U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

February 2020

Final 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

$2,300,000

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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Introduction

This programmatic environmental impact statement (PEIS) evaluates creating and maintaining systems 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; sagebrush communities 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.

What is a Fuel Break?

In the most general sense a fuel break is a gap between fuels A fire needs fuel, oxygen, and heat to burn. In a wildfire there is little that can be done to affect the heat or the oxygen available to a fire; therefore wildland firefighters generally focus on interrupting the fuels available to a fire. They do this in a variety of ways:

- Dig a fire line from where the fire has already burned along the sides of the fire and then heading it off.
- Dig a fire line by hand or with a dozer and then start a back fire that will move toward the oncoming fire and consume the fuel before the wildfire can use it.
- Spray water and foam on the vegetation to wet it and make it less flammable.
- Drop fire retardant on the vegetation to make it less flammable.

Whenever possible, firefighters make use of existing fuel gaps like roads and rocky or bare areas and expand on them to stop a fire. Depending on the fuel and weather conditions, firefighters need larger or smaller gaps to effectively stop a fire. In hot, dry, and windy conditions, firefighters may need a very wide fuel break to start a back burn safely. If a fuel gap is not available, then the firefighters have to make one. Building lines with hand crews and dozers is slow work and keeps firefighters in front of a dangerous wildfire.

The BLM is proposing systems of fuel breaks within the Great Basin to increase firefighter safety and provide increased opportunities for stopping wildfires.

How are fuel breaks used?

Firefighter safety is the number one goal in wildland firefighting. Firefighters cannot attack a wildfire when it is unsafe to do so. Firefighters either have to wait until the weather conditions change or they have to attack the wildfire indirectly. Indirect attack is accomplished by moving a safe distance in front of the fire (maybe many miles) to an adequate fuel gap with good escape routes and expanding that gap until it is safe to back burn into the fire. Pre-made fuel breaks act as advance fire lines and save firefighters significant time in preparing to attack a fire.

What makes a fuel break effective?

Fuel breaks can be effective in two ways. First, they provide an advance fire line that saves firefighters time in attacking a fire and allows firefighters to safely attack a wildfire in a wider range of weather and fuel conditions.

Second, in mild to moderate weather and or fuel conditions, a fuel break may alter the behavior of the wildfire and slow or even stop the fire without additional aid from firefighters. This type of effectiveness represents a small portion of the value that fuel breaks provide. It is more common that fuel breaks will be used as a starting point for firefighters to attack a wildfire. Just as not all fire lines will hold a wildfire, not all fuel breaks will stop all fires. The true value of fuel breaks is that they give firefighters more time and opportunity to control wildfires.

Maintenance of fuel breaks is essential to their success. If a fuel break is unmaintained then it is not a fuel break anymore. Fire fighters need a gap in the fuels to safely begin attacking a fire and an unmaintained fuel break may not provide that gap.

Why is the BLM proposing so many fuel breaks?

The sagebrush sea in the Great Basin is home to about 350 species of wildlife, including many special status species. It is also a vital part of western working landscapes. Wildfire and cheatgrass invasions are threatening this habitat; approximately 45 percent of the historical range of sagebrush has been lost. Between 2009 and 2018, over 13.5 million acres have burned within the project area. Cheatgrass invasions increase the likelihood of additional wildfires which prevents sagebrush recovery. The Great Basin is faced with losing all of the sagebrush sea if the cheatgrass and wildfire cycle is not interrupted. Fuel breaks represent a tool that can help firefighters interrupt this cycle by catching wildfires earlier. This can reduce the acres burned and provide more time for sagebrush to recover from past fires.

Purpose and Need

The purpose of the actions analyzed in this EIS is to implement systems of strategically placed fuel breaks in the Great Basin region to improve firefighter safety by slowing the spread of wildfires; thereby reducing wildfire size, and providing an anchor point for fire suppression activities. In addition, fuel breaks can create buffers for maintaining important habitats.

Strategically placed fuel breaks are a necessary tool to address wildfires, which have increased 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. 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 decision would identify the approach, design features and the associated impacts of constructing systems of fuel breaks within the project area. This decision would not authorize any site-specific projects but, would provide the impacts analysis for local offices to rely on when implementing site specific fuel break projects. Where the site specific project adheres to the parameters of the selected approach and a site specific Determination of NEPA Adequacy finds that the impacts of the proposal are adequately covered in the PEIS; the Field Office may sign a decision and implement the project. Where the impact analysis of this PEIS does not adequately cover the impacts of a site specific project, the local office could analyze the inadequacies in a shortened NEPA document before signing a decision and implementing the project. Examples of where additional analysis would be warranted include projects in areas excluded from analysis in this PEIS (See **Section 2.2.1**), 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, BLM would implement individual fuel break projects with site-specific NEPA.

Alternative B

Up to approximately 8,700 miles of new fuel breaks may be created and maintained over a potential treatment area of approximately 529,000 acres along Maintenance Level 5 roads. The types of tools proposed to create and maintain fuel breaks would be limited under Alternative B to manual and mechanical treatments. Prescribed fire, chemical treatments (herbicides), and targeted grazing would not be used to create or maintain fuel breaks. No sagebrush would be removed. Fuel breaks would be planted with native plant material 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 and maintained along Maintenance Levels 3 and 5 roads and BLM-administered ROWs under Alternative C. 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 and maintained along Maintenance Levels 1, 3, and 5 roads and BLM-administered ROWs. Management of manual, chemical, prescribed fire, reseeding, and targeted grazing would be the same as under Alternative C. However, fuel breaks could be created and maintained 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 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 removal and/or 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-4**. 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) and the National Marine Fisheries Service 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; consultation is ongoing.

HOW THIS PEIS WILL BE USED

When the PEIS is complete and a ROD is signed, the selected alternative with the associated analysis will be available for individual offices to use in developing fuels breaks projects. An interdisciplinary team would review the selected alternative and using local data would develop a project that adheres to the guidance of the PEIS. Then the team would evaluate whether the impacts from the project fall within those analyzed in the PEIS using a Determination of NEPA Adequacy (DNA) in accordance with BLM National Environmental Policy Handbook (H-1790-1). If the vegetative and habitat conditions and the impacts for their proposed project are in line with those analyzed in the PEIS, then the office could sign a decision based on this PEIS and their DNA and implement the project. If some aspects of the proposed project are different from those analyzed in the PEIS then the office would have to do a new NEPA analysis, incorporating the pertinent analysis from the PEIS and analyzing the site specific issues that are outside the analysis of this PEIS before issuing a decision and implementing their project. Any such decision will be subject to appeal pursuant to 43 CFR Part 4. Coordination with Tribal, state and local governments, affected parties, and the public would still be required, but the degree of coordination and outreach would be at the discretion of the Authorized Officer.

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 consistent with the PEIS analysis. **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**

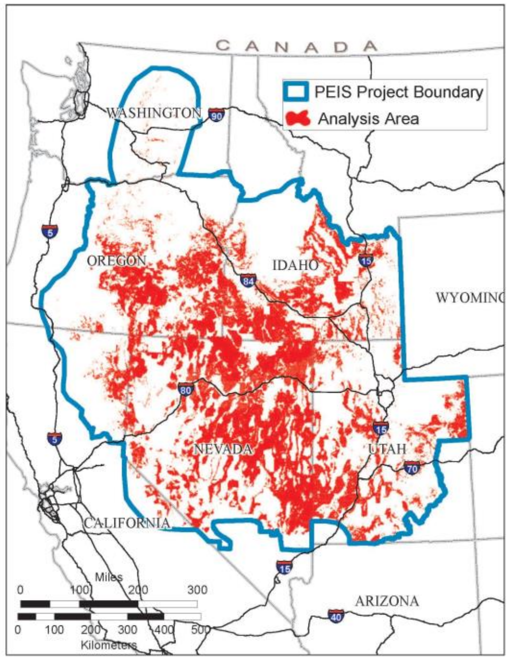
Source: BLM GIS 2018

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



The BLM is taking a strategic approach to protecting, conserving, and restoring sagebrush communities in the Great Basin in line with Executive Order 13855 (Promoting Active Management of America's Forests, Rangelands, and Other Federal Lands To Improve Condition and Reduce Wildfire Risk) and Secretarial Order 3372 (Reducing Wildfire Risks on Department of the Interior Land Through Active Management). This PEIS is consistent and supports the Federal Wildland Fire Management Policy, BLM's Fire Management Planning Policy, National Fire Plan, the National Cohesive Wildland Fire Management Strategy, and BLM Handbook 9211, which among other provisions, require that firefighter and public safety be the first priority and that a full range of fire management activities be used to achieve ecosystem sustainability. Fuel break construction is one tool used in an overall fire and fuels management strategy.

The BLM will continue cooperating and coordinating with other federal, Tribal, state, and local government agencies consistent with applicable laws and regulations pertaining to planning and implementing fuel breaks within the analysis area. 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 fuel break project, as documented in a Determination of NEPA Adequacy (BLM 2008). Therefore, the analysis in this PEIS covers a range of treatments, 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 on a special designation area.

1.2 PURPOSE AND NEED

The purpose of the actions analyzed in this EIS is to implement systems of strategically placed fuel breaks in the Great Basin region to improve firefighter safety by slowing the spread of wildfires; thereby reducing wildfire size, and providing an anchor point for fire suppression activities. In addition, fuel breaks can create buffers for maintaining important habitats.

Strategically placed fuel breaks are a necessary tool to address wildfires, which have increased 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. 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 Fire and Invasives Assessment Tool (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.

Additionally, the BLM is preparing another PEIS that addresses fuels reduction and rangeland restoration projects (Draft Programmatic EIS for Fuels Reduction and Rangeland Restoration in the Great Basin). Collectively, this Fuel Breaks PEIS and the Fuels Reduction and Rangeland Restoration PEIS analyze components of an interconnected, region-wide strategy for addressing threats to sagebrush communities from the increasing trends in wildfire, and the spread of invasive species, including nonnative annual grasses, and pinyon-juniper. Implementing the actions proposed in these PEISs would contribute to the BLM's goal in the RMPAs of restoring sagebrush communities in the Great Basin.

1.4 Relationship to Laws, Regulations and 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 policies, plans, or 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*; BLM Manuals 8110, *Identifying and Evaluating Cultural Resources* and 8140, *Protecting Cultural Resources*; and BLM Manual 1780, *Tribal Relations* (See **Appendix C**). The BLM will also consider 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. Should Field Offices decide to construct fuel breaks in these areas, additional site-specific analysis would be required:

- Riparian exclusion 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 with riparian vegetation)—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, wet meadows, vernal pools, and springs)—300 feet from the edge of feature or the outer extent of riparian vegetation, whichever width is greater
- Wilderness
- Wilderness Study Areas
- Lands with wilderness characteristics that are managed to maintain or enhance those characteristics, including natural areas managed to protect their wilderness character
- National Conservation Areas and National Monuments
- Areas designated through the John D. Dingell Jr. Conservation, Management, and Recreation Act (2019)
- 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 and trail ROWs/corridors as identified in the Trailwide Comprehensive Plan and applicable land use plan
- 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. Due to missing or incomplete data, the exclusion areas depicted on the maps do not represent all exclusion areas within the project boundary. Instead, the field offices will defer to the exclusion areas described in **Section 2.2.1**. The model is used for analysis and comparison purposes only; actual treatment locations and methods would be based on site-specific conditions. In some areas it may be most efficient to have fuel breaks continue across multiple land ownerships. Where this occurs, the BLM would collaborate with willing landowners to create and maintain effective fuel breaks. If landowners are unwilling then the BLM would have to alter the fuel break location.

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 and maintain fuel breaks (see **Map 1** and introductory text in **Appendix A**).

2.2.4 Fuel Break Placement Criteria

Site specific conditions may necessitate deviation from these criteria to maximize fuel break effectiveness but generally offices should follow these criteria in siting fuel breaks. All fuel breaks proposed in this PEIS would be placed along existing roads or BLM-administered linear ROWs. Coordination across ownership and management boundaries is encouraged to maximize the efficacy of any fuel break system. Fuel break effectiveness potential would be maximized while minimizing, to the extent practicable, impacts to high-value resources:

1. position fuel breaks in areas with high fire probability
2. position fuel breaks where they are most effective for firefighters
3. position fuel breaks to protect the most important at-risk habitats and resources
4. position fuel breaks to protect existing and ongoing restoration actions
5. place fuel breaks in already disturbed/degraded areas
6. place fuel breaks adjacent to rather than through remnant patches of sagebrush
7. use the minimum number of fuel breaks needed to effectively protect large intact sagebrush patches and minimize edge effects

2.2.5 Permitted Grazing

The alternatives would not change permitted grazing in accordance with 43 Code of Federal Regulations (CFR) 4130 (2005). However, the BLM may work with permittees through voluntary agreements or coordination within the authorized permitted use to temporarily modify grazing to increase the success of seedings or targeted grazing within fuel breaks.

2.2.6 Road Creation and Maintenance

No new roads would be created. Improvement or maintenance of roads beyond the current definition, designation, and maintenance level would require additional site-specific analysis. For the purposes of this PEIS, road maintenance levels 1, 3, and 5 are defined in BLM Manual MS 9113 - Roads. Maintenance level 1 roads are generally 2-tracks with little traffic that don't have a regular maintenance schedule and may be impassible for extended periods of time. Traffic is often seasonal (e.g., during hunting season). Maintenance level 3 roads are typically gravel roads with low to moderate traffic that are maintained for almost year-round use that have planned maintenance actions. Maintenance level 5 roads are typically paved but may be gravel, with high traffic volume that are intended for year-round use with scheduled annual maintenance actions. (see Manual MS 9113 for complete definitions.)

2.2.7 Native Plant Material Policy

It is BLM policy 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*, and the *National Seed Strategy for Rehabilitation and Restoration* (Plant Conservation Alliance 2019), requires that native plant material 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. For example, nonnative plant material may be used in areas with low resistance and resilience that are invaded by invasive annual grasses.

2.2.8 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 Manual H-1740-2 *Integrated Vegetation Management Handbook*; *Incorporating Assessment Inventory and Monitoring (AIM) for Monitoring Fuels Project Effectiveness Guidebook* (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. *Using Resistance and Resilience Concepts to Reduce Impacts of Invasive Annual Grasses and Altered Fire Regimes on Sagebrush Ecosystem and Greater Sage-Grouse: A Strategic Multi-Scale Approach* (Chambers et al. 2014b) should be used as a decision support tool to determine priority areas for management and to identify effective management strategies at a landscape scale. *Best Management Practices for Pollinators on Western Rangelands* (Xerces 2018) would be used to incorporate pollinator conservation into management decisions; the reference also describes associated monitoring practices for pollinator populations.

When constructing and maintaining fuel breaks, strategies should be determined by considering resilience to disturbance, resistance to invasive species, and the predominant threats to the sagebrush communities. The Landscape Cover of Sagebrush and Ecosystem Resilience and Resistance Matrix can be used as a decision support tool to provide better evaluation of risks and to decide where to focus specific activities to promote desired species and ecosystem conditions (Chambers et al. 2014b, Tables 2 through 4). Contributions to vegetation management strategies should include all necessary agency program areas such as invasive plant management, fuels management, range management, and wildlife. When applicable, other land owners, fire response partners, and agencies should be involved.

Monitoring is the key to adaptive management. When fuel breaks are not meeting objectives, modifications should be considered through adaptive management (per Chapter 5 of H-1740-2, Crist et al. 2019). Decommissioning of fuel breaks would be addressed in project objectives at the site-specific level. Monitoring would inform the need for 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 in **Appendix A** depicts 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** (shrub and grassland vegetation states) **and Map 4** (pinyon-juniper vegetation states) (**Appendix A**). Effective fuel breaks are those that expand the circumstances in which firefighters can attack a wildfire and reduce the time necessary to establish an effective fireline and stop a wildfire. Fire needs fuel and oxygen to continue burning, and since the agency can't affect the oxygen outside, it focuses on removing or modifying the fuel or making it less flammable. All wildland fire fighting involves interrupting fuels with a line of bare ground, burned vegetation, water, or fire retardant. Fuel breaks are pre-positioned fire lines situated in or adjacent to areas where a fire is likely and designed to increase the opportunities for firefighters to catch and control a wildfire. Time is a very limited and valuable resource in fire season. Fuel breaks can be constructed or maintained outside of the fire season which can give firefighters what they never have enough of; more time when confronting a wildfire. Human caused fires typically start along busy roadways. Fires burning in the short fuels of a fuel break adjacent to the road will burn more slowly than one burning in tall thick vegetation. This gives firefighters more time to get to the fire and control it. Wildfire behavior is dynamic and even with many years of well-developed firefighting techniques no technique assures that fires are small every time. Not every fuel break will be effective every time; even the best lines are jumped sometimes.

