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Draft Programmatic EIS for Fuel Breaks in the Great Basin

Volume 1: Executive Summary, Chapters 1 through 5

Estimated Lead Agency Total Costs
Associated with Developing and Producing this EIS

$2,100,000

The Bureau of Land Management'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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Executive Summary

Introduction

This programmatic environmental impact statement (PEIS) evaluates creating and maintaining a system of fuel breaks in the Great Basin region. The project area, covering nearly 224 million acres, includes portions of California, Idaho, Nevada, Oregon, Utah, and Washington (see **Map 1** in **Volume 2, Appendix A**). The fuel breaks would be placed along a subset of available linear features, such as roads and rights-of-way (ROWs) on Bureau of Land Management (BLM)-administered lands within sagebrush communities; these potential treatment areas cover approximately 38 million acres within the project area boundary. Areas excluded from analysis in this PEIS are described further in **Chapter 2**. While the treatment area identifies all potential acres that may be treated, only portions of this area would receive treatment.

Purpose and Need

A system of strategically placed fuel breaks in the Great Basin region would slow the spread of wildfires; thereby reducing wildfire size, improving firefighter safety and providing an anchor point for fire suppression activities, providing opportunities to control catastrophic wildfire, and creating buffers for maintaining important habitats. Fuel breaks would also offer greater protection to human life and property, sagebrush communities, and ongoing/pending habitat restoration investments, and reduce invasive plant species expansion.

Wildfires continue to increase in size and frequency throughout the western United States in recent years. Further, the number of areas that burn repeatedly before habitats can be re-established has increased. These fires negatively impact healthy rangelands, sagebrush communities, and the general productivity of the lands. In the last decade (2009-2018), 21 fires have exceeded 100,000 acres. During this same timeframe, the total number of acres burned in the project area was over 13.5 million acres. Efforts to suppress wildfires on BLM-administered lands in Utah, Nevada, and Idaho (for which data are available) have cost approximately $373 million dollars between 2009 and 2018. These wildfires result in increased destruction of private property, degradation and loss of rangelands, loss of recreational opportunities, and habitat loss for a variety of species, including the conversion of native habitats to invasive annual grasses. The conversion of rangeland habitats to invasive annual grasslands further impedes rangeland health and productivity by slowing or preventing recovery of sagebrush communities.

Decisions to Be Made

The BLM's decisions would include whether, and under what circumstances, fuel breaks projects would be constructed on BLM-administered lands in the Great Basin region. The alternatives evaluated in this PEIS would streamline future site-specific fuel break construction projects; however, site-specific actions may require further National Environmental Policy Act (NEPA) analysis. For instances where no additional analysis would be required, the BLM Field Offices may utilize a Determination of NEPA Adequacy (DNA) for site-specific fuel break projects; however, where needed a resource issue specific Environmental Assessment (issue-based EA) may be required. Examples of where additional analysis would be warranted include projects in areas excluded from analysis in this PEIS, projects outside of the potential treatment area, applying different tools than what were analyzed in this PEIS, and deviations from design features that would result in effects not disclosed in this PEIS.

SCOPING AND ISSUES

As part of the scoping process, the BLM considered public responses provided during 15 scoping meetings held throughout the project area during February 2018. It also considered public comments submitted during the scoping period and input from cooperating agencies and tribes. For more information on the scoping process, see the final scoping report on the BLM's project website: https://go.usa.gov/xnQcG and **Appendix M**.

Issues such as impacts on wildlife and special status species, direct and indirect costs and consequences of the project, and monitoring the effectiveness of fuel break construction and maintenance were identified during scoping and addressed in this PEIS. The full list of issue summaries is available in the final scoping report.

ALTERNATIVES

Alternative A—No Action Alternative

Under the No Action Alternative, a regional system of fuel breaks would not be constructed and maintained using this analysis. Individual fuel break projects could be implemented when NEPA is completed at the site-specific level.

Alternative B

Up to approximately 8,700 miles of new fuel breaks may be created over a potential treatment area of approximately 529,000 acres along Maintenance Level 5 roads. Of the 8,700 miles, a maximum of 2,349 miles could be brown strips and 6,351 miles could be mowed fuel breaks. No green strips or targeted grazing fuel breaks would be created. The types of tools proposed to create fuel breaks would be limited under Alternative B. Manual and mechanical treatments would be used, except for treating sagebrush. Prescribed fire, chemical treatments, and targeted grazing would not be used to create or maintain fuel breaks. Fuel breaks would be planted with native species only. Intact areas characterized by high resistance and resilience (Chambers et al. 2014a) would not be treated but could be protected via treatment of adjacent areas.

Alternative C

Up to approximately 11,000 miles of new fuel breaks (over a potential 792,000 acres) may be created along Maintenance Levels 3 and 5 roads and BLM-administered ROWs under Alternative C. Of the 11,000 miles, a maximum of 550 miles could be brown strips, 5,720 miles could be mowed or targeted grazing fuel breaks, and 4,730 miles could be green strips. Manual, mechanical, and chemical treatments, prescribed fire, and targeted grazing could be used in all areas, including sites with sagebrush. Fuel breaks would be constructed and maintained in accordance with the BLM's Integrated Vegetation Management Handbook (H-1740-2, see Chapter 8) and the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015). Limited treatments would occur in highly resistant/resilient sites with high fire probability or where adaptive management habitat triggers have been tripped; native plant materials would be required in these areas.

Alternative D—Preferred Alternative

Up to approximately 11,000 miles of new fuel breaks (over a potential 1,088,000 acres) may be created along Maintenance Levels 1, 3, and 5 roads and BLM-administered ROWs. The percentages of each fuel break type would be the same as described for Alternative C. Management of manual, chemical, prescribed fire, reseeding, and targeted grazing would be the same as under Alternative C. However, fuel breaks could be created in highly resistant and resilient sites without the constraints included in Alternative C.

Design Features

Under Alternatives B, C, and D, design features would be required, as applicable, when implementing site-specific projects in the potential treatment areas. BLM district and/or field office resource specialists would determine the locations for avoidance and where to apply design features to protect resources during site-specific analyses. Additional design features may be relevant to a given project, such as from currently approved land use plans.

IMPACT ANALYSIS

The following general impacts would be expected under the preferred alternative of this PEIS:

- Reduced wildfire size and intensity related to increased fire suppression opportunities and decreased potential for wildfire spread across fuel breaks. Increased protection for native habitats and restoration projects related to decreased potential for wildfire spread across fuel breaks.
- Vegetation modification and soil disturbance caused by fuel break creation and maintenance, which could be long term in some cases. This would be dependent upon the type of fuel break being constructed, for example brown strip versus mowing, or the type of tools being utilized in the construction of the fuel break.
- Potentially long-term wildlife habitat modification caused by development of fuel breaks, depending on the current vegetation community, desired conditions, type of fuel break, and tools.

The effects described would vary depending on the methods used and resource(s) affected. See **Chapter 4** for a more detailed analysis of impacts by method, fuel break type, and alternative.

COLLABORATION AND COORDINATION

The BLM is the lead agency for this PEIS. Organizations, state, local, and tribal governments, and other agencies invited to participate as cooperating agencies and consulting parties can be found in **Appendix M, Table M-3**. A more detailed summary of the BLM's consultation and coordination efforts can also be found in **Chapter 5**.

The BLM sent letters to California, Idaho, Nevada, Oregon, Utah, and Washington State Historic Preservation Offices (SHPOs) in December 2017 initiating consultation per Section 106 of the National Historic Preservation Act (NHPA).

To comply with Section 7(a)(2) of the Endangered Species Act of 1973 (ESA), the BLM began consulting with the United States Fish and Wildlife Service (USFWS) early in the PEIS process. The USFWS provided input on issues, data collection and review, and alternatives development. The BLM is consulting with the USFWS to identify ESA issues and to develop the draft biological assessment.

Chapter 1. Introduction

1.1 INTRODUCTION

The BLM, as lead agency, is preparing this PEIS in accordance with NEPA and Council on Environmental Quality (CEQ) guidance for effective use of programmatic NEPA reviews (CEQ 2014). This PEIS evaluates which BLM-administered lands in the Great Basin region would be available for fuel break construction and which tools could be used to create and maintain these fuel breaks. **Volume 2, Appendix A** presents maps and figures and **Volume 3, Appendix B** presents the acronyms, literature cited, and glossary.

The larger project area boundary includes portions of California, Idaho, Nevada, Oregon, Utah, and Washington; throughout this PEIS, this is referred to as the "project area" (see **Table 1-1** and **Map 1** below; **Map 1** in **Appendix A** shows a more detailed map of the project and treatment areas). The project area boundary includes all surface management and covers approximately 223 million acres; of these acres, BLM-administered lands cover approximately 90 million acres.

The analysis area is a subset of the project area boundary. It is defined by the current and historical presence of sagebrush on BLM-administered lands within the project area boundary. The analysis area was further refined by excluding areas described in **Section 2.2.1**. The analysis area covers approximately 38 million acres on BLM-administered lands within the project area boundary (see **Table 1-2** and **Map 1** below).

The fuel breaks would be placed along a subset of roads and linear rights-of-way (ROWs) on BLM-administered lands within the analysis area (see **Map 2**). The potential treatment areas vary by alternative and are defined in **Section 2.5**. While the potential treatment area identifies all acres that may be treated, only portions of this area would actually receive treatment.

Table 1-1
Surface Land Management in the Project Area

Surface Land Management	Total Surface Land Management Acres
BLM	90,137,000
US Forest Service	46,974,000
Private land or surface water	61,939,000
Bureau of Indian Affairs (tribal)	5,748,000
US Fish and Wildlife Service	1,720,000
State	9,071,000
National Park Service	2,304,000
Other federal	866,000
Bureau of Reclamation	819,000
Local government	175,000
Department of Defense	3,740,000
Total acres	**223,493,000**

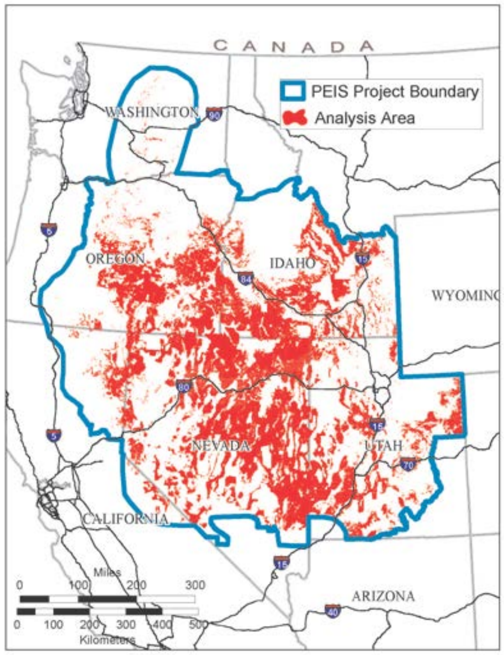
Source: BLM GIS 2018

Table 1-2
Analysis Area Acres within the Project Area

State	Analysis Area Acres
California	871,000
Idaho	7,071,000
Nevada	17,508,000
Oregon	6,795,000
Utah	5,743,000
Washington	29,000
Total acres	**38,017,000**

Source: BLM GIS 2018

Map 1. PEIS Project Boundary and Analysis Areas



This PEIS would aid in meeting provisions of the Federal Land Policy and Management Act (FLPMA), the Fire and Invasives Assessment Tool (FIAT), Executive Order 13855 (Promoting Active Management of America's Forests, Rangelands, and Other Federal Lands To Improve Conditions and Reduce Wildfire Risk), and Secretarial Order 3372 (Reducing Wildfire Risks on Department of the Interior Land Through Active Management). In accordance with NEPA, the BLM has and will continue to seek public and interagency input to identify potential issues. The BLM will also coordinate with other federal, tribal, state, and local government agencies in preparing the PEIS.

Whenever possible, this PEIS is intended to satisfy NEPA requirements for site-specific projects. As such, field staff could tier directly to this PEIS and complete an administrative determination for a proposed fuel break project, as documented in a determination of NEPA adequacy. Therefore, the analysis in this PEIS covers a range of fuel break types, methods, and tools and provides GIS analysis for a range of vegetation states and conditions. Additional NEPA analysis may be necessary where anticipated impacts deviate from those analyzed in this PEIS, for example, where there are environmental justice concerns or impacts to a special designation area.

1.2 Purpose and Need

A system of strategically placed fuel breaks in the Great Basin region would slow the spread of wildfires; thereby reducing wildfire size, improving firefighter safety and providing an anchor point for fire suppression activities, providing opportunities to control catastrophic wildfire, and creating buffers for maintaining important habitats. Fuel breaks would also offer greater protection to human life and property, sagebrush communities, and ongoing/pending habitat restoration investments, and reduce invasive plant species expansion.

Wildfires continue to increase in size and frequency throughout the western United States in recent years. Further, the number of areas that burn repeatedly before habitats can be re-established has increased. These fires negatively impact healthy rangelands, sagebrush communities, and the general productivity of the lands. In the last decade (2009-2018), 21 fires have exceeded 100,000 acres. During this same timeframe, the total number of acres burned in the project area was over 13.5 million acres. Efforts to suppress wildfires on BLM-administered lands in Utah, Nevada, and Idaho (for which data are available) have cost approximately $373 million dollars between 2009 and 2018. These wildfires result in increased destruction of private property, degradation and loss of rangelands, loss of recreational opportunities, and habitat loss for a variety of species, including the conversion of native habitats to invasive annual grasses. The conversion of rangeland habitats to invasive annual grasslands further impedes rangeland health and productivity by slowing or preventing recovery of sagebrush communities.

1.3 Relationship to the FIAT

As a part of the Greater Sage-grouse Resource Management Plan Amendment (RMPA) effort, completed in 2015, Nevada, California, Oregon, Idaho, and Utah completed several FIAT assessments. The FIAT assessments identified approximately 11,000 miles of potential fuel break locations along existing roads in the Great Basin region. These areas were identified and prioritized based on threats for fire operations and fuels management. The total mileage of fuel breaks, as determined in the FIAT assessments, was the starting point for the mileage of fuel breaks analyzed in this PEIS. FIAT assessments were not completed for portions of land within the project area boundary, such as Washington state; as a result, the existing road network was used as a starting point for those areas.

1.4 Relationship to Laws, Regulations and BLM and Non-BLM Policies, Plans and Programs

This PEIS is being developed in accordance with all applicable laws, rules, regulations, and guidelines (See **Appendix C**). No federal permits, licenses, or other entitlements are needed to implement this PEIS.

This PEIS does not contradict or change any BLM or non-BLM policies, plans, and programs. Any subsequent site-specific NEPA compliance will also adhere to all BLM policies, plans, and programs, including applicable resource management plans; BLM Manual 9211, Fire Planning Manual; BLM Manual 9200, Fire Program Management; BLM Manual 6840, Special Status Species Management; and BLM Cultural Programs Manuals, 8000 and 8100 Series; and BLM Manual 1780, Tribal Relations (See **Appendix C**). The BLM will also consider and adhere to any applicable non-BLM policies, plans, and programs during this project as well as subsequent site-specific NEPA compliance.

Chapter 2. Alternatives

2.1 Introduction

This chapter describes the proposed and alternative actions for fuel break construction on BLM-administered lands in the project area. The alternatives respond to various issues and alternative proposals raised during scoping, yet still meet the project's purpose and need (see **Chapter 1**). Applicable design features for the proposed action and alternatives are included in **Appendix D**.

2.2 Management Actions Common to All Action Alternatives

2.2.1 Analysis Exclusion Areas

While not prohibited under the action alternatives, fuel breaks are not being proposed in the following areas (see **Appendix G**). Should Field Offices decide to construct fuel breaks in these areas, additional site-specific analysis would be required:

- Riparian conservation areas
  - Perennial streams—300 feet on each side of the active channel, measured from the bank full edge of the stream, or the outer extent of riparian vegetation, whichever is greater
  - Seasonally flowing streams (including intermittent and ephemeral streams)—150 feet on each side of the active channel, measured from the bank full edge of the stream, or the outer extent of riparian vegetation, whichever is greater
  - Streams in inner gorge (defined by adjacent stream slopes greater than 70 percent gradient)—Top of inner gorge
  - Special aquatic features (including lakes, ponds, playas, seasonal wetlands, wetlands, seeps, vernal pools, and springs)—300 feet from the edge of feature or the outer extent of riparian vegetation, whichever width is greater
  - Other hydrological or topographic depressions without a defined channel—Width and protection measures determined through project level analysis
- Wilderness areas
- Wilderness Study Areas
- Lands with wilderness characteristics that are managed to maintain or enhance those characteristics
- Areas of Critical Environmental Concern
- Visual Resource Management Class I areas
- Areas within a quarter-mile of a Wild and Scenic River (including rivers found eligible and/or suitable)
- Within National Scenic and Historic Trails
- Areas within mapped Canada lynx distribution and wolverine primary habitat
- Native, sparsely vegetated areas or sparsely vegetated areas dominated by low sagebrush species

2.2.2 Modeling of Potential Treatment Areas

A geographic information system (GIS) model was implemented to create a comprehensive dataset for the action alternatives. For all action alternatives, the analysis area, on the broad scale, was determined by current and historical presence of sagebrush. The alternatives data shows potential treatment areas located on BLM surface administration within the project area. Each alternative is independent, and descriptions of the components of each alternative are described in **Section 2.5**; a detailed description of the datasets used to map each alternative is presented in **Appendix A**. The model is used for analysis and comparison purposes only; actual treatment locations and methods would be based on site-specific conditions. There would likely be areas where, in order to establish fuel breaks of a sufficient length that would be effective, proposed fuel breaks would cross lands under other jurisdictions. Where this occurs, BLM would attempt to work with other landowners to complete construction.

2.2.3 Applicable Vegetation Communities

The current and historic extent of sagebrush vegetation communities within the project area, including those areas where pinyon-juniper has encroached, would be treated to create fuel breaks (see **Map 1** and introductory text in **Appendix A**).

2.2.4 Permitted Grazing

The alternatives would not change permitted grazing in accordance with 43 Code of Federal Regulations (CFR) 4130.2 (2005).

2.2.5 Road Creation and Maintenance

No new roads would be created. Improvement or maintenance of roads beyond the current definition or designation would require additional site-specific analysis.

2.2.6 Native Plant Material Policy

It is the policy of the BLM to manage for biologically diverse, resilient and productive native plant communities to sustain the health and productivity of the public lands. This policy in BLM Handbook H-1740-2, Integrated Vegetation Management Handbook, requires that native species shall be used except under limited circumstances and provides necessary procedures for compliance. As a last resort, it may be necessary to introduce nonnative, non-invasive plant materials to break unnatural disturbance cycles or to prevent further site degradation by invasive plant species. Non-native seeds as part of a seeding mixture are appropriate only if: 1. suitable native species are not available, 2. the natural biological diversity of the proposed management area will not be diminished, 3. exotic and naturalized species can be confined within the proposed management area, 4. analysis of ecological site inventory information indicates that a site will not support reestablishment of a species that historically was part of the natural environment, and 5. resource management objectives cannot be met with native species.

2.2.7 Monitoring, Maintenance, and Adaptive Management

All vegetation management actions should be organized around phases of inventory, assessment, planning, implementation, monitoring, and evaluation and reassessment as described in BLM's H-1740-2; Incorporating Assessment, Inventory, and Monitoring (AIM) for Monitoring Fuels Project Effectiveness (BLM 2018a); Measuring and Monitoring Plant Populations (Elzinga et al. 1998); Sampling Vegetation Attributes (USDA and USDOI 1999); local RMP guidance; and other applicable guidance documents or policy.

In addition, when fuel breaks are not meeting objectives, modifications should be considered through adaptive management (per Chapter 5 of H-1740-2). Decommissioning of fuel breaks would be addressed in project objectives at the site-specific level. Monitoring would inform the need for fuel break maintenance on new fuel breaks. Maintenance may require re-treating certain areas, using the methods described in this chapter, to maintain effectiveness, minimize the presence of invasive plants, and to prevent tall shrubs from dominating treated areas. The BLM would manage invasive, nonnative, annual plants and noxious weeds in accordance with local weed program monitoring protocol, along with any additional RMP guidance, through manual and chemical methods. The BLM would do this to keep the invasive, nonnative, annual plants and noxious weeds from invading and dominating the fuel breaks or from spreading out of areas disturbed during fuel break construction. Noxious weeds and invasive plant monitoring and management would be incorporated into all soil disturbances, including pre-work evaluation and avoidance and post-work corrective action, where needed.

2.3 FUEL BREAK TYPES AND VEGETATION STATES

Figure 2-1 in **Appendix A** presents a depiction of an effective fuel break. Effective fuel breaks are those that have reduced fuel loading and continuity or increased fuel moisture, compared with surrounding vegetation. To achieve this, vegetation would be removed, modified, or replaced using various methods depending on vegetation states. Vegetation states were derived using data from the US Geological Survey National Land Cover Database, (Homer et. al. 2015) and are presented in **Appendix F** and shown on **Map 3** (**Appendix A**).

Table 2-1 and **Table 2-2** provide considerations for planning and creating three fuel breaks types to meet desired functions. Methods and tools are included in the table; however, some alternatives exclude or limit the use of certain tools, and these are described for each alternative in **Section 2.5**. Method and tool selection would be based on site-specific conditions and project objectives. Strategic fuel breaks would be constructed and maintained using the tools or methods described below.

Table 2-1
Fuel Break Types, Functions, and Considerations

Brown Strips: Removal/Unvegetated
Width[1]: 0-50 feet

Function: Limit fire starts and spread along highly traveled corridors.

Potential Locations: Treatment areas would be along interstates, state highways, and highly traveled corridors (roads with Maintenance Level 5).

Considerations:

- Preferred use is along interstates and highly traveled routes.
- Brown strips would require more intensive maintenance than other fuel break types and must be regularly maintained due to the higher likelihood of invasion by nonnative annual grasses compared to other fuel break types. Their effectiveness is short-lived without regular maintenance.
- Brown strips are the simplest of the linear fuel breaks with respect to potential fire behavior, because they are devoid of vegetation and thus cannot burn, however due to their narrow width, there is a higher potential for breaching, or breaking through, during higher intensity fires, where flame length or spotting distance exceed the width of the fuel break.

[1] Total maximum width of brown strip (This includes both sides of the road).

Mowed Fuel Breaks or Targeted Grazing Fuel Breaks:
Modification
Width [1]: 0-500 feet

Function: Reduce or compact the vertical extent of the fuel bed to lower flame lengths and possibly reduce rates of spread.

Potential Locations: Could occur in all vegetative states along any types of roads or BLM-administered linear ROW's.

Considerations:

- Mowed fuel breaks are the preferred method of treatment in patches of intact sagebrush, because they are relatively easy to implement and, if wide enough, can help to disrupt wind-driven fires and limit wildfire spread; however, reducing the canopy cover can increase herbaceous plants in the short term, necessitating further intervention (Shinneman et al. 2018).
- Native perennial grasses, as the target vegetation state, would not be removed. Other native vegetation could be retained.
- Follow-up pre-emergent treatments may be used in low resistance/resilience areas with less than 20 percent pretreatment perennial grass and forb cover.
- Treatments in certain vegetation states such as invasive annual grassland may need to occur every year. Treatments in sagebrush would be less frequent.
- Targeted grazing would be used to remove, reduce, or alter vegetation in the identified fuel break and may be used as a maintenance tool.

[1] Total maximum width of fuel break (This includes both sides of the road).

Green Strips: Replacement
Width[1]: 0-500 feet

Function: Replace more flammable and contiguous plant communities (particularly those dominated by invasive annual grasses, such as cheatgrass) with perennial plants that retain moisture later into the growing season, often by using plants that grow as widely spaced, low-statured individuals resulting in large, bare interspaces to reduce flame lengths and rate of spread of wildfires.

Potential Locations: Could occur in all vegetative states along any types of roads or BLM-administered linear ROW's.

Considerations:

- Preferred fuel break in areas that have undergone conversion to invasive annual grassland or areas highly susceptible to invasion by annual grasses or affected by repeated fire.
- If established under ideal conditions, may require relatively little maintenance, especially if planted species are drought resistant, tolerant of grazing, or able to survive fire or if they have competitive advantages over more fire-prone species.
- May require multiple treatments to reach desired objective.
- If not maintained, the ability of a green strip to alter fire behavior generally diminishes over time, due to the potential for reinvasion by invasive annual plant species and the risk of maladaptation.
- Targeted grazing could be used as a maintenance tool to remove or reduce cheatgrass, thereby decreasing fuel continuity and lowering competition with seeded species, helping to maintain the longevity of the fuel break. Targeted grazing could also be used as a tool for seedbed preparation in combination with other techniques.

[1] Total maximum width of fuel break (This includes both sides of the road).

Table 2-2
Fuel Break Type by Vegetation State

Vegetation State	Preferred Fuel Break Type[1]	Methods and Tools By Fuel Break Type
Invasive Annual Grasses	**1a: Brown Strip Fuel Break:** Method of treatment along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Green Strip Fuel Break:** Method of treatment in areas that have undergone conversion to invasive annual grassland outside of interstates and state highways or highly traveled corridors, or affected by repeated fire. **2: Mowed Fuel Break:** Method of treatment is relatively easy to implement in reducing the vegetation height and can be used in areas that have undergone conversion to invasive annual grassland or affected by repeated fire. **3: Targeted Grazing Fuel Break:** Could be implemented in any areas where there are invasive annual grasses or areas where mechanical mowing is inaccessible or other methods are not cost effective.	**Brown Strip Fuel Break:** Removal of vegetation by mechanical and chemical treatment. **Green Strip Fuel Break:** Initially removing vegetation through tilling, chemical, or prescribed fire or modifying vegetation via targeted grazing, followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). **Mowed Fuel Break:** Manipulation of vegetation through the use of a mowing implement. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep.
Invasive Annual Grasses with Shrubs	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Green Strip Fuel Break:** Method of treatment in areas that have undergone conversion to invasive annual grassland or affected by repeated fire. **2: Targeted Grazing Fuel Break:** Could be implemented in any areas with a sparse shrub layer, where there are invasive annual grasses.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical, mechanical treatments and targeted grazing. A broadleaf chemical treatment may be used to further reduce shrub cover, if needed. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up seeding treatments may be required to ensure success. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep.

[1] See **Appendix H, Section H.3** for a description of the methodology used to rank the fuel break types.

Vegetation State	Preferred Fuel Break Type[1]	Methods and Tools By Fuel Break Type
Invasive Annual Grasses with Shrubs	**3: Mowed Fuel Break:** Method of treatment is relatively easy to implement in reducing the vegetation height and can be used in areas that have undergone conversion to invasive annual grassland or affected by repeated fire.	**Mowed Fuel Break:** The manipulation of vegetation through the use of a mowing implement.
Perennial Grasses and Forbs	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Mowed Fuel Break:** Method of treatment that is relatively easy to implement in reducing the vegetation height and can be used along all roads where mechanized equipment can be utilized. **2: Targeted Grazing Fuel Break:** Could be implemented in any areas to reduce the vegetation height. **3: Green Strip Fuel Break:** These types of fuel breaks would be limited to areas with exotic perennial seedings, where fire risk remains, or in areas with vegetation that is more resistant to invasive plant species introduction.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **Mowed Fuel Break:** Manipulation of vegetation through the use of a mowing implement. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep. **Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical and mechanical treatments. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up seeding treatments may be required to ensure success.
Perennial Grasses and Forbs with Shrubs	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Mowed Fuel Break:** Method of treatment that is relatively easy to implement in reducing the vegetation height and can be used along all roads where mechanized equipment can be utilized. **2: Targeted Grazing Fuel Break:** Could be implemented in any areas with sparse shrub layer, where grasses and forbs are present to reduce the understory vegetation height.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **Mowed Fuel Break:** Manipulation of vegetation through the use of a mowing implement or other mechanical treatments such as chaining, Dixie harrowing, or land imprinting, or through manual treatments utilizing handsaw or chainsaws, grubbing, or hoeing, or broadleaf chemical application. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep.

Vegetation State	Preferred Fuel Break Type[1]	Methods and Tools By Fuel Break Type
Perennial Grasses and Forbs with Shrubs	**3: Green Strip Fuel Break:** These types of fuel breaks would remove shrubs within the fuel break and retain the native understory. In areas with exotic perennial seedings, where fire risk remains, or in areas with vegetation that is more resistant to invasive plant species introduction.	**Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical and mechanical treatments. A broadleaf chemical treatment may be used to further reduce shrub cover, if needed. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up seeding treatments may be required to ensure success.
Perennial Grasses and Forbs with Invasive Annual Grasses	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Targeted Grazing Fuel Break:** Could be implemented in any areas to reduce the vegetation height. **2: Mowed Fuel Break:** Method of treatment that is relatively easy to implement in reducing the vegetation height and can be used in areas that have undergone conversion to invasive annual grassland or affected by repeated fire. **2: Green Strip Fuel Break:** These types of fuel breaks would be limited to areas with exotic perennial seedings, where fire risk remains, or in areas with vegetation that is more resistant to invasive plant species introduction.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep. **Mowed Fuel Break:** Manipulation of vegetation through the use of a mowing implement. **Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical and mechanical treatments. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up seeding treatments may be required to ensure success.
Shrubs and Perennial Grasses and Forbs with Invasive Annual Grasses	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5). **1b: Mowed Fuel Break:** Method of treatment that is relatively easy to implement and reduces vegetation height and can be used along all roads where mechanized equipment can be utilized. **2: Targeted Grazing Fuel Break:** Could be implemented in any areas with sparse shrub layer, where grasses and forbs are present to reduce the understory vegetation height.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **Mowed Fuel Break:** Manipulation of vegetation through the use of a mowing implement or other mechanical treatments such as chaining, Dixie harrowing, or land imprinting or through manual treatments utilizing handsaw or chainsaws, grubbing, or hoeing, or broadleaf chemical application. **Targeted Grazing Fuel Break:** Manipulation of vegetation through the use of cattle, goats, or sheep.

Vegetation State	Preferred Fuel Break Type[1]	Methods and Tools By Fuel Break Type
Shrubs and Perennial Grasses and Forbs with Invasive Annual Grasses	**3: Green Strip Fuel Break:** These types of fuel breaks would remove shrubs and invasive annual grasses from within the fuel break.	**Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical and mechanical treatments. A broadleaf chemical treatment may be used to further reduce shrub cover, if needed. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up seeding treatments may be required to ensure success.
Shrubs with Depleted Understory	**1a: Brown Strip Fuel Break:** Can be used along interstates and state highways or highly traveled corridors (roads with Maintenance Level 5).	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment.
	1b: Mowed Fuel Break: Method of treatment that is relatively easy to implement and reduces vegetation height and can be used along all roads where mechanized equipment can be utilized.	**Mowed Fuel Break:** Method of manipulating vegetation through the use of a mowing implement or other mechanical treatments such as chaining, Dixie harrowing, or land imprinting, or through manual treatments utilizing handsaw or chainsaws, grubbing, or hoeing, or broadleaf chemical application.
	2: Green Strip Fuel Break: Method of treatment involving multiple stages.	**Green Strip Fuel Break:** Removal of vegetation using prescribed fire or a combination of chemical and mechanical treatments. A broadleaf chemical treatment may be used to further reduce shrub cover, if needed. Followed by drill, aerial, or ground broadcast seeding (follow-up cover treatment using chaining, harrowing, or imprinting would follow broadcast reseeding). Follow up chemical and seeding treatments may be required to ensure success.
Sites with Pinyon or Juniper	**Phase I[2]:** Due to the low tree cover, fuel break establishment would be dependent on the dominant vegetation state as described above. Limbing of trees may be required to eliminate ladder fuel component.	**Phase I:** Identify dominant vegetation state to determine preferred fuel break type and reference treatment methods described above.

Vegetation State	Preferred Fuel Break Type[1]	Methods and Tools By Fuel Break Type
Shrubs with Depleted Understory	**Phase II or III[2]:** Fuel break establishment within these vegetation states would require treatment of both the overstory and understory. Overstory treatments would increase spacing between trees to reduce the canopy closure to reduce crown fire potential. Limbing remaining trees may be required to eliminate ladder fuel component. Understory treatments would be determined by vegetation states described above.	**Phase II or III:** Identify dominant vegetation state to determine preferred fuel break type and reference treatment methods described above. Mastication in phase II or III pinyon-juniper areas (Miller et al. 2008) would include aerial seeding before treatment, as needed on a site-specific basis, unless additional seedbed preparation occurs. Burn piles or other intensely burned areas, as found in jackpot burning, would also be seeded following burning as needed on a site-specific basis. Trees left in fuel breaks may require limbing to reduce ladder fuels.

Source: Shinneman et al. 2018; Monsen et al. 2004; Maestas et al. 2016; BLM interdisciplinary team input
[2] Phases refer to successional phases of pinyon-juniper. See glossary in **Appendix B, Section B.3** for definitions of the successional phases.

2.4 METHODS FOR FUEL BREAK CREATION AND MAINTENANCE

With some limitations among alternatives, fuel breaks would be constructed along a variety of road types including interstates, state highways, county roads, BLM-administered roads, and primitive roads, as well as along developed, linear ROWs such as transmission line routes. Cross-country fuel breaks would not be constructed. Fuel breaks would be constructed using a variety of widths, depending on site conditions, but they would be limited to a maximum of 500 feet; this includes both sides of the road but does not include the width of a roadway. If additional width is needed, additional analysis can be completed.

Methods described in Restoring Western Ranges and Wildlands (Monsen et al. 2004, pages 57-294) would be used for fuel break construction and maintenance under all action alternatives and are incorporated by reference. Additional tools not described in Monsen et al. (2004) are manual methods and targeted grazing; these are described below. BLM-approved chemical treatments (herbicides), application methods, and conditions of use are incorporated by reference in this document from the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statements and the Final PEIS on using Aminopyralid, Fluroxypyr, and Rimsulfuron (BLM 2007 pages 4-1 to 4-11, BLM 2016, pages 4-1 to 4-6), including all standard operating procedures contained therein. These include the following chemical treatments: 2,4-D, bromacil, chlorsulfuron, clopyralid, dicamba, diuron, glyphosate, hexazinone, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, triclopyr, imazapic, diquat, diflufenzopyr (in formulation with dicamba), fluridone, aminopyralid, fluroxypyr, and rimsulfuron. Chemical treatment application methods can be applied on the ground with vehicles or manual application devices or aerially with helicopters or fixed-wing aircraft (BLM 2007, pages 2-13 to 2-14). The success of any method or tool is subject to a wide variety of uncontrollable environmental factors; given this uncertainty, it is sometimes necessary to treat an area multiple times to achieve the desired objectives.

The BLM would follow the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015), which guides the development, availability, and use of seed needed for timely and effective restoration.

2.4.1 Manual Treatment Methods

Manual treatment involves the use of hand tools and hand-operated power tools to cut, clear, remove, or prune herbaceous and woody species to reduce fuel continuity. Potential hand tools that could be used include the handsaw, axe, shovel, rake, machete, grubbing hoe, mattock (combination of cutting edge and grubbing hoe), Pulaski (combination of axe and grubbing hoe), brush hook, and hand clippers. In addition, power tools, such as chainsaws and power brush saws, may be used.

2.4.2 Mechanical Treatment Methods

Mechanical treatments would be used where manual treatments would be impractical or too expensive. Mechanical treatment methods are for vegetation reduction or removal, seedbed preparation, seeding, and special uses and are described in detail in Monsen et al. (2004, pp. 65–88). Vegetation removal equipment includes agricultural mowers and masticators. An agricultural mower can be used to reduce the height of herbaceous vegetation. Masticators can also be used to cut and chop or grind vegetation which is usually left in place as mulch. A common type of masticator uses a rotary drum equipped with steel chipper tools to cut, grind, and clear vegetation. In addition, an air curtain burner can be used in wildland-urban interface (WUI) areas to remove vegetation, due to its low environmental impact from smoke. Seedbed preparation equipment includes disks and plows, chains and cables, pipe harrows, rails and drags, land imprinters, and root plows. Equipment used for seeding includes drills, broadcast seeders, seed dribblers, brillion seeders, surface seeders, interseeders, and hydro seeders. Finally, mechanical tools for special uses includes transplanters, roller choppers, dozers and blades, trenchers, scalpers and gougers, fire igniters, chemical sprayers, and steep-slope scarifier seeders. The selection of a particular mechanical method would be based on the characteristics of the vegetation, seedbed preparation or re-vegetation needs, topography and terrain, soil characteristics, and climatic conditions.

2.4.3 Prescribed Fire Methods

Prescribed fire can be used to reduce or modify existing fuel loads or prepare the ground for seeding. Qualified personnel would implement prescribed fire under specific weather and wind conditions. Implementation would comply with direction from the Departmental Manual 620, the BLM Manual 9214 Fuels Management and Community Assistance Manual, and the 9214 Manual and Handbook direction.

Examples of prescribed fire are broadcast, jackpot, and pile burning. Prior to broadcast burning, a fireline may be constructed via digging, wet line, or other means around the perimeter to assist in containment. The need for a fireline, how it is constructed, width, and length are based on site-specific conditions. The BLM would develop a prescribed fire burn plan in accordance with guidance in the PMS-484 Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2017). For a detailed description of prescribed fire treatments and techniques, see Monsen et al. (2004, pp. 101-120).

2.4.4 Targeted Grazing Methods

Targeted grazing uses livestock (goats, sheep, and/or cattle), intensively managed by a grazing operator, to consume vegetation within a specific area. Land managers would decide on a site-specific basis when and where to apply targeted grazing. This would be based on a number of factors, including vegetation state, desired vegetation objective, terrain, and current year growing conditions. A targeted grazing plan would be used to achieve objectives, while avoiding damaging nontarget species (see **Appendix D**, Design Features 19 through 22).

For fuel break maintenance scenarios in which targeted grazing may be used, repeated treatment may be necessary. Timing of targeted grazing treatment would depend on the vegetation being targeted and the objectives of the treatment, balanced with other design features.

Temporary fencing may be used to limit the grazing to the fuel break footprint. Where temporary fencing is not used, the grazing operator would follow a graduated-use plan to limit grazing impacts outside the fuel break footprint. (See **Appendix D, Section D.1** for a complete description of the graduated-use plan.)

2.5 Description of the Alternatives

A narrative description of each alternative is presented below and a table comparing the alternatives is shown in **Table 2-3**. A map of roads and ROWs within the project area boundary is shown in **Map 2** in **Volume 2, Appendix A**.

2.5.1 Alternative A—No Action Alternative

Under the No Action Alternative, a regional system of fuel breaks would not be constructed and maintained. Individual fuel break projects could be implemented when NEPA is completed at the site-specific level.

2.5.2 Alternative B

Under Alternative B, up to approximately 8,700 miles of new fuel breaks may be created. Assuming a 500-foot fuel break width, 8,700 miles represents approximately 529,000 acres that would potentially be disturbed. The potential treatment area under Alternative B would also be approximately 529,000 acres (see **Map 4** in **Appendix A**). Fuel breaks would be created along roads and the types of fuel breaks would be prioritized based on vegetation states (see **Table 2-2**).

Of the 8,700 potential miles of new fuel breaks, no more than 2,349 miles could be brown strips constructed using mechanical treatments (i.e., tilling). The potential number of miles of brown strips is calculated using roads within the potential treatment area that are categorized as Maintenance Level 5, which is defined as frequently traveled and maintained roads like interstates, state highways, county roads. Construction of brown strips along these types of roads would reduce the potential for the spread of human caused ignitions.

Under Alternative B, no more than 6,351 miles could be fuel breaks constructed using mechanical treatments (i.e., mowing). The potential number of miles of mowed fuel breaks is based on meeting the objective of reducing vegetation height along existing roads in vegetation states dominated by invasive annual grasses or perennial grass, forbs and shrubs (except for sagebrush) with less than 5 percent invasive annual grass cover.

Under Alternative B, green strips would not be created because the limitations on tools under this alternative, described below, would preclude their effective establishment and maintenance.

The types of tools proposed to create fuel breaks would be limited under Alternative B. Manual and mechanical treatments would be used, except for treating sagebrush. Prescribed fire, chemical treatments, and targeted grazing would not be used to create or maintain fuel breaks. Fuel breaks would be constructed and maintained with native species only, and intact areas characterized by high resistance and resilience (Chambers et al. 2014a) would not be treated but could be protected via treatment of adjacent areas.

2.5.3 Alternative C

Under Alternative C, up to approximately 11,000 miles (667,000 acres) of new fuel breaks may be created. Assuming a 500-foot fuel break width, 11,000 miles represents 667,000 acres that would potentially be disturbed. The potential treatment area under Alternative C would be approximately 792,000 acres (see **Map 5** in **Appendix A**). Fuel breaks would be created along roads and BLM-administered ROWs (Maintenance Levels 3 and 5). Prioritization based on vegetation states would be the same as for Alternative B and shown in **Table 2-2**.

Of the 11,000 potential miles of new fuel breaks, no more than 550 miles could be brown strips constructed using mechanical treatments (i.e., tilling). In addition, no more than 5,720 miles could be mowed or targeted grazing fuel breaks. Mowed fuel breaks would be as described for Alternative B. Targeted grazing fuel breaks could be created in all vegetation states except shrubs with depleted understory and Phases II and III pinyon-juniper.

Under Alternative C, no more than 4,730 miles of fuel breaks could be green strips constructed first by removing vegetation using both manual and mechanical treatments as described above, and then replacing this vegetation by drill, aerial, or ground broadcast seeding. It may be necessary to follow up with cover treatments using chaining, harrowing, or imprinting, especially following broadcast seeding. Further, where invasive annual grasses are present, the use of a preemergent chemical treatment would be applied after seeding to prevent the reestablishment of invasive annual grasses. Green strips could be created in all vegetation states except Phases II and III pinyon-juniper.

Manual, mechanical, and chemical treatments, prescribed fire, and targeted grazing could be used in all areas, including sites with sagebrush. Chemical treatments could be used in accordance with the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statements and the Final PEIS on using Aminopyralid, Fluroxypyr, and Rimsulfuron (BLM 2007, 2016) and existing local guidance. Fuel breaks would be constructed and maintained in accordance with the BLM's Integrated Vegetation Management Handbook (H-1740-2, see Chapter 8) and the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015). Native plant materials would be used in highly resistant/resilient sites. Fuel breaks could be created and maintained in areas of high resistance and resilience that have high fire probability or where adaptive management habitat triggers, as defined in applicable land use plans, have been tripped.

2.5.4 Alternative D—Preferred Alternative

Under Alternative D, up to approximately 11,000 miles (667,000 acres) of new fuel breaks may be created (over a potential treatment area of approximately 1,088,000 acres) (see **Map 6** in **Appendix A**). Fuel breaks may be created along roads, BLM-administered linear ROWs, and primitive roads (Maintenance Levels 1, 3, and 5). Prioritization based on vegetation states would be the same as for Alternative B and shown in **Table 2-2**.

The maximum miles of each fuel break type would be the same as described for Alternative C.

Management of manual, chemical, prescribed fire, and targeted grazing would be the same as under Alternative C. Fuel breaks would be constructed and maintained in accordance with the BLM's Integrated Vegetation Management Handbook (H-1740-2, see Chapter 8) and the National Seed Strategy. However, fuel breaks could be created in highly resistant and resilient sites without the constraints included in Alternative C.

2.5.5 Design Features

The BLM developed design features to minimize or eliminate adverse impacts of the action alternatives on identified resources (see **Appendix D**). BLM district and/or field office resource specialists would determine the locations of avoidance areas and where to apply design features to protect resources during fuel break creation and maintenance. Additional design features may be relevant to a given project on a site-specific basis, such as design features included in land use plans.

Table 2-3
Comparison of Alternatives

#		Alternative A: No Action	Alternative B	Alternative C	Alternative D (Preferred)
1.	Total miles (acres) of fuel breaks by potential fuel break type	N/A	Up to approximately 8,700 miles (529,000 acres) of new fuel breaks would be created over a potential treatment area of approximately 529,000 acres. Brown strips: expected to be no more than 2,349 miles. Mowed fuel breaks: expected to be no more than 6,351 miles. No targeted grazing or green strip fuel breaks would be created.	Up to approximately 11,000 miles (667,000 acres) of new fuel breaks would be created over a potential treatment area of approximately 792,000 acres with an additional with limitations. Brown strips: expected to be no more than 550 miles. Mowed or targeted grazing fuel breaks: expected to be no more than 5,720 miles. Green strip fuel breaks: expected to be no more than 4,730 miles.	Up to approximately 11,000 miles (667,000 acres) of new fuel breaks would be created over a potential treatment area of approximately 1,088,000 acres. The expected mileage of each fuel break type would be the same as Alternative C.
2.	Fuel break locations	N/A	Fuel breaks would be created along roads (Maintenance Level 5).	Fuel breaks would be created along roads (Maintenance Levels 3 and 5) and BLM-administered ROWs.	Fuel breaks would be created along roads, primitive roads (Maintenance Levels 1, 3, and 5), and BLM-administered ROWs.
3.	Highly resistant/resilient sites	N/A	Intact areas characterized by high resistance and resilience would not be treated but could be protected via treatment of adjacent areas.	Fuel breaks could be created and maintained in areas with high fire probability or where adaptive management habitat triggers have been tripped.	Vegetation would be treated throughout the project area.
4.	Prescribed fire	N/A	Prescribed fire would not be used.	Prescribed fire could be used.	Same as Alternative C
5.	Manual	N/A	Manual treatments could be used except for treating sagebrush.	Manual treatments could be used in all areas, including sites with sagebrush.	Same as Alternative C

#		Alternative A: No Action	Alternative B	Alternative C	Alternative D (Preferred)
6.	Mechanical	N/A	Mechanical treatments could be used except for treating sagebrush.	Mechanical treatments could be used in all areas, including sites with sagebrush.	Same as Alternative C
7.	Chemical	N/A	No chemical treatments would be applied to create or maintain fuel breaks.	Chemical treatments could be used in accordance with the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statements and the Final PEIS on using Aminopyralid, Fluroxypyr, and Rimsulfuron (BLM 2007, 2016) and existing local guidance.	Same as Alternative C
8.	Targeted grazing	N/A	No targeted grazing would be used to create or maintain fuel breaks.	Targeted grazing could be used to create or maintain fuel breaks.	Same as Alternative C
9.	Use of natives/nonnatives	N/A	Only native species would be used in construction and maintenance of fuel breaks.	Fuel breaks would be constructed and maintained in accordance with the BLM's Integrated Vegetation Management Handbook (H-1740-2, page 82) and the National Seed Strategy. In high resistant/resilient sites, only native species would be used.	Fuel breaks would be constructed and maintained in accordance with the BLM's Integrated Vegetation Management Handbook (H-1740-2, page 82) and the National Seed Strategy.

