass
Terrestrial Avian Species										
Bald Eagle (*Haliaeetus leucocephalus*)	Associated with large bodies of water, forested areas near the ocean, along rivers, and at estuaries, lakes and reservoirs	SEN Delisted			**X**	**X**	**X**	*	*	*
Bobolink (*Dolichonyx oryzivorus*)	Edges of cropland / pastures; lake / pond shorelines	SEN; OR-SSV				**X**	**X**	*	*	*
Brewer's Sparrow (*Spizella breweri*)	Sagebrush steppe; salt desert scrub; lodgepole pine forest				**X**			**(-)**	**(+)**	**(+)**
Burrowing Owl (*Athene cunicularia*)	Sagebrush steppe, grasslands, pastures, roadsides where vegetation is sparse and terrain is level	OR-SSV		**X**		**X**	**X**	**(-)**	**(+)**	**(+)**
Calliope Hummingbird (*Stellula calliope*)	Subalpine scattered trees and shrub; edge of recently burned forest; streamside / wetland shrubland				**X**			*	*	*
Ferruginous Hawk (*Buteo regalis*)	Occupy habitats with low tree densities and topographic relief in sagebrush plains of the high desert and bunchgrass prairies in the Blue Mtns.	OR-SSV		**X**	**X**			**(-)**	**(+)**	**(+)**
Flammulated Owl (*Psiloscops flammeolus*)	Ponderosa pine forests/ aspen	OR-SSV			**X**			**(-)**	**(+)**	**(+)**
Golden Eagle (*Aquila chrysaetos*)	Inhabits shrub-steppe, grassland, juniper and open ponderosa pine and mixed conifer/deciduous habitats preferring areas with open shrub component for foraging				**X**	**X**	**X**	*	*	*
Greater Sage-Grouse (*Centrocercus urophasianus*)	Sagebrush obligate, found E. of the Cascades. They require large expanses of sagebrush with healthy native understories of forbs	SEN; OR-SSV						**(-)**	**(+)**	**(+)**
Green-Tailed Towhee (*Pipilo chlorurus*)	Brushy slopes; Scattered Ponderosa pine / juniper woodland; sage steppe; mountain mahogany				**X**			**(-)**	**(+)**	**(+)**
Lewis's Woodpecker (*Melanerpes lewis*)	Ponderosa Pine, Cottonwood riparian or Oak habitats with an open canopy, brushy understory, dead and down material, available perches and abundant insects	SEN; OR-SSC		**X**	**X**			*	*	*

Species	Habitat Summary	Special Status	BLM Strategic Species	Species of Concern	Birds of Conservation Concern	Birds of Management Concern	Focal Species	Alt. 1 - No Action	Alt. 2 –Prop. Action	Alt. 3 - Biomass
Loggerhead Shrike (*Lanius ludovicianus*)	Inhabits grasslands, pastures with fence rows, ag. fields, sagebrush with scattered juniper and open woodlands. Requires elevated perches for hunting and nesting	OR-SSV			X			*	*	*
Northern Goshawk (*Accipiter gentilis*)	Forest mosaic; aspen stands used for breeding in basin and range	OR-SSV		X				*	*	*
Olive-Sided Flycatcher (*Contopus cooperi*)	Conifer forest openings and ecotones	OR-SSV		X				*	*	*
Peregrine Falcon (*Falco peregrinus*)	Wide range of habitats, nests on cliff ledges, bridges, quarries	SEN; OR-SSV			X			*	*	*
Pileated Woodpecker (*Drycopus pileatus*)	Mixed conifer forests and deciduous stands in valleys	OR-SSV						*	*	*
Pinyon Jay (*Gymnorhinus*	Juniper woodland; Ponderosa Pine woodland				X			(+)	(-)	(-)
Sage Sparrow (*Amphispiza belli*)	Sagebrush steppe; Bitterbrush – big sagebrush shrubland				X			(-)	(+)	(+)
Sage Thrasher (*Oreoscoptes montanus*)	Sage Steppe; salt desert scrub; seasonally wet playa				X			(-)	(+)	(+)
(Canadian) Sandhill Crane (*Grus Canadensis rowani*)	Shallow lakes or rivers at night and irrigated croplands, pastures, grasslands, or wetlands during the day		X	X				*	*	*
(Greater) Sandhill Crane (*Grus Canadensis tabida*)	Shallow lakes or rivers at night and irrigated croplands, pastures, grasslands, or wetlands during the day	OR-SSV						*	*	*
Tricolored Blackbird (*Agelaius tricolor*)	Cattails or tule wetlands	SEN		X	X	X	X	*	*	*
White-headed Woodpecker (*Picoides albolarvatus*)	Mixed conifer forests (< 40 % canopy cover) dominated by old growth Ponderosa Pine and open habitats where standing snags and scattered tall trees remain	SEN; OR-SSC		X	X			*	*	*
Williamson's Sapsucker (*Sphyrapicus thyroideus*)	Mixed forest; streamside shrubland				X			*	*	*

Species	Habitat Summary	Special Status	BLM Strategic Species	Species of Concern	Birds of Conservation Concern	Birds of Management Concern	Focal Species	Alt. 1 - No Action	Alt. 2 –Prop. Action	Alt. 3 - Biomass
Willow Flycatcher (*Empidonax traillii adastus)*	Edges of recently burned /cut forest; streamside shrubland; wet montane meadow	OR-SSV		**X**	**X**			*	*	*
**Yellow-billed Cuckoo (*Coccyzua americanus*)	Dense Riparian/cottonwoods	FT OR-SSC			**X**			*	*	*
Yellow-Breasted Chat (*Icteria virens*)	Riparian thickets			**X**				*	*	*
Aquatic Avian Species										
Long-billed Curlew (*Numenius americanus*)	Mixed grasslands and agricultural fields	OR-SSV			**X**	**X**	**X**	*	*	*
Mammals										
California Myotis (*Myotis californicus*)	Shrub steppe and juniper - shrub	OR-SSV						(-)	(+)	(+)
Fringed Myotis (*Myotis thysanodes*)	Trees, snags, buildings, caves, cliffs, and bridges.	SEN; OR-SSV						*	*	*
Gray Wolf (*Canis Lupus*)	Woodlands, forests, grasslands, and deserts	FE; SEN; OR-SS						*	*	*
Hoary Bat (*Lasiurus cinereus*)	Shrub steppe during migration	OR-SSV		**X**				(-)	(+)	(+)
Kit Fox (*Vulpes macrotis*)	Desert scrub and grassland communities	SEN						*	*	*
Long-Eared Myotis (*Myotis evotis*)	Willow bordered creeks in shrub steppe and coniferous forests			**X**				*	*	*
Long-Legged Myotis (*Myotis volans*)	Desert riparian areas, rock outcrops, and coniferous forests	OR-SSV		**X**				(+)	(-)	(-)
Pallid Bat (*Antrozous pallidus*)	Arid regions/rocky outcroppings	SEN; OR-SSV		**X**				*	*	*
Preble's Shrew (*Sorex preblei*)	Sagebrush, bitterbrush, aspen, marshes, riparian			**X**				(-)	(+)	(+)

Species	Habitat Summary	Special Status	BLM Strategic Species	Species of Concern	Birds of Conservation Concern	Birds of Management Concern	Focal Species	Alt. 1 - No Action	Alt. 2 –Prop. Action	Alt. 3 - Biomass
Pygmy Rabbit (*Brachylagus idahoensis*)	Sagebrush with deep soils	SEN; OR-SSV		**X**				**(-)**	**(+)**	**(+)**
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	Lava fields/Rocky Cliffs /Abandoned Structures	SEN; OR-SSC		**X**				*	*	*
Silver-haired Bat (*Lasionycteris noctivagans*)	Coniferous forests, juniper woodlands, mixed deciduous-coniferous forest and rangelands where it forages along small streams	OR-SSV		**X**				**(+)**	**(-)**	**(-)**
Spotted Bat (*Euderma maculatum*)	Cliff Habitat	SEN; OR-SSV		**X**				*	*	*
Western Small-Footed Myotis (*Myotis ciliolabrum*)	Arid rangeland near cliffs, but little is known			**X**				*	*	*
White-tailed jackrabbit (*Lepus townsendii*)	Bunchgrass habitats	OR-SSV						*	*	*
Yuma Myotis (*Myotis yumanensis*)	Close association with water, perhaps fast flowing streams with willow/alder			**X**				*	*	*
Reptiles										
Northern Sagebrush Lizard (*Sceloporus graciosus graciosus*)	Sagebrush; juniper stands			**X**				*	*	*
Pacific (Western) Pond Turtle (*Actinemys marmorata*)	Permanent and intermittent waters, including marshes, streams, rivers, ponds, and lakes	SEN; OR-SSC						*	*	*
Insects										
**Western Bumblebee (*Bombus occidentalis*)	Areas with appropriate flowering plants	SEN; OR-SS						**(-)**	**(+)**	**(+)**

<u>TABLE LEGEND</u>
(+) – Positively affected
(-) – Negatively affected
***** – Negligible or no identified impacts
FC – Candidate for listing under the Endangered Species Act
FE – Federal Endangered Species
FT – Federal Threatened Species
Delisted – formerly federally listed species
**Suspected on LRA
SEN – BLM Sensitive
OR-SSC – State of Oregon Sensitive Species – Critical
OR-SSV – State of Oregon Sensitive Species – Vulnerable

<u>Eagles</u>

Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (as amended; 16 U.S.C.A. §§668-668c), in addition to the MBTA.

No Bald Eagle nesting or roosting habitat exists within this project area. Nesting and roosting does occur on U.S. Forest Service lands to the west. It is suspected they are occasional visitors to the project area. Bald Eagle foraging could occur within the project area; however it is likely restricted to occasional scattered carrion. For this reason, none of the alternatives likely have any measurable impacts on Bald Eagles or its habitat and this species will not be carried forward for further analysis.

Golden Eagles (BCC species) have been observed within the project area, and three nest sites are located outside the project area, but within the breeding territory buffer (Willow, Moss, and Ennis Creeks). None of the alternatives would have any measurable impacts to this species or its habitat. For this reason, Golden Eagles will not be carried forward for further analysis.

<u>Brewer's Sparrow</u>

The project area is within the summer range of this species. This species was documented on the LRA during surveys conducted for the Oregon Breeding Bird Atlas (Miller 2006a) and is suspected to occur in the project area. This species is closely associated with sagebrush and open prairie. However, it also occurs in ecotypes with juniper.

<u>Burrowing Owl</u>

Burrowing Owls prefer sagebrush–steppe habitat that is free of juniper. Potential habitat for Burrowing Owls does occur, however, this species has not been confirmed within the area to date. There are no inventories or incidental sightings of Burrowing Owl.

Ferruginous Hawk

Ferruginous Hawks have been observed foraging in the open juniper woodlands and sagebrush-steppe habitats, with the open sagebrush-steppe habitats being their optimum foraging habitat. These hawks commonly nest on the ground or in sturdy trees. Potential habitat for Ferruginous Hawk does occur within the project area, however there have been no inventories or incidental sightings

Flammulated Owl

Flammulated Owls have not been observed within the project area, however, they may occur to the west on Forest Service lands. Small pockets of aspen occur within the project area, however juniper has encroached in the groves limiting habitat for this species.

Greater Sage-Grouse

Although the USFWS has determined that sage-grouse no longer warrant protection under the ESA (USFWS 2015), it is still a BLM sensitive species. This determination was based partly on the collaborative conservation efforts to ameliorate the primary potential threats to the species.

Sage-grouse habitat occurs throughout most of the project area. The project area contains approximately 16,318 acres (83%) of priority habitat management area (PHMA), as well as 1,799 acres (9%) of general habitat management area (GHMA) (Map 7). The Clover Flat Project Area is located in the Tucker Hill priority area for conservation (PAC). Sage-grouse within this PAC are somewhat isolated from other populations. Tucker Hill PAC is bordered by extensive areas of non-habitat (Fremont National Forest, Chewaucan Marsh, and salt desert scrub). Based on ODFW's most recent sage-grouse lek data from 2017, there are three occupied and two pending leks within the project area (Table 3-6). Sage grouse have not been documented on lek LA1180-01 since 1988. Lek LA1135-01 has been unknown or inactive since 1980.

Table 3-6. Clover Flat Sage-Grouse Leks[1]

Lek Number	2017 Conservation Status	2017 Annual Status	2016 Annual Status
LA1121-02	Occupied	Active	Active
LA1121-01	Occupied	Active	Active
LA0928-01	Occupied	Active	Active
LA1135-01	Pending	Inactive	Unknown
LA1180-01	Pending	Unknown	Inactive

[1] Source: ODFW Lek Database.

The *Oregon Greater Sage-Grouse ARMPA* (BLM 2015b) states that site-specific information should be incorporated for PHMA using the indicators described in the Habitat Assessment Framework (HAF; see Stiver *et al*. 2010, 2015), when available, to characterize sage-grouse habitat quality. PHMA has been identified as the habitat having the highest conservation value to maintaining sustainable sage-grouse populations. PHMA includes over 90% of Oregon's breeding sage-grouse populations and 84% of occupied leks. GHMA reflects lek density strata, connectivity corridors, and winter use areas. ODFW's "low density" habitat, combined with the remaining occupied habitat outside of PHMA is classified as GHMA in Oregon.

Appropriate HAF indicators were used to assess the quality of sage-grouse habitat on BLM-administered lands within the Clover Flat Project Area. HAF data was collected at the fourth order (site-scale) in a portion of the project area in 2014. Fourth order habitat selection at the site-scale describes the more detailed vegetation indicators, such as sagebrush cover, sagebrush height and shape, and associated herbaceous understory vegetation required during nesting and brood rearing. At the fourth order level, habitat indicators that influence use of or movements between seasonal ranges can be examined to determine if limiting factors for habitat use exist. The site-scale HAF data collected at 78 sample locations within the project area was used to determine fine-scale habitat suitability by assessing the random points grouped by ecological site potential polygons. Some suitable areas overlap, indicating sage-grouse habitat is suitable at those sites for more than one season. Suitable breeding and late brood rearing habitat is limited, at 8% and 11% respectively (Table 3-7). Although HAF measurements indicate relatively low availability of suitable nesting and summer habitat, the birds are likely using areas rated as marginal. Sage-grouse pellets have been documented in marginal areas. Additionally, two of the three occupied leks are located in marginal rated habitat. Many of these areas were rated as marginal due to the co-dominance of invasive annual grasses.

Table 3-7. Sage-Grouse Habitat Assessment Framework (HAF) Summary

Sage-Grouse Seasonal Habitat	**Acres**	**Percent of Project Area**
Breeding Season		
• Suitable	1,560	8
• Marginal	8,312	42
Summer Season		
• Suitable	2,076	11
• Marginal	6,420	33
Winter Season		
• Suitable	8,568	44
• Marginal	3,269	17
Seasonal Sage-Grouse Habitat Summary (Suitable at some time during the year; see Map 8)	8,643	44

Winter suitable habitat is abundant (Table 3-7). Some polygons rated as suitable do have small, unsuitable inclusions. Ecological site polygons were rated based on the suitability of the majority of HAF sample points within that polygon. For example, areas in the southeast portion of the project area with juniper are rated as suitable because many of the points fell in large open areas and those points influenced the suitability of the larger ecological site polygon. Marginal or unsuitable points within a polygon indicate where invasive annual grasses or juniper have degraded the site, or there was a lack of adequate forbs, or there was less than 10% sagebrush cover. Overall, approximately 8,643 acres (44%) of the Clover Flat project area provides suitable sage-grouse habitat at least part of the year (Map 8).

Although site scale HAF data for the Clover Flat area was collected prior to ARMPA approval, the suitability findings for the sample points were updated according to the indicators listed in Table 2-2 of the ARMPA. See Table 3-7 and Map 8 for seasonal habitat suitability. Approximately 20 to 25% of the Clover Flat project area is considered non-habitat. Those areas are mainly in the northwest, near Tucker Hill, and in the greasewood desert scrub or steep rocklands.

Movement patterns of sage-grouse are highly variable. However, many individuals show high fidelity to leks and seasonal habitats used in previous years (Berry and Eng 1985; Fischer *et al*. 1993). The use and movement patterns typically observed of non-migratory sage-grouse indicate that large areas of sagebrush habitat in good condition are important to sage-grouse. In better habitat conditions, birds may not need to range as far to meet lek and seasonal use requirements. In a study conducted in the northwestern portion of Lake County, Hanf *et al*. (1994) found that sage-grouse showed non-migratory movement patterns. Connelly *et al.* (2004) found most sage-grouse nest within four miles of a lek. Females typically distribute their nests spatially in relation to the location of leks with 80% of nests located within a 6.4 km (4.0 mi) radius of lek sites. However, Crawford and Gregg (2002) noted some radio-marked hens did move considerable distances from the lek during the nesting and brood-rearing seasons in one study conducted in south central Oregon and northwest Nevada. One hen moved her brood more than 22 miles from the nest site. It is important to note that no telemetry data is available for this project area and movement patterns for this population are largely unknown.

Sage-grouse rely heavily on sagebrush systems throughout the year for foraging and cover (Knick and Connelly 2011). They also require residual herbaceous cover around nesting sites to conceal them from nest predators each spring (Gregg *et. al.* 1994, Holloran *et al.* 2005, Knick and Connelly 2011). Sage-grouse also require open areas each spring for use as strutting grounds with adequate visibility to detect predators, both aerial and terrestrial. Sage-grouse avoid juniper communities for strutting, nesting and winter use (Doherty *et al*. 2008; Freese 2009); however, they occasionally use open juniper communities for shade during hot summer afternoons. Currently, juniper expansion is negatively impacting sage-grouse nesting and brood rearing habitats within the area by reducing available nesting cover, reducing native grass and forb cover, providing perches for aerial predators, and providing cover for coyotes and other terrestrial predators (BLM 2015a)

One risk factor identified in the Monograph, the Oregon Strategy, and the 12-Month Finding is West Nile Virus spread by mosquitoes around standing water (Knick and Connelly 2011, ODFW 2011, USFWS 2010). Sage-grouse are susceptible to West Nile Virus (Clark *et al*. 2006) and mortality may be as high as 100% (Naugle *et al*. 2004) in some areas. The virus is primarily transmitted by infected mosquitoes, and was first detected in southeastern Oregon near Burns Junction in 2006, and then later near Crane and Jordan Valley that same year. From 2006-2010, ODFW provided each successful sage-grouse hunting permit applicant with two Nobuto strips to collect blood samples from each harvested grouse to be assayed for West Nile Virus. A total of 1,839 samples were assayed with one positive detection of the virus in the Beulah WMU harvest in 2008 (letter from ODFW dated July 28, 2014). Some birds may have developed antibodies to this virus, and survived up to the hunting season. This assay does not account for birds that may have perished prior to the hunting season or birds not taken by hunters; however, overall, the risk of virus spread or associated mortality within Oregon is likely low at the present time.

Green-Tailed Towhee

The project area is within the summer range of this species. This species was documented on the LRA during surveys conducted for the Oregon Breeding Bird Atlas and is suspected to occur in the project area (Scheuering and Powell 2006). This species prefers dense shrub habitats with limited trees, often near streams.

Pinyon Jay

The project area is within the northwestern range of this nomadic species. They have been documented elsewhere within the Lakeview Resource Area during surveys conducted for the *Oregon Breeding Bird Atlas* (Miller 2006b) and are suspected to utilize juniper stands within the project area on occasion. This species is closely associated with juniper and forages on its seeds, as well as pine seeds; however, their diet also consists of insects and eggs of smaller birds (Miller 2006b).