Table 2-1 and **Table 2-2** provide considerations for planning, creating, and maintaining 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**. The different fuel break types may be combined to increase their effectiveness in some situations. 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 grasses 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 grasses 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 mechanical, chemical, and prescribed fire treatments or targeted grazing to reach desired objectives.
- 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 *(Miles of Roads and ROWs with each Vegetation State)*[3]	**Preferred Fuel Break Type**[1]	**Methods and Tools By Fuel Break Type**
Invasive Annual Grasses *Maintenance Level 1 Roads: 617 miles* *Maintenance Level 3 Roads: 988 miles* *Maintenance Level 5 Roads: 2,533 miles* *ROWs: 548 miles*	**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 grasses 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 grasses 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 and Shrubs *Maintenance Level 1 Roads: 635 miles* *Maintenance Level 3 Roads: 1,181 miles* *Maintenance Level 5 Roads: 2,650 miles* *ROWs: 537 miles*	**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 grasses 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. **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 grasses or affected by repeated fire.	**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. **Mowed Fuel Break:** The manipulation of vegetation through the use of a mowing implement.

[1] See **Appendix H, Section H.4** for a description of the methodology used to rank the fuel break types.

Vegetation State *(Miles of Roads and ROWs with each Vegetation State)*[3]	**Preferred Fuel Break Type**[1]	**Methods and Tools By Fuel Break Type**
Perennial Grasses and Forbs *Maintenance Level 1 Roads:* *471 miles* *Maintenance Level 3 Roads:* *601 miles* *Maintenance Level 5 Roads:* *1,461 miles* *ROWs:* *262 miles*	**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 nonnative 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, Forbs, and Shrubs *Maintenance Level 1 Roads:* *2,219 miles* *Maintenance Level 3 Roads:* *2,856 miles* *Maintenance Level 5 Roads:* *6,326 miles* *ROWs:* *858 miles*	**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. **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 nonnative 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 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. **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, Forbs, and Invasive Annual Grasses *Maintenance Level 1 Roads:*	**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.

Vegetation State *(Miles of Roads and ROWs with each Vegetation State)*[3]	**Preferred Fuel Break Type**[1]	**Methods and Tools By Fuel Break Type**
792 miles *Maintenance Level 3 Roads:* *1,600 miles* *Maintenance Level 5 Roads:* *3,501 miles* *ROWs:* *810 miles*	**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 grasses or affected by repeated fire. **3: Green Strip Fuel Break:** These types of fuel breaks would be limited to areas with nonnative perennial seedings, where fire risk remains, or in areas with vegetation that is more resistant to invasive plant species introduction.	**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, Perennial Grasses, Forbs, and Invasive Annual Grasses *Maintenance Level 1 Roads:* *2,247 miles* *Maintenance Level 3 Roads:* *4,269 miles* *Maintenance Level 5 Roads:* *8,312 miles* *ROWs:* *1,270 miles*	**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. **3: Green Strip Fuel Break:** These types of fuel breaks would remove shrubs and invasive annual grasses from within the fuel break.	**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. **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). Follow up seeding treatments may be required to ensure success.
Shrubs with Depleted Understory *Maintenance Level 1 Roads:* *586 miles* *Maintenance Level 3 Roads:* *1,511miles*	**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.	**Brown Strip Fuel Break:** Removal of vegetation through the use of chemical treatment and mechanical treatment. **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.

Vegetation State *(Miles of Roads and ROWs with each Vegetation State)*[3]	**Preferred Fuel Break Type**[1]	**Methods and Tools By Fuel Break Type**
Maintenance Level 5 Roads: 3,678 miles *ROWs: 845 miles*	**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 *Maintenance Level 1 Roads:* *6,362 miles* *Maintenance Level 3 Roads:* *12,808 miles* *Maintenance Level 5 Roads:* *2,783 miles* *ROWs:* *4,130 miles*	**Phase I[2]:** Due to the low tree cover, fuel break establishment would depend on the dominant vegetation state as described above. Limbing of trees may be required to eliminate ladder fuel component. **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 I:** Identify dominant vegetation state to determine preferred fuel break type and reference treatment methods 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.

[2] Phases refer to successional phases of pinyon-juniper. See glossary in Appendix B, Section B.3 for definitions of the successional phases.

[3] Miles of roads are estimates based on existing road data, which may not be complete.

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

2016a, 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 environmental factors; given this complexity, 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, hand held 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. Debris will be removed from the road surface to allow for access through the treatment area. 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 reduce or modify vegetation within a specific area. Targeted grazing may be implemented through agreement or contract, including coordination with affected permittees. This will be determined by the local field office on a project basis. 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 21 through 24).

Targeted grazing may be used to maintain established fuel breaks in certain vegetation states (**Table 2-1** and **Table 2-2**). Timing of the treatment will be dependent on current year growing conditions and the type of fuel break being maintained. Repeated treatments may be required to accomplish the objective of the fuel break and will be dependent on current year growing conditions.

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 5** in **Volume 2, Appendix A**.

2.5.1 Alternative A—No Action Alternative

Under the No Action Alternative, BLM would implement individual fuel break projects with site-specific NEPA.

2.5.2 Alternative B

Under Alternative B, up to approximately 8,700 miles of new fuel breaks may be created and maintained along maintenance level 5 roads. 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 6** in **Appendix A**). Fuel breaks would only be created and maintained along roads and the types of fuel breaks would be prioritized based on vegetation states (see **Table 2-2**). No sagebrush would be removed under this alternative.

Under Alternative B, only manual and mechanical treatments would be used. 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 plant material 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 and maintained along maintenance level 3, and 5 roads and along BLM-administered ROWs. 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 7** in

Appendix A). Prioritization based on vegetation states would be the same as for Alternative B and shown in **Table 2-2**.

Targeted grazing fuel breaks could be created and maintained in all vegetation states except shrubs with depleted understory and Phases II and III pinyon-juniper.

Under Alternative C, 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 and maintained 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, 2016a) 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 2019). 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 and maintained (over a potential treatment area of approximately 1,088,000 acres) (see **Map 8** in **Appendix A**). Fuel breaks may be created and maintained along maintenance level 1, 3, and 5 roads, and BLM-administered linear ROWs. Prioritization based on vegetation states would be the same as for Alternative B and shown in **Table 2-2**.

Management of manual, chemical, prescribed fire, and targeted grazing treatments 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 and maintained in highly resistant and resilient sites without the constraints included in Alternative C.

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 and maintained over a potential treatment area of approximately 529,000 acres1.	Up to approximately 11,000 miles (667,000 acres) of new fuel breaks would be created and maintained over a potential treatment area of approximately 792,000 acres1 with an additional with limitations.	Up to approximately 11,000 miles (667,000 acres) of new fuel breaks would be created and maintained over a potential treatment area of approximately 1,088,000 acres1.
2.	Fuel break locations	N/A	Fuel breaks would be created and maintained along maintenance level 5 roads. No sagebrush would be removed.	Fuel breaks would be created and maintained along maintenance level 3 and 5 roads and BLM-administered ROWs. Sagebrush may be mowed or removed to create and maintain fuel breaks	Fuel breaks would be created and maintained along maintenance level 1, 3, and 5 roads and BLM-administered ROWs Sagebrush may be mowed or removed to create and maintain fuel breaks.
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 (BLM 2015).	Vegetation could 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	Manual treatments could be used in all areas.	Same as Alternative C
6.	Mechanical	N/A	Mechanical treatments could be used.	Mechanical treatments could be used in all areas,.	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*	Same as Alternative C

				Rimsulfuron (BLM 2007, 2016a) and existing local guidance.	
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 plant material 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 plant material 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

[1] Acreages are based on incomplete existing road data and serve as a comparison between alternatives, not a limit.

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.

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 in its entirety and would be inconsistent with policy (BLM Handbook H-4700-1). 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 (DNA or short EA) and will also document conformance with 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 and maintained over a potential treatment area of 529,000 acres.	Up to 11,000 miles of new fuel breaks would be created and maintained over a potential treatment area of 792,000 acres.	Up to 11,000 miles of new fuel breaks would be created and maintained 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 maintenance level 5 roads 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 and maintained along maintenance level 3, and 5 roads and BLM-administered ROWs. 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 and maintained along maintenance level 1, 3, and 5 roads, and BLM-administered ROWs. 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.
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.	

Consequence	Alternative A No Action	Alternative B	Alternative C	Alternative D (Preferred)
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 and maintenance. 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 Resource Management Class I Areas
- Wilderness
- Wilderness Study Areas
- Wild and Scenic Rivers (including rivers found eligible and/or suitable)
- Lands with wilderness characteristics that are managed to maintain or enhance those characteristics, including natural areas managed to protect their wilderness character
- National Conservation Areas and National Monuments
- Areas designated through the John D. Dingell Jr. Conservation, Management, and Recreation Act (2019)
- Areas of Critical Environmental Concern
- Within National Scenic and Historic Trails and trail ROWs/corridors as identified in the Trailwide Comprehensive Plan and applicable land use plan
- Lands and realty
- Riparian resources
- Comprehensive travel and transportation management
- Noise
- Livestock grazing
- Wild horses and burros
- Water resources

While impacts to visual character and aesthetic qualities are discussed in **Section 3.8**, Cultural and Tribal Resources and **Section 3.10**, Recreation, and the corresponding sections in **Chapter 4**, a detailed analysis of impacts on visual resource management (VRM) categories is not included. All site specific projects are required to comply with the Visual Resource Management lined out in applicable land use plans. 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 or riparian exclusion 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 allow vegetation to cure (dry out). Combined with frequent thunderstorms and wind events, dry vegetation conditions increase 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 drying of fuels throughout the summer.

Fire has always been an integral natural process in most ecosystems. Past management practices, such as fire suppression, introduction of nonnative perennial grasses, and historic grazing, 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 9** in **Appendix A** depicts the total acres burned from wildfires between 1960 and 2018 on BLM-administered lands in the project area.

The primary benefit of fuel breaks is to provide fire fighters with increased opportunities to safely attack wildfire. Fuel breaks also change the behavior of fires entering fuel-altered zones. Fuel breaks along existing linear disturbances, such as roadways, support fire suppression while minimizing ecosystem changes (Chambers et al. 2017 p. 103). Modified fire behavior increases the probability that suppression crews will successfully contain a wildland fire (Agee et al. 2000). Wildland fire can encounter a fuel break under a variety of normal to extreme weather conditions; in most cases, fuel breaks are not designed to stop fires on their own, especially fires occurring during severe weather conditions (Syphard et al. 2011).

Desired fuel break type, location, and width depend on the vegetation conditions within which the fuel break is placed and the intended function of the fuel break (Agee et al. 2000). Currently there are 5,126 miles of fuel breaks of varying widths and types within the project area (see **Map 10** in **Appendix A**; USGS 2018). Established fuel break treatments in the project area influence fire behavior and provide direct and indirect attack suppression opportunities at a site-specific level (see **Appendix K**).

As depicted in **Table 4-3** and **Appendix H**, wildfires in taller vegetation have longer flame lengths, which force firefighters to stay farther away from a wildfire for safety. The 12 general fuel models in the project area are described in **Appendix H, Section H.1**, along with the fuel models of the desired fuel breaks found in **Appendix H, Section H.2**. 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.3**, Fire Behavior; **Figures H-1- H-3**.

Longer flame lengths increase the potential for fires to breach or 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,** Fire Behavior; **Figures H-1-H-3**). The management of surface fuels to reduce flame lengths, potentially reduces rates of spread below thresholds in **Table H-1** in **Appendix H**, and supports firefighter safety, can be accomplished through removal of vegetation, adjusting fuel arrangement to produce a less flammable fuelbed (mowing), or by introducing live understory vegetation to raise average moisture content of surface fuels (Agee et al. 2000).

Fuel break effectiveness is based on several factors including the underlying and surrounding fuel models, vegetation and soil moisture content, macro- and micro-weather conditions, fuel break width and type, fuel break maintenance condition, firefighter access to the fuel break, and firefighter availability. In a 28-yearlong study, Syphard et al. (2011) identified 53 fire events that intersected fuel breaks, of which the fuel breaks effectively constrained 23 (46%). In seven other instances, the fuel breaks changed fire behavior, which allowed for subsequent suppression. This increased fuel break effectiveness to 56%. In 11 of the remaining occasions where fire spread across fuel breaks, fire crews could not access the fuel break to establish an anchor point for suppression.

Even with fuel breaks and suppression resources available, 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 H, Figure H-4** 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, engines, 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 as described in **Table H-2** in **Appendix H**. In some areas within the project boundary, topography and limited access preclude direct attack suppression. Aircraft is often the only means of suppression.

Providing multiple anchor points and modifying vegetation across the landscape as part of a fuel break system can effectively alter wildland fire behavior, even if fire crosses individual fuel break segments within the system. Fuel breaks can also be combined with area-wide fuels treatments to further influence fire behavior and increase suppression opportunities (Agee et al. 2000).

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).

Climate and Weather Patterns

The Great Basin region is characterized by a semiarid temperate climate with cold, wet winters, wet springs and warm, dry summers. Precipitation is spatially and temporally highly variable, with the variation usually decreasing as precipitation increases (MacMahon 1980; Miller et al. 2013). Typical wind conditions associated with the breakdown of the upper ridge/cold front passage pattern are sustained winds of 15 to 30 miles per hour, with gusts of 30 to 50 miles per hour. These are general conditions; local variations and exceptions should be expected. The breakdown can take days or hours and depends on the intensity of the surface cold front and associated upper level trough.

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). Studies indicate that about 90 percent of smoke particles emitted during wildland fires are less than 10 microns in diameter (PM10) and about 90 percent of the PM10 is less than 2.5 microns in diameter (PM2.5) (NWCG 2018b).

PM2.5 is the most significant of the regulated pollutants in relation to fire and the pollutant of most concern for fire managers (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 11**. Prescribed fires in or near nonattainment and maintenance areas may be subject to general conformity rules (NWCG 2018b). 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 CLIMATE

The plants and animals in the Great Basin are adapted to the historic climate of the area; as the climate shifts, these species also need to shift either their location or behavior to survive. Current climate predictions suggest that the Great Basin will become warmer with slightly more precipitation (IPCC 2014). The impact of shifting climate and how sagebrush communities can sequester carbon will be an important function within the Great Basin. Intact sagebrush with perennial grasses and forbs sequesters and holds more carbon than invasive annual grasslands. Carbon storage by shrubs is primarily in deeper soil layers underground (Meyer 2012; Bradley et al. 2006). Additionally, potential climatic shifts may enhance invasion of cheatgrass into resistant ecosystems (Bradley et al. 2016). As a result, the protection of healthy intact ecosystems provides the associated native plants and animals a better opportunity to persist and adapt compared with ecosystems that have already been converted to invasive annual grasses.

3.4 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. Lower precipitation levels and less herbaceous cover promote crust development, making biological soil crusts more prevalent at lower elevations compared to higher elevations. 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 12**. 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 in Analysis Area
California	4,000
Idaho	52,000
Nevada	6,000
Oregon	24,000
Utah	5,000
Washington	0

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).

3.5 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 grasses and perennial grasses 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 grasses	0–5
Moderate invasive annual grasses	6–25
High invasive annual grasses	26+
Low perennial grasses and forb	0–5
Moderate perennial grasses and forb	6–19
High perennial grasses and forb	20+

Source: BLM interdisciplinary team input. The table is derived from the vegetation management protocol developed by the BLM that guides the 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, 2] (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 guides the 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.

[2]Vegetation acres may not be consistent with the total treatment analysis area due to the double-counting of acres where pinyon-juniper areas overlap with other vegetation states.