Source: BLM Interdisciplinary Team input

2.6 Alternatives Considered but Eliminated from Detailed Analysis

The alternatives discussed below were considered, but not analyzed in detail.

Use of wild horses and burros to reduce vegetation. During scoping, commenters suggested the use of wild horses and burros to manage vegetation, noting that, since wild horses eat cheatgrass, they could remove nonnative invasive annual grasses. This alternative was dismissed because it would not meet the purpose and need for the project. Wild horses and burros are to be managed within existing Herd Management Areas (HMAs) and within appropriate management levels (AMLs); therefore, such an alternative would be restricted to HMAs that presently are below minimum AMLs only. According to the Wild Free-Roaming Horses and Burros Act of 1971, as amended, wild horses and burros are to be managed as free roaming and at the minimum feasible level. Managing wild horses and burros in an intensive manner to ensure only target vegetation and areas are to be grazed would be contrary to the 1971 Act.

Creating fuel breaks solely in the WUI. The BLM considered constructing fuel breaks only in the WUI; however, this PEIS is intended to construct fuel breaks in order to protect a multitude of resources and not solely the WUI areas. While fuel breaks in the WUI may assist in providing firefighter staging areas and faster response in some areas, focusing only on the WUI would not meet the purpose and need in its entirety.

Constructing fuel breaks only in areas with nonnative vegetation. Scoping comments also suggested constructing fuel breaks only in areas with nonnative vegetation, such as invasive annual grasses and crested wheatgrass. This would be overly restrictive, since there is often a need to create fuel breaks in areas of native or mixed native/nonnative vegetation communities adjacent to intact sagebrush communities. Further, while this would provide opportunities for fire suppression and protection of intact native plant communities in some areas, it would be ineffective in meeting the purpose and need across the entire project area and would unduly restrict the location of fuel breaks.

Alternatives to fuel breaks. Scoping comments suggested alternatives to fuel breaks, such as increasing suppression by locating more fire personnel closer to important habitats and increasing aerial fire detection and suppression. These actions would complement fuel breaks, but they alone would not meet the purpose and need to slow the spread of wildfires, improve firefighter safety, and create buffers for maintaining important habitats.

2.7 Land Use Plan Conformance

This PEIS is in conformance with all applicable land use plans. Subsequent implementation-level actions will tier to this PEIS during site-specific NEPA compliance and will also document conformance with all applicable land use plans at that time. Guidance in land use plans within the project area supersedes management actions presented in this PEIS.

2.8 COMPARISON OF THE CONSEQUENCES OF EACH ALTERNATIVE

Table 2-4
Comparison of the Consequences of Each Alternative

Consequence	Alternative A No Action	Alternative B	Alternative C	Alternative D (Preferred)
Outcome	Fuel break projects would continue on a site-specific basis.	Up to 8,700 miles of new fuel breaks would be created over a potential treatment area of 529,000 acres.	Up to 11,000 miles of new fuel breaks would be created over a potential treatment area of 792,000 acres.	Up to 11,000 miles of new fuel breaks would be created over a potential treatment area of 1,088,000 acres.
Short-Term Impacts	No change in opportunities for fire suppression or ability to slow wildfire spread.	This alternative would increase opportunities for safer and more effective fire suppression actions; however, these opportunities would be limited based on location and extent of fuel break construction and maintenance. Construction would be limited to manual and mechanical treatments and roads (Maintenance Level 5); no prescribed fire, chemical treatments, or targeted grazing would be used to create or maintain fuel breaks. Further, no treatments would be used on sagebrush or high resistance and resilience sites; therefore, large portions of the project area would be excluded from fuel breaks.	Relative to Alternative B, there would be greater opportunities for more effective and safer wildfire suppression in the project area. Fuel breaks would be created along roads and BLM-administered ROWs (Maintenance Level 3 and 5). Further, more tools could be used for fuel break construction and maintenance, such as prescribed fire, chemical treatments, and targeted grazing. Manual and mechanical treatments could be used in areas with sagebrush. There would remain certain constraints on these tools, especially in areas with high fire probability or where adaptive management habitat triggers have been tripped.	Relative to the other alternatives, Alternative D would provide the most opportunities for fuel break creation and maintenance. Fuel breaks would be created along roads, primitive roads, and BLM-administered ROWs (Maintenance Level 1, 3, and 5). Further, the full suite of tools would be available to create or maintain fuel breaks, even in areas with sagebrush or in highly resistant and resilient sites. Short-term impacts would be as described for Alternative C.

Consequence	Alternative A No Action	Alternative B	Alternative C	Alternative D (Preferred)
Short-Term Impacts (Cont.)		These limitations would reduce short-term adverse impacts on such resources as wildlife, vegetation, soils, and air, which would relate to disturbance caused by fuel break construction and maintenance.	This also means that this alternative would have greater short-term adverse impacts related to disturbance from fuel break construction and maintenance.	
Long-Term Impacts	Projects would take longer to implement, which could limit fire suppression opportunities in the project area. Future fire intensity would be unconstrained by changes in the fuel bed, which would influence fire intensity and behavior could limit opportunities to safely suppress fire. This would have further impacts on resources within the project boundary, including degradation and loss of vital sagebrush communities and habitat, threats to firefighter safety, and consequences for communities in areas vulnerable to wildfire.	Programmatic analysis would streamline and accelerate the implementation of fuel break projects in the project area. Thus, over the long term, this alternative would increase opportunities to effectively suppress wildfire. This would increase opportunities for the preservation and protection of vital resources and communities within the project boundary.	Like Alternative B, programmatic analysis would streamline and accelerate the implementation of fuel break projects in the project area. Compared to Alternative B, the expanded availability of treatable locations and tools would increase opportunities for fuel break creation. This, in turn, would modify wildfire intensity and improve effective wildfire suppression, which would contribute to greater long-term preservation and protection of sagebrush communities within the project boundary.	Like Alternatives B and C, programmatic analysis would streamline and accelerate the implementation of fuel break projects in the project area. However, Alternative D would provide the greatest opportunities to modify wildfire intensity and improve effective wildfire suppression, thereby providing the greatest contribution to long-term preservation and protection of sagebrush communities within the project boundary.

Chapter 3. Affected Environment

This section provides an evaluation of the baseline condition of the environment (i.e., resources identified during internal and external scoping as requiring analysis) potentially affected by implementation of the alternatives. The evaluation is a description of the current condition (affected environment) of identified resource issues; consequences or effects expected from implementing each alternative are presented in **Chapter 4**. Maps are shown in **Appendix A**.

Elements of the human environment have been reviewed and the following are either not present in the project area, or would not be affected by any of the alternatives; therefore, they will not be addressed further in this document:

- Visual resources
- Wilderness Areas
- Wilderness Study Areas
- Wild and Scenic Rivers (including rivers found eligible and/or suitable)
- Lands with wilderness characteristics managed to maintain or enhance those characteristics
- Areas of Critical Environmental Concern
- National Scenic and Historic Trails
- Other special designations areas, such as National Conservation Areas and National Monuments
- Lands and realty
- Riparian resources
- Comprehensive travel and transportation management

Unless site-specific analysis is performed, fuel break construction, tools and methods proposed in this PEIS would not occur in the areas listed above, such as wilderness areas or riparian areas, or would not affect or change the management of other resources, such as lands and realty and comprehensive travel and transportation management. Accordingly, fuel break creation and maintenance would have no effect on these resources, and it is unnecessary to consider them further. A more detailed description of why these resources will not be addressed is presented in **Appendix G**.

3.1 Fire and Fuels

Weather conditions and topography influence vegetation conditions and wildfire behavior. For example, during the summer and early fall, generally June through early October, extended periods with limited precipitation allows vegetation to cure. Combined with frequent thunderstorms and wind events, cured vegetation conditions influence fire behavior, such as fire rates of spread, flame lengths, and spotting distances. There is also a higher probability of fire ignitions due to the continuing drying of fuels throughout the summer.

Fire has always been an integral natural process in most ecosystems. Past management practices, such as fire suppression and grazing management, combined with nonnative annual grasses invasions have affected vegetation conditions within the project boundary. These factors have resulted in an upward trend in the number of acres burned annually. The trend of larger areas being converted to annual grasses following fire leads to highly ignitable vegetation capable of escaping initial attack and spreading rapidly to other vegetation communities. Because annual grasses cure earlier in the season compared with perennial grasses and sagebrush, there is a trend of longer fire seasons, which further contributes to the amount of areas burned annually. **Figure 7** depicts the total acres burned from wildfires between 1960 and 2018 on BLM-administered lands in the project area.

Fuel break treatment history in the project area, shown in **Map 8**, influences fire behavior and provides direct attack suppression opportunities at a site-specific level. Fuel break type, location, and width are based largely on the vegetation conditions within which the fuel break is placed. The 12 general fuel models in the project area are described in **Appendix H, Section H.1**. Fuel models are grouped by fire-carrying fuel type. The number of fuel models in each fuel type varies (Scott and Burgan 2005). The rate of spread and flame length for these fuel models under the driest conditions are shown in **Appendix H** (see Rate of Spread and Flame Lengths for Fuel Types in the Project Area).

As depicted in **Table 4-3 and Appendix L**, wildfires in taller vegetation have longer flame lengths, which force firefighters to stay farther away from a wildfire for safety. Longer flame lengths increase the potential for fires to spot beyond fuel breaks. Wind speeds and slopes of the terrain influence the flame length and rate of spread of a wildfire (see **Appendix H**, Rate of Spread and Flame Lengths for Fuel Types in the Project Area).

Even with fuel breaks, crown fires and extreme surface fires can exhibit high rates of spread and flame lengths. Where these conditions exist, firefighters cannot safely engage in direct attack suppression at the head or flank of a fire. The surface fire characteristics chart in **Appendix K** includes curves for several flame lengths related to the rate of spread. It also contains symbols for fire suppression interpretations, ranging from fires that can be attacked by persons with hand tools to fires for which control efforts are ineffective (Andrews et al. 2011). Flame lengths greater than 4 feet are too intense for direct attack by persons using hand tools and require dozers, pumpers, and retardant aircraft to control. In vegetation conditions with corresponding flame lengths of less than 4 feet, crews using hand tools are generally able to directly attack the fire at the head or flank. In some areas within the project boundary, topography and limited access preclude direct attack suppression. Aircraft is often the only means of suppression. Fires in these areas can spread until they encounter different fuels, including within a fuel break, experience modified weather and topographic conditions, or are eventually suppressed via direct attack.

3.2 Air Resources

Air resources encompass climate, air quality, and the atmospheric components of changing climate conditions. BLM regulations require analysis of noise resources as a part of air resources; however, noise resources have been excluded from this analysis, as explained in **Appendix G**. In the BLM air resources management program, visibility and smoke management are considered a component of air quality (see **Appendix C** for a description of the Clean Air Act, Regional Haze Rule and EPA's Interim Air Quality Policy on Wildland and Prescribed Fires).

Air Quality

The EPA (2018a) has set national standards, National Ambient Air Quality Standards (NAAQS), for six classes of criteria air pollutants considered to be key indicators of air quality: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, particulate matter 10 microns or smaller (PM_{10}) and particulate matter 2.5 microns or smaller ($PM_{2.5}$). Although several pollutants listed as criteria air pollutants can be found in smoke, particulate matter is typically of most concern from a health and visibility standpoint and is a primary pollutant resulting from the combustion of fuels during wildfires and prescribed fires (NWCG 2018b).

$PM_{2.5}$ poses the greater risk to human health because the small size of the particles can cause respiratory and heart problems, particularly in sensitive populations (EPA 2018b). Notably, $PM_{2.5}$ is directly emitted into the atmosphere from combustion sources such as wildfire. The larger particles in PM_{10} are of less concern to human health, but they can be a localized source of reduced visibility in the form of windblown dust.

Wildfires are a significant contributor of particulate pollutants, especially from June through October, when smoke from wildfires is most abundant. Based on the National Emissions Inventory (EPA 2018c), agricultural burning, wildfires, and prescribed fires together made up 33 percent of national $PM_{2.5}$ emissions and 12 percent of national PM_{10} emissions in 2014. Most of the project area is in attainment with the national ambient air quality standards. Areas that are in nonattainment for PM_{10} and $PM_{2.5}$ are shown in **Map 9**. Smoke management agencies coordinate and, if necessary, limit prescribed fires in an airshed to minimize smoke-related impacts on human health and visibility.

Class I Areas and Visibility Protection

Class I areas within the project area boundary are shown in **Map 9**. Pollutants contributing to visibility impairment are sulfates, nitrates, organic carbon, elemental carbon, and crustal material (soil). Fires, including wildfire and prescribed fires, contribute to the formation of sulfates and nitrates and are a primary source of organic carbon and elemental carbon (Malm 2001). In the western United States, 25 to 40 percent of visibility impairment is attributable to organic carbon, and 5 to 15 percent of visibility impairment is attributable to elemental carbon (EPA 2003).

3.3 Soils

Soils in the project area are diverse and vary from arid saline soils to clayey glaciated soils. Similar soil types are grouped into soil orders (Jenny 1980). Ten soil orders are represented on public lands within the project boundary. A detailed description of soils by soil order is presented in the 2007 Programmatic EIS, Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (BLM 2007, pp. 3-7 to 3-9). According to BLM (2007), a majority of the project area is composed of aridisols, which have extreme water deficiency, low organic matter, and poor water infiltration. Such soils are populated by desert shrubs and bunchgrass (BLM 2007).

More detailed mapping of soils and associated information can be found in individual soil surveys completed for the western US; these are available at http://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/U34T.

Biological Soil Crusts

Biological soil crusts are commonly found on open spaces in semiarid and arid environments in the project area; however, data on the number of acres of biological soils crusts present in the project area is not available. Biological soil crusts provide important functions, such as improving soil stability and reducing erosion, fixing atmospheric nitrogen and contributing nutrients to plants, and assisting with plant growth (Belnap and Gardner 1993; Evans and Ehleringer 1993; Eldridge and Greene 1994; Belnap and Gillette 1998; Harper and Belnap 2001). Importantly, biological soil crusts present in warmer and drier sagebrush communities improve the resistance of such ecosystems by reducing the germination and establishment of invasive annual grasses such as cheatgrass (Chambers et al. 2014a).

Erodible Soils

Erodible soils are particularly prevalent in the semiarid rangelands found in the project area (BLM 2007). Portions of the project area that have been disturbed by events such as wildfire, road development, and extensive grazing, are now more susceptible to erosion. Soils susceptible to wind erosion in the project area are detailed in **Table 3-1**, below, and are shown in **Map 10**. Highly erosive soils have wind erodibility group (WEG) values of 1 or 2 and are classified as high WEG soils.

Table 3-1
Soils Susceptible to Wind Erosion

State	Acres of Highly Erodible Soils	Percent of Acres Administered by BLM in the Project Area
California	524,500	24
Idaho	794,800	7
Nevada	11,507,400	26
Oregon	1,509,100	11
Utah	2,116,600	11
Washington	44,300	14

Source: BLM GIS 2018

While erosion occurs under natural conditions, more vegetated areas and areas with biological soil crusts are less susceptible to erosion due to reduced wind erosion rates and reduced nutrient loss by dust emissions (Li et al. 2007). Disturbed areas, and areas with minimal herbaceous ground cover, such as in pinyon juniper stands, typically experience higher rates of erosion (Pierson et. al. 2013).

3.4 VEGETATION

Vegetation can be described using relative amounts of shrub, perennial grass and forb, and annual invasive grass foliar cover, as described in **Appendix F**, Vegetation Framework and Methodology. The range of cover classes for the shrub (sagebrush) and invasive annual grass and perennial grass and forbs (grasslands) components are shown in **Table 3-2.** Percent cover of conifer components (pinyon-juniper) is shown in **Table 3-3**. The percent cover of these vegetation components is a determining factor when describing the vegetation state, as shown in **Table 3-4**.

Table 3-2
Vegetation Cover Class Breakpoints

Vegetation Type	Percent Foliar Cover Class[1]
Low sagebrush	0–5
Intermediate sagebrush	6–14
Moderate sagebrush	15–25
High sagebrush	26+
Low invasive annual grass	0–5
Moderate invasive annual grass	6–25
High invasive annual grass	26+

Vegetation Type	Percent Foliar Cover Class[1]
Low perennial grass and forb	0–5
Moderate perennial grass and forb	6–19
High perennial grass and forb	20+

Source: BLM interdisciplinary team input. The table is derived from the vegetation management protocol developed by the BLM that should guide the most appropriate conservation strategy under commonly occurring site conditions. See **Appendix F** for this protocol.

[1]This column indicates the foliar cover ranges that characterize each vegetation type. Foliar cover is the percentage of ground covered by the vertical projection of the above ground portion of plants. It is distinguished from landscape cover, which is the proportion of a given area that is covered by the vegetation type.

Table 3-3
Conifer Habitat Classes with Cover Breakpoints

Conifer Habitat Class	Percent Foliar Cover[1] (Acres)
Phase 1 (unburned)	0–9 (5,315,000)
Phase 2	10–30 (3,406,000)
Phase 3	Over 31 (1,765,000)

Source: BLM interdisciplinary team input. The table is derived from the vegetation management protocol developed by the BLM that should guide the most appropriate conservation strategy under commonly occurring site conditions. See **Appendix F** for this protocol.

[1]This column indicates the foliar cover ranges that characterize each vegetation type. Foliar cover is the percentage of ground covered by the vertical projection of the above ground portion of plants. It is distinguished from landscape cover, which is the proportion of a given area that is covered by the vegetation type.

The analysis is limited to vegetation states in the following vegetation communities: sagebrush communities, grasslands, and pinyon-juniper woodlands (see **Table 1-2** which presents potential treatment area acreages).

Vegetation management treatments can be tailored by vegetation state. This helps to inform which vegetation treatments would most effectively create and maintain a fuel break, while increasing resilience to disturbance and enhancing resistance to invasive species (Chambers et al. 2014b).

Sagebrush

Kuchler (1970) describes two potential natural vegetation types in which sagebrush is dominant: the sagebrush steppe and the Great Basin sagebrush.

The sagebrush steppe vegetation type once occurred over approximately 44.8 million acres (Barbour and Billings 2000). It occurs in the northern portion of the project area, in northern California, Idaho, northern Nevada, Oregon, northern Utah, and Washington (Kuchler 1970); however, the sagebrush steppe vegetation type has been converted to farmland in portions of the project area, and fire suppression, excessive livestock grazing, and invasive annual grass expansion have been responsible for permanent degradation (Pellant 1994, McIver et al. 2010). This is when vegetation moves from one stable state to another and cannot return to its previous state without active management (Briske et al. 2006). Degraded areas correspond to the vegetation states invasive annual grasses with shrubs, shrubs and perennial grasses and forbs with invasive annual grasses, and shrubs with depleted understory, as summarized in **Table 3-4**. Vegetation states are shown in **Map 3** (**Appendix A**).

At sites in higher elevations with greater precipitation levels and higher soil moisture content, sagebrush steppe vegetation is more resistant to cheatgrass invasions and wildfires and more resilient to disturbances (Chambers et al. 2014b).

Table 3-4
Description of Vegetation States within the Analysis Area

Vegetation State	Percent Cover by Vegetation Type			Description	Acres
	Shrub	Perennial Grass and Forb	Invasive Annual Grasses		
Barren/sparsely vegetated	0–5 (low)	0–5 (low)	0–5 (low)	Rock, playas, and open water	5,168,000
Invasive annual grasses	0–5 (low)	0–5 (low)	6+ (moderate to high)	Sites dominated by invasive annual grasses (may include *Poa* spp.)	1,940,000
Invasive annual grasses with shrubs	6–25 (low to moderate)	0–5 (low)	6–26 (moderate to high)	Sites dominated by invasive annual grasses and shrubs	2,983,000
Perennial grasses and forbs	0–5 (low)	6+ (moderate to high)	0–5 (low)	Sites dominated by perennial grasses and forbs, including exotic seedings	1,329,000
Perennial grasses and forbs with shrubs	6+ (intermediate to high)	6+ (moderate to high)	0–5 (low)	Intact vegetation and similar to reference state	7,211,000
Perennial grasses and forbs with invasive annual grasses	0–5 (low)	6+ (moderate to high)	6+ (moderate to high)	Perennial grassland with invasive annual grasses occupying interspaces	3,291,000
Shrubs and perennial grasses and forbs with invasive annual grasses	6+ (intermediate to high)	6+ (moderate to high)	6+ (moderate to high)	Intact vegetation with invasive annual grasses occupying interspaces	8,202,000
Shrubs with depleted understory	15+ (moderate to high)	0–5 (low)	0–26+ (low to high)	Shrub-dominated vegetation	6,162,000

Source: BLM interdisciplinary team input. The table is derived from the vegetation management protocol developed by the BLM that should guide the most appropriate conservation strategy under commonly occurring site conditions. See **Appendix F** for this protocol.

In contrast to the sagebrush steppe vegetation type, the Great Basin sagebrush type occurs south of the sagebrush steppe and north of the creosote (*Larrea tridentata*) and blackbrush (*Coleogyne ramosissima*) deserts. The Great Basin sagebrush type is more arid and resembles deserts, whereas the sagebrush steppe type is similar to a semiarid grassland. The open density, erosive soils, and low herbaceous cover contribute to the vulnerability of this sagebrush type to plant invasions. Overall, the stability of the Great Basin sagebrush type is less than that of the sagebrush steppe type (Barbour and Billings 2000).

Within both the sagebrush steppe and Great Basin sagebrush types (hereinafter referred to as "sagebrush communities"), there are two groups of sagebrush: tall and low. These groups are generally differentiated by the soil types they occur on. The tall sagebrush group typically comprises four major subspecies of big sagebrush (*A. tridentata*): Basin big sagebrush (*A. t.* ssp. *tridentata*), Wyoming big sagebrush (*A. t.* ssp. *wyomingensis*), mountain big sagebrush (*A. t.* ssp. *vaseyana*), and scabland big sagebrush (*A. t.* ssp. *xericensis*). Each of the subspecies occurs within a range of site conditions that include all soil textural classes.

The low sagebrush group comprises the sagebrush species little sagebrush (*A. arbuscula*) and black sagebrush (*A. nova*), species that are widely dominant in the western United States (Steinberg 2002). The low sagebrush group is particularly susceptible to fire damage. These species are usually killed by fire and do not resprout (Steinberg 2002). Site conditions are typified by relatively widely-spaced shrubs with limited herbaceous cover in the interspaces. Grass productivity is often limited by adverse growing conditions, such as eroded surfaces that expose clay-textured and calcified soils (Barbour and Billings 2000, Steinberg 2002). The low sagebrush group is relatively tolerant of wet conditions that arise due to ponding from topography and relatively low permeability of these soil types (Barbour and Billings 2000).

Grasslands

Grasslands in the Great Basin include vegetation states dominated by native perennial grasses, invasive annual grasses, and nonnative, perennial grasses. Perennial grasslands generally correspond to the perennial grasses and forbs and perennial grasses and forbs with invasive annual grasses vegetation states as summarized in **Table 3-4**. Common perennial grasses associated with sagebrush communities are Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and Sandberg bluegrass (*Poa secunda*) (Barbour and Billings 2000). Grasslands in the sagebrush community also include perennial, nonnative seeded species such as crested wheatgrass (*Agropyron cristatum*), which has been widely seeded in arid and semi-arid regions of the Western US (Zlatnik 1999).

In many places, repeated fire in areas with shortened fire return intervals has caused cheatgrass (*Bromus tectorum*) to replace sagebrush communities (Barbour and Billings 2000). These areas generally correspond to the invasive annual grassland and invasive annual grasses with shrubs vegetation states as summarized in **Table 3-4**. Degraded areas with a reduced cover of perennial grasses are more susceptible to the invasion of annual grasses, such as cheatgrass, as well as the encroachment of pinyon-juniper woodlands.

Pinyon-Juniper Woodlands

As noted above, portions of sagebrush communities in the project area are now characterized by encroaching pinyon-juniper woodlands as shown in **Table 3-3**. This contributes to the loss of sagebrush-dominated areas and increases the risk of high-severity fires. Such fires are the result of increased fuel loading and the creation of dense, closed-canopy woodlands susceptible to crown fires (Chambers et al. 2014b; Rowland et al. 2008).

The trend of increasing rates of pinyon-juniper woodland establishment is expected to continue. This is due to factors such as fire suppression, and changes in climate conditions, such as rising temperatures and increased atmospheric carbon dioxide (Rowland et al. 2008). Pinyon-juniper encroachment has been more pervasive in the more arid Great Basin sagebrush communities. This is because the Great Basin sagebrush type is generally less resistant to wildfires and less resilient to disturbances than the sagebrush steppe type (Chambers et al. 2014b). In the sagebrush steppe, co-dominance of perennial grasses, greater densities of shrubs, and higher soil moisture generally limit pinyon-juniper woodland invasion.

In Miller et al. (2014a), the encroachment of pinyon-juniper woodlands is described as successional phases, which proceed from shrub- and herb-dominated communities to woodland-dominated communities. These successional phases are used to determine appropriate vegetation management treatments. Phase I is represented as a shrub- and herb-dominated community, where trees may be present but make up less than 10 percent of the canopy cover. In Phase II, trees and shrubs are codominant and the tree canopy ranges from 10 to 30 percent. In Phase III, the trees are the dominant vegetation and tree canopy cover is greater than 30 percent.

3.5 WILDLIFE

The project area provides habitat for 3,000 species of amphibians, reptiles, birds, and mammals, many of which have been affected by increasing frequency and size of wildfires. The status and condition of vegetation types in the project area are described in **Section 3.4**, Vegetation; they reflect the availability of wildlife habitat features in the project area. **Maps 11** and **12** show the locations of sagebrush and pinyon-juniper habitats, respectively, across the project area. The condition of these habitats influences the extent to which certain wildlife species use them. For example, some sagebrush-obligate species avoid areas with juniper encroachment or low sagebrush cover, while areas with dense herbaceous understories would have commensurately higher species diversity. Site conditions are described by the percent cover of the shrubs, invasive annual grasses, perennial grasses and forbs, and conifer components (**Tables 3-2** and **3-3**; vegetation states are presented in **Table 3-4**).

Terrestrial Wildlife Species

Big Game

Big game are among the species that use habitat in the project area. They include elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*). Some species, such as mule deer, have broad habitat needs and depend on both sagebrush and pinyon-juniper vegetation communities; others, such as pronghorn, use mainly sagebrush, avoiding denser vegetation (NatureServe 2018). See **Map 13** for a map and **Table 3-5** for the acreage of big game habitat in the project area.

Table 3-5
Big Game Habitats in the Project Area

Species	Acres of All Habitat Types	Acres of Crucial Winter Range
Bighorn sheep	12,163,000	24,000
Mule deer	65,741,000	3,985,000
Pronghorn	54,251,000	1,666,000
Elk	26,712,000	N/A

Source: BLM GIS 2018

The high nutrient levels of sagebrush and availability above snow during winter make it a good source of forage for big game species. Animal preference of sagebrush varies with subspecies, populations, and even individual plants, due to chemical variation found in the foliage. Deer and elk tend to prefer mountain big sagebrush, followed by Wyoming big sagebrush, and finally basin big sagebrush (USDA

2018). The BLM assessed the condition of habitat for big game species throughout the project area, based on sagebrush cover, pinyon-juniper threat, and invasive annual grass threat (**Table 3-6**).

Table 3-6
Big Game Habitat Conditions in the Project Area

Species	Sagebrush Cover[1]		Pinyon-Juniper Threat[2]		Invasive Annual Grass Threat[3]	
	All habitat	Crucial Winter Range	All habitat	Crucial Winter Range	All habitat	Crucial Winter Range
Bighorn sheep						
Low	1,525,000	2,000	840,000	0	3,383,000	5,000
Moderate	0	0	378,000	0	0	0
Moderate/High	5,954,000	6,000	0	0	4,096,000	3,000
High	0	0	172,000	0	0	0
Mule deer						
Low	10,323,000	691,000	5,663,000	468,000	23,823,000	1,652,000
Moderate	0	0	3,553,000	450,000	0	0
Moderate/High	40,422,000	2,596,000	0	0	26,922,000	1,635,000
High	0	0	1,798,000	266,000	0	0
Pronghorn						
Low	10,459,000	432,000	2,352,000	79,000	17,527,000	496,000
Moderate	0	0	1,020,000	23,000	0	0
Moderate/High	28,846,000	789,000	0	0	21,778,000	725,000
High	0	0	268,000	10,000	0	0
Elk						
Low	3,145,000	0	2,511,000	0	11,005,000	0
Moderate	0	0	2,070,000	0	0	0
Moderate/High	16,940,000	0	0	0	9,080,000	0
High	0	0	1,203,000	0	0	0

[1]Low and moderate/high levels of sagebrush cover correspond to 0–5% and 6% or greater cover, respectively,
[2]Low, moderate, and high levels of pinyon-juniper threat correspond phase 1, phase 2, and phase 3 canopy cover, respectively,
[3]Low and moderate/high levels of invasive annual grass threat correspond to 0–5% and 6% or greater cover, respectively,

Source: BLM GIS 2018

Small Mammals

Terrestrial mammals, such as ground squirrels, cottontails, and mice, are common throughout much of the project area. Rodents and other small mammals use structural features, such as rocks and snags, to hide from predators and to avoid extreme temperature. Vegetation, cover, elevation, soil, and other factors influence the distribution of species; many small mammals use features of both sagebrush and pinyon-juniper vegetation.

Small mammal species that rely on pinyon-juniper woodlands for security and forage include mountain cottontail (*Sylvilagus nuttallii*) cliff chipmunks (*Tamias dorsalis*), rock squirrels (*Spermophilus variegatus*), brush mice (*Peromyscus boylii*), pinyon mice (*P. truei*), rock mice (*P. difficilis*), deer mice (*P. maniculatus*), white-throated woodrats (*Neotoma albigula*) desert woodrats (*N. lepeda*) and Mexican woodrats (*N. mexicana*) (Findley et al. 1975, in Gottfried et al. 1995).

Sagebrush provides thermal cover, security, and food for many small mammals. Species that are associated with sagebrush vegetation communities include black-tailed jackrabbits (*Lepus californicus*), white tailed jackrabbits (*L. townsendii*), desert cottontails (*Sylvilagus audubonii*), mountain cottontails (*S. nuttallii*), deer mice (*Peromyscus* spp.), Merriam's shrew (*Sorex merriami*), and kangaroo rats (*Dipodomys* spp.) (McAdoo et al. 2003). Many of these species use sagebrush seasonally or occasionally, while others, such as the sagebrush vole (*Lemmiscus curtatus*), are sagebrush-obligates and require sagebrush for at least part of their life cycles (McAdoo et al. 2003).

Many species of bats may be found in both sagebrush and pinyon-juniper habitats. Roost sites are widely distributed and include rock crevices, trees, caves, buildings, and bridges. Bat species that are commonly found in pinyon-juniper habitats include eight species of *Myotis*, big brown bats (*Eptesicus fuscus*), spotted bats (*Euderma maculatum*), western pipistrelles (*Pipistrellus hesperus*), and pallid bats (*Antrozous pallidus*) (Findley et al. 1975, in Gottfried et al. 1995). At least nine species may be found in sagebrush habitats, but many are more closely associated with caves, rock crevices, and water sources (McAdoo et al. 2003).

Raptors

Many raptor species, including a wide variety of hawks, falcons, and bald and golden eagles, inhabit the project area permanently or as migrants. Bald eagles prefer to nest in tall trees close to open bodies of water with access to fish and waterfowl. They are known to use sagebrush habitats, such as deer winter range, where they often forage for deer and other mammal carcasses during the winter and to a lesser extent throughout the remainder of the year. Golden eagles are found near mountainous areas in open country and nest on cliffs or large trees throughout the project area. Open foraging raptor species, such as ferruginous hawks (*Buteo regalis*), may nest in pinyon-juniper near the edge of open grasslands and shrublands, especially outlier trees from main woodlands (Gillihan 2006).

Migratory Birds

Diverse bird species use a variety of habitats for breeding, nesting, foraging, and migration throughout the project area. Both sagebrush and pinyon-juniper provide food, security, and nesting sites for various bird species. A representative list of migratory bird species with the potential to occur in the project area are listed in **Appendix I**. In the project area, fragmentation and loss of sagebrush cover and invasive annual grass conversion have decreased habitat suitability for sagebrush-dependent species.

The Birds of Conservation Concern 2008 report (USFWS 2008) identifies migratory and non-migratory bird species with the highest conservation priorities (beyond those species already designated as federally threatened or endangered). The project area overlaps the Great Basin Bird Conservation Region (BCR) 9, the Northern Rockies BCR 10 (US portion only), and the Southern Rockies/Colorado Plateau BCR 16 (USFWS 2008).

BirdLife International identified Important Bird and Biodiversity Areas (IBAs) as areas that are globally important for the conservation of bird populations using an internationally agreed set of criteria. The project area overlaps 38,018,000 acres of IBAs, including 871,000 acres in California, 7,071,000 acres in Idaho, 17,508,000 acres in Nevada, 6,795,000 acres in Oregon, 5,743,000 acres in Utah, and 29,000 acres in Washington (BLM GIS 2018).

Reptiles and Amphibians

Western rattlesnakes (*Crotalus viridis*), gopher snakes (*Pituophis catenifer*), leopard lizards (*Gambelia wislizenii*), horned lizards (*Phrynosoma hernandesi*), and other reptiles also occupy sagebrush habitat, typically using talus slopes, cliffs, and rock outcrops as nesting and feeding habitat, thermal and escape cover, and nesting sites. Amphibians inhabit only areas near water sources that may be surrounded by sagebrush or other upland habitat (McAdoo et al. 2003).

Likewise, pinyon-juniper woodlands provide valuable cover and habitat for various reptiles, including the northern desert horned lizard (*Phrynosoma platyrhinos platyrhinos*), Great Basin fence lizard (*Sceloporus occidentalis biseriatus*), Great Basin whiptail lizard (*Cnemidophorus tigris tigris*), and Great Basin gopher snake (*Pituophis melanoleucus deserticola*) (Llewellyn 1980).

Invertebrates

Previous studies reviewed the diversity of communities of soil-associated invertebrates from arid deserts that adjoin pinyon-juniper woodlands (Crawford 1986, 1990, in Gottfried et al. 1995). While invertebrate communities in sagebrush are not as well understood, they are important to an area's effectiveness as wildlife habitat. Invertebrates provide high-protein forage, especially in spring and early summer, when plant protein is not yet available (WGFD 2017). Invertebrates are the primary pollinators of sage-grouse preferred forbs thus helping to proliferate important components of the sage-grouse diet. Insect diversity can be attributed to large, diverse, and relatively undisturbed areas of sagebrush habitat.

3.6 Special Status Species

Threatened and endangered species and BLM sensitive species that occur or have the potential to occur in the project area are listed in in Appendix J, Special Status Species in the Project Area.

The special status species with the potential to occur in the project area were grouped by habitat association into the following three groups: sagebrush-dependent species, grassland-dependent species, and pinyon-juniper-dependent species. Representative species for the sagebrush-dependent species group include the greater sage-grouse (*Centrocercus urophasianus*) (including the Bi-State DPS), pygmy rabbit (*Brachylagus idahoensis*) (including the Columbia Basin DPS), black-tailed jackrabbit (*Lepus californicus*), and slickspot peppergrass (*Lepidium papilliferum*). The greater sage-grouse, which is an important sagebrush obligate and whose habitat needs are similar to other sagebrush species, is discussed in further detail below.

Representative grassland-dependent species include the burrowing owl (*Athene cunicularia*), Carson wandering skipper (*Pseudocopaeodes eunus obscurus*), and Palouse thistle (*Cirsium brevifolium*). Representative pinyon-juniper-dependent species include the ferrigunous hawk, pinyon jay (*Gymnorhinus cyanocephalus*), and Barneby ridge-cress (*Lepidium barnebyanum*).

Greater Sage-Grouse

Greater sage-grouse is a sagebrush-obligate species; it relies on sagebrush on a landscape level and on a microhabitat scale. Greater sage-grouse require large, intact, interconnected expanses of sagebrush shrubland (Connelly et al. 2004; Wisdom et al. 2011). As a landscape-scale species, greater sage-grouse move between habitats seasonally, and they generally require contiguous winter, breeding, nesting, and summering habitats to sustain a population (Connelly et al. 2011).

Sagebrush habitats vary considerably across the range of greater sage-grouse. They use tall, woody big sagebrush subspecies year-round, but shorter species such as black sagebrush (*A. nova*) may provide important winter, nesting, and brood-rearing habitat. Occasionally, they use shrub species, such as rabbitbrush (*Chrysothamnus* spp.), for nesting cover (Connelly et al. 2011).

During the spring breeding season, male greater sage-grouse congregate to perform courtship displays to attract females in areas called leks. Males begin gathering near leks in late winter and stay on leks through spring. Leks are frequently located in open sites, surrounded by dense sagebrush cover, and sage-grouse use the same lek sites year after year (Connelly et al. 2011). Leks are an indication of nearby nesting habitat (Bradbury et al. 1989; Fedy et al. 2012) and early brood-rearing habitat. In the project area, approximately 34,556,000 acres are within a 6.2-mile distance of occupied leks.

The 2019 BLM Greater Sage-Grouse Records of Decision and Approved Resource Management Plan Amendments, as amended (BLM 2019a, b, c, and d), identified specific habitat management areas for the greater sage-grouse, as shown below in **Table 3-7**.

Table 3-7
Greater Sage-Grouse Habitat Types in the Project Area

Greater Sage-Grouse Habitat Areas[1]	Description	Acres in Project Area
Priority areas for conservation (PACs)[2]	Areas identified in the USFWS Conservation Objectives Team report (USFWS 2013) as essential for greater sage-grouse conservation	29,167,600
Priority habitat management areas (PHMAs)	BLM-administered lands identified as having the highest habitat value for maintaining sustainable greater sage-grouse populations; PHMAs largely coincide with PACs.	20,010,500
Important habitat management areas (IHMAs)	BLM-administered land in Idaho that provides a management buffer for and that connects patches of PHMAs; IHMAs encompass areas of generally moderate to high habitat value or populations but are not as important as PHMAs.	2,737,200
General habitat management areas (GHMAs)	BLM-administered greater sage-grouse habitat that is occupied seasonally or year-round and is outside of PHMAs	13,382,900
Other habitat management areas (OHMAs)	BLM-administered land in Nevada and northeastern California, identified as greater sage-grouse habitat that contains seasonal or connectivity habitat areas	4,869,700

Source: BLM 2019a, b, c, and d; USFWS 2013

[1] PHMA, GHMA, OHMA and IHMA are not identified in Washington.
[2] This is not a discrete habitat category and may overlap categories below.

3.7 CULTURAL AND TRIBAL RESOURCES

Cultural resources present in the project area include archaeological sites, historic and architectural buildings and structures, other resources with important public and scientific uses, and sites of traditional cultural or religious importance to specific social or cultural groups.

Tribal resources are a subset of cultural resources and include a wide range of overlapping economic, social, traditional, and religious practices and uses. They are also found throughout the project area. Economic resources can include treaty obligations and Indian Trust Assets (ITAs). Common examples of ITAs and treaty rights may be lands, minerals, hunting and fishing rights, water rights, other natural resources, and financial assets. Currently, tribal members may be using public lands for subsistence, religious, and other cultural purposes.

The Great Basin and the Plateau cultural regions overlap the project area. Highly varied climate patterns, landforms and distinct culture histories within the regions have resulted in diverse cultural traditions and adaptations over thousands of years. These diverse traditions are evidenced primarily by archaeological sites and ongoing contemporary use by modern Native Americans.

Prehistoric archaeological sites of the Great Basin and Plateau culture regions are as varied as the project area itself. Isolated Paleo-Indian artifacts have been found within the project boundary, particularly in Utah and the western Great Basin. Other site types found include village sites with pit houses and later architecture, seasonal sites, temporary camps, burials, caches, rock art, and agricultural features. Locations and geographic features, caves, valley floors, and margins of pluvial lakes (Elston 1986), have been identified as particularly likely to contain one or several of these site types, depending on the time period and setting.

Historic period activities included mining, ranching, farming, railroad construction, and trail establishment. Historic-era cultural resources are early exploration settlements and camps, mineral exploration and mining locales, mining camps, historic farms and ranches, railroad tracks and associated boom towns, and historic trail routes and associated towns.

The locations of cultural resources are recorded through site- and project- specific inventories. Only portions of the project area have been inventoried to current standards, so the affected environment for cultural resources can be described in general terms only, until the fuel breaks locations are defined and required site- and project-specific inventories and analyses are conducted.

The identification and location of tribal resources and tribal interests in projects is also determined on a site- and project-specific basis. Although tribal members may use BLM-administered land resources for cultural, religious, and subsistence purposes, the BLM may not know specific locations of resources or the traditional importance of some areas. Tribal members may be reluctant to share knowledge of areas of traditional importance outside their own communities based on maintaining cultural values and religious perspectives.

While specific locations of tribal resources relevant to fuel breaks cannot be determined, tribal resources that have been identified as part of the affected environment of the project area include the following:

- Habitats for fish, wildlife, and plants of traditional cultural value to the tribes;
- Gathering locations for plants, forest products and materials for traditional subsistence, religious, tool making, or other activities; and
- Locations of religious and spiritual interest including ancestral village sites, graves, prayer sites, pictographs, petroglyphs, talus/cache pits, rock cairns and alignments, and various other locations

3.8 Paleontological Resources

The project area includes paleontological resources preserved in sedimentary geologic units of Precambrian to Pleistocene age and surface exposures or localities. These resources have experienced loss or destruction due to surface exposures and unlawful collections throughout the project area.

The BLM uses the Potential Fossil Yield Classification (PFYC) system to determine which geologic units have known or predicted fossil resources, and hence whether additional inventory or mitigation should be considered before the project begins. The potential for fossils to be present or affected in areas proposed for fuel breaks is highly variable and is assessed on a site- and project-specific basis.

3.9 RECREATION

The BLM's recreation program aims to sustain healthy land and water resources while promoting appropriate and responsible visitor use of those lands and waters (BLM 2014). The BLM focuses on managing recreation settings that produce recreation and tourism opportunities, allowing visitors the freedom to pursue activities that produce their desired outcome. Demand for recreational land has increased across the project area. Recreational activity in the project area has also been steadily increasing, as population growth continues and outdoor recreation activities on public lands has been growing in popularity (See BLM 2018b). The types and quality of recreation experiences vary, as do visitors' expectations and desired outcomes. Qualities and conditions of different recreation settings can result in distinctive recreation experiences and benefits.

Public lands provide visitors with a wide range of developed and dispersed recreation opportunities, including hunting, fishing, camping, hiking, cross-country skiing, boating, hang gliding, OHV driving, mountain biking, birding, scenery viewing, and visiting natural and cultural heritage sites. Many recreation opportunities depend on roads and trails for access. Recreation sites can include campgrounds, boat ramps, trailheads, picnic areas, informational kiosks, and visitor centers.

Recreation site visits and dispersed area visits to each state in the project area in 2016 are represented in **Table 3-8**, below.

Table 3-8
Estimated Recreation Use of BLM-Administered Lands During Fiscal Year 2016

State	Recreation Site Visits	Dispersed Area Visits
Idaho	2,933,000	3,121,000
Nevada	3,408,000	4,228,000
California	4,942,000	4,550,000
Oregon/ Washington	4,108,000	4,626,000
Utah	3,404,000	3,897,000

Source: BLM 2017

3.10 LANDS WITH WILDERNESS CHARACTERISTICS

Lands with wilderness characteristics are generally roadless areas of at least 5,000 acres of contiguous public lands that appear to have been affected primarily through the forces of nature, with the imprints of humans being substantially unnoticeable. Additionally, lands with wilderness characteristics provide outstanding opportunities for solitude or primitive and unconfined types of recreation and may contain areas which contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Lands with wilderness characteristics are present throughout the project area, and there is increasing regional interest for recreation opportunities across the project area, including in areas with wilderness characteristics. This PEIS addresses lands with wilderness characteristics that are managed to emphasize other multiple uses as a priority over protecting wilderness characteristics. Since these areas are not mapped throughout the project area, an accurate acreage of them is not available. Other lands with wilderness characteristics would not have the potential for significant impacts from the actions in this programmatic EIS because those areas were excluded from the analysis area and, so, were dismissed (see **Appendix G**).

3.11 Social and Economic Conditions

This section describes the data used for analysis of social and economic uses in the project area. More detailed data and a discussion of conditions and trends, including current conditions, trends, population and migration, housing, income distribution and poverty level, jobs and employment, public services, fiscal conditions, local economic activity, market and commodity values, nonmarket values, and ecosystem services, are provided in the Socioeconomic Baseline Report, which can be found on the project's website.

Wildland Urban Interface

The buffer distance used to define the Wildland Urban Interface (WUI) used in this analysis is 1.5 miles (2.4 kilometers) around at-risk communities as defined in the Healthy Forests Restoration Act of 2003. The WUI in the project area contains approximately 17.8 million acres of WUI on BLM-administered lands and approximately 51 million acres of WUI on non-BLM-administered lands.

Demographic and Economic Overview

The six states included in the project area vary greatly in population. Since 2000, the population growth rate in the project area has been twice the United States average. In many areas, housing has expanded into the WUI to accommodate population growth. Approximately 17.3 percent of the project area WUI contains homes (Gude et al. 2008; Headwater Economics 2018). It is likely that the number of homes in the WUI and the amount of resources dedicated to preventing, suppressing, and fighting fires there will increase.

As seen in **Table 3-9**, unemployment rates in the project area are generally similar to the national average and have been for the past 10 years. Since 2008, state-level unemployment rates have been decreasing in the project area.

Table 3-9
Project Area Employment and Unemployment (2017)

State	Labor Force	Unemployment	Unemployment Rate
Washington	3,724,722	177,292	4.8
Idaho	833,462	26,299	3.2
Nevada	1,462,955	73,583	5.0
California	19,311,958	918,881	4.8
Utah	1,560,846	50,638	3.2
Oregon	2,104,078	86,786	4.1
United States	**160,597,000**	**6,982,000**	**4.4**

Source: Bureau of Labor Statistics 2018

Note: Annual unemployment rate for 2017; reflects revised population controls and model re-estimation.

