Subject: Report on the results of a Bureau of Land Management analysis of NEPA records and field verification in support of establishment of a categorical exclusion for pinyon pine and juniper management projects.

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Analyst:

Linda Wright
US Department of the Interior
Bureau of Land Management
20 M Street SE
Washington, DC 20003

Dan Brunkhorst
US Department of the Interior
Bureau of Land Management
20 M Street SE
Washington, DC 20003

INTRODUCTION

The purpose of this document is to substantiate the Bureau of Land Management's (BLM's) proposal for the creation of a new categorical exclusion (CX), the Pinyon-Juniper Management CX (PJCX). The BLM is proposing this CX for authorizing pinyon pine or juniper (PJ) management prescriptions to protect, restore, and enhance native wildlife species' habitats and associated ecosystems. The September 15, 2017, Secretarial Order 3356 *Hunting, Fishing, Recreational Shooting, and Wildlife Conservation Opportunities and Coordination with States, Tribes and Territories* directed the BLM to develop a proposed CX for "proposed projects that utilize common practices solely intended to enhance and restore habitat for species such as sage-grouse and/or mule deer" (section d(5)). The BLM has developed this proposed CX responsive to the direction from this Secretarial Order.

Council on Environmental Quality (CEQ) regulations implementing NEPA define a CX at 40 CFR §1508.4 as: a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (§1507.3) and for which, therefore, neither an environmental assessment (EA) nor an environmental impact statement (EIS) is required. This document presents the BLM's proposed text for the new proposed PJCX, limitations on the CX based on extraordinary circumstances, and an evaluation of the activities proposed for the CX demonstrating that the activities normally do not individually or cumulatively have a significant effect on the human environment.

Given the serious threat of PJ encroachment to the health of millions of acres under BLM management and the evidence of no significant effects from PJ removal, the BLM has identified and described in this report that establishing the PJCX is both appropriate and necessary for expediting maintenance of sagebrush habitats essential to mule deer and sage-grouse. As described in this report, the BLM has been managing sagebrush ecosystems for these species for over a decade, implementing PJ removal treatments to restore habitat mosaics within the landscape and meet the various habitat needs of these species. Establishing the PJCX would streamline the process for PJ removal projects that normally do not require analysis in order to determine significance through an EA or EIS.

Department of the Interior (DOI) procedures for complying with and implementing NEPA are in 43 CFR Part 46. The BLM procedures for complying with and implementing NEPA, consistent with CEQ regulations and DOI procedures, are in Chapter 11 of Part 516 of the Departmental Manual (516 DM 11). The list of BLM actions eligible for categorical exclusion is located in section 11.9 of 516 DM. All references to parts of the DM correspond with the manual text provided in the proposed revision (for example, this proposed CX is proposed for a new subsection of section 11.9, inserted as subsection J and re-lettering the existing subsection J as a new letter K).

The use of CXs allows the BLM to act more efficiently by (a) reducing the resources spent analyzing proposals that generally do not have significant environmental impacts and (b) focusing resources on proposals that may have significant environmental impacts.

Regardless of the level of NEPA compliance conducted, the BLM's actions are guided by land use plans on BLM-administered public lands. The land use plans identify where and under what conditions management activities can occur consistent with plan decisions. Therefore, regardless of the terms of any particular CX, the proposed action would also be constrained by any limits written into the applicable land use plan. The BLM intends the proposed PJCX to capitalize on the fact that each land use plan includes restrictions specific to the planning area, in order to streamline documentation of NEPA compliance for actions proposed to implement that plan.

1. ***Proposed CX Language***

The following italicized text is the BLM's proposed DM CX citation at 516 DM 11.9 J. (1) Habitat Restoration:

(1) *Covered actions on up to 10,000 acres within sagebrush and sagebrush-steppe plant communities to manage pinyon pine and juniper trees for the benefit of mule deer or sage-grouse habitats. Covered actions include: manual or mechanical cutting (including lop-and-scatter); mastication and mulching; yarding and piling of cut trees; pile burning; seeding or manual planting of seedlings of native species; and removal of cut trees for commercial products, such as sawlogs, specialty products, or fuelwood, or non-commercial uses. Such activities:*

- *(a) Shall not include: cutting of old-growth trees; seeding or planting of non-native species; chaining; pesticide or herbicide application; broadcast burning; jackpot burning;construction of new temporary or permanent roads; or construction of other new permanent infrastructure.*
- *(b) Shall disclose the land use plan decisions providing for protections of the following resources and resource uses in the documentation of the categorical exclusion:*
  - *(1) Specifications for management of mule deer habitat;*
  - *(2) Specifications for management of sage-grouse habitat;*
  - *(3) Specifications for erosion control measures;*
  - *(4) Criteria for minimizing or remedying soil compaction;*
  - *(5) Types and extents of logging system constraints (e.g., seasonal, location, extent);*
  - *(6) Extent and purpose of seasonal operating constraints or restrictions;*
  - *(7) Criteria to limit spread of weeds;*

(8) Size of riparian buffers or riparian zone operating restrictions; and
(9) Operating constraints and restrictions for pile burning.

A. <u>Documentation Requirements for this CX</u>

CEQ NEPA regulations direct federal agencies to rely on established categorical exclusions to reduce both paperwork (40 CFR 1500.4(p)) and delay (40 CFR 1500.5(k)). Where the BLM can document compliance with NEPA by reliance upon an applicable categorical exclusion, the BLM can fulfill the directive in the CEQ NEPA regulations to reduce paperwork and delay.However, this direction is not an exemption from completing *any* documentation when necessary or appropriate for the use of a CX. The BLM's NEPA policy clarifies that a categorical exclusion is a form of NEPA compliance available for use when the analysis that occurs in an EA or an EIS is not necessary; it is not an exemption from NEPA's requirements (BLM NEPA Handbook, p. 17).

The BLM's NEPA policy requires in most cases that, unless there is a good rationale for not doing so, the BLM must document the applicability of a CX to a particular proposed action (BLM NEPA Handbook, p. 20). The BLM's documentation of the application of a category does not constitute a decision document. Specifically, BLM policy requires documentation of the following (BLM NEPA Handbook, Appendix 6):

- basic information (office name, project title, project location);
- a full description of the proposed action (including any specific project design features or best management practices that are included in the project's design);
- discussions specific to land use plan conformance (including listing of specific decisions directing the action or protecting resources from the action);
- a discussion of compliance with NEPA (including listing of which specific category is applied for the action and documentation of the extraordinary circumstances review); and
- identification of an authorizing official and contact person.

The DOI NEPA regulations require that the specifics of any action approved or authorized in reliance upon a CX established by the BLM must be reviewed against the 12 extraordinary circumstances (43 CFR 46.205 and 46.215). The BLM's NEPA policy requires this review to be documented unless there is a good rationale for not doing so. The BLM NEPA policy requires documentation of the basic information and full description of the proposed action to support documentation of this review.

The BLM land use planning regulations at 43 CFR 1610.5-3 require that all actions approved or authorized by the BLM must conform to the existing land use plan for the area. Although it is not a NEPA requirement, the BLM includes a statement about the conformance of the proposed action with the existing land use plan in each of its NEPA documents, including documentation of reliance on a CX, to address this land use planning requirement. The BLM's land use planning regulations state that the term "conformity" or "conformance" means that "… a resource management action shall be specifically provided for in the plan, or if not specifically mentioned, shall be clearly consistent with the terms, conditions, and decisions of the approved plan or amendment" (43 CFR 1601.0-5(b)). Documentation of land use plan conformance involves documentation of the decisions that specifically provide for the action proposed, or documentation of how the action is clearly consistent with the land use plan decisions when it is not specifically provided for. The BLM NEPA policy requiring documentation of the full description of the proposed action to support documentation of this land use plan conformance, as both the action being taken and inclusion of any project design features or best management practices is consistent with this requirement for land use planning conformity.

The BLM proposes through the establishment of this CX to require documented disclosure of the land use planning decisions related to the resources and activities listed in part (b) of the proposed CX to both ensure documentation of plan conformance and to ensure that protective measures required to meet land use planning decisions applicable to the planning/action area are incorporated into the design of any project supported by the proposed CX. As discussed in the Methods section below, the BLM found in the review of the evaluated EAs and sampled CX documents that projects including design components addressing these resources and activities consistent with the decisions in the land use plan provided protections that assisted in determining that the proposed actions evaluated in the EAs had no significant impacts. These are not "mitigated" Findings of Significant Impacts (FONSIs); rather, they are FONSIs reached for proposed actions limited by the requirement that they conform to the applicable land use plan. This element, that, for BLM, proposed actions must conform to the applicable land use plan, combined with the evaluation of extraordinary circumstances, ensures that the actions proposed for inclusion under the new CX would not result in significant impacts, and would also take into account the fact that environmental conditions vary by planning area and therefore the BLM must tailor its proposed actions accordingly.

BACKGROUND

The BLM manages millions of acres of Federal land within sagebrush ecosystems in the western U.S. Expansion of conifers into sagebrush systems, primarily by pinyon and juniper trees[1], has resulted in loss of sagebrush plant communities and their ecological functions. Sagebrush (*Artemisia* spp.) plant communities are the sole habitats for Greater sage-grouse (*Centrocercus urophasianus*) and one of the most valuable habitats for mule deer (*Odocoileus hemionus*) on arid and semiarid lands in the western U.S. (Kerr 1979). Encroachment by pinyon pine and juniper trees impacts both the quantity and quality of available habitat for both species.

Pinyon and juniper (PJ) woodlands[2] were estimated to occupy less than 3 million hectares (7 million acres) prior to Euro-American settlement (1870s), but now occupy over 30 million hectares (74 million acres), a 10-fold increase attributed to many factors including fire suppression, grazing, land clearing, and climate change (Miller and Tausch 2001). Pinyon-juniper species can be aggressive invaders into more productive shrub-steppe communities that historically occupied deeper soils than the PJ woodlands. As of 2016, sagebrush ecosystems in the U.S. occupied only about one-half of their historical distribution (Pyke et al. 2017).

[1] Pinyon pine species include but are not limited to *Pinus edulis* and *Pinus monophylla*. Juniper species include but are not limited to *J. occidentalis* (western juniper), *J. scopulorum* (Rocky Mountain juniper), *J. osteosperma* (Utah juniper), *J. deppeana* (alligator juniper), and their hybrids.

[2] Pinyon pine and juniper tree species do not always occur together. Pinyon-juniper (PJ) therefore means trees of one or both genera.

Expansion and increasing canopy cover (shading effects) of PJ woodlands have decreased the distribution and abundance of sagebrush -- the main food for sage-grouse and an important winter browse plant for mule deer -- as well as the diversity and productivity of understory forage plants important for both species. These changes degrade sagebrush-associated wildlife habitat and directly reduce sage-grouse habitat by displacing sagebrush, other shrubs, and herbaceous understory, while providing abundant perches for avian predators of sage-grouse (Fire and Invasive Assessment Team 2014). These changes degrade the quality of forage and, therefore, the available nutrition needed to support the maintenance and reproductive requirements of mule deer populations (Cox et al. 2009).

PJ expansion with its increasing canopy closure presents a modified fuel arrangement and woody fuel loading that results in higher-intensity crown fires and higher-frequency fires (Miller et al. 2014, Young et al. 2014). This scenario is characterized by catastrophic fires followed by annual grass (particularly cheatgrass [*Bromus tectorum*]) invasion and dominance (Miller et al. 2008, Tausch et al. 2009, Roundy et al 2014, Cline et al. 2010). Researchers believe this process causes the system to pass a biotic threshold into a self-reinforcing feedback loop of weed dominance and recurrent fire at increased fire intervals, sometimes called the grass/fire cycle, which essentially converts sagebrush shrublands into annual grasslands (Williams et al. 2017). Current trends of spreading PJ woodlands and increasing canopy closure (crown density) indicate that many more acres are at risk of ecosystem conversion by fire (Miller and Tausch 2001). Wildfire and conversion of sagebrush to invasive annual grasses are two of the primary threats to sustaining habitat for the Greater Sage-grouse (sage-grouse) in the western portion of its range (Fire and Invasive Assessment Team 2014), and are also recognized as threats to mule deer habitat (Cox et al. 2009, p. 2; Mule Deer Working Group 2015b, p. 2).

The Fire and Invasive Assessment Team (FIAT) (2014) identified approximately 5.7 million acres of high-priority sage-grouse sagebrush habitat at risk of loss; 2.6 million acres in Priority Areas for Conservation (PACs) were assessed at risk due to encroaching PJ. The FIAT considers 25 percent sagebrush cover as the minimum cover for maintaining sage-grouse leks and 65 percent sagebrush cover as the minimum cover for sustaining sage-grouse populations *Ibid*.

Mule deer populations have experienced a steady decline over most of the species' traditional range. For instance, as of 2005 the approximately 600,000 mule deer in Colorado represented only about half of the peak population estimated for the state in the 1940s; the population in California was estimated to be less than half of approximately two million estimated in the 1950s; and in Utah and New Mexico, populations have been halved in less than 30 years (Ferguson 2005). In Wyoming, the mule deer population declined by 31 percent just between 2000–2011 (Mule Deer Working Group 2013 in Sherrill et al. 2014.) Habitat changes, including the encroachment of pinyon and juniper, are among the factors contributing to population declines. Historically, the Intermountain West ecoregion was the epicenter of mule deer distribution; in this region alone, thousands of acres of valuable mule deer range, primarily shrublands (including sagebrush communities), are being taken over by PJ each year (Miller et al. 2008 in Cox et al. 2009). In sagebrush communities, the Western Association of Fish & Wildlife Agencies (WAFWA) recommend management directed toward protecting and enhancing sagebrush, bitterbrush, and other important browse species for mule deer, particularly on winter ranges, for which the control and reduction of PJ invasion is an important tool (Cox et al. 2009).

Removing PJ trees is one of the main restoration methods for sagebrush communities, used when desired plant species or groups are poorly represented after PJ encroachment (Fire and Invasive Assessment Team 2014). Reducing tree canopies and promoting sagebrush productivity through PJ removal are the mechanisms to restore sage-grouse habitat, and providing a mosaic of openings for forage production within PJ woodlands is the mechanism to restore mule deer habitat (Mule Deer Working Group 2015b, p. 33). The BLM has analyzed the effects of PJ removal projects in EAs pursuant to NEPA using the best available science, has implemented these projects, and has not observed significant environmental effects after treatments (PJ removal), as detailed in Section 1 of the Methods section of this report.

ADMINISTRATIVE PROCESS

CXs are a form of NEPA compliance that identify certain types of actions for which it is not necessary to prepare an EA or EIS. Routine actions that a Federal agency has determined do not generally result in individually or cumulatively significant effects are good candidates for categorical exclusion from further detailed analysis. Federal agencies can establish CXs through an administrative process according to requirements set forth in CEQ's NEPA regulations and explained in CEQ guidance (2010). The BLM is proposing this PJCX as a new administrative CX consistent with the CEQ process.

Federal agencies may establish a new or revised CX in a variety of circumstances. An agency may identify a potential new CX after performing NEPA reviews and finding that a class of actions, when implemented, resulted in no significant environmental impacts. When mitigation commitments are part of the basis for proposing to exclude a category of actions from further analysis, the agency should clearly present mitigation commitments as required design elements in the description of the category of actions being considered for exclusion in a new CX. In addition, the agency must acknowledge extraordinary circumstances which would preclude the use of the CX and necessitate the preparation of an EA.

Pursuant to Section 1507.3(a) of the CEQ regulations, Federal agencies are required to consult with the CEQ and publish the proposed CX in the *Federal Register* for public comment. Following public comment, the agency must consider and respond appropriately to any comments received, engage in additional consultation with CEQ, and publish the final CX.

To establish an administrative CX, an agency must document (substantiate) that the actions proposed for exclusion from any further detailed analysis do not generally result in significant effects. Agencies can substantiate a CX using one or a combination of the following methods[3]:

a) Monitoring or otherwise evaluating the effects of implemented actions analyzed in EAs that consistently supported Findings of No Significant Impact (FONSIs);
b) Conducting an impact demonstration project to assess and document the environmental effects of the action(s)
c) Citing professional expertise, experience, and judgment or scientific analyses such as peer-reviewed or other findings based on high-quality accurate technical and scientific

[3] Council on Environmental Quality; Final Guidance for Federal Departments and Agencies on Establishing, Applying, and Revising Categorical Exclusions under the National Environmental Policy Act, 75 FR 75628, Dec. 6, 2010.

information; or

d) Benchmarking other agency experiences based on a comparable CX and the administrative record developed when the other agency's CX was established.

METHODS

To substantiate this PJCX, the BLM utilized two methods: 1) evaluating effects of implementing PJ removal projects for which the BLM prepared EAs and FONSIs; and 2) reviewing scientific literature and citing research findings from peer-reviewed published studies. Section 1 of this Methods section contains a summary of BLM projects for which the BLM prepared EAs and reached FONSIs, along with their key findings. Section 2 of this Methods section contains summaries of the literature. A Glossary of Terms is included in Appendix E.