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

Vegetation State	Percent Cover by Vegetation Type: Percent Shrub Cover	Percent Cover by Vegetation Type: Percent Perennial Grass and Forb Cover	Percent Cover by Vegetation Type: Percent Invasive Annual Grass Cover	Description	Acres (Percent of Analysis Area)
Invasive Annual Grasses	0–5 (low)	0–5 (low)	6+ (moderate to high)	Sites dominated by invasive annual grasses	1,988,000 (5%)
Invasive Annual Grasses and Shrubs	6–25 (low to moderate)	0–5 (low)	6–26 (moderate to high)	Sites dominated by invasive annual grasses and shrubs	3,074,000 (8%)
Perennial Grasses and Forbs1 Perennial Grasses, Forbs, and Shrubs	0–5 (low) to 6+ (intermediate to high)	6+ (moderate to high)	0–5 (low)	Desired condition; intact plant community	1,379,000 (3%) 7,281,000 (19%)
Perennial Grasses and Forbs2	0–5 (low)	6+ (moderate to high)	0–5 (low)	Sites dominated by nonnative perennial grasses and forbs, including nonnative seedings	2,815,000 (3%)
Perennial Grasses, Forbs, and Invasive Annual Grasses	0–5 (low)	6+ (moderate to high)	6+ (moderate to high)	Perennial grassland with invasive annual grasses occupying interspaces	3,274,000 (9%)
Shrubs, Perennial Grasses, Forbs, and Invasive Annual Grasses	6+ (intermediate to high)	6+ (moderate to high)	6+ (moderate to high)	Intact vegetation with invasive annual grasses occupying interspaces	8,029,000 (21%)
Shrub with Depleted Understory	15+ (moderate to high)	0–5 (low)	0–26+ (low to high)	Shrub-dominated vegetation	6,142,000 (16%)

Source: BLM interdisciplinary team input (See **Appendix F)**.

Note: Under these alternatives, vegetation type acres may not be consistent with the total treatment analysis areas due to the double-counting of acres where pinyon-juniper areas overlap with other vegetation types.

[1] with a native perennial grass and forb-dominated layer

[2] with a nonnative perennial grass and forb-dominated layer

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 total analysis area acres within the project area).

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 adjacent to a fuel break (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 in the western US (Barbour and Billings 2000). It now occurs in the northern portion of the project area, in northern California, Idaho, northern Nevada, eastern Oregon, northern Utah, and eastern Washington (Kuchler 1970). However, the sagebrush steppe vegetation type has been converted to farmland or seeded with nonnative perennial grass (e.g., crested wheatgrass) for livestock forage in portions of the project area, and fire suppression, excessive livestock grazing before the passage of the Taylor Grazing Act in 1934, and invasive annual grass expansion (see *Grasslands* below) have been responsible for permanent degradation throughout the project area (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 following vegetation states as summarized in Table 3-4: invasive annual grasses and shrubs; shrubs, perennial grasses, forbs, and invasive annual grasses; and shrubs with depleted understory. Vegetation states within the project area are shown in **Map 3** (**Appendix A**).

At sites in higher elevations sagebrush steppe vegetation is more resistant to cheatgrass invasions and wildfires and more resilient to disturbances due to greater precipitation levels and higher soil moisture content (Chambers et al. 2014b). In these areas, pinyon-juniper woodlands (see Pinyon-Juniper Woodlands below) naturally spread into sagebrush and perennial grass communities. When ecological function of the plant community is balanced, pinyon-juniper encroachment into sagebrush and perennial grass communities varies based on the natural fire return interval. In these transition areas, fire suppression and historic excessive grazing have provided an opportunity for encroaching pinyon-juniper to persist within sagebrush and perennial grass communities.

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). However, similar to the sagebrush steppe, higher elevations within the Great Basin sagebrush type tend to have higher resilience to disturbance, such as wildfire, and resistance to invasive species.

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 most common tall sagebrush groups include 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 most common occurrences of low sagebrush include 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, forbs, and invasive annual grasses vegetation states (**Table 3-4)**. Common native perennial grasses associated with sagebrush communities include but are not limited to 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; NRCS 2006; McAdoo et al. 2016).

Replacing native vegetation with nonnative perennial grasses, such as crested wheatgrass, was a common practice in the western U.S. Crested wheatgrass was first introduced in the late 1800s and early 1900s. Since its introduction it has been planted across millions of acres. It was planted to improve forage for livestock and as part of emergency stabilization and rehabilitation seeding projects. These seeded rangelands often have reduced plant diversity, especially related to forbs and shrubs (Zlatnik 1999; NRCS 2006; McAdoo et al. 2016).

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 grasses and invasive annual grasses and shrubs vegetation states (**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.

Invasive Annual Grasses

In 2016, the BLM estimated that over 79 million acres of BLM-administered lands are infested with invasive plants (DOI 2016). In addition, an estimated 17 million acres in the Great Basin are currently dominated by the invasive annual grass cheatgrass. Cheatgrass has established itself as a component of the broader plant community in an additional 62 million acres (Diamond et al. 2012 *in* Ielmini et al. 2015).

More broadly, invasive plants (invasive annual grasses and others) have been introduced into the US through a variety of pathways. Invasive plants are commonly introduced in contaminated seed, feed grain, hay, straw, and mulch; movement of contaminated equipment across uncontaminated lands; animal fur and fleece; contaminated gravel, roadfill, and topsoil; and from nursery sales as ornamental plants. Invasive plants typically colonize disturbed sites such as campgrounds, trailheads, along roads and trails, unmaintained fuel breaks, landing pads, oil and gas development sites, and wildlife or livestock concentration areas; however, some species may invade relatively undisturbed areas. Once introduced, invasive plants are primarily spread by vehicles, humans, wild horses, livestock, native wildlife, and physical processes like wind and water (BLM 1998).

Pinyon-Juniper Woodlands

When ecological function of the plant community is balanced, there is a natural ebb and flow of pinyon-juniper encroachment within the transition zone that is mitigated by the natural fire return interval. Pinyon-juniper naturally spreads into sagebrush and perennial grass communities. However, 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 southern portions of the project area. This is because the Great Basin sagebrush type in these areas is generally less resistant to wildfires and less resilient to disturbances than the sagebrush steppe type (Chambers et al. 2014b). In the northern portion of the project area, 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 (*See* **Table 3-3**).

Special Status Plants

Special status plants are those listed or proposed for listing under the Endangered Species Act (ESA) and species designated as sensitive by the BLM State Director. According to BLM policy, BLM actions must not adversely affect special status species. For this PEIS, the BLM reviewed the special status species list to determine which species have the potential to occur in the project area based on habitat association (**Appendix J**). This list includes 15 threatened, endangered, candidate, or proposed species, 5 of which have designated or proposed critical habitat. Federally listed species that may occur within the project area but would not be affected by the proposed action or alternatives were excluded. These include species associated with open water, riverine, alpine, or subalpine habitats. **Appendix J** also lists all BLM Sensitive Species with the potential to occur in the treatment area (i.e., species associated with sagebrush, pinyon-juniper, or sagebrush habitats).

Special status plant species occur in a variety of plant communities and physical habitats. Those species considered in this PEIS may be found in one or more of the vegetation states described above, wherein they often occupy unique habitats, sediment types, or microenvironments, such as ash outcrops, playas, and sand dunes (**Appendix J**). The general habitat types that support special status plants in the project area are sagebrush steppe, pinyon-juniper woodlands, and grasslands. Special status species are generally rare and limited in distribution, have specialized habitat requirements, and are subject to one or more threats that warrant their need for listing.

3.6 WILDLIFE

The project area provides habitat for 350 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 3.5**, Vegetation; they reflect the availability of wildlife habitat features in the project area. **Map 13** shows the locations of sagebrush and pinyon-juniper habitats 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 14** for a map and **Table 3-5** for the acreage of big game habitat in the project area.

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 3-5
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

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). Grasslands also provide habitat for small mammals however the number of species is typically lower. Some species such as black-tailed jackrabbit prefer a mosaic of sagebrush and grasslands where they can have cover and winter forage in the sagebrush with spring and summer forage in the grasslands.

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).

Common ravens (*Corvus corax*) is a migratory species that can have significant impacts on sage-grouse nesting success. Raven population abundance in sagebrush ecosystems has increased threefold during the previous four decades (Coates et al. 2016a). Howe et al. (2013) found ravens were most likely to nest near edges of adjoining big sagebrush and land cover types that were associated with direct human disturbance or fire. Ravens frequently depredate nests of species of conservation concern, such as greater sage-grouse (*Centrocercus urophasianus*), and activities that increase edge could increase raven densities and thereby decrease sage-grouse nesting success (Coates et al. 2016b).

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).

Table 3-6
Acres and Condition of Big Game Grassland and Shrubland Type Habitat Within the Analysis Area

Species	Grassland				Shrubland					Other[1]	Total
	Invasive Annual Grasses	Perennial Grasses, Forbs, and Invasive Annual Grasses	Perennial Grasses and Forbs	Total Grassland	Invasive Annual Grasses and Shrubs	Shrubs, Perennial Grasses, Forbs, and Invasive Annual Grasses	Perennial Grasses, Forbs, and Shrubs	Shrubs with Depleted Understory	Total Shrubland		
All Habitat											
Bighorn Sheep	256,000	445,000	214,000	915,000	665,000	1,804,000	1,201,000	836,000	4,506,000	915,000	6,336,000
Elk	543,000	1,232,000	757,000	2,532,000	1,055,000	5,049,000	5,594,000	2,562,000	14,260,000	2,893,000	19,685,000
Prong-horn	2,360,000	3,276,000	1,418,000	7,054,000	3,414,000	7,598,000	5,854,000	5,967,000	22,833,000	3,746,000	33,633,000
Mule Deer	1,924,000	4,119,000	1,492,000	7,535,000	3,646,000	11,260,000	9,134,000	5,984,000	30,024,000	5,811,000	43,371,000
Crucial Winter Range											
Bighorn Sheep	1,000	0	1,000	2,000	1,000	0	0	2,000	3,000	11,000	16,000
Elk	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]
Prong-horn	124,000	142,000	63,000	329,000	167,000	140,000	95,000	220,000	622,000	252,000	1,203,000
Mule Deer	273,000	331,000	141,000	745,000	506,000	715,000	704,000	710,000	3,635,000	1,470,000	4,850,000

Source: BLM GIS 2018
[1]Habitat lacking data on condition
[2] ND = No data. Elk crucial winter range was not mapped in a project area wide data set.

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.

3.7 Special Status Species

Threatened and endangered species and BLM sensitive animal 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 ferruginous 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). 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. Over 90 percent of sage-grouse nesting habitats occur within 6.2 miles of occupied leks (Aldridge and Boyce 2017); thus this distance was used as a basis for the analysis in this PEIS. In the project area, approximately 34,556,000 acres are within a 6.2-mile distance of occupied leks.

The 2015 BLM Greater Sage-Grouse Records of Decision and Approved Resource Management Plan Amendments (BLM 2015), identified specific habitat management areas for the greater sage-grouse, as shown below in **Table 3-7** and **Map 15**.

The bi-state distinct population segment (DPS), a genetically unique meta-population of greater sage-grouse in western Nevada and eastern California, is proposed for listing as threatened under the ESA. There are 654,000 acres of proposed critical habitat for the DPS within the project area (Table 3-7). Habitat use and life history of the DPS is similar to that of the general greater sage-grouse population; therefore, discussion and analysis for the greater sage-grouse encompasses both the general population and the DPS.

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	29,160,1000
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.	20,101,4000
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.	2,674,500
General habitat management areas (GHMAs)	BLM-administered greater sage-grouse habitat that is occupied seasonally or year-round and is outside of PHMAs	13,791,200
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	5,864,400
Buffered leks[2]	Known and occupied leks (communal area for courtship display) buffered by 6.2 miles	34,556,000
Bi-State Critical Habitat	Proposed Critical Habitat for the Bi-State DPS under the ESA	654,000

Source: BLM 2015; 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.

3.8 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 Native American Tribes and other specific social or cultural groups. Cultural resources may have locally or nationally significant heritage and scientific values. Archaeological site significance is defined by criteria set forth in 36 CFR 60.4 based on eligibility to the National Register of Historic Places (NRHP). Tribal resources are usually identified through government-to-government consultation (See Appendix C for a list of applicable authorities relating to consultation) and may be protected according to specific laws and regulations (See Appendix C, including E.O. 13007 and 512 DM 3).

The Great Basin and the Plateau Native American 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, oral and written histories, and ongoing contemporary use by Native Americans. A general culture history of the project area can be found within the Handbook of North American Indians, Volume 11: Great Basin, with peripheral areas covered within Volumes 8: California, 12: Plateau, and 9 and 10: Southwest (Sturtevant, gen. ed., various dates).

Pre-contact archaeological sites of the Great Basin and Plateau culture regions are as varied as the project area itself. The project area includes early Native American sites that date to at least 13,000 years ago and contain evidence for hunting large and small game, fishing, and plant processing (Jenkins et al. 2004). Later site types found show a generally expanding range of subsistence strategies and technologies, including village sites with pit houses and other forms of architecture, seasonal sites, temporary camps, burials, caches, rock art, pinyon nut procurement and wild plant processing sites, and agricultural features. Specific geographic settings such as 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 involved mining, ranching, farming, railroad construction, and trail establishment. Historic-era archaeological sites include 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 would be identified through site- and project- specific archaeological inventories and Tribal consultations. According to the BLM's National Cultural Resources Information Management System, less than 20 percent of the project area has been inventoried to current standards (BLM Instruction Memorandum IM 2018-079), so the affected environment for cultural resources can be described in general terms only until specific fuel breaks locations are defined, and required site- and project-specific inventories and analyses are conducted.

Tribal resources may involve a wide range of overlapping social, economic, traditional, and religious practices. Lands administered by the BLM within the project area continue to be used for subsistence, religious activities, and other cultural purposes with a range of overlapping regulations protecting these uses. Tribes may use these lands to access hunting and fishing rights, water rights, sacred places, and raw materials for uses such as basketry or tool manufacture. "Plants were integral components of American Indian lifeways, and in most instances are still used in religious practices, economic enterprises, and as subjects of cultural transmission for the heritage of future generations" (Halmo et al. 1993, p. 149). Gathering of plant materials remains an important activity within the project area (Couture et al. 1986, Hanes 1982). Access to pinyon pine may be of particular concern to some Tribes (Clemmer 1985). The project area is also likely to include locations of religious and spiritual interest, including ancestral village sites, graves, prayer sites, pictographs, petroglyphs, talus/cache pits, rock cairns and alignments, and other culturally significant sites and landscapes.

The identification and location of Tribal resources and Tribal interests in projects would be determined on a site- and project-specific basis through government-to-government consultation.

3.9 Paleontological Resources

The project area includes paleontological resources preserved in sedimentary geologic units of Precambrian to Pleistocene age and surface exposures or localities. Some resources have experienced loss or destruction due to erosion, weathering, and other impacts at surface exposures and unlawful collections throughout the project area.

The BLM uses the Potential Fossil Yield Classification (PFYC) system (BLM 2016b) 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 would be assessed on a site- and project-specific basis.

3.10 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, target shooting, rock climbing, 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

3.11 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**).

3.12 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 (https://go.usa.gov/xnQcG).

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.

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.

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.

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 fiscal year (FY) 2016, BLM lands in the project area supported a total of 3,960,017 permitted animal unit months of forage allocated to livestock grazing. In 2016, livestock grazing licenses, leases, and permit receipts for the project area was $7,930,906. (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 $1.9 million (USFS 2002). In comparison the FY 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). Both historically and today, annual suppression expenditures increase with the total number of acres burned (Ellison et al. 2015).

During the five-year period between January 2014 and December 2018, 11 separate wildland fires exceeded 100,000 acres in size and burned a combined total of 2.2 million acres within the Great Basin (Idaho, Utah, Nevada, Oregon, California), mostly on BLM-administered federal lands. In addition to the suppression costs of $21.0 million for these fires, the BLM obligated $51.4 million for Emergency Stabilization and Burned-Area Rehabilitation making the total costs $72.4 million to date. This figure will likely increase, because six of those fires occurred in 2017 and 2018, and the BLM continues to support recovery efforts for those fires (BLM 2019 unpublished data).