Across the project area, the greatest percentage of each states population is employed in service industries. Farming, agriculture, forestry and fishing and other jobs more directly related to public land use represent a minor portion of the state employment; however, these jobs may represent a higher proportion of employment at the local level.

Contributions from Public Lands

Contributions from public lands in the project area include those from livestock grazing, fluid mineral leasing, mining, recreation, ROW development, forest and woodland products, and revenue generated from payments in lieu of taxes (PILT). For FY 2016, the total revenue generated by receipts received by the BLM for ROW development, including for solar and wind projects, amounted to over $47,000,000 (BLM 2017). Value of all receipts from all wood product sales on BLM administered lands in the project area was $46,569,501 in FY 2016 (BLM 2017). PILT payments are Federal payments to local governments intended to help offset losses in property taxes due to non-taxable Federal lands within their boundaries. PILT payments for all Department of Interior (DOI) lands within each state in the project area for FY 2017 totaled $184,966,879 (DOI 2018).

In 2017, BLM lands in the project area supported a total of 6,001,584 active animal unit months of forage allocated to livestock grazing. In fiscal year (FY) 2016, livestock grazing licenses, leases, and permit receipts for the project area was $6,154,503 (BLM 2017).

Revenue related to oil and gas leasing and mining is difficult to determine, given the decentralized nature of the industries. However, the BLM reported that lease sale results for the calendar year 2017 in Utah amounted to $5,959,807; and in Nevada, $5,959,807 (BLM 2018c). According to the 2017 Public Land Statistics Report from 2017, the grand total value from new contract sales and use permits issued related to mining during fiscal year 2017 was $13,064,278 (BLM 2018c). For existing contracts and permits, the grand total value was $11,743,229 (BLM 2018c). Also based on FY 2016 data, there were a total of 176 applications for permits to drill for oil and gas and 1,879 producing leases on BLM-administered lands in the project area. In addition, in FY 2016, the BLM reviewed 267 notices and plans of mining operations. Receipts from mineral leases and permits in the project area totaled $3,445,484 (BLM 2017). Additional receipts were generated from mining claim holding fees, applications for permits to drill, and non-operating revenue.

Recreational opportunities include hunting, fishing, camping, hiking, cross-country skiing, boating, hang gliding, off-highway vehicle driving, mountain biking, birding, viewing scenery, and visiting natural and cultural heritage sites. In total, fees related to recreation activity and collected from BLM-administered lands in the project area in FY 2016 were $53,519,360 (BLM 2017).

Wildfire

The number of wildfire incidents and the acres burned in a fire season vary based on precipitation levels, seasonal fuel loading, and other conditions. In recent years, however, the number of acres burned by fires has generally increased (NIFC 2013, 2014, 2015, 2016, and 2017).

Costs associated with wildfire suppression and other wildfire management activities have likewise increased in recent years. Wildfire management appropriations began to increase in the late 1990s and increased significantly after FY2000, beginning with the severe 2000 fire season. In FY2001, the budget for the discretionary Department-wide Wildland Fire Management (WFM) program was $1,880,258 (USFS 2002). In comparison the 2018 budget request for the discretionary Department-wide WFM program was $873.5 million (DOI 2017b).

In recent decades, federal spending on wildfire suppression has increased dramatically. For example, suppression spending that on average accounted for less than 20 percent of the Forest Service's discretionary funds prior to 2000 had grown to 43 percent of discretionary funds by 2008 (USDA 2009), and 51 percent in 2014 (USDA 2014). See DOI suppression costs in **Table 3-10**, Federal Firefighting Costs (Suppression Only). Both historically and today, annual suppression expenditures increase with the total number of acres burned (Ellison et al. 2015).

No single database tracks direct property loss costs associated with wildfire. Between 2002 and 2006, one review estimated that an annual average of 1,248 structures were damaged in wildfires, at an estimated loss of $160.2 million. After adjusting for inflation using the consumer price index from the Bureau of Labor Statistics, the average per structure loss is $143,094 in 2016 dollars (Thomas et al. 2017). According to the National Interagency Fire Center (NIFC) data, a total of 4,312 structures were destroyed by wildfires in 2016, but it does not provide a dollar estimate of the losses. Using the average per structure loss calculated above, wildfires in 2016 resulted in an estimated $617 million in property damage (Thomas et al. 2017). The amount of homes built in the WUI are expected to increase wildfire prevention and suppression costs, as well as cost of damaged property from wildfire.

The following primary risk factors are driving the prospects of more severe fire, and in turn, increased wildfire suppression costs, in the future: continued accumulation of fuels in forests and rangelands; continued development in the WUI; continued drought; and a general increase in temperatures (USFS and DOI 2015). Based on current trajectories, these factors have worsened and will continue to worsen over the next 20 years and may lead to more destructive wildfires than the public is prepared for (USFS and DOI 2015).

Table 3-10
DOI Agency Firefighting Costs (Suppression Only)

Year	Fires[1]	Acres[1]	DOI Agencies Costs[2]
2013	47,579	4,319,546	$399,199,000
2014	63,212	3,595,613	$326,194,000
2015	68,151	10,125,149	$417,543,000
2016	67,595	5,503,538	$371,739,000
2017	71,499	10,026,086	$508,000,000
2018	58,083	8,767,492	$528,000,000
Total	**376,119**	**337,424**	**$2,550,675,000**

Source: NIFC 2018

[2]Annual fires and total acres include all private, state and federal lands in the US.

[1]DOI Agencies includes Bureau of Indian Affairs, Bureau of Land Management, National Park Service, and US Fish and Wildlife Service.

Note: Values account for nationwide statistics and are not limited to the project area.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

The Socioeconomic Baseline Report (BLM 2018b) provides more detail on the demographics of the counties in each state related to environmental justice. Data indicates that California has the most counties that meet the criteria for further consideration of environmental justice impacts, based on the percent of the population in those counties identified as low-income, minorities, or both. Due to the size of the project area, further site-specific analysis, such as that conducted for site-specific NEPA analysis for implementation actions, would be required to further define potential populations for consideration.

Chapter 4. Environmental Consequences

4.1 Introduction

This chapter discloses the direct, indirect, and cumulative impacts for each resource and provides the scientific and analytical basis for evaluation of the potential effects of each of the alternatives described in **Chapter 2**.

4.1.1 Assumptions for Analysis

The following analysis assumptions for analyzing direct, indirect, and cumulative impacts apply to all resource sections in this chapter. Resource-specific assumptions are detailed under each resource below.

- Fuel breaks can reduce the intensity, flame length, rate of spread, and residence time of wildfire, when used in conjunction with other fire suppression resources; fuel breaks are frequently observed affecting fire behavior and can be important in controlling wildfires and their severity (Moriarty et al. 2016; Agee et al. 2000; Davison and Smith 1997; Maestas et al. 2016).
- A fuel break width of 500 feet wide (including both sides of the road or ROW) is used as the basis for this analysis because it is the greatest width needed under all vegetation types to allow for safe firefighter engagement of a wildfire. This safe separation distance of 500 feet is based on the width needed to change fire behavior such as reducing flame lengths and rate of spread and allowing for safe suppression operations; however, site-specific projects may implement smaller fuel breaks based on local conditions. Brown strips would be a maximum of 50 feet wide (including both sides of the road or ROW).
- Fuel breaks would be maintained with regular treatments in order to meet project objectives. The potential for a fuel break to fail to initially serve its function as described in **Table 2-1** is an expected outcome to some degree under all action alternatives. In this case, the short-term effects of fuel break construction as described under each resource below would continue until a fuel break is established successfully.
- Fuel breaks may be associated with previously disturbed corridors, thus reducing the potential for new adverse impacts.
- Acres presented represent the acres within the potential treatment area that would be available for fuel break construction. Not all of these areas would experience direct effects from fuel break construction, since the maximum potential acreage of fuel breaks under each alternative would be less than the potential treatment area. Indirect impacts on resources may occur outside directly affected areas. For instance, the potential treatment area under Alternative B would be 529,000 acres, corresponding to 8,700 miles.
- Targeted grazing would not cause a substantial increase in invasive annual grasses or noxious weeds because it would be intensively managed to prevent the introduction or spread of these species (Launchbaugh and Walker 2006; Davison et al. 2007) (See Design Feature 19 and **Section D.1** in **Appendix D**).

- Fuel break construction and maintenance would occur intermittently over several decades and short-term effects from construction and maintenance would last from several hours to several days.

4.1.2 Cumulative Effects Assessment Approach

The evaluation of potential cumulative impacts considers how incremental impacts of the proposed project overlap in place and time with the impacts from past, present, and reasonably foreseeable future actions and may be resource specific. Fuel breaks could be influenced by activities and conditions on adjacent public and non-public lands; therefore, fuel break project assessment data and information could span multiple scales, landownerships, and jurisdictions. These assessments involve determinations that are often complex and, to some degree, subjective.

The cumulative impacts discussion that follows considers the alternatives in the context of the broader human environment, specifically actions that occur outside the potential treatment areas but within the larger project area boundary.

Past, Present, and Reasonably Foreseeable Future Actions

Projects and activities identified as having the greatest likelihood to generate potential cumulative impacts when added to the Fuel Breaks PEIS alternatives are displayed in **Table 4-1**, below. It is assumed that these past, present, and reasonably foreseeable future actions would continue under all alternatives and for all resources.

Additional analysis of local projects will occur at the site-specific level during implementation.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions that Comprise the Cumulative Impact Scenario for Fuel Breaks

Past and Present Projects, Plans, or Actions	
Human Actions	
Fire Suppression	Fire suppression was practiced throughout the western US for most of the 20th Century with full suppression of any wildfire. This practice has led to an increase in fuel loading and increased risk of high-intensity wildfires in grasslands and sagebrush communities. Wildfire is now recognized as a natural ecosystem process necessary for ecosystem health; however, fire suppression is still practiced in many areas including on some public lands. Interagency Federal fire policy requires that every area with burnable vegetation must have a Fire Management Plan (FMP). Accordingly, the BLM has established FMPs in parts of the project area. Examples include the Central Utah FMP, and the California Master Cooperative Wildland FMP and Stafford Act Response Agreement. Further, entities such as NIFC coordinate five federal agencies and cooperate with state and local jurisdictions to develop and implement federal wildfire policies.

Past and Present Projects, Plans, or Actions	
Fuel Breaks	Fuel break projects have been and continue to be implemented throughout the project area by the BLM, other federal agencies such as the Forest Service, local or regional partnerships, and other groups. While this is not a complete list of projects, examples include: Multi-State (Oregon, Nevada, Idaho) • Tri-State Fuel Breaks Project Nevada/California • Battle Mountain District Office Roadside Fuel Break Hazardous Fuels Reduction Project • Granger Canyon Fuel Break Project • Deer Creek Community Fuel Break Idaho • Bruneau Fuel Breaks Project Jarbidge Fuel Project • Paradigm Fuel Break Project • Soda Fuel Breaks Project • Big Desert Fuel Breaks Project Oregon/Washington • Cascade Crest Fuel Breaks Project Utah • Midway Fuel Break Project • Dry Basin Greenstrip Project These projects have created and will continue to create fuel breaks in the project area over the next several years, regardless of decisions made in this PEIS. Existing conditions regarding fuel breaks are described in **Chapter 3**.
Vegetation Management	Vegetation management projects have occurred throughout the project area and projects such as hazardous fuels reduction, conifer removal, seedings, shrub planting, and invasive plant species control have affected vegetative cover and structure, which in turn influence wildfire risk. Other aspects of vegetation management plans, including but not limited to commercial timber harvesting, pre-burn slashing, prescribed burning, and thinning have also occurred. Vegetation projects will continue throughout the project area and new projects will likely be proposed.
Resource Management/ Land Use Plans	Multiple land use plans dictate the management of certain areas within the project area. Goals, objectives, and strategies for managing wildfire and improving vegetation conditions are described in specific comprehensive plans and vary among them. Land use plans will continue to dictate the management of certain areas within the project area, with impacts varying based on specific plan goals and objectives. Plans will continue to be updated to reflect best management decisions for current conditions.
Roads and Rights-of-Way (ROWs)	Effects on vegetation and wildfire potential from roads and ROWs (including pipelines, electrical transmission lines, infrastructure ROWs, and large renewable energy projects, such as wind development projects) have occurred throughout the project area. Increasing development and population growth have increased demand and construction of transportation routes within the project area. Use of roads is a common cause of wildfires due to roadside ignitions. This trend is expected to continue.

Past and Present Projects, Plans, or Actions	
Livestock Grazing	Excessive historic grazing pressure has modified sagebrush communities over many areas in the western United States. Domestic livestock modified much of the native grass in the Great Basin by the early 20th Century, and more recently, less than 1 percent of the sagebrush communities in the project area remains untouched by livestock (Paige and Ritter 1999). To ensure that BLM administration of grazing helps preserve currently healthy conditions and restores healthy conditions of rangelands, the BLM has approved Grazing Management (43 CFR 4120 [2005]) and Authorized Grazing Use (43 CFP 4130 [2005]) to guide grazing management.
Mining and Fluid Mineral Development	Mining and fluid mineral leasing, exploration, and development have been and continue to occur in the project area. Impacts associated with mining and fluid mineral exploration and development relate to surface and subsurface disturbance from exploration and development actions and infrastructure developed to support mining and fluid mineral exploration and development activities. Examples of past and present mineral development activities within the project area include the following: • May Day Mill/Crescent Creek Mine • Tucker Hill Perlite Mine Expansion EIS • Uinta Basin Natural Gas Development Project EIS
Recreation	Visitors to the project area participate in a variety of dispersed, concentrated, and organized recreation activities. Dispersed activities, such as hunting or backpacking, occur throughout the project area with typically localized, short-term changes to resource conditions. Organized and concentrated activities generally take place near roads, trails, water bodies, and developed recreation areas with more intense resource impacts compared with dispersed recreation, but over a smaller area. Overall visitor use is generally higher in the summer months, but specific activities, such as hunting or cross-country skiing, have more participants and associated impacts outside the summer season.
Natural Processes	
Spread of Noxious and Invasive Weeds	Noxious weeds have invaded many locations in the project area, carried by wind, humans, machinery, and animals. Integrated weed management programs, including biological, chemical, mechanical, and educational methods, act to minimize noxious weed spread. Examples are the Burns District Noxious Weed Management Program, the Twin Falls District Noxious Weed and Invasive Plant Treatment Program, and the Spokane District Programmatic Vegetation Restoration Project. State and regional entities such as the California Invasive Plant Council, the Pacific Northwest Invasive Plant Council, and Northern Rockies Invasive Plant Council rely on management tools such as the establishment of weed management districts; invasive plant mapping and prioritization schemes; and prevention, early detection and rapid response measures to manage vegetation in their respective areas. These invasive plant councils also develop and support public policy initiatives at the state and national levels to help control the spread of invasive plants.
Wildfire and Fuels	Fires in the project area are both natural and human caused. The approximate number and size of wildfires in the project area are presented in **Chapter 1**. Wildfires have been widely distributed in terms of frequency and severity. Factors contributing to the fire frequency and severity include increased fuel loading and fuel continuity in high risk fire areas, and drier conditions caused by drought. Increasing recurrence and severity of drought conditions could increase the occurrence and severity of wildfires in the project area.

<table>
<tr><th colspan="2">Reasonably Foreseeable Future Projects, Plans, or Actions</th></tr>
<tr><td colspan="2">Human Actions</td></tr>
<tr><td>Fire Suppression</td><td>Fire suppression throughout the project area will continue. NIFC will continue to coordinate federal agencies and cooperate with state and local jurisdictions to develop and implement wildfire policy with a focus on protection within the WUI. Further, BLM will continue to implement and update mandated project area Fire Management Plans in light of new technology and changing environmental conditions. State and local agencies are likewise expected to continue developing, updating, and implementing fire management policies in response to changing technology and environmental conditions.</td></tr>
<tr><td>Fuel Break Projects</td><td>Future fuel break projects in the project area include those fuel break projects identified in the present actions, changes to such projects based on changing technology and environmental conditions, and new plans for fuel break projects. These projects would continue regardless of decisions made in this PEIS. Examples are as follows:
Tri-State Fuel Breaks Project EIS
Jarbidge Wildfire Fuel Breaks EA
Sage Hen Flats Fuels Project EA</td></tr>
<tr><td>Vegetation Management Activities</td><td>Future vegetation management activities in the project area include BLM plans like those listed in the past and present actions as well as a PEIS for fuels reduction and rangeland restoration throughout the same 6-state area within the Great Basin that is under development by the BLM. The PEIS analyzes locations and tools that could be used for fuels reduction and rangeland restoration projects.

Initiatives by invasive plant councils to develop and implement vegetation management policies at the state and national level would continue. Examples are as follows:
BLM Programmatic EIS for Fuels Reduction and Rangeland Restoration in the Great Basin
BLM California Hazard Removal and Vegetation Management Programmatic EA
Twin Falls District Vegetation Treatment for Noxious and Invasive Weeds EA
Glendale Bench Vegetation Management Project EA</td></tr>
<tr><td>Roads and Rights-of-Way</td><td>Urban development patterns, the continuing growth of vehicle-based recreation, planned road and highway projects, infrastructure and ROW development (such as pipelines, electrical transmission lines, and wind energy projects), and population growth are expected to increase demand for, and construction of, transportation routes in the project area. Continued use of transportation corridors is expected to increase the risk of roadside ignition of wildfires.</td></tr>
<tr><td>Mining and Oil/Gas Leasing</td><td>Future mining and oil and gas leasing projects in the project area are expected to continue and, in addition to those projects listed above, include the following:
The Sienna Hills Mineral Materials Sale
Coeur Rochester POA 10 Expansion EIS
Diamond Fork Phosphate Mine</td></tr>
</table>

Reasonably Foreseeable Future Projects, Plans, or Actions	
Recreation	All forms of dispersed, organized, and concentrated recreation would continue throughout the project area. There would continue to be specific management for certain activities per the recreation management allocations in individual BLM resource management plans. Recreation projects, such as building, expanding and maintaining recreation facilities, would continue. Overall visitation to the project area and BLM-administered lands in the project area is expected to increase; however, the number of visitors would vary by season, year, location, and type of activity. WUI areas are expected to have the largest increase in visitation.
Natural Processes	
Spread of Noxious and Invasive Weeds	Noxious and invasive weed species are expected to continue spreading on all lands and increase risk of wildfire. Future management for invasive weeds will help mitigate impacts. The BLM management plans identified in the past and present actions would be expected to continue. In addition, these management plans may change in response to new and improved technology, changed environmental conditions, or new policy regarding the spread of noxious weeds and invasive plants. Invasive Plant Council initiatives and policy as identified above in the past and present actions are also expected to continue and evolve to address the spread of noxious weeds and invasive plants.
Wildfire and Fuels	The increasing recurrence and severity of drought conditions could, in turn, increase the occurrence and severity of wildfires in the project area.

Source: BLM Interdisciplinary Team Input

4.2 Fire and Fuels

4.2.1 Assumptions

The assumptions for analyzing the impacts on fire and fuels are as follows:

- Similar vegetation states, weather, and topographic conditions would have similar influences on fire behavior.
- Desired fuel models for fuel breaks are GR1 (mowed or targeted grazing fuel break), SH1 (green strip fuel break), and NB9 (brown strip fuel break) (see **Appendix H, Section H.2**).
- Exact fuel break project locations are not known; however, general locations where fuel breaks would potentially be created have been identified.
- Treatments in fuel breaks would be site specific and would influence the vegetation there.
- Once established, fuel breaks would be effective, regardless of vegetation type, because treatments types would be selected specific to the vegetation types found in that area.
- Vegetation type and continuity influence the rate of fire spread and the flame length, both of which affect wildfire suppression.
- There are no differences in the fuels found in or outside of the WUI. The primary difference is that fire suppression resources may be closer to the WUI, allowing for a faster response time that could keep fires smaller.

4.2.2 Nature and Type of Effects

The location, type, and conditions of vegetation in a fuel break influence the flame length of a wildfire passing through and potentially the rate of spread within the fuel break. **Table 4-2** outlines the locations, types, and potential treatment areas of new fuel breaks, and the anticipated short- and long-term programmatic outcomes under each action alternative.

Table 4-2
Fuel Break Characteristics and Programmatic Outcomes

Fuel Break Characteristics	Alternative B	Alternative C	Alternative D
Total Miles	8,700	11,000	11,000
Total Acres[1]	529,000	667,000	667,000
Potential Treatment Area (acres)	529,000	792,000	1,088,000
Types and Locations	2,349 miles of new brown strips and 6,351 miles of mowed fuel breaks along Maintenance Level 5 roads outside sagebrush and highly resistant and resilient sites	550 miles of new brown strips, 5,720 miles of mowed/targeted grazing fuel breaks, and 4,730 miles of green strips along Maintenance Level 3 and 5 roads and BLM-administered ROWs, including in sagebrush communities and in some highly resistant and resilient sites	The same mileage of each fuel break type as for Alternative C, along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs, including in sagebrush communities and highly resistant and resilient sites
Anticipated Programmatic Outcome for Fire and Fuels	Fewer fire starts along roads; improved direct attack suppression opportunities but limited to areas with Maintenance Level 5 roads; some modified fire behavior and reduced rates of spread from mowed fuel breaks. Limits on treatment methods and reseeding lead to maintenance challenges and potential for limited changes to fire behavior until the fuel break is established.	Fewer fire starts along roads; improved direct attack suppression opportunities along Maintenance Level 3 and 5 roads and BLM-administered ROWs; modified fire behavior and reduced rates of spread from mowed/targeted grazing fuel breaks and green strips. Limits on reseeding could lead to maintenance challenges in highly resistant and resilient sites, changes to fire behavior would be limited in those areas until the fuel breaks are established.	Fewer fire starts along roads; improved direct attack suppression opportunities along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs; modified fire behavior and reduced rates of spread from mowed/targeted grazing fuel breaks and green strips. A system of fuel breaks reduces rate of wildfire spread in remote areas where direct attack is more challenging.

[1]See Table 2-1. Assumes the following widths by fuel break type: brown strips: 50 feet; mowed/targeted grazing: 500 feet; green strips: 500 feet.
[2]Maintenance Level 5 includes interstates, state highways, county roads and other highly traveled paved and unpaved roadways.

The vegetation state and height, the fuel model, and the approximate flame length determine the minimum fuel break width that would allow for firefighters to safely suppress wildfires. **Table 4-3** depicts the approximate flame lengths and minimum fuel break widths for each vegetation state and fuel model found in the project area.

Table 4-3
Fuel Model Flame Lengths and Minimum Fuel Break Widths to Establish Safe Separation Distance

Original Vegetation State and Fuel Model[1]	Vegetation Height	Approximate Flame Length (Feet)[2]	Minimum Width of Fuel Break (Feet)[3]
Invasive annual grasses (Models GR1, GR2, GR4, GR7)	1-3 feet	3-63	96-288
Invasive annual grasses with shrubs (Models GR2, GR4, GR7, GS1, GS 2, and SH1)	1-3 feet	11-63	96-288
Perennial grasses and forbs with invasive annual grasses (Models GR2, GR4, and GR7)	1-3 feet	11-63	96-288
Perennial grasses and forbs (Models GR1 and GR2)	<1 foot – 1 foot	3-11.5	96
Shrubs with perennial grasses and forbs (Models GS1, GS2, SH1, and SH5)	1-3 feet or 4-6 feet	8-38	96-288 or 384-576[4]
Shrubs and perennial grasses and forbs with invasive annual grasses (Models GR2, GR4, GR7, GS1, GS2, SH1, and SH5)	1-3 feet or 4-6 feet	11.5-63	96-288 or 384-576[4]
Shrubs with depleted understory (Models SH1, SH2, SH5, and SH7)	1 foot or 4-6 feet	8-38	96 or 384-576[4]
Phase I pinyon-juniper, recently burned (Models NB9, GR1 and GS1)	0 feet - 1 foot	0-11	0-96
Phase I pinyon-juniper, unburned (Models GS1, GS 2, SH1, SH2, and TU1)	1 to 3 feet or 10-30 feet	5.5-14.5	96-288[5]
Phase II pinyon-juniper (Models SH1 and TU1)[6]	1 foot or 10-30 feet	8 or 65+[7]	96-288[5]
Phase III pinyon-juniper (Model TU1)[8,9]	10-30 feet	65+[7]	500+[4]

Source: BLM interdisciplinary team input
[1] See **Appendix H** for a description (**Section H.1**) and photos of fuel models in the project area. Photos of fuel models were taken from Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model (Scott and Burgan 2005) and Guide for Quantifying Fuels in the Sagebrush Steppe and Juniper Woodlands of the Great Basin (Stebleton and Bunting 2009).
[2] Under the driest conditions (3%, 4%, 5% dead fuels moistures and 30% herb/60% woody live moisture) and assuming a 20 percent slope and a 20 miles/hour midflame wind speed (see **Appendix K**).

[3] See **Appendix L** for fuel break widths for safe separation distances based on various fuel heights. Assumes 20 percent slope and a 20 miles/hour wind speed. Minimum fuel break with is the total for two fuel breaks, one on each side of a road. For example. a minimum fuel break width of 400 feet accounts for two 200-foot fuel breaks with one on each side of a road.
[4]Additional analysis would need to be completed if the minimum width of fuel break is greater than 500 feet.
[5]Assumes safe separation distance for the understory would be sufficient because the trees are sparse.
[6]In Phase II, the fuel break widths would be the same as Phase I because the trees would most likely be removed within in the fuel break and understory vegetation treated.
[7]Assumes a crown fire that can occur in a dense tree stand.
[8]Assumes there is limited vegetation under the trees and that understory vegetation treatments would not occur. A fuel break would break up opportunities for a crown fire or allow for a break is that the crown fire could return to a surface fire.
[9] For fuel breaks in Phase 3, tree removal would be needed and a minimum tree spacing of two times the average tree height. This would reduce opportunities for crown fire initiation on flat to gently rolling slopes. On steeper slopes (>15%) tree spacing requirements would increase. Limbing may also be necessary to reduce ladder fuel components.

Taller vegetation creates longer flame lengths when burned by a wildfire. Longer flame lengths force firefighters to stay farther away from a wildfire for safety. This increases the potential for spotting, which can limit methods and opportunities for wildfire suppression. Taller vegetation warrants correspondingly wider fuel breaks to provide safe engagement in suppression activities. Even with wide fuel breaks, crown fires and extreme surface fires would exhibit high rates of spread and flame lengths minimizing suppression opportunities (see **Appendix K)**.

In fuel models with corresponding flame lengths of less than 4 feet, wildfires would generally be directly attacked at the head or flanks by persons using hand tools. Flame lengths greater than 4 feet would be too intense for direct attack by persons using hand tools and would require such equipment as dozers, pumpers, and retardant aircraft to control. In these conditions, a fuel break would provide the added advantages of modifying fire behavior and providing an anchor point for suppression.

As depicted in the graphs in **Appendix H** (see Rate of Spread and Flame Lengths for Fuel Types in the Project Area), the flame length and rate of spread of a wildfire would increase as the wind speed or slope of the terrain increases. Where flame lengths exceed 4 feet, fuel breaks would provide desired opportunities to reduce flame lengths, allowing for direct attack at the head or flanks. The result of reduced flame lengths and subsequent direct attack suppression would be the increased potential for slower rates of fire spread and fewer burned areas from wildfires. The number of burned acres would also depend on weather conditions, vegetation, and the ability of firefighters to access the head or flank of the fire.

Removing vegetation in areas with ignition sources, such as along roadways, reduces the potential for fire starts. Brown strips, which are devoid of vegetation, would be the most effective at preventing new starts in such areas. Mowed and targeted grazing fuel breaks would have similar vegetation types and densities as surrounding areas, as a result, they would be susceptible to ignition and fire could spread to surrounding vegetation. Green strips would have higher moisture content during a longer portion of the fire season and wider plant spacing; this would make green strips less susceptible to ignition, compared with surrounding vegetation communities. However, vegetation in green strips could still carry a new fire start to vegetation outside the fuel break.

The functions, locations, vegetation state, and method and tools for each type of fuel break, as described in **Table 2-1**, would directly and indirectly influence fires and fuels. The nature and types of impacts would include changes in fire behavior, rate of spread with and without fire suppression, and the ignitability of the fuel break. Without direct attack suppression, such as during the early phases of a wildfire (pre-detection) or for fires in rugged terrain, vegetation conditions in fuel breaks could disrupt fire behavior and subsequently reduce fire spread. Under the assumed weather and fuel moisture conditions described in **Table 4-3**, vegetation conditions in fuel breaks could directly modify flame lengths, based on the fuel model and associated fuel break width; this would have corresponding indirect impacts on fire spread. The potential for a fire to ignite within a fuel break would depend on vegetation type and density.

Brown strips, represented by fuel model NB9 (see **Appendix H, Sections H.1** and **H.2**), would be a total maximum of 0–50-feet wide (including both sides of the road) along highly traveled corridors such as roadways. These could be applied in all vegetation types and would reduce the potential for fire starts and would widen the anchor points already provided by roadways to support suppression operations. Under the assumed weather and fuel moisture conditions described in **Table 4-3**, wildfires burning into brown strips would encounter an abrupt change in fuel characteristics, which would allow for the safe engagement of firefighters to suppress wildfires. However, fires with longer flame lengths could breach or spot beyond brown strip fuel breaks, which would limit their capacity to reduce the rate of fire spread, especially in the absence of suppression.

Mowed or targeted grazing fuel breaks, represented by fuel model GR1 (see **Appendix H, Sections H.1** and **H.2**), would be a total maximum of 0–500 feet wide, (including both sides of the road), depending on vegetation types and heights. They could be located along any type of road or BLM-administered ROW. Such breaks would provide similar opportunities to support suppression as described for brown strips. In the absence of suppression, mowed or targeted grazing fuel breaks with the minimum widths specified in **Table 4-3** could reduce flame lengths and spotting distances allowing fires to be more readily suppressed, either via direct attack along the fuel break or in later phases of the fire. Targeted grazing fuel breaks could be implemented in areas, such as steep slopes, where mechanical treatments would not be feasible. This would further reduce the burned acreage potential in difficult to access areas.

The effectiveness of mowed or targeted grazing fuel breaks in disrupting wildfire behavior would diminish incrementally over the course of each fire season. This is because, as vegetation cures in the fuel break throughout the season, it would become less effective at altering fire behavior. Depending on precipitation, vegetation in mowed and targeted grazing fuel breaks could continuing growing throughout the season, requiring repeat treatment to remain effective. Additionally, because these types of fuel breaks would not change the density of vegetation in the fuel break, there would continue to be a consistent source of fuel as the fire burns through the break. The continuous fuel in a mowed or targeted grazing fuel break would also allow a fire to move through the break to taller vegetation outside it.

The nature and types of effects on fire and fuels from green strip fuel breaks, represented by fuel model SH1 (see **Appendix H, Sections H.1** and **H.2**), are similar to those described for mowed or targeted grazing fuel breaks. The primary exceptions would be that the introduction of widely spaced, short statured perennial plants that retain moisture later into the growing season could disrupt fire behavior longer into the fire season. Areas of unvegetated surface would decrease fuel continuity as a wildfire moves through the break, which combined with higher moisture content vegetation, would slow the rate of fire spread. These characteristics would also limit ignitability and the potential for a new start to move through the fuel break to surrounding vegetation.

A regional system of interconnected or strategically placed fuel breaks of different types would provide opportunities to reduce flame lengths and disrupt the movement of a wildfire on multiple fronts as it moves across the landscape. It would also support direct attack from multiple anchor points through safe firefighter access. The combined effect would be a reduced potential for fire spread and subsequent burned areas.

4.2.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained using this analysis. Fuel breaks would continue to be employed throughout the project area on a site-specific basis (see **Figure 3-2** and **Table 4-1**); however, without a programmatic approach, fuel breaks that provide protection for suppression actions would take longer to implement. Fuel breaks that are implemented would be done without a systematic focus on the landscape geared toward enhancing fire suppression opportunities at the regional level. This could reduce their overall effectiveness. The result would be an ongoing challenge to effectively modify wildfire behavior and have a system of anchor points from which to allow for the safe engagement of firefighters and to initiate direct attack.

Areas without fuel breaks would likely continue to experience unchecked fire spread, with corresponding upward trends in burned area per fire and overall total annual acres burned in the project area. Because there would be no new fuel breaks along highways, there could also be new ignitions and subsequent fire spread in those location.

4.2.4 Effects Common to All Action Alternatives

Under the action alternatives (Alternatives B, C, and D), a plan to implement a regional system of fuel breaks would be created, and consultation completed that could be applied at the site-specific level. Compared with Alternative A, this would expedite tiered NEPA compliance and could result in more fuel breaks being created across the landscape and more opportunities for fire suppression.

In the short-term, under all action alternatives, some fuel breaks may not serve their functions. The short-term effects of failure would be that those impacts described under Alternative A would continue until the fuel break is established successfully.

Over the long term, the action alternatives would promote greater opportunities for safer fire suppression and fire behavior modification. However, the types and locations of fuel breaks and the number of acres treated would contribute to different impacts on fire and fuels under each action alternative.

4.2.5 Effects from Alternative B

Compared with Alternative A, construction of up to 8,700 miles of mowed or brown strip fuel breaks within a 529,000-acre potential treatment area would increase the likelihood of a wildfire encountering a fuel break, especially along roads. Treated vegetation in each type of proposed fuel break could directly modify fire behavior and directly and indirectly affect fire spread, as described in the *Nature and Types of Effects*.

A new regional system of fuel breaks along roads under Alternative B would allow for the safe engagement of firefighters where a greater number of wildfires could be directly attacked, which would increase the likelihood for fire to burn fewer acres, compared with Alternative A. Brown strips would also reduce the potential for sparks from vehicles on roadways to ignite vegetation along the roadway. The potential for reduced fire starts would depend on factors such as the type of roadway surface, traffic volumes and types, and weather conditions.

Avoiding treatments in sagebrush and highly resistant and resilient sites would limit disturbances in those desirable vegetation communities; it would also restrict the available types of vegetation communities where fuel breaks could be placed. Requiring native seeds for reseeding fuel breaks could limit the viability of reseeding and the effectiveness of the fuel breaks to modify fire behavior (Hulet et. al. 2010; Monsen et al. 2004; Kilcher and Looman 1983). Reapplications could be necessary to ensure success. These reapplications could reduce vegetation recovery and reduce fuel break effectiveness in the short term (Miller et. al. 2015). In addition, the BLM's ability to modify fire behavior and limit fire spread would be restricted, especially during the early phases of a fire.

Locating fuel breaks along Maintenance Level 5 roads would reduce ignition potential, influence wildfire behavior, and reduce fire spread in those locations; however, where these roads are not present, there would be no opportunities to influence wildfire behavior. This would result in the same potential for direct and indirect impacts on wildfire in those areas as Alternative A. Concentrating new fuel breaks along roads could also limit the number of fuel breaks installed and maintained annually. Overall, Alternative B would limit the BLM's ability to create a system of different types of fuel breaks in all vegetation conditions; it would not provide a comprehensive approach to modifying vegetation conditions, improving suppression opportunities, or reducing fire ignitions along Maintenance Level 1 or 3 roads or BLM-administered ROWs.

4.2.6 Effects from Alternative C

Compared with Alternative A, up to 11,000 miles (667,000 acres) of new fuel breaks within a 792,000-acre portion of the project area would increase the likelihood of a wildfire encountering Treated vegetation in each type of proposed fuel break could directly modify fire behavior and directly and indirectly limit fire spread, as described in the *Nature and Types of Effects*.

Under Alternative C, a new regional system of multiple types of fuel breaks would be created along Maintenance Level 3 and 5 roads and BLM-administered ROWs using the full suite of fuel break tools. Including targeted grazing, prescribed fire, manual, and chemical and mechanical treatments, would allow for the behavior of more wildfires to be modified, allowing firefighters to safely engage in direct attack suppression. Using targeted grazing would also allow for the placement of fuel breaks in difficult to access areas. Collectively, these factors would increase the likelihood for fuel breaks and suppression opportunities, compared with Alternative A.

Brown strips and green strips would also reduce the potential for fire starts, compared with Alternative A, reducing ignition potential along roads and BLM-administered ROWs. If effective in reducing ire starts, brown strips and green strips would decrease the demand for subsequent suppression resources. Implementing preemergent chemical treatments would maintain the viability of fuel breaks over time and would prevent subsequent conversion of treated areas to invasive annual grasses with associated fuel models.

Constructing fuel breaks under certain conditions in highly resistant and resilient sites could cause impacts as described above in *Nature and Type of Effects*; however, allowing some sites to be treated would increase opportunities to disrupt fire behavior and increase direct attack opportunities in certain vulnerable highly resistant and resilient sites. These expanded opportunities could improve the effectiveness of a regional fuel break system while providing the flexibility to avoid more sensitive sites.

Including the potential for mowed or targeted grazing fuel breaks in highly resistant and resilient sites with high fire probability or where adaptive management habitat triggers have been tripped would maintain the ability of those sites to influence wildfire behavior. Reseeding these areas with native species could reduce those potential effects, given their inherent resistance to annual grass invasion and spread and environmental conditions that support plant growth (Chambers et al. 2014a). Outside of highly resistant and resilient sites, Alternative C requires the use of native plant material but allows exceptions for the use of nonnatives per Handbook H-1740-2, these actions would work to improve and maintain vegetation relative to project objectives.

Creating fuel breaks along roads and BLM-administered ROWs would increase the potential for an interconnected, comprehensive fuel break system; however, since Maintenance Level 1 roads are excluded from fuel break construction under Alternative C, there would be fewer potential fuel break locations than in Alternative D. This would correspondingly reduce areas for safe firefighter engagement and to reduce enhanced direct attack opportunities, especially in more remote areas . This would allow the continued potential for unmodified fire behavior in locations where those Maintenance Level 1 roads exist.

4.2.7 Effects from Alternative D

The impacts on fire and fuels would be similar to those under Alternative C, except that new fuel breaks could be constructed in a 1.088,000-acre portion of the project area. This is because the treatment area would include highly resistant and resilient sites, Maintenance Level 1, 3, and 5 roads, and BLM-administered ROWs. Alternative D would allow for the most comprehensive and interconnected system of fuel breaks to be constructed and provide the greatest flexibility for site-specific projects to effectively build fuel breaks while avoiding sensitive resources (see, for example, Design Features 1, 4, 7, and 8, among others). Treated vegetation in each type of proposed fuel break could directly modify fire behavior and potentially limit fire spread, as described in the *Nature and Types of Effects*. Alternative D would allow for multiple direct attack anchor points across the landscape, increase opportunities for safe engagement of firefighters, and would contribute to reduced ignition potential and modified fire behavior on larger portions of the project area.

The impacts from reseeding and implementing chemical treatments on preemergent vegetation would be similar to those under Alternative C, although seeding per Handbook H-1740-2, with exceptions for the use of nonnative plant material, throughout the potential treatment area could improve the likelihood of successful reseeding in fuel breaks in vegetation communities currently compromised by invasive species, especially in the near term. In highly resistant and resilient sites, this would allow for the maintenance and improvement of the ability of those sites to influence fire behavior.

4.2.8 Cumulative Effects

The cumulative effects analysis area consists of lands within the project area boundary; however, past, present, and reasonably foreseeable future actions outside the project area would also influence the location and intensity of cumulative effects in the project area. Examples are weather and climate patterns, interstate highways and linear ROWs, vegetation management, and wildfires. Due to the large project area, the dispersed nature of other actions, and the localized influence of fuel breaks, cumulative effects on fire and fuels would not be uniform across the project area. Because fuel breaks would be maintained long after their initial treatment, and other actions are expected to persist for the foreseeable future, the cumulative effects timeframe extends for many years and potentially decades after fuel break construction.

Past, present, and reasonably foreseeable future projects, plans, or actions, and natural processes (see **Table 4-1**) that affect fire and fuels include fire suppression that has led to uncharacteristic fuel loading and increased risk of high-intensity wildfires in grasslands and sagebrush communities; installation of fuel breaks; hazardous fuels reduction, conifer removal, seedings, shrub planting and invasive plant species control projects; livestock grazing; mining and fluid mineral development; recreation; and ROWs.

Additionally, for much of the past several decades, most of the project area has experienced multi-year droughts and changes in the type, seasonality, and distribution of precipitation (Chambers 2008; Snyder et al. 2019; Heim 2017). Lower than average precipitation and higher than average temperatures in winter and spring can result in vegetation becoming cured earlier in the fire season and over a broader area. This increases the risk of wildfire ignition spread. Surface disturbance, including in burned areas, has contributed to an upward trend in the distribution of invasive annual grasses, which is expected to increase the spread of wildfires and the subsequent reestablishment of invasive annual grasses. This is expected to perpetuate the trend toward shorter fire return intervals.

Past, present, and reasonably foreseeable future ROW development, recreation, and OHV use would increase the risk of fire ignitions from power lines, motor vehicles, target shooting, and campfires. Drought, increased human activity, and the conversion of native grasslands and sage communities to invasive annual grasses are combining to shorten fire return intervals, while increasing the likelihood of new ignitions from human and natural sources spreading across larger areas. Fuels reduction and rangeland restoration activities and livestock grazing would continue to reduce fuel loads and, in some cases, restore vegetation conditions to resemble historical fire regimes.

The BLM's reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin would protect and restore resistant and resilient sagebrush communities that fuel breaks would help protect. Where fuels reduction and rangeland restoration treatment projects have occurred, wildfires would be more likely to move across the landscape in a mosaic pattern, rather than as large contiguous fronts, as such treatments would alter the structure and function of certain vegetation communities across the landscape.

Fuel breaks, ROWs, recreation sites, and infrastructure associated with some types of solid and fluid mineral development would continue to provide anchor points to support wildfire suppression and, in some cases, would disrupt fire behavior by reducing flame lengths. These actions could help to minimize the rate and extent of fire spread in certain areas. Each of the factors above, when combined, would continually influence the criteria used to determine the potential fuel break locations described in **Chapter 2**. For example, new roads would provide new opportunities for fuel breaks, while changes in highly resistant and resilient sites, such as following fire, would change the areas where new fuel breaks may be implemented under certain alternatives.

Alternatives B, C, and D would increase the potential for new fuel breaks in the project area. These fuel breaks would improve suppression opportunities which could increase the likelihood of reducing flame lengths and rate of fire spread and contribute to retaining intact, unburned sagebrush habitat. They would also increase firefighter safety during suppression by providing anchor points. Brown strips along roadways would decrease the potential for new fire starts from motor vehicles.

These factors would cumulatively reduce the rate of spread and size of fires, compared with Alternative A. Fewer burned areas would decrease postfire stabilization and recovery needs and decrease the likelihood for subsequent conversion of burned areas to invasive annual grass vegetation, with the associated long-term impacts on fire and fuels. Maintaining larger areas of unburned sagebrush vegetation and native grasses and forbs that are naturally resistant to disturbances such as invasive annual grasses and resilient to wildfire would cumulatively decrease the likelihood for impacts from future wildfires.

Alternative B would increase the likelihood for fuel breaks to cumulatively influence wildfire behavior, reduce ignition potential, provide direct attack anchor points, and maintain firefighter safety; however, those opportunities would be limited to 529,000 acres (8,700 miles) along Maintenance Level 5 roads that are outside highly resistant and resilient sites. Combined with past, present, and reasonably foreseeable future actions, Alternative B would increase firefighter safety and improve suppression opportunities more so than Alternative A, especially near major highways. In areas where there are no major highways, including in highly resistant and resilient sites, cumulative impacts would be the same as current conditions. Additionally, a focus on narrow brown strips would allow fires to breach or spot beyond the fuel breaks; this would be especially likely in fuel models with higher flame length potentials. Limited treatment options for maintaining fuel breaks could reduce their effectiveness over time.

In most areas, the restricted tools available under Alternative B, combined with past, present, and reasonably foreseeable future actions, would have a limited effect on the trend of sagebrush communities being converted to invasive annual grasses, with the associated long-term cumulative effects on fuel models described above.

Fuel breaks under Alternative C would increase opportunities to influence wildfire behavior, improve suppression opportunities and firefighter safety, and reduce new ignitions, compared with Alternative A. Alternative C would do this to a greater extent than Alternative B because there would be 667,000 acres of fuel breaks along 11,000 miles of roads and BLM-administered ROWs. In addition, Alternative C would create fuel breaks in certain highly resistant and resilient sites, extending the protection provided by fuel breaks to more areas.

Compared with Alternative A, implementing all forms of fuel break types and treatments, including in certain highly resistant and resilient sites, would decrease the likelihood of sagebrush communities being converted to invasive annual grasses. Over time, combined with the Fuels Reduction and Rangeland Restoration PEIS, fuel breaks under Alternative C would facilitate the shifting of vegetation and associated fire regimes toward desired conditions in some areas. However, because there would be limited fuel breaks in highly resistant and resilient sites and none along Maintenance Level 1 roads, recent vegetation trends, including annual grass colonization, would likely continue in those areas. The result would be the potential for future fires to move uninhibited from adjacent annual grass or other vegetation communities into highly resistant and resilient sites.

The greatest opportunity for fuel breaks to contribute to the cumulative impacts on fire and fuels in the project area would be under Alternative D. This is because there would be the potential to create

11,000 miles (667,000 acres) of fuel breaks within a 1,088,000-acre treatment area, which would provide the greatest flexibility in building fuel breaks across the project area. Potential treatment areas would include highly resistant and resilient sites and locations along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs. Implementing preemergent chemical treatments and allowing native and nonnative seed mixes would maintain the viability of fuel breaks over time. The increased footprint of the system of fuel breaks under Alternative D, combined with the Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, would have the greatest potential to improve ecological site conditions, increase the fire return interval, and shift vegetation toward desired conditions, while improving fire suppression opportunities and firefighter safety.

4.3 AIR QUALITY

4.3.1 Assumptions

- Prescribed fire would produce less smoke than wildfires because the meteorological and fuel load conditions under which burns occur can be controlled. On a per acre basis, emissions from unplanned or high-severity wildfire can be substantially higher than during managed wildfire or prescribed fire (North et al. 2012).
- The impacts of fuel break construction would be temporary, localized, and intermittent; the impacts of prescribed fire would be greater than other fuel break construction methods but would be subject to state smoke management regulations and environmental prescribed burn conditions. The primary pollutants of concern would be $PM_{2.5}$ and PM_{10}.