Sage Sparrow

The project area is within the summer range of this species. This species was documented on the LRA during surveys conducted for the *Oregon Breeding Bird Atlas* (Miller 2006c) and is suspected to occur in the project area. This species prefers open areas of big sagebrush habitat.

Sage Thrasher

The project area is within the summer range of this species. This species was documented on the LRA during surveys conducted for the *Oregon Breeding Bird Atlas* (Miller 2006d) and is suspected to occur in the project area. This species prefers open areas consisting of sagebrush; however, it does occur in areas with scattered juniper.

Long-billed Curlew

The project area is within the summer range of this species. Long-billed curlews have been documented within the project area. Breeding habitat for this species is mostly areas with ample mixed grasses. It spends much of its time in open areas, shrub-steppe grassland mosaics, and agricultural fields.

Yellow-billed Cuckoo

Yellow-billed Cuckoo (*Coccyzua americanus*) are rare irregular visitors to eastern Oregon and no known breeding populations are located in this state. In Oregon, individuals have been reported in willow dominated riparian habitats. Potential habitat exists along Willow Creek, but surveys have not been conducted. The probability of their presence is low because this habitat may be of insufficient size to support breeding pairs. Therefore this species will not be carried forward for further analysis.

Bats

Two species of bats that migrate, silver-haired and hoary bats, may occur within the area, but likely only involve foraging individuals passing through from adjacent habitat. The silver-haired bat and long-legged myotis are closely associated with conifers. The hoary bat and California myotis prefer open areas in shrub-steppe habitat. Long-legged myotis has been documented in the project area, however the occurrence of the other bat species is unknown as very few surveys have been conducted in the project area.

Gray Wolf

Gray wolves (*Canis lupus*) are present on the Lakeview Resource Area. It is possible that they travel through the area during dispersal. However, the Clover Flat project area is not within a one mile buffer zone of a wolf den or even within an Oregon Department of Fish and Wildlife (ODFW) designated Area of Known Wolf Activity (AKWA). Therefore, this species will not be carried forward for further analysis.

Preble's Shrew

The Preble's shrew (*Sorex preblei*) prefers habitats consisting of shrub-steppe and aspen. Although this species is known to occur in Lake County, it is not known to occur within the project area, and no surveys have been conducted.

Pygmy Rabbit

Pygmy rabbits occur in pockets of big sagebrush habitats with friable soil conditions necessary for burrowing (Verts and Carraway 1998). Potential habitat for pygmy rabbits in the area is limited to big sagebrush sites with deep soils. Surveys have been conducted for pygmy rabbits in suitable locations in the area, but no pygmy rabbits or evidence of pygmy rabbits were found.

Western bumblebee

One Special Status Species insect, the western bumblebee (*Bombus occidentalis*), may occur in the project area. There are no records documenting their occurrence, and no surveys have been conducted. This species occurs in habitats with abundant flowering plants.

Livestock Grazing

Four entire grazing allotments and part of a fifth allotment, grazed under permits by six livestock operators, occur within the project area (Table 3-8).

Table 3-8. Grazing Allotments within the Project Area

Allotment	Acres of BLM	Active AUMs	Grazing season of use	Grazing system
Willow Creek	11,996	565	Spring and summer,	Rest rotation, spring
West Clover Flat	711	15	Spring and summer	Spring and summer
Pine Creek	406	18	Spring, summer, fall, winter	Grazed intermittently during the year in conjunction with private lands.
Clover Flat	2,506	200	Spring, summer	Deferred rotation
Tucker Hill	3,644	136	Unknown	Currently ungrazed

Rangeland health assessments have been completed on the majority of the allotments within the project area (BLM 2003c; 2004a; 2005a; 2006a; 2015a; 2015e) following appropriate methodologies (BLM 1997a). A summary of these assessments is included in Table 3-9. Portions of the Pine Creek and Willow Creek Allotments did not meet all applicable standards, but livestock grazing was not a causal factor. The recent health assessments completed on Clover Flat and Willow Creek Allotments identified juniper encroachment as an issue impacting rangeland health conditions. The Willow Creek Interdisciplinary Team recommended treating invasive juniper. The Pine Creek rangeland health assessment noted about 20% of the allotment is non-habitat for sage-grouse due to juniper encroachment and noxious weed infestations (BLM 2015a, 2015e).

Table 3-9. Rangeland Health Assessment Summaries

		Rangeland Health Standard					
Allotment Name	**Date**	**1**	**2**	**3**	**4**	**5**	**Comments**
Willow Creek	2015	Met	Not Met	Met	Not Met	Met	Standard 2 was not met due to annual invasive grasses compromising ecological processes. Standard 4 was not met due to Willow Creek not meeting state temperature standards. Livestock grazing was not a causal factor for standards not being met.
West Clover Flat	2005	Met	Met	Met	N/A	Met	
Pine Creek	2014	Met	Not Met	Met	N/A	Met	Standard 2 was not met on a portion of Pine Creek. Livestock grazing in this area was not a causal factor for not meeting the standard because all riparian habitat has been excluded from grazing.
Clover Flat	2003	Met	Met	Met	Met	Met	
Tucker Hill	Not Completed						No rangeland health assessment has been completed on this allotment as it is currently vacant.

Cultural Resources and Native American Traditional Uses

Cultural and Historic Resources

The project area is high in known cultural resource sites and ranks as having high potential for the location and recording of more sites. Over 69 archaeological sites are known for this area. Sites include, but may not be limited to, rock cairns, prayer seats, vision quest sites, petroglyphs, stone house rings, lithic scatters, temporary occupation sites, village sites, stone tool quarry sites, and burials. Many of these sites would also be considered as Native American "Traditional Use" sites (see next section). Currently about 42% (8,165 acres) of the project area has been surveyed intensively for cultural and historic resource sites. This represents virtually 100% of the area where juniper treatment is proposed on the ground.

Native American Traditional Uses

The Clover Flat area is high in locations which have religious significance to the Native Americans of the area, The Klamath Tribes in particular. The Klamath Tribes, along with the Burns Paiute, consider this area to be part of a larger cultural landscape of the lower Summer Lake and Abert Lake regions. The area has many locations where rock cairns are present, particularly along the edges of rims and on ridges and peaks within the area. These cairns are said to have several meanings and uses. They may be vision quest locations, prayer seats, trail markers, individual life event markers, or simple prayers marked by the placement of rock(s). The Native Americans of the region hold these sites in high regard, and consider them to be some of the most important cultural resources upon the landscape. They hold the belief(s) that they should be revered, and should not be touched, damaged, or destroyed. In addition, these same groups hold the archaeological sites and resources of the area as being part of the sacred landscape. Portions of the project area are within the boundaries of the Red Knoll ACEC (BLM 2001a and 2003b) which was created to recognize and manage traditional uses in this area.

Native Americans of the region consider the project area to be part of a larger cultural landscape. In recent years, the BLM has received numerous comments or requests from Native Americans representing The Klamath Tribes, the Burns Paiute Tribe, the Fort Bidwell Indian Community, and one individual from the Confederated Tribes of Warm Springs to inventory, designate, and/or manage a larger Traditional Cultural Property (TCP)[12] covering the entire Chewuacan Basin. However, BLM's (2005b) *Land Use Planning Handbook* lists the designation and management of TCPs as a land use planning decision addressed during the development of a resource management plan. In contrast, the proposed project represents a site-specific

[12] Traditional Cultural Property is a term that is not found in existing law or regulation, but has become used synonymously with the term "properties of traditional religious and cultural importance" referenced in the National Historic Preservation Act (section 101(d)(6)(A) and (B), and the regulations implementing this act (36 CFR 800). They are places that are prominent in a particular group's cultural practices, beliefs, or values, that have 1) been widely shared within the group, 2) been passed down through the generations, and 3) served a recognized role in maintaining the group's cultural identity for at least 50 years.

implementation plan. In addition, consideration of a TCP proposal falls outside the purpose and need for action described earlier in Chapter 1.

Culturally Important Plants

A variety of culturally important plants which are used for food, fiber, religious practices, and medicine exist in the surrounding watershed. These plant uses have been identified in previous ethnographic studies (Kelly 1932; Aikens 1986; Fowler 1986) of the area and through past consultation with appropriate tribes (Northern Paiute, Klamath, Modoc, and Warm Springs). Several cultural plants have been documented within Red Knoll ACEC. These include sego lily (*Calochortus macrocarpus*), wild onion (*Allium parvum*), white stemmed mentzelia (*Mentzelia albicaulis*), rock gooseberry (*Ribes cereum*), broomrape (*Orobanche fasciculata*), and several species of desert parsley (*Lomatium macrocarpum, L. nevadense, L. nudicaule* and *L. canbyii*).

Areas of Critical Environmental Concern (ACEC)

The Red Knoll ACEC occurs within the project area (Map 2). The Red Knoll ACEC was designated to provide special management of the following relevant and important values: cultural resources (both sites and culturally important plants), a special status plant (long-flowered snowberry), and wildlife habitat (sage-grouse). These values are described in more detail in the cultural, special status plants, and wildlife habitat sections earlier in this document. The ACEC is managed according to the management direction contained in the *Lakeview RMP/ROD* (BLM 2001a, page A-248; 2003b, pages 57 to 69, as maintained).

Wilderness Values

Wilderness is one of the multiple resources the BLM manages. There are no designated wilderness areas or wilderness study areas located within the project area (BLM 1989, 1991a). For this reason, these values will not be addressed further. However, the BLM is required to maintain its wilderness inventory under Section 201 of the FLPMA. Lands with wilderness characteristics contain values as defined in section 2(c) of the wilderness act: at least 5,000 acres in size, apparent naturalness, and outstanding opportunities for solitude or primitive and unconfined recreation. They may also include supplemental values (BLM 2012c). During BLM's original wilderness inventory it not find wilderness characteristics to be present within the area (BLM 1979a, 1979b, 1979c, 1980a, 1980b). Since 2007, the BLM has been conducting wilderness inventory updates following current inventory guidance (BLM 2007a, 2008c, 2012c) where an ID team has reviewed the existing inventory information contained in BLM's wilderness inventory files, previously published inventory findings, and citizen-provided wilderness information (such as ONDA 2005, 2015). BLM conducted field inventory, completed route analysis forms, made unit boundary determinations, and evaluated wilderness character within each identified inventory unit (BLM 2011, 2017b). BLM's latest wilderness inventory update is available upon request.

The BLM uses the land use planning process to determine how to manage lands with wilderness characteristics (BLM 2005b). The Lakeview Resource Area has not yet undertaken a land use plan, since completing the latest wilderness characteristics inventory, to consider management of these areas. Proposed actions in areas found to possess wilderness characteristics are currently managed according to a 2010 settlement agreement with the Oregon Natural Desert Association (ONDA). This agreement states that the “BLM shall not implement any projects…that fall within an inventory unit determined by BLM to possess wilderness character, where such action would be deemed by BLM to diminish the size or cause the entire BLM inventory unit to no longer meet the criteria for wilderness character… Until the BLM has completed an RMP amendment, if a project is proposed or scheduled for implementation… and would be in an area the BLM found to possess wilderness character, the BLM will analyze the effects on wilderness character through each project’s NEPA process. Such analysis shall include an alternative that analyzed both mitigation and protection of any BLM-identified wilderness character that exists within the project area.”

During its most recent inventory, the BLM found one unit (Tucker Hill) in the project area to possess wilderness characteristics (BLM 2017b). A summary follows.

Tucker Hill (OR-015-116): In 2017, the unit was determined to meet the minimum size criteria at approximately 8,314 acres and was found to be in a natural condition primarily affected by the forces of nature. The unit was found to have outstanding opportunities for solitude due to topographic relief, as the unit is dominated by a large rim and plateau running north to south with lateral fallen/broken ridges, and drainages sloping to knolls and nobs arranged around its circumference providing excellent screening. In addition, juniper have increased in height, width, density, and distribution since the original inventory, providing additional vegetative screening. Scattered pockets of juniper in the northwest corner of the area and a band of high-density juniper at the southern tip of the unit along Willow Creek provide vegetative screening that contributes to outstanding opportunities for screening. The unit was also found to have outstanding opportunities for primitive and unconfined recreation due to the combined diversity of hiking, backpacking, hunting, camping, sightseeing, photography, wildlife viewing, and horseback riding. Primitive recreation associated with challenge and feeling of risk due to elevation gain and topography of the large, long, rim running north to south with lateral fallen/broken ridges, and drainages sloping to knolls and nobs stood out as a unique opportunity. The BLM also noted the presence of supplemental values including wildlife (s sage-grouse, bighorn sheep, and raptor habitat) cultural, geological, and botanical values.

Recreational Opportunities

Recreation within the Clover Flat project area is managed for multiple activities, opportunities, and experiences (see map R-3, BLM 2003b). Recreation within the majority of the area is managed for Semi-Primitive Motorized experiences (15,570 ac.; 79%). These areas are managed to provide a moderate probability of experiencing isolation, closeness to nature, and self-reliance in outdoor skills. The recreation setting in these areas manages for low user interaction, but allows for limited evidence of other users and few isolated structures.

Recreation along the Clover Flat Road (2-10, 2-10A), the main access routes within the project area, is managed for Roaded Natural experiences (3,793 ac.; 19%). These areas are managed to provide an equal probability of experiencing other user groups, as well as, isolation from the sights and sounds of others. The recreation setting in these areas are managed to allow for a high degree of interaction with the natural environment, but primitive types of recreation is not as important. User interaction should be low to moderate. Resource modifications and utilizations can be evident, but should harmonize with nature. Opportunities for both motorized and non-motorized forms of recreation are possible.

Recreation along Highway 395 is managed for Rural recreational activities, opportunities, and experiences (269 ac.; <2%). These areas are managed to allow for the convenience of developed sites and possess a high probability of experiencing other users. Moderate to high user interaction is acceptable. Activity factors are generally more important than the setting of the physical environment. Resource modification and utilization practices are designed to emphasize recreation activities. Facilities are often provided and are typically geared toward motorized use, with parking available.

There are no developed recreation sites in the project area. Most recreation in the project area is associated with undeveloped recreation activities, opportunities, and experiences such as hiking, backpacking, horseback riding, ATV riding, hunting, target shooting, dispersed camping, sightseeing, photography, wildlife viewing, and driving for pleasure.

The majority of project area (18,125 acres, 92%) is within a “Limited” OHV Area Designation. “Limited” designations restrict motorized use to either Limited to Existing (7,003 acres) or Limited to Designated (11,122 acres) routes and trails. The remaining 1,504 (8%) acres of the project area are open to cross-country travel.

Typically, one to two special recreation permits (SRPs) are issued within the project area each year for commercial horseback riding or hunting activities. The recent management direction within the *Oregon Greater Sage-Grouse ARMPA* (BLM 2015b) now limits SRPs within the project area seasonally due to sage-grouse habitat. Motorized SRPs are prohibited from operating within four miles of an active or pending lek March 1st through June 30th, while non-motorized SRPs are prohibited from operating within three miles of an active or pending lek during the same timeframe.

For additional information related to primitive recreation opportunities, see the Lands with Wilderness Characteristics section.

Visual Resources

The BLM is required to manage public lands to protect visual resources (BLM 1984). Visual Resource Management (VRM) is the term the BLM uses to describe the system through which the agency classifies and assigns differing degrees of protective management. Based on inventory, public comment, and management considerations of other resources, the BLM assigns VRM Classes I-IV through the land use planning process (BLM 2005b). Class I is the most protective, whereas Class IV allows for the most modification to the landscape (see definitions of classes below). Proposed projects are compared and contrasted to the existing features of the landscape, which focus on form, line, color, and texture. Degrees of contrast are rated as none, weak, moderate, or strong and factors to be considered are distance, angle of observation, length of time project is in view, size/scale, seasons of use, light conditions, recovery time, and spatial relationships.

VRM Classes were designated in the project area in the Lakeview RMP/ROD (see map VRM-3, BLM 2003b). The Clover Flat project area contains VRM Classes II, III and IV (Table 3-10 and Map 10).

Table 3-10. Visual Resource Management Classes in the Project Area*

VRM I	VRM II	VRM III	VRM IV
0 ac./ 0%	11,097 ac./ 57%	2,542 ac./ 13%	5,801 ac./ 30%

*VRM I management objectives are to "preserve the existing character of the landscape … level of change should be very low and must not attract attention."
VRM II is managed to "retain the existing character of the landscape. The level of change to landscape characteristics should be low. Management activities can be seen, but should not attract the attention of the casual observer."
VRM III is to "partially retain the existing character of the landscape, moderate levels of change are acceptable."
VRM IV is managed to allow for "major modifications to the landscape," though "every effort should be made to … minimize disturbances and design projects to conform to the characteristic landscape" (BLM 2001, page 290).

Approximately, 5,162 acres (27%) along the eastern side of project area is located within the Oregon Outback National Scenic Byway Corridor along Highway 31 (Map 10). The *Lakeview RMP/ROD* recognized this same area as a major route/scenic corridor where the management direction requires "all developments, land alterations, and vegetation manipulations within a 3 mile buffer… of all major routes and recreation use areas to be designed to minimize visual impacts (unseen areas within these zones will not be held to this standard)… All projects will be designed to maximize scenic quality and minimize scenic intrusions" (BLM 2003b, page 88, as maintained).

The BLM found there to be a higher visual sensitivity along the Clover Flat, Round Pass Lane, and Pine Creek County Roads (approximately 8,770 acres or 45% of the project area) than the VRM Class indicates due to public interest, amount of use (moderate to high), type of users (sightseers or those driving for pleasure), adjacent land use (bed and breakfast), special areas (ACEC), and serving as main access routes to the adjacent Fremont-Winema National Forest.

The project area is topographically dominated by a rocky spine and steep escarpment running north to south from Tucker Hill to below Red Knoll, with numerous points, knobs, and moderate rims in the northern two-thirds of the unit. The eastern portion consist of large plateaus sloping down to the edge of Chewaucan Marsh. The southeast portion is dominated by Indian Spring Ridge and Pine, Willow, and Coyote Creek drainages. The western portion of the unit is characterized by Clover Flat along with Moss and Clover Creeks. Vegetation across the project area is diverse. Scattered juniper, sagebrush, and grass communities dominate the northern two-thirds of the unit. Juniper stands mixed with ponderosa pine, mountain mahogany, and aspen dominate the western and southern third of the project area.

Observable developments/treatments/ecological disturbances/facilities in the project area affecting the criteria for VRM classes (form, line, color, and texture) include about 12,956 acres of recent herbicide treatments, 3,172 acres of seeding, 1,577 acres of past wildfire, 430 acres of past prescribed burning, 227 acres of past mechanical weed treatments, 155 acres of past and ongoing mining disturbance (including Tucker Hill Perlite Mine), 41 miles of open motorized routes, 4 miles of reclaiming routes, 3.5 miles of closed routes, 37 miles of fence, 490 feet of pipeline, 9 waterholes, 7 developed springs, 5 reservoirs, and 4 troughs.

Fuels and Fire Fighter Safety

Fuels within the project area consist generally of juniper, bitterbrush, big sagebrush, low sagebrush, bunch grasses, medusahead and cheat grass. Ponderosa pine stands also occur on BLM-administered lands along the forest fringe.