A major contributor to suppression costs is the use of retardant. Delivering retardant to wildland fires is a reactive response that functions in a similar manner to fuel breaks in that it acts to slow a fire's progress. During the same five-year period (2014-2018), the BLM delivered over 30 million gallons of retardant at a cost of $87.4 million which does not include aircraft costs associated with delivery. For reference, an average large air tanker would use almost 16,000 gallons of retardant to cover a distance of one mile at a total cost of over $77,000. Another consideration is that a retardant drop is a one-time treatment that would not be effective during subsequent fire seasons. Other costs associated with wildfires are related to direct property losses, though no single database tracks such costs. 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).

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**.

The BLM provided funding to the United States Geological Survey (USGS) to review the existing data and provide an initial assessment of fuel breaks:

- their effectiveness in altering fire behavior and reducing area burned
- the ecological costs and benefits
- the need for further research

In its report (Shinneman et al. 2018), USGS indicated that there is very little peer-reviewed literature on the effectiveness or effects of fuel breaks. USGS describes the fuel conditions, fire behavior and fire trends in the Great Basin and reviews the literature related to vegetative treatment/land use authorizations (e.g. roads) that result in habitat alterations similar to fuel breaks. The report clearly identifies problems in the Great Basin resulting from longer fire seasons, more acres burned, and shorter fire return intervals largely due to the invasive annual grass-fire cycle. The report also indicates that current climate models suggest that future conditions could be even more conducive to the annual grass-fire cycle. The report goes on to identify potential impacts of fuel breaks on wildlife including habitat loss and fragmentation, increasing edge effects, potential for ecological traps, and further expansion of invasive annual grasses. The report concludes by recognizing that fuel breaks are an important strategy in the Great Basin to reduce the impacts of wildfire and they recommend that land managers exercise caution and adaptive learning in implementing fuel breaks. In 2019, Shinneman et al. published a peer-reviewed article summarizing the 2018 USGS Report. In it, the authors reaffirm their concerns about the lack of experimental data to identify the effectiveness and the ecological effects of fuel breaks. In their conclusions, they recognize that taking a conservative approach and restricting fuel break implementation until more research is available may not be realistic given the current fire trends in the Great Basin.

The BLM recognizes the potential impacts and risks associated with fuel breaks in the Great Basin. The agency also recognizes that the current fire trends in the Great Basin do not allow agencies to wait for full experimental assessment of the concept before implementing fuel breaks on the ground. As Shinneman et al. recommend in the report and article, the BLM is being cautious and is designing fuel break networks in ways that minimize their potential ecological impacts to wildlife while maximizing their potential to assist firefighters in attacking wildfires:

- Fuel Breaks are proposed along existing roads where some of the fragmentation, edge effects and movement of invasive species may be already occurring.
- Fuel Breaks are placed outside of existing sagebrush in invasive annual communities or in non-native perennial communities where possible.
- Fuel Breaks avoid remnant sagebrush stands where feasible.
- Maintenance of fuel breaks and treatment of noxious weeds is integrated.

The potential effectiveness of fuel breaks in the Great Basin has been questioned primarily because of a misunderstanding about the role of fuel breaks in fire suppression and the perception that they are somehow a new idea. Fuel breaks can be compared to a fire ring around a campfire. Campers put a ring of rocks around a camp fire to contain the flames; firefighters dig a fire line around wildfires. Virtually every aspect of fire suppression relies on the creation of some type of fuel break. Firefighters have controlled thousands of wildfires through the years by interrupting the fuel continuity in front of a wildfire. One of the most limiting resources in fighting a wildfire is time; in hot dry and windy conditions, firefighters rarely have the time they need to construct adequate fire line when a wildfire is headed their way. Hand digging or even bulldozing a fire line is slow when compared to a wildfire moving 30-40 miles per hour. Fuel Breaks are advance fire lines that give firefighters extra time and a safer place to start attacking a wildfire. Fuel breaks can be placed in carefully targeted locations along existing roads to minimize the effects on ecosystem processes and can aid fire suppression efforts (Chambers et al. 2017). See **Appendix K** for examples of how fuel breaks have been used within the Great Basin. This suggests that advance fuel breaks may be less impactful than dozer lines since there is more time and forethought involved in their creation.

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 within the analysis area 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 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 21 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.

Unless otherwise specified below, the cumulative effects analysis area is the fuel breaks project area boundary. The timeframe used for the cumulative effects analysis is the period over which fuel breaks projects would be constructed and maintained, likely several decades.

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.
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: Nevada/California ● Battle Mountain District Office Roadside Fuel Break Hazardous Fuels Reduction Project (30,000-acres of fuel breaks [no mileage given]) ● Granger Canyon Fuel Break Project (4.5 miles of fuel breaks)

Past and Present Projects, Plans, or Actions	
	Idaho ● Bruneau Fuel Breaks Project (128 miles of fuel breaks) ● Paradigm Fuel Break Project (294 miles of fuel breaks) ● Soda Fuel Breaks Project (442 miles of fuel breaks) ● Big Desert Fuel Breaks Project (30 miles of fuel breaks) Oregon/Washington ● Cascade Crest Fuel Breaks Project (852-acres of fuel breaks [no mileage given]) Utah ● Midway Fuel Break Project (7.5 miles of fuel breaks) ● Dry Basin Greenstrip Project (13 miles of fuel breaks) 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, pinyon-juniper removal, and invasive species control have impacted vegetative cover and structure, which in turn influence wildfire risk. These projects have been and continue to be implemented not only by the BLM but also by other federal and state land management agencies and private landowners (sometimes in coordination with federal or state agencies). While this is not a complete list of projects, examples include: Nevada/California ● West Carson Fuels Project (500-acre project area) ● BLM California State Office Hazard Removal and Vegetation Management Project (up to 20,000-acre project area) Idaho ● Goose Creek Sage-Grouse Habitat Restoration Project (49,839-acre project area) ● Sawtooth and Boise National Forests Invasive Species Project (4,437,000-acre project area) ● Bruneau-Owyhee Sage-Grouse Habitat Project (617,000-acre project area) ● Challis and Salmon Sagebrush-Steppe Vegetation Restoration Project (164,300-acres project area) ● Trout Springs Juniper Treatment (13,734-acre project area) ● Pole Creek Juniper Treatment (6,608-acre project area) Oregon/Washington ● Alder Slope Cooperative Partnership (6,546-acre project area) ● South Warner Juniper Removal Project (69,000-acre project area) ● Otis Mountain/Moffet Table Fuels Management Project (22,547-acre project area) ● Northwest Malheur County Greater Sage-Grouse Habitat Restoration Project (258,556-acre project area) Utah ● Glendale Bench Vegetation Management Project (905-acre project area) ● Tom Patterson Prescribed Fire Hazardous Fuel Reduction (23,697-acre

Past and Present Projects, Plans, or Actions	
	project area) ● Hamlin Valley Sagebrush Habitat Restoration (1,376 acres) ● Fremont-Little Valley Mastication and Reseeding (1,350 acres) ● Range Creek Phase I Maintenance (60,184-acre project area) Other aspects of vegetation management plans, include but are not limited to commercial timber harvesting, lop and scatter, prescribed fire, and thinning have also occurred. The exact projects and their site-specific impacts vary throughout the project area, though treatment effects are often similar to those described for this project: improved structure, function, and diversity of plant communities in the ecosystem. Vegetation projects will continue throughout the project area and new projects will be proposed, regardless of decisions made in this PEIS. Existing conditions regarding fuels reduction and rangeland restoration are presented in Chapter 3.
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.
Human Developments	Human developments, such as mining and materials sites, energy projects (e.g., solar), utility projects (e.g., transmission lines), and commercial and residential construction, have removed native habitats, often reducing habitat value for many species. This has contributed to habitat fragmentation, changes in wildlife habitat use patterns, and increase in invasive plant introduction and spread.
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. In addition, the BLM has designated the west-wide energy corridors, which run through the project area. Increasing development and population growth have increased demand and construction of transportation routes within the project area. Use of roads in the project area is a common cause of wildfires because of the increased potential for roadside ignition; road use is also a source of spread for invasive annual grasses. This trend is expected to continue.
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 CFR 4130 [2005]) to guide grazing management.
Agriculture	According to LANDFIRE, approximately 14.6 million acres within the project area (6.5 percent) are categorized as "agriculture." Agricultural practices have historically converted native habitats to cultivation or dairy/cattle operations, often reducing habitat value for many species. Agriculture has contributed to habitat fragmentation, changes in wildlife habitat use patterns, and dust.
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

Past and Present Projects, Plans, or Actions	
	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 ● Uinta Basin Natural Gas Development Project ● Smoky Canyon Phosphate Mine ● Blackfoot Bridge Phosphate Mine
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.

Reasonably Foreseeable Future Projects, Plans, or Actions	
Human Actions	
Fire Suppression	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.
Fuel Break Projects	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:

Reasonably Foreseeable Future Projects, Plans, or Actions	
	● Tri-State Fuel Breaks Project (1,539 miles of fuel breaks) ● Jarbidge Wildfire Fuel Breaks (160 miles of fuel breaks)
Vegetation Management Activities	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 Fuels Reduction and Rangeland Restoration in the Great Basin (38-million-acre analysis area) ● BLM California Hazard Removal and Vegetation Management Project (up to 20,000-acre project area) ● Twin Falls District Vegetation Treatment for Noxious and Invasive Weeds (3.9-million-acre project area) ● Sage Hen Flats Fuels Project (9,000-acre project area)
Agriculture	The conversion of native habitats to cultivation or dairy/cattle operations is expected to slow or possibly be reduced. According to the USDA's 2017 Census of Agriculture (USDA 2019), the acres of land in farms have decreased in most states in the project area.
Human Developments, Roads, and Rights-of-Way	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 and further spread invasive annual grasses.
Mining and Oil/Gas Leasing	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 ● Dairy Syncline Phosphate Mine ● Caldwell Canyon Phosphate Mine
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

Reasonably Foreseeable Future Projects, Plans, or Actions	
	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 numbers of fuel break project locations are not known; however, general locations where fuel breaks would potentially be created and maintained 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.
- Fuel breaks would be maintained appropriately to ensure they maintain their efficacy.
- 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	Combination of brown strips and mowed fuel breaks along Maintenance Level 5 roads.	A combination of brown strips, f mowed/targeted grazing fuel breaks, and green strips along Maintenance Level 3 and	A combination of brown strips, mowed/targeted grazing fuel breaks, and green strips could be constructed along

Fuel Break Characteristics	Alternative B	Alternative C	Alternative D
	No sagebrush would be removed and no fuel breaks would be constructed in highly resistant and resilient sites	5 roads and BLM-administered ROWs could be constructed, including in sagebrush communities and in some highly resistant and resilient sites	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. Systems of fuel breaks reduce 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. More detailed information regarding flame lengths and fuel break widths is in **Appendices H** and **L**.

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 (Fuel Models GR1, GR2, GR4, GR7)	1-3 feet	3-63	96-288
Invasive annual grasses and shrubs (Fuel Models GR2, GR4, GR7, GS1, GS 2, and SH1)	1-3 feet	11-63	96-288

Original Vegetation State and Fuel Model[1]	Vegetation Height	Approximate Flame Length (Feet)[2]	Minimum Width of Fuel Break (Feet)[3]
Perennial grasses, forbs, and invasive annual grasses (Fuel Models GR2, GR4, and GR7)	1-3 feet	11-63	96-288
Perennial grasses and forbs (Fuel Models GR1 and GR2)	<1 foot – 1 foot	3-11.5	96
Shrubs, perennial grasses, and forbs (Fuel Models GS1, GS2, SH1, and SH5)	1-3 feet or 4-6 feet	8-38	96-288 or 384-576[4]
Shrubs, perennial grasses, forbs, and invasive annual grasses (Fuel 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 (Fuel 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 (Fuel Models NB9, GR1 and GS1)	0 feet - 1 foot	0-11	0-96
Phase I pinyon-juniper, unburned (Fuel 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 (Fuel Models SH1 and TU1)[6]	1 foot or 10-30 feet	8 or 65+[7]	96-288[5]
Phase III pinyon-juniper (Fuel 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% herbaceous/60% woody live moisture) and assuming a 20 percent slope and a 20 miles/hour midflame wind speed (see **Appendix H-3, Figures H-1-H-3**).

[3] See **Appendix L** for minimum 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 width 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 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 where a 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 H, Section H.3)**.

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, engines, and retardant aircraft to control as described in **Table H-2**. 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 **Section H.3** Fire Behavior Figures H-1-H-3), 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 methods 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 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 grows and 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 continue 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.

Systems 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, subsequent burned areas, and associated demand on agency fire personnel.

4.2.3 Effects from Alternative A

Under Alternative A, the existing 5,126 miles of fuel breaks on BLM-administered lands would have the potential to modify fire behavior and provide anchor points for suppression where fires encounter them (see **Appendix H.3** and **Table 4-1**). The BLM would also implement new fuel breaks on a site-specific basis throughout the project area. Fuel break success would depend on the fuel break width and type, maintenance condition, firefighter access and availability, underlying and surrounding fuel models, vegetation and soil moisture content, and weather conditions. On average, fires encountering existing fuel breaks would be effectively constrained nearly half of the time. Combined with suppression, fuel break effectiveness would be more than 50 percent (see Section 3.1; Syphard et al. 2011). However, without a programmatic environmental analysis, new fuel breaks would take longer to implement. The result would be an ongoing challenge to establish systems of fuel breaks to effectively modify wildfire behavior and provide systems of anchor points from which to allow for the safe engagement of firefighters and to initiate direct attack.

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 trends would likely continue as described in **Section 3.1**, Fire and Fuels.

In areas with existing mowed fuel breaks, the fuel bed would be less flammable, while areas with green strip fuel breaks would have higher moisture content (Agee et al. 2000). Rates of spread in these areas would be more likely to remain below the thresholds in **Table H-1** in **Appendix H** compared with areas without fuel breaks. 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. Areas along highways without brown strip fuel breaks could experience new ignitions and subsequent fire spread. Wildfire flame lengths in taller vegetation (see **Table 4-3** and **Appendix H**) would prevent firefighters from safely engaging in direct attack. Where topography precludes direct attack, in the absence of fuel breaks, fires would burn unchecked until encountering less flammable fuels, modified terrain or weather conditions, or eventual suppression via direct attack.

Overall, under Alternative A, the number of fire starts, acres burned, and associated annual agency spending on suppression would continue to increase (see **Section 3.12**). Without corresponding increases in staffing, higher suppression costs and demand on personnel would increasingly limit the availability of emergency personnel to respond to simultaneous fires and other hazards and emergencies (see **Section 4.13**).

4.2.4 Effects Common to All Action Alternatives

Under the action alternatives (Alternatives B, C, and D), a plan to implement systems 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 and maintained 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*.

Systems 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, compared with Alternative A, new fuel breaks under Alternative B would increase the likelihood for fires to burn fewer acres, while improving safe direct attack opportunities. Brown strips along Maintenance Level 5 roadways would reduce the potential for new fires and associated demand on suppression resources. However, Alternative B would limit the BLM's ability to create systems 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 a fuel break. 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, systems of multiple types of fuel breaks would be created and maintained 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 fire 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 regional fuel break systems 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 and maintaining fuel breaks along roads and BLM-administered ROWs would increase the potential for interconnected, comprehensive fuel break systems that would increase the likelihood for fires to burn fewer acres compared with Alternative A, while improving safe direct attack opportunities. Where fuel breaks effectively constrain fires, there would be a reduced demand on suppression resources and associated reduction in the overall suppression costs for the fire. Excluding Maintenance Level 1 roads from fuel break construction under Alternative C would limit areas available for safe firefighter engagement. There would be the continued potential for unmodified fire behavior in remote locations where only 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. A treatment area that includes highly resistant and resilient sites, Maintenance Level 1, 3, and 5 roads, and BLM-administered ROWs would allow for comprehensive and interconnected systems of fuel breaks to be constructed and provide more flexibility than the other alternatives 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, 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. Compared with Alternative A, firefighters would be more capable of responding to simultaneous fires, which would further increase fuel break effectiveness. The higher likelihood of a fire encountering a fuel break and being successfully constrained would contribute to lower annual suppression costs and increase the availability of emergency personnel for other hazards and emergencies.