4.3.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Constructing fuel breaks would have short-term, direct impacts on air quality from vehicle- and equipment-related exhaust emissions and from ground-disturbing activities that entrain particulate matter ($PM_{2.5}$ and PM_{10}) in the air. Ground vehicles used to access fuel break construction locations and powered equipment used to construct the fuel breaks would emit criteria pollutants and small amounts of hazardous air pollutants through combustion of fossil fuels such as diesel fuels and gasoline. Because these emissions would be temporary and intermittent, they would not affect local or regional air quality conditions over the long term.

Ground disturbance during fuel break construction and travel on unpaved roadways to access fuel break construction locations would be direct sources of particulate matter in the form of fugitive dust under all treatment methods. Emissions would be localized to the area surrounding any given ground-disturbing activity and would cease when that activity ends and the entrained dust settles. Because fuel breaks would be constructed along existing roadways, short-term impacts may include reduced visibility for drivers, depending on the level of soil disturbance and the direction and speed of wind conditions.

Short-term, localized increases in particulate matter would not substantially increase local or regional levels of particulate matter over the long term where soils are stabilized through low vegetative cover rather than converted to bare ground (brown strip fuel breaks). Brown strip fuel breaks, and temporary disturbance areas that are not reclaimed, would be susceptible to windblown soil erosion and could increase local or regional levels of particulate matter over the long term.

Maintaining fuel breaks using manual, mechanical, or chemical treatment methods or prescribed fire would emit criteria and hazardous pollutants, but at a lower level, compared with fuel break construction. Over the long term, a regionwide fuel break system would reduce wildfire ignitions (in brown strips along roadways), slow the spread of wildfire (in green strips), and promote greater opportunities for fire suppression where wildfires do occur. This would reduce the likelihood of new fire starts along highways and slow the rate of spread of wildfires in areas where fuel breaks have been developed, which would reduce wildfire-related impacts on air quality over the long term.

Effects from Manual and Mechanical Treatments

Constructing fuel breaks using manual and mechanical methods would have short-term, direct impacts on air quality from vehicle- and equipment-related exhaust emissions. In addition, ground vehicles used to access fuel break construction locations would emit criteria pollutants and small amounts of hazardous air pollutants, as described above under *Effects from Fuel Break Construction and Maintenance*.

Ground disturbance during fuel break construction using mechanical means, including mowing, and travel on unpaved roadways to access fuel break construction locations, would be direct sources of particulate matter in the form of fugitive dust, as described above under *Effects from Fuel Break Construction and Maintenance*.

Effects from Prescribed Fire Treatments

Prescribed fire in the form of broadcast or jackpot burning to clear fuel break areas and pile burning to burn vegetation that has been removed can cause locally high particulate matter concentrations. This could reduce visibility and affect public health by causing respiratory complications for certain individuals. Prescribed fire also emits carbon monoxide, nitrogen oxide, sulfur oxide, and volatile organic compounds. This would temporarily reduce air quality until the gases and particulates that make up smoke dissipate. Burned areas would be susceptible to windblown soil erosion until they are revegetated and the exposed soils are stabilized.

Emissions from prescribed fires could exceed air quality standards, especially for $PM_{2.5}$ and PM_{10} (USFS 2014, p. 471). Because of the potential impact on air quality and visibility from prescribed fire in an airshed, this activity is regulated by states through state smoke management programs. This is particularly the case when there is a combination of multiple burn activities or when there are prolonged impacts from poor meteorological conditions, such as temperature inversions that prevent smoke from dispersing and trap it near the ground (NWCG 2018b, pp 164-188).

Smoke management agencies coordinate and, if necessary, limit prescribed fires in an airshed to minimize smoke-related impacts on air quality, human health, and visibility. Burning within the prescriptions, regulations, and best management practices of each smoke management program would minimize smoke emissions and their associated impacts.

Effects from Chemical Treatments

Chemical treatments would be temporary sources of small volumes of volatile organic compounds. As described in the BLM Vegetation Treatments Using Herbicides Final Programmatic EIS (BLM 2007, p. 4-10) and the Vegetation Treatments Three New Herbicides Final Programmatic EIS (BLM 2016, p. 4-7), none of the approved chemical treatments would be likely to result in substantial volatilization from soils based on their vapor pressures and therefore, these treatments would not affect air quality through volatilization.

Effects from Targeted Grazing Treatments

Targeted grazing would have negligible impacts on air quality, as air pollutant emissions would be limited to equipment used to transport animals to and from the treatment locations.

4.3.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained. Short-term impacts from constructing fuel breaks, as described under *Nature and Type of Effects*, would continue to occur as fuel break projects are implemented in the project area on a case-by-case basis. Long-term trends would be as described in **Section 4.1.3**, Fire and Fuels, Effects from Alternative A. These fire trends would continue to affect local and regional air quality, as described in **Section 3.2**, Air Resources.

4.3.4 Effects from Alternative B

Under Alternative B, constructing up to 8,700 miles (529,000 acres) of new fuel breaks using only manual and mechanical treatment methods would result in short-term emissions as described under *Nature and Type of Effects*. Short-term emissions from fuel break construction would be greater than under Alternative A, as more miles of fuel breaks would be constructed, and such fuel breaks would be constructed on a regional scale. There would be no impacts from chemical treatments, prescribed fire, or targeted grazing, as these tools would not be used under Alternative B. Given the limited treatment methods that would be used under this alternative, there would be a low potential for violating air quality standards.

Construction of fuel breaks only along Maintenance Level 5 roads may result in reduced dust impacts from accessing the fuel break areas to the extent that more of these roads are paved; however, all fuel breaks would be either brown strip or mowed. Brown strips would be susceptible to windblown erosion over the long term, as described under *Nature and Type of Effects*.

Alternative B would have the potential to improve fire suppression, compared with Alternative A, by increasing the potential for fuel breaks to disrupt fire behavior and provide anchor points for suppression, especially along roads outside of highly resistant and resilient areas. Over the long term, increased fire suppression opportunities and decreased rate of wildfire spread across fuel breaks would reduce fire severity and intensity in treated areas, thus reducing the impacts of wildfire on air quality; however, the effectiveness of fuel breaks in the Great Basin over the long term would be limited by the restrictions on tools available for construction and maintenance and by the location and types of fuel breaks allowed under Alternative B.

4.3.5 Effects from Alternative C

Short-term emissions from fuel break construction would be greater than under Alternatives A and B, as more acres of fuel breaks (up to 667,000 acres) would be created in a 792,000-acre potential treatment area, the second largest of all action alternatives. Impacts could occur in certain highly resistant and resilient areas. Effects related to short-term emissions from using the full suite of treatment methods, including targeted grazing, prescribed fire, and chemical treatments, would be as described under *Nature and Type of Effects*.

To prevent any potential for violating air quality standards, the BLM would follow the prescribed fire measures described in **Section 2.4.3**, the smoke management program requirements of each state, and the required design features described in **Appendix D** (Design Features 10, 11, and 13-18). These measures would ensure that all prescribed fire operations follow their respective burn plans; that atmospheric conditions are within prescriptions when a prescribed burn is ignited and smoke is monitored throughout the burn; that debris piles are ignited only when soils are wet or frozen; and that all operations comply with state requirements to ensure that emissions remain below NAAQS $PM_{2.5}$ thresholds.

Construction of fuel breaks along major paved highways would result in minimal dust impacts from accessing these fuel break areas; however, construction of fuel breaks along BLM-administered ROWs would result in short-term dust impacts from travel on unpaved surfaces. Brown strips would be susceptible to windblown erosion over the long term, as described under *Nature and Type of Effects.* In green strips and mowed or targeted grazing fuel breaks, the BLM would use native seed mix only in highly resistant and resilient areas, which could potentially require multiple seedings should initial seedings not establish, leaving soils susceptible to wind erosion until vegetation is established in these areas.

Alternative C would have the potential to improve fire suppression, compared with Alternative A, by increasing the potential for wildfires to be stopped by fuel breaks along roads and BLM-administered ROWs. Over the long term, increased fire suppression opportunities and decreased potential for wildfire spread across fuel breaks would reduce fire severity and intensity in more areas of the Great Basin, reducing the impacts of wildfire on air quality, compared with Alternative A.

4.3.6 Effects from Alternative D

Short-term emissions from fuel break construction would be the same as described for Alternative C given that the same acreage (up to 667,000 acres) of fuel breaks would be created.

Alternative D could result in more short-term dust impacts from travel on unpaved surfaces compared with Alternative C, given the larger potential treatment area (1,088,000 acres) that includes the addition of Maintenance Level 1 roads. Brown strips would be susceptible to windblown erosion over the long term, as described under *Nature and Type of Effects*. Green strips would preferentially use native plant material, with exceptions for the use of nonnative plant material, even in highly resistant and resilient areas, which would reduce the amount of time that these areas remain unvegetated and susceptible to wind erosion. Short-term impacts and measures to prevent any potential violations of air quality standards would be as described under Alternative C.

Alternative D would have the same type of long-term impacts on air quality as described for Alternative C, except that treatment areas would include Maintenance Level 1 roads and all highly resistant and resilient areas without those limitations identified in Alternative C. This would allow for the most comprehensive, interconnected system of fuel breaks with the most fire suppression opportunities and the greatest decreased potential for wildfire spread across fuel breaks. As such, Alternative D would reduce fire severity and intensity and the resultant impacts on air quality as described under *Nature and Type of Effects* to the greatest degree.

4.3.7 Cumulative Effects

The cumulative effects analysis area for air quality is the air basins in and overlapping the six-state project area. This is because air pollutants from multiple sources combine in an air basin and also may be transported to downwind areas. The time frame used for the cumulative impacts analysis is the period over which fuel breaks would be created or maintained, likely several decades. Past, present, and reasonably foreseeable future actions (see **Table 4-1**) that could cumulatively affect air quality are suppression, fuel break projects, vegetation treatments, mining and fluid mineral development, and roads and ROWs, as well as the spread of invasive weeds and wildfire trends.

The buildup of fuel loads as a result of fire suppression and the spread of noxious weeds and invasive plants have contributed to an increased wildfire severity and intensity in the project area (Bracmort 2013; Brooks and Lusk 2008). Drought interacts with these and other factors to further affect fire behavior (Littell et al. 2016). This has affected air quality and visibility in areas of the Great Basin by generating smoke and ash in the short term and fugitive dust from exposed soils in the long term (fire exposes soil by removing vegetation; exposed soil is a source of windblown dust until soils have been stabilized by vegetation). Individual fuel break projects and vegetation management actions have been implemented to address these effects. These actions have had localized, short-term impacts on air quality similar to those described under *Nature and Type of Effects* from treatment methods used for both types of actions.

Over the long term, previous individual fuel break projects have reduced the impacts of wildfire on air quality in limited areas by improving fire suppression opportunities and decreasing the potential for wildfires to spread, thus reducing fire severity and intensity. Individual vegetation management actions have improved vegetation conditions in limited areas, indirectly affecting air quality by improving resiliency and resistance and reducing wildfire effects in these areas. These actions combined, however, have been unable to reduce overall trends in wildfire occurrence in the Great Basin and the resulting impacts on air quality.

Roads, ROWs, mining, and fluid mineral developments would continue to be a source of fugitive dust emissions, primarily from travel on unpaved surfaces for recreation, access and maintenance of ROWs, and access to mining and fluid mineral developments. These actions, in combination with other sources of fugitive dust and emitted particulate matter, such as transportation sources, power generation facilities, wood burning, and wildfire, have reduced visibility at some Class I areas and caused some areas in the Great Basin to be designated as nonattainment for PM_{10} or $PM_{2.5}$ (see **Figure 3-3**).

Cumulative effects common to all action alternatives would occur from constructing and maintaining a regional system of fuel breaks. Creating and maintaining fuel breaks would include short-term impacts on air quality from fugitive particulate matter. In the long term, fuel breaks would improve fire suppression opportunities and could potentially slow the rate of wildfire spread, thereby reducing impacts of wildfire on air quality. The relative contribution to cumulative impacts from each action alternative would differ based on the treatment areas and methods proposed.

Alternative B would have the fewest short-term combustion-related and fugitive dust impacts on air quality. This is because fewer acres would be treated, tools would be limited to mechanical and manual methods, and fuel breaks would be constructed only along a limited type of roadway. Combined with other past, present, and reasonably foreseeable fuel break and vegetation management actions in the project area, the creation and maintenance of a regional system of fuel breaks under Alternative B could decrease the potential for uncontained wildfires in treated areas. It would result in a cumulative improvement in air quality in portions of the Great Basin.

Under Alternatives C and D, the BLM would construct and maintain 2,300 more miles of fuel breaks than Alternative B, using a full suite of treatment tools, including chemical treatment and prescribed fire. The short-term impacts from fuel break construction would be greater under these alternatives, including emissions during construction activities and fugitive particulate matter. The creation and maintenance of a regional system of fuel breaks under Alternatives C and D would increase the potential for wildfires to be stopped by a fuel break, which would reduce the rate of spread and associated impacts from smoke.

The BLM's reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin would establish resistant and resilient sagebrush communities. Fuel breaks would help protect the rangelands by increasing the BLM's opportunities to manage wildfire. These two actions in combination would have the greatest potential to improve ecological site conditions and increase the fire return interval. At the same time, they would improve fire suppression opportunities such that fire severity and intensity would be reduced across the Great Basin. This would cumulatively reduce smoke and particulate matter under both Alternatives C and D over the long term.

Alternative D would expand treatment to highly resistant and resilient areas and could develop fuel breaks along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs. Because of this, it would provide the most comprehensive system of fuel breaks of all the action alternatives and the largest reduction in smoke-related impacts on air quality compared with the other action alternatives, because it would provide the greatest flexibility in creating an effective regional system of fuel breaks that could in turn potentially reduce the intensity and severity of wildfire over the long term.

4.4 SOIL RESOURCES

4.4.1 Assumptions

- Soil instability increases as slopes become steeper, especially for soils that are susceptible to wind and water erosion. Highly erosive soils would be at greater risk to potential surface-disturbing activities than other less erosive soils.
- Over the long term, fuel breaks that remove invasive vegetation, reduce fuels, and restore native plants should increase water availability and reduce soil susceptibility to wind erosion (Pierson et al. 2013).
- Biological soil crusts, if present, will be affected if treatments result in surface disturbance, as such disturbance could result in the destruction or reduction in prevalence of biological soil crusts. Biological soil crusts are less likely to occur on sites that have incurred multiple disturbances (such as repeated fires) (USGS 2004). Lower precipitation levels and less herbaceous cover promote crust development, making biological soil crusts more prevalent at lower elevations compared to higher elevations.

4.4.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

In general, short-term effects on soils are from the increased potential for soil erosion due to removal of vegetation (especially on brown strips) and changes in soil structure, porosity, and organic matter content due to surface disturbance and compaction. Soil disturbance stimulates erosion, breaks up soil aggregates, and promotes the loss of organic matter. Soil compaction changes soil structure, reduces the size and continuity of pores, and increases soil density. Soil compaction becomes a problem when the increased soil density limits water infiltration, increases runoff and erosion, and limits plant growth or nutrient cycling (Soil Quality Institute 2001).

Fuel breaks constructed as brown strips would completely remove vegetation, making soil disturbance more pronounced, and would increase wind and water erosion. Mowed strips would primarily use manual, mechanical and targeted grazing treatments to reduce the vertical extent of fuels which would compact soils but limit vegetation removal, providing soils with an erosion buffer. Seeding for construction of green strips would result in short-term soil disturbance; however, green strips would affect soils the least over the long term because annual invasive grasses would be replaced with perennial vegetation that retains moisture later into the growing season. This results in increased water infiltration rates to soils (see **Section 4.5, Vegetation**).

Over the long term, a regional system of fuel breaks and the associated improvement in fire suppression opportunities would help protect vegetation and biological soil crusts. This would lead to maintenance of soil stability and improved water infiltration rates, decreasing the likelihood for wind and water erosion. In areas where biological soil crusts are disturbed however, impacts on crust integrity can take up to 50 years to recover, depending on the species composition; if mosses and lichens were affected, these species could take up to 250 years to recover (USGS 2004). The following sections will discuss short-term and long-term impacts related to the proposed treatment methods.

Effects from Manual Treatments

Manual treatments with hand tools would allow for more selective removal of vegetation and would minimize soil compaction and cause localized soil disturbance. Localized, short-term soil disturbance and soil compaction could occur from vehicle operators accessing fuel break locations next to roads and BLM-administered ROWs. On biological soil crusts especially, these impacts would decrease aggregate stability, organic matter, and soil nutrients, which could decrease organism diversity (USGS 2004). Manual treatments would have fewer direct effects on soil than the other proposed treatments.

Effects from Mechanical Treatments

Soils, including biological soil crusts, could be compacted or disturbed from heavy machinery used for mowing, disking, and seeding during fuel break construction. This effect would be more pronounced when soils are dry or on fine-textured soils, such as silts and clays (Belnap et al. 1998). Soil compaction can break apart soil aggregates; it also can indirectly affect water infiltration, air movement, and the rate of chemical transport in soils by reducing the pore space between aggregates (increasing bulk density). In areas where biological soil crusts are affected, soil compaction could decrease soil stability and degrade organic matter, making soils even more susceptible to wind erosion. Disturbance of biological soil crusts would indirectly affect soil nutrient availability. That is because these crusts contain organic matter and nitrogen-fixing microorganisms (Belnap 1994). This disturbance would also have an indirect impact on native vegetation diversity, as biological soil crusts provide essential plant nutrients that foster plant survival (Ferrenberg et al. 2017). Additional impacts, such as water erosion, would depend on the amount of soil exposed (for instance, through tilling) during the treatment and site conditions, especially slope, local soil properties, and patterns of precipitation.

Effects from Prescribed Fire Treatments

Direct, short-term impacts on soils from prescribed fire would be from removing vegetation, consuming organic matter, and damaging soil organisms at the surface of the soil horizon. This could decrease soil organism diversity. The effects on soil structure due to vegetation removal would be similar to those described under *Effects from Mechanical Treatments*. The removal of soil surface stabilizers, such as vegetation, organic matter and biological soil crusts would expose bare mineral soils (Shinneman et al. 2018). This would reduce soil resistance to degradation and wind erosion, especially for highly erosive soils.

Localized pile and broadcast burning would transfer heat into the soil, exposing it to thermal extremes, which would have a direct impact on soil nutrient availability and soil porosity, limiting water infiltration (Busse et al. 2010). This could result in dry or water-repellant soils that lack cohesion between soil particles and are susceptible to water erosion and runoff. Dry conditions already persist in regions of the Great Basin. Aridisols, which are characterized as dry soils with low infiltration rates, are the most common soil type in the project area (see **Section 3.3**). Depending on the severity of the impact, vegetation may become reestablished in the short term. If soils are sterilized, long-term soil deposition may be needed before soils would support vegetation again, thus affecting the growing conditions for future vegetation communities (Busse et al. 2010). Removing woody vegetation by prescribed fire treatments could increase soil moisture availability (Rau et al. 2008). In the short term, some soil nutrients would be lost, while nutrient levels, soil pH, and organic matter would increase after exposure to fire over the long term (Rau et al. 2008). Increased soil pH would directly affect biological soil crust organisms that require acidic conditions (USGS 2004).

Effects from Chemical Treatments

Chemical use would remove plants and indirectly impact soil by decreasing organic matter and nutrient availability, especially water, and would increase erosion susceptibility (BLM 2016). Short-term impacts on biological soil crusts are unlikely because they are present in the open spaces between vegetation (see **Section 3.3**). Overall, impacts would not be uniform because herbicides have varying half-life ranges (a few days or up to a year) and degrade at different rates depending on the type of herbicide used (BLM 2016). Impacts would also depend on soil texture; soils with more clay and organic matter tend to hold water and dissolved chemicals longer (LaPrade 1992).

Effects from Targeted Grazing Treatments

Domestic animals and associated infrastructure could damage biological soil crusts at treatment sites through physical disruption, including shearing and compacting soil (Belsky and Blumenthal 1997; USFS 2017). This would decrease water infiltration rates and increase soil erosion. BLM would use the appropriate livestock type(s) according to the vegetation type(s) being treated to avoid grazing pressure on native species. Effects would vary, based on intensity and duration of grazing and type of livestock. For example, cattle prefer to graze on low and flat areas whereas sheep and goats prefer to graze on steep slopes (Walker et al. 2006). Compaction of soil on steeper slopes by sheep and goats would increase susceptibility to erosion where soil is already unstable. Grazed sites have higher compaction, as evidenced by the higher bulk density, than sites that are not grazed (Tate et al. 2004). Cattle would affect the uniformity of the soil horizon (including biological soil crusts) by breaking the crust and forming indentations. This would increase susceptibility to erosion, particularly on steeper slopes. Loss of biological crust would directly affect soil microorganisms and macroorganisms that depend on the surface horizon to recycle soil nutrients.

4.4.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained. Individual fuel break projects would continue, but a lack of a programmatic approach in the Great Basin would not contribute to improved fire suppression opportunities on a region-wide scale. Also, site-specific fuel break construction projects could be limited in their effectiveness. The continuation of intense wildfires without improved suppression opportunities would continue to damage soils and soil crusts and to clear vegetation in the long term. This would strip soil nutrients and increase the potential for wind erosion. It could also limit soil infiltration rates and create water-resistant soils, which would increase the risk of water erosion. There would be no direct or immediate short-term impacts on biological soil crusts or highly erosive soils due to vegetation removal, soil compaction, prescribed burning, or targeted grazing; however, large-scale soil erosion would be possible due to the continued potential for wildfires over the long term.

4.4.4 Effects from Alternative B

Under Alternative B, 514,000 acres of soil would be available for up to 8,700 miles of fuel break construction; 16,000 of these acres have highly erosive soils (**Table 4-4**). As prescribed fire and chemical and targeted grazing treatments would not be used under Alternative B, impacts on soil surfaces would be limited to manual and mechanical treatments, and the effects would be as described under *Nature and Type of Effects*.

Over the short-term, constructing fuel breaks adjacent to Maintenance Level 5 roads would remove vegetation and compact soil in these areas, which increases wind and water erosion susceptibility. Impacts on nutrient availability would be localized and related to surface disturbance. These effects would not occur in highly resistant and resilient sites or in sagebrush, since these areas would be avoided under Alternative B. This exclusion would greatly limit the extent of impacts. Reseeding with native vegetation would increase soil stability and reduce the likelihood for wind erosion over the long term. However, native vegetation establishment in treatment areas could be limited in certain ecological situations (see **Section 4.5.4**). Therefore, maintenance would be ongoing to monitor native seeding success; failure to establish after initial treatment could result in multiple treatments that increase short-term impacts on soils.

Table 4-4
Acres of Highly Erosive Soils Available for Fuel Break Construction

Alternative	Acres of Highly Erosive Soils Available for Fuel Break Construction
B	16,000
C	32,000
D	45,000

Source: BLM GIS 2019

Design Features 1-3, 6-8, and 33-38 could minimize the impacts of ground-disturbing treatments on highly erosive soils, steep slopes, in areas with high cover of biological soil crusts, and on previously disturbed soils (see **Appendix D**). Under Alternative B, long-term impacts would be as mentioned under *Nature and Type of Effects*, which would improve soil stability and water infiltration rates, decreasing the likelihood for wind and water erosion, compared with Alternative A.

4.4.5 Effects from Alternative C

Under Alternative C, 774,000 acres of soil would be available for up to 11,000 miles of fuel break construction, 32,000 acres of which have highly erosive soils (**Table 4-4**). Use of mechanical treatments in all sagebrush communities would increase impacts of soil compaction in these areas as described under *Nature and Type of Effects*, compared with Alternative B. Short-term impacts on soils from constructing fuel breaks would occur next to Maintenance Level 3 and 5 roads and BLM-administered ROWs. Fuel breaks could be constructed but only under limited conditions: in areas with high fire probability, or where adaptive management habitat triggers have been tripped. This would increase protection and decrease soil disturbance in those areas.

Design features listed for Alternative B would also apply under Alternative C, but they would be applied over a larger area. This is because the potential treatment area and fuel breaks miles would be greater under Alternative C.

Pile and broadcast burning would result in the loss of topsoil and its organic matter and biological soil crust. Such prescribed fire methods would reduce water infiltration rates, directly affecting soil erosion capacity, especially in highly erosive soils. Implementing Design Feature 14, which states that soils must be wet or frozen during pile burning, would help minimize these impacts (see **Appendix D**).

Domestic animals used for targeted grazing treatments would break the soil surface, including any biological soil crusts, with their hooves. They also would mix soils and expose them to wind erosion, as described under *Nature and Type of Effects*. Applying Design Features 20 and 22 would require rest from grazing, which would allow for native plant establishment and site stabilization (see **Appendix D**).

The short-term impacts of Alternative C would be similar to those of Alternative B but would include additional loss of organic matter, topsoil, and biological soil crust. This is because this alternative would allow the use of additional treatment methods (targeted grazing, prescribed burning, and chemical treatment) and would create more miles of fuel breaks; however, these impacts would be minimized using Design Features 14, 20, and 22 and those mentioned under *Effects from Alternative B*. Expanding the potential treatment area and maximum miles of fuel breaks would increase fire suppression opportunities across the Great Basin over the long term and could offer increased protection of existing soils, biological soil crust, and vegetation, compared with Alternative B. Reseeding with natives would have impacts as described for Alternative B, but requirements to reseed with native species only in highly resistant and resilient areas under Alternative C could reduce those potential effects, given the inherent resistance of these sites to annual grass invasion and spread and environmental conditions that support plant growth (Chambers et al. 2014a).

4.4.6 Effects from Alternative D

Under Alternative D, 1,066,000 acres of soil would be available for up to 11,000 miles of fuel break construction, 45,000acres of which have highly erosive soils (**Table 4-4**). Use of mechanical treatments throughout the project area would be the same as described in Alternative C. Short-term impacts on soils from constructing fuel breaks would occur next to Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs. Fuel breaks would also be allowed in highly resistant and resilient sites, which would disturb the soil in these areas over the short term. However, the preferential use of natives for reseeding, with exceptions for the use of nonnatives per Handbook H-1740-2, would limit follow-up treatments and future maintenance of fuel breaks thus limiting further short-term impacts on soils.

The short-term impacts of prescribed fire and manual, mechanical, and chemical treatments would be the same as those described under Alternative C, except over a larger potential treatment area. The long-term impacts from creating a system of fuel breaks across the Great Basin would be similar to those described under Alternative C as well; having the largest potential treatment area under Alternative D provides greater flexibility for fuel break placement and may improve fuel break siting and the likelihood of success, thus increasing potential protection of soils, biological soil crust, and vegetation, compared with Alternative C.

4.4.7 Cumulative Effects

The cumulative effects analysis area is the project area boundary. Effects are not expected to extend beyond the project area, because impacts on soils would be localized to the fuel break locations. Due to the large project area and localized effects from fuel breaks, the effects on soils would not be uniform across the project area. The Great Basin has a variety of soil types and biological soil crusts are not evenly distributed (see **Section 3.3**). Fuel breaks would be maintained long after their initial treatment, so the timeframe for cumulative effects on soils would likely continue up to several decades after fuel break construction.

Past, present, and reasonably foreseeable future human actions and natural processes have improved soil conditions through vegetation management and fuel break projects; however, fire suppression during the twentieth century has increased fuel loads in the Great Basin (**Table 4-1)**. This has contributed to larger, more severe wildfires that increase soil erosion and destroy biological soil crusts, as described under *Effects from Alternative A*.

Past, present, and reasonably foreseeable future livestock grazing projects and such developments as fluid mineral leasing and land use projects (**Table 4-1**) have increased and would continue to increase surface disturbance, exposing soil surface layers and biological soil crusts to wind erosion. Construction of transportation routes for OHV, recreation, and other uses is a reasonably foreseeable future action in the project area that would increase the risk of roadside fire ignition. This would expose soils to thermal extremes and limit infiltration rates, as described under *Nature and Type of Effects*, and would result in drier soils.

The natural spread of invasive annual grasses and noxious weeds, combined with natural and human-caused fires, would continue to reduce native vegetation cover. Soils and biological soil crusts would become less stable and more susceptible to wind erosion and would have reduced nutrient availability where invasive vegetation is dominant.

All action alternatives would result in the construction and maintenance of a regional system of fuel breaks. This would cumulatively contribute to an increase in short-term and long-term impacts on soils, while increasing opportunities to manage wildfires throughout the project area. Constructing and maintaining fuel breaks under Alternative B would affect the fewest acres of soil: up to 16,000 acres of soils with high wind erosion potential (see **Table 4-4**). Even when combined with other fuel break and vegetation management projects described in **Table 4-1**, Alternative B may not provide enough opportunities to improve current wildfire conditions. In turn, severe wildfires would likely continue to affect soils, increasing the potential for wind erosion and damage to biological soil crusts.

Alternatives C and D would construct and maintain 2,300 more miles of fuel breaks than Alternative B and would result in a greater contribution to cumulative impacts on soils than Alternative B. In the long term, the use of multiple methods and tools for fuel break construction under Alternatives C and D would provide the BLM with the widest range of tools to construct effective fuel breaks, while minimizing impacts on soil resources by implementing the design features listed in **Appendix D**. Alternative D would offer the BLM more flexibility; consequently, the cumulative contribution in conjunction with human development, livestock grazing, vegetation removal, and other fuel breaks projects would be greatest under Alternative D.

Under Alternative B, construction of fuel breaks next to Maintenance Level 5 roads would minimize the effect of roadside fire ignition due to transportation development and OHV use and would reduce burning-related impacts on soils as described under *Nature and Type of Effects*. Alternatives C and D would mitigate this further by allowing construction next to BLM-administered ROWs; Alternative D would include construction next to Maintenance Level 1 roads. By using multiple treatment methods and constructing more miles of fuel breaks, Alternatives C and D would be more effective than Alternative B at potentially slowing the spread and limiting the size of severe wildfires; Alternative D would also provide the most flexibility to utilize tools. In turn, severe wildfires that increase the potential for wind erosion and damage biological soil crusts may disturb fewer areas under Alternatives C and D than Alternative B, with Alternative D providing the greatest suppression opportunities.

The BLM's Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, in combination with the fuel breaks proposed under this PEIS, would have a synergistic cumulative effect that would be most pronounced under Alternatives C and D. Fuels reduction and rangeland restoration would establish resistant and resilient sagebrush communities, which would alter wildfire movement and behavior on the landscape and ultimately improve the structure and function of vegetation communities in the project area. Fuel breaks would help to protect these restored areas by providing a buffer around them and by increasing the suppression opportunities to manage wildfires. Together, these factors would improve the biological, physical, and chemical properties of soils and biological soil crusts and decrease the potential for erosion in the long term.

4.5 VEGETATION

4.5.1 Assumptions

- Desired vegetation would vary by fuel break type and desired fuel model.
- Mechanical treatment of vegetation would reduce vegetation cover and enhance the growth of grass and forb species.
- Prescribed fire in sagebrush communities would reduce the percent cover of sagebrush and increase the cover of grass species.
- Chemical treatments would reduce the cover of target plant species.
- Targeted grazing would reduce the target plant cover in the grass and forb vegetation stratum.

- The treatments listed above that would reduce cover of target vegetation and enhance the growth and coverage of grass and forb species would only do so if an intact, native seedbank remained on the ground.
- The BLM would manage invasive, nonnative annual plants, and noxious weeds in accordance with local weed program monitoring protocol, along with any additional RMP guidance.
- The effects of wildfires on vegetation are from changes in wildfire behavior and fuel models, as described under **Section 4.2**, Fire and Fuels**.**

4.5.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Creating and maintaining fuel breaks would directly modify or remove vegetation in the fuel break, resulting in localized changes to the vegetation. As described in **Section 4.2.1**, Fire and Fuels, this would result in the potential for changes to flame length and fire behavior, ignition potential, and suppression opportunities, and the effects would depend on the type of fuel break constructed. Indirectly, these changes would affect vegetation in and outside of the fuel break. The intensity of the effects would vary between the alternatives, because the alternatives would use one or more types of fuel breaks in varying amounts.

As described in **Section 4.2.2**, in the long-term, brown strips would reduce the number of fire starts, and subsequently the amount of vegetation burned in the project area, though vegetation could be affected if fires with longer flame lengths breach or spot past the fuel break. Mowed or targeted grazing fuel breaks would provide similar opportunities to support suppression and would indirectly reduce the amount of vegetation burned in the project area in the short-term and with repeated treatment in the long-term. In the absence of suppression, mowed or targeted grazing fuel breaks could reduce the rate of wildfire spread and subsequent amount of vegetation burned. However, without regular maintenance, the potential that mowed or targeted grazing fuel breaks would indirectly reduce the amount of vegetation burned in the project area would incrementally diminish over the long-term (see **Section 4.2.2**).

Green strip fuel breaks, as described in **Section 4.2.2**, could indirectly reduce rates of spread and amount of vegetation burned in the project area over time as well as reduce the potential for a new start to move through the fuel break to surrounding vegetation.

Creating and maintaining fuel breaks, regardless of the fuel break type, would directly modify or remove vegetation in the fuel break, resulting in localized changes to the vegetation state. The magnitude of this effect would vary, depending on the existing vegetation state, the type of fuel break proposed, and the method proposed for fuel break construction or maintenance. The effects specific to each treatment method are described below.

Effects from Manual Treatments

Manual treatments would selectively cut, clear, remove, or prune vegetation in fuel breaks. Manual treatments would directly remove or modify target vegetation, in turn changing vegetation structural and functional components by reducing percent cover of target species or changing species composition. Manual treatments would occur in areas where mechanical equipment use would be unlikely, such as on steep slopes or rocky sites or near sensitive resources.

Manual treatments would have less potential to damage or kill nontarget vegetation than other methods, including mechanical treatments, prescribed fire, and targeted grazing. This is because workers could avoid nontarget vegetation and because the amount of surface disturbance associated with manual treatments is generally minor and localized. Nontarget vegetation may be damaged or killed by foot or vehicle traffic in the treatment locations, but this effect would be short term and localized.

Manually removing the shrub canopy in fuel break could release desired perennial grasses and other herbaceous species that are present in the shrub understory (Monsen et al. 2004). Indirectly, this would decrease flame length by changing the vegetation structural and functional components in the fuel break by increasing percent cover of understory herbaceous species in the long term.

Manually removing the shrub canopy in the fuel break could also release invasive annual grasses that are present in the shrub understory (Davies et al. 2011a). This would also change vegetation structural and functional components by increasing the percent cover of invasive annual grasses in both the fuel break, and potentially in the adjacent vegetation communities, for one to several seasons. Managing invasive, nonnative plants in accordance with local weed program monitoring protocol would reduce or prevent this detrimental impact.

Manual treatments would generally be used to create and maintain fuel breaks in vegetation states containing a shrub component. These include the following vegetation states: perennial grasses and forbs with shrubs; shrubs and perennial grasses and forbs with invasive annual grasses; and shrubs with depleted understory (see **Table 2-2**). Manual treatments could also be used in sites with pinyon or juniper to limb trees left in fuel breaks, in combination with mechanical treatments.

Effects from Mechanical Treatments

Mechanical treatments would remove vegetation and prepare and sow seedbeds to create and maintain fuel breaks in areas where manual treatments would be impractical. Similar to manual treatments, detrimental effects on existing vegetation in the fuel break would generally occur over the short term as vegetation is removed and the soil surface disturbed during treatments. Removal would be done by use of vehicles with attached implements designed for vegetation treatments, such as agricultural mowers, masticators, disks and plows, chains and cables, and harrows and imprinters. The intensity of the detrimental effects may be greater, because mechanical treatments would generally result in surface disturbance and vegetation removal over a larger area compared with manual treatments.

Similar to manual treatments, reduction of shrub overstory using mechanical treatments could beneficially impact vegetation in the fuel break by releasing desired perennial grasses and forbs in the shrub understory (Monsen et al. 2004). Like manual treatments, mechanical treatments may also have detrimental effects by indirectly increasing the percent cover of invasive annual grasses in the fuel break and potentially in adjacent vegetation communities (Davies et al. 2011a). Both effects may be greater when mechanical treatments are used, since mechanical treatments would generally affect larger contiguous areas. As described for manual treatments, managing invasive, nonnative plants in accordance with local weed program monitoring protocol would reduce potential detrimental impacts from release of invasive annual grasses.

Negative effects on vegetation stemming from surface disturbance as described above, may be more intense when such features as cryptobiotic soil crusts (USFS 2017) are present (see **Section 4.4**, Soils).

This is because cryptobiotic crusts stabilize soil, reduce or eliminate erosion, retain soil moisture, and shelter and increase germination success for plant seeds. Thus, these features help to maintain vegetation condition in the long term.

Airborne dust would be generated during surface disturbing activities caused by mechanical treatments. Dust settling on nearby vegetation could detrimentally affect plant photosynthesis, respiration, and transpiration in the short-term, in turn negatively affecting pollinator efficiency and thus plant reproduction (Farmer 1993, Waser et al. 2017).

Mechanical treatments would generally be used to create and maintain brown strip, green strip, and mowed fuel breaks in all vegetation states described in this document (see **Table 2-2**). As described above, treatments would indirectly help reduce wildfire severity and intensity by increasing fire suppression opportunities and decreasing the potential that wildfires would spread across fuel breaks. The effects from specific mechanical treatment types are described below.

Tilling would effectively remove vegetation in the short term by uprooting and burying it, thereby creating an unvegetated area that would not carry fire. Tilling would also create a seedbed suitable for desired species establishment. Relative to other mechanical methods, tilling would result in the most disturbance to vegetation in the fuel break in the short term. This method is most suited for situations where complete vegetation removal is desired, and it is generally used in conjunction with other treatments, such as chemical treatments. For example, post-tilling chemical treatments would reduce germination of, or treat, nonnative invasive plants or fire-prone vegetation that has germinated in the treatment area. Tilling in areas where nonnative, invasive plants are present, without follow-up chemical treatment, would increase the potential for long-term increases in nonnative, invasive plant cover (Zouhar 2003) both in the fuel break and in adjacent vegetation. Conducting follow-up treatments would have beneficial effects by helping to more quickly move vegetation in the fuel break toward desired conditions in the long term.

Harrowing and imprinting would reduce vegetation in the short term by crushing and uprooting plants. The impact intensity would generally be less than tilling, because unlike tilling, harrowing would not remove all vegetation in a fuel break. However, impact intensity would increase with more harrow use in a given area, because more vegetation would be removed with each pass of the harrow. Treatment areas would have reduced shrub cover, effectively lowering flame length and rates of spread as fire moves into the fuel break. Like tilling, follow-up treatments would generally be used to reduce germination of, or treat, nonnative invasive plants or fire-prone vegetation that has germinated and to prepare and sow the seedbed for desired species establishment. This would have beneficial effects by helping to more quickly move vegetation toward desired conditions in the long term.

Chaining would reduce shrub cover, prepare the seedbed, and cover broadcast seed in the fuel break. By reducing shrub cover, chaining would lower flame lengths and rates of spread when fire moved into the fuel break, allowing for more efficient management of fire. Like tilling and harrowing, chaining would also disturb the soil. When soils are dry and loose, chaining can result in a seedbed that is generally not conducive to seeding establishment (Monsen et al. 2004). Chaining would be adjusted by the appropriate season to reduce this impact, improving seeding success and establishment of desired species in the fuel break. As described above, follow-up chemical treatments would generally be used to reduce germination of, or treat, nonnative invasive plants or fire-prone vegetation that has germinated, which would have beneficial effects by helping to more quickly move vegetation in the fuel break toward desired conditions in the long term.

Mowing would cut herbaceous and woody vegetation above the ground surface. It would reduce fuel heights in the fuel break in the short term, indirectly lowering flame length and reducing rates of fire spread when fire moved into the fuel break. To maintain a reduced fuel load, mowing would be repeated as herbaceous biomass and shrub canopies regrow and exceed heights that would produce flame lengths greater than 4 feet; vegetation heights and their corresponding flame lengths are described in **Table 4-3** and **Section H.2**, **Appendix H**.

Like other mechanical treatments, mowing could increase the potential for release of both desired perennial grasses and forbs (Monsen et al. 2004), and invasive annual grasses (Davies et al. 2011a), that are present in the shrub understory in the fuel break. However, the amount of surface disturbance would be reduced compared to tilling, harrowing, or chaining, which may decrease the potential for invasive annual grass release or germination compared to other mechanical treatments. As described above, follow-up chemical treatments would generally be used to reduce germination of, or treat, nonnative invasive plants or fire-prone vegetation that has germinated, which would have beneficial effects by helping to more quickly move vegetation in the fuel break toward desired conditions in the long term.

Mastication removes woody vegetation in the fuel break, having similar impacts as mowing. A vehicle attached to the masticator can damage nontarget vegetation in the short term by crushing, though crushed vegetation would likely recover over one to several growing seasons. Treatment areas are generally seeded before mastication, and mulch generated during treatment is generally left in place to aid in seed incorporation, germination, and establishment. In the long term, mastication would have beneficial effects by increasing the percent cover of desired vegetation in the fuel break.

Effects from Revegetation

Revegetation using seeds and seedlings would change the structural and functional components of vegetation in fuel breaks in the long term. Revegetation would have beneficial effects by increasing percent cover of desired species in the fuel break. Revegetation would also have the beneficial effect of helping to decrease potential invasive annual grass germination in fuel breaks by providing competition in the form of desired perennial grass and forbs and thus reducing available resources and growing space. This would reduce the potential for invasive annual grass to spread outside of fuel breaks, in turn, helping to reduce ecosystem degradation in the long term from the annual grass invasion-wildfire cycle (D'Antonio and Vitousek 1992; Brooks et al. 2004).

To best meet project objectives, revegetation plant selection would be decided at the site level using guidance from BLM Handbook 1740-2. In accordance with the Handbook (BLM 2008, p. 87), the BLM would prioritize native plant material for revegetation. Nonnative plants could be used in certain circumstances provided several conditions are met; these are cases when the natural biological diversity would not be diminished by nonnative species, when nonnative species could be confined to the treatment areas, when site inventory indicates a site would not support native species reestablishment, and when resource objectives could not be met with native species.

Per BLM Handbook 1740-2 (BLM 2008, p. 87), an additional condition of using nonnative plants is an unavailability of suitable native species. However, because the BLM would follow the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015), which guides the development, availability, and use of seed needed for timely and effective restoration, it is unlikely that suitable native seed would be unavailable for fuel break revegetation.

In the Paradigm Fuel Break Project EA (BLM 2011), the BLM determined that there was a low potential for the nonnative species prostrate kochia (*Bassia* [*Kochia*] *prostrata*) plant material used in fuel breaks to spread into established sagebrush and perennial bunchgrass stands. Similarly, prostrate kochia is unlikely to spread into adjacent dense cheatgrass communities (Harrison et al. 2002; Monaco et al. 2003); however, prostrate kochia has been shown to spread into disturbed areas with abundant bare soils and few native perennial species and into naturally sparsely-vegetated areas (McArthur et al. 1990; Clements et al. 1997; Harrison et al. 2000; Harrison et al. 2002; Sullivan et al. 2013). Project-level analysis would determine site suitability for revegetation using nonnative plant material, such as prostrate kochia.

Various types of seeding treatments in fuel breaks would be used in combination with mechanical and other treatments. Short-term negative effects on existing vegetation in fuel breaks from seeding are localized, damaged or destroyed vegetation and surface disturbance from vehicles or machinery, as discussed for mechanical treatments. In the long term, seeding treatments would have beneficial effects such as increasing the percent cover of desired vegetation in the fuel break, and helping to more quickly move vegetation in the fuel break toward project objectives.

In some cases, seeded species may spread into adjacent vegetation (McArthur et al. 1990; Gray and Muir 2013), altering the species composition of these areas. The potential for this impact, and whether the impact was beneficial or detrimental to existing vegetation, would depend on the seeding method proposed (e.g., drill seeding versus broadcast seeding), the species seeded, and existing vegetation conditions in adjacent areas.

Effects from Prescribed Fire Treatments

Prescribed fire would be used under specific weather and wind conditions to remove plant biomass from fuel breaks. Prescribed fire treatments could generally be used to create and maintain green strip fuel breaks in all vegetation states described in this document (see **Table 2-2**), except for sites with pinyon or juniper woodlands.

When used in conjunction with other treatments, prescribed fire can help move vegetation in the fuel break toward desired conditions by improving seed bed conditions and facilitating desired vegetation establishment. For example, in areas with high invasive annual grass cover, prescribed fire would reduce the above-ground live plant and residual biomass cover and invasive annual grass seed bank in the short term, reducing competition for revegetation. Removing above-ground biomass can also release existing perennial grasses and forbs by freeing resources for growth (Monsen et al. 2004)

Heat from prescribed fire may alter the physical, chemical, and biological properties of the soil, thus negatively affecting the growing conditions for future vegetation (Busse et al. 2010, Busse et al. 2013). This effect is unlikely during broadcast burning but is more likely during pile burning, when fire is more concentrated in one location on the ground. This impact would be relatively short term and minor when burning small piles and potentially longer term and more intense when burning larger piles or piles containing large pieces of wood (Busse et al. 2013, Rhoades et al. 2015).

Heat from prescribed fire can also damage or kill desired vegetation; the intensity of this effect depends on the species and its ability to withstand fire or regrow following fire. Rhizomatous perennial grasses, bottlebrush squirreltail (*Elymus elymoides*), and Sandberg's bluegrass (*Poa secunda*), tend to be more fire resistant, along with shrubs like rabbitbrush that resprout after fire. Sagebrush species tend to have a high death rate following fire (Miller et al. 2014b; Monsen et al. 2004), and bitterbrush does not recover well after repeated burning (Busse and Riegel 2009). Because prescribed burning is most damaging to plants during their active growth period, prescribed burning would be most likely to occur when plants are dormant, to minimize negative impacts on desired vegetation.

Establishing fire line during certain prescribed fire operations would have direct, negative impacts on existing vegetation where the line was established. This is because constructing hand lines would involve physically scraping or digging with hand tools to bare mineral soil, which would remove vegetation in the process. Hand lines would generally be one to three feet wide, depending on existing vegetation. Digging hand line may also result in local increases in nonnative invasive grass germination due to soil disturbance, however, follow-up chemical and seeding treatments would reduce or prevent this impact. These impacts would not occur when a wet line was used because no vegetation removal or surface disturbance would occur using this method. Overall, negative impacts of fire line construction would be offset by beneficial impacts in the long term, which would be an outcome of meeting project objectives.