As shown in sections 1 and 2 below, PJ removal to improve sagebrush ecosystems is an established and well-studied practice. The BLM, other agencies, and researchers have implemented PJ removal in sagebrush communities and have studied the results. A large body of scientific literature has identified that these projects predominantly result in incremental and gradual benefits to the ecosystem, without significant impacts.

The BLM has been conducting projects to remove encroaching pinyon and juniper trees from sagebrush communities for decades, and has evaluated the effects of those projects using the best available science. The BLM's EA analyses cite to a large body of peer-reviewed research studies in reaching their conclusions. Based on the science, as reflected in the BLM FONSIs, implementing these projects does not result in significant effects. The BLM's experience with implementing and monitoring these types of project mirrors the scientific literature; when taken together, they support establishment of this CX.

1. *BLM Projects*

A. *Previously Implemented Actions*

An agency's assessment of the environmental effects of previously implemented actions is an important source of information to substantiate a CX. Such assessment evaluates BLM's experience with carrying out the actions proposed for the CX, and allows for refining the CX terms on the basis of field data. For this evaluation of implemented actions, the BLM compiled EAs with FONSIs for manual and mechanical PJ removal projects with activities similar to those proposed in this CX, and reviewed the available post-implementation information.

BLM maintains an on-line register called ePlanning that houses NEPA and associated supporting documents, at the following URL: https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do. The NEPA register is cross-referenced by state, office, fiscal year, type of planning or project effort and program area. To assess the environmental effects of previously implemented actions, BLM utilized this database to identify projects that address conifer encroachment.

BLM used key word and primary program area searches. Keywords used to search the database were: "pinyon," "juniper," "conifer," "restoration," and "removal." Primary program areas searched were: "fish and wildlife," "forestry and timber," "rangeland management," "hazard management and resource restoration," "vegetation," and "wildland fire management." All document types (CX, Determination of NEPA Accuracy [DNA], EA, and EIS) were queried. Primary dates of query were from 2012 to 2016. The ePlanning site was not widely used prior to 2012, and projects after 2016 were not queried because they were unlikely to have been implemented yet, and therefore, post-implementation impacts would not yet be observable. The BLM conducted concurrent outreach to BLM field and state office program leads for similar known projects that may have been completed prior to implementation of ePlanning; none were identified.

To ensure that projects were representative across the geographic spectrum, BLM selected a range of projects from the ecoregions where BLM is implementing PJ removal actions. Through this query, projects listed in Table 1 below were identified for evaluation. The documents included programmatic and implementation-level analyses.

PJ and other conifer removal actions may often be analyzed as a part of other actions, or tiered to larger actions, which makes it difficult to search and compile a comprehensive list of all projects and associated actions. These actions are also commonly implemented by other agencies such as the U.S. Forest Service, as well as through private and federal collaborative partnerships such as the Sage Grouse Initiative (SGI). The selected documents were ones that clearly proposed and analyzed the activities proposed in the CX, without lumping analysis results with other activities.

The goal of this query process was to collect representative BLM environmental analysis information from NEPA documents for each action, in order to provide an objective assessment of the overall environmental effects as it applies to all actions proposed for categorical exclusion across the geographic spectrum.

B. Evaluating the effects of implemented actions, including actions evaluated in an Environmental Impact Statement (EIS) or an Environmental Assessment (EA) for which Findings of No Significant Impact (FONSI) were documented

BLM reviewed the projects listed in Table 1 and evaluated them as described below to determine whether they supported establishment of a CX, or whether there were any countervailing factors.

a) The type of NEPA document used to support the activity.

All projects analyzed were supported (for NEPA purposes) by EAs. Three of the 18 EAs reviewed for this CX were large-scale, programmatic analyses; the others were management-unit implementation-level projects. The fact that the BLM has PJ treatment projects for which the BLM has prepared EIS level documents to support implementation of PJ treatment projects does not undermine this reliance on the EA/FONSIs as evidence that establishment of a CX for PJ treatments is warranted, because the PJ treatment projects evaluated through EISs are quite dissimilar in size and scope to the projects evaluated in EAs and under consideration for the CX; these projects encompassed far more acres and generally included and analyzed activities not proposed in the CX.

Table 1. Previously Implemented Pinyon-Juniper Control Projects Analyzed in BLM EAs

Year	NEPA Type	Document Name	Location	Primary Ecological Region
2009	EA	South Warner Juniper Removal Project	Lakeview FO, OR	North American Deserts
2010	EA	Southwest Gerber Habitat Restoration	Klamath Falls FO, OR	Northwestern Forested Mountains
2013	EA	Vya Habitat Restoration and Fuels Reduction	Surprise FO, CA	North American Deserts
2014	EA	Hassayampa W.U.I Interface Fire Defense System	Hassayampa FO, AZ	Temperate Sierras
2014	EA	Encroaching Juniper Removal	Little Snake FO, CO	North American Deserts
2014	EA	North Springs Pinyon-Juniper Treatment	Price FO, UT	North American Deserts
2014	EA	Clay Basin/Brown's Park Sagebrush Treatments	Vernal FO, UT	Northwestern Forested Mountains
2015	EA	Applegate Sage-Steppe Habitat Restoration	Applegate FO, CA	Northwestern Forested Mountains
2015	EA	Bryant Mtn Vegetation Treatment EA	Klamath Falls FO, OROR	Northwestern Forested Mountains
2015	EA	Silva Flat Sage Steppe Restoration	Alturas FO, CAA	Northwestern Forested Mountains
2015	EA	South Cliffs Pinyon-Juniper Removal	CRV FO, CO	Northwestern Forested Mountains
2015	EA	Phase II South Cliffs Pinyon-Juniper Removal	CRV FO, CO	Northwestern Forested Mountains
2015	EA	New Hayden Fox Environmental Assessment	Klamath Falls, FO, OR	Northwestern Forested Mountains
2015	EA	Deer Pen West Pinyon-Juniper Removal	CRV FO, CO	Northwestern Forested Mountains
2015	EA	Clay Basin/Brown's Park Sagebrush Enhancement II	Vernal FO, UT	Northwestern Forested Mountains
2016	EA	Greater Sage Grouse Habitat Restoration Plan For The Clover Flat Area	Lakeview FO, OROR	North American Deserts
2014	EA	Wild Turkey EA	Miles City FO, MT	Great Plains
2016	EA	Powder River Basin Sage Grouse Habitat Restoration EA	Miles City FO, MT	Great Plains

For instance, the North Steens Ecosystem Restoration Project (DOI-BLM-ORWA-B060-2007-0005-EIS) evaluated proposed treatments on 336,000 acres and a proposal to use jackpot burning, broadcast burning, and single-tree burning, and to implement unspecified future methods per adaptive management (EIS pp. 46-48); the Bruneau-Owyhee Sage-Grouse Habitat Project (BOSH) (DOI-BLM-ID-B000-2014-0002-EIS) evaluated a study area of 1.6 million acres, and a proposal to treat up to 726,000 acres, including treatment units of 40,000 to 60,000 acres in size (to be implemented depending on annual budget); the Programmatic EIS for Fuel Breaks in the Great Basin (BLM-ID-B000-2014-0002-EIS) evaluated a study area of 38 million acres and a proposal to use a combination of broadcast burning, chemical treatments, and grazing treatments; the Tri-state Fuel Breaks Project EIS in progress (DOI-BLM-ID-B000-2015-001-EIS) evaluates a study area of 3.5 million acres, and a proposal to use a variety of treatment methods to establish and maintain fuel breaks. Both the size and complexity of the proposed actions evaluated in these EIS were anticipated to result in significant impacts. Assessment of these EISs helped to identify thresholds of significance in defining the scope of this proposed CX by identifying actions and sizes that were not appropriate to include in its terms.

b) Specific actions that were analyzed in each EA.

The proposed actions evaluated in the EAs all included some form of manual or mechanical cutting, combined with various methods of spreading or disposal of debris, including yarding and piling, pile burning or log removal, lop/scatter, and mastication with mulching. Some projects called for seeding and planting of native plants. The projects assumed the use of off-road equipment and thereby included analysis of the effects of equipment moving across soils (to conduct the work). The BLM does not usually need new roads[4] to implement PJ treatments and is not proposing construction of new (temporary or permanent) roads for this CX. While three of the projects evaluated in these EAs proposed pesticide or herbicide treatments, 15 did not, and these analyses were sufficient to determine PJ treatment effects in the absence of these treatments.

Appendix A includes a cross-reference for which type of actions included in the proposed CX were evaluated in each environmental document. Cross-referencing the actions proposed for the CX with actions analyzed in the NEPA document allowed iterative refining of the proposed CX language. For example, actions that were proposed for the CX as a preliminary matter were eliminated if they were not supported by NEPA analysis. This means that if the type of treatment and activities were not analyzed as elements of the projects listed in Table 1, they were removed as a covered action in the proposed CX. One such activity removed in this manner was chaining. Activities that were rarely proposed in the EAs and, therefore, had no comprehensive record of effects across projects, were also removed from the CX. Activities that fell into this category were construction of temporary roads and application of herbicides or pesticides. Conversely, if actions were consistently subject to NEPA analysis and were not included in the preliminary CX terms, they were eventually considered for inclusion. There were no actions of this latter type that warranted further consideration for inclusion in the CX.

[4] The BLM defines a road as: A linear route declared a road by the owner, managed for use by low-clearance vehicles having four or more wheels, and maintained for regular and continuous use. (BLM Roads and Trails Terminology [2006], Technical Note 422, BLM/WO/ST-06/006+9113, p. 10).

c) The size of each project.

The BLM established the 10,000-acre size for this CX because it was well within the bounds of acres analyzed in the BLM's EAs for which FONSIs were reached, yet is near the upper limit of what many BLM offices can plan for and treat from an operational standpoint, given their capacity (constrained by labor and budgets) (J. Boeck, personal communication). Seven (7) of the EAs listed in Appendix A evaluated projects of 10,000 acres or more, of which five were 10,000-30,000 acres in size and two were ≥100,000 acres.Two projects were 8,000-10,000 acres in size, and the remaining nine were <8,000 acres. It is important to note that while several EAs said that implementation of treatments would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

The effects of the larger projects were evaluated to be the same as those of the smaller projects. There were no differences in effects at the larger treatment sizes that would suggest limiting the CX to a particular size. Therefore, the 10,000-acre limit is proposed for the CX based on recent trends in planning and implementing PJ treatment projects, where 10,000 acres is approximately the upper limit of what an individual BLM office could plan for and treat within the relevant budget cycle. This is supported by professional experience (J. Boeck, personal communication) as well as the decisions supported by the EAs for the three largest projects (Applegate Sage Steppe Habitat Restoration EA, the Vya PMU Habitat Restoration EA, and the North Springs Pinyon-Juniper Treatment EA) to treat 10,000 acres per year (Applegate and Vya projects) or 15,000 acres per year (North Springs project). Establishment of a CX for up to 10,000 acres would enable the BLM to make as much headway as possible on restoring habitat, without undue risk of incurring significant impacts.

This acreage size also recognizes that larger projects are beneficial and indeed necessary to counteract the continuing encroachment of conifers into crucial sagebrush habitats, and existing BLM NEPA analysis for these actions have demonstrated that projects of this size routinely occur without having significant effects. As noted by the WAFWA, the scale of habitat restoration and management needed to begin and sustain recovery of (Wyoming's) mule deer populations is a landscape-level effort. (Mule Deer Working Group 2015b) and only landscape-scale habitat improvement will make long-term gains in mule deer abundance in many areas (Cox et al. 2009). Furthermore, *"It seems apparent after all these years, and studies, and successes and failures, that we know what to do, we just can't do it on a large enough scale, or circumstances don't allow us to do what is necessary. The need is to apply management practices to reverse current trends in vegetative communities and land uses over large areas on either watershed or landscape scales"* (Cox et al. 2009, p. 66). It is also important to note that the BLM's treatment areas are patchy in nature rather than contiguous across an entire project area based on management objectives (maintaining an appropriate habitat mosaic) and account for the varying habitat needs of sage-grouse and mule deer.

Relative to configuration of the treatments, the BLM's PJ treatments have predominantly been implemented in a mosaic (or patchy) fashion on the landscape. Because the BLM evaluates site-specific conditions when proposing appropriate PJ treatments, and because site conditions change with topography and elevation (among other factors), the configuration of proposed treatments is usually a mosaic of treated and untreated patches. Furthermore, treatments targeting mule deer habitat are patchy by design in order to manage for a range of seral ecosystem stages. Therefore, while this CX would authorize 10,000 acres of treatment, the BLM expects the treatments to be scattered across the landscape rather than in a large contiguous block. Table 2 provides descriptive notes about the proposed configuration of PJ treatments for representative EA projects evaluated for this CX and listed in Appendix A.

The following bullets summarize some of the situations contributing to the typical planned mosaic pattern of PJ treatments:

- Projects focused on certain phases of woodland development (PI, PII, or PIII)
- Varying treatments based on the pre-existence of invasive weeds
- Differential management objectives that vary across the landscape, based on natural conditions as well as past treatments
- Treatments focused on certain site-specific habitat use areas, such as within the radius of sage-grouse leks, which are inherently spaced out within the landscape
- Treatments to improve specific grazing allotments, which vary in size and location across the terrain.

The actions and acreage proposed for the CX have been carefully considered in order to include only methods with predictable effects and allow project sizes that take advantage of economies of scale, but that are also suitable for maintaining patchy (mosaic) habitat conditions across the sagebrush landscape, as currently recommended for wildlife by scientific research (Jones et. al. 2019, pp. 6, 27). Appendix A shows information about treatment acres identified by each project.

Table 2. Acreage Configurations for Representative EAs

Appendix A EA List No.	**BLM EA No.**	**Configuration Notes**
1	DOI-BLM-CA-N020_2015-EA-0004 -- Applegate Sage Steppe Habitat Restoration	Implementation of juniper reduction treatments within the Focus Area on any given year will occur in smaller treatment areas within the Project Area (typically from 20 to 1,000+ acres) based on resource objectives and ability to secure funding for a certain project area. FONSI p. 2 and the DOI-BLM-CA-NO70-2013-0005-EA - Vya PMU Habitat Restoration and Fuel Reduction Project EA also says implementation would occur on smaller areas from 20 to 1,000+ acres (EA. P.11, with mosaic-like pattern shown on EA p. 4)
6	DOI-BLM_ORWA-LO40-2015-0004-EA - Bryant Mtn Vegetation Treatment EA	The EA map on p. 71 (Map 1) shows a configuration of the proposed treatment areas in a mosaic pattern.
8	DOI-BLM-CO-N010-2014-0039-EA Encroaching Juniper Removal EA	The EA (p. 13) says that brush mowing treatments “are typically done in a mosaic fashion leaving 40 to 70% of the target area untreated."
12	DOI-BLM-OR-L040-2010-001-EA - Southwest Gerber Habitat Restoration EA	The EA proposed 17 juniper cutting units, from 10 to 1,600 acres in size (p. 7, Table 4), with acreages of 15, 60, 50, 600, 600, 400, 300, 1600, 720, 320,20,40, 260, 10, 20, 20, 45, and 15 acres. Figure 1 of the EA (p. 8) shows the various size units interrupted by untreated areas in a mosaic pattern.
13	DOI-BLM-UT-G020-2014-0046-EA - North Springs Pinyon-Juniper Treatment EA	The EA figure (EA p. 66) shows a mosaic of proposed treatment areas.
15	DOI-BLM-UT-G010-2014-0111-EA -Clay Basin/Browns Park Sagebrush Treatments/Fuel Reduction	The EA (p. 12) notes that projects would be implemented to achieve PJ removal objectives, including the desired mix of seral stages. The map on the last page of the EA (p. 56 of 56) shows a mosaic pattern of the proposed treatment areas.
18	DOI-BLM_MT-C020-2016-0105-EA - Powder River Basin Sage Grouse Habitat Restoration EA	This EA proposed treatments spread across priority lek circles and shows a map on p. 4 of the lek locations with radius circles, indicating that treatments would occur in a scattered pattern across the landscape. The EA (p. 3) further says the project would promote seral stages across landscape.

d) The intensity of the project (level of treatments)

Researchers and managers of pinyon-juniper encroachment often refer to Miller et al.'s (2005) classification of pinyon-juniper woodland expansion stages (Jones 2019). The stage of woodland development (i.e., succession) affects plant community structure, composition, seed pools, wildlife habitat, and ecological processes. The three stages are defined as follow:

- Phase I woodlands - *trees are present but represent less than 1/3 cover in biomass; shrubs and herbs dominate ecological processes*
- In Phase II - *trees represent between 1/3 and 2/3 cover in biomass; shrubs, herbs and trees share relative dominance, all influence ecological processes*
- In Phase III - *trees represent over 2/3 cover in biomass; tree canopy dominates ecological processes*

Intensity of treatments is directly related to these phases of pinyon-juniper woodland development. Phase I treatments are typically maintenance prescriptions that involve manual or mechanical cutting or mastication. Often disposal can be achieved through mulching or lop and scatter methods. Phase II and Phase III treatments require additional energy inputs involving more extensive removal of biomass and debris which often includes piling/yarding and jackpot/pile burning and associated remedial activities such as seeding/planting and herbicide application.