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

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 5,841 miles of fuel breaks, including 5,126 miles on BLM-administered lands; 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 and 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. Treatments implemented under the Fuels Reduction and Rangeland Restoration PEIS in the Great Basin and this PEIS would collectively slow the spread of wildfire and improve suppression opportunities by reducing the abundance and continuity of fuels and providing anchor points for suppression. Modified fire behavior and suppression access, which are important factors in containing a wildfire (Agee et al. 2000 and Syphard et al. 2011), would improve the likelihood of fewer overall acres burning and lower costs of suppression.

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 and resilient to wildfire and invasive annual grass establishment would cumulatively decrease the potential 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 and suppression resources 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 and maintain 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 provide opportunities to modify fire behavior and suppress fires through direct attack. This would reduce the number of acres burned and 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 and maintain 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 systems of fuel breaks under Alternative D, combined with the Fuels Reduction and Rangeland Restoration PEIS in the Great Basin, would cumulatively improve suppression opportunities and the potential for fires to encounter modified vegetation conditions with associated benefits on fire behavior. Alternative D would result in improved ecological site conditions, a longer fire return interval, and a shift in vegetation toward desired conditions, while improving firefighter safety and reducing the demand on suppression resources.

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 pollutant of concern would be $PM_{2.5}$ (NWCG 2018b).

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 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. The most significant pollutant of concern is $PM_{2.5}$ (NWCG 2018b).

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 pollutants and hazardous pollutants, but at a lower level, compared with fuel break construction. Over the long term, systems of fuel breaks regionwide 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, primarily for $PM_{2.5}$ (NWCG 2018b). 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 (see **Appendix D**, Design Feature 17). 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).

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 2016a, 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, systems 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 Map 10 and Table 4-1); however, without a programmatic approach, effects as described in Section 4.1.3, would occur.

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 locations.

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**. 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 and maintained 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 15-20). 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 and maintained.

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 systems 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. 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} (see **Map 9**).

Cumulative effects common to all action alternatives would occur from constructing and maintaining systems 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 from smoke 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 systems 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 systems 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 lengthen 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 systems 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 effective systems of fuel breaks that could in turn potentially reduce the intensity and severity of wildfire over the long term.

4.4 CLIMATE

4.4.1 Assumptions

- Nothing proposed in the action alternatives will measurably slow or accelerate climate change.
- Current climate change projections may add to the competitive edge of cheatgrass in the Great Basin.
- Healthy intact native vegetative communities have the best opportunity to adapt to a changing climate.
- Shortened fire return interval and increases in invasive annual grasses inhibit a native communities' ability to adapt to climate change.
- Carbon sequestration is higher in intact native systems compared with invasive annual grasslands with a shortened fire return interval.
- Changes in climate may alter the growing conditions of a specific site and make it more difficult for native vegetation to reestablish.

4.4.2 Nature and Type of Effects

Creating and maintaining fuel breaks would generally reduce the carbon sequestration within the footprint of the fuel breaks. Any reduction in size of wildfires would reduce or prevent additional carbon release and maintain the carbon sequestration ability of the vegetative community in between fuel breaks.

4.5 SOIL RESOURCES

4.5.1 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). Since fuel breaks would be sited in disturbed areas (see design feature 7), there would be a low likelihood for disturbance to biological soil crusts.

4.5.2 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 4.6, Vegetation**).

Over the long term, systems 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 are 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 3.4**). 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). Initially, some soil nutrients would be lost to volatization, while nutrient levels, soil pH, and organic matter would increase in soil after exposure to fire several years following treatment (Rau et al. 2008). Increased soil pH toward less acidic conditions would be less favorable to 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 2016a). Short-term impacts on biological soil crusts are unlikely because they are present in the open spaces between vegetation (see **Section 3.4**). 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 2016a). 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.

4.5.3 Effects from Alternative A

Under Alternative A, systems 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 **Map 10** and **Table 4-1**); however, without a programmatic approach, effects as described in **Section 4.1.3**, would occur.

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.

4.5.4 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*.

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

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 4.6.4**). 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.

Design Features 1-3, 6-8, and 36-41 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.

4.5.5 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 16, 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 Feature 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 and maintain more miles of fuel breaks; however, these impacts would be minimized using Design Features 16 and 21-24 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).

4.5.6 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, 45,000 acres 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 and maintaining systems 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.

4.5.7 Cumulative Effects

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 3.4**).

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.

Existing 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.

All action alternatives would result in the construction and maintenance of fuel breaks systems. 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.

4.6 VEGETATION

4.6.1 Assumptions

- Desired vegetation would vary by fuel break type and desired fuel model.
- Mechanical treatment of shrub and pinyon-juniper 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 perennial 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.
- If unfenced, targeted grazing would affect areas within the graduated use buffer area, which extends up to ½-mile from the edge of the fuel break (see **Section D.1** in **Appendix D**).
- 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.

4.6.2 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 changes to flame length and potentially rates of spread, 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, regularly maintained, mowed or targeted grazing fuel breaks could reduce the rate of wildfire spread and subsequent amount of vegetation burned. However, without 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, including the potential for increased cover of invasive annual grasses in the short term. 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. Long-term monitoring and maintenance of fuel breaks would reduce the magnitude of the effects from invasive annual grass increase. The effects specific to each treatment method are described below.

Localized changes to the vegetation state in fuel breaks could also affect plant pollinator populations, both in and outside of fuel breaks. In fuel breaks, direct effects would occur, while indirect effects could occur outside of fuel breaks. As above, the specific effects would vary based on existing pollinator habitat quality, and the type of fuel break and treatment method proposed. Indirectly, design features (**Appendix D**) or other measures may reduce the intensity of direct effects on pollinators, as 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 or pinyon-juniper canopy in fuel breaks 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 or pinyon-juniper canopy in the fuel break could also release invasive annual grasses that are present in the 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 impact.

Manual treatments would generally be used to create and maintain fuel breaks in vegetation states containing a shrub or pinyon-juniper component. These include the following vegetation states: perennial grasses, forbs, and shrubs; shrubs, perennial grasses, forbs, and 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, existing vegetation in the fuel break would be reduced 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 these 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 or pinyon-juniper overstory in the fuel break using mechanical treatments could release desired perennial grasses and forbs in the understory (Monsen et al. 2004). Like manual treatments, mechanical treatments may also indirectly temporarily increase 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 temporary release of invasive annual grasses.

Biological soil crusts are important to the long-term health of the vegetative community. When they are removed or fragmented through mechanical treatment, the effects to the plant community may be more intense (USFS 2017) because biological soil crusts stabilize soil, reduce or eliminate erosion, retain soil moisture, and shelter and increase germination success for seeds (see **Section 4.5**).

Vegetation removal and associated soil disturbance during mechanical treatments would directly remove nesting habitat (e.g., for ground-nesting bees) and nectar sources in the fuel break footprint. Individual pollinators may be crushed or injured during treatments. Pollinators outside of the fuel break footprint would experience reduced availability and cover of some nectar sources and potential nesting habitat in the fuel break footprint. However, given the discrete and limited size of the fuel break footprint compared with nectar sources and potential nesting habitat in surrounding areas, this effect would be relatively minor.

Depending on the vegetation state and the prioritization as described in **Table 2-2**, a variety of mechanical treatments may be necessary to create and maintain brown strip, green strip, and mowed fuel breaks **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 help to more quickly move vegetation in the fuel break toward desired conditions in the long term by reducing the potential for increases in nonnative, invasive plant cover in fuel breaks.

Harrowing and imprinting would reduce vegetation cover 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 or pinyon-juniper 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 help to more quickly move vegetation toward desired conditions in the long term by reducing the potential for increases in nonnative, invasive plant cover in fuel breaks.

Chaining would reduce shrub or pinyon-juniper cover, prepare the seedbed, and cover broadcast seed in the fuel break. By reducing shrub or pinyon-juniper 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. This would help to more quickly move vegetation in the fuel break toward desired conditions in the long term by reducing the potential for increases in nonnative, invasive plant cover in fuel breaks.

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 or pinyon-juniper 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.3**, **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 or pinyon-juniper 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. This would help to more quickly move vegetation in the fuel break toward desired conditions in the long term by reducing the potential for increases in nonnative, invasive plant cover in fuel breaks.

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 increase 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 increase percent cover of desired species in the fuel break. Revegetation would also help to decrease potential invasive annual grass germination in fuel breaks by providing competition in the form of desired perennial grasses and forbs and thus reducing available resources and growing space. This would reduce the potential for invasive annual grasses 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 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, or 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 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 increase the percent cover of desired vegetation in the fuel break, and help to more quickly move vegetation in the fuel break toward desired conditions.

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 its intensity would depend on the seeding method proposed (e.g., drill seeding versus broadcast seeding), the species seeded, and existing vegetation conditions in adjacent areas.

During revegetation treatments, the BLM would follow BLM Instruction Memorandum No. 2016-013, *Managing for Pollinators on Public Lands*, which would require incorporating at least one pollinator-friendly native plant species in all fuels projects that include seeding. This would reduce the loss of pollinator nectar sources in fuel break footprints.

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 reducing the suitability of growing conditions for future vegetation (Busse et al. 2010, Busse et al. 2013). This effect is unlikely to result from 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 damage to desired vegetation.

Establishing fire lines during certain prescribed fire operations would directly remove 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.

As described under *Effects from Mechanical Treatments*, biological soil crusts (see **Section 4.5**, Soils) help to maintain vegetation condition in the long term. Biological soil 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 biological soil crusts if they are present in the fuel break. However, local, impacts would be offset in the long term by larger-scale conservation of biological soil crusts in adjacent sagebrush communities as a result of 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 burning 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).

Pollinator response to fire, including prescribed fire, would vary by pollinator species. Direct injury or mortality of pollinators in the fuel break footprint could occur if prescribed fire is conducted during sensitive pollinator life cycle periods, such as the egg or larval stage when individuals are immobile. Design Feature 16 (**Appendix D**), burning debris piles when soils are wet or frozen, is consistent with prescribed fire best practices for pollinators on western rangelands (Xerces 2018), including dormant season burning and avoiding high-intensity fire. This measure would reduce or avoid direct pollinator injury or mortality from prescribed fire during sensitive pollinator life cycle periods.

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 to 4-76) and the 2016 Final PEIS for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States (BLM 2016a, p. 4-25 to 4-38).

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, *Impacts Common to All Treatments*). 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 2016a, 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 directly kill existing target vegetation in the fuel breaks. Chemical treatments could also periodically remove reestablishing vegetation in fuel breaks to maintain their effectiveness and achieve project objectives over the long term.

The effects of chemical treatments on pollinators would depend on the chemical used, treatment timing, and plant and pollinator species affected. As described in BLM 2007 (pp. 4-101 to 4-118) and BLM 2016a (pp. 4-39 to 4-41), some chemical formulations can be toxic to pollinators; acute or chronic exposure to these formulations could result in mortality and reduced population sizes, indirectly reducing 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, such as using lowest effective rates, applying application buffers, and preventing drift, would minimize or avoid these impacts. These measures are consistent with best practices for pollinators on western rangelands (Xerces 2018), such as using formulations that are least toxic to pollinators, using the lowest effective rates, timing application to avoid pollinator exposure, incorporating application buffers, and preventing drift.

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.

For example, spring season targeted grazing of invasive annual grasses, prior to the perennial grass active growth period, can effectively suppress invasive annual grasses (Strand et al. 2014). In areas where cheatgrass is already established, the amount of carryover above-ground biomass can influence cheatgrass cover the following year, since cheatgrass has been shown to germinate readily in residual fall litter. Fall targeted grazing treatments to reduce litter may be used to further reduce spring germination (Schmelzer et al. 2014, Foster et al. 2015). Thus, spring season targeted grazing of invasive annual grasses, coupled with fall season litter removal may reduce invasive annual grass density over time.

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 in 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 4.5**, Soils, may be more intense when such features as biological soil crusts (USFS 2017) are present. This is because biological soil 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 because biological soil crusts are not likely to be present.

Implementing design features that reduce impacts from targeted grazing, including a targeted grazing plan, would minimize impacts on nontarget species (see **Appendix D**). If unfenced, targeted grazing would affect areas within the graduated use buffer area, which extends up to ½-mile from the edge of the fuel break (see **Section D.1** in **Appendix D**).

Targeted grazing would reduce aboveground biomass in the fuel break footprint, altering pollinator habitat conditions there. Since targeted species would mainly be invasive annual and nonnative perennial grasses in previously disturbed vegetation states, reductions in these species would not typically decrease pollinator habitat quality or nectar sources.

4.6.3 Effects from Alternative A

Under Alternative A, systems 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 **Map 10** and **Table 4-1**); however, without a programmatic approach, effects as described in **Section 4.1.3**, would occur.

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**.

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 locations. Accordingly, 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 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.

4.6.4 Effects from Alternative B

Where used, manual and mechanical treatments would generally affect 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. Under Alternative B, creation and maintenance of fuel breaks would disturb up to 529,000 acres; this represents about 1.4 percent of the acres within the sagebrush analysis area. Fuel breaks would be placed along existing roads where most vegetation communities are degraded and fragmented to some degree. Fuel breaks would not affect all of the acres as described in **Section 4.1.1**.

Brown strips would directly remove vegetation in the fuel break in the short term, which would prevent fire starts in the fuel break footprint and dissipate flame lengths that facilitate suppression when fires move into the fuel break. 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 or wind driven events 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 and 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, forbs, and shrubs	82,000(17%)	139,000 (18%)	219,000 (21%)
Perennial grasses, forbs, and invasive annual grasses	67,000 (14%)	95,000 (13%)	118,000 (11%)
Shrubs, perennial grasses, forbs, and 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.

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.

Use of only manual and mechanical treatments to create and maintain fuel breaks may limit the number of new fuel breaks constructed 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 or pinyon-juniper overstory may release and facilitate invasive annual species growth in the short term. Chemical treatments are the most efficient method to control invasive annual species in this situation; however, since Alternative B disallows follow-up chemical treatments, 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). Revegetation with native plant materials in these areas without a pre- and/or post-chemical treatment on invasive annual grasses would likely result in the treatment area being reinvaded; therefore, the rate of fire spread in these treatment areas would be only temporarily reduced.

Because highly resistant and resilient sites (Chambers et al. 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 systems 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 fuel break systems. 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 25, 26, and 29), repeated mowing (Design Feature 27), using locally adapted or genetically appropriate seed species (Design Feature 28), and minimizing activities in erosive soils (Design Feature 36) (**Appendix D**).

4.6.5 Effects from Alternative C

The use of manual and mechanical treatments would have effects similar to those described under Alternative B but over a larger area, since there would be more potential treatment locations under this alternative such as treatments within high resistance and resilience areas and along both maintenance level 3 and 5 roads (see **Table 2-3**). Under Alternative C, creation and maintenance of fuel breaks would disturb up to 667,000 acres; this represents about 1.8 percent of the acres within the sagebrush analysis area. Fuel breaks would be placed along existing roads where most vegetation communities are degraded and fragmented to some degree. he direct effects of prescribed fire, targeted grazing, and chemical treatments on vegetation would be as described in *Nature and Type of Effects*.

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.

Treatments to create green strips could increase the potential for initial release of invasive annual grasses (Davies et al. 2011a) that are part of the pre-project vegetation state. However, this effect would be reduced over time as seeded or planted perennial vegetation in the green strip becomes established and competes with invasive annual grasses for resources. Over time invasive annual grasses and the subsequent fine fuel loading would decrease and fuel break efficacy would be enhanced.

Nonnative plants could only be used for reseeding outside of highly resistant and resilient sites when conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) are met. This could improve revegetation success, facilitate fuel break function, and reduce the likelihood for nonnative annual invasion, particularly in fuel breaks with an existing invasive annual grass component 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.

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 systems 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 reduce the time needed to establish fuel breaks and allow for more fuel breaks to be created and maintained. For example, use of chemical treatments after manual or mechanical treatments would facilitate establishment of fuel breaks in areas 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 21–24) and prescribed fire (Design Features 15–20) (**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 2016a, Table 2-5).