As described under *Effects from Mechanical Treatments*, cryptobiotic crusts (see **Section 4.4**, Soils) help to maintain vegetation condition in the long term. Cryptobiotic crusts can be seriously damaged by high-severity fire, however, low-severity fire poses a lower risk to these features (USFS 2017). Constructing fire line or other surface disturbing activities during prescribed burns may cause localized damage to cryptobiotic crusts if they are present in the fuel break. However, local, negative impacts would be offset in the long term by larger-scale conservation of cryptobiotic crusts in adjacent sagebrush communities from fewer large-scale wildfires.

Developing and implementing a prescribed fire burn plan in accordance with the PMS-484 Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2017) would reduce the potential of prescribed fire escaping the treatment area and causing unintended negative impacts in adjacent vegetation. Further, plans would ensure that prescribed fire would be conducted in appropriate treatment areas. For example, broadcast burning would be unlikely in low-elevation sagebrush areas, because without successful follow up vegetation seeding/establishment, it would likely create conditions conducive to cheatgrass invasions (BLM 2003).

Effects from Chemical Treatments

The effects of chemical treatments on vegetation are described in detail in the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (BLM 2007, p. 4-44) and the 2016 Final PEIS for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States (BLM 2016, p. 4-25).

As described in those PEISs, chemical treatments can be used to remove target plants, or decrease target plant growth, seed production, and competitiveness, thereby releasing native or desirable species from competitive pressure and aiding in their reestablishment where vegetation modification is desired. Potential impacts on nontarget vegetation, as described in those PEISs, include death, reduced productivity, and abnormal growth from unintended contact with chemicals via drift, runoff, wind transport, or accidental spills and direct spraying. The degree of impacts depends on the chemical used and its properties, such as persistence, the application rate, the treatment method, the physical site conditions, and the weather (such as wind or rain) during treatments (BLM 2007, p. 4-47). These effects would generally be limited to the short term during and immediately following treatments, and following standard operating procedures (BLM 2007, Table 2-8) and mitigation measures (BLM 2016, Table 2-5) described in the PEISs would prevent impacts or reduce impact intensity.

Chemical treatments would generally be used to create and maintain green strip and brown strip fuel breaks in all vegetation states described in this document (see **Table 2-2**), except on pinyon or juniper trees. Chemical treatments would have adverse effects on existing vegetation in the fuel breaks because these treatments would directly remove vegetation in the fuel break. However, chemical treatments could also periodically remove reestablishing vegetation in fuel breaks to maintain their effectiveness and achieve project objectives over the long term.

Chemical treatment can have beneficial or adverse effects on pollinators (BLM 2007, pp. 4-101 to 4-118), this would depend on the chemical used, treatment timing, and plant and pollinator species affected. As described in the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement and the Final PEIS for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States PEISs (BLM 2007, 2016), some chemical formulations can be toxic to pollinators; acute or chronic exposure to these formulations could result in mortality and reduced population sizes, indirectly negatively affecting ecosystem function. Some pollinators would benefit from treatments that remove nonnative species and indirectly increase native plant species growth and cover. Following standard operating procedures and mitigation measures described in the PEISs would prevent negative impacts or reduce impact intensity.

Effects from Targeted Grazing Treatments

Livestock (cattle, sheep and goats) would reduce the height and cover of invasive annual grasses and nonnative perennial grasses in fuel breaks in the short term, thereby reducing flame lengths and rate of spread when fire entered the fuel break. Targeted grazing could be used to maintain targeted grazing fuel breaks in all vegetation states except shrubs with depleted understory (see **Table 2-2**).

Targeted grazing would reduce the ability of target vegetation to compete with desired vegetation in the fuel break. This would come about because grazing would remove or reduce the functional leaf area of target plants. This would reduce photosynthetic capacity and alter the competitive interaction among plant species. This would lead to a change in species composition, as the competitive advantage shifts from target to desired vegetation. Targeted grazing would indirectly decrease the seed bank for these species by preventing seed production, contributing to reduced cover of these species in the long term. The intensity of these effects would vary depending on the grazing intensity (i.e., number of head), livestock type, grazing season and frequency, and grazing resistance of target vegetation (Heitschmidt and Stuth 1991). Consequently, targeted grazing would be designed and implemented taking into account the development morphology and physiological function of the targeted plant species.

Direct impacts on vegetation would vary depending on the type of livestock used. While cattle generally prefer to graze on grass, about half of a typical sheep diet is forbs and edible portions of shrubs (browse), and a typical goat diet is made up primarily of browse (Walker et al. 2006). Thus, sheep and goats generally forage more selectively and would remove the highest quality forage first, resulting a reduced cover of forbs and woody species. Sheep, goats, and cattle readily consume grass-dominated diets, provided grasses are plentiful (Mosley and Roselle 2006). Sheep and goats are also capable of grazing lower to the ground relative to cattle and can reduce the cover of annual grasses and prostrate plants more effectively than cattle (Mosley and Roselle 2006, Walker et al. 2006).

In addition to differences in diet preference, cattle, sheep, and goats differ in the parts of the landscape on which they prefer to graze. Cattle prefer lower flatter areas, while sheep and goats will use steeper slopes, and have a strong tendency to graze into the wind. This can result in overuse on the side of a pasture from which prevailing winds blow (Walker et al. 2006).

While overall targeted grazing would reduce invasive annual grass cover, livestock may contribute to habitat degradation through surface disturbance. This effect would generally be minor but as described in **Section 4.4**, Soils, may be more intense when such features as cryptobiotic soil crusts (USFS 2017) are present. This is because cryptobiotic crusts stabilize soil, reduce or eliminate erosion, retain soil moisture, and shelter and increase germination success for plant seeds, helping to maintain vegetation condition in the long term. However, sites that are typically suitable for targeted grazing fuel breaks, such as those dominated by invasive annual grasses and nonnative perennial grasses, have already been disturbed, so additional impacts on vegetation in these areas from livestock would be minor or discountable.

Implementing design features that reduce impacts from targeted grazing, including a targeted grazing plan, would minimize impacts on nontarget species (see **Appendix D**).

4.5.3 Effects from Alternative A

Under Alternative A, fuel break projects would continue to be employed throughout the project area on a site-specific basis, and a regional system of fuel breaks would not be constructed and maintained. Thus, there would be a slower response to fuel break project planning and implementation. Current ecosystem trends and processes, as described in **Chapter 3**, would continue. Conversion to cheatgrass and other invasive annual grasses, which increase the presence of fine fuels and threaten the sagebrush communities, would likely continue at a similar rate. There would be a continued trend toward conversion of sagebrush communities to one dominated by invasive annual grasses, eventual loss of native plant diversity, and degraded ecosystem structure and function throughout the project area boundary, particularly in areas with lower resistance to invasion and lower resilience from disturbance such as wildfire.

4.5.4 Effects from Alternative B

Where used, manual and mechanical treatments would generally have effects on vegetation, as described in the *Nature and Type of Effects*, for these treatment methods. The acres of vegetation states that would be available for fuel break construction are summarized in **Table 4-5**, below. Fuel breaks would not affect all of the acres below as described in **Section 4.1.1**.

Of the 8,700 potential miles of new fuel breaks, approximately 2,349 miles could be brown strips constructed using such mechanical treatments as tilling along Maintenance Level 5 roads. Brown strips would directly remove vegetation in the fuel break in the short term, which would prevent fire starts and dissipate flame lengths that facilitate suppression. Indirectly, and in the long term, this would reduce the acres of vegetation loss or conversion in sagebrush communities, as described in the *Nature and Type of Effects*. However, fires with longer flame lengths could breach or spot past brown strips given their relatively narrow width. As a result, in this scenario, these treatments would be less likely to reduce rates of fire spread in the absence of suppression. This could reduce the magnitude of the effect described above.

Table 4-5
Acres of Vegetation States Available for Fuel Break Construction[1]

Vegetation State	Alternative B	Alternative C	Alternative D
Invasive annual grasses	28,000 (6%)	38,000(5%)	54,000 (5%)
Invasive annual grasses with shrubs	42,000 (9%)	59,000 (8%)	80,000 (8%)
Perennial grasses and forbs	21,000 (4%)	28,000 (4%)	42,000 (4%)
Perennial grasses and forbs with shrubs	82,000(17%)	139,000 (18%)	219,000 (21%)
Perennial grasses and forbs with invasive annual grasses	67,000 (14%)	95,000 (13%)	118,000 (11%)
Shrubs and perennial grasses and forbs with invasive annual grasses	135,000 (27%)	214,000 (28%)	295,000 (28%)
Shrubs with depleted understory	70,000 (14%)	97,000 (13%)	116,000 (11%)
Sites with trees	47,000 (10%)	85,000 (17%)	121,000 (12%)

Source: BLM GIS 2018
[1] Alternative A was excluded because it is the No Action Alternative. The total acreage of these treatments does not match the total potential treatment area due to gaps in the vegetation states dataset; percentages refer to proportion of total treatment area under each alternative.

Of the 8,700 potential miles of new fuel breaks, approximately 73 percent (6,351 miles) could be mechanical treatments (i.e., mowing) in each vegetation state (**Table 2-2**). Mowed fuel breaks would directly change the vegetation structural component by lowering vegetation height. Indirectly, this would reduce flame lengths when fire burned into the fuel break, increasing suppression opportunities and decreasing the amount of vegetation burned in the project area in the long term. Mowed fuel breaks may also reduce breaching or spotting potential in the absence of suppression, lowering rates of fire spread and similarly reducing the amount of vegetation burned in the long term. These effects would diminish over time in the absence of maintenance, as fuels in the mowed fuel break regrow and cure.

Limiting the types of treatments to create and maintain fuel breaks to manual and mechanical treatments may in turn, limit the number of new fuel break construction in areas that are open to it. This is because limiting the types of treatments may reduce treatment efficacy and impede fuel break function. For example, in some vegetation states, manual or mechanical removal of the shrub overstory may release and facilitate invasive annual species growth in the short term; by disallowing follow-up chemical treatments in such situations, invasive annual grasses may become prevalent or dominant in the fuel break in the long term, reducing its functionality.

Similarly, restricting revegetation to native plant materials may result in fewer fuel break projects being implemented for the same reason as above, or, reduced treatment efficacy when projects were implemented. For example, in some situations, native or desired species may not compete well in vegetation states with invasive annual grasses (Miller et al. 2015). Post-treatment revegetation with native plant materials in these areas without a follow-up chemical treatment would likely result in the treatment area being reinvaded by invasive annual grasses; therefore, the rate of fire spread in these treatment areas would be only temporarily reduced.

Because highly resistant and resilient sites (Chambers 2014a) would be avoided, no direct effects on vegetation in these areas are expected. These sites may be indirectly conserved in the long term if fuel breaks in adjacent areas increase suppression opportunities, and therefore decrease the potential that wildfire would burn into highly resistant and resilient sites.

Over the long term, creating and maintaining a regional system of fuel breaks would protect sagebrush communities and recovering and rehabilitated vegetation more effectively than Alternative A; however, limiting treatment options would minimize the advantages of the regional fuel break system. This is because fewer fuel break projects would likely be implemented due to potential challenges in meeting project objectives. Where implemented, fuel break efficacy would be reduced by disallowing prescribed fire, chemical, and targeted grazing treatments and using only native plant material for revegetation.

Implementing design features would reduce the intensity of direct effects on vegetation described above from creating and maintaining fuel breaks. Design features to reduce direct effects on vegetation from manual and mechanical treatments would include siting fuel breaks in already disturbed areas (Design Features 1 and 7), weed management (Design Features 23 and 24), repeated mowing (Design Feature 25), using locally adapted or genetically appropriate seed species (Design Feature 26), and minimizing activities in erosive soils (Design Feature 33) (**Appendix D**).

4.5.5 Effects from Alternative C

The acres of vegetation states that would be available for fuel break construction under Alternative C are summarized in **Table 4-5**. The use of manual and mechanical treatments would have effects similar to those described under Alternative B but over a greater potential treatment area. The direct effects of prescribed fire, targeted grazing, and chemical treatments on vegetation would be as described in *Nature and Type of Effects*.

Of the 11,000 potential miles of new fuel breaks, approximately 550 miles could be brown strips along Maintenance Level 3 and 5 roads and BLM-administered ROWs, and approximately 5,720 miles could be mowed or targeted grazing fuel breaks, which could be done in any of the vegetation states (**Table 2-2**), except that targeted grazing would not be done in the shrubs with depleted understory vegetation state. Effects, as described under Alternative B, would be distributed over a larger area since there would be more potential treatment locations.

Of the 11,000 potential miles of new fuel breaks, approximately 4,730 miles could be green strip fuel breaks in any of the vegetation states (**Table 2-2**). Treatments to create and maintain green strips would likely involve multiple methods, such as mechanically removing vegetation, seeding, and using chemical treatments where invasive annual grasses were present. Green strip fuel breaks would directly alter the sagebrush community's structural and functional components by replacing more flammable and contiguous vegetation with perennial plants that retain moisture later into the growing season and decreasing fuel continuity by increasing the amount of bare ground in the fuel break. Indirectly, this would reduce rates of spread and amount of vegetation burned in the project area over the long term. Discontinuous fuels with higher moisture content, would also limit ignitability and the potential for a new start to move through the fuel break to surrounding vegetation.

Nonnative plants could be used for reseeding outside of highly resistant and resilient sites, provided conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) were met. This could improve revegetation success, facilitate fuel break function, and reduce the likelihood for nonnative annual invasion, particularly in fuel breaks with existing invasive annual grass cover or where soils are degraded or otherwise unable to support native vegetation.

Creating and maintaining fuel breaks in highly resistant and resilient sites with a high fire probability or where adaptive management triggers have been tripped, would increase the short-term direct effects on vegetation in these areas, compared with Alternative B. Since fuel breaks would indirectly lower flame lengths, reduce the rate of fire spread, and increase the BLM's opportunities to manage wildfires, vegetation in these areas would be conserved in the long term.

Limiting revegetation to native plant materials in highly resistant and resilient sites may slow movement toward objectives, as described in Alternative B. However, soil moisture and temperature regimes of highly resistant and resilient sites render these areas more productive and less hospitable to invasive annual grasses than drier, warmer sites (Chambers et al. 2014a). Soil moisture and relative lack of competition from invasive annual grasses would improve chances of successful revegetation using native materials in these areas.

Over the long term, creating and maintaining a regional system of fuel breaks would protect sagebrush communities and recovering and rehabilitated vegetation more effectively than Alternative A. Furthermore, allowing additional treatment methods to create and maintain fuel breaks would increase fuel break efficacy and function. For example, chemical treatment after manual or mechanical treatments would reduce maintenance needs in fuel breaks with invasive annual grasses.

The effects of implementing design features would include those described for Alternative B. Additional design features would be incorporated to minimize impacts from targeted grazing (Design Features 19–22) and prescribed fire (Design Features 13–18) (**Appendix D**). In addition, as described under *Effects from Chemical Treatments*, the potential impacts on nontarget vegetation from chemical treatments would be reduced by adhering to Standard Operating Procedures (BLM 2007, Table 2-8) and mitigation measures (BLM 2016, Table 2-5).

4.5.6 Effects from Alternative D

The acres of vegetation that would be available for fuel break construction under Alternative D are summarized in **Table 4-5**. The same suite of treatments described for Alternative C could be used under Alternative D, and the same potential miles of fuel breaks would be created; however, a larger area would be available for fuel break creation. Despite the increased area available for fuel break construction, mitigation measures applied to Alternative C will apply to Alternative D. The increased potential area available will thus grant site-specific projects more flexibility and in turn may improve the likelihood for successful fuel break siting and establishment while also avoiding sensitive resources.

Nonnative plant materials could be used for revegetation, including in highly resistant and resilient sites, provided conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) were met. As described in *Effects from Revegetation*, native plants would be prioritized, and suitable native seed sources would typically be available for fuel break revegetation because BLM would follow the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015). Where nonnative plant materials were used to revegetate fuel breaks, they would not spread outside of the fuel break, per Handbook H-1740-2 (BLM 2008, p. 87).

The BLM could create and maintain fuel breaks in highly resistant and resilient sites without the constraints included in Alternative C. As a result, direct adverse effects on highly resistant and resilient vegetation through destruction and removal during fuel break construction in these areas would likely increase, compared with the other action alternatives. This adverse impact would be offset by long-term conservation of vegetation in highly resistant and resilient areas, because creating and maintaining fuel breaks there would decrease the amount of vegetation that would be burned by wildfire. Further, mitigation measures described for other action alternatives would still apply, reducing the extent and intensity of adverse impacts from fuel break construction and maintenance in these areas.

Over the long term, creating and maintaining a regional system of fuel breaks would protect sagebrush communities, including intact and recovering and rehabilitated vegetation, more effectively than Alternative A. More diverse habitat types and ecosystems within the project area would be affected. This is because more areas would be available for treatments, even though the same number of miles of fuel breaks could be created. Because there would also be minimal constraints on vegetation treatments, there would be a maximum range of flexibility for implementing combinations of vegetation treatments to enhance fuel break function. This would increase the likelihood for success of initial treatments.

The effects from implementing design features would be the same as described under Alternative C because the same design features would apply under Alternative D.

4.5.7 Cumulative Effects

The analysis area for cumulative effects is the project area boundary, because the cumulative effects on vegetation would extend beyond the fuel break footprints and potential treatment areas. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades.

Past, present, and reasonably foreseeable future human actions, combined with such natural processes as drought, that have affected vegetation in the cumulative effects analysis area are wildfires and fuel loading, wildfire suppression, noxious and invasive weed spread, fuel break and other vegetation management projects, livestock grazing, road, ROW, mining and fluid mineral development, and land use planning, as summarized in **Table 4-1**. The effects from these human actions and natural processes are briefly discussed below.

The size and frequency of natural and human-caused wildfires has increased throughout the project area in recent years, resulting in widespread impacts on vegetation in sagebrush communities. Depending on severity, wildfire has altered vegetation by reducing sagebrush cover and facilitating invasive annual grass spread. Increased fuel loading and continuity from both pinyon-juniper woodland encroachment and invasive annual grass spread has contributed to increased wildfire frequency and severity (Rowland et al.

2008; Davies et al. 2011a). Furthermore, the increasing recurrence and severity of droughts have increased the occurrence and severity of wildfires in the project area (Scasta et al. 2016; Breshears et al. 2016). This, in turn, has increased changes in vegetation. Vegetation composition and condition in burned areas depend on multiple factors, including site resistance to invasive annual grasses, site resiliency from disturbance, and postfire ESR and other restoration treatments.

Past wildfire suppression in the project area has increased fuel loading and associated severe wildfire risk in sagebrush communities by allowing fuels to accumulate (Hanna and Fulgham 2015). Additional suppression-related effects on vegetation are removal during fire line construction, and the associated increased potential for invasive annual grass establishment in areas disturbed during suppression activities. Though wildfire suppression is still carried out on public lands in the project area, wildfire is recognized as a natural ecosystem process necessary for ecosystem health (USGS 2002). As described in **Table 4-1**, NIFC will continue to coordinate with multiple agencies and jurisdictions to develop and implement wildfire policy. Moreover, fire managers are expected to continue to develop, update, and implement fire management policies in response to changing technology and environmental conditions.

Noxious weeds and invasive plant species have invaded many locations in the project area, carried by wind, humans, machinery, and animals. Invasive annual grasses increase fuel loading and continuity in sagebrush communities and thus increase the risk and rate of wildfire spread. Increased cover of invasive annual grasses has also initiated annual grass invasion/wildfire cycles characterized by shortened fire return intervals and larger, more contiguous fires (D'Antonio and Vitousek 1992; Brooks et al. 2004).

The spread of noxious weeds and invasive plants is managed under federal-, state-, and local-level plans, as described in **Table 4-1**. Noxious and invasive weed species are expected to continue spreading on all lands in the project area, increasing the risk of wildfires. Future management for invasive annual grasses and noxious weeds would help mitigate impacts, and management may change in response to new and improved technology, changed environmental conditions, or new policies on the spread of noxious weeds and invasive plants.

Numerous fuel break projects, undertaken by the BLM, other federal agencies, local and regional partnerships, and other groups, have created and maintained fuel breaks in the project area, as described in **Table 4-1**. The area affected by these projects would continue to expand as new fuel breaks continue to be created as part of already approved projects and as part of reasonably foreseeable fuel break projects over the next several years. In general, fuel break projects have altered vegetation structure by reducing fuel loading and continuity in the breaks. Such projects have also affected vegetation on the landscape scale by improving opportunities for wildfire response; this has helped to reduce wildfire severity and intensity, minimize alterations in vegetation condition, and reduce noxious weed and invasive plant species prevalence.

Other types of vegetation management projects have affected vegetation in the project area. Hazardous fuels reduction, conifer removal, seedings, shrub planting, and invasive plant species control projects have affected vegetation cover and structure and reduced noxious weed and invasive plant species prevalence. In turn, these projects have reduced wildfire risk and thereby reduced the potential for impacts from high-intensity wildfires. Reasonably foreseeable future vegetation management projects, including those planned under the BLM's Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, currently under development, will have similar effects where they are carried out. Creating and maintaining a regional system of fuel breaks would protect vegetation that has been rehabilitated by these projects and is now recovering.

Historical grazing pressure has modified sagebrush communities in the project area by influencing vegetation condition and structure and affecting wildfire fuel loading (Strand et al. 2014). To address this, the BLM now evaluates and manages livestock grazing in accordance with established policy that has been approved by the Secretary of the Interior (43 CFR 4120-4130), with the overall objective of preserving and restoring rangeland conditions.

Multiple kinds of past and present development and planning have affected vegetation in the project area, such the construction and maintenance of roads and other ROWs for transmission lines, pipelines, renewable energy developments, and minerals exploration and development. Typically, impacts on vegetation from development are localized, when surface disturbing activities like site grading remove vegetation. Indirectly, developments have also affected vegetation conditions by facilitating noxious weed and invasive plant spread. In some cases, development can indirectly affect vegetation on a larger scale. For instance, roadside wildfire ignitions can cause landscape-scale affects where fuel loading, continuity, and weather conditions facilitate severe wildfire spread.

Authorized developments are generally subject to minimization measures as part of the land use planning process, which have reduced impact intensity and extent. Reasonably foreseeable continued population and recreation growth will increase demand for, and construction of, these types of development.

Under Alternative A, vegetation condition would continue to be affected by the past, present, and reasonably foreseeable human actions and natural processes described above. Fuel break projects would continue to be constructed and maintained throughout the project area on a site-specific basis, but a regional system of fuel breaks would not be constructed and maintained. As a result, opportunities for wildfire response would not be improved, and vegetation would continue to be affected by wildfires. These effects would likely be worsened by expected trends of continuing noxious weed and invasive plant species spread and by the increasing recurrence and severity of droughts.

Cumulative effects common to all action alternatives would come from implementing a regional system of fuel breaks. Creating and maintaining fuel breaks could potentially slow wildfire spread and would improve opportunities for wildfire suppression response, thereby cumulatively affecting vegetation by helping protect sagebrush communities, including intact and recovering and rehabilitated vegetation. The relative contribution to cumulative impacts from each action alternative would differ, based on the treatment areas and methods proposed under each action alternative; these differences are discussed below.

Cumulative effects common to all action alternatives would also come about from implementing design features (**Appendix D**) during fuel break design, construction, and maintenance and by designating treatment exclusion areas (**Section 2.2.1**). In general, implementing design features would minimize the cumulative adverse impacts from constructing and maintaining fuel breaks. Features would minimize vegetation removal by, for example, siting fuel breaks in previously disturbed areas (Design Features 1 and 7) and minimize the potential for noxious weed and invasive plant species spread by conducting weed management (Design Features 23 and 24).

Constructing and maintaining fuel breaks under Alternative B would directly remove the smallest amount of vegetation of all the action alternatives as described in the analysis of direct and indirect effects above. As a result, Alternative B would have the smallest impact on effectively slowing the spread or limiting the size of severe wildfires. In turn, wildfires would likely continue to detrimentally affect vegetation in sagebrush communities.

Alternatives C and D would have the potential to remove more vegetation during fuel break construction and maintenance than under Alternative B. As a result, the relative contribution to cumulative impacts under these alternatives would be greater than under Alternative B. Incorporating the same design features described above, as well as features to minimize detrimental impacts from targeted grazing (Design Features 19–22) and prescribed fire (Design Features 13–18) (**Appendix D**), would minimize the adverse cumulative impacts. Fuel break effectiveness would also likely be increased under these alternatives. This is because all treatment methods would be allowed, with some use constraints. In particular, Alternative D would have a maximum range of flexibility for implementing combinations of vegetation treatments to enhance fuel break function. As a result, Alternative D would likely be most effective at improving wildfire suppression and in turn potentially reducing the amount of sagebrush communities burned in the long term.

4.6 WILDLIFE

4.6.1 Assumptions

- Design features, such as seasonal and spatial restrictions, would limit direct impacts on some species.
- Impacts on wildlife depend on impacts on the habitat of sagebrush, pinyon-juniper, and grassland wildlife species.
- The vegetation state reflects habitat conditions and the extent to which habitat for certain wildlife species is suitable.
- Different tools would be used to meet desired conditions, based on current conditions.
- Aquatic habitat would be avoided, and no impacts on aquatic wildlife species would occur.
- The effects of wildfires on wildlife are from habitat loss and modification and change in wildfire trends and fuel models, as described under **Section 3.1**, Fire and Fuels**.**

4.6.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Construction and maintenance of fuel breaks would have direct short-term effects on wildlife species during treatments. Wildlife occupying treatment areas could be disturbed by equipment, vehicles, and human presence. This could change their behavior, such as inducing habitat avoidance or flight response. Some wildlife, such as small mammals, reptiles, or ground-nesting birds, could be injured or killed by treatments if they are not able to leave treatment areas quickly enough. The direct impacts of disturbance would be limited to the period of construction and maintenance. Fuel breaks would occur near roads or BLM-administered ROWs (depending on the type of fuel break and alternative). For example, brown strips would be built along interstates and highly traveled routes, which are likely either already minimally used by wildlife or where similar effects have already manifested; thus, the number of individuals experiencing impacts would be less than for higher-quality habitats. Areas surrounding Maintenance Level 1 (primitive) roads or ROWs may support greater densities of wildlife, and therefore the construction of fuel breaks along these linear features would potentially impact a greater number of animals.

Long-term effects of fuel breaks on wildlife would mainly consist of habitat modification. There would be different results, depending on the type of fuel break, current vegetation state, and resulting conditions. Some species may avoid treatment areas completely due to a lack of appropriate cover or food, while others may experience no difference in habitat due to the scale of habitat use. In addition, some wildlife may be attracted to the fuel breaks when resulting vegetation closely matches its preferred habitat type and may use these areas temporarily for feeding or travel. Depending on the species and type of fuel break (**Section 2.5**), the habitat quality provided by fuel breaks would vary.

Brown strips are devoid of vegetation and thus would provide no habitat features for wildlife. Vegetation removal to construct this type of fuel break would alter habitat conditions for wildlife by removing such features as cover, forage, and nesting and perching sites. This could decrease habitat functionality and increase predation. There would also be short-term direct impacts on wildlife, such as disturbance and potential for injury or mortality, from the tools used to create and maintain brown strips; these are described under the sections for each treatment method below: chemical, manual, mechanical, prescribed fire, and targeted grazing (**Table 2-1**). Brown strips would be narrow (0–50 feet including both sides of the road) and would occur on fewer miles since they would primarily occur near level 5 roadways; therefore, the area affected would be less than for other fuel break types. More intensive maintenance would be required for brown strips, which could cause greater levels of disturbance to wildlife than other fuel break types.

Mowing or targeted grazing fuel breaks would alter habitat conditions by reducing or compacting the vertical extent of vegetation. This would reduce habitat quality for species that rely on taller grasses or shrubs for cover, nesting, or forage. However, native perennial grasses, as the target vegetation state, would not be removed, though they could be mowed or grazed. Therefore, mowed or targeted grazing fuel breaks may serve as low- or non-functioning wildlife habitat for shrub-dependent species; however, they may be suitable habitat for grassland-dependent species.

Green strips would provide adequate cover for some grassland species such as small mammals, reptiles, and ground-nesting birds. Diversified vegetation and increased native flowering plant species, where included in seed mixes, would increase habitat availability for pollinators. This would require pollen- and nectar-rich forage resources (Xerces Society 2017). Where shrubs or trees are removed to create these fuel breaks, habitat features for shrubland and pinyon-juniper species would be removed.

Using perennial plants in addition to grasses would provide some level of cover and forage for shrubland species. Mowed or targeted grazing and green strip fuel breaks would be 0–500 feet wide (including both sides of the road or ROW). This could create a greater area of habitat subject to alterations than with brown strips.

Over time, increased fire suppression opportunities and a decreased potential for wildfire spread across fuel breaks would reduce fire severity and intensity. This would protect wildlife, reduce habitat loss and alterations due to fire, and allow for the recovery of natural and seeded plant communities, which mostly consist of sagebrush habitats. Protecting native habitat and restoration investments from future wildfire would prevent loss of and enable recovery of suitable habitat for wildlife that require or favor shrub habitats for breeding, hiding, thermal cover, and foraging.

Effects from Manual Treatment Methods

The impacts of manual methods would generally be of lower intensity and would occur over smaller areas than other treatment methods. The use of hand tools and hand-operated power tools to cut, clear, or prune herbaceous and woody species could directly disturb wildlife from human presence and noise in the short term. Mobile species would not be injured or killed, and less mobile wildlife species (such as insects, hibernating reptiles or hibernating small mammals) would likely not be killed by manual methods. This is because qualified personnel would avoid individuals during treatment activities.

Effects from Mechanical Treatment Methods

Mechanical treatments would have direct impacts on wildlife from compaction or visual and audible disturbance associated with use of heavy machinery during fuel break construction. Mechanical treatments, including the use of agricultural mowers, masticators, and seedbed preparation equipment, could result directly in injury or death of small animals with limited mobility. Mechanized equipment could also disturb or destroy shallow burrows. Treatments that occur during hibernation periods may not affect animals if they have burrowed deep enough to avoid physical disruption. Vegetation removal could make small mammals and reptiles more vulnerable to predation due to a lack of protective hiding cover.

The potential for wildlife harm due to mechanical treatments following burning is expected to be reduced by the effects of prescribed fire, which would cause wildlife to leave the area as described below.

Effects from Prescribed Fire

Prescribed fire may kill less mobile wildlife species that are unable to vacate the area. Some species could avoid impacts by hiding in burrows, while others could flee prescribed fires and avoid associated human activity. The level of impact would depend on the habitat quality of the area being burned and the type and scale of burning.

The use of prescribed fire would be of low risk to surrounding habitats. This is because burns would be contained in fuel breaks to reduce or modify existing fuel loads or prepare the ground for seeding. After prescribed burning, follow-up chemical treatments or seeding, or both, would prevent invasive annual grasses from dominating treatment areas.

Effects from Chemical Treatment Methods

Potential impacts of chemical treatments on wildlife would vary, depending on the type of chemical treatment, the vegetation being treated, the time of application, and the duration and mechanism of exposure. The effects of chemical treatments on wildlife are described in the Vegetation Treatments using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (BLM 2007) and the 2016 Final PEIS for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States (BLM 2016). Potential short-term impacts would be reduced through the implementation of standard operating procedures (BLM 2007, Table 2-8) and mitigation measures (BLM 2016, Table 2-5) described in those PEISs.

As described in the PEISs, wildlife could experience effects due to exposure during or after chemical treatments, including direct spray and spills, indirect contact with foliage after direct spray, and ingestion of contaminated food items after direct spray. For most terrestrial wildlife species, the risk of exposure generally would be low or nonexistent. Species that primarily consume grass would have a relatively greater risk for adverse effects than animals foraging on other vegetation. This is because chemical residue is higher on grass; however, harmful doses of chemicals are not likely, unless the animal forages exclusively in the treatment area for an entire day (BLM 2007, pp. 4-101 to 4-118).

The PEISs further describe the impacts of chemical treatment on pollinators, which would depend on the species; some pollinators would benefit from treatments that remove nonnative species that inhibit native plant species, whereas other species that pollinate invasive plant species could experience a reduction in nectar sources (BLM 2007, pp. 4-101 to 4-118). Visual and audible human disturbance to wildlife would occur during chemical treatment. The impacts would be similar to those described for mechanical treatment methods.

Effects from Targeted Grazing

Targeted grazing could kill or injure less mobile wildlife species from trampling, altered habitats, and the loss of habitat features over the long term. The presence of livestock could also directly displace wildlife, but competition for forage would be unlikely. Because treatment areas would be along previously disturbed sites, the risk of increased spread of invasive weeds would be low.

Targeted grazing may require temporary facilities for implementation, such as water haul sites, temporary fencing, and salt or mineral supplementation. Water and salt sites could attract big game species, whereas fences could create the potential for collisions by big game and birds. Installing temporary fencing or following a graduated-use plan would minimize impacts on habitat outside the fuel break footprint, but impacts as described in the previous paragraph could still occur from herding.

4.6.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained; instead, fuel break projects would continue only on a site-specific basis. Wildfires and the resultant conversion to cheatgrass and other invasive annual grasses would likely continue at a similar rate. This would increase the presence of fine fuels, threaten sagebrush communities, and continue to degrade wildlife habitat. These continued effects would contribute further to the loss of wildlife diversity in the project area.

General Wildlife

Repeated fires have altered and simplified plant communities, leading to increased homogeneity of landscapes and annual grass invasions (Balch et al. 2013; West 2000). Community responses to repeated fires and habitat changes depend on the traits of the key species present (Bakker et al. 2011). In general, wildfires could injure or kill various wildlife species and alter habitat by eliminating or reducing shrub cover and increasing the likelihood of invasive annual grass establishment (Brooks et al. 2015; D'Antonio and Vitousek 1992).

Loss of shrub cover and structural diversity over the long term would reduce or fragment wildlife populations that favor or depend on shrub habitats for breeding, nesting, hiding, thermal cover, and foraging. This would increase abundance of grassland species and decrease the site's overall biodiversity (Coates et al. 2016). Data have shown that the diversity and abundance of small mammals are lower in recently burned or nonnative grassland sites, relative to shrub-dominated sites (Klott et al. 2007).

The potential replacement of perennial grass and forb cover with noxious weeds or invasive annual grasses at lower elevations may eventually reduce habitat quality for grassland species. This would be the result of reducing the structural diversity of the cover as well as the biological diversity of plant and insect forage species (Coates et al. 2016; D'Antonio and Vitousek 1992).

Big Game

Big game species would experience continued long-term habitat loss and modification due to the potential for fast-moving wildfires. Habitat loss from fire and cheatgrass invasion has been identified as a main cause of reductions in mule deer populations in Nevada (Cox 2008). Although cheatgrass may provide fall and spring forage for mule deer, it does not provide thermal or hiding cover, or any forage while it is buried by snow. Recurring fire in and near the project area would continue to reduce the quality of mule deer habitat, particularly winter habitat; unburned mule deer habitat in the big game project area could be degraded by increased levels of use by mule deer. Effects of recurring fire would be similar for elk, pronghorn, and bighorn sheep; however, these species depend less on shrublands for forage and cover than mule deer.

Migratory Birds

Migratory birds that prefer or require sagebrush or other shrubs would also experience continued habitat loss from potential wildfires. They would modify their home ranges or seasonal use areas based on habitat availability and quality. Continued wildfires and loss of shrubland habitat would increase the distribution and abundance of grassland bird species in the project area, especially those that can use disturbed areas and exotic herbaceous habitat types. Repeated fires across the shrub-steppe landscape generally reduce habitat diversity, resulting in reduced bird species diversity.

4.6.4 Effects from Alternative B

General Wildlife

Wildlife could be killed or disturbed, and their habitat degraded by fuel break construction and maintenance on up to 8,700 miles in a 529,000-acre potential treatment area over the duration of the project. Grassland and pinyon-juniper habitat types would primarily be affected (**Table 4-6**, below). Species associated with these habitat types would experience short-term direct and indirect impacts from the use of manual and mechanical treatment methods, as described under *Nature and Type of Effects*. The total proportion of habitats affected would be low, corresponding to a maximum of 1 percent of total grassland and <1 percent of total pinyon-juniper habitats in the project area. Fuel break construction and maintenance would occur along roads, which provide lower quality habitat, so relatively few individuals would experience direct effects.

Table 4-6
Acres of Habitat Types Available for Potential Fuel Break Construction by Alternative[1]

Habitat Type	Alternative B	Alternative C	Alternative D
Grassland	116,000 (1%)	161,000 (1%)	214,000 (1%)
Pinyon-juniper	47,000 (<1%)	85,000 (1%)	121,000 (1%)
Sagebrush	329,000 (1%)	509,000 (1%)	710,000 (2%)

[1]Numbers in parentheses indicate the percent of total acres of a habitat type on the project area
Source: BLM GIS 2018

Seeding fuel breaks with native species could increase habitat availability and quality for grassland species, particularly in areas that were previously dominated by invasive annual grasses. However, as described in **Section 4.5**, above, seeding only with native species could result in reduced success, requiring re-treatment, which would extend short-term effects.

Direct effects from the use of manual and mechanical treatments for fuel break establishment on sagebrush-dependent wildlife species would be limited because sagebrush would not be treated under this alternative. Manual or mechanical treatments of other vegetation types within areas classified as sagebrush habitat could still cause impacts such as disturbances, injury, or mortality to wildlife within these areas. This is because most wildlife species likely use a variety of vegetation types, even if they are sagebrush specialists. Because sagebrush itself would not be treated, habitat alterations would consist of removal or alteration of other vegetation types within sagebrush areas. The existing sagebrush cover would remain.

Design features would reduce or eliminate the effects of ground-disturbing activities on wildlife by avoiding sensitive periods or high-value habitats (**Appendix D**). For example, fuel breaks would be constructed where vegetation has already been disturbed by wildfire or surface-disturbing activities (Design Features 1 and 7). Ground-disturbing treatments in areas with highly erosive or saturated soils would be minimized (Design Features 33 and 34). Treatments in greater sage-grouse, big game, migratory bird, and raptor habitat would be subject to temporal and spatial restrictions (Design Features 40–66). Following land use plans, which have required design features for greater sage-grouse, would reduce treatment-related impacts on other shrub-nesting birds and wildlife. In addition, prohibiting fuel break construction and maintenance in greater sage-grouse breeding habitat during the breeding season would reduce treatment-related impacts on other shrub-nesting birds and wildlife that are active during that time frame (Design Feature 44).

Over the long term, the establishment of fuel breaks under Alternative B would increase the effectiveness of wildfire suppression opportunities in areas where they occur (i.e., along roads) relative to Alternative A. The effectiveness of fuel breaks in the Great Basin over the long term would be limited by the restrictions on tools available for construction and maintenance and by the location and types of fuel breaks allowed under Alternative B. Brown strips would improve direct attack opportunities and reduce fire start potential along highways. This would indirectly reduce the potential for impacts on wildlife, such as mortality and habitat loss, as the fire moves beyond the fuel break. Mowed fuel breaks would disrupt fire behavior and reduce the rate of spread, which would improve the chances for wildfire containment and smaller areas of habitat loss. These impacts would be limited to areas where there are roadways outside sagebrush and highly resistant and resilient sites. Where there are no nearby roads, the effects would be the same as Alternative A.

Big Game

Types of impacts on big game species from the use of manual and mechanical treatment methods would be as described under *Nature and Type of Effects*. The acres of big game habitat that would be available for potential fuel break construction, and thus be subject to potential impacts, are shown in **Table 4-7**; these acres correspond to less than 1 percent each of total bighorn sheep, mule deer, and pronghorn habitat types, respectively, and 0 percent of total bighorn sheep, and less than 1 percent each of total mule deer and pronghorn crucial winter range in the project area. Fewer acres of big game habitat would be directly affected by fuel breaks because a maximum of 8,700 miles would be constructed, and these acres would be spread throughout the potential treatment area (529,000 acres). It is unlikely that all fuel break locations would occur within big game habitat.

Table 4-7
Acres of Big Game Habitat Available for Potential Fuel Break Construction by Alternative

Habitat Type	Alternative B	Alternative C	Alternative D
Bighorn sheep			
Crucial winter range	0	0	0
All habitat types	34,000	48,000	71,000
Mule Deer			
Crucial winter range	38,000	67,000	93,000
All habitat types	502,000	760,000	1,037,000
Pronghorn			
Crucial winter range	9,000	14,000	14,000
All habitat types	320,000	463,000	644,000

Source: BLM GIS 2019

Avoiding treatment of sagebrush would minimize short-term impacts on wildlife from vegetation removal, such as disturbance from large equipment. Design features for big game species would set limits on the removal of shrub cover suitable for browsing and would set time restrictions on project activities (Design Features 46-48 in **Appendix D**). Over the long term, effects from fuel break establishment on big game under Alternative B would be the same as those described under *General Wildlife*.

Migratory Birds

Types of impacts on migratory bird species from the manual and mechanical treatment methods would be as described under *Nature and Type of Effects*. Migratory bird habitats that would be affected by fuel break construction are pinyon-juniper and grassland vegetation types; impacts on these habitat types are discussed under *General Wildlife*.

The temporary loss of pinyon juniper habitat from fuel break construction and maintenance could shift migratory bird assemblages in the fuel break footprint toward an increase in grassland bird species; however, the amount of habitat proposed for disturbance would be relatively small, compared with the total amount of habitat available for migratory birds throughout the project area (1, <1, and 1 percent of total grassland, pinyon-juniper, and sagebrush habitats, respectively). Further, impacts would be spread throughout the potential treatment area. Design features would reduce impacts on migratory birds by avoiding fuel break construction and maintenance during the peak of the local nesting season for priority migratory bird species (e.g., Birds of Conservation Concern, BLM sensitive species; Design Feature 49 in **Appendix D**). Additional impacts on migratory bird species from the use of manual and mechanical methods are the potential for nest abandonment over the short term and reduced nesting sites over the long term. Over the long term, effects from fuel break establishment on migratory birds would be the same as those described under *General Wildlife*.

4.6.5 Effects from Alternative C

General Wildlife

The types of impacts on wildlife from proposed activities under Alternative C would be similar to those as described under *Nature and Type of Effects*. The potential for short-term, direct impacts on wildlife species would be greater than under Alternatives A and B because up to 11,000 miles (667,000 acres) of fuel breaks over a potential treatment area of 792,000 acres would be constructed. Also, the full suite of tools would be available for fuel break construction and maintenance, including treatment of sagebrush. There would be limitations on the use of treatment methods in highly resistant and resilient sites; since such sites may host a more diverse species assemblage (Cleland 2011), the number of species groups potentially affected may be lower than if no restrictions were imposed. Highly resistant and resilient sites with high sagebrush cover provide conditions where sagebrush-dependent species, such as the greater sage-grouse, are likely to persist (Chambers et al. 2014a). Restrictions on fuel breaks within these areas may hinder the implementation of strategically placed anchor points that could help reduce habitat loss from potential wildfire.

More miles of fuel breaks would be created, corresponding to 1 percent of each total grassland, pinyon-juniper, and sagebrush vegetation types in the project area, respectively. Because of this, the maximum potential acres of habitat types affected by fuel breaks would be greater than under Alternative B (**Table 4-6**, above). The availability and quality of grassland habitat by seeding fuel breaks with native and nonnative species would also increase, relative to Alternative A. The use of nonnative plant materials if certain criteria are not able to be met with native plant material would increase the effectiveness of seeding treatments. According to the BLM Handbook H-1740-2, Integrated Vegetation Management Handbook, nonnative, noninvasive plant species would be used only under limited circumstances to break unnatural disturbance cycles or to prevent further site degradation by invasive species. Because nonnative plants would be used in specific circumstances when they would not jeopardize the natural biological diversity of an area (see **Section 2.2.6** Native Plant Material Policy), the potential for adverse impacts to wildlife habitat, such as creation of a monoculture, would be low.

Because fuel breaks could be created in highly resistant and resilient sites either in high fire probability areas or if certain adaptive management triggers have been met, there would be a greater potential for short-term impacts on wildlife that use these areas, relative to Alternative B; however, design features intended to protect the greater sage-grouse and sagebrush habitat would ensure that the amount of sagebrush removed would not reduce habitat functionality for all sagebrush-dependent wildlife species. An example of this is ensuring that sagebrush treatments do not lead to a soft or hard adaptive management trigger trip (Design Feature 45 in **Appendix D**).

Additional design features related to grazing, prescribed fire, and chemical treatments would reduce impacts on wildlife (Design Features 13, 19, 21, 22, and 39-66 in **Appendix D**). For example, a targeted grazing plan would be completed before grazing begins (Design Feature 20 in **Appendix D**). The plan would minimize the risk of spreading invasive species and avoid damage to desired plant species, which would reduce the risk of wildlife habitat degradation. Wildlife escape ramps in temporary tanks would facilitate the use of and escape from livestock watering troughs by wildlife.

Over the long term, the regional system of fuel breaks would be expected to increase the effectiveness of wildfire suppression opportunities relative to Alternative A. Over time, the reduced intensity and severity of wildfires would be expected to allow for the recovery of previously burned or restored shrubland habitats used by many wildlife species. Sagebrush-dependent species, such as black-tailed jackrabbits (*Lepus californicus*), would benefit from an increase in availability of habitat and habitat features that would result from the anticipated decrease in wildfire intensity and severity. Although these changes may gradually reduce the amount of habitat available for grassland species such as short-eared owls, grassland species would ultimately experience beneficial impacts due to reduced potential for exotic grass invasion and increased habitat quality. Most species would benefit from increased forage and nesting habitat. Less mobile species, particularly those that do not burrow, would experience potential reductions in mortality due to improved wildfire suppression throughout the project area.

Big Game

The types of impacts from additional tools and locations for fuel break construction and maintenance under Alternative C would be similar to those described under *Nature and Type of Effects*. Because more miles of fuel breaks would be created, and some treatments could occur in highly resistant and resilient sites, the maximum potential acres of big game habitats and crucial winter range affected by fuel breaks would increase relative to Alternative B (**Table 4-7**, above). A maximum of less than 1, 1, and less than 1 percent of total bighorn sheep, mule deer, and pronghorn habitat areas, and 0, 1, and less than 1 percent of total bighorn sheep, mule deer, and pronghorn crucial winter range in the project area could be affected by fuel break development. The area would likely be much lower because fuel breaks would be spread out across all habitat types.