Most of the projects that were evaluated prioritize or focus treatments in Phase I and Phase II areas because treatment costs for Phase III become cost prohibitive for the treatment of larger areas. Also, pinyon-juniper removal projects in Greater Sage-grouse (GRSG) habitats may be prioritized using the Fire and Invasive Assessment Tool (FIAT) that applies resistance and resilience concepts outlined in Chambers et al. 2014b (Rocky Mountain Research Station General Technical Report 326). However, the BLM has conducted treatments in Phase III forests, has reason to treat in Phase III forests, and has found that the environmental effects are similar to treatments in the other stages.

e) What were the environmental consequences of the proposed actions and how is BLM going to ensure that the use of the CX will not result in significant adverse effects?

All associated NEPA documents were reviewed to determine the scope of environmental consequences anticipated to result from the proposed actions. For each resource area topic, a list of expected beneficial and adverse consequences was generated and summarized in Appendix B. Those consequences are described in Appendix B in the *Predicted Impacts* row. None of the EAs anticipated that any of the direct, indirect, or cumulative effects from the actions or alternatives would rise to the level of significant impacts. A FONSI was signed for all 18 EAs reviewed.

The EAs included best management practices (BMPs) that are standard in BLM's implementation of PJ treatment projects, based on the emerging science of PJ removal techniques (see literature citations in Appendix D).

There were no instances where any of the evaluated projects would have resulted in a need to complete an EIS had these measures not been applied as a feature of the proposed action or alternatives. That is, mitigation measures were not required to reduce impacts below the threshold of significance; these were not mitigated FONSIs. Of these projects, the BLM received only one challenge on PJ removal activities - an appeal associated with the Encroaching Juniper Removal Project (DOI-BLM-CO-N010-2014-0039-EA). The appeal of October, 2014, which claimed that the BLM had not documented Lands with Wilderness Characteristics, was dismissed for lack of standing by the Interior Board of Land Appeals (IBLA) in April 2015. No decisions from the other EAs or the Determinations of NEPA Adequacy (DNAs) for projects implementing the Programmatic EAs were appealed.

f) Observed environmental consequences of projects as implemented (validation)

A Federal agency may rely on the expertise, experience and judgement of its professional staff to assess the potential environmental effects (CEQ 2010). Information from subject matter experts (SMEs) in the field was solicited for each of the projects listed in Table 1. Due to staffing limitations and resource sharing across field offices and districts, some SMEs served as representatives for multiple projects. Two representatives for each project were contacted and interviewed. Twenty-four SMEs were contacted in total. Selection criteria for SMEs was based on familiarity with implementation or monitoring of individual projects. SMEs either served as core interdisciplinary team members in the development of the analysis and FONSI or were responsible for implementation and compliance with the terms specified in each decision. Each SME had direct observation and experience with impacts resulting from implementation of projects listed in Table 1 and provided validation that impacts matched those predicted in the EA/FONSI.

SMEs disclosed that there were no significant impacts beyond those predicted. Preference for SME interview selections was given to project managers, Contracting Officer's Representatives (CORs) or specialists responsible for project implementation whose area of expertise directly related to key topics and environmental effects listed in Appendix B. Professional staff were contacted and interviewed for the following key areas: Wildlife/Threatened and Endangered Species, Fuels/Wildland Fire, Vegetation/Botany/Special Status Species, Soils, Noxious/Invasive species, Rangeland Resources, Air Quality/Climate, and Cultural/Tribal Interests.

Interview questions were developed to compare effects from treatments described in EAs and FONSIs to actual, post-treatment, observed impacts. The objective of each interview was to determine the following:

- Were actual impacts the same as predicted impacts?
- Was the degree of each impact predicted accurately?
- Were there unanticipated impacts?
- Some EAs disclosed that there was a potential for impact. If the EAs predicted a potential impact, did the impact occur?
- Was the NEPA analysis challenged, or was there any concerns raised from other agencies, tribes or the public during implementation?

Appendix C shows the list of questions that were asked of each specialist to confirm the presence or absence of impacts for each project. Questions were developed and directed towards addressing all neutral, beneficial, or adverse environmental effects that might result from pinyon-juniper removal projects. Answers provided by field staff confirmed that actions described in the proposed CX would not have significant impacts when applied. A field validation summary response for each predicted environmental effect is presented in Appendix B.

Appendix B summarizes neutral, beneficial, and adverse environmental effects from pinyon-juniper control treatments. All actions and alternatives include best management practices, standard operating procedures, and design features that minimize environmental consequences. Often, through application of design elements, environmental effects are minimized to the degree that resource issues were eliminated from further analysis due to application of these project elements. While long-term benefits of reducing fuel loading and improving sagebrush-steppe habitats are primarily beneficial, neutral, or result in no effect findings, there are documented instances of adverse, residual environmental consequences associated with implementation of these treatments. These environmental consequences are not considered individually or cumulatively significant based on the conclusions from the EA analyses, which are summarized by topic below.

Soil Disturbance

Direct damage to vegetation and soils does occur from these actions; however, surface disturbance that adversely impacts existing vegetation and soils is short-term (3-5 years). Disturbance is localized to areas of pile/jackpot burning and areas subject to mechanical damage from skidding, yarding, short-radius turns and repeat travel by heavy equipment. Project implementation, when pile burning is used, creates 1-20 piles/acre that are generally about four feet in diameter. Depending on project design and fuel loading, projects may use larger piles of 10’ x 20’. The largest surface disturbance of any of the projects involved 30 landing sites that were approximately 0.75 acres each and spread over a 1,200-acre project area. Most projects use smaller piles that often include hand carrying or skidding. Surface disturbance from mastication-only projects is limited to impacts from machine travel. Rubber-tired vehicles often result in little to no surface disturbance. Tracked machines can cause localized disturbance, but are usually equipped with arms that reach beyond the path of the equipment resulting in less total area impacted by direct travel. Constraints are incorporated to avoid repeated travel to eliminate the creation of trails. When offering firewood collection, piles are typically dragged near existing roads to prevent unauthorized off-highway travel. Common design features include restrictions on project implementation when soils are wet or muddy. Often projects are completed when soils are frozen to further reduce risk of damage.

Overall, treatments are effective in maintaining and returning ecological sites towards their natural potential as described in ecological site descriptions. Restoration and enhancement of a mosaic of vegetative communities and various seral stages is being achieved through project design. Many projects target special vegetative communities such as sagebrush, aspen, bitterbrush, sumac, chokecherry and mountain mahogany that are threatened by conifer encroachment. Maintenance and enhancement of these communities increases diversity at the plant community, watershed, and landscape levels.

Soil Moisture
Predicted adverse impacts from mulching were never realized. Conversely, actual impacts from mulching act to maintain soil moisture and protect new growth. Mulching depths are restricted in contract standards and never accumulate to depths where vegetation is adversely impacted.

Invasive Plants
Increased potential for weed/invasive species colonization and expansion is minimal because of existing integrated weed management plans or design features which provide monitoring and post-implementation treatment of noxious/invasive species. Pinyon-juniper treatments maintain and restore healthy, intact ecosystems which are more resilient to noxious weed and exotic annual grass invasion.

Noxious and invasive species are present in these systems to varying degrees. The extent that noxious weeds and invasive species impact project areas correlates with the amount these impacts are already present in the system. Many sites are selected in areas that are ecologically intact where treatments are most effective in maintaining resiliency from invasion by exotic species. Project design features for control of noxious/invasive species are sufficient in preventing the spread of existing species or introduction of new species. Post-treatment monitoring and herbicide applications are being applied if necessary. Seedings are also a common tool that are being applied directly to burned pile areas. These areas are free from competition and have nutrient availability that is effective in revegetating sites with desirable vegetation.

Wildlife
Temporary displacement of wildlife from noise, mechanical equipment, and human presence is limited to the immediate period during implementation of projects, which typically only lasts several days. Field interviews verified that there were no observations of direct mortality. Project design features commonly include seasonal restrictions that prevent disruption to wildlife species.

Pinon-Juniper Obligate Species
Long-term displacement of pinyon-juniper obligate species is not significant because many of these species may select mature or other ecological stages or distribution of juniper stands. Universal retention of old-growth juniper is a condition for use of the proposed CX. Other areas of mature pinyon-juniper woodlands are retained through design features and best practices such as retention of pinyon-juniper on moderate to severe slopes, thin and rocky soils, watershed drainages, big game corridors, and in areas that may contain cultural resources.

While habitat for pinyon-juniper dependent species is reduced by implementing these projects, the availability of woodland habitats is not limiting. Expansion of pinyon-juniper woodland habitats exceeds the natural range of historic distribution and is reducing the availability of other key habitat components. Many species that are considered to be juniper-dependent species also rely on these other special vegetative communities and woodland edges for foraging and other life cycle needs.

Post-treatment release of shrubs and perennial grasses from juniper understory is successful in improving habitat for sage-steppe dependent species. Benefits in increased forage, especially in winter range, have been realized while still maintaining adequate hiding and thermal cover for big game. Habitat improvements such as increased sagebrush cover and positive response to important browse and forage species have been noted.

Visual Resources

Impacts to visual resources in the form of modifications to line, form, and texture are blended into the natural landscape within 3-5 years. All treatments conform to RMP decisions for Visual Resource Management. Validated impacts were similar to those predicted in EAs. Short-term changes to line, form, and color were observed initially, but after pile burning and vegetation re-established, there were little to no long-term impacts to visual quality. Only rare, localized instances were noted beyond expected short-term disturbance. Those disturbances were primarily related to incomplete jackpot burnings where residual materials were left unburned. These impacts are not considered significant because they can be remedied to meet visual resource management objectives by subsequent re-burning or additional hand-treatments.

Big Game Species

Thermal and hiding cover for big game species are reduced; however, forage abundance and availability is considered to be an equal, if not more important, indicator of the quality of winter range. Post-treatment emergence of shrubs and perennial grasses from juniper understory is successful in improving sage-steppe and other key habitats. Benefits in increased forage, especially in winter range, have been realized while still maintaining adequate hiding and thermal cover for big game. Common design features and constraints include protecting old-growth along drainages and ridgelines. Other resource considerations, such as slope restrictions and cultural buffers, often leave additional areas of mature woodlands. Remaining stands and treatment areas create a mosaic of habitats consistent with mimicking natural variation in seral stages.

Wilderness Characteristics

Loss of vegetative screening results in short-term impacts to wilderness characteristics by reducing the opportunity for solitude and impacts to naturalness. No permanent features are constructed that would affect existing inventories for wilderness characteristics or would affect qualifications for these areas to meet the criteria to be identified as lands with wilderness characteristics. Treatments are effective in the restoration of natural conditions and processes. Validation reports indicate that there are no long-term impacts to the size, naturalness, or opportunities for solitude that would disqualify an area based on the implementation of these projects. After 3-5 years, little evidence remains that projects occurred.

Impacts to solitude are caused by mechanical equipment, noise, and human presence during project implementation. Impacts to solitude are not considered significant because impacts are rare, isolated, and short-term, lasting only several days to a few weeks.

Treatments were effective in the restoration of natural conditions and processes which has long-term, overall lasting benefits to naturalness. To the degree certain areas are managed for wilderness characteristics, a variety of design features are used to reduce short-term impacts. Projects routinely implement design techniques such as feathering to prevent hard lines between forested and un-forested areas. Lighter treatments, such as mastication, pile burning and use of rubber tire vehicles are used to further limit surface disturbance and residual slash. Other measures incorporated into areas with wilderness characteristics include, decreased stump height objectives and increased pile consumption objectives.

<u>Cultural Artifacts</u>

Direct ground disturbances from fallen trees, vehicle traffic, heavy machinery, and heat damage (such as burning, spalling, cracking) can result in artifacts being damaged by treatments. While potential impacts to cultural resources are less from those that would be realized from wildfire events, there are potential risks to cultural resources from pinyon-juniper treatment projects. Many of those risks are substantially reduced by requirements to conduct field inventories/surveys, consultation with tribes and state historic preservation offices and implementing appropriate mitigation measures. Common mitigation measures include full-avoidance or restricting treatment methods to hand-treatment only within and adjacent to sites. Use of hand treatments are also used to limit livestock concentrations in protected areas where they seek shade. In some areas, cultural sites coincide with the presence of old-growth timber which is already protected under retention measures for old growth. There have been no observed impacts to cultural resources beyond those predicted in the environmental assessments.

A potential for indirect impacts to cultural and historic resources as a result of increased human access could potentially lead to illegal artifact collection. Project design features include masking cultural sites or adjusting project boundaries to exclude sensitive areas from treatment altogether. These techniques are commonly incorporated in project design to prevent the identification of protected areas which could potentially result in illegal collection or vandalism.

<u>Tribal Resources</u>

Tribal groups are generally supportive of pinyon-juniper treatments for the restoration of ecological health. They recognize the risks that catastrophic wildfire presents to cultural resources. Tribal concerns that have been identified during consultation and staff-to-staff coordination efforts include protection of areas of religious and cultural significance such as burials, rock art, eagle traps, wickiups, old-growth timber, and traditional plant collecting areas. As with other cultural resources and historic sites, these areas are avoided or hand-treated to reduce impacts. Constraints on cutting old growth further protects traditional use of pinyon pine nuts since trees do not produce seeds until maturity.

<u>Air Quality</u>

Reduced visibility, lung irritation, smoke odor, and temporary short term increases in local air pollution can occur from dust emanating from mechanical and manual treatments and smoke produced from pile burning. Decreased fuel loading of pinyon-juniper across treatment areas reduces the potential spread and intensity of wildland fire.. Treatments result in changes to ladder fuel arrangement which decreases fuel height and flame length. Differences in treated versus untreated areas is especially notable when needle hazards are removed in treated areas.

Exposure to harmful emissions or air quality would be minimal because all projects that utilize pile burning are conducted in conformance with local, county and state emissions standards. Regulatory parameters vary by state, but are typically set to limit time and tons of fuel per acre. Residual emissions from wildfire or prescribed fire may persist for several days in smoke sensitive areas when stagnant air or inversions are present. Dust produced from project-related activities and smoke from jackpot/pile burning are even shorter term. Field reports indicate that residual times for these activities do not exceed more than a few hours. The maximum distance smoke has been observed is 20-30 miles. Piles usually burn within a few hours and smoldering does not occur for long periods of time because no litter and duff layers are consumed. While many individuals are sensitive to smoke irritations, compliance with local, county and state guidelines restrict burning to specific burn windows when weather conditions are favorable to disperse impacts to air quality. Press releases and public notices of burning activities are also a common tool to assist residents in avoiding exposure to smoke.

Biomass (Carbon)

The amount of biomass (corresponding to carbon) removed as a result of pinyon-juniper removal actions is substantially less than during either prescribed or wildfire events. Although there are treatments in late-successional woodland areas, pinyon-juniper projects primarily target early and mid-succession phases where the least amount of biomass is removed. Due, in part, to the remote nature of many pinyon-juniper projects, large biomass removal treatments are cost-prohibitive and usually only used on smaller acreages. Further design features incorporated into the treatments routinely include retention of woodland stands for the protection of wildlife habitat, old-growth values, visual screening, and cultural resources. Pockets, islands, and corridors of timbered stands leave additional biomass onsite that would likely be consumed in a prescribed or wildfire event. Projects that include only mastication, thinning, and cut/leave reduce impacts to carbon stocks further.

2. Peer-reviewed research findings, professional opinions and reports

Published peer-reviewed literature provides statistically supported findings about the effects of PJ removal and associated sagebrush habitat restoration activities included in the proposed PJCX. The BLM reviewed this literature for the proposed PJCX activities and has summarized key findings relative to the effects of these activities below. Literature cited is shown in Appendix D.

The effects of PJ removal have been studied for over 40 years. The below literature includes peer-reviewed articles about individual studies as well as literature reviews. The two most recent literature reviews (Jones 2019 and Miller et al. 2019) each examined hundreds of research findings spanning from the 1970s to 2018. These literature reviews represent comprehensive understandings of mechanical PJ treatment studies completed to date.[5] Because this information

[5] Research methods usually show or disprove effects (changes) by statistical analysis, and so the literature frequently refers to the observed

is a compilation of studies conducted in PJ woodlands throughout the western U.S., under various site-specific conditions, and includes the PJ removal methods proposed in the CX, these reviews provide not only specific data informing direct effects but also inform any consideration of cumulative effects of these types of projects.