4.6.6 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; however, a larger area would be available for fuel break creation and maintenance. Under Alternative D, creation and maintenance of fuel breaks would disturb up to 667,000 acres; this represents about 1.8 percent of the acres within the sagebrush analysis area. Fuel breaks would be placed along existing roads where most vegetation communities are degraded and fragmented to some degree. Design features 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, when 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 vegetation removal and potential soil disturbance during fuel break construction in these areas would likely increase, compared with the other action alternatives. Opportunity to create and maintain fuel breaks in highly resistant and resilient areas could decrease the vegetation that burns by wildfire, thereby enhancing long-term conservation of these areas. Further, design features described for Alternatives B and C would still apply, reducing the extent and intensity of impacts from fuel break construction and maintenance in these areas.

Over the long term, creating and maintaining systems of fuel breaks under Alternative D 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 than Alternatives B and C. Alternative D provides the most flexibility to choose the appropriate combination of vegetation treatments to maximize fuel break effectiveness and minimize impacts outside of fuel breaks and maintenance requirements.

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.

4.6.7 Cumulative Effects

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**. In general, human actions and natural processes have affected vegetation state conditions, including the resistance and resilience of some areas. The effects from these human actions and natural processes are briefly discussed below.

The size and frequency of natural and human-caused wildfires have increased throughout the project area in recent years, reducing the extent of sagebrush communities 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 like wildfire, 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 degree of invasion depends in part on site resistance to invasive annual grasses, and site resiliency from disturbance such as wildfire.

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

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 and maintained 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 acres burned by wildfire, 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 increased species diversity and structural complexity and reduced noxious weed and invasive plant species prevalence in degraded vegetation communities. In turn, these projects have increased vegetation community resistance to invasion and reduced wildfire risk and thereby reduced the potential for impacts from high-intensity wildfires. These projects have also increased vegetation community resiliency from future disturbance. 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 systems of fuel breaks would protect rehabilitated and recovering vegetation under these projects.

Further, existing 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.

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). This has generally resulted in vegetation communities with lower resistance to invasion, and resilience from disturbance. 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.

Vegetation in the project area has been removed and fragmented by past and present development, such as 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, surface-disturbing developments have facilitated noxious weed and invasive plant spread, decreasing vegetation state resilience. In some cases, development can indirectly affect vegetation on a larger scale. For instance, roadside wildfire ignitions can cause landscape-scale effects 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. 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 systems 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 25, 26, and 29).

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 21–24) and prescribed fire (Design Features 15–20) (**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.

4.7 WILDLIFE

4.7.1 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**.**

4.7.2 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 cause behavioral alterations, 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 and the level of disturbance may be reduced for some species through the application of designed features intended to minimize these types of effects. 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 relative to larger roads, 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 and fragmentation. For example, vegetation reductions could modify habitat by decreasing habitat features such as forage and cover for some species. Fuel breaks built along existing roads would increase fragmentation by widening the current linear features. This could further limit movement or migration of some wildlife species which prefer to stay hidden under the cover of vegetation and which require larger patches of shrubs (Hanser and Huntly 2006). However, not all species would be sensitive to gaps in shrub cover or unvegetated areas and those that are limited are not expected to be numerous since great basin wildlife are already adapted to habitat types which typically have intermediate disturbance frequencies (which also create areas with gaps in shrub cover). The magnitude of the gap in cover would depend on fuel break width, pre-treatment vegetation and road width. Areas with heavier road use, wider fuel breaks and which break up smaller residual shrub patches in an already fragmented landscape may have the greatest effects. Buffers for special status species or for other resource protection purposes which create pockets of untreated vegetation within fuel breaks may provide bridges for some species which provide a covered corridor for them to cross fuel breaks.

Habitat effects would vary depending on the type of fuel break, current vegetation state, and resulting conditions. Effects may be greatest where fuel breaks are constructed along lightly traveled roads (Maintenance Level 1) because these areas may serve as higher quality habitat relative to roads with higher traffic volume. 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. 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 (Dasmann et al. 1967).

Some wildlife species may already use existing roads as movement corridors. Widening corridors through the creation and maintenance of fuel breaks may improve movement conditions by increasing the distance between usable habitat and the roads and reducing chances of collision with vehicles. However, widened corridors may also enhance hunting opportunities for terrestrial predators (Shinneman et al. 2019). Some fuel breaks may serve as browse corridors or "browseways," which may provide high forage quality for big game species relative to surrounding areas (Dasmann et al. 1967). Depending on the species and type of fuel break (**Section 2.5**), the habitat quality provided by fuel breaks would vary.

Although existing roads have already created sharp transitions with surrounding habitats (i.e., edge habitat), fuel breaks may increase the edge habitat by widening it. Associated edge effects may include changes in species composition and abundance, environmental gradients, and biotic interactions (e.g., predation) as well as increased parasitism and competition (Shinneman et al. 2018). Effects would vary with the type of fuel break and wildlife species. Some species that forage in open habitats (e.g., horned larks and burrowing owls) but use adjacent shrubs as cover may be attracted to transition areas between sagebrush stands and sagebrush removal areas (McAdoo et al., 2004; Beck et al. 2012), while others, such as pygmy rabbits, may avoid habitat edges that increase the presence of competitors (Pierce et al. 2011).

Brown strips are devoid of vegetation and thus would provide little or 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. Given their narrow width, the contribution of brown strips to habitat fragmentation would be less relative to wider fuel break types. More intensive maintenance would be required for brown strips, which could cause greater levels of disturbance to wildlife than wider fuel breaks.

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, including habitat fragmentation, than with brown strips.

Over time, increased fire suppression opportunities would reduce the total number of acres burned. 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 2016a). Potential short-term impacts would be reduced through the implementation of standard operating procedures (BLM 2007, Table 2-8) and mitigation measures (BLM 2016a, 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). As described under **Section 4.6**, Vegetation, following standard operating procedures and mitigation measures described in the PEISs as well as best practices for pollinators on western rangelands (Xerces 2018) would minimize or prevent negative impacts or reduce impact intensity. 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.

4.7.3 Effects from Alternative A

Under Alternative A, systems 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; however, without a programmatic approach, effects as described in **Section 4.1.3** would occur.

Areas without fuel breaks would likely continue to experience unchecked fire spread, with corresponding upward trends in acres burned per fire and overall total annual acres burned in the project area. Because there would be fewer new fuel breaks along highways, there could also be new ignitions and subsequent fire spread in those locations. Accordingly, wildfires and the resultant conversion to cheatgrass and other invasive annual grasses would likely continue at a similar rate. Wildlife population sizes and distributions are expected to decline, especially at lower elevations where fire and invasive annual grass is reducing native plant diversity and species habitat associations are expected to shift towards species which prefer grasslands or are generalists. See **Section 3.1**, Fire and Fuels, and **Section 3.5**, Vegetation, for a description of current habitat trends as they relate to vegetation and wildfire.

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 the abundance of grassland species and decrease the site's overall biodiversity (Coates et al. 2016). Data shows 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 nonnative herbaceous habitat types. Repeated fires would continue to reduce habitat diversity, resulting in reduced bird species diversity.

4.7.4 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. This represents the maximum acres of habitat types available for treatment, but the actual area treated would be less due to limitations on treatment areas and because fuel breaks would be spread out across all habitat. 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 4.6**, 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 36 and 37). Treatments in greater sage-grouse, big game, migratory bird, and raptor habitat would be subject to temporal and spatial restrictions (Design Features 42–57). 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 46).

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, pronghorn, and elk 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
Elk			
Crucial winter range	ND[1]	ND[1]	ND[1]
All habitat types	190,000	336,000	505,000

Source: BLM GIS 2019

[1] ND = No data. Elk crucial winter range was not mapped in a project-area-wide data set.

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 48-50 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 51 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*.

4.7.5 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 Alternative A 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 and maintained, 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 A (**Table 4-6**, above). 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 2.2.7** 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 and maintained in highly resistant and resilient sites either in high fire probability areas or if greater sage-grouse adaptive management triggers have been tripped, there would be a greater potential for short-term impacts on wildlife that use these areas; however, design features intended to protect greater sage-grouse and sagebrush habitat would ensure that the amount of sagebrush removed would not reduce habitat functionality for other sagebrush-dependent wildlife species. An example of this is ensuring that sagebrush treatment levels do not lead to a soft or hard adaptive management trigger trip (Design Feature 47 in **Appendix D**).

Additional design features related to grazing, prescribed fire, and chemical treatments would reduce impacts on wildlife (e.g., Design Features 21-24, 15-20, and 14 in **Appendix D**). For example, a targeted grazing plan would be completed before grazing begins (Design Feature 21 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 systems 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 nonnative invasive 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 maintained, 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). Not more than 1 percent of any big game species habitat is being analyzed and less would be treated by fuel break development.

The use of targeted grazing as a treatment method could 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 21 and 49 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 48-50 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 targeted 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*.

4.7.6 Effects from Alternative D

General Wildlife

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 and maintained 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, No more than 2 percent of total big game habitat 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 human disturbance, 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 could have fuel breaks, 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*.

4.7.7 Cumulative Effects

Cumulative Baseline

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.

Ongoing 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 in localized areas. 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 in localized areas 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 repeated wildfires. The creation and maintenance of fuel break systems 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. Fuel break projects based on this PEIS would not likely overlap existing fuel breaks or those included in proposed or in-progress projects unless methods included in this PEIS could augment project design and efficiency. In cases where existing or proposed fuel breaks are meeting goals and objectives, the scale of effects from this PEIS would be reduced. For example, over 30,000 acres of fuel breaks in Nevada and over 22,390 acres plus an additional 582 miles of fuel breaks in Idaho (**Table 4-1)** have been or are proposed to be implemented; if project objectives are met, then a large area of sagebrush habitat would not require treatments under this PEIS.

The BLM is developing a Great Basin-wide Fuels Reduction and Rangeland Restoration PEIS that is intended to return areas to their natural vegetation state, reduce invasive annual grasses, and allow for natural fire return intervals. Ultimately, this would increase habitat resistance to invasive plant species and resilience to disturbances such as wildfire. The synergistic 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 and maintenance 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 fuel break systems 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 action 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 action 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 fuel break systems 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, 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, systems 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.

4.8 SPECIAL STATUS SPECIES

4.8.1 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 4.2,** 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.

4.8.2 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 4.6.2.** 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 would reduce the total number of acres burned. 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 4.6.2**. 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 4.6.2** 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 4.6**, 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 4.6**, 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 2.2.7** 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 4.6**, 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

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, p. 4-44 to 4-76) and the 2016 Final PEIS for Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on BLM Lands in 17 Western States (BLM 2016a, p. 4-25 to 4-38). Effects are also summarized in **Section 4.6**, Vegetation.

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]). As described under **Section 4.6**, Vegetation, following standard operating procedures and mitigation measures described in the PEISs as well as best practices for pollinators on western rangelands (Xerces 2018) would minimize or prevent negative impacts or reduce intensity of impacts on pollinators.

Off-site impacts from chemical treatments are unlikely, as applicators must adhere to label restrictions that reduce the potential for off-site drift. 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 21 in **Appendix D**).

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 4.7**; however, such impacts can have a magnified effect on special status species, given their existing vulnerability. The Biological Assessment (BA) contains analysis for species and habitats protected under the ESA. The BA analyses all threatened, endangered, proposed, or candidate species that would potentially be affected by the analysis. Species proposed for listing under the ESA and non-essential experimental populations whose continued existence is not likely to be jeopardized by the proposed action, were excluded from detailed analysis. Proposed critical habitats that are not likely to be adversely modified by the proposed action were also excluded. These are the bi-state greater sage-grouse DPS and proposed critical habitat, the black-footed ferret, and the California condor (See Appendix B of the BA). Adhering to conservation measures identified in the BA would avoid or reduce impacts to ESA-listed species. Design feature 43 would ensure that the BLM implements restrictions and conservation strategies for special status species, including federally listed, proposed, candidate, and BLM sensitive species, as contained in approved recovery and conservation plans, cooperative agreements, and other instruments in whose development the BLM has participated. Design features from the Greater sage-grouse RMP/LUPA, or other BLM RMPs as amended, would also be followed and would reduce impacts on greater sage-grouse individuals and habitat (See Appendix C in BLM 2015). Treatments that occur in the California portion of the bi-state population's range would adhere to the design features and protections included in the Bishop RMP (BLM 1993); this would ensure potentially adverse treatment effects on this population are minimized and beneficial effects are maximized. Residual effects after the application of conservation measures to the bi-state greater sage-grouse population are as described for greater sage-grouse.

Special status wildlife species, such as pygmy rabbits and greater sage-grouse, generally rely on relatively large and contiguous areas of habitat to support home ranges and/or migration routes (Pierce et al. 2011; Wisdom et al 2011; Shinneman et al. 2018). Therefore, habitat fragmentation, such as from fuel breaks, can have negative effects on special status wildlife. Fragmentation may influence distributions of passerines such as Brewer's sparrows (*Spizella breweri*), sage sparrows (*Amphispiza belli*), and sage thrashers (*Oreoscoptes montanus*) (Knick and Rotenberry 2002), and is correlated with abandonment of sage-grouse leks (Wisdom et al, 2011). Sagebrush patches in occupied leks are approximately 10 times as large as patches in non-occupied leks (Wisdom et al. 2011). Fragmentation may also interfere with movement and migration, but empirical evidence for sagebrush-associated wildlife is lacking (Shinneman et al. 2018).

As discussed in **Section 4.7**, building fuel breaks along existing roads would limit the level of fragmentation compared to existing levels. It would still increase the amount of edge habitat, which would have varying effects depending on the species and type of fuel break. For pygmy rabbits in Utah, abundance increased significantly with distance from the edge created by mechanical treatment (Pierce and others, 2011). Widening edge habitat may also increase the vulnerability of grassland or sagebrush species (e.g., greater sage-grouse) by attracting predators, such as corvids (Coates and Delehanty 2010). However, it could also increase the safety of habitat that occurs along roads by increasing the distance between usable habitat from the road and decreasing the risk of collision. Effects may be greater where fuel breaks are built along lightly traveled or primitive roads that may serve as higher quality wildlife habitat.

In addition to the design features described for wildlife, others would be implemented in place to reduce impacts on special status wildlife species (see **Appendix D, Section D.2**) and are described under the appropriate action alternatives. The BLM would also adhere to all required design features in the Greater Sage-Grouse RMPAs/EISs (BLM 2015). For example, the BLM would, "where applicable, design fuels treatment objectives to protect sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patterns that most benefit Greater Sage-Grouse habitat" (see Appendix C of Idaho and Southwestern Montana Greater Sage-Grouse Approved RMPA; there are six RMPs, but design features are similar among them; BLM 2015). Following the RMPA design features would reduce impacts to greater sage-grouse and other sagebrush-dependent wildlife.

Long-term impacts from fuel breaks on special status wildlife would also be similar or the same as those described for wildlife in **Section 4.7** 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).

4.8.3 Effects from Alternative A

Special Status Plant Species

Under Alternative A, systems of fuel breaks would not be constructed and maintained using this analysis. Fuel break projects would continue to be implemented throughout the project area on a site-specific basis. Without a programmatic approach, effects as described under **Section 4.1.3** would occur. As noted there, 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 locations. 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. This 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, a regional analysis of fuel break construction would not be completed; therefore, project activities would not affect special status wildlife species on a regional scale. This may result in short-term benefits to special status wildlife species that may otherwise experience potential for adverse impacts from treatments in new areas.

Fuel break projects would continue to be implemented throughout the project area on a site-specific basis, but the lack of a regional analysis would cause a slower project planning process and would delay implementation as compared with a regional planning process. This would perpetuate current trends in the level and condition of habitat for sagebrush-obligate species, such as the greater sage-grouse, pygmy rabbit, and sage thrasher (**Appendix J**), to some extent across the project area.

Current trends in sagebrush habitat include intense wildfires and the subsequent increased potential for 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 invasive annual 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).

Species such 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 nonnative invasive 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

Pinyon-juniper has expanded into sagebrush communities within the Great Basin and is more common and extensive than it was historically. 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.

4.8.4 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 42), complying with conservation measures developed during ESA consultation (Design Feature 57), constructing fuel breaks in areas where vegetation disturbance by wildfire or surface-disturbing activities has already occurred (Design Features 1 and 7), and implementing invasive plant management (Design Features 25, 26, and 29).