The use of targeted grazing as a treatment method would pose a risk to bighorn sheep within the project area by increasing the potential for disease transmission; however, the risk would be low because a targeted grazing plan would minimize the chance of contact and disease transmission between domestic sheep used for grazing and desert and Rocky Mountain bighorn sheep (Design Features 19 and 47 in **Appendix D**). For example, use of domestic sheep or goats for targeted grazing would be avoided within 30 miles of bighorn sheep habitat, and the USFWS would be consulted if impacts on listed bighorn species are expected.

Design features to reduce impacts on big game species would include those described under Alternative B with additional design features to reduce impacts from grazing, prescribed fire, and chemical treatments (Design Features 46-48 in **Appendix D**). Over the long term, effects from fuel break establishment on big game would be the same as those described under *General Wildlife*.

Migratory Birds

The types of impacts on migratory birds from proposed activities under Alternative C would be as described under *Nature and Type of Effects*. The potential for direct impacts on migratory birds, including loss of nesting sites and nest abandonment, would increase relative to Alternative B due to the increase in miles of fuel breaks that could be constructed. Increases in impacts would also result from the addition of grazing, prescribed burning, and chemical treatments as potential treatment methods. Prescribed burning in particular could reduce structural features that may serve as potential nest sites and flush birds from existing nests.

Design features to reduce impacts on migratory birds would be similar to those described under Alternative B with additional features to reduce impacts from grazing, prescribed fire, and chemical treatments (**Appendix D**). Over the long term, effects from fuel break establishment on migratory birds would be the same as those described under *General Wildlife*.

4.6.6 Effects from Alternative D

General Wildlife

Compared with Alternative C, the larger potential treatment area under Alternative D would allow for increased flexibility in siting fuel breaks within the project area while avoiding sensitive resources; however, direct impacts are expected to be the same as those described for Alternative C since the same number of miles of fuel breaks would be created under both alternatives. The acres of habitat types open to potential fuel break establishment would increase relative to all alternatives, corresponding to 1, 1, and 2 percent of grassland, pinyon-juniper, and sagebrush habitats, respectively (**Table 4-6** above). Under Alternative D, vegetation could be treated in all highly resistant and resilient sites subject to constraints outlined in design features. These areas generally receive more precipitation and have more diversity in vegetation (Chambers et al. 2014) and may host a greater of species assemblages (Cleland 2011). Therefore, the implementation of fuel breaks within these areas may provide anchor points that could help reduce habitat loss for more species from potential wildfire.

Design features applicable to wildlife under Alternative D would be the same as those described for Alternative C. Long-term impacts on wildlife and wildlife habitat are also expected to be similar to those described for Alternative C; however, fewer constraints on the locations of fuel break construction and maintenance could increase the effectiveness of wildfire suppression opportunities. This would lead to optimal protection of wildlife and wildlife habitats and could increase wildlife species diversity throughout the project area.

Big Game

Under Alternative D, a maximum of less than 1, 1, and less than 1 percent of total bighorn sheep, mule deer, and pronghorn habitat areas and 0, 2, and less than 1 percent of total bighorn sheep, mule deer, and pronghorn crucial winter range in the project area would be available for fuel break construction.

Treating vegetation in highly resistant and resilient sites, subject to constraints in design features, may mean that fewer treatments associated with reseeding would be required overall, since seeding success is high in these areas (Chambers et al. 2014). This would result in fewer impacts, such as reductions in shrub cover, on big game.

Design features applicable to big game under Alternative D would be the same as those described for Alternative C. Over the long term, effects from fuel break establishment on big game would be the same as those described under *General Wildlife*.

Migratory Birds

The direct impacts of fuel break construction and maintenance under Alternative D on migratory birds are expected to be similar to those described for Alternative C with the same tools available for construction and maintenance of fuel breaks. The acres of habitat types available for fuel break construction would increase, relative to the other alternatives (**Table 4-6**, above). Highly resistant and resilient sites, which would be available for fuel break construction and maintenance under Alternative D, may serve as potential habitat for some migratory birds. Reducing the shrub cover on these sites may reduce habitat features for migratory birds over the long term, such as nesting and perching sites; however, the reduced need for chemical and mechanical treatments would reduce the potential for direct impacts from these methods, as described under *Nature and Type of Effects*.

Design features applicable to Alternative D would be the same as those described for Alternative C. Over the long term, effects from fuel break establishment on migratory birds would be the same as those described under *General Wildlife*.

4.6.7 Cumulative Effects

Cumulative Baseline

The cumulative analysis area for wildlife is the project area boundary, due to indirect effects on wildlife from fuel break creation and maintenance. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades.

Actions that could cumulatively affect wildlife and wildlife habitat are human development, such as construction of roads and ROWs, mining and oil/gas leasing, and conversion of wildlife habitat to cropland, livestock grazing, activities associated with fire and vegetation management plans, other fuel breaks projects, fuels reduction and restoration projects, noxious weed spread, and wildfires.

Development in and encroachment on wildlife habitat, such as for mining, fluid mineral development and agricultural activities, urban development, and construction of ROWs and roads, will continue to affect wildlife throughout the project area. This would be the result of habitat modification, loss, and fragmentation, and the increased potential for injury or death.

Approximately 21 percent of land in the western states (including those covered in this PEIS, excluding Alaska) has been converted to intensive uses, such as urbanization, agricultural land, and pastureland, which provide fewer benefits for wildlife than undisturbed habitats (BLM 2007). Although wildlife may find food and shelter in highly modified habitats, these habitats generally provide fewer habitat values and less structural complexity than unmodified areas; therefore, they support fewer wildlife species and numbers (BLM 2007).

Areas that have not been converted have still undergone alterations that reduce their value to wildlife (USDA Forest Service and USDI BLM 2000, cited in BLM 2007). In the interior Columbia Basin, which overlaps the project area, there has been an overall downward trend in habitat value from desired conditions for nearly all habitat types. Species that use older forests, sagebrush, and grassland habitats have been most affected by loss and modification of habitat in the region, including various migratory bird species (USDA Forest Service and USDI BLM 2000, cited in BLM 2007).

As human population levels rise, the extent of urban areas will further encroach on wildlife habitat. This will be the case especially on private lands, which are scattered throughout the project area, particularly in central Washington, northern Oregon, northern California, northern Utah, and southeastern Idaho (**Figure 1-1** in **Appendix A**, and **Table 1-1**). Wildlife habitat, including sagebrush, grassland, and pinyon-juniper, could be reduced. As this occurs, the importance of the remaining habitat for supporting populations would increase. Increasing development and road use associated with higher population levels would increase the risk of injury or death due to collisions with vehicles or structures.

Permitted livestock grazing and trailing occurs throughout most of the project area and is expected to continue. The effects of ongoing livestock grazing are expected to vary by wildlife species and the habitat quality within allotments. Species that use more open habitats are expected to benefit, while species that require taller vegetation, such as taller grasses, could be negatively affected by grazing.

Livestock could disturb, displace, or trample small and less mobile animals, such as reptiles and ground-nesting birds. Grazing livestock could also alter wildlife habitat by consuming or trampling vegetation used by wildlife for food and cover. Furthermore, construction may require removing habitat and pose a threat of collision for some species. Current and future livestock use on public lands at permitted levels would not compete with the forage and cover requirements for wildlife within or adjacent to fuel break treatments. This is because Standards for Rangeland Health and Guidelines for Livestock Grazing Management are in place to prevent these effects.

The effects of past, present, and reasonably foreseeable vegetation treatments will continue to vary, depending on the location, original vegetation community, and treatment methods. Examples of such treatments are shrub thinning or removal, vegetation planting and seeding, noxious weed treatments, and postfire treatments on wildlife (see **Table 4-1** for examples of past and ongoing vegetation management projects in the project area).

Vegetation projects can increase the risk of injury or death of less mobile wildlife species during treatments. Large-scale pinyon-juniper removal projects may decrease habitat for species associated with the pinyon-juniper habitat type. Large shrub planting projects may help recover shrub communities more quickly relative to natural recruitment. Region-wide vegetation and fuels reduction and rangeland restoration projects would improve habitat for most wildlife in the proposed project area. Where successful, restored native vegetation and increased plant diversity will continue to increase habitat availability and features, such as cover and forage for wildlife throughout the project area.

The accumulation of past, present, and reasonably foreseeable vegetation treatments across the cumulative analysis area is expected to improve the overall quality of wildlife habitat by decreasing the risk of invasive plant species and increasing native species that provide forage and cover; however, treatment success is expected to be limited in areas that continue to experience repetitive wildfires. The creation of a region-wide system of fuel breaks would, therefore, protect investments from vegetation treatments across the cumulative analysis area.

In general, wildfire suppression from fire management plans throughout the cumulative analysis area protects wildlife and their habitats by reducing potential habitat loss, but it also leads to altered habitat conditions by increasing stand density, favoring shade-tolerant species, and promoting encroachment of invasive plant species and trees into grasslands and shrublands (Zouhar et al. 2008). Encroaching shrubs and trees crowd out grasses and forbs used by wildlife for forage and cover, while invasive annual grasses provide little forage value or habitat structure for wildlife. Declines in big game winter range, density of nesting raptors, and non-game bird abundance have also been observed in cheatgrass-dominated areas (USDA Forest Service and USDI BLM 2000).

Other fuel break projects that will continue to be implemented throughout the project area will help increase wildfire suppression opportunities and potentially decrease the loss of wildlife habitat. The BLM is developing a Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS that is intended to alter wildfire continuity, increase fire return intervals, and shorten the fire season. Ultimately, this would increase habitat resistance to invasive plant species and resilience to disturbances such as wildfire. The combined effects of fuel breaks and fuels reduction and rangeland restoration projects would protect wildlife and wildlife habitat and also help restore habitat to desired conditions, which might otherwise be altered by fire suppression.

Natural processes, such as wildfires, and the spread of invasive annual grasses affect wildlife through habitat loss and alterations (Balch et al. 2013; West 2000). Invasions of annual grasses reduce habitat quality and biological diversity (Coates et al. 2016; D'Antonio and Vitousek 1992). Pinyon-juniper encroachment into grasslands and shrublands may increase cover and forage for some wildlife species, such as mule deer (Gruell 1986; Austin 2000; Innes 2013); however, this encroachment decreases habitat availability for sagebrush and grassland species.

General Wildlife

Under all action alternatives, the use of tools for fuel breaks treatments would increase the risk of injury or death, such as from road use and vegetation projects, particularly for small species with limited mobility. This effect would be greatest under Alternative D, which proposes the most acres of wildlife habitat types open to fuel break establishment and the greatest flexibility in the use of tools. Protection of wildlife and their habitats throughout the cumulative analysis area due increased wildfire suppression opportunities would outweigh the short-term contribution to increased risk of injury or mortality because protected areas would be much larger than the fuel break footprint.

The creation of fuel breaks within wildlife habitats would add to the cumulative effect of wildlife habitat modifications from past, present, and reasonably foreseeable future actions, such as from development. This is because vegetation modification for fuel break construction could reduce the availability of habitat features, such as cover, forage, and nesting and perching sites. This could decrease habitat functionality and increase predation within the footprint of fuel breaks (up to 529,000 acres under Alternative B and up to 667,000 acres under Alternatives C and D across all habitat types (**Table 4-5**)). Ultimately, protection of wildlife habitats throughout the cumulative analysis area would outweigh the contribution to adverse habitat alterations because areas protected would be much larger than the fuel break area. For all action alternatives, improved wildfire suppression opportunities and the creation of buffers that protect important and vulnerable habitats from wildfire would potentially increase wildlife habitat availability over the long term. This would offset losses or modifications of habitat features within the fuel break footprint. This is because the area experiencing potential protections from wildfire would be much larger than the fuel break itself. When combined with the baseline effects of human and natural activities that reduce or modify wildlife habitat, it would have a countervailing effect; although these losses and alterations cannot be negated, habitat protection provided by fuel breaks would help reduce potential loss to wildfires and improve the ability of remaining habitat to support wildlife. The magnitude of this impact could be large; extensive areas of sagebrush, grassland, and pinyon-juniper would be protected from loss to wildfires throughout the project area. When combined with habitat improvements from vegetation and fuels reduction and rangeland restoration projects, both the quality and quantity of wildlife habitat would increase. Fuel breaks would increase the success of vegetation and fuels reduction and rangeland restoration projects within the project area (see Cumulative Baseline) by protecting these investments. For example, pinyon-juniper removal projects would augment the benefits to sagebrush and grassland habitat that would be expected from successfully implemented fuel breaks because habitat would be protected and its functionality to sagebrush and grassland species would be improved.

Big Game

The short-term effects from fuel breaks treatments would add to the cumulative effect of big game habitat modification, such as from urban encroachment. This is because vegetation modification and shrub removal for fuel break construction could reduce the availability of habitat features, such as cover and forage. In cases where fuel breaks are reseeded (i.e., green strips), forage availability and nutritional quality would increase, particularly in areas previously dominated by invasive annual grasses (Clements et al. 1997; NRCS 2006). Only areas directly in the footprint of a fuel break would be modified by treatments.

When combined with the baseline effects of human and natural activities that reduce or modify big game habitat, the establishment of a regional fuel break system under all action alternatives would lessen the consequences of past, present, and reasonably foreseeable habitat losses or modifications. This would come about by improving wildfire suppression opportunities. Potential habitat protection from wildfires would not negate the effects of habitat reductions and alterations due to human land use, such as urban encroachment, and natural processes, such as wildfires and invasive species spread. These uses and processes are likely to continue in big game habitat; however, it would increase habitat availability, relative to no protection, and would improve the ability of this habitat to support big game over the long term. This would be the case especially when combined with habitat improvements from vegetation projects and the Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS.

The greater acreage available for fuel break construction under Alternative D could increase the effectiveness of fuel breaks treatments and the opportunities to control wildfires in big game habitat. It would also contribute to long-term habitat improvements due to decreased risk of invasive grass spread and shrub removal resulting from wildfire.

Migratory Birds

Under all alternatives, the use of tools for fuel break treatments would add to the cumulative effects from other past, present, and reasonably foreseeable future actions, such as from road use and land conversion, by increasing the risk of both habitat loss or modification as well as species injury or death. For example, certain habitat features like perching and nesting sites may be lost, or ground-nesting birds could be injured or killed from fuel break treatments if they are not able to leave treatment areas quickly enough to avoid impacts. Under all alternatives, the contribution to increased risk of injury or death would be limited to the footprint of the fuel break. This is because this is where treatment activities would occur.

When combined with the baseline effects of human actions and natural processes that reduce or modify migratory bird habitat, the establishment of a regional fuel break system under all alternatives would lessen the consequences of past, present, and reasonably foreseeable habitat losses or modifications. This would come about by improving wildfire suppression opportunities, which would lead to greater protection of habitat and structural features, such as trees and shrubs, that may serve as potential nest of foraging sites. Over the long term, potential increases in migratory bird habitat availability and habitat features is expected to offset short-term losses or alterations under all action alternatives because areas protected would be much larger than the fuel break area. When combined with habitat improvements from vegetation projects and the Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS, a region-wide system of fuel breaks would protect these investments, resulting in an increase in migratory bird quantity and quality throughout the cumulative analysis area.

Due to the fewest restrictions on fuel break tools and locations, which would allow optimal fuel break placement, Alternative D would most protect migratory bird habitat over the long term. It would therefore contribute most to increases in migratory bird habitat availability and habitat features, especially when combined with habitat improvements from vegetation treatments.

4.7 Special Status Species

4.7.1 Assumptions

- Impacts on special status species are directly correlated to impacts on their associated habitat type or critical habitat. Species were grouped by habitat association into the following groups: sagebrush-dependent species, grassland-dependent species, and pinyon-juniper-dependent species. See **Appendix J**, Special Status Species in the Project Area for a crosswalk of species and their habitat associations.
- The vegetation state reflects habitat conditions for special status species and the extent to which certain wildlife habitats are suitable.
- Design features for special status species would reduce impacts.
- Effects of wildfire on special status species are related to loss of habitat, wildfire trends, and fuel models as described under **Section 4.3,** Fire and Fuels.
- Acreage calculations are based on the maximum potential treatment areas within a 500-foot buffer (including both sides of roads and BLM-administered ROWs); nevertheless, indirect impacts on special status species may occur outside these areas.

4.7.2 Nature and Type of Effects

Special Status Plant Species

Effects from Fuel Break Construction and Maintenance

To substantially reduce or eliminate potential impacts direct and indirect effects on special status plant species during project implementation, avoidance measures through design features are incorporated into all action alternatives. After avoidance, impacts would primarily be due to the lack of detection of special status plants or their seed banks during pre-project planning. Surveys may not accurately account for annual species, which do not reliably appear every year, so impacts would be greatest for this group of plants. Long-lived perennials are persistent year-round and are more reliably detectable; therefore, impacts on this group of undetected species would be lower. Special status plants in unique habitats, such as ash outcrops, playas, and sand dunes, would have minor if any impacts. That is because these habitats are generally easily avoided. Areas receiving mechanical, prescribed fire, and chemical treatment would have the greatest impact, as opposed to manual treatments and targeted grazing.

General impacts from fuel breaks and impacts from specific treatment methods and different types of fuel breaks on undetected special status plant species would be similar to those described for vegetation in **Section 4.5.2.** Impacts include soil surface disturbance, vegetation removal or trampling, and death. These effects may be magnified for special status plant species, due to their rarity, limited extent, and specialized habitats of many of these species. If multiple types of treatments are used in the same location, the potential for damage or destruction of undetected special status plants increases.

Over time, increased fire suppression opportunities and a decreased potential for wildfire spread across fuel breaks would contribute to the reduction of fire severity and intensity. This would protect special status plant species, reduce habitat loss and alterations due to wildfire, and allow for the recovery of natural and seeded plant communities. Protecting native habitat and restoration investments from future wildfire would prevent loss of and enable recovery of suitable habitat that may support special status plants in the future.

Effects from Manual Treatment Methods

Manual treatments would have the same localized effects on undetected special status plant species described in **Section 4.5.2**. Impacts of manual methods would generally be of lower intensity, compared with other methods. They would occur only within the direct footprint of the fuel break. The likelihood for injury or death of special status plant species would be nonexistent to low for all categories of undetected special status plants. This would be due to the small size of the project, targeting individual plants for treatment, and being able to control the level of vegetation disturbance. Annuals would be most likely to be affected because they are less likely to be detected and therefore avoided.

Effects from Mechanical Treatment Methods

Mechanical methods would have the same direct impacts as described in **Section 4.5.2** on undetected special status plant species and seed banks, through damage and disturbance, as described above. Impacts would be greater than if manual treatments were used, due to the size of the affected area, the amount of soil surface disturbance, and the continuity of the disturbed area. Broadcast mechanical treatments, such as chaining or masticating, could remove special status plant species, because equipment operators would not be able to selectively target species (Benton et al. 2016). The above impacts would occur on all undetected annual and perennial special status plants; special status plants occurring in unique habitats, such as sparsely vegetated areas and easily avoided unique soil inclusions, would be avoided.

Effects from Revegetation Treatments

As described in **Section 4.4**, seeding perennial plant species for construction of green strips would change the condition of the vegetation community in the treatment footprint. It would accomplish this by replacing annual grasses and forbs with perennial species to ensure fuel breaks consist of low stature, competitive, fire-resilient, perennial species.

As described in **Section 4.5**, selection of plants for revegetation would be decided at the site level using BLM Handbook 1740-2. In accordance with the Handbook (BLM 2008, p. 87), the BLM would prioritize native plant material for revegetation. Nonnative, noninvasive plant species would be used only under limited circumstances to break unnatural disturbance cycles or to prevent further site degradation by invasive plant species. Because nonnative plants would be used in specific circumstances when they would not jeopardize the natural biological diversity of an area (see **Section 2.2.6** Native Plant Material Policy), the potential for impacts on special status species such as competition or attraction of a different suite of pollinators would be low.

Over the long term, changes to the vegetation community from fuel break construction would reduce the intensity and severity of wildfires that may damage or destroy special status plants and their habitat. The BLM Instruction Memorandum (IM) 2016-013 directs the BLM to integrate pollinator-friendly native plant species into seeding treatments (BLM 2015). The increase in such species from reseeding fuel breaks would further increase the vegetation community's ability to support special status plants within and adjacent to fuel breaks.

Effects from Prescribed Fire

As described in **Section 4.5**, Vegetation, pile or broadcast burning may reduce seed reserves in the soil and alter its physical, chemical, and biological properties. This would affect the conditions for future vegetation communities (Busse et al. 2010) over the short or long term, depending on the method used (Rhoades et al. 2015). Burned areas would be reseeded as described above to prevent the risk of cheatgrass and other annual plant invasion caused by broadcast burning (BLM 2003). Fireline creation associated with broadcast burning would require vegetation removal, which would increase the risk of injury or destruction of undetected special plant species. When used in conjunction with other treatments, prescribed fire can aid in the successful implementation of vegetation treatments for fuel break establishment.

Effects from Chemical Treatment Methods

Chemical treatments would target invasive annual grasses and forbs; native vegetation such as sagebrush would also be treated to reduce cover. Nontarget vegetation could be harmed or killed over the long term from repeated chemical treatments to control invasive annual plants in the fuel breaks. These treatments pose potential risks to undetected special status plants and their pollinators, depending on the selectivity, application timing, and chemical persistence in the soil.

Broadcast chemical treatment applications would have the largest impacts on undetected special status plants, due to the inability of those doing the broadcasting to select for target species; however, the potential for loss of nontarget species and pollinators would be low, due to design features and adherence to management efforts to protect both special status plants and their pollinators (see Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement [BLM 2007, p. 4-38 to 4-41, 4-52 to 4-53]).

Off-site impacts from chemical treatments are unlikely, as applicators must adhere to label restrictions that reduce the potential for off-site drift. The effects from chemical treatments on native plant species are described in Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (BLM 2007) and are summarized in **Section 4.4**, Vegetation. Treatments would likely affect plant species composition and diversity over the long term (BLM 2007, p. 4-47). Over time, chemical treatments would have positive indirect effects on adjacent vegetation communities, special status plants, and pollinators by decreasing the likelihood of annual grass invasions (BLM 2015).

Effects from Targeted Grazing

Targeted grazing could directly affect target and nontarget plant species through trampling, herbivory, and an overall decrease in vegetation cover. Impacts would be minimized through targeted grazing plans that would optimize successful reduction of target species and avoid damage to desired plants (Design Feature 19 in **Appendix D**). Targeted grazing would be managed to conserve suitable habitat conditions for special status species, while implementing rangeland health standards and guidelines.

Where targeted grazing is used to reduce invasive annual grasses, targeted grazing can shift the structure and function of the plant community toward greater cover and diversity of desirable plant species. Targeted grazing of nonnative perennial grasses alters the structure and function of the plant community by reducing aboveground biomass and increasing the diversity of age classes in the community and, in the long term, the frequency and severity of wildfire. When used in combination with other treatments for seedbed preparation, targeted grazing would improve the establishment of new seedings but potentially at the expense of undetected species. Over the long term, these changes would improve conditions for special status plant species outside the treatment area by reducing the potential for population and habitat loss due to wildfire and invasive plant species spread.

Special Status Wildlife Species

General impacts from fuel breaks and impacts from specific treatment methods on wildlife special status species would be similar or the same as those described for wildlife in **Section 4.6**; however, such impacts can have a magnified effect on special status species, given their existing vulnerability. In a study on the effects of sagebrush treatments on greater sage-grouse, the authors identified certain types of treatment as having negative or negative to neutral effects on greater sage-grouse, as follows: mowing sagebrush and meadows, broadcast burning sagebrush and meadows, using mechanical broadcast methods, chaining to remove conifers, and planting small and large nonnative species postfire (NatureServe 2016).

In addition to the design features described for wildlife, others would be developed in place to reduce impacts on special status wildlife species (Design Features 33-35, 38-45, 47, 49–66 in **Appendix D**) and are described under the appropriate action alternatives.

Long-term impacts from fuel breaks on special status wildlife would also be similar or the same as those described for wildlife in **Section 4.6** and include decreased potential for wildfire spread but increased potential for habitat protection. Habitat protections would likely be of greater importance to special status wildlife because mainly of these species have restricted ranges or population sizes (e.g., Columbia Basin pygmy rabbit and Carson wandering skipper).

4.7.3 Effects from Alternative A

Special Status Plant Species

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained. Therefore, the effects from the use of treatment methods as described under *Nature and Types of Effects* would not occur. This may result in short-term benefits to undetected special status plant species that may otherwise experience potential for adverse impacts from treatment methods.

However, current wildfire trends would likely continue, which would have long-term adverse impacts to special status plant species throughout the project area. Wildfires would continue to alter the structure and composition of plant communities, including special status plants and their pollinators, due to the loss of shrub cover and the potential for establishment of nonnative invasive annual plants or perennial grasses seeded postfire to impede invasive plant species (Balch et al. 2013; West 2000). Postfire changes to plant communities are accompanied by modification of the amount and arrangement of open plant interspaces, areas shaded and exposed to sunlight, and seasonal and daily moisture distribution; thus, structural and compositional changes that result postfire could change both the physical environment and competition between special status plants for resources.

Special Status Wildlife Species

Sagebrush Species

Under Alternative A, the effects from the use of treatment methods as described under *Nature and Types of Effects* would not occur because a regional system of fuel breaks would not be constructed and maintained. This may result in short-term benefits to special status wildlife species that may otherwise experience potential for adverse impacts from treatment methods, but current wildfire trends would likely continue to cause long-term adverse impacts.

Under Alternative A, habitat for sagebrush-obligate species, such as the greater sage-grouse, pygmy rabbit, and sage thrasher (**Appendix J**), would continue to decline across the project area. This would be due to the continued trend of intense wildfires and the subsequent increased potential for landscape fragmentation and the spread of invasive annual grasses, such as cheatgrass and medusahead (Bakker et al. 2011; Balch et al. 2013). Conversion of low-elevation shrublands to grasslands, dominated by either perennial grasses or annual invasive grasses, would continue to reduce the suitability or fragment the habitat for greater sage-grouse over the long term, which depend on sagebrush for breeding, nesting, hiding, thermal cover, and foraging. Cheatgrass-dominated grasslands without sagebrush tend to perpetuate at lower elevations, because recurrent fires prevent reestablishment of sagebrush, native forbs, and grasses (Knick and Hanser 2011).

Such species as Brewer's sparrow, sagebrush sparrow, and sage thrasher would be capable of recolonizing areas that recover in the absence of fire. Recovery of greater sage-grouse would take longer because they require higher densities of sagebrush and exhibit high nest and breeding site fidelity (Connelly et al. 2004, 2011). Although greater sage-grouse may continue to use fire-affected habitat in the years immediately following wildfire, nest survival and adult female survival rates may be reduced (Foster et al. 2018). Without establishing fuel breaks across the project area, there would be a reduced likelihood of the successful recovery of greater sage-grouse and other sagebrush obligates in the project area.

Continued wildfires and the loss of sagebrush habitat would negatively affect golden eagles in the long term, due to the potential for large-scale loss of shrubland and a subsequent decrease in their main prey, black-tailed jackrabbits, whose populations are closely correlated with sagebrush cover (Kochert et al. 2012; Sands et al. 1999). Likewise, potential reductions in shrubland would limit prey for bald eagles, which opportunistically feed on various mammals (NatureServe 2018). Fast-moving wildfires would reduce nesting sites, such as tall trees, foraging features, and resting/preening perches for eagles. Other special status raptor species that use shrubland habitat, such as ferruginous hawks, would be similarly affected.

Burrowing species, such as Piute ground squirrel, would likely avoid direct impacts associated with burning; however, they would experience reduced habitat quality through loss of sagebrush and by habitat conversion to exotic annual-dominated communities by wildfires (Cassola 2016). Reduced biodiversity resulting from current fire trends could reduce prey for special status birds and larger mammals, such as kit foxes.

Grassland Species

Ground-nesting species, such as burrowing owls, short-eared owls, grasshopper sparrows, and long-billed curlews, could be directly affected by wildfires due to habitat loss, and all grassland species could be indirectly affected through loss of nesting and foraging habitat. Grassland species would likely experience increased habitat availability in the years following fires due to an abundance of grassland habitats as grasses become reestablished; however, the potential for spread of invasive annual grasses that often results from opening the shrub canopy (Davies et al. 2011b) may reduce the quality of grassland habitat by reducing the structural diversity of the cover and the biological diversity of plant and insect forage species (Block et al. 2016; Coates et al. 2016). Special status reptiles, such as desert horned lizards, are generally vulnerable following wildfires due to invasions of annual grasses into their habitat. This is because the high density of vegetation and lack of open spaces inhibits their movement (Hall et al. 2009; Newbold 2005).

Pinyon-Juniper Species

Continuing wildfire trends would reduce the amount of intact pinyon-juniper habitat, thereby reducing habitat functionality for species that use pinyon-juniper features for nesting, roosting, forage, and cover. Wildfires that consume large areas of pinyon-juniper habitat have already reduced habitat availability for pinyon jays (Balda 2002), and this trend is expected to continue. Many bat species, such as Yuma myotis, use a variety of habitats and therefore may adapt to postfire conditions by expanding their distribution to areas outside the burn. Habitat loss could also reduce populations of small mammals, such as red-tailed chipmunks, or pinyon-juniper specialist birds, such as pinyon jay.

4.7.4 Effects from Alternative B

The types of direct and indirect impacts that could occur on special status plant and wildlife species from the use of manual and mechanical treatment methods are described under *Nature and Type of Effects*. Specific impacts related to Alternative B are provided below.

Special Status Plant Species

The potential for direct and indirect effects (see *Nature and Type of Effects*) on undetected special status plant species from the use of manual and mechanical treatment methods would increase, relative to Alternative A. The maximum potential acres of habitat types that would be available for potential fuel break construction would also increase, relative to Alternative A (**Table 4-6**, above). In total, 1, <1, and 1 percent of total grassland, pinyon-juniper, and sagebrush vegetation types in the project area would be available for potential treatments; however, the area impacted would likely be lower because fuel breaks would be spread out among habitat types. Where fuel breaks are constructed within these habitat types, undetected special status plant species that are within proposed fuel break installation may experience direct and indirect impacts associated with fuel break construction and maintenance.

The use of native plant material for reseeding and replanting could improve habitat conditions for special status species by promoting the retention of native plant communities, pollinators, and diversity. However, there could be potential challenges associated with only using native plant materials. In some areas, such as those vegetation states dominated by invasive annual grasses, native plant materials may have a low chance of establishment, and thus the likelihood of successfully implementing the fuel break would be low. This would reduce the chance of long-term benefits to special status plant species associated with habitat protection from wildfire.

Sagebrush would not be treated, so direct effects from the use of manual and mechanical treatments for fuel break establishment on sagebrush-dependent special status plant species would be unlikely. Treatments in highly resistant and resilient sites would also be avoided; since such sites may host a more diverse species assemblage (Cleland 2011), the number of plant species groups potentially affected may be lower than if no restrictions were imposed. However, the lack of fuel breaks within these areas may hinder the implementation of strategically placed anchor points that could help reduce loss of special status plant species and habitat from potential wildfire.

Some design features would limit impacts on special status plant species associated with fuel break construction and maintenance. Examples are surveying for special status plants (Design Feature 39), conducting ESA consultation (Design Feature 41), constructing fuel breaks in areas where vegetation disturbance by wildfire or surface-disturbing activities has already occurred (Design Features 1 and 7), and implementing an invasive plant management plan (Design Feature 23).

Over the long term, the establishment of fuel breaks under Alternative B would increase the effectiveness of wildfire suppression opportunities in areas where could be constructed (i.e., along roads) relative to Alternative A. The effectiveness of fuel breaks in the Great Basin over the long term would be limited by the restrictions on tools available for construction and maintenance and by the location and types of fuel breaks allowed under Alternative B. Brown strips would improve direct attack opportunities and reduce fire start potential along highways. This would indirectly reduce the potential for impacts on special status plant species, such as mortality and habitat loss, as the fire moves beyond the fuel break. Mowed fuel breaks would disrupt fire behavior and reduce the rate of spread, which would improve the chances for wildfire containment and smaller areas of vegetation loss. These impacts would be limited to areas where there are roadways outside sagebrush and highly resistant and resilient sites. Where there are roadless areas adjacent to special status plants and their habitats, the effects would be the same as Alternative A.

Special Status Wildlife Species

Sagebrush-Dependent Species

The acres of total greater sage-grouse habitat types and occupied leks available for potential fuel break construction in the project area are shown in **Table 4-8**, below. Not all fuel breaks would be established in these habitats, and treatment of sagebrush and in highly resistant and resilient sites would be avoided. Highly resistant and resilient sites with high sagebrush cover provide conditions where sagebrush-dependent species, such as the greater sage-grouse, are likely to persist (Chambers et al. 2014). Restrictions on fuel breaks within these areas may hinder the implementation of strategically placed anchor points that could help reduce habitat loss from potential wildfire.

Because sagebrush would not be treated, it is unlikely that vegetation removal and reseeding for fuel break establishment would degrade habitat features such as shrub cover for sagebrush-dependent special status wildlife species. Manual and mechanical treatments of grasslands within greater sage-grouse habitats could potentially alter habitat conditions of sage-grouse brood-rearing habitat, by removing vegetation other than sagebrush and reducing grass height. Design features would limit potential impacts by prohibiting fuel break construction and maintenance in sage-grouse breeding habitat during the breeding season (Design Feature 44) and ensuring treatments are conservative (Design Feature 45).

Table 4-8
Maximum Potential Acres of Greater Sage-Grouse Habitat Types Available for Fuel Break Construction by Alternative

Greater Sage-Grouse Habitat Areas[1]	Alternative B	Alternative C	Alternative D
Priority areas for conservation (PACs)[2]	236,000	345,000	500,000
Priority habitat management areas (PHMA)	157,000	238,000	347,000

Greater Sage-Grouse Habitat Areas[1]	Alternative B	Alternative C	Alternative D
General habitat management areas (GHMA)	127,000	181,000	219,000
Other habitat management areas (OHMA)	24,000	35,000	35,000
Important habitat management areas (IHMA)	31,000	51,000	95,000
Occupied leks[3]	297,000	438,000	612,000

Source: BLM GIS 2019

[1]PHMA, GHMA, OHMA, and IHMA are not identified in Washington.
[2]This is not a discrete habitat category and it may overlap categories below.
[3]Area calculated as occupied lek area surrounded by a 6.2-mile buffer.

Direct impacts on eagles associated with fuel break construction and maintenance would not occur, due to design features that impose spatial and temporal restrictions on treatments near nest sites (Design Features 49-52). Design features described for migratory birds (**Section 4.7,** Wildlife) would also reduce impacts on eagles.

Design features would reduce the impacts of treatment methods on special status wildlife by implementing restrictions and conservation strategies (Design Feature 39), minimizing ground-disturbing treatments in areas with highly erosive or saturated soils (Design Features 33 and 34), implementing noxious and invasive weed management (Design Feature 23), requiring surveys in suitable or potential habitats for federally listed, proposed, candidate, and BLM special status species before treatment (Design Feature 39), and other measures to reduce impacts on vegetation (**Appendix D**).

Because the fuel break system proposed under Alternative B would avoid treatment of sagebrush, the habitat would not fully benefit from fuel breaks' preventative effects, although fuel breaks in nearby areas could slow the rate of fire spread into sagebrush communities. Where fuel breaks successfully reduce fire intensity and severity in in grasslands, some of these areas may gradually increase in sagebrush cover. In existing sagebrush areas adjacent to fuel breaks, sagebrush communities would be less likely to decline compared with Alternative A. In sagebrush areas not adjacent to fuel breaks, such sagebrush-dependent species as the greater sage-grouse would continue to experience declines in habitat availability and functionality due to the limited capacity to affect wildfire suppression. As a result, there would be reduced sagebrush cover, which would increase predation and reduce nesting sites and forage. This would also potentially decrease habitat for small mammal species that serve as prey for eagles and other birds of prey.

Grassland- and Pinyon-Juniper-Dependent Species

A maximum of 116,000 acres or 1 percent of grassland habitat and 47,000 acres or <1 percent of pinyon-juniper habitat in the project area would be available for potential fuel break construction. The area impacted would likely be lower because fuel break locations would be spread out among all habitat types. Species associated with these habitat types would experience short-term direct and indirect impacts from the use of manual and mechanical treatment methods, as described under *Nature and Type of Effects*. Fuel break construction and maintenance would occur along roads, which provide lower quality habitat, so most special status grassland and pinyon-juniper species would experience few direct effects.

Seeding fuel breaks with native species could increase habitat availability and quality for grassland special status species, particularly in areas that were previously dominated by invasive annual grasses. However, the success of reseeding treatments would be limited in areas where objectives cannot be met with native species. The increase in pollinator-friendly native plant species from reseeding fuel breaks would further increase the vegetation community's ability to support grassland-dependent special status wildlife; however, reestablished non-woody vegetation in fuel breaks would not provide habitat for pinyon-juniper species. This is because most of these species require woody vegetation for cover and nesting.

Fuel breaks in grassland and pinyon-juniper habitats would improve opportunities for suppression to some extent; however, limitations on the use of methods to create fuel breaks would slow their establishment, and the limited total extent and potential locations of the fuel breaks would lower the system's effectiveness. The ability of fuel breaks to protect grassland and pinyon-juniper habitats would increase along roads outside of highly resistant and resilient sites relative to Alternative A. Where there are no nearby roads, the effects would be the same as Alternative A.

4.7.5 Effects from Alternative C

The types of direct and indirect impacts that could occur on special status plant and wildlife species from the use of manual, mechanical, chemical, prescribed fire, and targeted grazing methods are described under *Nature and Type of Effects*. Specific impacts related to Alternative C are provided below.

Special Status Plant Species

The maximum potential acres of habitat types available for fuel break construction would increase relative to Alternatives A and B (**Table 4-6**, above). This would correspond to 1 percent each of total grassland, pinyon-juniper, and sagebrush vegetation types in the project area. If they are present in the treatment area, special status plant species may experience direct and indirect impacts from the use of all treatment methods. Undetected special status plant species in these habitats would be affected, as described under *Nature and Types of Effects*.

Creation of fuel breaks along BLM-administered ROWs and roads (Maintenance Level 3 and 5) may affect more special status plant species compared with Alternative B. This is because the ROWs generally experience a lower volume of traffic (motorized or other) and may provide higher quality habitat due to less dust and lower potential for weed spread compared with roads. It is possible that ROWs can serve as conservation areas for plants and wildlife compared with adjacent roads or agricultural lands (McCleery et al 2015). Given that more special status species may occur along ROWs, the development of fuel breaks along these linear features would increase the potential for impacts on undetected special plant species.

Limiting treatments in highly resistant and resilient areas would reduce the potential for impacts on undetected special plant species because highly resistant and resilient areas may support greater diversity of species assemblages (Cleland 2011). Native species would be used for seeding in highly resistant/resilient sites, which may improve habitat conditions for special status species by maintaining and promoting the retention of native plant communities, pollinators, and diversity. Limiting revegetation to native plant materials in highly resistant and resilient sites could slow movement toward objectives, as described under Alternative B. However, soil moisture and relative lack of competition from invasive annual grasses (Chambers et al. 2014a) would improve chances of successful revegetation using native materials in these areas, and special status plant species may still benefit from protections provided by successfully established fuel breaks.

In some cases, nonnative plants could be used for reseeding outside of highly resistant and resilient sites, provided conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) were met (see **Section 2.2.6** Native Plant Material Policy). This could improve the chances of revegetation success, facilitate movement toward fuel break objectives, reduce the likelihood for nonnative annual invasion, and ultimately increase habitat protections for special status plant species, particularly in fuel breaks with existing invasive annual grass cover or where soils are degraded or otherwise unable to support native vegetation. Additional site-specific ESA Section 7 consultation would be required if seeding were proposed in the known range of proposed or listed ESA plants (Design Feature 41).

In addition to design features described under Alternative B, features to reduce impacts from grazing, prescribed fire, and chemical treatments would apply under this alternative (see **Appendix D**). For example, an optimized grazing plan would be implemented that would reduce the spread of invasive plant species and avoid damaging nontarget plant species. The increased availability of tools and the extent of fuel breaks are expected to increase fuel break function and opportunities for suppression, relative to Alternative A. Special status species and their habitats adjacent to fuel breaks would experience protections due to the potential for slower rates of fire spread. Impacts would be limited to areas adjacent to roads and ROWs outside of areas of high resistance and resilience except those that have high fire probability or where adaptive management habitat triggers have been tripped.

Special Status Wildlife Species

Sagebrush-Dependent Species

The maximum potential acres of greater sage-grouse habitat types available for fuel break construction would increase, relative to Alternatives A and B (**Table 4-6**, above). This would correspond to 2 percent of total sage-grouse habitat types and 1 percent of total occupied leks in the project area, but the actual area of disturbance associated with fuel breaks (667,000 acres) would be less.

The development of fuel breaks along BLM-administered ROWs would increase the potential for impacts on special status wildlife species compared with Alternative B. This is because areas along ROWs have been shown to have conservation value for rare plants, mammals, amphibians, birds, and insects (McCleery et al 2015). Impacts would include potential for species injury or destruction and habitat alterations from shrub removal. Conversely, effects on some species, such as greater sage-grouse, would be less likely to occur when fuel breaks are created along BLM transmission line ROWs because these areas provide low-quality habitat due to higher risk of avian predation (Coates et al. 2014).

Effects from habitat modifications, primarily reduced shrub cover, on greater sage-grouse would have the greatest direct effects where fuel breaks are constructed in PACs and PHMAs. This is because greater sage-grouse depend on the higher sagebrush cover and habitat value of these areas for nesting and protection from predators.

Reductions in shrubland habitat associated with fuel break establishment under Alternative C could modify potential foraging and nesting habitat for eagles, as described under Migratory Birds in **Section 4.7,** Wildlife. As noted above, the amount of shrubland that would be subject to impacts (limited to the footprint of the fuel breaks) would increase, relative to Alternative A, but would be relatively small (1 percent of the total acres of sagebrush habitat on the project area).

Design features would reduce impacts on greater sage-grouse and their habitat. For example, prohibiting fuel break construction and maintenance in greater sage-grouse breeding habitat during the breeding season would avoid disturbing nesting greater sage-grouse (Design Feature 44 in **Appendix D**). In greater sage-grouse biologically significant units (BSUs) in PHMAs and IHMAs, design features would ensure that sagebrush treatments do not lead to a soft or hard habitat trigger trip (Design Feature 45 in **Appendix D**), thereby reducing the potential for habitat modification.

Design features to reduce impacts from grazing, prescribed fire, and chemical treatments would also be in place (see **Appendix D**). For example, a targeted grazing plan would require wildlife ramps to be placed in watering troughs to help greater sage-grouse and other wildlife use and escape from them (Design Feature 19 in **Appendix D**).

Over the long term, fuel break establishment in sagebrush habitat would protect these areas from future wildfire and reverse the trend of sagebrush cover loss in the project area. This would increase the availability of habitat features, such as forage, nesting sites, and cover for sagebrush species.

Grassland- and Pinyon-Juniper-Dependent Species

A maximum of 161,000 acres and 509,000 acres of grassland and pinyon-juniper habitat, respectively, would be available for fuel break construction under Alternative C. This is an increase in the area affected, which could lessen the habitat features for grassland and pinyon-juniper-dependent species over a greater area, relative to Alternatives A and B. The treatment footprint would be minimal (1 percent of each habitat type), compared with the available habitat in the proposed project area. Use of the full suite of tools would increase the potential for direct impacts on grassland and pinyon-juniper species and habitats, relative to Alternatives A and B.

Although some species may avoid fuel breaks during construction and maintenance, reseeding currently degraded areas with perennial vegetation, such as for the creation of green strips, could benefit some special status species by increasing habitat availability, forage, and cover over the long term. However, the narrow width of fuel breaks and their proximity to roads would limit their usefulness as foraging or breeding habitat.

Over the long term, the proposed fuel break system would provide increased opportunities for wildfire suppression along roads and ROWs outside of areas of high resistance and resilience except those with high fire probability or where adaptive management habitat triggers have been tripped. This would potentially lead to reduced wildfire spread, which would reduce the loss of grassland habitat from wildfire as well as the likelihood for invasive annual grasses to dominate following wildfire. Reduced potential for wildfire spread would also benefit pinyon-juniper-dependent species, such as the pinyon jay, which have been affected by large-scale loss of habitat due to wildfire (Balda 2002; Cassola 2016).

4.7.6 Effects from Alternative D

Special Status Plant Species

The direct and indirect impacts of fuel break creation and maintenance under Alternative D on special status plant species would be similar to those described for Alternative C, with the same tools available for fuel break construction and maintenance. The maximum potential acres of habitat types available for potential fuel break creation and maintenance would increase, corresponding to 1, 1, and 2 percent of total grassland, pinyon-juniper, and sagebrush habitat types within the project area. Even though Alternatives D and C proposed the same total area of new fuel break construction, the actual acres of habitat types affected may differ under Alternative D, due to there being fewer constraints on the locations of fuel breaks. For instance, treating vegetation in highly resistant and resilient sites may increase impacts on special status plant species. This is because such sites may host a more diverse species assemblage (Cleland 2011). However, design features limiting impacts to sensitive resources would remain in place.

Nonnative plant materials could be used for revegetation, including in highly resistant and resilient sites, provided conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) were met. However, native plants would be prioritized, and suitable native seed sources would typically be available for fuel break revegetation because BLM would follow the National Seed Strategy for Rehabilitation and Restoration (Plant Conservation Alliance 2015). Use of nonnative plant materials to revegetate fuel breaks, per Handbook H-1740-2 (BLM 2008, p. 87), could improve treatment success and ultimately increase habitat protections for special status plant species, particularly in fuel breaks with existing invasive annual grass cover or degraded soils. Additional site-specific ESA Section 7 consultation would be required if seeding were proposed in the known range of proposed or listed ESA plants (Design Feature 41).