A. *Tree Removal: Manual Cutting, Machine Cutting, Mastication with Mulching, Yarding, Piling, and Removal*

The scientific literature includes studies on the effects of mechanical PJ tree cutting and removal activities on understory vegetation, invasive non-native plants, wildlife habitat, soil erosion and stability, and fuel loads. The section below focuses on the effects of the methods proposed in the CX, which include cut-and-leave (lop-and-scatter), cut-and-remove, cut-and-pile-burn, and masticate-and mulch (sometimes referred to as shredding).

a) *Understory Vegetation*

Tree removal eliminates overstory tree canopy, exposing understory plants and soils to increased levels of sun and precipitation. Therefore, one of the primary responses is a change in understory vegetation. Studies of vegetation changes after mechanical PJ treatments (= removal activities) have included lop-and-scatter, lop-pile-burn, machine cutting (feller-buncher), and mastication removal methods. For all types of treatments, with or without seeding, researchers have predominantly observed an increase in understory cover and density, including increased richness and cover of perennial and annual grasses and native forbs (herbaceous plants) (Jones 2019 p.18; Hartsell et al. 2020 p. 9).

Specific changes among vegetation groups after cutting treatments have been described. Williams et al. (2017) measured plant cover and density on cut (by chainsaw with cut trees left on the ground) vs. uncut plots with different PJ densities at 10 sites across the Great Basin. Cut plots had greater tall grass cover than uncut plots at 3 years and 6 years after treatment. Shrub density was similar on cut and uncut plots at 3 years, but at 6 years, shrub density was higher on cut plots than untreated plots. Sagebrush cover was similar on cut and uncut plots at year 3, but was 2.7 percent higher on cut plots than uncut plots by year 6. Cheatgrass (*Bromus tectorum*) cover on cut plots was greater than on untreated plots at years 3 and 6 when pre-treatment tree cover was 50 percent or more. Exotic forb cover was similar on cut and uncut plots at 3 years and 6 years. Overall, these researchers found that cutting at low (0 – 0.34 tree density index) to mid-density (0.34-0.67) tree cover resulted in herbaceous plant cover percentages similar to untreated plots at the comparable (target) tree density (i.e., a more intact vegetation community).

Chambers et al. 2014a found that in big sagebrush (*Artemisia tridentata*) communities, increases in perennial native herbaceous species and shrub recruitment occurred across a range of pretreatment tree densities (Phase I through Phase II woodlands) after cut-and-leave PJ treatments.

Miller et al. 2005 compiled results from seven studies of vegetation responses to cutting treatments of juniper. Each of the seven studies reported meaningful increases in the cover,

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responses as “significant” or “not significant”. This use of “significant” is unrelated to significant effects as defined under the NEPA; rather it is an indication of the probability of a correlation or cause-and-effect relationship as concluded by statistical analysis. Therefore, this section refers to effects with statistical significance as “meaningful” or “noticeable” results.

density or biomass of understory plants, on the order of 50 percent, 100 percent, 300 percent, and 900 percent increases, varying by study and parameter. Some studies showed more response by grasses and perennial forbs, others showed more response by shrubs and perennial plants.

Bates et. al 2005 conducted a longer-term (13-year) study of understory response after cutting treatments, where cut trees were left in place and livestock excluded. By year 2, the total standing crop of herbaceous vegetation was 10 times higher in the cut than the uncut (untreated) sites. In the early successional stages (1-2 years after treatment), perennial bunchgrasses and Sandberg's bluegrass were co-dominant. By year 5, cheatgrass had replaced Sandberg's bluegrass as the co-dominant with perennial bunchgrasses. Cheatgrass peaked in biomass in the sixth year and then began declining while perennial bunchgrasses increased. From years 5 to 13, herbaceous standing crop and perennial grass densities remained constant. By year 13, perennial bunchgrasses had 16 times greater biomass in the cut area than the untreated area and represented nearly 90 percent of total herbaceous biomass; cheatgrass was only 4 percent of the total standing crop. Annual forb standing crop was higher in the cut area than the untreated area but represented < 5 percent of the total. Standing crop of perennial annual forbs did not vary between the cut and uncut sites.

Studies on the effects of mulching after mastication have indicated a beneficial effect of mulch for understory vegetation. Mulching retains residual vegetation and potential native seed propagules on site. The mulching provides a physical barrier on the soil surface that, on the one hand, may hinder native plant growth, but on the other may promote soil stability, higher soil moisture and nutrient content, and cooler soil microclimates believed beneficial for native plant recruitment and survival (Havrilla et al. 2017, p. 616). Mulching also temporarily reduces soil-available nitrogen, which may dampen establishment by invasive exotics with high nitrogen demand, allowing time for native plants to establish. In addition, shredding from mastication converts canopy fuels to small 1- and 10-hour fuels, which can reduce fire spread and enable containment (Roundy et al. 2014). The debris (mulch) increases infiltration and reduces sediment production in interspaces (Cline et al. 2010).

Some studies have found a greater percent of invasive non-native plants when mastication/mulching was implemented compared to cut-and-leave treatments. Mulching has been specifically shown to reduce cheatgrass germination; however, Havrilla et al. (2017) found that an unseeded mastication treatment resulted in a high (29 percent) cover of cheatgrass after six years of treatment, higher than seeded mastication plots, and seeded broadcast burning plots. At the same time, however, the unseeded mastication treatment exhibited high cover of native species (approximately 48 percent) compared to 7 percent in the untreated control. This native species cover was higher than in seeded mastication plots and seeded broadcast burning plots, and similar to seeded plots treated by cutting followed by pile burning (Havrilla et al. 2017, p. 613).

The research clearly shows a rebound of desired native sagebrush-community vegetation through PJ mechanical removal treatments. That PJ removal reverses the decline in desirable sagebrush community-associated vegetation is clear enough that researchers recommend implementing tree reduction at Phase I and early Phase II PJ woodlands in order to avoid significant loss of shrub and sagebrush cover, and recommend tree reduction at Phase II and early Phase III to avoid significant loss of perennial herbaceous cover (Williams et al. 2017).

b) Invasive Plant Species

Mechanical PJ treatments involve soil-disturbing activities associated with the risk of introducing or expanding invasive plant species, specifically non-native annual grasses (Jones 2019, p. 19). Vectors include uprooting existing vegetation and soils, exposing existing invasive plant seedbed, and importing seeds from off-site. The risk increases with the use of machinery (machine cutting, yarding, and mastication) due to its weight and tread, factors not associated with manual cutting and lop-and-scatter methods. [Note: The published literature does not specify whether machinery and tools were washed prior to entering the treatment sites.]

The literature indicates that PJ removal activities often increase the abundance of invasive annual grasses, with cheatgrass being a focus of much of the research. Jones (2019) describes that some researchers have found post-treatment annual grass dominance correlated to high pre-treatment components of those grasses (i.e., they were there before treatment) and that certain pre-treatment densities of desirable perennial grasses would resist post-treatment cheatgrass dominance (p. 19). Other researchers have focused on the relationship of invasives and shrub/perennial herbaceous cover. However, studies have shown that annual grass cover changes over time as the plant composition changes. The longer-term studies have shown that initial spikes in annual grasses (cheatgrass), even in burn piles, tend to diminish over time. In the most severe case of cheatgrass co-dominance (50 percent cover) in litter/debris areas and burn piles (see study by Bates et al. 2007 below), its abundance declined in favor of native species over time (by year 13).

Williams et al. 2014 found that cheatgrass cover on cut PJ plots was greater than on untreated plots at years 3 and 6 when pre-treatment tree cover was 50 percent or more. The study notes that as the cover of tall grass increases, the cover of cheatgrass decreases (such landscapes are more resilient and resistant to the effects of wildfire). On the cut plots, cheatgrass cover was a minor fraction of the tall grass cover: the ratio of cheatgrass to tall grass was 0.1-0.2 on the cut plots.

Other researchers have also shown that cheatgrass declines as perennial herbaceous cover, particularly perennial grasses, increases. Bates et. al 2005 conducted a 13-year study of understory vegetation response that tracked cheatgrass after cutting treatments, where cut trees were left in place and livestock excluded. In the first two years after treatment, perennial bunchgrasses and Sandberg’s bluegrass were co-dominant in biomass, and cheatgrass was barely represented. Cheatgrass increased in year 3 and by year 5, had replaced Sandberg’s bluegrass as the co-dominant along with perennial bunchgrasses. Cheatgrass peaked in biomass in the sixth year and then began declining; by year 13, it was only 4 percent of the total standing crop. Roundy et al. 2014 found that cheatgrass increased after shredding (mastication) or after shredding and seeding, but that cheatgrass cover declined as perennial herbaceous cover increased; sites with over 35 percent perennial herbaceous cover had less than 10 percent cheatgrass cover.

There is some evidence that litter from cut-and-leave operations provides sites favorable for annual grass (cheatgrass) establishment, at least temporarily. Bates et al. 2007 (pp. 554-558) reported on vegetation dynamics over a 13-year period for cut-and-leave juniper stands, and evaluated vegetation responses as a function of tree litter. The study compared vegetation in three zones: old canopy locations (the litter mats beneath the cut trees); “debris” locations (former interspace areas between trees where cut tree materials were placed); and interspaces (open areas between or outside of the litter and debris zones). They found substantial differences among the zones over time. By year 6, annual grass (primarily cheatgrass) represented almost 50 percent of the total biomass in debris and canopy locations; however, by year 13, the percentage had dropped to 6 and 14 percent, respectively (p. 557), and perennial grasses dominated these zones. Annual grass densities remained lower in the interspaces (with no litter accumulation) than the canopy and debris locations, having an increasing cover of predominantly perennial bunchgrasses throughout the 13-year study period. Perennial grass cover increased in all locations over time, and comprised the highest proportion of herbaceous cover in all zones by year 13. The researchers postulated that taking away litter and debris would dampen the establishment of annual grass after treatments (p. 557).

Chambers et al. (2014a) reported results of a controlled study of PJ removal by mechanical cut-and-leave treatment (compared to broadcast burning treatments) on plots of 8 to 20 hectares (approximately 20 to 50 acres) in size, in Wyoming big sagebrush (*Artemisia tridentata var. wyomingensis*) and mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. vaseyana [Rydb.] Beetle) communities. In the cut-and leave treatments, the percent cover of annual exotic plants and annual grasses (cheatgrass) dipped the first year after treatment, after which the results varied by community type. In the Wyoming sagebrush community, the percent cover of both annual forbs and cheatgrass steadily increased in years 2, 3 and 4. The pre-treatment annual exotic cover of approximately 10 percent increased to approximately 20 percent in the cut-and-leave plots. The pre-treatment cheatgrass cover of approximately 5 percent rose to approximately 10 percent in the cut-and-leave plots. In the mountain big sagebrush community, the percent cover of both annual forbs and cheatgrass in the cut-and-leave treatments remained very close to the untreated control areas (remaining around 1 percent) for all four years (as shown in graphs in Figures 4 and 5 on pp. 445-446).

Chambers et al. (2014a) concluded that sites in cool and moist (cool frigid/xeric) soil temperature/moisture regimes (the mountain big sagebrush sites) tend to have moderately high resistance to invasives, as do sites with sufficient pre-treatment perennial grasses. Even on warm sites more favorable for cheatgrass, increases were not always observed; on relatively warm sites, increases in cheatgrass and other exotic annuals were not observed when the pretreatment perennial native grass and forb cover was at least 20 percent. Williams et al. (2017) have also noted that the risk of cheatgrass is minimal on cooler wetter sites. These researchers have increasingly noted that perennial native herbaceous species are a primary determinant of site resilience to disturbance and management treatments or resistance to cheatgrass and exotic forbs under some site conditions (Chambers et al. 2007, Chambers et al. 2014a and 2014b, Williams et al. 2017). These concepts of resilience and resistance have become recognized by other scientists and have been incorporated into contemporary guidelines and handbooks for sagebrush restoration, including Pyke et al. 2017, Chambers et al. 2017, and Miller et al. 2019.

The research overwhelmingly shows that PJ removal restores ecosystem values associated with the rebound of native shrubs (including sagebrush), perennial grasses, and forbs, even when there may be a component of non-native forbs and annual grasses. Despite the expectation that annual grasses (e.g., exotics like cheatgrass) often increase after PJ treatment, the current literature shows that the native plant communities reestablish after mechanical PJ removal treatments, becoming dominant (over nonnative species) either immediately after treatment or within a few years. As noted under *Herbaceous Vegetation Cover*, vegetation responses after cut treatments show increased richness and cover of understory groups, including perennial and native forbs in addition to annual grasses (Jones 2019, p.18).

c) *Wildlife Habitat*

Sage Grouse

The section on *Understory Vegetation* described that mechanical PJ removal treatments result in the rebound of native shrubs, perennial grasses, and forbs that are more beneficial to sage grouse than the former PJ canopies. Sage grouse avoid or are negatively affected by even very low percents of conifer cover; studies have found no active leks in sagebrush communities with ≥ 4 percent tree cover, and movements are believed to be inhibited at ≥ 2 percent tree cover (Chambers et al. 2017, pp. 29-30). The Jones (2019) literature review reported no studies showing that pinyon-juniper removal had negative effects on sage-grouse habitat, and 60 percent of the relevant studies found that PJ removal in sagebrush communities increased sage-grouse use of the treated areas.

Mule Deer

A review of PJ treatment effects on deer and elk habitat by Bombaci and Pejchar (2016), cited by Jones (2019), found that mechanical treatments have variable effects on deer and elk use of sage-steppe ecosystems, both seasonally and annually, ranging from decreased use to increased use. Some researchers concluded that the size and configuration of the treatments contributed to differences in effects.

Treatments were found to improve forage values, sometimes at the expense of cover used for other daily and seasonal needs (Jones 2019). The decision to manage for forage or cover is dependent on the condition and location of mule deer populations relative to their habitat needs.

Mule deer require high-quality forbs and shrubs, and some grasses, to support reproduction, body maintenance, and antler growth (Mule Deer Working Group 2015a). Disturbances such as mechanical PJ removal result in the rebound of native shrubs, perennial grasses, and forbs that are beneficial for mule deer foraging needs. *Ibid*. Mule deer are limited by forage quality and quantity on winter range throughout much of the Intermountain West (Cox et al. 2009) and cover is seldom considered limiting in most parts of the Colorado Plateau Ecosystem whereas forage quality and availability are critical factors (Watkins et al. 2007, p. 11). Cox et al. (2009) states that regardless of habitat type, quality of typical winter range diets is inadequate to prevent winter weight loss in mule deer, and that the rate of weight loss can be reduced by improving winter range forage conditions. For instance, Freddy (1985) (cited in Watkins et al. 2007, p. 12) found that presence or absence of thermal cover influenced deer behavior, but had no effect on deer body mass, suggesting that effects of available cover on survival were probably minimal. These findings indicate that PJ treatments, shown to increase forage quantity and quality (see section on *Understory Vegetation*), provide beneficial impacts for mule deer and their habitat.

Cox et al (2009, pp. 2-3) notes that the availability and condition of the shrub component is an underlying issue, since deer use and rely on sagebrush for winter browse (p. 18) and the availability of highly nutritional plants is fundamental to highly productive deer populations (p. 58). Shrubs occur mostly in early successional (recently disturbed) habitats, indicating that disturbance is key in maintaining high quality deer habitat. In addition to enhancing shrub expansion, disturbance stimulates new growth which is more palatable and more nutritious than older mature plants (Cox et al. 2009, p. 58). However, deer cannot subsist on sagebrush alone for extended periods of time, nor juniper or pinyon trees; other forage plants are important for deer nutrition. *Ibid*. Miller et al. 2005 reports that crude protein levels in cut PJ treatment areas were 50 percent higher than in untreated areas, and that the period of green forage production may extend by 4 to 8 weeks for at least the first several years after PJ control.

Resource managers have identified that benefits of PJ removal projects vary with the size and configuration of openings, and have produced numerous handbooks for restoration treatments by region, including Watkins et al. 2007, Cox et al. 2009, and the Mule Deer Working Group 2015b. PJ removal probably benefits elk as well, because elk have been observed to utilize mule deer treatment areas rather than their traditional wintering areas (Cox et al. 2009, p. 21).

Other Birds and Mammals

Research of ***bird*** species responses to PJ removal have been relatively consistent in reporting that use of the treated areas sagebrush-associated species increased after PJ treatments, while use by PJ woodland species decreased (Jones 2019 pp. 26-27).

Research on ***small mammal*** responses to total PJ removal did not find statistically meaningful differences between treated and untreated sites (Jones 2019, p. 27; Bomback and Pejchar 2016, p. 39). Studies where PJ was thinned (but not completely removed) found increases in small mammal richness, biomass, and density compared to non-thinned conditions, with the exception of the pinyon mouse (*Peromyscus truei*), a pinyon woodland obligate. Population increases were attributed to increased ground cover from residual slash or increased grass and herbaceous growth stimulated by tree removal.