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. Analysis for the greater sage-grouse encompasses both the general population and the bi-state Distinct Population Segment. 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). Avoiding creation and maintenance of fuel breaks within these areas may hinder the implementation of strategically placed anchor points that could help reduce habitat loss from potential wildfire.

Table 4-8
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]	233,000	339,000	492,000
Priority habitat management areas (PHMA)	168,000	247,000	355,000
General habitat management areas (GHMA)	146,000	206,000	250,000
Other habitat management areas (OHMA)[3]	33,000	45,000	45,000
Important habitat management areas (IHMA)[4]	31,000	51,000	93,000
Buffered leks[5]	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]Nevada and California only
[4]Idaho only
[5]Area calculated as occupied lek area surrounded by a 6.2-mile buffer.

Because sagebrush would not be cut or removed, 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 grasses 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. Where fuel breaks are constructed within sagebrush habitats, the resulting landscape would consist of widened linear features (up to 500 ft including both sides of the road or ROW) with the same amount of sagebrush cover but potentially reduced height and amount of grass and other vegetation. Habitat modification would occur over up to 1 percent of the total sagebrush vegetation types in the project area (likely less). In the case that fuel breaks in a certain area are not needed (i.e., no future wildfires occur), these areas would still serve as functional habitat for sagebrush obligates, including greater sage-grouse, but may be of lower quality due to potential reductions in forbs and hiding cover. The level of habitat modification is not expected to cause population-level effects for sagebrush species. Brown strips could not be feasibly constructed in sagebrush habitat under this alternative because it would not be feasible to implement with restrictions on sagebrush removal. Widening of the already existing edge habitat along roads and ROWs would increase the distance of habitat used by wildlife from traffic and potentially reduce the potential for collisions.

Design features would limit potential impacts on greater sage-grouse by prohibiting fuel break construction and maintenance in sage-grouse breeding habitat during the breeding season (Design Feature 46) and ensuring treatments are conservative (Design Feature 47). Design features from RMPs as amended would also be followed and would reduce impacts on greater sage-grouse individuals and habitat (See Appendix C in BLM 2015).

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 51-54). Design features would reduce the impacts of treatment methods on other special status wildlife by implementing restrictions and conservation strategies (Design Feature 43), minimizing ground-disturbing treatments in areas with highly erosive or saturated soils (Design Features 36 and 37), implementing noxious and invasive weed management (Design Features 25, 26,and 29), requiring surveys in suitable or potential habitats for federally listed, proposed, candidate, and BLM special status species before treatment (Design Feature 42), and other measures to reduce impacts on vegetation (**Appendix D**).

Because the fuel break systems proposed under Alternative B would avoid cutting or removing sagebrush, the habitat would not fully benefit from fuel breaks' preventative effects, although fuel breaks in some sagebrush habitats and nearby areas could slow the rate of fire spread into sagebrush communities. Where fuel breaks successfully reduce acres burned, 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 and maintain fuel breaks would slow their establishment, and the limited total extent and potential locations of the fuel breaks would lower the systems' 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.

4.8.5 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 and maintenance 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 relative to larger roads due to less dust and lower potential for weed spread compared with roads. 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.

Nonnative plants could only be used for reseeding outside of highly resistant and resilient sites when conditions in BLM Handbook H-1740-2 (BLM 2008, p. 87) are met (see **Section 2.2.7** 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.

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 smaller.

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 may support greater densities of wildlife relative to larger roads. 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. After establishment of fuel breaks along existing roads and ROWs, the resulting landscape would consist of widened linear features (up to 500 ft including both sides of the road or ROW) with reduced vegetation height and amount, including some bare areas (brown strips).

Sagebrush could be treated or removed, which would reduce habitat features for sagebrush obligates. It would also reduce sagebrush patch size, leading to increased fragmentation, which is correlated with reduced lek occupation (Wisdom et al. 2011). However, the scale (1 to 2 percent) and nature (narrow strips of habitat modification vs anthropogenic disturbance) of this fragmentation while considering the landscape scale of habitat use by sage-grouse is not expected to lead to isolation of populations or reduced lek occupation. In the case that fuel breaks are not needed in a certain area (i.e., no future wildfires occur), there may be a net loss in habitat that is not compensated for by protection of habitat from wildfire. While green strips and mowed fuel breaks may still be used as lower quality habitat, brown strips would not serve as functional habitat. Habitat modification or loss could occur over up to 1 percent of the total sagebrush vegetation in the project area, but the area impacted would likely be less. Adverse effects and habitat modifications are not expected to lead to population-level effects as they would be minimized by adhering to design features from the PEIS (see Alternative B) and from the Greater sage-grouse RMPs/EISs (See Appendix C in BLM 2015). For example, "where appropriate, [the BLM would] ensure that treatments are configured in a manner that promotes use by Greater Sage-Grouse" (See Appendix C in BLM 2015). Some beneficial effects would be possible due to widening the distance of habitat used by wildlife from traffic and potentially reducing disturbance and collisions.

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 46 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 47 in **Appendix D**), thereby reducing the potential for habitat modification. Design features from the Greater sage-grouse RMPs/EISs would also be followed and would reduce impacts to individuals and habitat (See Appendix C in BLM 2015).

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 21 in **Appendix D**).

Over the long term, fuel break establishment in sagebrush habitat would protect these areas from potential future wildfire and reverse the trend of sagebrush cover loss in the project area. Where fuel breaks also successfully reduce acres burned in grasslands, some of these areas may gradually increase in sagebrush cover. This would increase the availability of habitat features, such as forage, nesting sites, and cover for sagebrush obligate wildlife 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 systems 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).

4.8.6 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 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 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 systems 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 systems 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.

Because more acres of greater sage-grouse habitat types and leks would be available for potential treatments under this alternative, the potential for impacts and the area of habitat modified would be greater relative to other alternatives. As described under Alternative C, the resulting landscape would consist of widened linear features (up to 500 ft including both sides of the road or ROW) with reduced vegetation height and amount, including some bare areas (brown strips). Treatment or removal of sagebrush would reduce habitat features, such as cover and nesting sites, for sagebrush obligates. It would also reduce sagebrush patch size and increase habitat fragmentation, particularly where brown strips are constructed. These changes would potentially occur over a greater area of sagebrush habitats compared with other alternatives (up to 2 percent of the total sagebrush vegetation in the project area). If no future wildfires occur in some areas, there may be a net loss in habitat that is not compensated for by protection of habitat from wildfire. However, adverse effects and habitat modifications are not expected to lead to population-level effects. This is because they would be minimized by adhering to design features from the PEIS (see Alternative B) and from the Greater sage-grouse RMPs/EISs (See Appendix C in BLM 2015). Some beneficial effects would be possible due to widening the distance of habitat used by wildlife from traffic and potentially reducing vehicular collisions.

Design features 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 systems 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 variety 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 systems would be expected to improve wildfire suppression opportunities and reduce acres burned. 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.

4.8.7 Cumulative Effects

Cumulative Baseline

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 4.7.7** and general vegetation in **Section 4.6.7**. 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 action alternatives, the increased potential for injury or death would be substantially reduced or eliminated by implementing avoidance measures through design features. Ultimately, successful fuel break systems 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 systems—up to 529,000 acres under Alternative B and up to 667,000 acres under Alternatives C and D. Under all action 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.

When combined with other fuel break projects that will continue to be implemented throughout the project area, the cumulative effects of potential for injury or mortality and habitat modification in the fuel break footprint due to the current PEIS would be reduced. This is because in areas where existing or proposed fuel breaks are meeting goals and objectives, fuel breaks would not need to be authorized under this PEIS. For example, the fuel breaks projects listed in **Table 4-1** include over 30,000 acres of fuel breaks in Nevada and over 22,390 acres plus an additional 582 miles of fuel breaks in Idaho (**Table 4-1**); if project objectives are met, then a large area of sagebrush habitat would not require treatments under this PEIS.

The establishment of fuel break systems 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.

Over the long term, fuel break systems are 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.

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 action 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 fuel break systems 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.

4.9 CULTURAL AND TRIBAL RESOURCES

4.9.1 Assumptions

- This analysis provides a broad overview of cultural resource types and potential effects, based on available information. However, data are incomplete and information from past inventories may be geographically biased toward project-oriented undertakings. Additional cultural resource inventories and consultations would usually be required to determine the need for project redesign or other mitigation to identify and protect significant sites known as "historic properties" from adverse effects as defined by the National Historic Preservation Act, Section 106 and regulations under 36 CFR Part 800. Inventories and consultations would be appropriate to the scale and level of disturbance.
- Avoiding historic properties during treatments may compromise the effectiveness of treatments in some circumstances, and it may be necessary to minimize effects to such sites through data recovery, recordation, monitoring, or other appropriate measures.
- Further site-specific research and consultation would be needed to determine whether Tribal treaty- or trust-based rights or other federal/Tribal agreements are applicable and to identify potential impacts to Tribal interests, as well as to determine means to avoid or minimize such impacts.
- Some Tribal resources may be accessed from existing roads and turnouts, and thus there may be short-term loss of Tribal access and privacy for cultural uses during treatment.
- Identification of Tribal resources may not be possible outside those communities, and may require the expertise of traditional practitioners, elders, or others with specialized traditional knowledge. Potential impacts may be difficult or impossible to determine unless disclosed during Tribal consultation.
- Outside of fuel break areas, effectiveness of fuel breaks (**Section 4.2.1**) would have long-term benefits on archaeological resources by decreasing the acres burned (**Section 4.2.8**) and promoting long-term soil stability (**Section 4.5.1**), and on potential Tribal resources by providing greater opportunities for protection and restoration of native plant communities (**Section 4.6.7**) and aiding in the protection of wildlife habitat (**Section 4.7.2**).

4.9.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

Fuel breaks and associated construction and maintenance activities can directly affect the physical and spatial integrity and visual setting of cultural resources. Indirect effects can result from erosion or increased visibility of archaeological resources, thus making them more susceptible to vandalism and illegal artifact collection. The potential for impacts would vary by fuel break type, width of disturbance, methods employed, and local environmental conditions like soil type. Effects on the integrity of surface and near surface archaeological sites could occur from all fuel break types. Avoiding archaeological sites during certain treatments can also cause effects such as from cattle congregating under trees remaining after tree removal in the surrounding area; islands of untreated vegetation signaling site presence to potential looters (Haas 1983); or erosion from lack of seeding of sparsely vegetated ground (Harmon 2011). Damage, destruction, or movement of archaeological artifacts and site features may result in a loss of aspects of integrity of historic properties that may contribute to their eligibility to the NRHP, including the ability of the site to contribute information on important research questions such as site function, dates of use, subsistence practices, and environmental change. Under all action alternatives, undertakings involving fuel breaks would continue to be subject to site-specific cultural resources review, Tribal consultation, compliance with Section 106 of the NHPA and other design features listed in **Appendix D**. If archaeological 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. Such measures would help to minimize impacts to significant cultural resources under all action alternatives.

Creation and maintenance of up to 50-foot wide brown strips could increase erosion under some circumstances as described in Section 3.4, and lead to exposure of buried sites not identified during inventory. However, because brown strips are narrow and only proposed along interstates and highly traveled routes, effects are more likely to be limited to smaller portions of individual sites that have already been somewhat affected by ongoing road use and maintenance.

Other fuel break types analyzed could occur on up to 500-foot wide strips. Typically, the disturbance would be 250 feet or less on each side of the road, but could be shifted to either site due to resource concerns or topography. The wider width would increase the potential for disturbance of cultural resources during construction and maintenance and through temporary exposure of artifacts to erosion and illegal artifact collection. Reseeding or retaining existing vegetation in mowed fuel breaks would reduce the potential for erosional disturbance. In all types of fuel breaks, there is the potential for removal of plant foods, material or other resources valued by Tribal users.

Changes to visual setting from the creation and maintenance of fuel breaks could affect certain cultural resources, such as historic roads and trails, cultural landscapes, and Tribal resources, such as spiritual sites. Some types of cultural resources tend to be concentrated along historic travel routes. Creating large strips of modified vegetation may affect the existing visual character of nearby cultural resources. During treatments, there may be a temporary loss of access to Tribal resources, as well as decreased privacy and seclusion at culturally important sites. Creating and maintaining fuel breaks could result in removal or chemical treatment of pinyon or other traditional plant resources near roads where Tribal elders and families may concentrate their gathering efforts, particularly if such resources are not identified for avoidance during consultation.

Fuel breaks would reduce the risk of impacts from wildfire on archaeological and Tribal resources. Wildfire can cause a broad range of direct and indirect effects to cultural resources. A summary of these can be found in Ryan et al. (2012). Constructing fuel break systems would also reduce the potential for impacts on significant cultural resources from emergency fire suppression activities. Strategically placed fuel breaks would provide anchor points or staging areas where resource concerns have already been identified and addressed.

Effects from Manual Treatments

Because of the low potential for significant ground disturbance and the lack of heavy equipment use, manual treatments would have a very low potential to impact archaeological resources. Further, resources not observed during archaeological inventories (such as small features obscured by vegetation) could be more easily discovered and avoided as the work progresses.

Effects from Mechanical Treatments

Depending on the specific tools and types of equipment used to remove plants, mechanical techniques could cause surface and near-surface disturbance, including displacement of archaeological materials over short vertical and horizontal distances, artifact damage, or destruction of features. Repeated treatments in the same areas could have additive effects. Significant displacement of soils containing buried intact archaeological deposits could affect scientific values of sites. Buried archaeological deposits may not be detected during pre-work inventories unless there are surface exposures. Treatments requiring heavy ground disturbance, such as tilling to create brown strips or to clear ground for green strips, would have greater potential effects on archaeological resources. Drill seeding or harrowing where usually only narrow furrows are created would cause less surface disturbance than tilling, and effects on lithic artifact scatters would be negligible in many cases, depending on soil texture and other site characteristics (Bryan et al. 2011, Halford et al. 2016). Some artifact types like ceramics, wood, or bone would be more easily damaged by crushing or compaction (Halford et al. 2016). Effects from chaining or imprinting would also vary depending on vegetation, soil, and resource conditions. For example, chaining to remove live trees may have substantial impacts on archaeological site integrity due to the soil disturbance of uprooting that may reach three feet or more in depth (Gallager 1978, DeBloois et al. 1978). Chaining where standing dead trees are broken off rather than uprooted or where only shrubs and grass are present would result in less substantial effects. Mowing (McCormick and Halford 2003) and mastication would normally have little or no effect on site types like lithic artifact scatters aside from effects from the vehicles. Short-term tracked and rubber-tired vehicle use can have impacts ranging from compaction, displacement or soil loosening (Wood 1982) to horizontal disturbance of several inches or more if soils are soft and/or wet or when tracked vehicles turn within a site (Foster-Curley and Horn 2008). Non-portable features such as rock cairns or wall remnants could be damaged if driven over during any type of fuel break creation or maintenance. Mechanical methods would be less effective than manual methods in avoiding previously undiscovered or undocumented resources, since workers would be in less direct visual contact with resources.

Effects from Prescribed Fire Treatments

Impacts from prescribed fire treatments could occur due to the loss of combustible artifacts and features to fire as well as damage through chemical and thermal alteration of bone, rock art, stone, and ceramic artifacts (see Ryan et al., eds. 2012). The physical or chemical characteristics of materials that have scientific information potential could be altered by heat and fire. Impacts could occur on Tribal resources, including loss of subsistence resources, visual impacts to nearby sacred sites, short-term loss of access, or 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 analyses; however, chemicals would have 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 application may also limit the use of Tribal resources in the vicinity of treatments or result in chemical exposure (Ando et al. 2002). The duration of such impacts may be long term, 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 for months or years after treatments.

Effects from Targeted Grazing Treatments

Targeted grazing would concentrate livestock into smaller areas to increase the grazing intensity and reduce fuels within fuel breaks. Concentrated livestock grazing increases the risk of damage to surface artifacts. 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). Potential fuel breaks would be surveyed for cultural resources prior to construction and appropriate design features would be included to minimize the potential for damage to cultural resources from targeted grazing. Indirect impacts may include accelerated erosion and gullying, subsequent exposure, and increased potential for illegal artifact collection and/or vandalism.

4.9.3 Effects from Alternative A

Under Alternative A, systems of fuel breaks would not be constructed using this analysis; 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 systems of fuel breaks and, in turn, improved region-wide opportunities to suppress fire, the impacts from wildfires and wildfire suppression on cultural 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.