Design features to reduce impacts on special status plant species would be the same as those described under Alternative C. Long-term impacts on undetected special status plant species and their habitat due to the increased extent of the fuel break system would also be similar to those described under Alternative C; however, placing fewer constraints on the locations of fuel breaks could increase the successful establishment of the fuel break system and the effectiveness of wildfire suppression. This would reduce the likelihood of loss of special status plant species' populations and habitat degradation.

Special Status Wildlife Species

Sagebrush-Dependent Species

Under Alternative D, the direct and indirect impacts of using tools to construct and maintain fuel breaks on sagebrush-dependent species, such as the greater sage-grouse and eagles, are expected to be similar to those described for Alternative C. Even though Alternatives D and C propose the same total area of new fuel break construction, the potential acres of greater sage-grouse habitat types available for constructing and maintaining fuel breaks would increase, corresponding to 2 percent of both total greater sage-grouse habitat types and total occupied leks in the project area. The actual acres of sagebrush that would be treated would be lower, because fuel break locations would be spread out across all habitat types.

Design features to reduce impacts on greater sage-grouse and eagles would be the same as those described under Alternative C. Long-term impacts on sagebrush-dependent species due to an increased potential for sagebrush habitat recovery due to fuel break establishment in sagebrush habitats would also be similar to those described for Alternative C; however, fewer constraints on the locations of fuel breaks would increase the successful establishment of the fuel break system and the effectiveness of wildfire suppression. This could allow for avoidance of and increased protection to sagebrush habitats, enhance such habitat features as nesting sites and forage, and further promote the recovery of such sensitive wildlife species as the greater sage-grouse.

Grassland- and Pinyon-Juniper-Dependent Species

Grassland- and pinyon-juniper-dependent species could experience direct and indirect impacts from fuel break construction over a greater area, relative to Alternatives A and B. Fuel breaks could be constructed without constraints in highly resistant and resilient sites, which generally receive more precipitation and have more diversity in vegetation (Chambers et al. 2014); thus, these areas may host a greater of species

The total area available for potential fuel break construction represents a small proportion of total grasslands (1 percent) and total pinyon-juniper habitats (1 percent) in the project area, and the actual are treated would be smaller because fuel breaks would be spread out across all habitat types. Direct impacts on grassland- and pinyon-juniper dependent species in the treatment area would include of disturbance and habitat avoidance, primarily during fuel break construction and maintenance. Depending on the type of fuel break, habitat alterations and loss may also occur. Habitat availability for grassland species in green strips may increase as reseeded vegetation becomes established. Brown strips would remove habitat for all wildlife species.

Ultimately, the increased extent of the fuel break system would be expected to improve wildfire suppression opportunities and influence wildfire behavior, which would potentially reduce the rate of wildfire spread and associated burned areas. This would decrease the potential for grassland and pinyon-juniper habitats being burned and subsequently reduce the potential invasions of annual grasses. Grassland and pinyon-juniper habitat throughout the project area would be better maintained compared with Alternative A. Special status species associated with grassland habitats would eventually experience decreases in habitat availability, as reduced wildfire spread promotes sagebrush recovery.

4.7.7 Cumulative Effects

Cumulative Baseline

The cumulative analysis area for special status species is the project area boundary, due to indirect effects on special status species from fuel break creation and maintenance. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades.

The baseline effects of past, present, and reasonably foreseeable future actions on special status plant and wildlife species are similar to those described for general wildlife in **Section 4.6.7** and general vegetation in **Section 4.5.7**. In general, given their specific habitat requirements and limited distribution, special status species are more sensitive to development and wildfire, which reduce or degrade habitat; therefore, the long-term effect of native habitat declines would be more severe for both special status plant and wildlife species.

Sagebrush-dependent special status species that require high shrub density, such as the greater sage-grouse, are particularly vulnerable to the long-term effect of continuous shrub cover decline due to natural processes, such as wildfire and invasive annual grasses (Brooks et al. 2015; Coates et al. 2016). The greater sage-grouse land-use plans and records of decision (BLM 2019a, b, c, and d) will have potentially beneficial cumulative effects on sage-grouse by reducing disturbance in special habitat areas and providing guidelines for suitable habitat conditions.

Pinyon-juniper-dependent species are affected by large-scale thinning of pinyon-juniper and habitat alteration and loss due to wildfire. Conifer removal projects reduce important features, such as cover and nesting sites used by such species as the pinyon jay, and these types of activities are increasing (NatureServe 2018). Grassland-dependent species have lost habitat due to conversion for human land uses (Lark et al. 2015). Further habitat loss or alteration due to nonnative grass invasions, which are exacerbated by wildfire, is ongoing (Halofsky et al. 2018).

Region-wide vegetation and fuels reduction and rangeland restoration projects, such as the Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS, would improve habitat for most special status plant and wildlife species in the proposed project area. Where successful, restored native vegetation and increased plant diversity will continue to increase habitat availability and quality throughout the project area.

Special Status Plant Species

When combined with the baseline effects of natural and human-caused wildfires, vegetation treatments, and human development, all action alternatives would increase the potential for injury or mortality of undetected special status plant species. This is because fuel breaks would remove or trample vegetation, disturb the soil surface, and injure or kill undetected special status plant species. This would add to ongoing and future sources of injury or mortality, such as from wildfire, but the contribution from the use of tools for fuel break development would be limited to the footprint of the fuel breaks, where such tools would be applied. Additionally, the cumulative contribution would be temporary, limited to the time during which fuel break are constructed and maintained. Under all alternatives, the increased potential for injury or death would be substantially reduced or eliminated by implementing avoidance measures through design features. Ultimately, a successful region-wide fuel break system would serve as a buffer for adjacent plant communities and contribute to the protection of special status plant species and their habitats. Benefits to special status plant species throughout the cumulative analysis area from this end result would outweigh the short-term increase in potential for injury or mortality.

Effects from fuel breaks would also add to the cumulative effect of habitat modification resulting from past, present, and reasonably foreseeable future action, such as from development, which directly removes vegetation and degrades habitat. This is because fuel break construction would modify the vegetation community and disturb the soil surface. Approximately 21 percent of land in the western states (including those covered in this PEIS, excluding Alaska) has been converted to intensive uses, such as urbanization, agricultural land, and pastureland, which generally provide lower quality habitat than undisturbed habitats (BLM 2007). In contrast, the contribution of actions under each alternative to injury or mortality or habitat alteration would be limited to the area of the fuel break system—up to 529,000 acres under Alternative B and up to 667,000 acres under Alternatives C and D. Under all alternatives, the contribution to habitat modification from the construction of fuel breaks would be limited to the footprint of the fuel breaks (**Table 4-6**), where such tools would be applied. Protection of special status plant species and their habitats throughout the cumulative analysis area due increased wildfire suppression opportunities would outweigh the adverse impacts from habitat alterations within the fuel break.

Over the long term, a region-wide fuel break system is expected to provide a buffer to surrounding areas, increase habitat for special status plant species, and reduce the risk of injury or death due to wildfire. This would offset short-term losses or alterations of vegetation and habitat features, leading to potential increases in habitat availability. When combined with the baseline effects of human and natural activities that reduce or modify special status species plant habitat, habitat protection would offset the effects over the long term. The establishment of a regional system of fuel breaks would protect investments such as from vegetation projects and the Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS, which would add to habitat improvement and facilitate species recovery. The area impacted would extend beyond the footprint of the fuel breaks to potentially include the entire cumulative analysis because wildfire can spread large distances.

Alternative D would have the greatest contribution to long-term increases in habitat availability and reduced risk of death from wildfire. This is because it proposes the greatest flexibility in fuel break locations and area (**Table 4-6**). This could increase the effectiveness of fuel breaks treatments and therefore would result in increased potential protection of special status plant species and habitats.

Special Status Wildlife Species

Under all action alternatives, the use of tools for fuel break treatments would increase the risk of injury or death of special status wildlife species in combination with past, present, and reasonably foreseeable actions such as road use and vegetation projects. Under all alternatives, design features and avoidance measures would limit the contribution to increased risk of injury or death and the area impacted would be limited to the footprint of the fuel break. Protection of special status wildlife and their habitats throughout the cumulative analysis area due increased wildfire suppression opportunities would outweigh the short-term contribution to increased risk of injury or mortality because protected areas would be much larger than the fuel break footprint.

Short-term effects from fuel break construction would add to the cumulative effect of habitat modification, such as from human development. This is because vegetation modification for fuel break construction could reduce the availability of such habitat features as cover, forage, and nesting and perching sites. This could decrease habitat functionality and increase predation. In cases where fuel breaks are reseeded, habitat availability and quality for grassland special status species would increase, particularly in areas that were previously dominated by invasive annual grasses. The cumulative contribution would be limited to habitat directly in the footprint of a fuel break (**Table 4-6**). In contrast, approximately 21 percent of land in the western states (including those covered in this PEIS, excluding Alaska) has been converted to intensive uses, such as urbanization, agricultural land, and pastureland, which provide fewer benefits for wildlife than undisturbed habitats (BLM 2007).

Over the long term, potential increases in habitat availability for special status wildlife species due to improved wildfire suppression opportunities would offset short-term losses or alterations of habitat features. When combined with the baseline effects of human and natural activities that reduce or modify habitat, increased wildfire fighting opportunities would offset the effects by reducing potential habitat loss to wildfire and improving the ability of remaining habitat to support special status wildlife species. When combined with habitat improvements from vegetation projects and the Fuels Reduction and Rangeland Restoration PEIS, the establishment of a regional system of fuel breaks would protect these investments. Increased habitat availability from wildfire protection in combination with improved habitat quality from vegetation projects would ultimately facilitate species recovery.

Alternative D would have the greatest contribution to long-term increases in habitat availability, because it proposes the greatest flexibility in fuel break locations and area (**Table 4-6**). Alternatives C and D would increase habitat availability for special status wildlife species throughout the project area, including species that extensively use sagebrush, pinyon-juniper, and grassland habitats. Because sagebrush would not be treated under Alternative B, habitat protections would be limited to areas where there are roadways outside sagebrush and highly resistant and resilient sites.

4.8 CULTURAL AND TRIBAL RESOURCES

4.8.1 Assumptions

- This analysis provides a broad overview of estimated potential effects, based on available information. Existing information and cultural resource records provide some insight into the potential for cultural resources in the project area; however, data are incomplete and information from past inventories may be geographically biased toward project-oriented undertakings.
- The BLM would conduct cultural resource inventories and consultations appropriate to the scale and level of disturbance, in advance of project activities, and the results early in project planning to determine the need for project redesign or other mitigation.
- Before the BLM authorizes any undertakings, it would be subject to cultural resources review and compliance with Section 106 of the NHPA. It would do this in accordance with the National Programmatic Agreement between the Advisory Council on Historic Preservation and the BLM, state protocol agreements with respective SHPOs, and guidelines set forth in BLM 8100 Manual and Handbook.
- For this analysis, the effects on cultural resources will be significant if historic properties are damaged, destroyed, or removed from federal protections without appropriate consideration or mitigation. The BLM typically favors avoiding actions and locations that could result in adverse effects through site-specific redesign; however, it may consider other measures to eliminate, minimize, or resolve adverse effects through data recovery, recordation, monitoring, or other appropriate measures.
- Further site-specific research and consultation would be needed to determine whether treaty-based rights or other federal/tribal agreements are applicable and to identify affected resources or impacts on tribal interests.
- Native American cultural uses and interests are diverse, as are the habitats, targeted resources, and spiritual importance in proposed fuel breaks project areas. Tribal resources are most easily and typically accessed from existing roads and turnouts and thus there may be short-term loss of tribal access and privacy for cultural uses during treatment.
- Areas of importance to Native Americans may not be readily identifiable outside those communities due to unique values and perspectives. As such, impacts are difficult to determine or quantify because aspects of tribal interest in the project area may not be specified or mapped.
- The BLM would consult with appropriate tribes, according to guidance set forth in BLM Manual and Handbook 1780, and relevant authorities listed therein. They would do this to identify and address potential resource concerns before constructing fuel breaks likely to affect the access or availability of resources or locations important to traditional lifeways, including subsistence, economy, ritual, and religion.
- The impacts on areas or resources of tribal interest and the severity of impacts depend on the perspective and context of the affected tribes. In other words, individual tribes will have to

consider whether impacts may occur based on what is culturally or spiritually important to them and then communicate that to the BLM.

- Fuel breaks may beneficially or negatively affect the integrity of the historic or visual setting of cultural and tribal resources, where setting is an important aspect of the resource's significance.
- Fuel breaks may reduce the potential for fire-sensitive cultural resources to be lost during wildfires and wildfire suppression. They could promote long-term enhancement and health of natural resources such as pinyon that are important to tribal cultures by increasing wildfire suppression opportunities that ultimately contribute to reduced wildfire intensity and severity and removing undesirable species.

4.8.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Fuel breaks and associated construction and maintenance activities can affect the physical integrity of archaeological sites and the integrity of visual settings. The potential for direct and indirect impacts would vary by fuel break type, width of disturbance, and methods employed. If present, direct effects on the physical integrity of surface and near surface archaeological sites could occur from all fuel break types.

Creation of up to 50-foot wide brown strips (including both sides of the road) would remove all the vegetation, which could displace artifacts and site features resulting in the loss of valuable cultural resource information on the site function, date of use, subsistence, past environments, and other research questions. Brown strips could potentially increase erosion and possibly expose buried sites not identified during inventory. While the smaller width of the brown strip fuel break would limit the potential for direct disturbance of cultural resources; the potential for brown strips to reduce the rate of fire spread would be limited and indirect effects from wildfire on cultural and tribal resources may occur.

Mowed or targeted fuel breaks and green strips could cause surface disturbance on up to a 500-foot wide strip (including both sides of the road). Typically, the disturbance would be 250 feet or less on each side of the road, but this could shift due to resource concerns or topography. This disturbance could physically displace artifacts and site features, if present. Green strips would replace the vegetation that was removed with less flammable plant material, potentially stabilizing soils and protecting the physical integrity of archaeological sites. Reseeding could reduce the potential for the effects of erosion after treatments. In all types of fuel breaks, there is the potential for removal of plant foods, material or other resources valued by tribal users. The wider width of the targeted fuel breaks and green strips would increase the potential for direct disturbance of cultural resources that may be present from construction, maintenance and suppression. However, the potential for disrupting wildfire behavior, reducing the rate of fire spread and acres burned would be greater than the brown strips and may reduce the potential for indirect effects from wildfire on cultural and tribal resources.

Changes to visual setting from the creation and maintenance fuel breaks could affect certain cultural and tribal resources, such as historic trails, historic roads, cultural landscapes, or Native American spiritual sites. Some types of cultural resources may be more concentrated along historic travel routes. Creating large strips of vegetation removal of varying sizes may affect the existing visual character of the treated areas. During treatments there may be a temporary loss of access tribal access and privacy for cultural uses and cultural sites. Temporary loss of access to culturally significant resources would be minimized through consultation under all alternatives.

If cultural resources are encountered during construction or maintenance, all ground-disturbing activity near the discovered resource must cease until the resource is evaluated by an appropriate BLM resource specialist. Under all alternatives, undertakings involving fuel breaks would continue to be subject to site-specific cultural resources review, tribal consultation, and compliance with Section 106 of the NHPA (See **Appendix D**).

Planning and constructing a regional system of fuel breaks could indirectly reduce the potential for impacts on cultural and tribal resources from emergency suppression activities by providing anchor points or staging areas that have been assessed for cultural and tribal resources. In addition, fuel breaks would potentially disrupt the movement of wildfire across the landscape. This would increase the BLM's opportunities to reduce the risk of impacts from wildfire on cultural and tribal resources.

Creating and maintaining fuel breaks would remove vegetation next to existing roads; potentially removing pinyon and other plant resources at locations where tribal elders and families may concentrate their gathering efforts. It is anticipated that the creation of fuel breaks and subsequent use and maintenance of the fuel breaks and roads may lead to additional impacts on cultural resources. Fuel breaks may also indirectly provide new entry points to adjacent areas for cultural uses, and tribal resource gathering, including pinyon nuts and other plant products; however, these entry points could lead to incompatible activities, resource loss, unauthorized collection, and vandalism by members of the public.

Effects from Manual Treatments

Because this treatment requires workers on-site using hand tools, manual techniques may have the least potential for surface and near-surface disturbance that could directly damage and alter the spatial integrity of artifacts and features at archaeological sites or cause erosion. There is some potential to disturb tribal resources, such as cultural sites and tribal plant use, or resource gathering areas. Undiscovered or unrecorded resources may be located and avoided as the work progresses.

Effects from Mechanical Treatments

Depending on the specific tools and types of equipment being used to remove plants, mechanical techniques could cause surface and near-surface disturbance. This could directly damage and alter the spatial integrity (location and distribution) of any artifacts and features at archaeological sites. Treatments requiring heavy ground disturbance, such as tilling to create brown strips or to clear ground for green strips, would have greater potential effects, and repeated treatments in the same areas could have additive effects. Mechanical methods would also have a similar potential for direct disturbance of any tribal resources. Mechanical methods would be less effective than manual methods in avoiding previously undiscovered or undocumented resources.

Effects from Prescribed Fire Treatments

Impacts from prescribed fire treatments could occur on artifacts and assemblages of artifacts that may be damaged or destroyed by fire. The physical characteristics of materials that have information potential could be altered by heat and fire. Potential impacts can occur from the fracturing of stone artifacts, the loss of artifacts and features to fire, and damaging through chemical alteration of bone, obsidian, rock art, and ceramic artifacts. Impacts could occur on tribal resources, such as cultural sites and areas where tribes use plants, or other traditional sites and resources. This would be the result of removal or loss of these resources, temporary loss of access for cultural uses and the intrusion of smoke during treatment.

Effects from Chemical Treatments

Chemical use may affect archaeological sites by altering or contaminating organic materials or by leaving traces on artifacts and features that might otherwise be used for scientific analysis; however, chemicals may result in less potential for impacts than mechanical or manual treatments. This is because their use would eradicate invasive annual grasses in archaeological sites without disturbing the ground. Chemical use may also limit use of tribal resources in the vicinity of where chemical applications are used. The duration of such impacts may be long term and adverse, especially in areas used for gathering plants for traditional cultural purposes, such as medicines, subsistence practices, or basketmaking. Traditional users may be reluctant to gather in these areas or adjacent areas after fuel breaks are constructed.

Effects from Targeted Grazing Treatments

There would be some potential for surface and near-surface disturbance to cultural resources and loss of plant resources through livestock trampling and concentration. Grazing generally results in only minor surface disturbances with limited potential for direct effects to cultural resources. Past studies have demonstrated that grazing impacts on cultural resources are primarily of concern in areas of concentrated livestock use, such as around water sources and corrals (Roney 1977; Osborn et al. 1987). Indirect impacts may include accelerated erosion and gullying, subsequent exposure, and increased potential for illegal artifact collection and/or vandalism.

4.8.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed; instead, projects would continue on a site-specific basis only. The potential for impacts from constructing fuel breaks and the methods used would be similar to those described for *Nature and Type of Effects*. BLM undertakings involving fuel breaks would continue to be subject to cultural resources review and compliance with Section 106 of the NHPA, consultation with tribes, and consideration of tribal interests; however, without a system of fuel breaks and, in turn, improved regional opportunities to suppress fire, the impacts from wildfires and wildfire suppression on fire-sensitive cultural resources and tribal resources, including destruction or damage to resources, would continue. On the other hand, those impacts described under *Nature and Type of Effects* relating to constructing fuel breaks would not occur on a programmatic scale.

4.8.4 Effects from Alternative B

As described under the *Nature and Type of Effects*, manual and mechanical treatment methods have the potential for direct surface and near-surface disturbance on archaeological sites and indirect risk of wildfire from the strict limits on the location and methods used to create fuel breaks.

Restricting the types of treatments and the treatment acreage, confining treatments to Maintenance Level 5 roads, and excluding highly resistant and resilient sites and sagebrush would limit the risk of direct ground-disturbing impacts on cultural and tribal resources. By percentage, the most common fuel break type anticipated would be mowed, but brown strips would also be used, while green strips and targeted grazing fuel breaks would not be. The creation of the fuel breaks may impact the visual setting of cultural and tribal resources, that would be assessed on a site-specific basis. Design features 27-30 would continue to be implemented to address required compliance with Section 106 of the NHPA, consultation with tribes, and consideration of tribal interests that would be implemented under all alternatives (see **Appendix D**). Alternative B would result in a landscape-scale system of fuel breaks throughout the Great Basin; however, the potential for improving wildfire suppression and potentially reducing the impacts of wildfire on fire-sensitive cultural and tribal resources in the long term may be constrained by the limits placed on treatments under Alternative B.

4.8.5 Effects from Alternative C

Use of manual and mechanical treatments would have impacts as described under Alternative B. Since more acres of fuel breaks would be constructed under Alternative C, there would be an increased potential to disturb cultural and tribal resources and their settings where fuel breaks are constructed and maintained compared with Alternatives A and B.

As described under the *Nature and Type of Effects*, there are additional potential cultural and tribal impacts associated with chemical treatments and prescribed fire. The potential for ground-disturbing impacts would be greater than those described for Alternative B for areas treated, because, unlike Alternative B, Alternative C allows the use of these tools. The expanded methods, tools and acreage that could be treated under this alternative would result in a greater initial risk of impacts from fuel break construction and maintenance on cultural and tribal resources. There also would be an overall increase in wildfire suppression opportunities, which would potentially reduce impacts from wildfire on fire-sensitive cultural and tribal resources over the long term. This is because the expanded treatment methods and acreages would allow for greater flexibility in effectively locating and maintaining fuel breaks across the project area.

4.8.6 Effects from Alternative D

The potential for surface and subsurface impacts on cultural and tribal resources and their settings under Alternative D would be similar to those under Alternative C; however, the inclusion of Maintenance Level 1 (primitive) roads may increase the potential for disturbing historic roads, trails, and tribal and cultural resources that could be found nearby. Primitive roads may be historic and fuel breaks may affect the character of their historic setting. In addition, primitive roads are less likely to have had previous disturbance in adjacent areas, so cultural and tribal resources may be intact and cultural uses may be more likely.

The potential overall footprint of the fuel break system, along with its direct and indirect impacts described under *Nature and Type of Effects*, would be the same as described for Alternative C. Over the long-term, however, Alternative D would provide the most flexibility for fuel break construction and placement, and thus the most potential for improving the BLM's opportunities to respond to wildfires throughout the project area. By influencing fire behavior through improved suppression opportunities, Alternative D would also potentially reduce burned areas, which would benefit cultural resources.

4.8.7 Cumulative Effects

The analysis area for cumulative effects on cultural and tribal resources would be where fuel breaks would be constructed and buffered and, indirectly, the project area boundary. Cultural and tribal resources that may be directly or indirectly affected occur throughout the project area in a variety of environments. The timeframe for the cumulative effects analysis would likely extend over decades, depending on the time needed to construct the fuel breaks and on the life of the fuel breaks created. Because some types of cultural and tribal resources are nonrenewable, the effects on these resources may be permanent in some cases.

The past, present and reasonably foreseeable actions in **Table 4-1** likely have affected and would continue to affect cultural and tribal resources through direct impacts or degradation of these resource values. These actions are fire suppression, fuel break construction, vegetation management, roads and utility ROWs, livestock grazing, mining, oil and gas leasing, urban development, recreation, and population growth. Each of these actions or activities involves ground disturbance, the potential removal or damage of cultural or tribal resources, access restrictions for cultural uses, access leading to unauthorized collection and vandalism, and the potential for increasing erosion. Cultural resources have been directly affected by these actions through the modification, displacement and loss of artifacts, features, and middens, which have resulted in the loss of valuable cultural resource information regarding site function, date of use, subsistence and past environments.

Impacts on setting have likely occurred on historic properties, where setting is an integral component of that property's integrity and significance. Likewise, impacts on the setting of tribal resources have occurred from by past or ongoing actions where setting is important to tribal religious or cultural uses.

Wildfire has disturbed or caused the loss of cultural and tribal resources, primarily through direct destruction or modification of artifacts, historic structures, and resource gathering areas. Wildfire has also exposed large areas where vegetation has burned, increasing the potential for illegal gathering of artifacts. Fire control and suppression involve disturbing the ground and have also directly affected cultural resources. This has come about by damaging or destroying features and altering the spatial relationships of artifacts and features on archaeological sites. The availability of certain tribal plant resources and their habitats have likely been affected by human intervention in the natural role of wildfire in landscape regeneration. Past policies that allowed fuel loads to build up, while suppressing most fires, have created a situation where beneficial fire is difficult to maintain.

Over time, impacts on cultural and tribal resources from natural processes, such as wildfire, erosion, drought effects, and weathering, will continue to affect the integrity of cultural and tribal resources. Such impacts will continue regardless of the BLM's fuel break management strategies. BLM-authorized actions that could affect cultural and tribal resources would be subject to project and Section 106 compliance review.

All of the action alternatives would create a regional system of fuel breaks. This would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus cumulatively protect cultural and tribal resources across the landscape. The BLM's concurrent and reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin would also cumulatively protect cultural and tribal resources. There would be more potential for cumulative effects from ongoing maintenance, especially in areas with annual invasive grasses, and use of the fuel breaks for staging. Fuel breaks would be constructed along roads, which would limit the potential for new disturbances; however, siting them along roads could influence access to sites and increase other activities or cause erosion. Areas where fuel breaks would be sited have likely been modified to some degree during the construction of the linear feature. Any of these could affect cultural or tribal resources cumulatively; however, such impacts would be minimized by relying on project design features and measures identified during the Section 106 consultation process. Design features 27-30 would continue to be implemented to address required compliance with Section 106 of the NHPA, consultation with tribes, and consideration of tribal interests that would be implemented under all alternatives (see **Appendix D**).

Alternative B, which limits fuel treatment methods and would treat the fewest acres, would have the least potential of the action alternatives to contribute to cumulative impacts in fuel break construction areas; however, the potential for reducing impacts from wildfires and wildfire suppression on fire-sensitive cultural and tribal resources in the long term may be constrained by these limits. Alternative B would serve to reduce fire starts and improve suppression along roadways. Where there are no roads nearby, impacts would be the same as Alternative A. Impacts would be avoided or minimized through the use of design features and Section 106 consultation.

The potential for cumulative effects under Alternative C would be similar to those described for Alternative B; however, the use of more treatment tools and the potential to affect more acres in undisturbed areas would have more potential to contribute to the cumulative impacts from fuel breaks construction. Impacts would be avoided or minimized through the use of design features and Section 106 consultation. Over the long term, however, under Alternative C, the increased treatment and development of fuel breaks would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus cumulatively improve protection of cultural and tribal resources across the landscape.

Alternative D would have the greatest potential for contributing to the cumulative impacts from the construction and maintenance of fuel breaks. This would be the result of further expanding treatment tools and treatment acres and reducing constraints. Expanding fuel breaks to include Maintenance Level 1 roads may increase the potential for affecting the character of historic roads and trails and tribal and cultural resources that could be found nearby. Maintenance Level 1 roads are less likely to have had previous disturbance in adjacent areas, so cultural and tribal resources may be intact and cultural uses may be more likely. Impacts would be avoided or minimized through the use of design features (see **Appendix D**) and Section 106 consultation. Over the long term, however, Alternative D would provide the most potential for improving the BLM's opportunities to respond to wildfires throughout the project area and would thus potentially increase protection of cultural and tribal resources across the landscape.

Potential direct cumulative effects on cultural and tribal resources from fuel break construction from using the full suite of treatment tools would be greatest under Alternatives C and D and would be less under Alternative B. Other reasonably foreseeable actions may affect cultural and tribal resources through loss or disturbance of those that are not protected, by changes in setting, by pressure from incremental use, or by loss of access or vandalism. Enforcing measures to protect cultural and tribal resources and places used by tribal groups would become more difficult as population and use demand increases; however, the creation and maintenance of a regional system of fuel breaks, along with the BLM's reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, would reduce fire spread potential, impacts from suppression, and the potential damage to cultural and tribal resources from wildfire. The cumulative effects would be greatest under Alternatives C and D.

4.9 PALEONTOLOGICAL RESOURCES

4.9.1 Assumptions

- Occurrences of paleontological resources are closely tied to the geologic units, such as formations, members, or beds, that contain them. The probability of finding paleontological resources can be broadly predicted from the geologic units exposed at or near the surface.
- This analysis provides a broad overview of estimated potential effects, based on available information. Existing information, such as the potential fossil yield classification (PFYC) mapping, geologic mapping, and locality records, provide some insight into the potential for paleontological resources in the project area; however, data on the overall project area are incomplete.
- In general, fossil localities that may be affected by the depths of disturbance associated with fuel breaks may be few. Fossil exposures often do not support vegetation.
- The need for a paleontological inventory would be determined based on criteria set forth in Instruction Memorandum (IM) 2016-124 using PFYC mapping, if available, or geologic characteristics and previous study data, if not. The BLM would conduct inventories and consultations appropriate to the scale and level of disturbance before project activities begin. The BLM would use the results early in project planning to determine the need for project redesign or other mitigation.
- Constructing fuel breaks in areas with paleontological resources would be addressed on a site-by-site basis, and project activities at significant paleontological sites would be coordinated with the regional BLM paleontologist. This would be done to determine mitigation or monitoring needs in areas with a high potential for fossil resources in order to minimize adverse effects.
- The potential for impacts on both surface and subsurface paleontological resources, if present, would be proportional to the extent and depth of disturbance associated with the fuel break.
- Those conducting inventories before and during surface-disturbing activities could identify and evaluate previously undiscovered paleontological resources. These resources would be managed according to applicable policies including BLM Manual 8270. Paleontological Resource Management and BLM Handbook 8270-1. General Procedural Guidance for Paleontological Resource Management.
- Fuel breaks may increase activity and potentially leading to new discoveries, but they could also lead to unauthorized collection and vandalism.

4.9.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Fuel breaks can affect the physical integrity of fossils and fossil localities and increase their visibility. Reseeding could reduce the potential for the effects of erosion after treatments. If present, direct effects on the physical integrity of surface and near surface fossil localities could occur from all fuel break types. All fuel break projects are subject to BLM review to determine the need for further inventory. The BLM would address any potential impacts on a case-by-case basis. If paleontological resources are encountered during project implementation, all ground-disturbing activity near the find would cease until the resource is evaluated by an appropriate BLM resource specialist.

Creation of 25-foot wide brown strips on each side of the road would remove all the vegetation, which may expose or physically damage fossils and potentially increase erosion. While the smaller width of the brown strip fuel break would limit the potential for direct disturbance; the potential for brown strips to reduce the rate of fire spread would be limited and indirect effects from wildfire on paleontological resources may occur.

Mowed or targeted fuel breaks and green strips could cause surface disturbance on up to a 500-foot wide strip (including both sides of the roads) and could also physically affect surface exposures of fossils. Green strips and reseeding could reduce the potential for the effects of erosion after treatments. The wider width of the targeted fuel breaks and green strips would increase the potential for direct disturbance of surface fossils that may be present from construction, maintenance and suppression. However, the potential for disrupting wildfire behavior and reducing the rate of fire spread and acres burned would be greater than the brown strips and may reduce the potential for indirect effects from wildfire on paleontological resources and may reduce the long-term potential for fossils to be lost during wildfires and wildfire suppression

Effects from Manual Treatments

Manual techniques are associated with some potential for causing surface and near-surface disturbance. Either of these could directly damage fossils or lead to erosion and exposures of localities; however, this disturbance is not anticipated to be at a depth or intensity to cause impacts. There is some potential for locating undiscovered resources as the work progresses.

Effects from Mechanical Treatments

Depending on the specific tools and types of equipment used to remove plants, mechanical techniques can cause surface and near-surface disturbance. This could directly damage and alter the spatial integrity and condition of any fossils that may be present.

Effects from Prescribed Fire Treatments

Surface fossils may be damaged or destroyed by fire use. Potential impacts on fossils are spalling, fracturing, and altering them through heat.

Effects from Chemical Treatments

The use of chemicals may leave residues on fossils; however, chemical use may be preferred to mechanical/manual techniques, because the use of chemicals would not disturb the ground.

Effects from Targeted Grazing Treatments

There would be some potential for surface and near-surface disturbance through livestock trampling; however, this disturbance is not anticipated to be at a depth or intensity to cause impacts.

4.9.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained; instead, projects would continue on a site-specific basis only. The potential for impacts from constructing fuel breaks and the methods used would be similar to those described for *Nature and Types of Impacts*. The need for a paleontological inventory would be determined using the PFYC, if available, or geologic characteristics and previous study data on a project-by-project basis. There would not be a system of fuel breaks and anticipated greater regional opportunities to suppress fires. The potential for impacts from wildfires and wildfire suppression on paleontological resources would continue in areas where fossil resources may be present.

4.9.4 Effects from Alternative B

As described under the *Nature and Type of Effects*, manual treatment methods would have some limited potential for surface and near-surface disturbance on paleontological resources, if present. Limiting fuel breaks to Maintenance Level 5 roads and restricting the types of treatments and fuel break acreage, would reduce the risk of new ground-disturbing direct impacts along roadways where the fuel breaks would be constructed. Elsewhere, potential direct impacts would be the same as Alternative A. Impacts would be avoided or minimized through the use of Design Features 27, 31, and 32 (see **Appendix D**). While Alternative B would result in a landscape-scale system of fuel breaks throughout the Great Basin, the potential for reducing impacts from intense wildfires and wildfire suppression on paleontological resources in the long term may be constrained by these limits. Alternative B would, however, reduce potential fire starts and the potential for fire spread within treatment areas, reducing the potential for wildfire impacts on paleontological resources. As under Alternative A, the potential for impacts from wildfires and wildfire suppression on paleontological resources would continue in areas where fossil resources may be present.

4.9.5 Effects from Alternative C

Under Alternative C, the potential for encountering paleontological resources would be greater than Alternatives A and B due to the inclusion of a full range of treatment tools and allowing fuel breaks to be created over a larger potential treatment area. As described under the *Nature and Type of Effects*, there would be some potential for impacts associated with each of the treatment methods, which would be addressed in site-specific review. Impacts would be avoided or minimized through the use of design features (see **Appendix D**). The potential for impacts from wildfires and wildfire suppression on paleontological resources would continue in areas where fossil resources may be present. Alternative C may result in a greater potential reduction in impacts from wildfires and wildfire suppression on paleontological resources over the long term, because the expanded treatment methods and acreages would allow for greater flexibility in effectively locating and maintaining fuel breaks across the project area.

4.9.6 Effects from Alternative D

Under Alternative D, the potential for encountering paleontological resources would be greater than Alternative C due to the larger potential treatment area that would include all levels of roads and sites, which may have been minimally disturbed in the past. However, the increased treatment area could provide more options to improve siting to avoid sensitive resources. The potential overall footprint of the fuel break system, along with its direct and indirect impacts described under *Nature and Type of Effects*, would be the same as described for Alternative C.

As described under the *Nature and Type of Effects*, there is some potential for impacts associated with each of the treatment methods; this would be addressed in site-specific review. Impacts would be avoided or minimized through the use of design features (see **Appendix D**). Over the long term, however, Alternative D would improve the BLM's opportunities to respond to wildfires throughout the project area and would result in a greater reduction in impacts from wildfires and wildfire suppression on paleontological resources. It would increase suppression and reduce the rate of spread. The potential burned areas and associated impacts on paleontological resources would be less than Alternative A.

4.9.7 Cumulative Effects

The analysis area for direct cumulative effects on paleontological resources is the fuel break construction areas within the project area boundary. The potential for encountering paleontological resources varies, based on geologic units and exposures. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, which may likely be decades.

The past, present, and reasonably foreseeable cumulative actions in **Table 4-1** that involve ground disturbance may have affected paleontological resources, if present, through direct damage from construction, excavation, collection, and natural processes. Natural processes, such as wildfires, erosion, and weathering, would continue regardless of BLM-implemented fuel breaks management. BLM-authorized actions would be subject to project and compliance review.

Other cumulative actions and plans may be reviewed by other federal, state, or local agencies, as necessitated by applicable law. The potential for impacts from reasonably foreseeable actions would be similar to the past and present actions. Construction, excavation, collection, and natural processes would increase the potential for disturbing soils and consequently increasing the potential to damage, destroy, remove, or bury paleontological resources. Paleontological resources would be prone to damage from fuel break construction, wildfires, and fire suppression.

All of the action alternatives would create a regional system of fuel breaks. Design Features 27-32 would continue to be implemented to address the need for inventory and discovery of resources during construction under all alternatives (see **Appendix D**). This would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus cumulatively protect paleontological resources across the landscape. The BLM's concurrent and reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin would also provide additional cumulative protections for paleontological resources. Fuel break construction would occur along roads which would limit the potential for new disturbances.

Alternative B, which limits fuel breaks to roads and would treat the fewest acres overall, would have the least potential of the action alternatives for cumulative impacts from fuel break construction. Impacts would be avoided or minimized through project review and the use of design features. Over the long term, however, the establishment of a regional system of fuel breaks under Alternative B would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus protect paleontological resources from wildfire and fire suppression. It would improve direct attack opportunities and disrupt fire behavior which would reduce the rate of spread. Brown strips would also reduce the potential for new fire starts along roadways.

Cumulative effects under Alternative C would be similar to those described for Alternative B; however, the use of more treatment tools and the potential to affect more acres in undisturbed areas would more greatly contribute to adverse cumulative impacts from the construction of fuel breaks. Impacts would be avoided or minimized through project review and the use of design features. Over the long term, however, the establishment of a regional system of fuel breaks under Alternative C would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus increase protection of paleontological resources across the landscape from wildfire.

Alternative D would have the greatest potential for incremental adverse cumulative impacts from the further expansion of treatment tools, treatment acres, and reduced constraints due to the larger potential treatment area that would include all levels of roads and sites, which may have been minimally disturbed in the past. However, the increased treatment area could provide more options to improve siting to avoid sensitive resources. Impacts would be avoided or minimized through project review, redesign, and the use of design features. Over the long term, however, the establishment of a regional system of fuel breaks under Alternative D would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus increase protection of paleontological resources across the landscape from wildfire.

Potential direct cumulative impacts on paleontological resources from fuel break construction using the full suite of treatment tools would be greatest under Alternatives C and D and would be less under Alternative B. Other reasonably foreseeable actions may affect paleontological resources through loss or disturbance of those that are not protected, and from the pressure of incremental use and vandalism; however, the creation and maintenance of a regional system of fuel breaks, along with the BLM's reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, would reduce fire spread potential, the impacts from suppression, and the potential damage to paleontological resources from wildfire. Cumulative effects would be greatest under Alternatives C and D.

4.10 Recreation

4.10.1 Assumptions

- Fuel breaks can reduce the intensity and limit the spread of wildfires, which would help protect recreation opportunities.

4.10.2 Nature and Type of Effects

Recreation setting, experiences, and opportunities may be directly affected in the short term during construction or maintenance of fuel breaks by increased noise or unnatural smells from chainsaws, power tools, and heavy equipment, or a reduction in visibility and air quality during prescribed burns. Further, fuel break construction or maintenance may require temporary road or trail closures. This could result in localized and temporary displacement of recreation opportunities to other areas; increased visitation to nearby sites could potentially decrease the quality of the recreation experience at these sites due to overcrowding. This displacement would last for the duration of the fuel break construction or maintenance activity. During seasons when recreation activity is generally high, such as summer and during hunting season, some activities may be disproportionately impacted by fuel break construction and maintenance when compared with those activities taking place during low-activity seasons. Fuel breaks are unlikely to affect recreationists who use public land away from roads and ROWs, where fuel breaks will be confined under the alternatives.

Over the short term, hunting opportunities may be affected by increased human presence, fuel break construction and maintenance activities, and vegetation removal. The creation of fuel breaks would cause a short-term loss in hunting opportunities by reducing cover and forage for both big game and fur bearing game species. Impacts would be concentrated in the fuel break footprint and would dissipate as distance from the fuel break increases.

The removal, modification, or replacement of vegetation to create a fuel break could also result in scenic degradation and disruption of the aesthetic and visual quality of the recreation setting over the short and long terms. For instance, travel routes along paved and unpaved roads used for scenic touring by car, motorcycle, or bicycle may be affected by the construction of fuel breaks in the short term; however, fuel breaks that are revegetated following construction, such as green strips, are unlikely to reduce visual quality in the long term. Likewise, targeted grazing fuel breaks would likely have a lesser impact on scenic value, as they would remain vegetated over the long term. Brown strips would have greater impacts on scenic value, though the higher use and development along interstates and highways, where brown strips would be created, inherently limits their scenic value compared to less developed byways. Regardless, before constructing a brown strip along an interstate and highway, a DNA or site-specific analysis will be completed to assess hazards to human health and safety. Further, the BLM will consider additional guidance on habitat planning for beneficial pollinators (See Hopwood et al. 2016) at the site-specific level and to the extent practicable that the fuel breaks will support maintenance of pollinators.

Constructing a regional system of fuel breaks under any of the action alternatives would contribute to the maintenance of a more aesthetically pleasing landscape and protection of wildlife habitats throughout the project area for recreationists over the long term, because fuel breaks would increase opportunities for wildfire suppression and in turn potentially reduce fire effects on the landscape, as described below. Without a system of fuel breaks, recreation is likely to be impacted by wildfire through a reduction of scenic value, closure of recreation sites during fire suppression activities, and lessened opportunities for recreation in newly burned or currently burning areas.

4.10.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained; rather, fuel break projects would continue to be created throughout the project area on a site-specific basis, as discussed in **Table 4-1**.

Wildfires would likely continue with increased intensity and severity in the project area, with current suppression opportunities, and having direct effects on the recreation setting and opportunities mainly in the summer when fire season is at its peak. Airborne particulate matter and smoke from wildfires may alter the recreation experience for visitors through lessened visibility and poor air quality. Wildfires may also damage or destroy trails and recreation facilities or infrastructure and could result in the temporary closure of recreation sites when fires are nearby.

Fires may alter large swaths of the landscape by removing native vegetation and increasing the spread of invasive annual plants. The movement toward herbaceous communities would change the recreation setting, such as decreasing the scenic value in some areas. For instance, annual grasses may cure and turn brown earlier in the season, which may be less visually appealing than live, green vegetation.

In the absence of a system of fuel breaks, dozer and hand lines created during fire suppression may be used more frequently and may become unofficial trails, which could increase the incidence of OHV use on unauthorized routes. These linear disturbances may degrade the recreation setting, as well as detract from the visual recreation experience; however, they would likely be targeted for rehabilitation post-fire. In the long term, wildfires would regularly displace visitors and directly and indirectly modify recreation settings and experiences, especially in areas dominated by invasive annual grasses.

4.10.4 Effects from Alternative B

Manual and mechanical treatment methods would affect the recreation experience as described under *Nature and Type of Effects*. There would be no impact on the recreation setting and experience in sagebrush or in highly resistant and resilient sites, since no treatments would occur in these areas. Scenic quality for recreationists is likely to be affected to a greater extent where the BLM uses brown strips, since these fuel breaks would not be revegetated. However, the impact would not be substantial, as brown strips would be a maximum of 50 feet (including both sides of the road). Additionally, brown strips would be along Maintenance Level 5 roads, typically major highways and thoroughfares, which limits their scenic value. In those areas where fuel breaks are constructed through mowing, vegetation would be retained at a lower stature, thus lessening the impact on scenic quality when compared to brown strips. Fuel breaks which are reseeded with native species are likely to only experience short-term impacts as scenic quality would be restored once reseeded vegetation becomes established. Specific design features would be incorporated to diminish the impacts of fuel break construction on recreation. For instance, fuel breaks would be constructed along major roads only and thus are not likely to bisect hiking, mountain biking, or OHV trails. However, they may impact those bike or hiking trails which parallel roads receiving treatments.

Design features, like confining fuel break construction to areas where disturbance has already occurred, (Design Features 1 and 7, **Appendix D**), would reduce the impacts on the recreation setting and experience. This would come about by constructing fuel breaks where wildfires or surface-disturbing activities have already occurred. Additionally, under all action alternatives, the BLM would manage soil to prevent noxious and invasive weeds to invade after treatments. This could prevent an invasion of annual grasses that would decrease the aesthetic quality of the recreation setting.

Compared with Alternative A, fuel breaks would improve suppression opportunities, which would reduce the potential for fire spread; however, fuel breaks would be concentrated along Maintenance Level 5 roads, limiting the potential for modified fire behavior and reduced spread in other areas. In the long term, wildfire would regularly displace visitors and directly and indirectly modify recreation settings and experiences in areas without fuel breaks, especially in areas dominated by invasive annual grasses.

4.10.5 Effects from Alternative C

Under Alternative C, recreation experiences and settings would be affected along roads and BLM-administered ROWs as described under *Nature and Type of Effects*. Impacts would increase compared with Alternatives A and B because Alternative C would increase the authorized mileage of fuel breaks and allow for the use of all treatment methods to construct a maximum of 11,000 miles (667,000 acres) of fuel breaks in the treatment area. Over the short term, recreationists are likely to be impacted through temporary closures and an increased presence of construction equipment over a wider area when compared to Alternative B.

Scenic quality for recreationists is likely to be affected to a greater extent where brown strip breaks are used; this is because they would not be reseeded with vegetation. Green strip breaks would be reseeded; this would lead to a shorter-term impact on scenic quality, as scenic quality would be restored once reseeded vegetation becomes established. Where mowed or targeted grazing fuel breaks are used, there is only likely to be a very short-term impact on recreation settings and experiences during treatment intervals, as the scenic quality is not likely to be lessened for any period post-treatment.

Compared with Alternative B, impacts from fuel break construction along Maintenance Level 5 roads, such as impacts on scenic value, would essentially be the same, whereas impacts would increase along Maintenance Level 3 roads and BLM-administered ROWs, which would reduce the potential for fire spread; however, fuel breaks would not be constructed along Maintenance Level 1 roads, which would limit the potential for modified fire behavior and reduced spread in those areas.

Design features would be applied under this alternative to mitigate impacts on recreationists. These design features include posting signs to notify the public of any potential hazards (for example, Design Feature 10, **Appendix D**).

4.10.6 Effects from Alternative D

Impacts on recreation under Alternative D would be similar to those described under Alternative C and *Nature and Type of Effects*. Construction of fuel breaks along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs, as well as in highly resistant and resilient sites without those limitations identified in Alternative C, would affect recreation to the greatest extent compared with the other action alternatives. Design features that would mitigate impacts on recreation would be the same as those for Alternative C.