Available research on ***larger non-game mammals*** is limited and focused on chained treatment sites, where wildlife use of the treated areas increased for some species and decreased for others (Jones 2019, p. 27).

d) Soil Erosion and Stability

PJ removal eliminates overstory tree canopy, thereby exposing soils to increased levels of sun and precipitation. When machine-based treatments are used (feller-bunchers, masticators/shredders, yarding), soils are disturbed when rubber-tired and track-mounted vehicles move across the ground. Mastication leaves a layer of woody mulch on the ground, providing nutrients, shade, and microclimates. The impacts of these effects on soil erosion and stability have been researched in hundreds of studies.

A synthesis by Williams et al. (2018) of 250 published studies on the ecohydrologic effects of PJ removal concluded that tree reductions by mechanical means enhance understory and vegetation and improve site-level ecohydrological function over time. The overwhelming conclusion has been that PJ removal has positive effects on soils, soil erosion, and hydrological function. Mechanical treatments (both manual and machine) appear to initially enhance infiltration and reduce hillslope runoff and erosion where tree debris is well-distributed into bare inter-canopy areas and in good contact with the soil surface.

Baseline soil conditions prior to PJ removal often include ongoing erosion. Pierson et al. (2005) describes that in the later stages of Phase II PJ woodlands, declining understory vegetation leaves extensive and contiguous patches of bare ground within the inter-canopy, reduces rainfall interception and infiltration, and increases the water available for runoff, thus promoting overland flow. Put another way, “the potential for significant erosion and rill formation increases with western juniper dominance” (Miller et al. 2005). In these scenarios, research has found that PJ treatments reduce erosion over time by increasing vegetative cover on the soil surface (the certain outcome of canopy removal). While all treatments provide this, soil stabilization may be enhanced when mastication equipment is used because of the residual slash left on the soil surface (Jones 2019; Pierson et al. 2015).

Relative to different PJ mechanical treatment types, studies of erosion and runoff after treatments by lop and scatter, mechanical removal, and mastication methods found no significant differences between them and no increases in erosion (Jones 2019). The only treatment type associated with increased erosion and runoff was chaining. *Ibid*.

Relative to biological soil crusts, which protect the soil surface and contribute to aggregate soil stability, the research indicates that mechanical treatments (equipment) can remove crusts. However, research shows that soils are stable and shrubs/herbs rebound after PJ tree removal by tree cutting and mastication, conditions that are favorable for soil crusts. (Redmond et. al 2013 and Webb 1983 cited in Jones 2019, p. 36). Early-successional cyanobacteria and chlorophyta return within one to two years, with mosses and lichens requiring longer (possibly decades) to develop (Redmond et. al 2013 and Webb 1983 cited in Jones 2019, p. 36). Research pointing to long-term delays in soil crust development, also associated with runoff and erosion, arose from disturbances such as chaining and recreational off-road vehicle use (Redmond et. al 2013 and Webb 1983 cited in Jones 2019, p. 36).

e) Fuel Loads

Cutting treatments may leave cut wood on the ground (e.g., lop and scatter) or move it into piles to be burned or removed from the site, thus altering fuel loads. The resulting effects on fuel loading have been analyzed in relation to the pre-treatment (existing) conditions. Tausch and Hood (2007) note that as trees have encroached into sagebrush ecosystems, fuel loads have increased. They estimate that fuel loads have doubled since Euro-American settlement and that they will double again in the next 40-50 years. They note that the infill tree canopies are very continuous and homogeneous, resulting in continuity of fuels across the landscape and that the ongoing increases in fuel loads are primarily in highly flammable fine fuels. As noted by Miller and Tausch (2001) and others, the increasing crown closure in PJ woodlands is increasing the occurrence of crown fires. Prior to European settlement, ecosystems like the Great Basin and southern Utah were shrub-dominated and more resilient to disturbance by fire. Researchers generally believe that PJ treatments that reduce the fuel loads and continuity of fuels are beneficial and necessary to prevent the destructive feedback loop of high-intensity (crown) fires transforming the landscape into annual invasive grasslands (Roundy et al. 2014, Williams et al. 2017, Young et al. 2013).

Researchers note differences among treatment types relative to fuel loading. Yarding and piling, followed by burning or removal from the site result in the greatest reduction in fuel loads. Lop and scatter leaves canopy fuels on the ground which could facilitate high-severity wildfire with subsequent herbaceous plant mortality (Young et al. 2013). Mastication reduces large canopy fuels to small class sizes, reducing fire intensity and rate of spread. *Ibid*. As indicated, not all post-treatment fuel scenarios are risk-free. However, mechanical PJ treatments are considered beneficial and not a significant impact because they reduce or eliminate canopy fuels currently considered the greatest threat to the persistence of sagebrush communities.

B. Prescribed Burning (Pile Burning)

Pile burning is a form of prescribed burning, as are jackpot burning and broadcast burning. All of these are used differently in managing, enhancing, and restoring vegetation in land management.

Pile burning burns slash only in discrete piles where cut logs and debris are placed. . In jackpot burning, cut fuels are placed close to where they fall and are burned in place. Broadcast burning involves application of fire to generally most or all of an area within a well-defined boundary.

While prescribed burning can provide valuable tools for reducing fuels and managing vegetation, and, therefore, habitat, it can also present threats to the same habitats. A threat of some types of prescribed burning to sagebrush communities arises from the responses of non-native (exotic) annual grasses and forbs, particularly cheatgrass (*Bromus tectorum*), which establish more readily after fire than native perennials and may displace them, intensifying non-native plant dominance (Shinneman et al. 2018, p. 3). These exotic plants produce dried fine fuels that facilitate fire spread and increase ignition rates and, therefore, increase the risk of promoting the grass-fire cycle (described in the Background section of this CX report). *Ibid*. These threats are predominantly found with broadcast burning because over large landscapes, broadcast burning has the potential to trigger the undesired transition to annual grass dominance. (Miller et al 2014; Williams et al. 2017; Chambers et al. 2014b; Redmond et al. 2014). In addition, burning can kill sagebrush, which can take from 15 to 100 years to recover, even when dominant before burning (Davies and Bates 2019). Recovery may be even slower where sagebrush was already excluded from the community, for instance by juniper encroachment, as the seed banks in these communities are likely sagebrush-seed limited (Bates et al. 2005; Davies and Bates 2019).

Where fire occurs in interspaces between cut trees (or remaining trees), the response of understory vegetation may be inhibited. Interspaces are a source of roots and seeds for recolonizing vegetation (Havrilla et al. 2017, p. 616), and many studies show that the interspaces are the locations of greatest densities of native vegetation after PJ treatments (refer to Understory Vegetation section in this report). Additionally, the interspaces are important because intact sagebrush and sagebrush-steppe communities have a structurally heterogeneous arrangement, where the woody (shrub) or herbaceous perennial components are balanced by bare soil gaps (canopy interspaces) that provide discontinuity in wildlife fuels (Shinneman et al. 2018, p. 29). Disturbance in the interspaces increases the threat of invasion of the interspaces by nonnative annual grasses, which provides a more continuous and fine-textured fuel bed that promotes burning and re-initiation of the invasive plant cycle. *Ibid*.

While the literature and the BLM's own experience have shown that desired vegetation communities can result from broadcast burns, the overall complexity of fire ecology and the current gaps in knowledge about long-term effects on plant communities indicate that projects proposing broadcast burning on large areas of the landscape warrant detailed analysis of site-specific conditions and alternatives through NEPA analysis. This is in keeping with the *Science Framework for Conservation and Restoration of the Sagebrush Biome: Linking the Department of the Interior's Integrated Rangeland Fire Management Strategy to Long-Term Strategic Conservation Actions, Part 1* (Chambers et al. 2017), which cautions that for treating conifer expansion: "Use prescribed burning cautiously and selectively in moderate to high resilience/resistance [cells]" (p. 106) and "Consider alternatives to prescribed burning where other treatment alternatives may meet management objectives." (p. 107). Miller et al. 2019 notes that "the increasingly overwhelming problem of invasive annual plants across the Intermountain Region requires cautious consideration when deciding to use prescribed burning treatments (p. 187). Due to the greater uncertainty and potential severity of burning effects in sagebrush ecosystems, broadcast burning and jackpot burning are not included in this CX.

Most of the literature relative to burning in PJ woodlands focus on the effects of broadcast burning as a treatment. For instance, Chambers et al. 2014a reported results of a controlled study of PJ removal by mechanical cut-and-leave treatment compared to broadcast burning treatments on plots of 8 to 20 hectares (approximately 20 to 50 acres) in size, in Wyoming sagebrush and mountain big sagebrush (*Artemisia tridentata* Nutt. ssp. vaseyana [Rydb.] Beetle) communities. For both treatments in both community types, the percent cover of annual exotic plants and annual grasses (cheatgrass) dipped the first year after treatment, after which the results varied by treatment type and community type. In the Wyoming sagebrush community, the percent cover of both annual forbs and cheatgrass steadily increased in years 2, 3 and 4, with the burning treatments having markedly greater cover than the mechanical treatments. The pre-treatment annual exotic cover of approximately 10 percent increased to approximately 35 percent in the burn plots by year 4 compared to approximately 20 percent in the cut-and-leave plots. The pre-treatment cheatgrass cover of approximately 5 percent rose to approximately 20 percent in the burn plots and approximately 10 percent in the cut-and-leave plots. In the mountain big sagebrush community, the percent cover of both annual forbs and cheatgrass in the cut-and-leave treatments remained very close to the untreated control areas (remaining around 1 percent) for all four years, while the percent cover of annual exotics in the burn treatments increased to approximately 15 percent and the cover of cheatgrass increased to approximately 12 percent (as shown in graphs in Figures 4 and 5 on pp. 445-446).

Unlike jackpot burning, pile burning allows the location of piles to be selectivly placed in areas of low risk and outside of important habitat interspaces, and pile size and numbers can be planned to limit the overall burn footprint within a treatment area. Because jackpot burning occurs at or near where fuels fall, this often results in fire disturbance in the interspaces between trees and sometimes comprise large percentages of the treatment area (for instance, areas of cut debris comprised about 20 percent of treatment sites described in Bates et al. 2017 (p. 551).

A few studies isolated the effects of pile burning within the overall treatment. In one such study, Redmond et al. 2014 found that of three applied PJ removal treatments -- mastication, cut and broadcast burn (which, based on the description of the methods, equated to jackpot burning), or cut and pile-burn – only the broadcast (jackpot) burn treatment resulted in a decline in shrub cover; the cut and pile burn did not (p. 1143).

C. *Seeding and Manual Planting of Seedlings of Native Species*

The scientific literature relative to seeding and planting as part of PJ treatments focuses on the effectiveness of seeding/planting in changing the vegetative community. The literature did not identify situations where seeding caused undesirable conditions. In some cases, seeding did not appear to improve vegetative outcomes and in some cases it did. Overall, the research shows that seeding may be neutral or beneficial. The strongest trend was that seeding after fire was considered important to dampen the increases in non-native species. Representative findings from some of the more recent studies are provided below.

The effects of seeding and planting native species on the understory vegetation has been variable, with differential success of understory groups and species (Hartsell et al. 2020). The effectiveness of seeding to boost the target species has varied, but no studies have reported adverse effects on vegetation communities. Roundy et al. (2014) found that after shredding (mastication), seeding made no meaningful difference in the response of vegetation cover groups. Miller et al. (2005) reported that broadcast seeding usually resulted in limited establishment of the seeded species, but that broadcast burning beneath slash or just prior to a disturbance may increase the success of establishment.

A number of researchers have observed that seeding perennial native species after treatment tends to increase those species and diminish the cover of invasive annuals. (Jones 2019, p. 19). Davies and Bates (2019) found that seeding mountain big sagebrush after juniper control, on sites where sagebrush had been largely excluded by canopy conditions, did make a statistical difference in sagebrush abundance, and that seeding was important in accelerating sagebrush growth and cover compared to not seeding. Sagebrush cover averaged about 1% in unseeded areas vs 30 % in seeded plots after 8 years (Davies and Bates 2017, p. 262). Havrilla et al. 2017 found that understory plant cover was more than three-fold higher in experimental plots where PJ had been removed and seeded than in seeded treatments alone. Davies and Bates (2017) postulate that sagebrush restoration varies by site characteristics, and that seeding failure may occur when herbaceous competition is high.

FINDINGS

The purpose of evaluating the BLM's EAs with FONSIs and subsequent field outreach in the Methods Section 1 was to determine whether activities associated with pinyon-juniper removal projects result in either significant individual or cumulative impacts on the quality of the human environment as determined by after-action reviews. No significant individual or cumulative impacts were predicted in the BLM EAs and FONSIs for the activities included in the proposed CX for pinyon-juniper control, the observed post-implemementation effects were similar to or less impactful than the effects predicted in the EAs/FONSIs, and there were no unanticipated impacts from the treatments.

The BLM has analyzed the effects of many PJ removal projects in EAs, and has monitored post-implementation results. The BLM's post-implementation observations align with the literature review summarized in the Methods Section 2. The BLM's review of the available literature demonstrates that the activities proposed for this new CX would not cause significant environmental effects, whether the activities were to be implemented individually or in combination. The BLM's experience with implementing and monitoring these types of project mirrors the scientific literature; taken together, they support establishment of this PJCX, providing the evidence that this type and scope of action can be categorically excluded from further detailed analysis.

The BLM specifically notes that with the current level of understanding, the advance of invasive species, whether pre-existing or new, may be an outcome of PJ treatment. However, as noted above, native sagebrush and sage-steppe vegetative composition and forage production improve despite the presence of invasive plant species. The BLM addresses actions for managing invasive plant species in their land use plans, and any implementation of this CX would be required to be in conformance with any protection measures required through the applicable plan. In addition, the BLM has not included activities with unknown or potentially high risks of introducing invasive plants in the proposed CX, namely broadcast burning, jackpot burning, and road construction.

CONCLUSIONS

Pinyon-juniper treatments are a common, effective tool that BLM uses to facilitate restoration of ecological diversity through the restoration and enhancement of a mosaic of vegetative communities. Treatments ultimately result in ecological communities capable of effectively supporting sage-steppe habitats that are more resistant to landscape-scale wildland fires and the advent of noxious and invasive weeds by increasing perennial grasses, forbs, and shrubs. Impacts from these actions have been found to be similar and consistent across a variety of project areas in the intermountain West.

Currently, BLM is incurring high costs relating to the amount of resource staff time associated with completing individual and programmatic environmental assessments. Establishment of a new CX that includes these actions associated with pinyon-juniper removal will facilitate more efficient implementation of such projects that are shown to have no significant impacts to the human environment. Review of extraordinary circumstances for each project, as required under 43 CFR 46.205, further ensures that there would be no significant impacts to the human environment from conducting these treatments.

In assessments for each project, predicted impacts often exceeded those that actually occurred during and after implementation because the analyses disclosed a potential for impacts that were never observed after project implementation. Based on the evidence, the specific classes of actions described in this proposed CX consistently do not produce significant individual or cumulative impacts. Adoption of the proposed pinyon-juniper removal CX is recommended.