Lands adjacent to the project area contain a typical assemblage of high desert juniper/sagebrush steppe: big sagebrush intermixed with areas of mixed-seral bitterbrush, and large expanses of low sagebrush. The project borders the Fremont-Winema National Forest to the south and west, where the fuels are made up of primarily ponderosa pine and white fir stands.

Past fire exclusion and other management activities have altered the fuel loading in the project area, as evidenced by the recent expansion of juniper. Though fuel loading can vary widely across an area due to a number of factors, it is estimated that the fuel loading associated with the sagebrush\juniper fuel types in the Project Area range from three to 14.7 tons per acre (mean four tons per acre) (Table 4-1; Stebleton and Bunting 2009, Ottmar *et al.* 1998) making about 58,830 to 288,267 tons of fuel available within the treatment units.

The greatest risk posed to fire fighter safety in the project area is due to the presence of fine fuels consisting of stands of medusahead and cheat grass which can add one to two tons per acre to the total fuel loading (Ottmar *et al.* 1998). Fine fuels allow a wildfire to spread rapidly and act as a ladder fuel, giving the fire access to the lower branches of juniper trees.

Fuel loading within the pine stands along the forest fringe is estimated to average around ten tons to the acre (Ottmar *et al.* 1998). Large pockets of duff and downed trees in these pine stands have created fuel levels that would make it very difficult to suppress a wildfire in this area. Under these high fuel loads, fire intensity can be great during burn periods creating problematic or unpredictable fire behavior, which increases the risk to fire fighter safety.

4. ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter analyzes the potential environmental impacts that are projected to occur as a result of implementing the three action alternatives. The baseline used for comparison of projected impacts is the current condition described previously in Chapter III. Impacts are described for the short-term (one to ten years) and for the long-term (10 to 20 years).

The following resource values have been considered and are either not present on BLM-administered lands, or would not be significantly affected by any of the alternatives considered: paleontological resources, prime and unique farmlands, floodplains, research natural areas, wild or scenic rivers, land tenure, geology, energy and minerals, or wild horses. In addition, there would be no impacts to low income or minority populations from any of the alternatives analyzed. Therefore, these issues/resource values are not discussed further in this document.

There are no known hazardous waste sites located on BLM-administered lands within the project area. Should such a site be located or a spill occur during management activities it would be handled in accordance with BLM's (2008b) hazardous materials emergency contingency plan. For these reasons, this issue will not be analyzed further.

Green House Emissions and Carbon Sequestration

Impacts Common to Alternatives 1 through 3

Wildfire represents a natural process that could occur under any of the alternatives and result in a substantial release of carbon dioxide into the atmosphere in a short period of time. Fire releases carbon stored in plant material into the air as carbon dioxide gas (Hurteau and North 2009; Wiedinmyer and Hurteau 2010). However, the amount of carbon released by future wildfires cannot be predicted accurately and would depend upon the frequency of ignition(s), fuel loading, moisture content, intensity of the burn, and amount of area burned. Several studies have concluded that carbon release from forests under wildfire conditions is much greater than carbon release under more-controlled prescribed fire conditions (Meigs *et. al*. 2009; Hurteau and North 2009; Wiedinmyer and Hurteau 2010). Some sites, if burned under wildfire conditions, would be at high risk of cheatgrass invasion. Some studies have suggested that conversion from perennial shrub-steppe to annual grasslands would increase the fire return interval and greatly reduce the site's potential for carbon storage (Rau *et. al.* 2009; Rau *et. al.* 2010) by longer-lived woody species.

While it is probable that a large portion of the above-ground carbon stored in biomass within a given burned area would be released during a wildfire, much of the below ground carbon would not be affected (Rau *et. al.* 2009). Carbon left on-site in the residual ash would also tend to leach back into the soil over time where it would become available to new plant growth.

Carbon sequestration would likely increase immediately following a wildfire, as vegetation reestablishes on the site and new plants store carbon in their above ground tissue and below ground roots during photosynthesis. This would partially offset the amount of carbon released to the atmosphere during a wildfire (Meigs *et. al.* 2009). The rate of sequestration would depend upon the intensity of the burn, amount of residual plants that survived the fire, amount of viable seed source in the soil, reestablishment rate of fine-rooted vegetation, rehabilitation/revegetation methods used, and soil chemistry (Meigs *et. al.* 2009). The total amount of sequestration that would occur would depend upon the size of the wildfire and the overall rate of vegetation recovery.

Alternative 1 - No Action

This alternative would continue existing management activities and likely see on-going climatic trends continue in the project area over the 10 to 20 year analytical timeframe. Generally, on-going natural processes and other management actions (such as livestock grazing and weed treatments) would continue and influence carbon sequestration and greenhouse gas emission processes during this same timeframe.

One recent environmental analysis summarizing the available science found that increasing atmospheric carbon dioxide levels and temperature could result in shifts in native plant communities over time that favor invasive, non-native species over natives, as well provide conditions that make invasive species harder to control (BLM 2010a, p. 171). Juniper would also continue to expand within existing sagebrush-steppe vegetation communities in the project area over this timeframe. A recent environmental analysis summarizing the available science found that increasing atmospheric carbon dioxide levels favor expansion and more rapid growth of juniper trees (BLM 2015c, p. 3-161). Some science suggests that woodland expansion into grasslands may increase carbon sequestration on the landscape (Norris *et. al* 2001; Hibbard *et. al*. 2003).

Carbon pools are generally separated into below ground or soil pools comprised of plant root systems and above ground pools consisting of vegetation and litter. In arid woodlands, above ground pools account for about 25% of the carbon storage, leaving the remaining 75% in below ground pools (Rau *et. al*. 2010). However, long-term above ground sequestration may not be possible in arid, fire-prone systems (Hurteau and North 2009; Rau *et. al*. 2010) such as the sagebrush-steppe where fire return intervals are relatively frequent.

Under this alternative most of the biogenic carbon would remain stored in living grasses, sagebrush, and juniper. As individual plants die over time, the carbon stored in the plant would be released into the environment very slowly over several decades as it naturally decomposes. Absent a wildfire, the rate/amount of new carbon sequestration that would occur through photosynthesis would be the lowest of all alternatives analyzed.

Alternative 2 – Proposed Action

<u>Fossil Fuels</u>

This alternative would require the use of motorized vehicles during project implementation. It is estimated that two pickup trucks and three OHVs would be used by field crews to drive to the project area, access treatment units, and perform treatments approximately two months each year (40 days). From these estimates, the annual amount of fuel consumption can be calculated as follows:

> Truck gasoline useage: 4 gallons per day * 40 days * 2 trucks = 320 gallons
> ATV gasoline useage: 2 gallons per day * 40 days* 3 ATVs = 240 gallons

Carbon dioxide emissions from burning a gallon of gasoline is about 19.4 pounds per gallon (USDOE 2010). Based on these estimates, annual carbon dioxide emissions for vehicle use can be calculated as follows:

> (560 gallons of gas * 19.4 pounds CO_2/1 gallon of gas) * (.0004535 metric ton/1 pound) = 4.9 metric tons

Between 1990 and 2007, the estimated annual total emissions of carbon dioxide from all transportation sources in the U.S. ranged from 1484.5 to 1887.4 teragrams (10^{12}) or 1,484,500,000 to 1,887,400,000 metric tons. The annual estimated total carbon dioxide emissions from all human sources in the U.S. ranged from 4,871,000,000 to 5,919,500,000 metric tons during this same time period (USEPA 2009b). Based on these estimates, the annual contribution of carbon dioxide from vehicle emissions associated with implementation of this alternative would represent an insignificantly small proportion of either the total U.S. transportation-related emissions or all U.S. human-related emissions.

Juniper Treatments

This alternative proposes to treat an estimated 3,682 acres of Phase 1 juniper stands by simply cutting and leaving on-site (Table 2-1). Under this treatment method most of the carbon would remain stored in the dead tree biomass and would be released into the environment very slowly over several decades as the trees naturally decompose. The Klamath Falls Resource Area, BLM estimated juniper production associated with several juniper removal projects has varied from a mean of 4 to 15 green metric tons/acre across all juniper phases. These estimates compare well with another study in the Great Basin where juniper biomass production varied from 3.0 to 14.7 tons per acre across all juniper phases (Table 4-1). In that study live green biomass specifically in Phase 1 juniper stands varied from 0.03 to 12.9 metric tons per acre, with a mean of 3.0 metric tons per acre (Stebleton and Bunting 2009).

Table 4-1. Biomass Estimates for Western Juniper Phases

Live Fuel Loading[1]	Biomass Range (metric ton/acre)	Biomass Mean (metric ton/acre)
Phase 1	0.03-12.9	3.0
Phase 2	1.3-21.3	7.9
Phase 3	3.1-38.0	14.7

[1]Source: Stebleton and Bunting 2009.

One local biomass study found approximately half of the live green weight of juniper was comprised of water (Breanna Sabin, personal communication). Assuming 0.5 metric ton of carbon released per metric ton of green biomass and 3.7 metric tons of carbon dioxide produced for each metric ton of carbon, carbon dioxide emissions can be estimated. Approximately 0.05 to 23.8 metric tons of carbon dioxide per acre would be released over several decades during natural decomposition. This would equate to approximately 184 to 87,632 total metric tons of carbon dioxide would be released from treatment of Phase 1 juniper stands over several decades.

About 4,520 acres of Phase 2 and 3 juniper stands would be treated by cutting and following up with prescribed fire (Table 2-1). Estimates of live green biomass in Phase 2 and 3 juniper stands in one study varied widely from 1.3 to 38.0 metric tons per acre (Stebleton and Bunting 2009). The means for Phase 2 and 3 stands were 7.9 and 14.7 metric tons per acre respectively (Table 4-1). Assuming about half of this weight is water, then the mean dry metric tons of biomass per acre vary from about 3.9 (Phase 2) to 7.3 (Phase 3).

The objective of prescribed burning is to consume 60 to 90 percent of the juniper biomass. Based on these assumptions, the biomass consumed by burning would result in estimated carbon dioxide emissions between 1.5 to 63.3 metric tons per acre and would result in estimated total emissions of 6,780 to 286,116 metric tons of carbon dioxide over the life of the project.

Carbon sequestration would resume within the small burned areas following prescribed fire, as vegetation reestablishes and new plants begin to grow and store carbon. The health and vigor of sagebrush-grass communities across most of the project area would also increase following cut and leave treatments. This would result in increased carbon sequestration and would partially offset the amount of carbon released from prescribed burning (Meigs *et al.* 2009).

Alternative 3 – Biomass Removal

<u>Fossil Fuels</u>

Under Alternative 3, this same level of BLM staff motorized vehicle use and resulting carbon dioxide emissions would occur annually as described under Alternative 2. Some additional fossil fuels would be burned in order to harvest, process, and transport biomass from the field to a biomass facility. An estimated one to three pieces of heavy equipment (ie. harvestor, skidder, chipper, or chip-hauling truck) would be used to harvest, process, and transport biomass over an estimated one year time-frame. Carbon dioxide emissions from heavy equipment operations can be estimated assuming the following:

> One piece of heavy equipment operating about 30 days/year x 8 hours per day x 6 gallons diesel fuel per hour x 5 years = 7,200 gallons of diesel fuel.
>
> Carbon dioxide emissions from burning a gallon of diesel average 22.2 pounds per gallon (USEPA 2010).

Based on these assumptions, carbon dioxide emissions for one piece of heavy equipment associated with biomass removal can be calculated as follows:

> (7,200 gallons of diesel * 22.2 pounds CO_2/1 gallon of diesel) * (.0004535 metric tons/1 pound) = 72.5 metric tons

For heavy equipment carbon emissions would range from about 72.5 to 217.5 metric tons total or about 14.5 to 43.5 metric tons during the one year when biomass removal occurs.

Based on these estimates, the annual contribution of carbon dioxide from vehicle/heavy equipment emissions associated with implementation of this alternative, though higher than Alternatives 1 or 2, would still represent an insignificantly small proportion of either the total U.S. transportation-related emissions or all U.S. human emissions.

<u>Juniper Biomass</u>

The potential effects of carbon release associated with cutting and leaving approximately 3,605 acres of trees in Phase 1 stands (Table 2-2) would be slightly less than Alternative 2, ranging from 180.3 to 85,799 metric tons. Up to 4,646 acres of Phase 2 juniper stands would be burned under this alternative (Table 2-2). Assuming the prescribed burning would consume 60 to 90 percent of the juniper biomass, an estimated 1.5 to 63.3 metric tons of carbon dioxide per acre would be released. This would result in estimated total emissions of 6,969 to 294,092 metric tons of carbon dioxide over the life of the project. Under this alternative more trees would be cut and burned on a per acre basis compared to Alternative 2, so the resulting carbon emissions would likely fall towards the higher end of this estimate.

This alternative also proposes to mechanically treat approximately 240 acres (Table 2-2) of Phase 2 and 3 juniper stands and remove an estimated 1,896 to 3,528 metric tons of juniper biomass.

If this juniper biomass was chipped and burned as hog fuel in a biomass energy (electricity) plant, virtually 100% of the chipped biomass would be burned (compared to 60-90 of the biomass associated with field burning). In addition, this material would be burned under more controlled conditions in a facility using pollution control technologies (USEPA 2001). An estimated 948 to 1,764 metric tons of carbon dioxide would be produced. This carbon release would be partially offset by less need to generate electricity from other fossil fuels (coal/natural gas), which also release carbon when burned.

If the juniper biomass was instead processed as clean chips or saw logs and utilized in hardboard or some other forest product it would result in short-term carbon sequestration and less contribution to greenhouse gas emissions.

Carbon sequestration would resume within the small burned areas following prescribed fire, as vegetation reestablishes and new plants begin to grow and store carbon. The health and vigor of sagebrush-grass communities across most of the treatment units would also increase following cut and leave, and biomass removal treatments. This would result in increased carbon sequestration into new biomass. This would partially offset the overall amount of carbon released from burning (Meigs *et. al.* 2009). The amount of sequestration that would occur would be slightly less than Alternative 2, as slightly fewer treated acres would be actively recovering.

Air Quality Impacts

Alternative 1 - No Action

Most management activities under this alternative would not directly produce any significant $PM_{2.5}$ emissions. However, the potential for future wildfires that could produce significant quantities of $PM_{2.5}$ would continue to increase as surface and ladder fuels accumulate in the project area. As an example, a single 2,000-acre wildfire could result in approximately 868 tons of $PM_{2.5}$ emissions in the area, which would occur under unknown dispersal conditions (i.e. would drift in whatever direction the wind is blowing), and could negatively affect one or more smoke sensitive areas in the region.

It is likely that prescribed burning elsewhere in the region would occur, but would be mitigated through the smoke management process described in Chapter 3. It is anticipated that regional smoke emissions from both prescribed and wildfire would vary annually and would have a short-term effects on air quality lasting for several days to several weeks.

Visibility under wildfire conditions would be subject to the prevailing weather/wind patterns at the time of the wildfire.

Alternative 2 – Proposed Action

Smoke emissions from prescribed burning activities vary depending on the method used (broadcast burn or pile and burn); the grass, shrub and tree species burned; the amount of fuel; the proportion of the fuel consumed by the fire; and weather conditions. BLM mitigates emissions from prescribed burning to the extent possible by adhering to seasonal and other timing restrictions imposed by Oregon Smoke Management Plan (OAR Chapter 629, Division 48), increasing interagency coordination, limiting new burning based on current or anticipated smoke accumulation and dispersion, and using predictive forecasting of atmospheric conditions.

Studies indicate that prescribed fires, ignited under fuel moisture conditions that reduce total fuel consumption and conducted when mixing heights and winds are more favorable for smoke dispersal, produce lower levels of particulate matter than uncontrolled wildfires. Therefore, while prescribed burning may have a temporary negative effect on air quality, in the long term, acute impacts of prescribed fires are less than those produced by a similar size wildfire (USFS and BLM 1997).

Visibility can also be affected by prescribed burning. Fine particulate matter, generally less than 2.5 microns in diameter, is the primary cause of visibility impairment. Prescribed burning emissions, which may stay suspended for many miles, are in the 0.1 to 2.5 micron size class, and would temporarily reduce visibility (USFS and BLM 1997). The Clean Air Act (Amendment of 1977) requires the State to consider strategies for reducing visibility impairment from prescribed burns. Visibility concerns would be mitigated utilizing restrictions described in the Smoke Management Plan.

Alternative 3 – Biomass Removal

The impacts of piling and burning treatments under Alternative 3 on air quality would generally be similar to those of Alternative 2. However, more material would be burned within those areas identified in Alternative 2 for “thinning” treatments. This would result in higher smoke and particulate emissions from those units compared to Alternative 2.

There would also be about 250 acres that would have biomass removed. If this material is burned as hogfuel in a biomass energy recovery plant (with air emission control technology) or used in special forest products there would be less smoke and particulate emissions expected from the biomass treatment units when compared to pile burning.

The Klamath Falls Resource Area, BLM has found juniper production associated with several recent juniper removal projects has averaged from 4 to 15 green metric tons per acre across all juniper phases. This compares well with the mean of 3 to 14.7 tons per acre recorded by Stebleton and Bunting (2009) across all three juniper phases (Table 4-1).

In the assessment of air quality effects, the following assumptions are made:

> One acre with 4 to 15 tons of piled, whole junipers burned under field conditions would emit about 48 to 179 pounds of $PM_{2.5}$.
>
> This same quantity of material burned in a biomass plant equipped with an electrostatic precipitator would produce about 2.5 to 9 pounds of $PM_{2.5}$ (Burke 1994, USEPA 2001).

Based on these assumptions, an estimated 18,584 to 69,690 pounds of $PM_{2.5}$ would be released by open pile burning over span of the project. It should be noted that open burning does not typically consume 100% of the juniper material.

Chipping and burning up to 240 acres of juniper in a biomass energy plant would result in an estimated 600 to 2,160 pounds of $PM_{2.5}$ emissions.

Under this alternative, there would be additional pollutant emissions of dust and diesel exhaust into the air from yarding, chipping, and hauling operations, but a reduction in total wood smoke and particulate emissions would result from utilizing some of the juniper biomass compared to Alternatives 1 or 2. Juniper utilized in a biomass plant would result in a reduction of approximately 95% of the particulate matter (less than 2.5 microns in diameter) into the atmosphere compared to burning under wildfire or prescribed fire conditions. Some burning of residual landing material would still occur in an open environment, but it is anticipated that up to 90% of the yarded biomass would be utilized as chipped hog fuel or as special forest products.

Soil and Microbiotic Crust Impacts

Alternative 1 - No Action

Vegetation conditions in the project area currently depart from historic reference conditions due to juniper encroachment. Juniper expansion into sagebrush-steppe can affect the spatial distribution of soil organic matter and nutrients. The loss of nutrients would also increase if woodland development results in accelerated erosion (Miller *et al.* 2005). Sites where juniper has expanded into sagebrush-steppe rangelands are prone to excessive soil heating during wildfires due to higher fuel loads. Sites that, in the past, would have burned under lower fuel loads and at a cooler temperature, would be more apt to burn hotter, potentially volatalizing soil nitrogen (Brown *et al.* 2003; Johnson *et al.* 1998). Under this alternative, soil surfaces are at a much higher risk of wildfire and nitrogen loss compared to Alternatives 2 and 3.