4.9.4 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. Design features 30-33 and 35 in compliance with Section 106 of the NHPA, consultation with Tribes, and consideration of Tribal interests that would be implemented under all action alternatives (see **Appendix D**) would minimize impacts to significant cultural resources. Impacts may still occur where applying design features or mitigation measures (i.e. leaving large areas untreated to avoid resources) would jeopardize the effectiveness of fuel break treatments, or where resources are not identified for avoidance prior to treatments.

Restricting the types of treatments and the treatment acreage, confining treatments to Maintenance Level 5 roads, and excluding treatments in highly resistant and resilient sagebrush communities would limit the risk of direct ground-disturbing impacts on cultural resources. However, this would also allow fewer opportunities to limit potentially damaging wildfire due to limits on the location and methods used to create and maintain fuel breaks. 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 and maintenance of the fuel breaks may also impact the visual setting of cultural resources. Alternative B would result in systems of fuel breaks throughout the Great Basin; however, the potential for improving wildfire suppression and potentially reducing the impacts of wildfire and suppression activities on cultural resources in the long term may be constrained by the limits placed on treatments under Alternative B.

4.9.5 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 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 resource impacts associated with chemical treatments and prescribed fire as opposed to Alternative B, though these methods are less likely to cause ground disturbance. 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 resources. There also would be an overall increase in wildfire suppression opportunities, which would potentially reduce impacts from wildfire and suppression activities on cultural 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.

4.9.6 Effects from Alternative D

The potential for surface and near-surface impacts on cultural resources and their settings under Alternative D would be similar to those under Alternative C; however, the inclusion of Maintenance Level 1 (primitive) roads would increase the potential for disturbing historic roads, trails, and other cultural resources that could be in association with them. Roads may have historic significance, and fuel breaks may affect the character of their historic setting. Primitive roads are less likely to have had previous disturbance in adjacent areas, so cultural resources may be more intact, and traditional Tribal uses may be more likely.

The potential overall footprint of the fuel break systems, 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. This would result in a greater reduction in impacts from wildfires and wildfire suppression on cultural resources. By influencing fire behavior through improved suppression opportunities, Alternative D would also potentially reduce burned areas, which would benefit cultural resources.

4.9.7 Cumulative Effects

Cultural resources that may be directly or indirectly affected occur throughout the project area in a variety of environments. Because some types of cultural resources are nonrenewable, the effects on these resources may be permanent in some cases. BLM-authorized actions that could affect cultural resources would be subject to Section 106 compliance review, though effects to cultural resources cannot always be eliminated through mitigation or design features.

The past, present, and reasonably foreseeable actions in **Table 4-1** likely have affected and would continue to affect cultural resources through direct and indirect impacts. These actions are fire suppression, fuel break construction, vegetation management, roads and ROWs, livestock grazing, mining, oil and gas leasing and recreation. These actions have the potential for ground disturbance, the removal or damage of cultural resources, access restrictions for Tribal uses, access leading to illegal collection and vandalism, and the potential for increasing erosion. Archaeological resources have been directly affected by such actions through the modification, displacement, and loss of archaeological materials in some cases, and thus the loss of valuable information regarding site function, dates of use, subsistence, and past environments.

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

Wildfire has disturbed or caused the loss of cultural resources, primarily through direct destruction or modification of artifacts, structures and other non-portable features, and Tribal resource gathering areas. Wildfire has also exposed large areas where vegetation has burned, increasing the potential for illegal collection of artifacts. Fire suppression often involves ground disturbance prior to the opportunity to identify and avoid significant resources and may result in 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. Past fire suppression policies allowed fuel loads to build up and altered the pre-contact fire regime.

Over time, impacts on cultural resources from natural processes, such as wildfire, erosion, drought effects, and weathering, will continue to affect the integrity of cultural resources. Such processes will continue to a greater or lesser extent regardless of the BLM's fuel break management strategies, though fuel breaks and enhanced rangeland restoration efforts may limit their effects. All of the action alternatives would create and maintain systems of fuel breaks. This would improve the BLM's opportunities to respond to wildfires throughout the project area and would thus cumulatively protect cultural resources across the landscape from wildfire and suppression activities. The BLM's concurrent and reasonably foreseeable Fuels Reduction and Rangeland Restoration PEIS in the Great Basin would protect and restore sagebrush communities, and fuel breaks would help protect these investments. 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. Enhancing soil stability through vegetation restoration and limiting wildfires would benefit the preservation of intact archaeological resources, and restoration would enhance the productivity of native plant and animal resources important to Tribal subsistence and heritage.

There would be added potential for cumulative effects from ongoing fuel break maintenance, especially in areas with annual invasive grasses, and by the use of the fuel breaks for staging during wildfires. Past, present, and reasonably foreseeable actions could affect cultural resources cumulatively in conjunction with projects implemented under this PEIS. However, these impacts would be minimized under all action alternatives by relying on project design features 30-33 and 35 (see **Appendix D**) and measures developed through compliance with NHPA Section 106, other relevant laws and regulations (see **Appendix C**), and the Tribal consultation process.

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 significant cultural resources in the long term may be constrained by these limits. Alternative B would serve to reduce fire starts and improve suppression along more heavily used roadways. Where there are no such roads nearby, impacts would be the same as Alternative A.

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 resources.

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 other cultural resources that could be found nearby. Maintenance Level 1 roads are less likely to have had previous disturbance in adjacent areas, so cultural resources may be intact and cultural uses may be more likely. However, Alternative D would provide the most potential for improving the BLM's opportunities to respond to wildfires throughout the project area while minimizing resource impacts through the planned placement of fuel breaks. Most impacts to significant cultural resources could be avoided during fuel break construction as opposed to during emergency firefighting activities. Allowing the greatest flexibility to create and maintain effective fuel breaks would also increase protection of cultural resources across the landscape since the fewest effects from fire and suppression activities outside of fuel breaks would be expected under this alternative.

Potential direct cumulative effects on cultural 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 resources as described above. Enforcing measures to protect cultural resources would become more difficult as population and use demand increases; however, the creation and maintenance of systems 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 resources from wildfire and suppression. Although local effects are expected, when combined with effects from past, present, and reasonably foreseeable actions, none of the alternatives would be expected to significantly alter the general cultural uses or scientific understanding of regional history within the project area.

4.10 PALEONTOLOGICAL RESOURCES

4.10.1 Assumptions

- The probability of finding paleontological resources can be broadly predicted from the characteristics of geologic units exposed at or near the surface.
- This analysis provides a broad overview of estimated potential effects, based on available information. Existing information provides some insight into the potential for paleontological resources in the project area; however, data on the overall project area are incomplete and local paleontological inventories may be required.
- In general, fossil localities that may be affected by the shallow disturbance associated with fuel breaks may be few. Fossil localities often do not support dense vegetation, which would limit treatment 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.
- Fuel breaks may increase activity, potentially leading to new discoveries, but they could also lead to unauthorized collection and vandalism.

4.10.2 Nature and Type of Effects

Effects from Fuel Break Construction and Maintenance

All fuel break types would have the potential to affect the physical integrity of surface and near surface fossil resources, increase erosional effects, and lead to greater exposure and visibility of fossils. Reseeding could reduce the potential for the effects of erosion after treatments.

All fuel break projects are subject to BLM review to determine the need for further inventory based on criteria set forth in Instruction Memorandum (IM) 2016-124 (BLM 2016b) using PFYC mapping, if available, or geologic characteristics and previous study data, if not, in order to identify potentially significant fossil resources with important scientific, educational, or public interest values. 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 according to applicable policies including BLM Manual 8270: *Paleontological Resource Management* and BLM Handbook 8270-1: *General Procedural Guidance for*

Paleontological Resource Management. 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 and maintenance of 50-foot wide brown strips would remove all vegetation, which may expose or physically damage fossils and potentially increase erosion over relatively narrow swaths. Other fuel break types could cause surface disturbance on up to a 500-foot wide strip and could also physically affect surface exposures of fossils. Reseeding or retaining existing vegetation in mowed fuel breaks 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 very limited potential for impacts on fossil localities due to limited ground disturbance and the greater potential for identifying undiscovered resources as the work progresses versus mechanical means where operators are not in close visual contact with potential finds.

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.

4.10.3 Effects from Alternative A

Under Alternative A, systems 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 under this alternative would be similar to those described for *Nature and Types of Impacts* for other resources, above. 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 systems of fuel breaks or anticipated greater regional opportunities to suppress fires. The potential for impacts from wildfires and wildfire suppression on paleontological resources would continue under current conditions.

4.10.4 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 30, 34, and 35 (see **Appendix D**). While Alternative B would result in systems 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 the potential for wildfire impacts on paleontological resources.

4.10.5 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 and maintained 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.

4.10.6 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 systems, 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.

4.10.7 Cumulative Effects

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 could be impacted by fuel break construction, wildfires, and fire suppression.

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.

Existing 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.

All of the action alternatives would create and maintain systems of fuel breaks. Design Features 30-35 would continue to be implemented to address the need for inventory and discovery of resources during construction under all action 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 project area. 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 existing roads which would limit the potential for new disturbances. BLM-authorized present and reasonably foreseeable actions would be subject to site-specific project and compliance review. Treatments would occur at the local level; inventories would focus on more likely locations for encountering paleontological resources, so some resources could be missed.

Alternative B, which limits fuel breaks to maintenance level 5 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 systems 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.

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 systems 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 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 Rights of Ways, which may have been 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 systems 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 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 systems 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. Overall, when combined with past, present, and reasonably foreseeable actions, none of the actions would be likely to limit the overall ability of significant paleontological resources to answer important scientific questions within the project area.

4.11 Recreation

4.11.1 Assumptions

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

4.11.2 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 big game, fur-bearing game and game bird species. Impacts would be concentrated in the fuel break footprint and would dissipate as distance from the fuel break increases. In the long term, implementation of systems of fuel breaks could improve habitat conditions, which would maintain and enhance hunting opportunities.

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 term[1]. 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

[1] References to scenic and visual quality are not a determination of whether VRM objectives would be met (see **Appendix G** for VRM contrast rating process.)

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.

Constructing systems 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 systems 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.

4.11.3 Effects from Alternative A

Under Alternative A, systems of fuel breaks would not be constructed and maintained using this analysis; rather, fuel break projects would continue to be created and maintained throughout the project area on a site-specific basis, as discussed in **Table 4-1**. The lack of a programmatic approach to fuel breaks under this alternative would result in effects as described above.

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 fuel break systems, 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.

4.11.4 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.

4.11.5 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 mileage of fuel breaks analyzed 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**).

4.11.6 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.

4.11.7 Cumulative Effects

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 systems 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.

4.12 Lands with Wilderness Characteristics Managed for Values Other Than Wilderness Character

4.12.1 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.

4.12.2 Nature and Type of Effects

Effects from Construction and Maintenance of Fuel Breaks

The creation and maintenance 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 apparent naturalness through the creation and maintenance 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 4.11,** 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.

4.12.3 Effects from Alternative A

Under Alternative A, systems of fuel breaks would not be constructed and maintained using this analysis; rather, fuel break projects would continue to be created and maintained throughout the project area on a site-specific basis, as discussed in **Table 4-1**. The lack of a programmatic approach to fuel breaks under this alternative would result in effects as described above.

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.

4.12.4 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, 16-17, 21, 22, 24, 25, 26, 28, 29, 36, 39, and 40 in **Appendix D**) built into action alternatives would 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.

4.12.5 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 and maintained. 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 (e.g., Design Features 25 and 26 in **Appendix D**). Over the long term, systems of fuel breaks would increase opportunities for wildfire suppression before a wildfire spreads into lands with wilderness characteristics, thereby maintaining their wilderness character.

4.12.6 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, systems 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.

4.12.7 Cumulative Effects

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.

Existing 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 help to minimize the rate and extent of fire spread in certain areas. This would influence the criteria used to determine the potential fuel break locations described in **Chapter 2**.

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 systems 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.

4.13 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 3.12** and the Socioeconomic Baseline Report (BLM 2018b).

4.13.1 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.

4.13.2 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 previous BLM costs 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 (2017 Dollars)

Method	Cost per Acre
Prescribed burn (aerial)	$15,000/day
Prescribed burn (hand ignition)	$40
Administrative costs (e.g., inventories and monitoring)	$10-50
Mechanical treatment	$40-300
Chemical treatment	$35-200
Seeding	$15-165
Seed type	$75-250
Conifer removal	$50-500

Source: BLM 2019

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. 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 4.2**, 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 4.3**). 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 3.12** 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 action alternatives, no changes to permitted levels of grazing would occur as a result of decisions associated with this analysis, 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 4.6**); 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 exclusion 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).

4.13.3 Effects from Alternative A

Under Alternative A, systems of fuel breaks would not be created and maintained using this analysis; instead, fuel breaks would continue to be employed throughout the project area on a site-specific basis (see **Map 10** and **Table 4-1**). 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*.

4.13.4 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 systems 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 1–14, 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 4.2**, 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 and maintain systems of different types of fuel breaks in all vegetation conditions (see **Section 4.2**, Fire and Fuels). This would maintain the potential for elevated wildfire-related costs, compared with other action alternatives.

4.13.5 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.

4.13.6 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.

4.13.7 Cumulative Effects

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. Existing 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, lengthening 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.

4.14 ENVIRONMENTAL JUSTICE

Based on the CEQ guidelines in **Section 3.12**, 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.

4.14.1 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 and maintenance 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 and maintenance 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 4.6**.
- 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 4.7**.

- Tribal communities that use vegetation for cultural practices could be affected in the short and long term by chemical treatments, as discussed in **Section 4.9**.
- Fuel break creation and maintenance could affect the social and economic well-being of all populations, including environmental justice populations, as discussed in **Section 4.13**. 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.

4.14.2 Effects from Alternative A

Under Alternative A, systems of fuel breaks would not be constructed and maintained using this analysis; 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 4.13**. In addition, resources used by environmental justice populations would have potential impacts from wildfire, as summarized under *Nature and Type of Impacts*.

4.14.3 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 30-35) 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 and maintain systems of different types of fuel breaks in all vegetation conditions, as discussed in **Section 4.2**.

4.14.4 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.

4.14.5 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.

4.14.6 Cumulative Effects

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 and maintenance 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) 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.

4.15 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.

4.16 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

4.17 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 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 or other vegetation treatments could disrupt traditional Tribal use of resources.
7. The use of nonnative plant material 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 PUBLIC REVIEW OF THE DRAFT PEIS

The BLM made the Draft PEIS available for public comment on June 21, 2019. The comment period lasted 45 days, ending on August 5, 2019. During this period, the BLM hosted 12 public meetings throughout the project area during the public comment period. These 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-2**. Individuals, public agencies, and nongovernmental organizations sent 138 unique submissions, which included 436 substantive comments. The BLM also received 907 submissions as part of form letter campaigns. The BLM developed concern statements to summarize similar comments and their responses. The BLM responded directly to comments not included in a concern statement. Further details can be found in the Comment Analysis Report in **Appendix N**.

5.3 CONSULTATION AND COORDINATION WITH AGENCIES AND TRIBAL GOVERNMENTS

5.3.1 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 and/or as cooperators. A list of Tribes who received letters inviting them to participate in formal consultation can be found in **Appendix M**, **Table M-3**, 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 has engaged in regular government-to-government consultation with the Shoshone-Paiute Tribes of Duck Valley Indian Reservation regarding this PEIS. Further consultation will be initiated with potentially affected Tribes as site-specific projects are developed and prior to chemical treatments that could affect important Tribal resources. The Shoshone-Paiute tribe expressed concerned about the maintenance of fuel breaks and the need for adequate cultural clearances on site specific projects. The Shoshone Paiute Tribes have requested Government to Government consultation on all fuel breaks using this PEIS.

5.3.2 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. Local project compliance with Section 106 of the NHPA would be done 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. This would include additional consultations and agreements with Tribes, SHPOs and the Advisory Council as required to avoid or minimize impacts to historic properties.

5.3.3 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.

5.4 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-4**, 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.

5.4.1 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-5**, List of Preparers, provides a list of people that prepared or contributed to the development of this PEIS.

5.5 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.