APPENDIX A - SECTION 1: BLM NEPA DOCUMENTS REVIEWED FOR ACTIONS PROPOSED IN CATEGORICAL EXCLUSION

No.	Document (EA) Name	Field Office	Size (acres)	Mechanical cutting	Mastication or Mowing	Piling or Yarding	Seeding	Jackpot and Pile Burning	Mulch	Commercial	Temporary Roads
1	Applegate Sage Steppe Habitat Restoration	Applegate FO, CA	150,000	X	X	X	-	X	-	-	X
	DOI-BLM-CA-N020_2015-EA-0004										
2	Hassayampa WUI Fire Defense System	Hassayampa FO, CA	22,084	X	X	X	X	X	-	-	-
	DOI-BLM-AZ-P010-2014-0030-EA										
3	South Warner Sagebrush Habitat Restoration Project	Lakeview FO, ORWA	24,670	X	-	X	-	X	-	X	-
	DOI-BLM-ORWA-LO50-2009-0037-EA										
4	GSG Habitat Restoration Plan For The Clover Flat Area	Lakeview FO, ORWA	8,201	X	-	X	-	X	-	-	-
	DOI-BLM-ORWA-LO50-2016-0006-EA										
5	Vya Habitat Restoration & Fuel Reduction Project	Surprise FO, CA	100,000	X	X	X	-	X	-	-	X
	DOI-BLM-CA-NO70-2013-0005-EA										
6	Bryant Mtn Vegetation Treatment	Klamath Falls FO, OR	2,110	X	X	X	X	X	-	X	-
	DOI-BLM_ORWA-LO40-2015-0004-EA										

No.	Document (EA) Name	Field Office	Size (acres)	Mechanical cutting	Mastication or Mowing	Piling or Yarding	Seeding	Jackpot and Pile Burning	Mulch	Commercial	Temporary Roads
7	Deer Pen West Pinyon-Juniper Removal	CRV FO, CO	834	X	-	-	-	-	X	-	-
	DOI-BLM-CO-N040-2015-0077 EA										
8	Encroaching Juniper Removal	Little Snake FO, CO	30,000	X	X	-	-	-	X	-	-
	DOI-BLM-CO-N010-2014-0039-EA										
9	Silva Flat Sage Steppe Restoration	Alturas FO, CA	180	X	-	X	-	X	X	-	-
	DOI-BLM-CA-N020-2015-0002-EA										
10	Phase II South Cliffs Pinyon-Juniper Removal	CRV FO, CO	258	X	-	-	-	-	X	-	-
	DOI-BLM-CO-040-2015-0078-EA										
11	South Cliffs Pinyon-Juniper Removal	CRV FO, CO	118	X	-	X	-	X	X	-	-
	DOI-BLM-CO-040-2015-0053-EA										
12	Southwest Gerber Habitat Restoration	Klamath Falls FO, OR	5,080	X	-	-	X	X	-	X	-
	DOI-BLM-OR-L040-2010-001-EA										
13	North Springs Pinyon-Juniper Treatment	Price FO, UT	10,791	X	X	X	X	X	X	X	-
	DOI-BLM-UT-G020-2014-0046-EA										
14	New Hayden Fox	Klamath Falls FO, OR	1,480	X	X	-	-	-	-	X	-
	DOI-BLM-ORWA-L040-2015-0015-EA										
15	Clay	Vernal FO,	3,695	X	X	-	-	-	-	-	-

No.	Document (EA) Name	Field Office	Size (acres)	Mechanical cutting	Mastication or Mowing	Piling or Yarding	Seeding	Jackpot and Pile Burning	Mulch	Commercial	Temporary Roads
	Basin/Browns Park Sagebrush Enhancement I	UT									
	DOI-BLM-UT-G010-2014-0111-EA										
16	Clay Basin Browns Park Sagebrush Enhancement II	Vernal FO, UT	2,150	X	X	-	-	-	-	-	-
	DOI-BLM-UT-G010-2015-0085-EA										
17	Wild Turkey	Miles City FO, MT	8,302	X	X	-	-	-	X	-	X
	DOI-BLM-MT-C020-2014-0118-EA										
18	Powder River Basin Sage Grouse Habitat Restoration	Miles City FO, MT	10,000	X	-	-	-	-	-	-	-
	DOI-BLM_MT-C020-2016-0105-EA										

APPENDIX A - SECTION 2

This section of Appendix A lists the 18 relevant PJ removal projects for which the BLM prepared EAs, reached FONSIs, and implemented as proposed. The observed effects after implementation were similar to or less intense than the effects anticipated in the EAs (indicated by notes in the below descriptions), and confirmed that the BLM's usual implementation practices for such projects produce predictable, repeatable results that do not result in significant environmental impacts.

1. Title: Applegate Field Office Sage Steppe Habitat Restoration Project
NEPA#: DOI-BLM-CA-N020-2015-EA-0004

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand treatment of juniper; mechanical treatment of juniper; broadcast burning of juniper; pile burning
- 150,000 acres treated over 10 years, approximately 15,000 acres per year[6]
- Cross-country vehicle travel routes and new temporary roads

Environmental consequences identified:

- Low risk of potential impacts to cultural resources
- Temporary loss in areas available for livestock grazing; long-term minor improvement in livestock foraging areas

- Included best management practices (BMPs) or project design features (PDFs):Standard Resource Protection Measures

Standard noxious weed prevention and control stipulations—including washing vehicles—is applicable to all supporting EAs in this list

Implementation: Multiple projects implemented on varying acreages. In 2019, 4,931 acres were identified in treatment areas of 5, 797, 1412, 157, 6, 19, 7, 930, 953, 545, 47, 53 acres.

2. Title: Hassayampa WUI Fire Defense System EA
NEPA#: DOI-BLM-AZ-P010-2014-0030-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand thinning; mastication; broadcast burning; pile burning; chemical treatment; seeding; prescribed grazing
- 22,084 acres
- No new roads

[6] Although this EA notes that implementation of the project would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

Implementation: 50 acres treated in 2015; 150 acres treated in 2016; 15,000 acres treated in 2017; and 30 acres treated in 2019.

3. South Warner Juniper Removal Project

NEPA#: DOI-BLM-ORWA-L050-2009-0037-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical cutting; piling; pile burning
- 24,670 acres
- No new roads

Implementation: all 24,670 acres treated between FY 2011-2020 (10 yrs) per the specifications stated in the EA.

4. Greater Sage Grouse Habitat Restoration Plan for the Clover Plat Area

NEPA#: DOI-BLM-ORWA-LO50-2016-0006-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand cutting; mechanical cutting; piling; pile burning
- 8,201 acres
- No new roads

Included BMPs and PDFs:

- PDFs and BMPs required for sage-grouse habitat
- BMPs specified in the applicable RMP
- No burning directly on top of cultural sites; on-site cultural monitoring during implementation

Implementation: began in 2016 and is ongoing, with treatment areas and acreages matching the specifications in the EA.

5. Vya Habitat Restoration & Fuels Reduction Project

NEPA#: DOI-BLM-CA-NO70-2013-0005-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand cutting; mechanical cutting; broadcast burning; pile burning
- 100,000 acres treated over 10 years, approximately 10,000 acres per year[7]
- New temporary road construction

Included BMPs and PDFs:

- Seasonal restrictions

[7] Although this EA notes that implementation of the project would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

- Pretreating fuels around sensitive plant species
- Buffer for active raptor nests

Implementation: 872 acres treated in 2014; 1,272 acres treated in 2015; 2,115 acres treated in 2016; 3,453 acres treated in 2017; 3,527 acres treated in 2018; 2,200 acres treated in 2019; 2,646 acres treated in 2020.

6. Bryant Mtn. Vegetation Treatment EA

NEPA#: DOI-BLM_ORWA-LO40-2015-0004-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand cutting; mechanical cutting; skidding; yarding; herbicide; underburning; pile burning; seeding; planting; commercial
- 2,110 acres
- 1.5 miles of new temporary road construction

Controlled burns limited to 1,450 acres;
Juniper-specific thinning limited to 2,110 acres; mixed conifer thinning on 1,372 acres

Included BMPs and PDFs:

- Seasonal restrictions
- Avoidance of sites eligible for the National Register
- 100’ Avoidance of Special Status Plant Species
- Soil moisture limits on cutting and burning

Implementation: 1,418 acres (mechanical and hand-cut) treated 2016-2019 (4 years).

7. Deer Pen West Pinyon-Juniper Removal

NEPA#: DOI-BLM-CO-N040-2015-0077 EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand cutting; mechanical thinning (hydro-axing); mulching
- 834 acres
- No new roads

Environmental consequences identified:

- Minimal impact to rare plant in the short-term; positive impact in the long-term (Harrington’s penstemon)
- Short-term negative impacts on livestock grazing resources
- Minimal visual resource impacts; maintaining Visual Resource Management (VRM) Classification II objectives

Included BMPs and PDFs:

- Seasonal restrictions
- Feathering or undulating edges would be incorporated into treatments where

practicable to break up any distinct lines created in the landscape

- Minimize surface disturbance on slopes greater than >30% and fragile soils

No eligible historic properties found
Surveys for rare plants conducted; patches identified.

<u>Implementation</u>: All 834 acres treated.

<u>8. Encroaching Juniper Removal</u>

NEPA#: DOI-BLM-CO-N010-2014-0039-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mastication; hand cutting; prescribed burning; pile burning; mulching; brush mowing; seeding
- 30,000 acres

Environmental consequences identified:

- Minor soil disturbance
- Minor displacement of birds
- No measurable impact to special status plants

Included BMPs and PDFs:

- Seasonal restrictions
- Planned fuels treatments will be limited to slopes less than 15%
- Avoidance for raptors (Surface Disturbance >0.25 miles)
- Avoidance of Bureau-Sensitive Species (plants)

No sage treatments authorized in sage-grouse preliminary priority habitat (PPH);
For treatments in greater sage-grouse preliminary general habitat (PGH) where fuels reduction is a priority, up to 50% of the sagebrush would be mowed or masticated.

No Wilderness Study Areas or Areas of Critical Environmental Concern (ACECs) would be treated.

<u>Implementation</u>: 15,457 acres were treated by the end of 2019, consisting of 71 acres treated in 2015, 3,356 acres treated in 2016, 2,199 acres treated in 2017, 8,294 acres treated in 2018, and 1,537 acres treated in 2019.

<u>9. Silva Flat Sage Steppe Restoration</u>

NEPA#: DOI-BLM-CA-N020-2015-0002-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; manual thinning; skidding; piling; chipping; pile burning;
- 180 acres
- No new roads

Environmental consequences identified:

- Minimal and short-term impacts to soils
- Minimal adverse impacts to visual resources
- Temporary loss of livestock foraging area
- Long-term benefits to forage and plant diversity

Included BMPs and PDFs:

- Seasonal restrictions
- The project area would be rested from cattle grazing for a minimum of two grazing seasons
- Cultural sites would be avoided
- Old growth tress would not be cut
- Buffers identified in the RMP would apply to active raptor nests

Special Status Plants surveyed; none identified in the project area.

Implementation: all 180 acres treated in 2015.

10 -11. Phase II South Cliffs Pinyon-Juniper Removal and South Cliffs Pinyon-Juniper Removal
NEPA#: DOI-BLM-CO-040-2015-0053-EA and NEPA#: DOI-BLM-CO-040-2015-0078-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; hand-thinning; mulching
- 258 acres (Phase II) and 118
- No new roads; off-route travel

Environmental consequences identified:

- Improvement of greater sage-grouse, mule deer, and elk habitat
- Temporary negative impact to Special Status Plant (Herrington's penstemon) related to crushing or trampling; long-term benefit to the species from removal of trees that compete for shared resources
- Temporary loss of opportunity for solitude in Lands Managed for Wilderness Character
- Temporary displacement of migratory birds due to machinery, noise, and human presence; similar for wildlife
- Low impact to visual resources; retaining conformance with VRM Classification II objectives

Included BMPs and PDFs:

- Seasonal restrictions for migratory birds
- Retention of older stands of Gambel Oak (unless facilitating sage-grouse predation)
- Surface disturbance limited to slopes less than 30% and non-fragile soils

No eligible cultural sites.

Implementation: all acres (258 and 118) treated.

12. Southwest Gerber Habitat Restoration

NEPA#: DOI-BLM-OR-L040-2010-001-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; hand-thinning; pile burning; seedling planting
- 5,080 acres
- No new roads; off-route travel

Environmental consequences identified:

- Potential for high levels of cheatgrass in the first few years post-burn in the transition area between pile-burns and unburned vegetation—with a higher likelihood closer to existing cheatgrass populations; similar potential for medusahead and ventenata
- Increase understory vegetation following chainsaw cutting of juniper trees
- Potential for take of special status bird species; long-term benefits to breeding habitat for the same species (Brewer's and vesper sparrow)
- Negligible displacement of mule deer winter range habitat (scale)
- Moderate localized short-term effects on soil productivity (from burning)
- Minor short-term decrease in available livestock forage; long-term benefit in palatable livestock forage
- Little to no impact on visual resources

Included BMPs and PDFs:

- Seasonal restrictions for migratory birds and noxious weeds
- Retention of juniper older than 150 years in age
- Restrictions on soil compaction (increase in bulk density of 15%); creation of adverse soil conditions (e.g. ruts > 6inches or loss of 50% of the A horizon from an area of 500 ft^2); and nutrient loss
- Cultural sites identified and avoided to the extent possible

No special status plants identified.
Wilderness character not present.

Implementation: 3,356 acres treated 2014-2016 (3 years).

13. North Springs Pinyon-Juniper Treatment

NEPA#: DOI-BLM-UT-G020-2014-0046-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; hand thinning; chipping/shredding; scattering; piling; pile burning; herbicide; seeding; biomass utilization; commercial

- 10,791 acres (to be implemented over the course of up to 10 years)[8]Potential for new routes; no new road construction

Environmental consequences identified:

- Minimal short-term impact on grazing activities; long-term increase in available quality and quantity of forage for livestock
- High potential for facilitated expansion of noxious weeds in the project area—particularly Tamarisk, houndstongue, hoary cress, and musk thistle, which are present in the project area
- Short-term impacts of mechanical treatments on soil compaction and rutting; short-term, negative impacts on rates of erosion, water infiltration, and resulting soil and soil-productivity loss; short-term impacts on soil crusts and soil structure from harrowing, with potential for short term loss in soil aggregate stability; long-term benefits to soil stability and rates of erosion
- Benefit to water quality; short-term interruption of gullies and rills
- Potential temporary displacement of mule deer and elk

Included BMPs and PDFs:

- Maintenance of islands of trees in a mosaic treatment pattern benefit wildlife and ecosystem function
- Avoidance of old-growth trees
- Riparian/ Headwater Buffers
- Mechanical thinning limited to slopes less than 40%
- Potential two-season resting of livestock grazing areas

<u>Implementation</u>: Phase I - 2,435 on state lands; Phase II - 4,484 ac; Phase III - 3,782 ac

<u>14. New Hayden Fox Environmental Assessment</u>

NEPA#: DOI-BLM-ORWA-L040-2015-0015-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Commercial thinning; small diameter thinning; brush mowing; underburning; pile burning; invasive weed treatments; conifer planting; herbicide
- 1,480 acres
- No new road construction

Environmental consequences identified:

- Reduction in invasive and noxious weeds, when the noxious weed treatments are included with the proposed action; without, there is a likely risk of introducing or spreading noxious weeds as a result of proposed activities (Medusahead rye and North Africa grass)

[8] Although this EA notes that implementation of the project would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

- BLM made a "Not likely to adversely affect" (NLAA) determination on the spotted owl and designated critical habitat under section 7 of the Endangered Species Act; FWS concurred with that determination
- Forage for deer and elk (*Ceanothus* shrubs—would initially be reduced by treatments as a result of brush mowing; this decrease would last less than five years. After this, quantity and quality of forage would be well above than current levels for 20-30 years
- Acorn production would increase above current levels slowly immediately post-treatment. A short-term reduction would be unlikely because of the selectivity of treatments and the difference in impacts by size-class of trees.
- Detrimental soil impacts (precise extent and magnitude unknown): potential for isolated compaction and topsoil displacement, creation of adverse surface conditions, and diminished site productivity; higher concentration of soil impacts on skid trails and landings; minimal soil impacts expected to result from underburning (mostly related to short-term nutrient loss)
- No expected hydrological effect

Included BMPs and PDFs:

- Seasonal restrictions for actively nesting birds in the project area (none known)
- Soil-moisture & frozen ground limitations on sub-activities
- BLM Sensitive Species population buffer (concurrent with seasonally wet area buffer)—Bellinger's wooly meadowfoam
- Avoidance of cultural sites (no eligible sites in the project area)
- Retention of snags (2.5 per acres)

<u>Implementation</u>: Not implemented because area was consumed by Oregon Gulch wildfire.

<u>15. Clay Basin/Browns Park Sagebrush Enhancement I</u>
NEPA#: DOI-BLM-UT-G010-2014-0111-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; hand thinning; mastication; chipping; scattering
- 3,695 acres
- No new road construction

Environmental consequences identified:

- Temporary adverse effect on opportunities for solitude and primitive or unconfined recreation in a BLM Natural Area/non-wilderness study area (WSA); no long-term impact on the area because the woody debris left as a result of the treatments will not be noticeable in 1-3 years
- Benefit to an ACEC managed for erosion and sediment control
- No impact on noxious and invasive weeds present in the project area—Low whitetop, Canada thistle, and broadleaved pepperweed
- No increase in soil erosion and sediment yields

- Minor shrub loss as a result of crushing by machinery
- Potential adverse impacts to migratory birds, including destruction of nests, eggs, and nesting habitat, fragmentation of habitat, reduction of habitat patch size, and nest abandonment
- Short-term impacts to big game species—notably deer, elk, and bighorn sheep—including increased stress, increased energy, expenditure, displacement during calving or fawning
- Positive impact for sage grouse by promoting younger sagebrush

Included BMPs and PDFs:

- Seasonal restrictions for elk calving and deer fawning
- Pre-project weed inventory and mapping; removal or treatment of weeds prior to treatment
- Spot treatment of noxious and invasive weeds with herbicide when encountered
- 0.5-mile buffer from occupied nesting sites of raptors

<u>Implementation</u>: 2,774 acres treated by end of 2016, consisting of 874 acres treated in 2014 and 1,900 acres treated in 2016.