Conifer encroachment (including juniper) into riparian corridors amplifies soil risks. Junipers absorb soil water very efficiently, dry out surrounding soils, out-compete other vegetative ground cover, create bare ground, and produce a water repellant litter. While encroaching conifers can provide stream shading in riparian corridors, they can also lead to the loss of site-appropriate riparian species such as sedges, willows, alder, and aspen which have more effective sediment catching properties. Further, conifers burn at higher temperatures during fast moving wildfires. For these reasons, the risk of stand-replacing wildfires burning along stream courses, resulting in excessive heating of riparian soils and transport of sediment are highest under this alternative.

Though little is known about biological crusts specifically within the project area, research elsewhere can be used to estimate potential fire impacts. Historic reference vegetation conditions would have typically provided little fuel to carry fire across soil crust cover in the sagebrush-steppe communities. In addition, the crusts themselves provide little fuel capable of carrying a fire through the interspaces, thereby acting to slow the spread of fire and decrease its intensity (Rosentreter 1986).

Fifty to 100 years has often been cited as the average historic fire return interval in shrub-steppe regions (Wright *et al.* 1979; Peters and Bunting 1994). This is an adequate timeframe to allow recovery of biological crust components following a fire. Unburned islands of vascular vegetation and biological soil crust provide propagules for crust reestablishment in burned areas. Johansen *et al.* (1993) observed that the crust's structural matrix was left intact following low-intensity fire, indicating that a lightly burned crust still functions to maintain stability against erosive forces for both vascular plants and biological soil crusts during the recovery period. Moss, which is a dominant component of local soil crusts, burns incompletely under regional reference conditions and would typically recover following fire. However, without site-specific data, the reference condition for crusts cannot be described specifically for the project area.

Fuel loads have increased in the project area due to juniper expansion. Higher fuel loads would generate hotter soil temperatures during wildfires and would damage the crust's matrix, limiting its ability to recover following wildfire. This alternative poses the greatest risk of large, stand-replacing wildfire and associated negative impacts to biological crusts compared to Alternatives 2 and 3.

Alternative 2 – Proposed Action

Overall, prescribed burning under proper soil and fuel moisture conditions, would reduce landscape scale erosion risk compared to what could happen following a large scale wildfire under Alternative 1. The impact of soil erosion from pile burning would be much less than what could be expected from a hot, fast-moving, stand-replacing wildfire. Wildfire in closed rangelands and pine forest poses more erosion risk over both the short and long-term compared to the proposed treatments.

Pile burning, combined with follow-up treatments, would maintain or enhance the vegetation diversity and sustain more appropriate detritus nutrient cycles over the long-term. Soil erosion risks would be moderated by promoting gains in well-rooted, native ground cover over the long-term. Considering the implementation timeframe and the scale of the project area, there would be local and temporary soil erosion risks for a season or two following each treatment activity until vegetative ground cover is re-established.

In some respects, the impacts of pile burning on microbiotic crusts under Alternative 2 would be similar to those associated with wildfire under Alternative 1. However, the total area burned would be much less. In addition, burned patches would be more likely to re-colonize over time from crusts on adjacent unburned areas.

Soil sedimentation risks would be less than Alternative 1 due to removing encroaching conifers in riparian corridors and promoting site-appropriate riparian species such as sedges, willows, alder, and aspen that are sediment catching plants. Compared to Alternative 1, there would be less risk for a hot, fast-moving, stand-replacing wildfire to occur along steam courses, which would also protect site-appropriate vegetative ground cover capable of catching sediment.

Alternative 3 – Biomass Removal

The impacts to soils and microbiotic soil crusts would be similar to those in Alternative 2 except at the proposed biomass removal units (250 acres; Map 6). Within biomass treatment units about 55% of the soils are rocky, fragile, and loose. There would be substantial soil and crust disturbance due to the use of heavy equipment causing rutting, soil compaction, crushing of crusts and other plants, and increased erosion potential.

Compaction would influence soil water and nutrient-holding capacity, which could lead to changes in soil crust species composition. These subtle compositional changes often occur before cover changes are apparent. Impacts of mechanical disturbance are especially noticeable at sites with highly erodible soils and large topographic relief (Belnap *et al.* 2001). By conducting mechanical treatments when soil surfaces are either frozen, dry, or have adequate snowpack, soil compaction impacts would be minimized. Further, most soils in the project area have high shrink-swell potential. These clay soils, especially the shallower soils, expand and contract with sufficient force during normal freeze-thaw and wet-dry cycles to lift rocks up onto the soil surface and are capable of rebounding from compaction impacts caused by mechanical equipment within a couple of years.

Watershed and Hydrology Impacts

Alternative 1 - No Action

There have been two reviews of juniper management that include discussions on the impacts of juniper expansion on hydrologic processes in southeast Oregon. The first was a scientific assessment of the Interior Columbia Basin (Eddleman *et al.* 1994). Their findings are summarized below and are applicable to the project area:

- In excess of 12% of annual precipitation can be intercepted[13] by the juniper canopy.
- On some juniper sites overland flow increases resulting in water and sediment loss.
- Research to date has been based on summer impacts with little done in fall, winter, and spring.

[13] Interception refers to precipitation hitting the plant surface and evaporating back into the air before it can hit the soil surface and soak into the ground.

The second scientific review is *Biology, Ecology and Management of Western Juniper (*Miller *et al*. 2005). The report found that "changes in hydrologic processes and water balance as tree abundance and dominance increase are not well understood. Evidence suggests that juniper can impact infiltration rates, sediment loss, and soil water storage and depletion rates. Accelerated soil water depletion rates in juniper-dominated stands can decrease the length of the growing season by as much as four to six weeks. However, the impacts of juniper on the water balance at the watershed or basin level have not been determined, nor have the impacts of woodlands on subsurface flow into streams and springs…Juniper has increased in density and distribution since the late 1800s and if left unchecked can have measurable impact on soil resources, plant community structure and composition, water and nutrient cycles, and wildlife habitat."

Knowledge gaps include: 1) the impacts of juniper on subsurface water flow and soil moisture storage, and 2) relationships between juniper expansion, site potential, current condition, hydrology, nutrients, erosion, and stream and spring flows.

A third study relevant to water resources is a critical review of the potential to increase water yields (increase annual streamflow volume) through juniper removal in the Klamath Basin (Kuhn 2007). Earlier studies found that increasing water yields by juniper removal is only feasible where annual precipitation is greater than 17.7 inches (Bosch and Hewlett 1982; Hibbert 1983; Wilcox 2002). Since only about 400 acres (2%) of the almost 20,000-acre project area annually exceeded 18 inches of precipitation on average, it appeared unlikely that juniper expansion would have a substantial impact on water yield at the watershed scale. However, newer research indicates the opposite.

Vegetative modeling showed that 9 to 35 trees per acre are enough to utilize all the available precipitation delivered to a site in a 13-inch annual precipitation zone (Deboodt *et al.* 2009). After treating western juniper in a paired watershed study, Deboodt *et al.* (2009) found late season spring flow increased 225%, days of recorded groundwater increased by an average of 41 days, and increased relative availability of late season soil moisture at soil depths of 0.76 meter. This study indicates that the potential for water yield effects due to juniper encroachment occur at much lower precipitation thresholds than previously understood. Precipitation across the Project Area ranges from 11 to 20 inches per year. Based on current research, water yield may be below its potential under the No Action alternative, since no juniper would be treated. These impacts would depend on site specific variables such as existing juniper canopy closure, local geology soil types, and local groundwater/surface water interactions.

Miller *et al.* (1986) reported that as juniper trees increased in size and density, transpiration[14] and interception took most of the water received. Eddlemen *et al.* (1994) reported that interception by mixed prairie grasses to be 14 to 22%. McMillan and Burgy (1960) found dry grass had more interception effect than green grass. While all vegetation types will intercept some precipitation, juniper has a greater interception effect than grassland communities. Juniper canopy cover can intercept as much as 12 to 42 % of storm precipitation, depending on the duration and yield of the storm, with as much as 74% being intercepted directly under the juniper canopy (Eddleman *et al.* 1994; Eddleman 1986; Larson 1993).

[14] Transpiration refers to the process of giving off water vapor through the stomata of plant tissues.

Depending on the water year and crown density, 2 to 5.6 inches of available ground moisture can be lost from transpiration by juniper. Juniper transpiration can remove two inches of soil moisture in a dry year and up to 5.6 inches in a wet year, shortening the understory growing season by as much as six weeks (Miller *et al.* 2005).

The shift to juniper dominance reduces the biomass and productivity of understory vegetation, as well as soil surface cover (Vaitkus and Eddleman 1987). This increased bare ground may reduce soil surface infiltration rates, which in turn increases overland flow and reduces soil water storage. Pierson *et al.* (2007) found that even at lower rainfall rates, juniper-dominated hillslopes produced significantly more soil surface runoff and erosion than hillslopes with juniper removed in southeast Oregon.

Under this alternative, juniper density in the project area would continue to expand in both aerial extent and density. As juniper stands transition from Phase 2 to Phase 3, interception of precipitation by the canopy would increase, ground cover would decrease, and more bare soil would become susceptible to erosion and loss of groundwater infiltration capacity (Pierson *et al.* 2007). These changes have the potential to negatively impact water quality, as well as the timing and quantity of water capture and release.

As juniper density along stream edges increases, competition between juniper and woody riparian species would increase, leading to a reduction of woody riparian species. This loss of woody riparian vegetation would result in a reduction in stream shading and contribute to increases in stream temperatures.

Alternative 2 – Proposed Action

Under this alternative, short term (one to two years post-burn) reduction in ground cover and increased erosion at localized burned sites is expected, however in the long term (greater than two years post burn) ground cover would increase following juniper removal and erosion would decrease compared to Alternative 1. Restoration of water cycles from juniper removal should also improve stream function (Miller *et. al*. 2005). There are numerous reported cases of stream and spring flow improvement after juniper management (Stabler 1985). Deboodt *et al.* (2009) found increased late season spring flow of 225%, increased days of recorded groundwater by an average of 41 days, and increased relative availability of late season soil moisture at soil depths of 0.76 meter after treating western juniper in a paired watershed study. This study indicates managing juniper may increase water yield at a much lower precipitation thresholds than what was previously understood.

The impacts of proposed prescribed fire activities are dependent upon the severity of impact to the soil and the rate of vegetation recovery following. Most studies have shown an increase in runoff and erosion rates the first year following fire (prescribed or wild), with a return to pre-fire rates within five years (Wright and Bailey 1982). Roundy *et al.* (1978) studied the impact of prescribed fire on hillslope hydrology of piñon-juniper woodlands on loamy soils in eastern Nevada. They found that fire had the greatest impact on areas directly below the juniper and sagebrush canopies with high surface litter accumulations. Water repellency in the juniper duff layer under unburned trees was greater than places where the duff layer had burned. Across the study area, fire had little effect on infiltration rates, but did significantly increase soil erosion. Pierson *et al.* (2003) summarized studies on the impact of fire within coarse-textured, sagebrush-dominated systems and concluded that the greatest impact of the fire was on overland flow dynamics and rill erosion. Fire induced significant water repellency, particularly in areas dominated by shrubs with large accumulations of litter (Pierson *et al.* 2002). However, such systems were also found to have a high degree of natural water repellency when extremely dry (Pierson *et al.* 2001).

Both burned and unburned woodlands can have runoff under intense rainfall in the absence of vegetation in the tree canopy interspace. The immediate effect of fire is the reduction of ground surface barriers, which include shrub, herbaceous vegetation, and litter. Water then concentrates and increases in velocity resulting in greater erosive energy (Pierson *et al.* 2003). Water moves more rapidly down slope and ultimately into stream channels, impairing water quality and potentially causing downstream flood damage.

An important component in evaluating the impacts of fire on the hydrology of a site is the vegetation response following fire, especially recovery of vegetation structure and surface litter. The BMPs that would be implemented with prescribed burning under this alternative (Appendices A and B) would reduce burn intensity and maintain vegetative ground cover and litter cover in the unburned areas between piles. Compared to broadcast burning, this would minimize the negative hydrologic and water quality impacts often associated with prescribed fire/fuel reduction projects.

Under Alternative 2, increased erosion at localized burned areas is expected over the short-term (one to two years post-burn), however over the long-term (greater than 2 years post-burn) less sediment would be expected to enter the streams as herbaceous and shrubby ground cover increases, compared to Alternative 1. Upland sites would have better infiltration and soil-holding grasses and forbs to stabilize slopes. The function of water cycles would improve, meeting the management goal of better capture, storage, and safe release of water in the system. Additionally, based on current research, increased water yield compared to Alternative 1 is anticipated as juniper is treated. Improving watershed and channel function would, in turn, improve water quality.

Alternative 3 – Biomass Removal

From a watershed perspective most of the impacts of juniper removal/treatment under this alternative would be similar to Alternative 2, as discussed above, except at the areas proposed for biomass removal (Map 6) where heavy machinery would be used. This alternative would treat a higher number of acres of juniper so there would be increased areas of short-term erosion and sedimentation as compared to Alternative 2. However, the long-term improvements to watershed function would exceed those of Alternative 2.

The direct impacts on hydrologic function through the use of mechanical equipment within the biomass units would include the potential to increase surface runoff and erosion due to compaction and soil/vegetation disturbance, especially if rutting and compaction result in the formation of new surface drainage networks within the skid trail network. Minimizing the aerial extent of the skid trail network would reduce the likelihood of flow re-routing during intense precipitation events. The application of full end suspension techniques, rather than one end, would reduce the potential disturbance associated with skidding.

Skid trails and yarding would result in the removal of vegetative cover, thus increasing erosion potential. If this disturbance results in the spread of invasive grasses, this would further increase the erosion potential. If the spread of annual invasive plants is persistent, this would likely cause long-term impacts to hydrologic function due to reduced infiltration.

Perennial shrubs and grasses have the capacity to induce higher rates of water infiltration and reduce erosion potential compared to areas with dense juniper or annual grass and forbs. Management actions that increase the amount of bare soil or induce the spread and colonization of annual plants such as invasive grasses would reduce hydrologic functions such as infiltration and groundwater recharge. Disturbed areas within biomass units with little or no grass and shrub cover would be especially vulnerable to compaction and erosion. Areas with increased runoff due to compaction and poor soil cover could lead to localized erosion and increases in peak flows in localized portions of the stream network. Disturbed areas would likely re-colonize with soil crusts and other plants over time due to on-site seed sources, recruitment from adjacent undisturbed areas, or active re-seeding. As upland ground cover increases, the potential for erosion would decrease.

The application of BMPs (Appendices A and B) would reduce or eliminate the risks of increased erosion and disturbance related impacts from biomass removal. Mechanical biomass activities would be limited to slopes less than 30% and would occur when soils are dry, frozen, or covered with snow to reduce disturbance and compaction impacts.

Water Quality, Riparian and Aquatic Habitat, and Special Status Aquatic Species

Impacts Common to Alternative 1-3

Due to the long distances from proposed treatment areas and strict adherence to manufacturer's label restrictions, herbicide application as proposed under all 3 alternatives would not impact drinking water quality in private ground water wells in the surrounding area.

Alternative 1 - No Action

In high-flow events, riparian species such as native rushes, sedges, willow, and alder have substantial root mass that is able to resist erosion and hold stream banks together better than upland species such as Kentucky bluegrass, sagebrush, and juniper (BLM 2015h). Under this alternative, juniper trees would continue to move into riparian sites and out-compete the native riparian vegetation, which could lead to an increase in bank erosion and stream channel widening in some areas over the long-term.

The amount and condition of the riparian canopy is important for moderating radiant solar energy input to streams and reducing stream temperatures, especially during the hot summer months (Beschta *et al*. 1987). The amount, type, and distribution of shade-providing vegetation at a given site are controlled by channel processes and land use. Although large juniper provide some stream shading, the level of shade provided by juniper is generally less than that created by the site-appropriate riparian shrub community. Continued juniper expansion into riparian areas under this alternative would result in a decrease in site-appropriate riparian shrubs, as well as a decrease in stream shading associated with riparian shrubs. This would result in a lack of adequate stream shading and water temperature increases in some areas.

In addition, juniper expansion would reduce native riparian species abundance and diversity, reduce bank stability, lead to channel incision, and decrease overall stream channel and riparian function.

Alternative 2 – Proposed Action

Treating juniper within riparian areas under this alternative would reduce competition and increase the health and vigor of the native riparian vegetation, including sedges, rushes, and riparian shrubs. These species have sufficient root mass to resist erosion and hold stream banks together during high-flow events (BLM 2015h). For this reason, increased bank stability would be expected over the long-term. This would also result in increased filtration and protection of the soil surface, as well as help retain both water and soil on-site (Pierson *et al*. 2007).

The amount and condition of the riparian canopy can be important for moderating radiant solar energy input to streams and reducing stream temperatures, especially during the hot summer months (Beschta *et al*. 1987). The amount, type, and distribution of shade-providing vegetation at a given site are controlled by channel processes and land uses. Although large juniper provide some stream shading, the level of shade provided is generally less than that created by a more site-appropriate riparian shrub community. Juniper removal would promote streambank stabilization and increased heath and vigor of the native riparian shrubs. Riparian vegetation improvements and associated stream shading would compensate for any loss of juniper-created shade. For this reason, water temperature/quality would be maintained or improved.

One small, unnamed spring (T35S, R19E, Sect. 34, SE ¼ of NE ¼) may need to be reassessed after treatment is completed to determine if additional restoration actions are needed to reach PFC. If additional actions are warranted, additional NEPA will need to be prepared.

Fish and aquatic habitat quality is directly tied to riparian condition and water quality. Generally, any action that improves the capture, storage, and gradual release of water in a watershed benefits fish and aquatic habitat. Since the proposed treatments would maintain or improve water quality (water temperature reductions, sedimentation reductions, and riparian vegetation condition improvement), they would also benefit fish, amphibian, and aquatic habitat.

Alternative 3 – Biomass Removal

The impacts of Alternative 3 would be similar to Alternative 2 over most of the project area. While about 240 acres would undergo biomass removal treatments (Map 6), no biomass removal activity would occur within or directly adjacent to any stream channel or riparian or wetland area (see BMPs in Appendices A and B). For this reason, the effects of this alternative on water quality, riparian and aquatic conditions, and fish and amphibian habitats would generally be similar to Alternative 2.

If skidding occurred across intermittent stream channels, only minor, short-term (less than two years) effects would be expected, given the BMPs that would be followed. In addition, any potential downstream effects (i.e. sediment deposition) in perennial fish and/or aquatic amphibian or reptile habitat outside the project area would be at an immeasurable, negligible level given the BMPs that would be followed (see Appendices A and B).

If road maintenance was needed as part of biomass removal activities, there could be an increase in short-term, but negligible sedimentation impacts in drainage ditches and area stream channels. Existing roads in their current condition may be responsible for depositing road-derived sediment into area streams and contributing to the degradation of stream channels, and associated aquatic, fish, and amphibian habitat conditions. Road maintenance (including installing and maintaining drainage features such as waterbars, ditches, culverts, etc.), particularly near stream channels, would benefit stream channels and associated habitats in the long term by: 1) reducing sediment deposition into streams and 2) reducing water quality and quantity impacts from roads.