Alternative D would have the greatest potential treatment area, thus allowing for a wider distribution of fuel breaks across the landscape and potential to increase the protection of the recreation setting and recreation sites and opportunities. Fuel breaks would be constructed along Maintenance Level 1 roads, and thus would elevate impacts, such as temporary closures, for those recreationists utilizing remote areas, such as hunters. Compared with other alternatives, fuel break construction under Alternative D would improve suppression opportunities along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs. This alternative would reduce the potential for fire spread to a greater extent than other alternatives, which would protect recreation settings and improve recreation experiences.

4.10.7 Cumulative Effects

The area of analysis for cumulative impacts on recreation is all lands within the project area boundary. Recreationists take part in a wide array of dispersed, concentrated, and organized activities throughout the project area. Further, they use a variety of roads to travel within, to, or from recreation sites; thus it is feasible that recreation opportunities throughout the project area could be impacted cumulatively. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades.

Human development, such as construction of roads, ROWs, and other infrastructure, as well as fluid mineral or renewable energy development, and mining, along with changes to land or resource management plans may displace or alter the availability of recreation opportunities in the analysis area over the short and long term. However, some projects may improve the recreation setting through enhancements of recreation opportunities via construction of roads, trails, and recreation sites, or through maintenance of those already in existence. However, improvements to, or creation of, recreation sites is likely to draw additional visitors, which may increase the risk for new fire starts, subsequently impacting the recreation setting.

Fire management and vegetation treatments, such as those identified in the BLM's Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, could affect recreation opportunities in the short term through closures, degradation of the recreation experience from the presence of vegetation management crews, or introduction of changes to the recreation setting through vegetation alteration and removal. In the long term, fire and vegetation management projects may help to protect the recreation setting from the effects of wildfires and would ultimately lead to a more desirable recreation experience through improvements to vegetation conditions.

Construction of fuel breaks, in combination with infrastructure and energy development described in **Table 4-1**, would cause short-term, localized changes to the recreation experience and opportunities through vegetation removal, scenic degradation, and temporary loss of access. Proposed fuel breaks under Alternative B would contribute to the effects of past, present, and foreseeable future actions, such as fire and vegetation management projects, to increase the opportunities for fire suppression, in addition to reducing fire intensity and severity. Together, these actions would result in long-term increased protection of the recreation setting along 8,700 miles of fuel breaks. This would come about by reducing the likelihood of severe wildfires that could alter habitat and degrade the scenic quality of the recreation setting. Over the long term, even when combined with other fuel break and vegetation management actions, Alternative B may not provide adequate opportunities to improve current conditions due to the limitations on locations and tools available under this alternative. This could increase the potential for severe wildfires to affect recreationists by degrading the recreation setting and reducing recreation opportunities.

Under Alternatives C and D, over the short and long term, there could be degradation of the recreation setting and reduction of recreation opportunities. The construction and maintenance of fuel breaks and fire and vegetation management projects together would increase opportunities for fire suppression along an additional 2,300 miles (approximately 26 percent more miles). Alternatives C and D, combined with infrastructure and ROW development and mining or oil/gas leasing, are likely to affect recreationists through temporary closures, increased human presence, and unnatural noises and smells more so than Alternative B.

Alternative D would expand construction of fuel breaks into highly resistant and resilient sites without those restrictions found under Alternative C. This would increase the cumulative impact on recreationists, when combined with human development and fire and vegetation management projects; however, over the long term, construction of fuel breaks under Alternative D would combine with fire and vegetation management projects to provide the BLM with the widest range of tools and largest potential treatment area compared with Alternative C. The BLM would use these tools to construct highly effective fuel breaks, minimizing the impact of wildfire on recreation settings and experiences. By using multiple methods and constructing additional miles of fuel breaks, Alternative D would likely be the most effective at slowing the spread of severe wildfires, thus protecting the recreation setting.

With the establishment of a regional system of fuel breaks under Alternatives B, C, and D, the recreation setting and experience could be diminished on a short-term basis, primarily during fuel break construction and maintenance. Restrictions during construction and maintenance may inhibit access for recreationists, though these would be temporary. The sounds and smells associated with mechanical and manual methods of treatment may also affect the recreation experience in the short term under all action alternatives; however, over the long term, all action alternatives are likely to increase opportunities for wildfire suppression, thereby preventing the destruction of recreation infrastructure, opportunities, and the settings that contribute to positive recreation experiences.

4.11 LANDS WITH WILDERNESS CHARACTERISTICS MANAGED FOR VALUES OTHER THAN WILDERNESS CHARACTER

4.11.1 Assumptions

- Under all action alternatives, fuel breaks may be constructed and maintained on lands with wilderness characteristics that are not managed to maintain those characteristics.
- Lands with wilderness characteristics that are not managed to maintain those characteristics likely will have some features, such as riparian areas, that would be avoided, and thus wilderness character would be maintained in those areas.
- Local RMP decisions may change management of lands with wilderness characteristics; these updates will be reflected in adaptive management that occurs at the site-specific level.

4.11.2 Nature and Type of Effects

Effects from Construction and Maintenance of Fuel Breaks

The creation of fuel breaks may have short- and long-term impacts on wilderness characteristics and supplemental values.

Over the short term, construction and maintenance would increase the presence of humans and vehicles, increase surface disturbance and soil compaction along roads, BLM-administered ROWs and primitive roads, increase noises and smells associated with power tools and heavy machinery, and increase temporary road closures. Impacts associated with these activities are a loss of naturalness through the creation of fuel breaks and the noises, smells, and visual disturbance brought about by their construction. Noise related to fuel break construction may also affect solitude and primitiveness, which would last for the duration of fuel break construction and maintenance. In addition, access to lands with wilderness characteristics for recreationists may be affected by short-term access restrictions during fuel break construction and maintenance (see **Section 4.10,** Recreation). Additionally, fires may lead to a loss of opportunities for solitude from increases in human and vehicle presence during wildfire suppression.

In the absence of fuel breaks, over the long term, wildfires may increase loss of naturalness in lands with wilderness characteristics via ecosystem alterations; however, fuel break construction would also ultimately improve wildfire suppression opportunities across the landscape, which in turn could reduce the amount and severity of burned areas in lands with wilderness characteristics. With this reduction, along with increasing suppression opportunities, fuel breaks would reduce the potential for impacts on wilderness characteristics.

4.11.3 Effects from Alternative A

Under Alternative A, the current trend of wildfires in the Great Basin is likely to continue; however, there would be no immediate direct impacts on lands with wilderness characteristics as a result of this management action, and they would remain at their current state. Suppression opportunities would remain at their current levels, which may result in the loss of some supplemental values due to wildfires. Such losses may include altered or destroyed scientific research areas or paleontological and historic resources, which contribute to wilderness character. There would be no design features in place to protect such resources. Wildfires may also result in widespread ecosystem alterations, such as intensifying cheatgrass invasion, which could move the landscape away from a natural state. Additionally, dozer and hand lines may be created to control wildfires, which could lead to a loss of naturalness and solitude due to the actions and presence of firefighting crews.

4.11.4 Effects from Alternative B

Impacts under this alternative would be similar to those described under *Nature and Type of Effects*. Mechanical and manual treatments under Alternative B may diminish opportunities for solitude and primitive and unconfined recreation along a maximum of 8,700 miles of roads. Such BLM roads classified as Maintenance Level 5 are infrequent and are inherently not within lands with wilderness characteristics, though they may form the border of such units. Where fuel breaks are constructed outside the unit on the opposite side of the road, there would not be an effect from these actions under this alternative where fuel breaks are constructed.

During construction and maintenance of fuel breaks, manual methods of vegetation removal are likely to have the least short-term impacts on lands with wilderness characteristics, as the use of chainsaws and brush saws would create sounds and smells that could reduce opportunities for solitude. Likewise, dozers, masticators, and mowers used for mechanical treatments would temporarily increase noise above ambient levels and could create exhaust smells.

Under this alternative, there would be no direct impact on wilderness characteristics in sagebrush or in highly resilient and resilient sites. Construction of fuel breaks along roads would not be likely to have long-term impacts on naturalness. During fuel break construction, there would likely be short-term increases in noise and surface disturbance, which could affect opportunities for solitude.

Design features (12, 14-15, 19, 20, 23, 24, 26, 33, 36, and 37 in **Appendix D**) built into action alternatives may help to mitigate some impacts of fuel break construction and maintenance on lands with wilderness characteristics. This would come about by preserving naturalness, minimizing new surface disturbance, and, where appropriate, revegetating areas with native plant materials after construction.

Compared with Alternative A, Alternative B would increase the likelihood of a fire reaching a fuel break before entering lands with wilderness characteristics, thereby reducing impacts from the fire and better preserving wilderness character. Additionally, if suppression activities are minimized through the addition of fuel breaks, this would likely decrease the impacts on opportunities for solitude.

4.11.5 Effects from Alternative C

Impacts under this alternative would be similar to those described under Alternative B and *Nature and Type of Effects*; however, lands with wilderness characteristics could be affected to a greater extent under this alternative over both the short and long terms, given the approximately 26 percent increase in mileage of fuel breaks that could be created. The likelihood of impacts from fuel break construction would increase along BLM roads (Maintenance Level 3 and 5) and BLM-administered ROWs, including highly resistant and resilient sites, that are within or next to lands with wilderness characteristics. These additional fuel breaks would lead to increases in noise and exhaust smells, which would detract from naturalness and solitude. However, these impacts would be short term, lasting only for the duration of fuel break construction. Likewise, the use of prescribed fire would have short-term and localized reductions in air quality and visibility, which would affect the naturalness of lands.

Under Alternative C, design features are in place to prevent soil disturbance and the spread of invasive weeds by using pre- and post-work evaluations and monitoring (Design Features 14-15, 19, 20-22 in **Appendix D**). Over the long term, a system of fuel breaks would increase opportunities for wildfire suppression before a wildfire spreads into lands with wilderness characteristics, thereby maintaining their wilderness character.

4.11.6 Effects from Alternative D

Impacts on lands with wilderness characteristics under Alternative D would be similar to those described under Alternative C and those described in the *Nature and Type of Effects*; however, impacts to lands with wilderness characteristics would be greatest under Alternative D due to a larger potential treatment area (i.e., addition of Maintenance Level 1 roads, typically considered primitive roads). Under this alternative, there would be an increased likelihood of long-term impacts from fuel break construction along primitive roads within or adjacent to lands with wilderness characteristics or in highly resistant and resilient sites where they overlap lands with wilderness characteristics. Under Alternative D, impacts would be the greatest of all action alternatives, due to the addition of treatments along primitive roads.

Design features under Alternative D would be the same as those under Alternative C. Over the long term, a system of fuel breaks would increase opportunities for wildfire suppression before a wildfire spreads into lands with wilderness characteristics, thereby maintaining wilderness character. However, due to the larger available treatment area, impacts to lands with wilderness characteristics may be reduced through increased flexibility in determining fuel break location.

4.11.7 Cumulative Effects

The area of analysis for cumulative impacts on lands with wilderness characteristics is all lands in the project area boundary, excluding those lands with wilderness characteristics that are managed to maintain those characteristics. Lands with wilderness characteristics managed for values other than wilderness character, may exist throughout the project area, and those lands have the potential to be affected cumulatively by this project and others. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades.

Lands with wilderness characteristics could be cumulatively affected by past, present, and reasonably foreseeable projects, plans, and actions, including land use plans, resource management plans, fire and vegetation management, and road and ROW construction.

Further development of ROWs and other infrastructure may have impacts similar to those from fuel break construction, which would result in temporary closures and short-term impacts on solitude and primitive recreation opportunities in those areas next to roads. Mining, fluid mineral, as well as other energy development, may take place within lands with wilderness characteristics not managed to maintain those characteristics, leading to long-term cumulative impacts in those areas.

Changes in land use plans or resource management plans may introduce alternative uses for lands with wilderness characteristics not managed to maintain those characteristics. This could modify such lands beyond a natural state. Fire and vegetation management, such as the BLM's planned EIS for fuels reduction and rangeland restoration throughout the Great Basin, would likely contribute to short-term loss of naturalness and opportunities for solitude during treatment intervals; however, opportunities for solitude would likely remain near their current levels and would not be diminished over the long term. Without a regional system of fuel breaks, current wildfire trends are likely to persist. More frequent fires may increase the loss of naturalness via ecosystem alterations. There would be a loss of opportunities for solitude as a result of the fire and through increases in human and vehicle presence during wildfire suppression.

Proposed activities under Alternative B would combine with past, present, and reasonably foreseeable actions to increase the effectiveness of fire suppression along Maintenance Level 5 roads to a greater extent than under Alternative A; however, there would be a short-term cumulative reduction in opportunities for solitude and naturalness, due to noise and human presence from this action in conjunction with past, present, and reasonably foreseeable actions.

Activities under Alternative C would combine with past, present, and reasonably foreseeable actions to increase the effectiveness of fire suppression to a greater extent than under Alternative B. This would happen along approximately 26 percent more miles of roads and BLM-administered ROWs over approximately 50 percent more acreage. However, the BLM would use a full suite of treatment methods under Alternative C, which would increase the cumulative short-term impacts of noise and human presence on solitude and naturalness of lands with wilderness characteristics concurrently with other projects and actions.

Proposed activities under Alternative D would cumulatively affect the effectiveness of fire suppression to a greater extent than under Alternative C. This is because fuel breaks would be constructed along Maintenance Level 1 (primitive) roads, in addition to roads and BLM-administered ROWs, throughout a larger potential treatment area (approximately 37 percent more acreage compared to Alternative C). Limited constraints on fuel break locations under Alternative D would likely have the greatest cumulative impacts on naturalness and solitude, though this would cumulatively increase the effectiveness of fire suppression over all other alternatives.

4.12 Social and Economic Impacts

Social and economic impacts are summarized below. Current conditions impacting the social and economic conditions in the six-state project area are provided in **Section 3.10** and the Socioeconomic Baseline Report (BLM 2018b).

4.12.1 Assumptions

- Reducing fire severity and intensity would decrease costs associated with suppression and recovery. While specific impacts cannot be quantified here due to the programmatic nature of the alternatives and analysis, these assumptions support the general impacts on social and economic conditions in the project area, as described below.

4.12.2 Nature and Type of Effects

Fuels treatment could result in direct impacts on costs of treatment and BLM fuel treatment budgets. The level of impacts would vary, based on the type, number, and location of treatments and total acres treated. Project- specific estimates for treatment costs are not available. General ranges of per acres treatment costs estimates based on available literature are summarized below in **Table 4-9** (see also BLM 2018b).

An additional societal cost associated with wildfire response is the potential for injury or death of firefighters. Over the past decade, the average annual fatality count for wildland firefighters at the federal, state, local, and tribal levels was 17 (Forest Service and DOI 2015).

Table 4-9
Estimated Cost of Treatments in Sagebrush Habitat (2010 Dollars)

Method	Cost per Acre
Prescribed burn	$5–175
Heavy machinery for mowing disking, and harrowing	$10–65
Herbicide treatment	$8–52
Reseeding	$94

Sources: SageStep 2011; Taylor et al. 2013

Fuel break construction and maintenance may result in short-term job opportunities, labor income, and value added to the regional economy. Impacts are likely to be site specific and limited and to contribute only minimally to the overall regional economy. The amount of economic contributions would be determined at the site-specific implementation level.

Proposed fuels treatments could indirectly decrease fire severity and intensity in the long term, as discussed in **Section 4.3**, Fire and Fuels. According to the socioeconomic baseline report (BLM 2018b), wildfire results in direct and indirect spending related to suppression and postfire recovery.

Should a high-intensity wildfire occur, economic repercussions could include short-term increases in economic contributions during the course of the fire and directly following. Local communities and businesses may benefit from fire suppression spending during this time, and local labor markets may be positively supported by suppression activities; however, capturing this spending by local contractors and vendors is variable and often depends on the fire location and competition with nationwide vendors.

In the long term, a decrease may be seen in other local economic sectors, based on changes to the local environment and community. Based on a study by Moseley (2010), overall county employment and wages were found to increase during wildfires, but natural resource and hospitality sectors of employment faced long-term decreases in employment and wages following wildfires. This may also include greater economic instability and may amplify seasonal variations in employment in areas that depend highly on these economic sectors.

In the short term, proposed fuel breaks could disrupt the social setting in local communities. In particular, prescribed fire can degrade local air quality (see **Section 4.5**). Proposed fuel breaks, in the long term, would generally support enhanced protection of the WUI and communities next to BLM-administered lands, including protecting property, lives, and infrastructure. Such protection would support maintained or increased economic contributions from area communities and would contribute to a stable social structure and setting.

As a result of fuel breaks, the costs of fire suppression, postfire restoration, and recovery for the BLM would likely decrease. As discussed in the socioeconomic baseline report (BLM 2018b), vegetation treatments, including fuel breaks, can diminish the size and cost of wildfires. Costs of suppression and postfire recovery in areas with fuel breaks can vary, based on such factors as location, fuel break methods, and maintenance.

Fuel breaks could temporarily displace some current land uses with economic and social importance for communities including but not limited to woodland product harvest, grazing, recreation, mining and fluid mineral development (see **Section 3.11** for details of current uses). Should such uses be restricted, it could affect the public's ability to access them and the jobs, income, and public lands receipts associated with them. The level of impacts on economic contributions would depend on an alternative source for the specific resource or resource use in the area. Should alternative sources be available, economic output would not be affected. Direct impacts from proposed management activities are likely to be site specific and limited and therefore to have minimal impacts on regional economic contributions.

Under all alternatives, no changes to permitted levels of grazing would occur, but temporary restrictions may be in place to facilitate fuel break creation. Restrictions could affect ranch operations, and the level of impacts would depend on the degree that the proposed management would exclude livestock during authorized seasons of use and the level to which individual operators are specifically affected; this would be determined at the site-specific stage. Targeted grazing treatments represent short-term localized opportunities for increased economic contributions and employment in the agricultural sector.

Likewise, temporary displacement of recreation activities could occur. This could displace recreationists from preferred recreation sites or change the recreation experience at these sites. This could affect both quality of life associated with recreation and economic contributions from this sector, should regional use and spending be affected. Impacts would be minimized by siting fuel breaks next to existing disturbance, such as roads and BLM-administered ROWs (see also **Section 4.11**, Recreation).

There could be site-specific, long-term impacts on the type or availability of woodland products due to changes in vegetation (see **Section 4.4**); this could affect receipts from such land use. The intensity of impacts would be affected by the acres treated, the existing vegetation types, and conditions in treated areas. Changes to receipts would most likely occur when woody vegetation is converted to forbs or grasses. In the long term, management that decreases the potential for high-severity fires would limit the loss of woodland products and would support continued contributions from public lands in the project area.

Proposed treatment activities of all types could affect ecosystem services on BLM-administered lands. In the short term, treatment could affect the visual setting and associated cultural ecosystem service contributions. Impacts would be minimized by measures that limit actions in riparian conservation and special designation areas. Impacts from fuel break construction would also be limited by the construction of fuel breaks along roads and BLM-administered ROWs.

In the long term, management that decreases the potential for high-severity fires would limit impacts and support continued contribution of ecosystem services from public lands in the project area. Should a fire occur, wildfire smoke would result in short-term impacts on air quality and impacts on public and environmental health. Later impacts could include reduced water quality from sediment and ash runoff.

Burned areas, once used for recreation or previously valued for their scenic beauty, could take lifetimes to fully recover, affecting local residents' quality of life and sense of place. Visitors' preference for moderately burned areas can return in the initial years after a fire. Severely burned landscapes can take much longer to return to desirable recreation conditions, which would affect recreation demand and ecosystem services (Bawa 2016).

4.12.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be created and maintained. There would be no direct or immediate impacts on the BLM's costs, economic contributions, or other land uses; instead, any such impacts would occur only in relation to discrete fuel break projects, which would continue to be used throughout the project area under other management direction and on a site-specific basis.

The absence of a programmatic design for fuel breaks could result in continued or increased high-intensity wildfires, given that there would continue to be a slower response to fuel break project planning and implementation. If area vegetation were to convert to cheatgrass and other invasive annual grasses, it would increase the presence of fine fuels, threaten sagebrush communities, and continue to degrade habitat for special status species. This would likely continue at a similar rate.

Other ecosystem trends and processes would continue, including trends in fire, and further convert sagebrush habitat to invasive annual grass monocultures; thus, should a wildfire occur, there could be impacts on local economies and community setting, as described under *Nature and Type of Impacts*.

4.12.4 Effects from Alternative B

Restrictions on treatment methods and locations under Alternative B would result in site-specific treatment costs for the BLM and a low level of direct economic contributions from treatment, as discussed in *Nature and Type of Impacts*. Treatment costs would be elevated over Alternative A, where no system of fuel breaks would be in place.

Limiting treatments to manual and mechanical methods and restricting the potential treatment area would limit direct impacts on other resources from fuel break construction. Restrictions also would limit the associated economic and social contributions from these resources, such as receipts from woodland product sales and economic contributions from recreationists, as detailed in *Nature and Type of Impacts*.

In addition, design features (**Appendix D**), such as general features 1–12, applied under Alternative B and all action alternatives would reduce impacts on other resources. This would come about by minimizing disturbance, requiring coordination with adjacent landowners, and considering visual contrasts with the surrounding landscape to minimize impacts on the visual setting.

Programmatic design of treatments could more effectively aid in the response to fires and help reduce the potential for high intensity fire in the project area, compared with Alternative A (see **Section 4.3**, Fire and Fuels). As a result, the short-term economic contributions from suppression and long-term decreases in employment and wages as a result of wildfire would be reduced, compared with Alternative A. Similarly, proposed treatments could result in site-specific limits on other resources, the public's ability to access these resources and uses, and the jobs, income, and public land receipts associated with them. In the long term, reducing the potential for high intensity fire would reduce the potential for impacts on ecosystem service contributions from public lands, including the use of woodland products and recreation.

Limiting tools and areas available for treatment under Alternative B, however, may reduce the effectiveness of fuel breaks, compared with the other action alternatives. This would be the result of limiting the BLM's ability to create a system of different types of fuel breaks in all vegetation conditions (see **Section 4.3**, Fire and Fuels). This would maintain the potential for elevated wildfire-related costs, compared with other action alternatives.

4.12.5 Effects from Alternative C

Allowing a full suite of treatments, including manual, mechanical, and chemical treatments, prescribed fire, and targeted grazing, would increase costs for the BLM and the potential for direct economic contributions from treatment, as described under *Nature and Type of Impacts*. Due to the increased area of treatment (approximately 11,000 miles of fuel breaks within a potential treatment area of 792,000 acres), there would be a greater potential for impacts on other land and resources uses and economic and social contributions from these uses (see Alternative B and *Nature and Type of Impacts*). Limiting treatment in highly resistant and resilient sites under Alternative C would limit the impacts of proposed treatment on other land uses in site-specific areas. Under such a scenario, the BLM could focus funds on areas where treatments are likely to have greater impacts on fire behavior.

In the long term, proposed treatments could reduce fire severity and intensity, which would reduce the economic and social costs from wildfire, as discussed under Alternative B and *Nature and Type of Impacts*. Suppression costs would likewise be reduced, compared with Alternative A.

As discussed under *Nature and Type of Impacts*, easier-to-manage fires would result in less economic instability, due to fewer disruptions of jobs and income from wildfires, while preserving nonmarket values. The indirect impacts on ecosystem services are preserving air and water quality and visual setting and other components affecting recreation use and enjoyment.

4.12.6 Effects from Alternative D

Impacts under Alternative D would be similar to those described under Alternative C. The total potential miles of treatment would remain the same, but the potential treatment area would be larger—up to 1,088,000 acres. Moreover, the area could be more intensively treated, since Alternative D would allow for the full suite of available treatment tools along Maintenance Level 1 roads, in addition to those areas identified under the other action alternatives. Alternative D would also allow treatment in highly resistant and resilient sites without those restrictions identified in Alternative C. Accordingly, Alternative D would result in the greatest level of flexibility for management, which would support the maximum potential for influencing future fire behavior. As a result, the long-term potential to decrease fire suppression costs and the social and economic impacts from wildfire would be greatest under Alternative D.

4.12.7 Cumulative Effects

The cumulative effects analysis area for socioeconomic impacts is the six-state project area. This is because social and economic impacts extend beyond public land boundaries to surrounding communities. The time frame for the cumulative effects analysis is the length of time over which fuel breaks would be created and maintained, likely several decades. Past, present, and reasonably foreseeable future actions that could cumulatively affect social and economic impacts are suppression, fuel break projects, vegetation treatments, mining, fluid mineral development, and roads and ROWs.

Social and economic conditions would also be affected by ecological trends, such as the spread of invasive weeds.

As discussed in the affected environment, historical and ongoing fire suppression has changed fire regimes and affected the costs of suppression and post-recovery efforts, as well as the social costs for communities. Fuel break projects may result in short-term costs for treatment and associated economic contributions. In the long term, treatment could reduce fire severity and intensity and increase the opportunities to effectively suppress them; this would ultimately reduce associated suppression costs.

Likewise, vegetation treatments could continue to affect vegetation cover and structure, which in turn influence long-term wildfire behavior and associated costs in locations where treatments have occurred. For example, the BLM's concurrent and reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, could shift vegetation toward a more historical setting, increasing fire return intervals. This would reduce suppression costs over the long term and those associated with wildfire recovery.

Impacts on social and economic conditions would vary on a site-specific basis, depending on the size of the project, treatment methods, and the type of vegetation affected. Such impacts could include short-term limits on accessing other resource uses. In the long term, fuels and vegetation treatments would likely support continued economic contributions from public lands and adjacent communities. Resource management/land use planning could also contribute to a cumulative reduction in fire risks and costs by providing a framework for vegetation objectives; however, impacts would vary, based on site-specific plan direction.

Developing roads, ROWs, and mining and fluid mineral development facilities in the project area would continue to increase associated infrastructure. This would increase the number of values at risk that would require protection should a fire occur, thereby increasing fire suppression costs. In addition, fuels on or next to developing roadways create a potential source of fire starts. Similarly, mining development and operations create ignition potential from equipment and combustible fuels; therefore, the proposed development of roads, ROWs, mines, and fluid mineral leases would increase the potential for human-caused fires and the suppression costs required to protect valuable infrastructure.

In the long term, continued ecological trends could perpetuate or increase the chances of a high-intensity wildfire. The spread of invasive weeds, notably cheatgrass, would continue to influence fire regimes and associated risks and costs in the project area. The increasing recurrence and severity of drought conditions could also increase the occurrence and severity of wildfires in the project area. Should a wildfire occur, there could be impacts on local economies and community settings related to immediate suppression efforts and, later, the costs of lost infrastructure and postfire reconstruction. This could contribute to local decreases in economic contributions and loss of economic stability for affected communities and a loss of nonmarket values.

As discussed under direct and indirect impacts, under Alternative B, increased opportunities for the BLM to respond to fires due to proposed fuel breaks would contribute to an incremental decrease in the potential for high-intensity fire in the project area. This would reduce cumulative economic and social impacts for suppression and postfire reconstruction. Fires that are easier to manage would also result in less economic instability related to wildfires, while preserving nonmarket values. Under Alternative B, treatments would be limited to mechanical and manual methods. Due to these restrictions, impacts to the cumulative economic and social contributions from other public land uses, such as recreation, would be minimized.

Alternatives C and D would have a greater contribution to cumulative impacts over the short and long terms. Allowing for a full suite of vegetation management tools under Alternatives C and D would increase the costs of treatment for the BLM and the potential for short-term cumulative economic contributions from treatments. Increasing the total miles available for fuel breaks would represent a greater potential for short-term impacts to interfere with or impede other land and resource uses and their cumulative contributions to economic and social contributions, as compared with Alternative B. For example, loss of recreation opportunities would be greater under these alternatives due to the increased footprint of potential fuel breaks.

In the long term, this management would also increase wildfire management opportunities, which would reduce costs associated with wildfire, increase ecosystem values, and contribute to the social and economic resources in the project area overall. The greatest potential to contribute to a cumulative reduction in fire-related costs would result from Alternative D. This is due to the increased flexibility for placement of fuel breaks as discussed under direct and indirect impacts, above.

4.13 Environmental Justice

4.13.1 Assumptions

Based on the CEQ guidelines in **Section 3.10**, Social and Economic Conditions, populations have been identified in the project area for further environmental justice consideration at the county level. Identified as low-income or minority populations are 10 counties in Idaho, 27 counties in California, 1 county each in Nevada and Utah, and 5 counties in Washington (see also BLM 2018b).

Site-specific projects would require further assessment of potential environmental justice impacts. This is because the locations of future site-specific fuel break projects remain unknown; thus, it is difficult to ascertain how such projects may affect populations identified for further environmental justice consideration.

4.13.2 Nature and Type of Effects

Effects from Construction and Maintenance of Fuel Breaks

Fuel breaks would be constructed across all identified treatment areas, with no discrimination over populations. The extent to which identified environmental justice populations would disproportionately affected by proposed action depends upon 1) the location of these populations in relation to proposed activities, and 2) the existence of adverse human health or environmental effects from the alternatives on any of the resources analyzed. Changes in the level of access to resource and resource uses which could limit traditional, subsistence, cultural, or economic use, may also affect the social and economic well-being of environmental justice populations.

The types of short- and long-term impacts that could occur from fuel break creation and maintenance are as follows:

- Direct shrub removal through manual or mechanical fuel break creation result in short and long-term site-specific reduction in the amount of fuelwood for individuals to heat their homes, which may play a more important role in low-income communities. In the long term, fuel break creation could result in the potential for changes to flame length and fire behavior, ignition potential, and suppression opportunities, and thus reduce the amount of vegetation burned. This could result in long term maintenance of fuel wood for use by environmental justice populations. Vegetation impacts are discussed in **Section 4.5**.

- Subsistence hunters may be affected by impacts on fish and wildlife or habitat. Short term impacts on wildlife include displacement and disturbance. Long term impacts would depend upon type of fuel break and species of wildlife. Increased fire suppression opportunities and a decreased potential for wildfire spread across fuel breaks would reduce fire severity and intensity, generally reducing wildlife habitat loss. For direct, indirect, and cumulative impacts on wildlife, see **Section 4.6**.
- Tribal communities that use vegetation for cultural practices could be affected in the short and long term by chemical treatments, as discussed in **Section 4.8**.
- Fuel break creation and maintenance could affect the social and economic well-being of all populations, including environmental justice populations, as discussed in **Section 4.12**. Short term impacts include site specific economic contributions from fuel break creation. In the long term, fuel breaks could reduce fire intensity and spread and decrease potential for higher-intensity fires. This could result in decreased destruction of public and private property and changes to community social structure, that can occur as a result of wildfire.
- Fuel break creation and maintenance could affect the public health of local populations, including environmental justice populations, due to short term impacts on air quality, as noted in **Section 4.3.** Over the long term, increased fire suppression opportunities and decreased rate of wildfire spread across fuel breaks would reduce fire severity and intensity in treated areas, thus reducing the impacts of wildfire on air quality.

The degree to which minority, low-income, and tribal populations are particularly vulnerable to the impacts or are more likely to be exposed to them depends on the specific location of proposed actions in relation to identified populations. Although fuel breaks would be constructed next to existing roads and BLM-administered ROWs (depending on the alternative), site-specific locations, timing, and details of treatment are not identified in this programmatic document. Impacts are likely to be limited and site specific in nature. However, site specific impacts would need to be analyzed to determine the potential for disproportionate adverse impacts on specific low-income, minority, or tribal populations before site-specific implementation.

4.13.3 Effects from Alternative A

Under Alternative A, a regional system of fuel breaks would not be constructed and maintained; instead, fuel break projects would continue to be constructed throughout the project area on a site-specific basis, as discussed in **Chapter 3** and in **Table 4-1**. The absence of a programmatic design for fuel breaks could continue or increase the potential for high-intensity wildfires, given that there would continue to be a slower response to fuel break project planning and implementation. If areas convert to cheatgrass and other invasive annual grasses, it would increase the presence of fine fuels, threaten sagebrush communities, and continue to degrade habitat for special status species. This would likely continue at a similar rate. Other ecosystem trends and processes would continue, including trends in fire, and cause sagebrush habitat to convert to invasive annual grass monocultures; thus, should a wildfire occur, all populations, including environmental justice communities, would be adversely affected due to potential for impacts for long term economic impacts and changes to social setting, as discussed in **Section 4.12**. In addition, resources used by environmental justice populations would have potential impacts from wildfire, as summarized under *Nature and Type of Impacts*.

4.13.4 Effects from Alternative B

There is some potential for short-term, site-specific impacts from constructing and maintaining fuel breaks on adjacent communities, including low-income, minority, and tribal populations. The intensity of impacts would depend on the site-specific location and method; however, impacts would be limited, due to the concentration of fuel breaks along Maintenance Level 5 roads and restrictions on where and how they would be treated.

In addition, design features for cultural resources (**Appendix D**, Design Features 27-30) under Alternative B would require consultation with potentially affected tribes prior to implementation of management that could affect resources important to traditional lifeways, subsistence, economy, ritual, or religion. This would limit the potential for disproportionate adverse impacts on tribal communities.

Allowing fuel breaks to be constructed using only manual and mechanical methods could provide a long-term reduction in high-intensity fire to all communities, including those identified for environmental justice consideration, as compared with Alternative A. Limiting treatment options may, however, limit the effectiveness of fuel breaks at a landscape level. This would come about by limiting the BLM's ability to create a system of different types of fuel breaks in all vegetation conditions, as discussed in **Section 4.3**.

4.13.5 Effects from Alternative C

Due to the inclusion of additional treatment methods and potential fuel break locations under Alternative C, the potential for temporary, site-specific impacts from constructing and maintaining fuel breaks (see *Nature and Type of Effects*) would be increased; however, the impacts would continue to be limited due to the concentration of fuel breaks along Maintenance Level 3 and 5 roads and BLM-administered ROWs and the limitations on constructing fuel breaks in highly resistant and resilient sites. Allowing for a full suite of treatments would likely increase fuel break effectiveness, resulting in a long-term reduction in impacts from fire for all populations, as compared with Alternative A. This includes populations identified for further environmental justice consideration.

4.13.6 Effects from Alternative D

Alternative D would allow the full suite of tools and would impose the fewest constraints on the locations of fuel breaks; because of this, it has the highest potential for short-term, direct impacts from fuel break construction and maintenance, as described under *Nature and Type of Effects*; however, impacts are still likely to be limited in scale due to the concentration of fuel breaks along Maintenance Level 1, 3, and 5 roads and BLM-administered ROWs.

Alternative D is likely to provide the highest level of effectiveness of treatments, as described above and in other resource sections. This is because it would result in a long-term reduction in the impacts from fires for all populations, including those identified for further environmental justice consideration. In addition, increased flexibility in fuel break treatment location under Alternative D could allow for placement of fuel breaks in locations to minimize impacts to identified environmental justice populations.

4.13.7 Cumulative Effects

The cumulative impacts analysis area and timeframe are the same as those defined in **Section 4.13**, Social and Economic Impacts. The social and economic wellbeing in all project area communities, including environmental justice populations, has likely been affected and will continue to be affected by the past, present, and reasonably foreseeable cumulative actions (see **Table 4-1**). As discussed in detail in relevant resource sections, historical and current fire suppression, fuel breaks, vegetation and resource management, and land use planning would continue to affect site-specific vegetation conditions and fire risks.

Impacts from site-specific treatment would include short-term limits on resource uses and the potential for long-term reduction of local impacts on resource and communities from wildfire. Continued development of roads, ROWs, mining and fluid mineral development would not only provide opportunities for community expansion and economic contributions but also would represent an increased number of values at risk. Such values would require protection should a fire occur. The risk of human-caused fires would increase by the possibility of ignition from equipment and combustible fuels and from increased human presence.

The continued spread of invasive weeds, drought, and ecological trends for wildfire would result in the same or an increased potential for high-intensity wildfires in the Great Basin in the long term compared to current conditions. Should a wildfire occur, impacts could affect populations and resources important for these communities, including those identified for further environmental justice consideration.

In the long term, all action alternatives could contribute to a cumulative reduction in impacts from fire for communities. Limiting fuel break locations and tools available for fuel break creation under Alternative B may reduce the effectiveness of fuel breaks, limiting cumulative contributions to reducing effects from fire for all communities, including those identified for environmental justice consideration, as compared with other action alternatives.

Due to the inclusion of additional treatment methods and locations for fuel breaks, the short-term impacts on cumulative contributions from other resources would be increased under Alternatives C and D. Impacts would continue to be limited, due to the concentration of fuel breaks along roads and ROWs. In the long term, the use of a full suite of treatments for fuel break construction under Alternatives C and D, and additional miles of fuel breaks (up to 11,000) a would likely increase fuel break effectiveness, as compared with Alternatives A and B. As a result, potential for high-intensity fire could be reduced, with a cumulative reduction to long-term impacts from wildfire for all communities, including environmental justice communities.

The greatest potential for contributions to cumulative reduction in impacts from wildfire would result from Alternative D. This would be due to the lack of restrictions in highly resistant and resilient sites and the expansion of treatment into areas along Maintenance Level 1 roads.

4.14 Irreversible and Irretrievable Commitments of Resources

A resource commitment is considered irreversible when direct and indirect impacts from its use limit future use options. Irreversible commitments apply primarily to nonrenewable resources, such as cultural resources, and to those resources that are renewable only over long periods of time, such as soil productivity. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for future use. Irretrievable commitment applies to the loss of production, harvest, or natural resources.

There would be some irreversible or irretrievable commitments of resources during the life of this project. These include:

- Ground disturbance and change that could result in increased erosion over the short term resulting from fuel break construction and maintenance
- Short-term impacts on air quality related to fuel break construction and maintenance
- Loss, alteration, or change in vegetation where fuel breaks are constructed and maintained with various treatments
- Loss, alteration, or abandonment of wildlife habitat and travel/migration patterns related to the construction and maintenance of fuel breaks
- Potential loss or damage to paleontological or cultural resources during fuel break construction.

4.15 Unavoidable Adverse Impacts

Unavoidable adverse effects may also be expected to occur during fuel break construction and maintenance. These effects would resemble those described above in **Section 4.15,** Irreversible and Irretrievable Commitments of Resources. Many adverse impacts could be lessened by design features but would not be completely eliminated or reduced to negligible levels. Some are short-term impacts, while others may be long-term impacts. These impacts and efforts to mitigate them have been described for each resource in **Sections 4.2** to **4.14**. Depending on the location and extent of fuel break construction, maintenance, and design features, unavoidable adverse impacts could potentially include:

- Loss of soil productivity related to surface disturbance and increased erosion over the short term during construction of fuel breaks
- Changes in surface flow and drainage patterns due to surface disturbance during construction of fuel breaks
- Loss, alteration, or fragmentation of vegetation habitat due to construction of fuel breaks
- Wildlife injury or mortality related to fuel break construction activities
- Loss, alteration, or fragmentation of wildlife habitat
- Changes in wildlife migration or travel patterns to avoid disturbances created during construction
- Potential loss or damage to paleontological and cultural resources related to fuel break construction
- Change in the existing visual resource inventory conditions (even if the VRM objectives are met) due to the introduction of any new manmade line, form, color, or texture into an existing landscape

4.16 Relationship Between Short-Term Uses and Long-Term Productivity

This section compares the potential temporary effects of the actions analyzed in this PEIS on the environment with the potential effects on its long-term productivity. The BLM must consider the degree to which the Proposed Action or alternatives could impact various resource or environmental values in the long term, for some temporary value to a project proponent or the public.

Specific impacts vary in kind, intensity, and duration according to the activities occurring at any given time. Fuel break construction may result in impacts over a longer period of time, particularly as fuel breaks are monitored, maintained, or altered after initial construction. Over the long term, if fuel breaks are decommissioned, natural environmental balances are generally expected to influence the project, though that balance will not for all resources mean a return to the exact state prior to original disturbance.

Design features would be implemented to reduce disturbances and reclaim or improve vegetation cover, soil, and wildlife habitat on affected lands. While the degree of reclamation is unknown, to the extent that disturbances can be reclaimed, other productive use of these lands would not be precluded in the long term.

A general discussion of short-term uses and long-term productivity is described below. These findings may vary depending on the location and extent of fuel break construction, maintenance, and design features.

- Short-term construction activities would impact air quality; long-term maintenance of existing vegetation resulting from fuel breaks may result in a reduction in impacts on air quality related to smoke from wildfires.
- There may be some loss of existing vegetation, soil, and habitat available for wildlife, but design features would be implemented to avoid most high-quality wildlife habitat. Full recovery of these lands and restoration of any lost habitat or associated wildlife is not assured.
- Fuel break construction and maintenance would cause removal of vegetation and disturbance of soil resources. While every effort would be made to restore vegetation and soil conditions, full restoration of preexisting conditions is not assured and would take many years. Increases in erosion due to disturbance of these surfaces would persist for lengthy, unknown periods. Implementing design features would reduce erosion in affected areas.

There may be some loss of special status species habitat under the alternatives, especially over the short term when habitat is disturbed for fuel break construction; however, some restrictions apply to the project alternatives to avoid habitat important to special status species; therefore, the project should not significantly contribute to population decline in special status species, leading to the federal listing of species, or lead to species extinction.

Chapter 5. Consultation and Coordination

Laws and requirements related to consultation and coordination are presented in **Appendix M**.

5.1 Public Involvement and Scoping

5.1.1 Notice of Intent

On December 22, 2017, the BLM published a notice of intent (NOI), titled "Notice of Intent to Prepare Two Great Basin-Wide Programmatic Environmental Impact Statements to Reduce the Threat of Wildfire and Support Rangeland Productivity," in the *Federal Register*. The NOI initiated the public scoping process for this Fuel Breaks PEIS as well as the Fuels Reduction and Rangeland Restoration PEIS. During this period, the BLM sought public comments to determine relevant issues that could influence the scope of the environmental analysis, including alternatives, and guide the process for developing the PEISs. The official comment period ended on March 2, 2018.

In the NOI, the BLM identified the following preliminary issues:

1. Fuel break construction and the associated road improvement for firefighter access could increase human activity in remote areas, introduce noxious and invasive weeds, and increase the incidence of human-caused wildfires.
2. Fuel break construction could remove or alter sagebrush habitat, rendering it unusable for some species.
3. Fuel break construction on either side of existing roads may create movement barriers to small-sized wildlife species by reducing hiding cover.
4. Fuel break construction in highly resistant and resilient habitats may not be necessary because those sites are less likely to burn or will respond favorably to natural regeneration.
5. After habitat restoration treatments, historical uses, such as livestock grazing and recreation, may be temporarily halted until the treatment becomes established and objectives are met.
6. Fuel reduction treatments in pinyon-juniper woodlands could disrupt traditional tribal use of these sites.
7. The use of nonnative species in fuel breaks could affect listed species and affect species composition in adjacent native plant communities.

The BLM also established a project website with information related to the development of the two PEISs: https://go.usa.gov/xnQcG. The website includes background documents, maps, information on public meetings, and contact information.

5.1.2 Public Scoping Meetings

The BLM hosted 15 public scoping meetings throughout the project area during the public comment period. These scoping meetings were held in an open-house format to encourage participants to discuss concerns and questions with the BLM and other agency representatives. The dates and locations of the open houses are provided in **Appendix M, Table M-1**. Materials presented at the public scoping meetings are available on the project website.

5.1.3 Summary of Public Comments

All written submissions received on or before March 2, 2018, were evaluated and are documented in the scoping summary report, which can be found on the project website. The BLM received 98 unique written submissions during the public scoping period, comprising 1,484 substantive comments. A summary of each of these comments and the BLM's consideration of those comments can be found in the scoping report. There were no unresolved environmental issues or conflicts raised during scoping. A majority of the comments received related to the following:

- The need for implementation of a monitoring program to quantify the effectiveness and maximize the success of fuel breaks
- The need to ensure the recovery of habitat components for species
- The treatment components and treatment areas to include or exclude from the PEIS alternatives in order to develop and maintain fuel breaks and prevent fires
- Evaluation of the direct and indirect costs of the project, including costs of construction, treatments, machinery, and maintenance as well as costs of the impacts on other resources and land uses as a result of proposed actions
- Evaluation of potential adverse impacts on natural, cultural, and socioeconomic resources due to fuels management on BLM-administered lands

5.2 Consultation and Coordination with Agencies and Tribal Governments

5.2.1 Government-to-Government Consultation with Native American Tribes

In December 2017, BLM offices in the six states in the project area sent letters to tribes inviting them to participate in formal consultation. A list of tribes who received letters inviting them to participate in formal consultation can be found in **Appendix M**, **Table M-2**, Tribal Consultation.

Of the tribes contacted, the Burns Paiute Tribe responded stating that it would like to engage in formal consultation. In addition, the BLM is currently engaged in informal consultation with the Shoshone-Bannock Tribes.

5.2.2 National Historic Preservation Act Consultation

The BLM sent letters to California, Idaho, Nevada, Oregon, Utah, and Washington SHPOs in December 2017 initiating consultation per Section 106 of the NHPA.

5.2.3 Endangered Species Act Consultation

In December 2017, the BLM sent a cooperating agency invitation to the USFWS and notified it of the project. The BLM has worked closely with the USFWS during ESA consultation to obtain feedback on affected species and the effects of the proposed action. The BLM is preparing a biological assessment, and consultation with the USFWS is ongoing. The BLM determined that consultation with the National Marine Fisheries Service was not needed since aquatic habitat is avoided and buffered by at least 300 feet.

5.3 Cooperating Agencies

Agencies and tribal entities that were invited and those who accepted and signed an MOU agreeing to participate as cooperating agencies for this NEPA process are presented in **Appendix M, Table M-3**, Cooperating Agency Participation. Other existing MOUs are in place between the BLM and state wildlife agencies; this PEIS does not list them all, but the BLM would coordinate as specified in the applicable MOUs.

5.3.1 List of Preparers

This PEIS was prepared by an interdisciplinary team of staff from the BLM and Environmental Management and Planning Solutions, Inc. (EMPSi). **Appendix M, Table M-4**, List of Preparers, provides a list of people that prepared or contributed to the development of this PEIS.

5.4 Recipients of this PEIS

Those agencies that have accepted an invitation to participate as a cooperator will receive a copy of this draft PEIS, along with those tribes that have accepted the invitation to engage in formal consultation. A copy of this list can be found in the administrative record. Should the list of cooperators change between publication of the draft and final PEIS, an updated list of those who will receive copies of the final PEIS will be included.