<u>16. Clay Basin/Browns Park Sagebrush Enhancement II</u>

NEPA#: DOI-BLM-UT-G010-2015-0085-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Hand thinning; bucking; scattering
- 2,150 acres
- No new road construction

Environmental consequences identified:

- Same impacts listed above, under: Clay Basin/Browns Park Sagebrush Enhancement I
- Same treatment program as earlier implementation, applicable also to Russian knapweed and any other noxious weed species encountered
- No impact to an ACEC designated to protect and prevent irreparable damage to important historic, cultural or scenic values, and fish and wildlife resources; or other natural system or processes, or to protect life and safety from natural hazards

Included BMPs and PDFs:

- Seasonal restrictions for elk calving and deer fawning
- Pre-project weed inventory and mapping; removal or treatment of weeds prior to treatment
- 0.5-mile buffer from occupied nesting sites of raptors

<u>Implementation</u>: 1,059 acres treated in 2016

17. Wild Turkey

NEPA#: DOI-BLM-MT-C020-2014-0118-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning; hand thinning; broadcast burning; pile burning;
- 8,302 acres (to be implemented over the course of up to 10 years)[9]
- No new road construction

Environmental consequences identified:

- Adverse impacts to cultural sites not eligible for listing in the National Register of Historic Places
- Short-term adverse impacts on water quality
- Soil compaction, resulting in slight, short-term decrease in infiltration and groundwater recharge, and a corresponding increase in overland flow;
- Accelerated erosion and sediment delivery into waterbodies
- Potential displacement of wildlife populations and migratory birds; potential take of wildlife species; habitat modification (beneficial and detrimental, depending on species)
- Long-term benefit to browsing ungulates as a result in vegetation responses to treatments
- Short-term potential effect on livestock foraging; long-term benefit
- Short-term adverse impact on opportunities for solitude
- Impact on line, color and texture of the landscape, particularly during the proposed action

Included BMPs and PDFs:

- Heavy equipment will not result in rutting of more than four inches on slopes greater than 40 percent
- Cultural sites eligible for listing in the National Register will be avoided
- Feathering cuts to mitigate visual contrasts
- Buffers on raptor nests

Implementation: 2,274 acres treated by end of 2019 consisting of 463 acres treated in 2015, 1,141 acres treated in 2016, 320 acres treated in 2017, and 150 acres treated in 2019.

18. Powder River Basin Sage Grouse Habitat Restoration

NEPA#: DOI-BLM-MT-C020-2016-0105-EA

Specific actions that were analyzed as well as acres or unit of measure for each action:

- Mechanical thinning;

[9] Although this EA notes that implementation of the project would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

- 10,000 acres (to be implemented over the course of 5-7 years)[10]
- No new road construction

Environmental consequences identified:

- No impact on cultural resources
- Short-term increased susceptibility to invasive species; long-term no impact

Included BMPs and PDFs:

- Feathering or undulating edges would be incorporated into treatments where practicable to break up any distinct lines created in the landscape

Implementation: 3,815 acres treated by end of 2019 consisting of 1,650 acres treated in 2016, 500 acres treated in 2017, 1,000 acres in 2018, and 665 acres treated in 2019. For 2020, 1,000 acres planned for treatment.

[10] Although this EA notes that implementation of the project would be phased over a number of years, the effects analyses were conducted as if the total proposed acreage would be implemented at the same time; analyses did not assume phased-in effects over time.

APPENDIX B: SUMMARY AND VALIDATION OF NEUTRAL, BENEFICIAL, AND ADVERSE CONSEQUENCES OF PROPOSED CATEGORICAL EXCLUSION BY RESOURCE

Resource	Effects from Proposed Pinyon-Juniper Treatments
Neutral or Beneficial Environmental Effects	
Wildland Fire	
Predicted impacts	Fire size, intensity and rate of spread would be decreased as a result of reduced fuel loading and continuity which would reduce the potential for landscape-scale, stand replacing wildland fire occurrences.
	Long-term benefits by shifting pinyon-juniper woodland areas toward a more desirable fire condition that could decrease the size, severity and duration of wildland fire would also decrease likelihood of indirect impacts to soils, vegetation, cultural and historical properties, visual resources, wildlife and threatened, endangered and sensitive species, air quality, climate, surface water, livestock, socio-economics and expansion of new and existing weed and invasive species colonization.
	Treatments would benefit public health and safety by decreasing fuel loading and reduce fire intensities along fire lines and in wildland urban interface and controlled areas.
	Treatments would result in decreased fuel loading and would decrease potential indirect impacts to soils, vegetation, cultural sites, visual resources, fire size, intensity and rate of spread which would decrease overall impacts to soils and vegetation.
Validated impacts	Impacts to soils, vegetation, cultural and historical properties, visual resources, wildlife/threatened, endangered and sensitive species, air quality, climate, surface water, livestock, socio-economics and expansion of weed and invasive species from this class of treatments is less than those that would be expected due to the occurrence of a wildland fire event. Decreased fuel loading of pinyon-juniper is effective enough to reduce the potential spread and intensity of wildland fire. Wildfire response is less severe in treated areas. Treatments result in changes to ladder fuel arrangement which decreases fuel height and flame length. Differences in treated versus untreated areas is especially notable when needle hazards are removed in treated areas. Some mature woodland areas are being treated in the wildland urban interface zones specifically to protect human health and safety from large wildfire events.
Wildlife	
Predicted impacts	The removal of encroaching pinyon-juniper trees would improve habitat conditions for wildlife species that use sagebrush shrublands.
	Habitat mosaics would be created which would support both juniper and shrub-steppe dependent wildlife habitats.
	Reducing juniper encroachment facilitates plant community succession, increases vigor of sage-steppe habitats and increases overall sagebrush cover which has beneficial impacts to Greater Sage-Grouse (GSG), pygmy rabbit, golden eagle, nesting raptors migratory birds, mule deer, pronghorn and bighorn sheep.
	Mechanical biomass treatments would improve habitat components for small, non-game species by releasing the understory vegetation that provides hiding cover, screening cover, forage and removing biomass that would improve the vegetative response and improve suitability of habitat.
	Treatments would increase vigor of sage-steppe habitats and increase sagebrush cover. Juniper reduction treatments would also result in increased habitat connectivity across the landscape as habitats that are currently separated by juniper were treated and juniper densities were reduced.
	Golden eagles would benefit from reductions in juniper cover that would increase prey population densities by improving the

Resource	Effects from Proposed Pinyon-Juniper Treatments
	shrub and herbaceous understory that support many prey species such as jackrabbits.
	Mule deer would benefit from rapid increases in shrub and browse species as juniper treatments were completed and understory vegetation began to dominate ecological processes. Improvements in browse communities would be most pronounced in mountain big sagebrush communities, but improvements in lower elevation communities would increase browse species in important mule deer winter ranges.
	Elk would benefit from rapid increases in shrub and browse species as juniper treatments were completed and understory vegetation began to dominate ecological processes.
	Overall, the treatments are expected to have positive effects to pronghorn antelope. Juniper reduction treatments would improve habitat quality for prey species that raptors commonly predate.
	Short term displacement due to noise, vehicles and human presence would be offset by increased availability of forage primarily in bitterbrush areas.
	Reducing trees and protecting sagebrush increases forage while still providing thermal cover and increasing survival and fecundity rates for deer and elk.
	The Proposed Action would improve habitat for Greater sage-grouse, a BLM Sensitive species, and would address juniper encroachment into sagebrush ecosystems that was rated as a high risk factor for sage-grouse.
	Besides improving conditions for greater sage-grouse, increases in distribution and local abundance could be expected for sagebrush sparrows, Vesper sparrows, sage thrashers, and Brewer's sparrows as well as other species that nest and rear young in sagebrush-dominated habitats.
	Removal of pinyon-juniper would return these ecological sites towards their natural potential as described in ecological site descriptions and increase biotic integrity.
	Treatments would increase diversity at the plant community, watershed, and landscape level. Old-growth juniper and quaking aspen woodlands would be restored by removal of younger juniper. Woodlands would provide habitat for many wildlife species onsite and from adjacent areas. Diversity at different spatial scales and connectivity of shrub and herbaceous vegetation would be increased.
Validated impacts	Post-treatment release of shrubs and perennial grasses from juniper understory is successful in improving habitat for sage-steppe dependent species. Benefits in increased forage, especially in winter range, have been realized while still maintaining adequate hiding and thermal cover for big game. Some species counts are available to determine quantifiable increases in numbers and expansion of distribution due to project implementation. Habitat improvements such as increased sagebrush cover and positive response to important browse and forage species are documented. Evidence of increased wildlife use was observed. Due to implementation of these projects, Greater Sage-Grouse are observed utilizing corridors where no birds had previously existed.
Noxious Weeds/Invasive Species	
Predicted impacts	The same moderate threat of the noxious weed invasion and spread that currently exists due to recreational use and on-going management activities would continue into the future.
	Proposed treatments would not significantly impact invasive, non-native species within the project area if project design features are followed.
	Restoring vegetative communities ultimately will result in an ecological community capable of effectively resisting invasion from noxious and invasive weeds.

Resource	**Effects from Proposed Pinyon-Juniper Treatments**
	A potential increased threat of noxious weed invasion and spread would be associated with an increase in wildfire suppression activities over time.
Validated impacts	Pinyon-juniper treatments maintain and restore healthy, intact ecosystems which are more resilient to noxious weed and exotic annual grass invasion. Noxious and invasive species are present in these systems to varying degrees. The extent that noxious weeds and invasive species impact project areas correlates with amount these impacts are already present in the system. Many sites are selected in areas that are ecologically intact where treatments are most effective in maintaining resiliency from invasion by exotic species. Project design features for control of noxious/invasive species are sufficient in preventing the spread of existing species or introduction of new species.
Land Health	
Predicted impacts	Projects would maintain land health standards.
	Removal of pinyon-juniper encroachment would return these ecological sites towards their natural potential as described in the ecological site descriptions and increase biotic integrity.
Validated impacts	Some projects were listed where conifer encroachment was a causal factor for failure to achieve land health standards. These projects are being implemented to achieve progress toward meeting that standard. In instances where maintenance or achievement of land health standards were not listed as a primary need to implement these projects, the resultant beneficial effects to vegetative communities, soils, and associated wildlife species maintains or improves conditions related to achievement of those standards.
Vegetation	
Predicted impacts	Restoration and enhancement of a mosaic of vegetative communities and early seral stages ultimately would result in an ecological community capable of effectively resisting invasion from noxious and invasive weeds.
	Reducing pinyon-juniper encroachment facilitates plant community succession, increases vigor of sage-steppe habitats and increases overall sagebrush cover which has beneficial impacts to Greater Sage-Grouse, pygmy rabbit, golden eagle, nesting raptors, migratory birds, mule deer, and pronghorn.
	Treatments would have long-term benefits to sensitive plant species by removing encroaching pinyon-juniper trees which compete with the native grasses and forbs for sunlight and nutrients.
	Removal of pinyon-juniper encroachment would have a long-term positive effect on the recovery of native perennials when compared to the effect of leaving cut trees unburned and in place (Bates and Svejcar, 2009).
	Mulch and debris would have a stabilizing effect on soils and vegetation.
	Removal of pinyon-juniper encroachment would return these ecological sites towards their natural potential as described in ecological site descriptions and increase biotic integrity.
	Treatments would increase diversity at the plant community, watershed, and landscape level. Old-growth juniper and quaking aspen woodlands would also be restored by removal of younger juniper. Woodlands would provide habitat for many wildlife species onsite and from adjacent areas. Diversity at different spatial scales and connectivity of shrub and herbaceous vegetation would be increased.
Validated impacts	Treatments are effective in maintaining and returning ecological sites towards their natural potential as described in ecological site descriptions. Restoration and enhancement of a mosaic of vegetative communities and various seral stages is being achieved through project design. Objectives are being met as outlined in the selected alternatives. One common design feature is to maintain old-growth pinyon-juniper stands by restricting cutting of old trees that exceed a diameter

Resource	Effects from Proposed Pinyon-Juniper Treatments
	standard or exhibit crown features characteristic of old-growth trees. These sites typically follow rocky ridges or drainages where fire has historically bypassed. Many projects target special vegetative communities such as aspen, bitterbrush and mountain mahogany that are threatened from conifer encroachment. Maintenance and enhancement of these communities increases diversity at the plant community, watershed and landscape level. Mulch from masticating helps maintain soil moisture and provides protection for new growth. Persistence in the environment is short-lived, usually not beyond 3-5 years.
Water	
Predicted impacts	Reducing the number of juniper trees would reduce competition for water and nutrients and improve the vigor of the remaining native shrubs, grasses, and forbs.
	Proposed treatments would result in long-term benefits to water resources, potentially resulting in improved hydrologic conditions and improved water quality.
Validated impacts	Field observations describe that conifer canopy reduction allow more precipitation to reach the understory layers which increases the amount of moisture and sunlight available to plants which contributes to flushes of new growth. There is evidence that this improves the overall hydrologic condition within watersheds. However given the variability of precipitation and localized project areas, there is no quantifiable data to support this effect.
Public Health and Safety/Air Quality	
Predicted impacts	The long-term beneficial effects from treatments would reduce the magnitude of negative effects from smoke generated from large wildfires.
	The proposed treatments would benefit public health and safety by decreasing fuel loads and reducing fire line intensities. These types of projects have been implemented on BLM managed public lands for decades with a high degree of success. Pinyon-juniper treatment projects across the western US have been studied and subject to peer review and have been shown to have numerous benefits to sage-steppe ecosystems. Proposed vegetative treatments represent accepted standard management practices.
Validated impacts	As in wildfire effects, decreased fuel loading of pinyon-juniper across treatment areas reduces the potential spread and intensity of wildland fire. Wildfire response is less severe in treated areas. Treatments result in changes to ladder fuel arrangement which decreases fuel height and flame length. Differences in treated versus untreated areas is especially notable when needle hazards are removed in treated areas. Some mature woodland areas are being treated in the wildland-urban interface zones specifically to protect human health and safety from large wildfire events. On projects that utilize pile/jackpot burning, tons per acre and ignition time length is substantially less than prescribed or naturally occurring wildfire threats therefore exposure is substantially reduced.
Recreation	
Predicted impacts	Implementation of the treatments would result in short-term effects to primitive recreation opportunities, ultimately leading to long-term ecosystem enhancement, promoting sustainable and viable biological communities, as well as continued opportunity for experiencing desirable primitive natural settings.
Validated impacts	There were no substantiated effects beyond those predicted. There were no long-term impacts to the travel networks, use of recreation sites or public access.
Socio-Economics	
Predicted	Contracted work associated with project implementation would be beneficial to local economy.

Resource	Effects from Proposed Pinyon-Juniper Treatments
impacts	Pinyon-juniper treatment and resultant improvements in rangeland health could increase forage production for both wildlife and livestock thereby maintaining, or possibly increasing, economic opportunities and fostering more desirable recreation opportunities with attendant economic benefits to the local economy.
Validated impacts	Many projects do utilize local or area contractors which provide direct economic contributions. Stewardship contracting is being utilized in some areas to meet long-term resource needs while providing materials to private organizations or businesses as partial payment. Implementation of the projects also typically involves extending seasons of fire crews or other seasonal staff which provides further social and economic benefits. Many projects allow collection of firewood as a byproduct of the treatments which provides an important source of heating and can be a method of subsistence and contributor to local economic activity. Other commercial products are being developed from pinyon-juniper treatments such as fence posts, milled lumber, biomass, poles and other decorative specialty products. Resultant forage increases have been realized that are widely supported by livestock permittees/lessees.
Lands with Wilderness Characteristics	
Predicted impacts	All methods would have beneficial effects helping to maintain ecological integrity within wilderness, thereby, helping to restore and preserve “natural” conditions and processes.
Validated impacts	Treatments were effective in the restoration of natural conditions and processes. There were no long-term impacts to the size, naturalness, and/or opportunities for solitude that would disqualify an area based on the implementation of these projects. Projects routinely implement design techniques such as feathering to prevent hard lines from forested/un-forested areas. Some after-action site tours have been offered or conducted to address concerns specific to wilderness characteristics and visual quality. When conducted, initial concerns from public participants and non-governmental organizations have been alleviated when observing post-treatment impacts. After 3-5 years, little evidence remains that projects occurred.
Adverse Environmental Effects	
Air/Climate	
Predicted impacts	Carbon release is expected to be less from pinyon-juniper treatments because fuel build-up of fuels and increased likelihood of wildfire occurrence would be reduced.
	Mechanical treatments would cause temporary short-term impacts from dust and exhaust emissions.
	Short-term impacts to air quality would be expected, however, lesser long-term effects to air quality would be expected due to a reduction in fuels. Total emissions and duration of emission events would be amplified without treatments. Wildfires would burn for longer periods and produce more smoke than average historic levels. Smoke production is generally reduced to negligible levels 2-3 days after ignition of a prescribed fire.
Validated impacts	The amount of carbon released by potential wildfires depends upon the frequency of ignition(s), fuel loading, moisture content, intensity of the burn, and amount of area burned. Several studies have concluded that carbon release from forests under wildfire conditions is much greater than carbon release under prescribed fire conditions (Meigs et. al. 2009; Hurteau and North 2009; Wiedinmyer and Hurteau 2010). The amount of biomass removed from project areas as a result of these classes of pinyon-juniper removal actions is substantially less than either prescribed or natural fire conditions. Although there are treatments in late-successional woodland areas, pinyon-juniper projects primarily target early and mid-successional succession where the