Upland Vegetation Impacts

Sagebrush-Steppe

Alternative 1 - No Action

This alternative would allow juniper to become denser, and continue crowding out the sagebrush, bitterbrush, and understory grasses and forbs (thus increasing fuel loads) (Miller *et. al.* 2005) across the project area. Existing sagebrush communities would be replaced by juniper stands with little or no sagebrush or forb/grass understory. In particular, the mountain big sagebrush community would slowly decrease in size as it is invaded by more juniper, whereas the juniper/mountain big sagebrush community would increase. The juniper/mountain big sagebrush community would also be reduced in vigor and species diversity as sagebrush and other shrubs (antelope bitterbrush and mountain mahogany) drop out of the understory as juniper increase. Absent some disturbance (ie. wildfire) this sagebrush community would eventually convert to a closed juniper woodland with limited understory in many locations (Miller *et al*. 2005).

Alternative 2 – Proposed Action

Treatments under Alternative 2 would have positive impacts to shrub-steppe communities over the long-term. Reducing the number of juniper trees would reduce competition for water and nutrients and improve the vigor of the remaining native shrubs, grasses, and forbs. Native shrub, grass, and forb relative abundance and cover would also increase over time.

Evans (1988) observed that the release of understory forbs and grasses was not always accomplished when prescribed fire removed overstory shrubs. The study found vegetative response was dependent on the existing plant diversity within the area and the amount and type of precipitation that followed burning. Kauffman and Sapsis (1989) note that native flora have generally evolved in response to periodic fire. Although variability exists in fire return intervals, fuel loading, and potential fire behavior, most native species are adapted to, or dependent on, fire to maintain health and vigor. Vegetative response is expected to be good in those treatment units which have an existing understory of healthy native perennial grasses established.

Pile burning would result in small, scattered disturbed patches. The reduction in the competition from the perennial trees and shrubs would provide extra moisture and nutrients, which both annual, invasive and native perennial grasses would be able to use to their advantage. For this reason, the patches would also be treated with an appropriate herbicide(s) and, if a native seed source is lacking in the soil, the sites would be reseeded with appropriate native species. Over time, native species recovery would occur within these burned areas.

The treatment of juniper would also reduce the current rate of juniper invasion into surrounding sagebrush communities by reducing the available juniper seed source. Other vegetation communities (antelope bitterbrush, mountain mahogany, and aspen) that provide ecological diversity in the project area would also benefit from the reduction of juniper trees because of the reduced competition for space, water, and nutrients.

Alternative 3 – Biomass Removal

The impacts of treatment activities under Alternative 3 would generally be the same as those described under Alternative 2 except for the areas where biomass removal is proposed. Mechanical equipment would be used to cut, skid, and yard juniper to landing areas (Map 6). Shrubs, grasses, and forbs would be crushed, damaged, or removed on approximately 250 acres of this area by mechanical equipment operation. This impact would be temporary as these disturbed areas would be reseeded with native vegetation following biomass removal activities. In addition, natural recruitment from adjacent undisturbed vegetation communities would occur. Adequate revegetation of these areas would occur within three to five years following treatment.

Forest and Woodland

Alternative 1 - No Action

Under this alternative, no juniper treatment would be completed. Juniper would continue to increase in density and aerial extent within the project area. Historic, pre-settlement juniper sites would continue to experience an increase in density of younger trees, with the potential for increased mortality of individual old-growth juniper trees on drier sites over time. Aspen stands in the project area would continue to decline and eventually die out due to the continued invasion and expansion of juniper and other conifers.

The increase in juniper would also increase the fuel loading and threat of a future large-scale, hot-burning wildfire within these same sites. Such a wildfire could destroy existing pre-settlement (old-growth) juniper stands, as well as pine and fir stands located along the forest fringe, and lead to expansion of undesirable invasive plants such as cheatgrass and medusahead.

Alternative 2 – Proposed Action

This alternative would remove many post-settlement juniper trees that are invading sagebrush-steppe and bitterbrush communities, aspen stands, and pine-fir forest fringe. This alternative would improve the health and vigor of several small aspen stands within the project area through the removal of the more competitive junipers.

Alternative 2 would also promote the health and vigor of pre-settlement (old-growth) juniper stands within the project area. While no old trees would be cut, some younger trees would be removed to reduce competition, reduce fuel loading and risk of wildfire, and preserve the old-growth character of these stands.

Alternative 3 – Biomass Removal

Impacts to forest and woodlands under Alternative 3 would be similar to those under Alternative 2 across most of the project area. However, more trees would be removed within some units compared to Alternative 2.

About 250 acres would be further impacted by the use of heavy mechanical equipment for cutting, skidding, and yarding, along with clearing of landings, that would be associated with biomass removal activities. As noted in other portions of this analysis, this would cause soil compaction and vegetation removal impacts within biomass treatment units, including landings and skid trails.

However, biomass removal would not occur in riparian areas, most aspen stands, pre-settlement (old-growth) juniper stands, or on slopes greater than 30% (Appendix A). For this reason, the potential impacts of the proposed biomass treatment specifically on forested habitat would be limited to only a few treatment units along the forest fringe where transitional forest habitat exists. Within these units, juniper and young pine/fir would be removed, while older trees would be left. This would reduce competition for light, water, and nutrients, and result in improved vigor and growth of trees left on-site. This would also reduce total fuel loading and future wildfire risk within forested units.

Special Status Plant Species

Alternative 1 - No Action

Continuing current management under this alternative would not cause impacts or other changes to the one existing special status plant species (Long-flowered snowberry) or its habitat within the project area over the analysis timeframe. The greatest risk to this species would be from a future wildfire event. Given the fire-adapted ecology and plant community history of the species, a future fire is not likely to significantly affect this plant population over the long-term. However, fire-fighting equipment and retardant used in suppression activities could have a damaging effect, if applied directly to individual plants.

Alternatives 2 and 3

The area of the long-flowered snowberry is not within any unit proposed for juniper treatment under either alternative. Therefore, impacts to snowberry would be similar to Alternative 1.

Noxious Weed and Invasive Non-Native Species Impacts

Impacts Common to All Alternatives

Noxious weeds and non-native invasive plants would continue to be managed throughout the project area regardless of the alternative chosen as the final decision, through implementation of the most recent integrated weed management plans (such as BLM 2007b, 2010b, 2015d, 2015f, 2016a, 2017). The impacts of these weed treatment activities have been documented in previous NEPA analyses (BLM 2007a, 2010a, 2015d). These analyses have been incorporated by reference herein in their entirety. Continued implementation of these plans would promote containment and reduction of current infestations across the project area over time due to implementing preventative measures, selective herbicide applications, and reseeding with favorable native seed mixes. Much of the project area (over 12,000 acres) has recently been sprayed with imazapic to treat invasive annual grasses (BLM 2015d, 2015f, 2016a, 2017). Staff have noted a substantial reduction in the presence of the target species during subsequent field visits following treatment. A summary of other impacts of this program are included in the Cumulative Effects section.

Alternative 1 - No Action

Under this alternative the same moderate threat of noxious weed invasion and spread that currently exists due to on-going motorized vehicle use, recreation, grazing, and other resource management activities would continue into the foreseeable future.

As juniper continue to out-complete native plants for soil moisture and nutrients, annual non-native grasses would continue to have a competitive advantage over native plants and may continue to invade areas with a high density of juniper. Annual grasses can survive in areas where juniper has out-competed most native sagebrush and grasses. This impact could occur even though non-native invasive plants would continue to be treated across the project area.

This alternative would have the smallest amount of ground disturbance across the project area in the absence of wildfire. This would tend to keep noxious weeds and non-native annual grass species in currently occupied areas, though they would still be subject to the typical rates of spread.

However, this alternative would allow for increased fuel loading over time and have the highest risk of a future, catastrophic wildfire. Such a wildfire and the associated fire suppression activities would have an increased potential threat of weed invasion and spread following fire.

Alternative 2 – Proposed Action

During the evaluations of the treatment units, invasive non-native annual winter grasses were found within the majority of units. The impacts from this alternative would be higher with respect to the risk of invasive species spread compared to Alternative 1. There would be several types of negative impacts from this alternative.

Additional traffic within the project area during implementation would lead to increased risk of weed seed spread by vehicles and people. The staff and contract crews working in the area would contribute to the potential spread of non-native invasive annual grasses species and other weeds as these species have the ability to attach to the shoes and clothes of people walking through infested sites and then be carried into other areas. The use of ATV/UTVs and other vehicles would also contribute to the spread of invasive species seed in the project area. Though the crews would be required to wash their vehicles/equipment to prevent weed seed spread (Appendices A and B), during the winter months (when many treatments would occur) it would be difficult to wash equipment due to freezing temperatures. The cut and leave, and cut, lop and scatter treatments would both have lower risk of weed spread during implementation (compared to cut, pile, and burn units) because most of these units have lower densities of juniper and would only be entered once for treatment.

One of the biggest factors influencing restoration success would be the location and pre-treatment condition of the proposed treatment unit. If the unit has annual invasive grasses or other weeds present prior to treatment then there would be a high probability that these species would be abundant after juniper treatment. Many of the treatment units have recently been sprayed with imazapic to reduce invasive annual grasses (BLM 2015d, 2015f, 2016a). Due to this treatment there is less viable invasive species seed within the project area. However, with the increased disturbance that would occur in the project area under this alternative, new weed sites would still likely emerge over time.

Areas where trees skeletons are left in place (cut and leave, and cut, lop and scatter treatments) would create small micro-climates that capture moisture, provide shade, and catch wind-dispersed seed. This would be beneficial for the establishment of both native and non-native plants. In addition, the down canopy cover of the trees would create areas where weed control efforts would be more difficult. Aerial herbicide application (such as the treatments completed over the last two years) would be less effective as the trees left on the ground would not allow the herbicide to contact the ground or weeds under the tree skeletons. However, tree densities in the majority of these (cut and leave, and cut, lop and scatter) treatment units are low and the amount of area surrounding individual trees where this would be a problem would be relatively small. Therefore, this impact on the overall herbicide treatment effectiveness would be low.

Prescribed burn treatments would cause temporary disturbance within the treatment units that would open up small areas where invasive species could potentially invade. The highest risk areas would be the treatment units with the cut, pile, cover, and burn prescription (Table 2-1; Map 5). The pile burning would leave small, temporary burn scars and bare soil. This would provide an opportunity for invasive annual grass species to invade. Cheatgrass expansion is a concern at elevations up to 6,000 feet throughout most of the project area. Above 6,000 feet, germination of cheatgrass is limited by colder temperatures. For this reason, these sites would also be treated with appropriate herbicides and reseeded (see Appendix C). Over time, native species recovery would occur within the burned areas.

All treatment prescriptions and juniper phases would have more resistance to invasive annual grasses in the cool/moist soils. These areas would likely recover naturally with little to no restoration after surface disturbance. Natural sagebrush recovery is likely to occur and any additional seeding or planting projects would likely be successful within these soil types. The removal of juniper would lead to a release of nutrients and water, which would lead to more productive plant communities and weed resistant landscapes.

The risk of expansion of invasive annual grasses would be moderately high on warmer and dryer soils. Treatment units with Phase 3 juniper on warm, dry soil types would likely result in annual grass infestation due to the lack of soil productivity or native seed source in the soils. Natural recovery of sagebrush and native herbaceous species in warm, dry soils is not likely due to competition by non-native, invasive species. On these soils, the risk of invasive annual grass expansion would be highest, whereas the likelihood of successful restoration would be less. For these reasons, the majority of the units with south facing slopes and warm, dry soils were removed from treatment during the development of this alternative.

Mediterranean sage, bull thistle, and Canada thistle would also have potential to expand within treated areas. These species grow in disturbed areas with bare soils, which makes newly burned areas an ideal area for these species to invade. However, if native species successfully re-establish as a result of natural recovery or reseeding, they would have the ability to out-compete invasive species over the long-term.

Generally, treatments would lead to less competition from conifers and additional soil moisture and nutrients which would lead to more diverse native plant communities and weed resistant landscapes developing within the project area over the long-term. Typically after such treatments there is a release of moisture and nutrients which leads to a flush of new perennial species such as elderberry and more robust native grass species which are capable of out-competing non-native species.

Alternative 3 – Biomass Removal

The effects to Alternative 3 would generally be similar to Alternative 2 over most of the project area. However, the use of heavy mechanical to perform the biomass removal would lead to additional disturbance within the biomass units (250 acres biomass treatment and ten acres of landings; Map 6). Vehicles and heavy equipment would serve as an additional vector for spreading weed seed. In particular, skidding trees to landing areas through areas with existing with invasive annual grasses would spread the seed across portions of the project area.

In addition, a few units located on south-facing slopes with warm/dry soils would be treated under Alternative 3. These areas could require additional follow up weed control treatment and re-seeding efforts. Due to the low productivity of the soils in these units, the long-term success of restoration efforts within these units would likely be low and more costly.

Terrestrial Wildlife Species and Habitat Impacts

Big Game Species and Habitat

Alternative 1 - No Action

Under this alternative juniper would increase in density and aerial extent which would result in habitat conversion from sagebrush-steppe to more closed (Phase 3) juniper woodland. Mule deer and pronghorn antelope habitat quality and quantity and forage availability would decline as this occurs. In addition, predator hiding cover would increase and may negatively impact mule deer numbers in the area (Blake and Gese 2016). Visits by bighorn sheep to the northern portion of the project area may become even more infrequent as juniper expands, as the amount of open habitat they prefer becomes more restricted. Potential elk habitat may degrade as the herbaceous grasses elk depend on for forage are reduced as juniper dominates the area.

Due to the increased fuel loads from juniper expansion, big game habitat could be substantially impacted by a future, large-scale, uncontrolled wildfire. Such fires could remove bitterbrush and sagebrush stands, plants that are important winter browse for mule deer. In addition, new shrub seedlings that re-establish following fire may not provide adequate browse for many years following fire. Mule deer use may be restricted to the outer perimeter of a large fire in close proximity to winter thermal cover.

Alternative 2 – Proposed Action

The proposed treatments would reduce juniper across the project area. During the treatment activities big game could be temporarily displaced by anthropogenic disturbances (noise from vehicle and chainsaw use). However, big game may still use treated areas when activities are halted, both on a daily or seasonal basis.

Once treatments are complete, native vegetation would experience less competition for soil moisture and nutrients. This would lead to improved health and vigor of native sagebrush, forbs, and grasses. This in turn would provide more forage for mule deer and pronghorn antelope. Though mule deer thermal cover would be reduced, areas of pre-settlement juniper, and some Phase 2 and Phase 3 juniper stands would be left uncut or only minimally thinned. These stands, along with other conifers along the forest fringe would provide adequate mule deer thermal cover to meet ODFW habitat objectives (ODFW 2003a) within the project area. Over the long-term, treatments would increase the overall quality and quantity of big game habitat.

Alternative 3 – Biomass Removal

The impacts of Alternative 3 would be similar to Alternative 2 over most of the project area. However, about 250 acres of the project area would undergo biomass removal treatments (Map 6). Biomass removal would not affect bighorn sheep as these treatment units are outside of known sheep habitat. In the short-term, there would be more temporary, anthropogenic and surface disturbance impacts to mule deer and potential elk habitat within biomass treatment units due to the use of heavy equipment. In addition, a small portion pronghorn habitat along the very western edge of the project area would also be temporarily disturbed by mechanical equipment. However, restoration actions would improve big game habitat quality over the long-term.

Small Mammal Species and Habitats

Alternative 1 - No Action

Juniper expansion in shrub-steppe, aspen groves, and riparian habitats would continue to decrease available habitat for small mammals that prefer these habitats. This alternative would have long-term, negative impacts by decreasing the suitability of these habitats for these species. The potential risk for a large-scale, high-intensity wildfire would be greatest under this alternative. Should such a fire occur during the analysis timeframe, it could cause substantial long-term, negative impacts on breeding, hiding, and foraging habitat for these species.

Alternative 2 – Proposed Action

The proposed treatments could temporarily displace individual animals while treatment activities occur, but no substantial negative impacts to populations would occur. Over the long-term, treatments would improve the health and vigor of native sagebrush-steppe, aspen, and riparian habitats and could even encourage the expansion of aspen within the project area. More grasses and forbs would be available as forage for small mammal use. This, in turn, would provide improved habitat for many small mammal species and would have long-term beneficial impacts for these species. Research suggests that the composition and relative abundance of some small mammals is greater in areas with juniper treatment compared to untreated areas. However some species occurrence in juniper is similar to shrub-steppe habitats (Baker and Frischknecht 1973; Willis and Miller 1999).

Alternative 3 – Biomass Removal

The impacts of Alternative 3 would generally be similar to Alternative 2 over most of the project area. However, about 250 acres of the project area (primarily forest fringe) would undergo biomass removal treatments (Map 6). In the short-term, there would be more temporary anthropogenic and surface disturbance impacts to small mammals due to heavy equipment use. However, restoration would improve the habitat suitability over the long-term within these treatment units.

Nongame Bird Species and Habitats

Alternative 1 - No Action

When western juniper density and cover increases and causes shrub and herbaceous understory suppression (as Phase 2 stands transition to Phase 3 stands), avian species diversity decreases (Reinkensmeyer *et al*. 2007). Avian species diversity is also likely to decrease as conifer stands continue to increase in basal area. This alternative would favor a few non-game bird species (such as Pinyon Jay, Gray Flycatcher, Ash-throated Flycatcher, and Juniper Titmouse) that prefer juniper woodlands, dense conifer stands, or older trees for cavity nesting.

Mountain mahogany, aspen stands, and riparian areas would also continue to be encroached and outcompeted by juniper, which would lead to the eventual loss of these limited habitats. Migratory bird species, which utilize these, would continue to decline as a result. This would lead to a loss in avian species diversity over the analysis timeframe.

Negative impacts would occur to shrub-steppe dependent and ground nesting bird species as juniper increases and shrubs and ground cover decrease. Populations of shrub-steppe obligate avian species, such as Sage Thrasher, Brewer's sparrow, and Green-tailed Towhee would likely decrease as a result, based on research by Holmes *et al*. (2017) in the South Warner juniper removal project area.

The potential risk for a large-scale, high-intensity wildfire would be greatest under this alternative. Should such a fire occur during the analysis timeframe, it could cause substantial long-term, negative impacts on breeding, hiding, and foraging habitat for both woodland and sagebrush-obligate species.

Alternative 2 – Proposed Action

The proposed treatments would reduce juniper across the project area. During the treatment activities birds could be temporarily displaced by anthropogenic disturbances (noise from vehicle and chainsaw use). However, birds may still use treated areas when activities are halted, both on a daily or seasonal basis.

Once treatments are complete, native vegetation would experience less competition for soil moisture and nutrients. This would lead to improved health and vigor of native sagebrush, forbs, and grasses. This, in turn, would provide improved vegetative structure and diversity of habitats, as well as available forage for sagebrush-steppe obligate non-game bird species, such as Sage Thrasher, Brewer's Sparrow, and Vesper Sparrow. Holmes *et al*. (2017) noted an increase in nesting pairs of Brewer's Sparrows, Green-tailed Towhees, and Vesper Sparrows following juniper removal from sagebrush habitats in the South Warner Mountains located southeast of the project area.

Migratory bird species, which utilize mountain mahogany, quaking aspen, and riparian communities, would benefit from juniper treatment since it would increase the health and vigor of these vegetation communities. Migratory bird diversity and richness is generally high in healthy aspen stands and riparian plant communities. However, non-game bird species that prefer juniper habitats (Pinyon Jay, Gray Flycatcher, Ash-throated Flycatcher, and Juniper Titmouse) would decline or be limited to the remaining juniper stands within the project area. Density of Gray Flycatchers decreased after juniper removal in the South Warner Mountains (Holmes *et al*. 2017). Over all, this alternative would have long-term, positive impacts on most non-game bird populations native to the area.

Alternative 3 – Biomass Removal

The impacts of Alternative 3 would generally be similar to Alternative 2 over most of the project area. However, about 250 acres of the project area (primarily in forest fringe) would undergo biomass removal treatments (Map 6). In the short-term, there would be more temporary anthropogenic and surface disturbance impacts to non-game birds due to heavy equipment use. However, restoration actions would improve bird habitat suitability over the long-term in these treatment units.

Upland Reptile Species and Habitats

Alternative 1 - No Action

In the near future, the no action alternative would likely have no measureable impact on reptile species or their habitat. Sagebrush lizards, short-horned lizards, gopher snakes, western yellowbelly racers (*Coluber constrictor mormon*), and western rattlesnakes utilize a variety of habitats. They are equally at home in open juniper-shrub, as well as the sagebrush steppe (Nussbaum *et al.* 1983). Western fence lizards, which like vertical structure more than the other reptile species (Nussbaum *et al.* 1983), are more likely to be found in juniper stands. Over time however, unabated juniper succession would result in negative impacts to those lizards that depend on a shrub component within their habitat and rarely utilize trees. Many prey species, such as rodents and insects, are also more abundant when an herbaceous understory remains, providing a more complex habitat. Therefore, as juniper succession moves toward Phase 3 and the understory vegetation declines, food resources for all but those reptile species who climb trees, may decline. This would negatively impact the diversity and abundance of reptiles over the long-term.

Alternative 2 – Proposed Action

Cutting of juniper, as proposed in Alternative 2, would ensure the restoration or persistence of sagebrush, bitterbrush, and native bunchgrasses. Those reptile species which directly or indirectly depend on the shrub and herbaceous vegetation habitat components would benefit. Because pre-settlement (old-growth) juniper would be preserved, patches of important habitat for snakes and lizards that prefer tree structure would remain unaltered. The rocky sites used for denning and basking by reptiles would also be maintained. Overall, this alternative would maintain or improve habitats for most reptile species over the long-term.

Alternative 3 – Biomass Removal

Under this alternative, the impacts to reptile species across the project area would generally be similar to Alternative 2 across the majority of the treatment units in the project area. However, more trees would be removed from some units compared to Alternative 2. Therefore, this alternatives would provide greater benefit to sagebrush-obligate reptile species and their associated habitat compared to Alternatives 1 or 2. Impacts to reptiles that prefer tree structure would be higher than Alternatives 1 or 2. Within the biomass treatment units where mechanical equipment is used, additional ground disturbance could impact individual lizards or snakes and result in their displacement from the area during treatment activities.

Special Status Species and Species with Special Management Designations

Alternative 1 - No Action

Impacts Common to All Special Status Species

The risk of a future, catastrophic, stand/habitat replacing wildfire occurring within the project area during the analysis timeframe would be highest under this alternative. The probability of such an event cannot be accurately predicted, but should a wildfire occur, both sagebrush and juniper-dependent species would be negatively impacted due to loss of habitat. The total acres of habitat that could be impacted also cannot be predicted with certainty and would depend upon a variety of factors including fuel loads, fuel moisture content, air temperature, wind speed/direction, fire suppression response, etc.

Birds

Brewer's Sparrow

Although Brewer's Sparrows use areas with juniper, they prefer open areas. This alternative would result in increased juniper density and canopy cover and would have negative impacts to this species over the long-term. The continued degradation of sagebrush habitat could also decrease foraging opportunities. The local population of the species would likely decrease over time.

Burrowing Owl

Burrowing Owls are not known to occur in the area; however, potential sagebrush habitat would continue to degrade due to juniper encroachment. This alternative would not have a direct impact on current populations in adjacent areas, but would likely limit the potential for a new population to inhabit the project area.

Ferruginous Hawk

Ferruginous Hawks prefer open areas in shrub-steppe habitats for foraging. This alternative would result in increased juniper density and canopy cover and would decrease available foraging habitat over time. This would result in long-term, negative impacts to this species.

Flammulated Owl

Flammulated Owls are not known to occur in the area; however, several small aspen stands (four acres of potential habitat) would continue to degrade due to continued juniper encroachment. This alternative would not likely have an impact on current populations, but would limit the potential for a new population to inhabit aspen stands in the project area in the future.

Greater Sage-Grouse

Sage-grouse are dependent upon intact, functioning sagebrush communities for all portions of their life-cycle. Juniper is found throughout much of the project area and has changed the existing composition and habitat quality of the sagebrush communities that support sage-grouse. Under Alternative 1, all sage-grouse habitat (approximately 18,117 acres of PHMA and GHMA) within the project area would continue to be degraded by juniper encroachment and continued expansion over the 10 to 20 year analysis timeframe. Sagebrush area is the best landscape scale predictor of sage-grouse persistence (Wisdom *et al*. 2011). Though the changes in sagebrush habitat would vary somewhat by juniper phase, the impact would generally be negative and long-term.

Research shows sage-grouse tend to avoid juniper woodlands and other areas with trees because they provide perch and nest sites for avian predators (Baruch-Mordo *et al*. 2013, Knick *et al*. 2013). Research conducted on the South Warner juniper treatment area showed that juniper cover in excess of 3% within 800 meters of nests decreased the probability of nest initiation (Severson *et al*. 2016). When nesting in the vicinity of juniper, sage-grouse select for clustered trees over scattered trees (Severson *et al*. 2016). Other negative impacts of conifer encroachment include diminishing the understory vegetation that is necessary for nest concealment and reducing the overall open structure needed during leking season (Connelly *et al*. 2000; Miller and Eddleman 2000). All of these factors directly affect breeding success and, therefore, influence local population levels. Suitable winter habitat in the southeast portion of the project area would continue to degrade as juniper closes in. Under this alternative, population trends within the project area would continue to decline due to declining sage-grouse habitat quality.

Green-Tailed Towhee

Green-tailed Towhees inhabit areas with no trees or sparsely scattered trees, but prefer open areas. This alternative would result in increased juniper density and canopy cover and would have negative impacts to this species over the long-term. The continued degradation of sagebrush habitat could also decrease foraging opportunities. The local population of the species would likely decrease over time.

Pinyon Jay

Pinyon Jays prefer conifers and juniper woodlands. Since this alternative would result in increased juniper density and canopy cover over the long-term, this could lead to an increase this species' range of habitat, and possibly an increase in its local population.

Sage Sparrow

Sage Sparrows prefer open areas of big sagebrush habitat. This alternative would result in increased juniper density and canopy cover and reduced sagebrush habitat. The continued degradation of sagebrush habitat could also decrease foraging opportunities. These factors would have negative impacts to this species and the local population of the species would likely decrease over the long-term.

Sage Thrasher

The Sage Thrasher inhabits areas with limited trees, and prefers open areas consisting of sagebrush. This alternative would result in increased juniper density and canopy cover and would have negative impacts to this species over the long-term. The continued degradation of sagebrush habitat could also decrease foraging opportunities. The local population of the species would likely decrease over time.

Long-billed Curlew

The Long-billed Curlew prefers open grassy habitats for breeding. This alternative would result in increased juniper density and canopy cover and would have negative impacts to this species over the long-term. The continued degradation of sage-steppe habitat could also decrease foraging opportunities. The local population of the species would likely decrease over time.

<u>Small Mammals</u>

Bats

Silver-haired bats and long-legged myotis could benefit from increased juniper density/cover; however, conversion of sagebrush to juniper dominated lands would lead to a greater risk of high intensity fires. This would not be beneficial for tree-roosting bats because a high intensity fire could destroy nesting, roosting, and foraging habitats. Hoary bats and California myotis prefer open areas in shrub habitat. Overall, this alternative would likely have a negative, long-term impact on these species.

Preble's Shrew

Juniper encroachment into shrub-steppe, aspen groves, and riparian habitats would continue to decrease available habitat for the Preble's shrew. This alternative would have long-term negative impacts by decreasing potential immigration into these habitats by this species.

Pygmy Rabbit

Pygmy rabbits are sagebrush obligates, preferring big sagebrush habitats. While this species is not known to occur in the project area, potential sagebrush habitat would continue to be degraded by juniper encroachment and expansion. This alternative would not have an impact on current populations that may exist in suitable adjacent areas, but would limit the potential for a new population to establish within the project area. This alternative would likely have negative long-term impact to potential pygmy rabbit habitat as increased juniper densities would convert sagebrush habitat into juniper woodland.

<u>Insects</u>

Western Bumblebee

The western bumblebee prefers habitats with flowering plants. Continued juniper encroachment and expansion would further restrict growth and abundance of flowering herbaceous understory plants. This alternative would have a negative, long-term impact on potential habitat for this species.

Alternative 2 – Proposed Action

<u>Birds</u>

Brewer's Sparrow

Treatments in this alternative would restore open sagebrush habitats, yet still retain a mosaic of interspersed areas with pre-settlement juniper, as well as uncut Phase 2 and Phase 3 stands. This habitat mosaic would provide for a sustainable, local population and would likely have long-term benefits for this species. In one recent study, nesting pairs of Brewer's Sparrows increased by 1,212 to 1,737 following completion of juniper removal in sagebrush habitats in the South Warner area (Holmes *et al*. 2017).

Burrowing Owl

Burrowing Owls are not known to occur in the project area; however, juniper treatments would increase potential habitat for this species and would likely have potential long-term benefits for this species.

Ferruginous Hawk

Ferruginous Hawks prefer open, sagebrush-steppe habitat with limited juniper. Sagebrush restoration treatments would have long-term, beneficial impacts for this species by improving and expanding sagebrush habitat.

Flammulated Owl

The proposed treatments would reduce encroachment in existing aspen stands and could allow for these stands to expand over the long-term. Larger aspen stands could provide potential habitat to encourage this species to immigrate into the area. This alternative would likely have potential, long-term benefits for this species.

Greater Sage-Grouse

Proposed treatment areas within the Clover Flat project area are currently unsuitable to marginal for sage-grouse use due to juniper encroachment. Under this alternative, treatments would remove encroaching juniper from sagebrush-steppe communities. Pile burning would be used to limit the potential loss of existing Wyoming and basin big sagebrush during prescribed burn activities. In addition, burn areas would be treated with appropriate herbicide(s) to control invasive annual grasses and be reseeded with native seed mixtures suitable for sage-grouse nesting and foraging habitat.

Juniper cutting would have short-term, negative impacts from noise and harassment on individual birds during project implementation. While Blickley (2013) found that intermittent noise, such as traffic, rather than consistent noise, had a greater impact on sage-grouse, the proposed juniper cutting would be carried out in accordance with the seasonal/daily timing limitations in MD SSS-9, MD SSS-11, MD SSS-13, and MD VEG 4, which would effectively mitigate the effects of this temporary disturbance. The proposed pile burning also represents a potential temporary disturbance, but this activity does not meet the definition of "jackpot" burning (as described in MD VEG-19) and would not impair the life-cycle of sage-grouse populations; therefore, these seasonal/daily timing limitation would not need to be applied to this treatment activity.

Over the long-term, the proposed treatments would improve sage-grouse habitat suitability by removing many of the potential predator perch sites and improving the health and vigor of the sagebrush-steppe community (sagebrush, grasses, and forbs) that serve as sage-grouse habitat. Recent research in the South Warner Mountains provided empirical evidence that conifer removal may increase population level vital rates of Greater Sage-Grouse, such as annual female survival and nest survival, the two most important parameters affecting population growth. When applied to population models, vital rate estimates in this area indicated a 25% increase in sage-grouse population growth relative to the control area where conifer was not removed (Severson *et al.* 2017). The proposed treatments would also benefit sage-grouse by reducing fuel loading and the potential risk of a future, large-scale wildfire occurring, which could have a substantial negative effect on sagebrush/sage-grouse habitat in the project area. Implementation of this alternative would move habitat towards achieving the objective of managing or restoring priority areas so that at least 70% of the land cover provides adequate sagebrush habitat to meet sage-grouse needs, identified in the Sage-Grouse National Technical Team Report (2011).

Green-Tailed Towhee

The Green-tailed Towhee prefers areas with limited tree cover and dense sagebrush. This alternative would increase the overall quality of the habitat for this species and would likely provide long-term benefits for this species. In one recent study, Green-tailed Towhees increased by 4.6 territories per km^2 after juniper removal from sagebrush habitats in the South Warner area (Holmes *et al*. 2017).

Pinyon Jay

Pinyon Jays prefer conifers and juniper woodlands. Juniper treatments would reduce the amount of habitat for this species in the project area; however, remaining pre-settlement and uncut Phase 2 and Phase 3 juniper stands would retain some suitable habitat for this species, as would forested lands to the west. This alternative would likely have long-term, negative impacts for this species.

Sage Sparrow

This alternative would increase the availability of suitable open sagebrush habitats for this species. This alternative would likely have a long-term benefit for this species.

Sage Thrasher

This alternative would increase the availability of suitable open sagebrush habitats for this species. This alternative would likely have a long-term positive benefit for this species.

Long-billed Curlew

Long-billed Curlews prefer open grassy areas for breeding in sage-steppe habitats. The proposed treatments would provide more of this type of habitat and would likely have a long-term, positive benefit for this species.

Small Mammals

Bats

Alternative 2 would reduce the amount of juniper within bat roosting and foraging habitat. Silver-haired bats and long-legged myotis would likely be negatively affected by this habitat change, whereas Hoary bats and California myotis would benefit from this habitat change. The proposed treatments would also reduce fuel loading and the potential risk of a future, large-scale wildfire occurring in the project area. This would help maintain bat habitat over the long-term.

Preble's Shrew

The proposed treatments would encourage the health, vigor, and possible expansion of existing shrub-steppe, aspen groves, and riparian habitats, which would provide a higher potential for immigration into these habitats by the Preble's shrew. This alternative would have a potential long-term, beneficial impact for this species.

Pygmy Rabbit

Pygmy rabbits are obligates of big sagebrush. This alternative would likely increase the potential for future pygmy rabbit use in the project area and would likely have a potential, long-term benefit for this species.

Insects

Western Bumblebee

The proposed treatments, especially those within dense, Phase 2 juniper stands, would promote a healthier and more vigorous understory, including promoting more herbaceous flowering plants. This would improve habitat suitability for the western bumblebee and would provide a long-term benefit for this species.

Alternative 3 – Biomass Removal

Impacts Common to All Special Status Species

The impacts of Alternative 3 on these species and their associated habitat would be similar to those described above for Alternative 2 across the majority of the treatment units in the project area. Generally, more trees would be removed from the "thinning" units compared Alternative 2 and the benefit to sagebrush-obligate special status species and their associated habitat would be higher than Alternative 2. The primary difference in impacts would occur within the areas proposed for biomass removal (Map 6). The remainder of this impact discussion focuses on the potential impacts within the biomass treatment units.

Birds

The heavy equipment used for biomass removal would cause additional surface disturbance and noise disturbance within the biomass treatment units compared to Alternative 2. Temporary displacement of individual birds could occur due to these disturbances. However, most sagebrush-dependent species would return and occupy these units once treatment activities are completed.

Small Mammals

Bats

The heavy equipment used for biomass removal would cause additional surface disturbance and noise disturbance within the biomass treatment units compared to Alternative 2. Temporary displacement of individual bats could occur due to these disturbances. However, sagebrush-dependent species (Hoary bats and California myotis) would likely return and occupy these units once treatment activities are completed, whereas Silver-haired bats and long-legged myotis would likely be negatively affected by this habitat change over the long-term.

Preble's Shrew

The heavy equipment used for biomass removal would cause additional surface disturbance and noise disturbance within the biomass treatment units compared to Alternative 2. Temporary displacement of individual shrews could occur during treatment activities, but the impact of these disturbances would be minimal and short-term. Alternative 3 would have a long-term benefit to this shrew by creating suitable habitat in the project area and displaced individuals would likely return and occupy these units once treatment activities are completed.

Pygmy Rabbit

The heavy equipment used for biomass removal would cause additional surface and noise disturbance within the biomass treatment units compared to Alternative 2. Although temporary displacement of individual rabbits could occur during treatment activities, the probability of rabbits actually occupying these units is low. but would be minimal and short-term. Alternative 3 could have a long-term benefit to this species by creating more potential suitable habitat in the project area, but this probability would be more dependent upon suitable soil characteristics for burrowing rather than the vegetation community.

<u>Insects</u>

Western Bumblebee

The heavy equipment used for biomass removal would cause additional surface disturbance within the biomass treatment units compared to Alternative 2. This disturbance would be minimal and short-term. Over the long-term, western bumblebee habitat in the project area would improve as more flowering herbaceous plants re-establish within the treatment units.

Livestock Grazing Impacts

Effects Common to All Alternatives

The Tucker Hill Allotment is currently vacant and has no grazing permit or authorized grazing use. For this reason, none of the alternatives would have any impact on livestock grazing use of other grazing management within this allotment.

Alternative 1 - No Action

Under this alternative, Phase I and II juniper stands within the four actively grazed allotments would not be treated and would continue to move toward Phase III stands. Native perennial bunchgrass communities would gradually be out-competed by both juniper expansion and increased juniper densities.

The understory vegetation currently provides 934 AUMs of forage for livestock within the four allotments. As available total forage decreases, average annual utilization levels could increase from 30 to 50% use within the allotments to 40 to 60% use within 20 to 30 years. (This assumes stocking levels remain the same and overall conversion from Phase I and II to Phase II juniper stands occurs slowly over a 20 to 30-year time period).

Due to increased fuel loading, the potential risk for a large-scale, high-intensity wildfire would be greatest under this alternative. Should such a fire occur during the analysis timeframe, it could cause substantial long-term, negative impacts on existing vegetation communities and negatively affect forage available for livestock use. This impact could include the need for permittees to rest pastures during fire recovery actions and find other available sources of forage to feed their livestock during this time.

Alternative 2 – Proposed Action

Treating juniper would provide a more stable shrub-steppe-grass vegetation community across the project area. This, in turn, would provide more reliable forage for livestock use within the four grazing allotments. However, no additional livestock forage would be allocated to any permittees as a result of project implementation.

Short-term impacts to livestock operators could occur, as livestock grazing rest may be required in pastures where prescribed burning then seeding treatments occur. The proposed cut and leave, and cut, lop, and scatter treatment units would not require any rest from livestock grazing following treatments. However, those prescribed burn treatment units would likely require weed and reseeding treatments, followed by rest to facilitate vegetation recovery. Implementing periods of rest would impact the logistics of existing livestock grazing operations. An estimated 500 to 1,000 acres of pile burning treatments could occur in any given year. Assuming 50% of those acres would require reseeding and rest from livestock grazing, an estimated 13 to 26 AUMs of allocated forage for livestock would be unavailable each year. This estimate is calculated utilizing the average stocking rate for the allotments in the analysis area (19.5 acres per AUM) and multiplying by the acres treated (500 or 1,000) and multiplying again by 50%.

Over the long-term, the improved health, vigor, and abundance of understory grasses and forbs would result in an increase in livestock forage availability, quality, and sustainability. This would indirectly benefit livestock producers. However, there would be no increase in forage allocation to any grazing permit as a result of this project. The increase in potential forage availability could increase the grazing management flexibility of timing, distribution, and rest of grazing within pastures. For example, livestock could potentially stay longer in one pasture where more forage is available while giving rest to another pasture within the allotment that would normally be grazed. With an increase in forage production and quality, the forage utilization levels within the allotments could potentially be reduced over a 20 to 30-year period from the current 30 to 50% average use to 20 to 40% average use.

Alternative 3 – Biomass Removal

Impacts would generally be similar to Alternative 2. However, more juniper would be removed from some units compared to Alternative 2 which could result in a little higher health, vigor, and abundance of understory grasses and forbs in these units over the long-term. This in turn would result in a slightly higher increase in livestock forage availability, quality, and sustainability in these units when compared to Alternative 2. This alternative would have additional and possibly higher impacts to about 250 acres associated with biomass treatment compared to Alternative 2. The impacts on livestock grazing management would not differ significantly in the short-term or long-term compared to Alternative 2.

Cultural Resources and Traditional Cultural Use Impacts

Cultural and Historic Resources

Alternative 1 - No Action

Cultural and historic resources would generally see no change in condition under this alternative. However, continuing current management would leave the area more prone to future, uncontrolled, hot-burning wildfires, which could negatively alter cultural site materials on or near the soil surface and potentially expose large areas to artifact collectors. Fire can destroy lithic artifacts, change their obsidian hydration rind, erase evidence of previous heat treatment for stone tool manufacture, change the chemical composition of the soils of a site, remove organic materials buried in sites, and add charcoals to sites which would impact C_{14} dating of sites.

Alternative 2 – Proposed Action

Cultural resources could be impacted during treatments near cultural sites. In general, proposed vegetation treatments in the vicinity of cultural sites were adjusted to mitigate potential effects. For instance, prescribed burning was removed from the proposed treatment prescription or pile locations were moved away from sites to eliminate the potential negative effects of fire on cultural resources. However, historic sites such as split rail CCC fences in the area could still be damaged during prescribed burning, if the fire escaped from the stacked piles.

Old trees may themselves be archaeological sites such as bow trees or trees with wickiup[15] formation on their bases, though neither site type is currently known to occur within the project area. However, old growth trees/stands would not be cut.

Falling of trees could knock over or cover rock stacks (cairns) and single rock placements. The loping and scattering of juniper limbs, which might be dragged across cultural sites could impact the surface of sites. Cutting and leaving trees unburned on sites would make future archaeological investigation or research work more difficult.

Alternative 3 – Biomass Removal

Cultural and historic resources under this alternative would generally see the same type and magnitude of impacts as described in Alternative 2 across most of the project area. However, pile burning could occur within several units with scattered cultural sites. A cultural site monitor would need to be present in these units during piling activities to insure piles were not placed on top of cultural sites. Pile burning on top of cultural sites would cause negative impacts to cultural resources similar to those described for wildfire under Alternative 1.

[15] A small temporary structure usually constructed of brush and poles, usually conical in shape.

The use of heavy equipment for cutting, skidding, and yarding for biomass removal would have the potential to cause heavy disturbance to sites within about 240 acres of the project area (Map 6). However, based the results of cultural resource surveys, no such sites exist within these units and, therefore, biomass removal activities would have no effects on cultural resources.

Native American Traditional Uses

Alternative 1 - No Action

Continuing current management would generally not change Native American traditional uses or potential TCP values within the project area.

Alternative 2 – Proposed Action

Native American traditional uses could be impacted under this alternative. Juniper is considered a sacred plant by Native Americans of the area. Since only pre-settlement juniper would be cut, the risk of removing potential bow trees would be minimal.

Cutting and burning juniper would have a negative impact upon the visual quality of the area, as viewed by Native Americans, which they would consider to have a negative impact upon the potential TCP value of the project area and surrounding region. Following treatment there would also be less screening available to Native Americans when conducting ceremonial or religious practices in the area.

Alternative 3 – Biomass Removal

Under this alternative, Native American traditional uses would generally experience the same impacts as described in Alternative 2 across most of the project area. However, the soils and visual quality within the biomass removal units (Map 6) would be further degraded by the use of heavy equipment for juniper cutting, skidding, and yarding on about 250 acres. Heavy equipment would cause tracks, rutting, and erosion, as well as displaced or up-ended rocks within these units (see *Soil and Microbiotic Crust Impact* section). This would have additional negative impacts upon the visual quality and potential TCP values of the surrounding area, as viewed by Native Americans.

Culturally Important Plants

Alternative 1 - No Action

The greatest risk of continuing current management would be the increased risk of wildfire in the project area. Fire usually does not have a negative impact on most culturally important plant species, as they are adapted to fire. In some cases, fire eliminates competition and culturally-important root crops, grasses, and shrubs recover and are healthier after a fire. However, the use of retardant during fire suppression can cause damage to geophytes. For this reason, requests have been made by Tribal people to not use retardant unless absolutely necessary in low sagebrush habitats (personal communication, with members of Burns Northern Paiute and Warm Springs) to minimize this risk.

Alternative 2 – Proposed Action

Treating juniper, as prescribed under this alternative, would improve the health and vigor of most sagebrush-steppe communities in the project area (see *Upland Vegetation Impacts* section). This would also improve the health and vigor of most native, culturally important plants which inhabit these same plant communities.

In discussions with Native American tribes and individuals, they have expressed a preference for smaller, low-intensity prescribed fires conducted under controlled conditions, which tend to improve the condition of culturally important plant habitats and cause less disturbance/risks to cultural sites than hot, uncontrolled wildfires. The pile burning prescription proposed under this alternative would meet these objectives.

Alternative 3 – Biomass Removal

Under this alternative, potential impacts to culturally important plants would be similar to Alternative 2 across most of the project area. However, the proposed biomass removal units (250 acres; Map 6) would be further impacted by the use of heavy equipment for juniper cutting, skidding, and yarding. In the short-term, culturally important plants would be negatively impacted by crushing or removal during heavy equipment operation, if present in those units. Soil disturbance could also lead to invasion of the units by non-native plants which could displace or impede recolonization by culturally important plants. However, over the long-term the disturbed area would revegetate naturally or through re-seeding efforts and culturally important plants would likely re-establish from on-site or adjacent seed sources.

Areas of Critical Environmental Concern (ACEC) Impacts

Alternatives 1 through 3

Under these alternatives, no juniper treatments would occur within the Red Knoll ACEC. Therefore, there would be no impacts to the relevant and important values (cultural resources, special status plants, and wildlife habitat) located within the ACEC boundary from any of the alternatives.

Lands with Wilderness Characteristics Impacts

Alternative 1 - No Action

Under the No-Action Alternative wilderness characteristics within the project area would continue to be influenced by other on-going management activities and natural processes (e.g. grazing, weed management, etc.). Unless a wildfire occurred in the future negatively impacting vegetative screening, areas possessing wilderness characteristics would not be expected to noticeably change over the analysis timeframe. Overall, impacts from this alternative would not diminish the size or cause the Tucker Hill inventory unit to no longer meet the wilderness character criteria.

Alternative 2 – Proposed Action

Alternative 2 would have negative impacts to wilderness characteristics within the Tucker Hill inventory unit. These impacts would vary depending on treatment type, tree characteristics (species, age class, height, width, density, screening) and landscape characteristics within each treatment unit.

Mitigation measures were incorporated into Alternative 2 to minimize potential impacts to wilderness characteristics and ensure the area retains the appearance that it is primarily affected by the forces of nature. Mitigation focused on the following: (1) maximizing control of targeted trees to cut or retain by utilizing hand tools (chainsaws) and prohibiting methods which tend to result in some degree of inadvertent additional cuts and or mechanical scaring (vegetation/ground); (2) minimizing unnatural sights (piles) and sounds (vehicle/chainsaw) within the unit to as short of a timeframe as possible; (3) minimizing visual impacts related to stump heights/profiles, chainsaw cuts/angles/colors, natural arrangement/groupings and transitional boundary edge effects of vegetation, and rings of unburned fuel from piles; (4) minimizing treatment methods which would tend to result in unnatural accumulation and distribution of cut and leave whole trees, sections of trees, or scattering of woody materials/branches; (5) retaining sufficient screening to limit and compartmentalize sight distances of unnatural features during treatment operations and post-treatment recovery; (6) favoring seeding methods that would result in more natural distribution/patterns of germination and require shorter rehabilitation timeframes; (7) utilizing monitoring and adaptive management to ensure conditions continue to meet wilderness criteria.

With mitigations measures, the Cut, Lop, and Scatter or Cut and Leave treatment units with young, short height, low-density juniper and moderate topographic screening would continue to meet the wilderness character criteria for naturalness. Cut, Pile, Cover, and Burn treatment units with high-density juniper, moderate heights, and few old-growth trees would have moderate negative impacts to naturalness criteria due to less screening of temporary (1-5 years) unnatural features (downed trees, scattered woody materials, unburned or recently burned piles). However, in the long-run (after 5-10 years), with application of mitigation measures, the Cut, Pile, Cover, and Burn treatments units would begin to revegetate with grasses and shrubs and meet the wilderness character criteria for naturalness.

In addition, several mitigation measures addressed the outstanding opportunities for solitude or primitive and unconfined recreation criterions. Specific measures would include shortening treatment timeframes, retaining sufficient mature and old-growth trees for vegetative screening and primitive recreation purposes (retain aesthetics, provide wind block and thermal cover/shade) (see Maps A-C in Appendix E), and utilizing monitoring and adaptive management. These mitigation measures would ensure adequate vegetation for screening remains in the northwest and southern portions of the unit to retain solitude opportunities. These measures would also preserve the unique diversity/challenge and feeling of risk associated with existing characteristic elements and opportunities of primitive recreation activities present in the unit that are dependent on sufficient densities and distribution of vegetative screening.

Mitigations to minimize effects to supplemental values within the Tucker Hill unit have also been included (see *Cultural Resources* section).

Application of these mitigations measures would ensure the Tucker Hill inventory unit continues to meet the wilderness character criteria for naturalness, outstanding opportunities for solitude or primitive and unconfined recreation following treatment. Overall, the proposed action would not diminish the size or cause the Tucker Hill inventory unit to no longer meet the wilderness character criteria.

Alternative 3 – Biomass Removal

Alternative 3 would not include mitigation measures to reduce impacts to wilderness characteristics and would have a high level of localized impacts to wilderness characteristics within eight biomass treatment units (totaling 55 acres) within the Tucker Hill wilderness inventory unit. Heavy equipment would cause tracks, rutting, erosion, mechanical scaring, large quantities of scattered slash, as well as displaced or up-ended rocks within this portion of the unit. Negative impacts would also occur from other treatment prescriptions including high stumps, hard/abrupt unit boundaries, excessive amount of cut-lop-scattered woody debris/chips, portions of cut trees up to 4 feet in height left above the ground, and highly contrasting, circular remnants of unburned debris piles across the inventory unit.

Since this alternative would only retain old-growth trees, there would be a substantial loss of vegetative screening, particularly in the northwest and southern portions of the inventory unit. This would result in a significant reduction in outstanding opportunities for solitude in the northwest and southern portions of the unit. This alternative would also eliminate the unique diversity/challenge and feeling of risk associated with the existing characteristic elements and opportunities of primitive recreation activities present in the unit that are dependent on sufficient densities and distribution of vegetative screening. For these reasons, significant negative impacts to wilderness characteristics, particularly in high density juniper treatment units, would result from this alternative.

Supplemental values within the Tucker Hill inventory unit would also be negatively impacted (see *Cultural Resources* section).

For these reasons, the proposed treatments under Alternative 3 would cause the Tucker Hill inventory unit to no longer meet the wilderness character criteria of apparent naturalness, outstanding opportunities for solitude or primitive and unconfined recreation.

Recreation Impacts

Alternative 1 - No Action

Under the No-Action alternative, current recreation opportunities, activities, experiences and visitation within the project area would be expected to remain relatively constant over the life of the plan. Recreation objectives for Semi-Primitive Motorized, Roaded Natural, and Rural recreational experiences would continue to be achieved.

Alternative 2 – Proposed Action

Alternative 2 would have negative, neutral, and positive impacts to recreation opportunities within the project area depending on treatment type, tree characteristics (species, age class, height, width, density, screening) and recreation management objectives. Areas managed for Semi-Primitive Motorized and Roaded Natural recreation settings/experiences would have some negative impacts in treatment areas with moderate to high-density juniper trees. Vegetative screening would be thinned and thus reduce the ability of users to experience isolation from others, as well as, practice and depend self-reliant outdoor skills such as navigation and orientation. Compared to Alternative 1, these negative impacts would be low due to the incorporation of mitigation measures, including groupings of old-growth and mature trees would retain some vegetative screening sufficient for Semi-Primitive Motorized and Roaded Natural recreation objectives (see Maps A-C in Appendix E).

Treatments conducted in areas managed for Rural recreation settings would have neutral impacts on recreation experiences as moderate to high user interaction in these areas is acceptable and thus, treatments that reduce vegetative screening would have no impact. On the other hand, recreation users seeking activities that are dependent on wildlife viewing and/or hunting would likely benefit from the proposed action due to reduced juniper density and improved wildlife habitat. As a result of treatments, the project area would become more open with less juniper, thus increasing opportunities to view wildlife, as well as, possibly increase population numbers of sagebrush-dependent wildlife species such as sage-grouse, mule deer, and bighorn sheep (see *Wildlife* section). In addition, the mitigation measures would ensure adequate juniper trees are retained across the project area to support dispersed primitive and motorized recreation, camping, wind blocks, thermal cover, and shade.

Alternative 3 – Biomass Removal

Alternative 3 would not include mitigation measures to reduce impacts to recreation. This alternative would result in negative impacts to Semi-Primitive Motorized and Roaded Natural experiences, and both neutral and positive impacts to Rural experiences across the project area similar to Alternative 2. However, the magnitude of negative effects would be higher than Alternative 2. Overall, Alternative 3 would have moderate to high negative impacts to recreation opportunities, particularly within biomass treatment units (250 acres) due to disturbance and large quantities of slash. . Only scattered old-growth juniper trees would be retained and screening would be significantly reduced in portions of the project area. For these reasons, Alternative 3 would potentially displace users seeking recreation activities and settings that are dependent on an adequate amount of mature trees for screening, primitive recreation, dispersed camping, and isolation.

Visual Resource Impacts

Alternative 1 - No Action

Outside of the Tucker Hill mining area, the No-Action alternative would continue to have minimal to low negative impacts to visual resources in the project area from past projects. The existing visual quality within the project area would continue to be influenced by other on-going management activities and natural processes (e.g. livestock grazing, weed management, etc.). Unless a wildfire occurred in the future, the visual quality would not be expected to change over the analysis timeframe. Visual resource objectives for VRM Classes II, III, and IV within the area would continue to be achieved under the No-Action Alternative.

Alternative 2 – Proposed Action

Alternative 2 would have varying degrees of negative impacts to visual resources across the project area depending on treatment type, tree characteristics (species, age class, height, width, density, screening), landscape characteristics, and VRM Class. For example, Cut, Lop, and Scatter or Cut and Leave treatment units in young, short height, low-density juniper stands, within a few hundred feet of a commonly used road would generally meet visual objectives even in VRM II areas (Red Knoll ACEC). On the other hand, Cut, Pile, Cover, and Burn treatment units with high-density stands, large tree heights, and few residual old-growth trees to provide screening, located as far as one to two miles away from a commonly used road, would generally not meet visual objectives in VRM II areas. Other factors, particularly distance, angle of observation, and time the project is in view from key observation points (KOPs) would also vary across the project area and contribute to varying degrees of visual impacts.

To assist in quantifying potential visual impacts, Visual Contrast Rating Worksheets (BLM form 8400-4; BLM 1984) were completed in two representative treatment areas (Visual Contrast Rating Worksheet are available in the project file). Contrast ratings were conducted using linear key observation points along Oregon State Highway 31 and county roads including Clover Flat, Round Pass Lane, and Pine Creek. The analysis revealed that the proposed treatments would not meet VRM II objectives in in denser juniper stands that are in close proximity to commonly used county routes, in both the short and long-term timeframes. While visual mitigations measures would be incorporated to minimize potential visual impacts, the overall contrast from some treatment prescriptions in VRM II would remain strong, mainly due to large-scale loss of juniper trees and changes to the associated visual contrast elements of form and texture. On the other hand, the proposed treatments would meet visual resource management objectives for VRM Classes III and IV (project area outside of the Red Knoll ACEC) due to incorporating mitigation measures and the treatment units being located on the outermost edge of the three-mile Highway 31 visual corridor.

Overall, Alternative 2 would meet visual objectives for VRM Classes III and IV. However, most of the Cut, Pile, Cover, and Burn treatment units and a few of the Cut, Lop, and Scatter treatments units in high-density juniper stands within VRM Class II (Red Knoll ACEC), in the central portion of the project area, would not meet visual resource objectives, even after incorporating appropriate mitigation measures. No other mitigation measures would be feasible and still meet the purpose and need for action (remove post-settlement western juniper from existing sagebrush communities to improve or restore Greater Sage-Grouse habitat).

Alternative 3 – Biomass Removal

This alternative would generally have more substantial impacts to visual resources than Alternative 2 across the project area. Heavy machinery would be used to perform biomass removal, which would lead to additional disturbance from juniper cutting, skidding, yarding, and constructed landings. Heavy equipment would cause tracks, rutting, erosion, mechanical scaring, large quantities of scattered slash, as well as displaced or up-ended rocks within these units (250 acres). Although, these units are managed for VRM IV objectives, all proposed biomass units are within a quarter mile of routes that are moderately to heavily traveled and thus, more visually sensitive than an area managed for VRM IV would generally imply.

In addition, Alternative 3 would not include mitigation measures for visual resources. As such, high negative impacts to visual resources, particularly within treatment units located in visual corridors and areas managed for VRM II (Red Knoll ACEC), would result. Such negative impacts would include high stumps, hard/abrupt unit boundaries, excessive amount of cut-lop-scattered woody debris/chips, portions of cut trees up to 4 feet in height left above the ground, and highly contrasting, circular remnants of unburned debris piles in close proximity to commonly used routes. More mature trees would be removed compared to Alternative 2. This would result in fewer natural vegetative formations or, groupings and increased visual contrast across the project area.

For these reasons, the proposed treatments under Alternative 3 would not meet visual resource objectives for VRM Classes II and III. In addition, while the project would technically meet visual objectives for VRM IV, biomass treatment units near commonly used, visually-sensitive corridors in VRM IV would result in substantial negative impacts in these areas.

Fuels and Firefighter Safety Impacts

Alternative 1 - No Action

Under the No Action Alternative fuel loading would increase; the encroachment of juniper due to fire seclusion would continue and the available fuel would change from fine (one to ten hours) fuels to woodier (100 to 1,000 hours) fuels as juniper and brush component crowd out the grass and forb component. The change in stand structure would allow for a less frequent fire return interval, yet the fires that do occur would be of greater intensity and involve more commitment of fire-fighting resources, time, and money to suppress.

One study showed that fuel loads doubled between Phase 1 and Phase 2 juniper stands and then double again between Phases 2 and 3. Fuel loads where as much as eight or more times what was present in the sagebrush ecosystem prior to tree encroachment (Chambers 2008). The 678 acres of pine are currently in a condition class 3 due to encroachment of white fir (*Abies concolor*) and juniper, as well as, over-stocking due to past fire suppression. The no action alternative would allow these pine stands to remain in a condition class 3, and would continue to be at risk for a stand replacement wildfire.

Alternative 2 – Proposed Action

Under Alternative 2, piling and covering would allow for prescribed burning during times of the year when typical (broadcast) burning conditions are not present. Pile burning would occur when soils are wet and or frozen and would result in an 80 to 90% consumption of the downed junipers. This technique would make a disruption of fuel continuity after cutting, localizes the fire disturbance to small areas, and may have fewer weather or logistical constraints when compared to broadcast burning techniques (Bates *et al*. 2006; Bates and Svejcar 2009; O'Connor *et al*. 2013). In addition, the risk of the type of prescribed escaping and causing unintentional burning of sagebrush would be substantially less than broadcast burning (BLM 2017c). Fuel loading would be substantially reduced within most treatment units which would greatly reduce the probability of a future, stand-replacing wildfire.

Alternative 3 – Biomass Removal

This alternative would have similar impacts on fuel loading as those of Alternative 2 over many of the treatment units in the project area. However, this alternative would remove more juniper within some units compared to Alternative 2. This would result in additional reductions in fuel loading within these treatment units.

In addition, about 250 acres of trees and slash would be removed by biomass treatment (Map 6). Mechanical biomass treatment activities would reduce fuel loading by 4 to 15 tons per acre in these units. However, the fuels from biomass treatment units would be consolidated in piles at landings and pose a short-term fire risk, especially from human caused ignition, due to the fact the landings would be located along main roads. This risk would remain until the biomass was removed. Overall, there would be less of a fire risk under Alternative 3, due to the fact that fuels would be removed shortly after cutting instead of needing to wait at least a year for the right burning conditions under Alternative 2.

Cost/Benefit Analysis

Understanding the stages (phases) of juniper encroachment is an important step in the decision of when to take action and selection of appropriate treatment methods. The earlier phases (1 and 2) of juniper encroachment are generally more inexpensive to not only remove, but also rehabilitate after initial treatment is complete.

In Phase 1 juniper stands young trees are few in number and are a subordinate component of the sagebrush-steppe community. Native grasses, forbs, and shrubs are able to articulate their full productive potential unrestrained by competition from juniper (Miller *et al.* 2005, Roundy *et al*. 2014). For these reasons, Phase 1 juniper stands are the cheapest phase to treat. The canopy cover and density is less labor intensive to thin and less likely to need prescribed burning to remove excess fuel loads. The area is dominated by other native plants and, therefore, typically does not need any further rehabilitation.

Phase 2 represents the mid-successional stage of juniper encroachment which entails an actively expanding canopy of trees which are co-dominant with the surrounding sagebrush-steppe community. Shrubs begin to die off as the web of shallow juniper roots begins to extend its occupation of the upper soil profile (Miller *et al*. 2005; Chambers *et al*. 2007). As the stand progresses into the later stages of Phase 2, shrubs may completely drop out on shallow and moderately deep soils while grasses persevere. At this stage the focus of treatment changes from prevention to restoration or repair. During this phase of juniper encroachment the costs of restoration increase and can vary greatly in cost depending on the canopy cover and rehabilitation needs.

During Phase 3, juniper dominates the site and its recruitment is now limited. The understories plant production declines and the remaining shrubs, grasses, and forbs die-off. Treatment costs for this phase of juniper increase dramatically, while the ability of the site to be successfully rehabilitated decreases substantially due to the need to treat weeds and non-native species and lack of native seed source in the soil causing a need to reseed the area with native seed.

Various treatment methods have been used to reduce juniper density and canopy cover. These treatment costs vary greatly depending on the juniper phase and restoration objectives. In particular, costs can vary greatly depending on the fuel management prescriptions employed.

Alternative 1 - No Action

Under this alternative, no treatment would occur, eliminating an opportunity to increase area employment or the ability to attract outside companies to come into the area to conduct treatments. This would eliminate an opportunity to temporarily boost employment opportunities or the local economy.

While there would be no treatment costs directly associated with this alternative, fuel loads in the project area would continue to increase which would lead to an increased risk of a large-scale, catastrophic wildfire. Should such a fire occur during the analysis timeframe, this would increase the costs of regional wildfire suppression activities.

Alternative 2 – Proposed Action

Juniper treatment costs would vary by prescription under this alternative (Table 4-2). For the cut and leave prescription, the variance comes from prices listed in the most current hazardous fuel reduction treatments IDIQ contract. When estimating the cost, the only tree density that was considered was from 0% to 5% canopy cover. This is due to the trees being small and sparse enough that they would not add to an increased fuel loading/fire danger and would not be large enough to serve as a raptor perch. The "thinning" treatment units would have only 30% to 50% of the existing juniper trees cut, but this would not affect the cost per acre.

Table 4-2. Treatment Prescriptions, Acreages, and Estimated Costs for Alternative 2

Prescription	Acres	Estimated Cost
Cut and leave	435	$7,830 - $46,980
Cut, lop, and scatter	2,807	$98,245 - $303,156
Cut, pile, cover, and burn[1]	1,831	$137,325 - $1,215,784
Thin and leave	230	$4,140 - $21,390
Thin, lop, and scatter	210	$7,350 - $22,680
Thin, pile, cover, and burn	2,688	$201,600 - $1,784,832
Total	**8,201**	**$456,490 - $3,394,822**

[1] Includes 18 acres identified for cut, move pile, cover and burn treatment.

Under the cut, lop, and scatter prescription the estimated cost varies based on different vendor quotes and the canopy cover ranges from 0 to 30%. These trees are usually taller and wider than six feet, so when they are cut they would need to be lopped so they would not remain as a raptor perch. When higher tree densities are cut, lopped, and scattered, the amount of hazardous fuels that remain would increase the danger of future catastrophic wildfires. In addition, the large amount of material remaining could cover and suffocate existing forbs and grasses (Bates and Svejcar 2009). The cost of burning was not added to this prescription because this treatment method would generally be used on low density juniper stands where the resulting dead material would not substantially increase fire danger.

The cut, pile, cover, and burn prescription is generally used in high-density juniper stands that, if left unburned, would create a significant fire hazard. The cost of burning juniper piles was included in this analysis.

This alternative would increase seasonal employment opportunities and provide a small boost to the local economy over the 10 to 20-year project implementation period.

Alternative 3 – Biomass Removal

The biomass alternative would be the most expensive treatment option (Table 4-3). This prescription would require the juniper to be severed, yarded to a chipper/grinder, and then hauled to a biomass plant. The equipment required to perform this task is very large and road maintenance will increase the cost to the government an average of $500 to $800 per mile as needed on BLM roads. Cost estimates vary and were derived from prices in the most recent vegetation stewardship contract. The hand work prescription costs under this alternative would be similar to Alternative 2.

Mechanical cutting and yarding prices were derived from a range of less than one hundred trees per acre to greater than 200 trees per acre. Mechanical cutting prices vary depending on the

Table 4-3: Treatment Prescriptions, Acreages, and Estimated Costs for Alternative 3

Prescription	Acres	Estimated Price
Cut and leave	807	$14,526 - $60,525
Cut, lop, and scatter	2,798	$97,930 - $302,184
Cut, pile, cover, and burn	4,646	$348,450 - $3,084,944
Biomass removal[1]	240[2]	$86,400-$235,920 (Mechanical Cutting & Yarding)
Total (does not include grinding and freight)	**8,491**	**$547,306-$3,683,573**

[1] Grinding and freight costs are estimated at an additional $8,400 per ton of chips, are not included in this estimate, and would need to be paid by the benefitting party.
[2] Does not include costs for 10 acres of landings.

density of trees per acre. Yarding of the trees is the same, but there are a couple of options. One of them is one-end suspension and the other is full suspension yarding. For this analysis, the costs for full suspension yarding was utilized in order to minimize damage to the sagebrush ecosystem by not dragging cut juniper trees to landing sites, even though one-end suspension yarding was less expensive.

There would be an additional cost of grinding the juniper into hog fuel and shipping to a biomass plant. The cost would be about $40 per ton of chips for grinding (when the distance from the job site is greater than 100 miles to the nearest biomass plant). At the time of this analysis the closest biomass plant is approximately 210 miles from the Clover Flat project area which would cost an estimated $8,400 to grind and ship a ton of hog fuel to this plant. If a biomass plant came on-line that was closer than 100 miles from the project site the cost would be reduced to $25 per ton for grinding or about $2,500 per ton with shipping. The costs of grinding and shipping chips to a biomass plant would likely have to be paid by the benefiting party. For this reason, the tonnage of clean chip biomass that could be produced at the project site was not estimated.

This alternative would increase seasonal employment opportunities and provide a small boost to the local economy over the 10 to 15 year implementation period similar to Alternative 2.

Cumulative Impacts

Introduction

This section discusses potential cumulative impacts of past, present and reasonably foreseeable future BLM actions. This section also considers the potential cumulative impacts of other agency actions, as well as, actions on private land within the analysis area. A cumulative impact is defined as the "impact on the environment which results from the *incremental impact* of the action when added to other past, present, and reasonably foreseeable future actions." (See 40 CFR § 1508.7.)

For the purposes of this analysis, cumulative impacts are considered within the bounds of the project area and surrounding BLM-administered grazing allotments. The BLM selected this geographic scale for its cumulative impact analysis because it has adequate knowledge of other on-going and potential reasonably foreseeable actions that may occur within this area. Some of these potential future actions have been identified in Appendix E3 of the *Lakeview Resource Management Plan/Record of Decision* (BLM 2003b) or other plans (BLM 1991b, 2004b, 2015d, 2015f, 2015g, 2016a, 2016b, 2016c, 2017). The timeframe of the cumulative effects analysis is defined as 15 to 30 years. Impacts from the treatment project would likely be negligible after this timeframe.

Past and Present Actions

The Council on Environmental Quality (CEQ) issued cumulative impact guidance on June 24, 2005 (CEQ 2005), that states the "environmental analysis required under NEPA is forward-looking," and review of past actions is required only "to the extent that this review informs agency decision-making regarding the proposed action." Use of information on the effects of past action may be useful in two ways: one is for consideration of the proposed action's cumulative effects, and secondly as a basis for identifying the proposed action's direct and indirect effects.

The CEQ stated that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This is because a description of the current state of the environment (i.e. affected environment section) inherently includes the effects of past actions. Further, the "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions." Information on the current environmental condition is more comprehensive and more accurate for establishing a useful starting point for a cumulative effects analysis than attempting to establish such a starting point by adding up the described effects of individual past actions to some environmental baseline condition in the past that, unlike current conditions, can no longer be verified by direct examination.

The second area in which the CEQ guidance states that information on past actions may be useful is in "illuminating or predicting the direct and indirect effects of a proposed action. The usefulness of such information is limited by the fact that it is anecdotal only, and extrapolation of data from such singular experiences is not generally accepted as a reliable predictor of effects".

The Department of Interior issued some additional guidance related to past actions which state, "when considering the effects of past actions as part of a cumulative effects analysis, the Responsible Official must analyze the effects in accordance with 40 CFR 1508.7 and in accordance with relevant guidance issued by the CEQ, such as 'The Council on Environmental Quality Guidance Memorandum (CEQ 2014) on Consideration of Past Actions in Cumulative Effects Analysis dated June 24, 2005, or any superseding Council on Environmental Quality guidance (see 43 CFR 46.115)".

The current conditions of the project lands are the result of a multitude of natural and human actions that have taken place over many decades. The description of the current state of the environment (i.e. "Affected Environment" section) inherently takes into account the impacts of past actions and serves as a more accurate and useful starting point for a cumulative impacts analysis. A complete catalogue and analysis, comparison, or description of all individual past actions and their individual impacts which have contributed to the current environmental conditions would be practically impossible to compile and unduly costly to obtain.

The importance of "past actions" is to set the context for understanding the *incremental* or additive impacts of the action alternatives. This context is determined by combining the current conditions with available information on the expected impacts of other present and reasonably foreseeable future actions.

Based on this guidance, BLM has summarized known disturbances that have occurred within the area as part of past or on-going management activities. These include: livestock grazing and range improvement project construction/maintenance, road construction/maintenance, vegetation treatments, including chemical treatment for brush and weed control, seedings, and mechanical juniper treatments, wildfire and prescribed fire, mining, and dispersed recreational activities such as hunting and OHV use. Approximately 6,000 areas of weed treatments were implemented in the analysis area under the recent *Integrated Invasive Plant Management for the Lakeview Resource Area Revised Environmental Assessment* and associated Decision Record plan in the fall of 2015 (BLM 2015d, 2015f). An additional 6,280 acres were treated in 2016 (BLM 2016a). Approximately 5,500 acres of the same area treated in 2015-2016 were re-treated in the fall of 2017 (BLM 2017).

The allotments in the project area have historically been grazed by cattle. Prior to the Taylor Grazing Act of 1935, grazing on public lands was essentially uncontrolled. After passage of the Taylor Grazing Act, grazing allotments were established tied to private base property owned by a permittee. At the time of passage, the number of grazing livestock was generally higher and the pattern of grazing use was generally more intense than what occurs today. Consequently, the impacts of current grazing are generally more dispersed across the landscape. Most ground disturbance is concentrated in areas where livestock tend to congregate such as watering sites and trailing along fences.

All of these past management activities have affected or shaped the landscape within the project area into what it is today. Current resource conditions are described earlier in Chapter 3, as well as in recent Rangeland Health Assessments and other environmental analyses (BLM 1991b, 1996, 2003a, 2003c, 2004a, 2004b, 2005, 2006a, 2013, 2015a, 2015e, 2016b). These descriptions of resource conditions are incorporated by reference herein in their entirety and need not be repeated here.

Table 4-4 includes a summary of estimated acres of active management, treatment, or disturbance associated with past or present actions within the impact analysis area based on GIS data or previous NEPA analyses (BLM, 1991b, 1996, 2003a, 2004b, 2013, 2015d, 2016b).

Table 4-4. Cumulative Disturbance Impacts within the Analysis Area

Past/Present Actions	
Roads	154
Juniper Treatment	52
Herbicide Treatment of Brush	807
Herbicide Treatment of Brush/Seeding	100
Prescribe Burn/Seeding (Medusahead) Treatment	390
Herbicide Treatment of Weeds (BLM 2015d, 2016a)	12,281[1]
Wildfire Rehabilitation Seeding	1,636
Range/Wildlife Enhancement Seeding	942
Seeding Maintenance	190
Concentrated Livestock Use Around Water Developments	5,280
Existing Approved Perlite Mining (BLM 2013)	70
Reclaimed Gravel Pits	1.3
Foreseeable Future Actions	
Road Maintenance	No change in existing footprint
Expanded Perlite Mining (BLM 2016c)	Up to 332
Juniper Treatment on Adjacent Private Lands	Up to 3,233
Incremental Effects of Alternative 2	
Juniper Treatment	8,201
Incremental Effects of Alternative 3	
Juniper Treatment	8,251
Biomass Treatment	250

[1] Approximately 5,500 acres of the areas treated in 2015-2016 were treated again in the fall of 2017 (BLM 2017).

Reasonably Foreseeable Future Actions

The *Lakeview RMP/ROD* (Appendix E3, pages A-143 to A-144, BLM 2003b) listed potential future projects within the allotments in the analysis area. These included additional pasture fencing (some of which has already been completed), juniper removal/control, and one new spring development. Table 4-4 includes a summary of estimated acres of disturbance from current reasonably foreseeable future actions based on GIS data or recent project NEPA analyses. Activities that may occur during the analytical timeframe include continued road maintenance, mine expansion, weed treatment activities, and juniper treatment on adjacent private lands (BLM 2013, 2015d, 2016a, 2016c, 2017).

The exact locations or durations of road maintenance activities cannot be determined at this time and would likely occur regardless of which alternative is selected. Approximately 13 miles of 2-lane county gravel road are maintained annually and kept open year-long. For analytical purposes, BLM assumes that an additional five to ten miles of roads/primitive roads could receive some spot maintenance or minimal level of re-grading over the analytical timeframe. However, these maintenance activities would generally be limited to the existing roadbed footprint and would not create new ground disturbance.

Weed and invasive non-native species control would continue to occur in the analysis area, as authorized through the recent *Integrated Invasive Plant Management for the Lakeview Resource Area Revised Environmental Assessment* (BLM 2015d) and associated Decision Record. The impact analysis contained in this EA is herein incorporated by reference in its entirety. In summary, the impacts of these treatments would include increased soil disturbance in the short-term and reductions in noxious weeds and invasive, non-native annual grasses, improved native plant communities, and improved wildlife habitats over the long-term (BLM 2015d, pages 78-82, 89-94, 112-128, and 174-177). Continued monitoring and treatment is expected to continue in future years, but vary as funding and staffing allows. Specific acres of treatments in future years would be identified through the preparation of annual treatment plans.

The existing, authorized 70-acre perlite mine at Tucker Hill could expand by up to an additional 332 acres. While the potential impacts of this proposal have not yet been fully analyzed, an EIS is currently in preparation (BLM 2016c). For purposes of this cumulative effects analysis, BLM assumes that all of the existing vegetation in this area would be removed during mine expansion operations (15 to 20 years) and would not return until several years after reclamation activities were successfully completed.

Up to 3,233 acres of juniper treatments could occur on adjacent private lands in the analysis area through Candidate Conservation Agreements with Assurances (CCAA) with Lake County Soil and Water Conservation District (SWCD). Some private land owners have completed or are currently planning future juniper removal treatments without CCAAs.

Cumulative Impacts Alternative 1 – No Action

This alternative would have no known additional incremental surface disturbance impacts beyond the total of past, present, and reasonably foreseeable actions described in the previous section. The analysis area has been influenced by the past and present management actions, treatments, or disturbances (Table 4-4) are currently disturbed or in various stages of revegetation or restoration. Juniper treatment projects on adjacent private lands would also have temporary displacement impacts to various wildlife species similar to those described in the wildlife impact section, but over the long-term these projects would restore additional sagebrush habitats and would benefit shrub-steppe dependent wildlife species in the region such as sage-grouse.

Cumulative Impacts Alternatives 2 and 3

In addition to the acres within the analysis area that have been influenced by past or present management actions, treatments, or disturbances, as described above under Alternative 1, the action alternatives would temporarily disturb an estimated incremental 8,201 to 8,501 acres by various treatment methods (Table 4-4). The incremental impacts of juniper treatments on BLM-administered lands, in combination with juniper treatments on adjacent private lands would include larger temporary displacement impacts to various wildlife species similar than those associated with Alternative 1, but over the long-term these projects provide a larger area of sagebrush habitat restoration and additional connectivity between sagebrush habitat blocks. This would provide additional benefits to shrub-steppe dependent wildlife species in the region such as sage-grouse.

Irreversible and Irretrievable Impacts

The staff time and federal funding that would be required to plan and implement the various alternatives would be irreversible and irretrievable. Removal of juniper would also be irretrievable, at least for a few decades. Junipers would require 40 to 120 years to return to their current aerial extent across the project area in the absence of wildfire.

5. CONSULTATION AND PUBLIC INPUT

Public/Interagency Involvement and Coordination

The following organizations or agencies were consulted during the planning stages for this project:

U.S. Fish and Wildlife Service
Fremont-Winema National Forests
Oregon Department of Fish and Wildlife
Lake County Soil and Water Conservation District

List of Recipients

A number of agencies, organizations, individuals and tribal governments were sent a notice of the EA and Finding of No Significant Impact (FONSI) availability along with a request for comments. This mailing list is located in the project file.

6. LIST OF PREPARERS

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