Resource	Effects from Proposed Pinyon-Juniper Treatments
	least amount of biomass is removed. Large biomass removal and treatments are cost-prohibitive and usually only used on smaller acreages. Further design features incorporated into the treatments routinely include retention of woodland stands for the protection of wildlife habitat, old-growth values, visual screening and cultural resources. Pockets, islands and corridors of timbered stands leave additional biomass on sight that would likely be consumed in a prescribed or wildfire event. Projects that include only mastication, thinning, and cut/leave reduce these impacts further. Many sites, if burned under wildfire conditions would be at high risk to cheatgrass invasion. Conversion from perennial shrub-steppe to annual grasslands would reduce the fire return interval and greatly reduce the sites potential for carbon storage (Rau et. al. 2009; Rau et. al. 2010).
Public Health and Safety	
Predicted impacts	Emissions from a fire can cause irritation to the eyes, nose, and mouth and can reduce visibility.
	Dust from mechanical and manual treatments and smoke from pile burning would reduce visibility and increase pneumonic irritation and smoke odor. Impacts would be a short-term increase in local air pollution.
Validated impacts	All projects that utilize pile burning were conducted in conformance with local, county and state emissions standards. Strict parameters are set to limit time and tons of fuel per acre. Residual emissions from wildfire or prescribed fire may persist for several days in smoke sensitive areas when stagnant air or inversions are present. Dust produced from project-related activities and smoke from jackpot/pile burning are even shorter term. Field reports indicate that residual times for these activities do not exceed more than a few hours. The maximum distance smoke has been observed is 20-30 miles. Piles usually burn within a few hours and smoldering does not occur for long periods of time because no litter and duff layers are consumed. While many individuals are sensitive to smoke irritations, compliance with local, county and state guidelines restrict burning to specific burn windows when weather conditions are favorable to disperse impacts to air quality. Press releases and public notices of burning activities is also a common tool to assist residents in avoiding exposure to smoke.
Noxious weeds/Invasive species	
Predicted impacts	The increase of invasive annual species such as cheatgrass, medusahead and ventenata can negate the positive habitat effects of removing pinyon-juniper.
Validated impacts	Noxious and invasive species are present in these systems to varying degrees. The extent that noxious weeds and invasive species impact post-treatment project areas correlates with amount these impacts are already present in the system. Many sites are selected in areas that are ecologically intact where treatments are most effective in maintaining resiliency from invasion by exotic species. Project design features for control of noxious/invasive species are sufficient in preventing the spread of existing species or introduction of new species. Post-treatment monitoring and herbicide applications are being applied if necessary. Seedings are also a common tool that are being applied directly to burned pile areas. These areas are free from competition and have nutrient availability that is effective in revegetating sites with desirable vegetation. While EAs may analyze the consequences that pinyon-juniper treatments have on noxious and invasive species, post-project treatments and applications of herbicide is typically conducted through integrated weed management plans which are tiered to broader analyses such as *Treatments Using Herbicides on BLM Lands in 17 Western States Programmatic EIS* and associated decisions. Significant impacts from chemical applications have previously been analyzed in those applicable EISs.

Resource	**Effects from Proposed Pinyon-Juniper Treatments**
Wildlife	
Predicted impacts	Some short-term impacts would occur to wildlife species including effects to habitat as result of vegetation treatments and effects related to implementation of projects, including noise disturbance. Short-term negative impacts would include mechanical equipment, noise, and human presence during project implementation.
	Short-term negative impacts would include mechanical equipment, noise, and human presence during project implementation. Wildlife would likely temporarily disperse to nearby areas during mechanical equipment operation.
	The removal of pinyon-juniper encroachment could have some negative impacts to pinyon-juniper obligate species. However, targeted trees are generally small and scattered and are within otherwise predominant sagebrush habitats
	Birds using pinyon-juniper woodlands would be displaced. Impacts are minimal because these species typically prefer mature woodlands that would be retained.
	The reduction of expanding juniper would crowd returning wildlife into other woodland habitats near treatments or force them to other areas to find suitable habitat. This could reduce productivity of wildlife species since crowding results in greater species density in areas of limited resources. These variations in number of individuals would still be well within the natural variation with the past fluctuations of pinyon-juniper through time. Cutting and jackpot burning or individual burning of scattered trees in big sagebrush vegetation types would have minimal effect on sagebrush species as most of the sagebrush canopy would be left intact and still useable by these species.
	Big game would be affected negatively by loss of hiding and thermal cover due to reduction of pinyon-juniper in each unit but would be beneficially affected by increases in grasses and forbs after treatment.
	Small mammals, such as various species of mice, voles and shrews adapted to structurally diverse habitat would be affected in the first few years by loss of habitat.
Validated impacts	Short-term displacement of wildlife during project implementation is likely. However, treatments are usually completed within a few days to several weeks. There were no observations of direct mortality. Project design features commonly include seasonal restrictions that prevent disruption to migratory birds and other wildlife species. While habitat for pinyon-juniper dependent species is reduced by implementing these projects, the availability of woodland habitats are not limiting. Expansion of pinyon-juniper woodland habitats exceeds the natural range of historic distribution and is reducing the availability of other key habitat components. Many species that are considered to be juniper-dependent species also rely on these other threatened habitats and woodland edges for foraging and other life cycle needs. Thermal and hiding cover for big game species are reduced, however, forage abundance and availability is considered to be an equal, if not more important, indicator of the quality of winter range. Post-treatment release of shrubs and perennial grasses from juniper understory is successful in improving sage-steppe and other key habitats. Benefits in increased forage, especially in winter range, have been realized while still maintaining adequate hiding and thermal cover for big game. Common design features and constraints include protecting old-growth along drainages and ridgelines, buffers of leave stands for other resource considerations and slope restrictions. Remaining stands and treatment areas create a mosaic of habitats consistent with mimicking natural variation in seral stages.

Resource	Effects from Proposed Pinyon-Juniper Treatments
Soils/Vegetation	
Predicted impacts	
	Soil disturbance, loss and localized compaction may result from treatments. Localized disturbance to vegetation would be offset by increases in perennial grass and forb productivity.
	Soils could be impacted during the mechanical process of juniper cutting, burning of slash piles, and by the decrease in thermal cover provided by pinyon-juniper. Implementation is expected to result in moderate localized short-term effects on soil productivity, with anticipated adverse impacts occurring within the first five years of project implementation.
	Expected impacts of varying amounts of soil disturbance depend on machine operator techniques and how fuels are distributed within a treatment unit. The forest floor and topsoil can easily be displaced, particularly where equipment makes small-radius turns.
	Temporary short-term increases in woody debris and mulch may temporarily inhibit understory growth. Change in structure and tree cover would be reduced. Some physical damage to vegetation due to heavy equipment would be anticipated.
Validated impacts	Direct damage to vegetation and soils does occur from heavy equipment, skidding and pile/jackpot burning. Project implementation, when pile burning is used, creates 1-20 piles/acre that are generally about four feet in diameter. Depending on project design and fuel loading, projects may use larger piles of 10’ x 20’. The largest surface disturbance of any of the projects involved 30 landing sites at approximately ¾ acres each that were spread over a 1200 acre project area. Most projects use smaller piles that often include hand carrying or skidding. Surface disturbance from mastication-only projects is limited to impacts from machine travel. Rubber-tired vehicles often result in little to no surface disturbance. Tracked machines can cause localized disturbance, but are usually equipped with arms that reach beyond the path of the equipment and result in less areas impacted by direct travel. Any temporary roads were rehabilitated. Constraints are incorporated to avoid repeated travel to eliminate the creation of trails. When offering firewood collection, piles are typically dragged near existing roads to prevent unauthorized off-highway travel. Common design features include restrictions on project implementation when soils are wet or muddy. Often projects are completed when soils are frozen to further reduce risk of damage. There were no observable long-term impacts to soils and vegetation documented beyond 5-10 years. Predicted impacts from mulching were never realized. Conversely, actual impacts from mulching acted to maintain soil moisture and protected new growth. Mulching depths were restricted in contract standards and never accumulated to depths were vegetation was adversely impacted.
Cultural/Tribal Interests	
Predicted impacts	Indirect impacts include increased human access that may lead to artifact collection, erosion due to the removal of vegetation, and the shade left by standing trees that may concentrate livestock disturbance on historic properties.
	Greater ground visibility resulting from planned treatments could result in greater levels of exposed resources, accidental damage, vandalism, and illegal collection within cultural resource localities in areas of heavy public use. The potential increase in illegal effects could contribute to potential cumulative effects, but only until vegetation returned within several growing seasons.
	Direct ground disturbances associated with this project include, but are not limited to, debris from fallen trees, vehicle traffic, artifacts being broken by heavy machinery, and heat damage (such as burning, spalling, cracking, and the altering of obsidian hydration rims of lithic artifacts) from fire.

Resource	**Effects from Proposed Pinyon-Juniper Treatments**
Validated impacts	While potential impacts to cultural resources are less from those that would be realized from wildfire events, there are potential risks to cultural resources from pinyon-juniper treatment projects. Many of those risks are substantially reduced by requirements to conduct field inventories/surveys, consultation with tribes and state historic preservation offices and implementing appropriate mitigation measures. Common mitigation measures include full-avoidance or restricting treatment methods to hand-treatment only within and adjacent to sites. Project design features often include measures that mask cultural sites or adjust project boundaries to exclude sensitive areas from treatment altogether. These techniques are commonly incorporated in project design to prevent the identification of protected areas which could potentially result in illegal collection and/or vandalism. Use of hand treatments are also used to limit livestock concentrations in protected areas where they seek shade. In some areas, cultural sites coincide with the presence of old-growth timber which is already protected under retention measures old growth. There have been no observed impacts to cultural resources beyond those predicted in the environmental assessments. Tribal groups are generally supportive of pinyon-juniper treatments for the restoration of ecological health. They recognize the risks that catastrophic wildfire presents to cultural resources. Tribal concerns that have been identified during consultation and staff-to-staff coordination efforts include; protection of areas of religious and cultural significance such as burials, eagle traps, wickiups, old-growth timber and traditional plant collection. As with other cultural resources and historic sites, these areas are avoided or hand-treated to reduce impacts. Constraints on cutting old growth further protects traditional use of pinyon pine nuts since trees do not produce seeds until maturity.
Lands with Wilderness Characteristics	
Predicted impacts	Short-term impacts to wilderness characteristics would potentially be slightly negative. Long-term impacts are expected to be positive. Overall, potential effects related to wilderness characteristics resulting from implementation of pinyon-juniper treatments are considered minor.
	Treatments would result in loss of vegetation screening that will impact solitude.
Validated impacts	Lands with wilderness characteristics exist within project areas to varying degrees. There are varying prescriptions for management of wilderness characteristics. Loss of visual screening was not identified as an issue by individuals or non-governmental organizations. Issues primarily center on impacts to naturalness and opportunities for solitude. Impacts to solitude are caused by mechanical equipment, noise, and human presence during project implementation. Impacts to solitude are not considered significant because impacts are rare, isolated and are short term lasting only several days to a few weeks. Treatments were effective in the restoration of natural conditions and processes which has long-term, overall lasting benefits to naturalness. To the degree which areas are managed for wilderness characteristics, a variety of design features are used to reduce short-term impacts. Projects routinely implement design techniques such as feathering to prevent hard lines between forested and un-forested areas. Lighter treatments, such as mastication, pile burning and use of rubber tire vehicles are used to further limit surface disturbance and residual slash. Other measures incorporated into areas with wilderness characteristics include, decreased stump height objectives and increased pile consumption objectives. Pile consumption is increased by allowing additional curing time. One project required cross-hatching of stumps to allow for quicker decomposition and breakdown of stump structures.

Resource	Effects from Proposed Pinyon-Juniper Treatments
	Some after-action site tours have been conducted or offered to address concerns specific to wilderness characteristics and visual quality. When conducted, initial concerns from public participants and non-governmental organizations have been alleviated when observing post-treatment impacts. After 3-5 years, little evidence remains that projects occurred. There have been no occurrences where impacts to the size, naturalness, and/or opportunities for solitude have disqualified an area from a finding of wilderness characteristics based on resulting impacts from these projects.
Visual Resources	
Predicted impacts	Pile/Jackpot burning would create small, irregularly shaped patches randomly placed throughout the landscape. Initial color would be black, but would fade over time and would be replaced by various shades of green from grasses and forbs. There would be minimal texture changes, unless large-scale pinyon-juniper removal accompanies jackpot burning. Total juniper reduction would remove vertical lines and forms and dark green colors attributable to conifers replacing them with horizontal lines and forms. Freshly cut, light tan tree trunks and stumps would contrast strongly with grayish, reddish browns of pinyon-juniper trunks, tan to brown to reddish soils, and various green shades of vegetation. These contrasts, and vegetation color changes from green to red and tan, would be visible for approximately six months to five years. Piling of cut trees would result in numerous, rough, spherical forms irregularly scattered across the landscape; however, these areas should blend in with adjacent vegetation within three years. After jackpot or pile burning, some horizontal lines and forms would remain, but vertical elements would be removed from the landscape. If cut trees are piled and burned, no tree boles would remain. Burn circles would be observable for up to three years.
	For both manual and motorized/mechanized treatments, removal of juniper trees would reduce vegetative screening.
	Pile Burning treatments could be accomplished by either hand piling or use of motorized equipment. Generally most, if not all, tree debris in piles would be consumed when burned. The only remaining unnatural appearing feature would be stumps.
	Burn circles would be observable for up to three years; however, where needed, hand-seeding could help with return of vegetation to blend in with surrounding unburned areas.
Validated impacts	Validated impacts were similar to those predicted in EAs. Short-term changes to line, form and color were observed initially, however after pile burning and vegetation re-established, there were little to no long-term impacts to visual quality after 3-5 years. One project objective was to make it appear that a project had never happened. Only rare, localized instances were noted beyond expected short-term disturbance. Those disturbances were primarily related to incomplete jackpot burnings where residual materials were left unburned. These impacts are not considered significant because they can be remedied to meet visual resource management objectives by subsequent re-burning or additional hand-treatments.
Livestock/Socio-Economics	
Predicted impacts	Rest requirements impacting; however in the long term it is expected that vegetation would establish and thrive increasing forage for livestock.
Validated impacts	Livestock exclusion is usually not required unless site-specific protection is needed for seedings, revegetation or where required by land use plans. Other design features typically include pasture deferments or modifications to grazing systems. Due to limited surface disturbance caused by these projects, these measures adequately provide for post-treatment recovery.

APPENDIX C: SAMPLE QUESTIONS USED FOR VALIDATION OF IMPACTS, BY RESOURCE

Resource	Questions
All	Did you observe the project implementation or visited the site post-project?
	Were there any impacts that were unexpected?
	Were there any impacts that were greater than predicted?
	Did the project receive any protests, appeals or informal complaints of impacts?
	If the project was protested/appealed, was NEPA upheld?
	Has monitoring been completed?
Fire/Fuels	Did project meet objectives in decreasing fuel loading?
	Were fuel loadings decreased enough to reduce size, severity and duration of wildland fire? Reduce the potential for landscape-scale stand replacing fires?
	Did pinyon-pine woodland areas shift toward a more desirable fire condition?
Wildlife	Did project improve habitat conditions for sagebrush-steppe shrub lands? Did it Improve other habitat mosaics (e.g. aspen bitterbrush, mahogany)
	What was the overall effect sagebrush cover?
	What were the effects on non-game and prey populations?
	Were there increases in Browse Species? Or big game winter forage?
	Was there any observations of short term displacement due to noise, vehicles and human presence?
	Was there any direct mortality?
	Was the loss of thermal and hiding cover significant for big game?
	How severe was the short-term impacts from implementation of projects from mechanical equipment, noise, and human presence during project implementation?
	Were birds or small mammals such as various species of mice, voles and shrews displaced?
TES	What were the effects on GSG habitat? Or other sagebrush obligates? Brewer's, Vespers, Sage thrashers other? Reduction of perch sites?
Vegetation	Was competition from removal of juniper achieved?
	Was the health of native perennials and native communities improved?
	Did mulch and debris stabilize and protect or smother?
	Was there any observed, measurable or otherwise, trend towards restoration of the natural potential as described in ecological site descriptions?
	Did project improve vegetative conditions for sagebrush-steppe shrub lands? Did it Improve other habitat mosaics and diversity? (e.g. aspen bitterbrush, mahogany)
	How much vegetation was damaged or destroyed? (acres)
	How much Localized disturbance or physical damage was there from heavy equipment?
	Was there any temporary, short-term increase in woody debris and that inhibited plant growth?
	Was there any increase or spread of weeds/invasive species?
Noxious Weeds/Invasive Species	Were there any increases in noxious weeds or invasive species?
	Were there any infestations of new species?
	Did pesticides or other weed control measures need to be applied post-project?
Land Health	Was the project identified as a requirement of making progress toward achieving land health standards? If so, did the project result in progress or achievement of the standard?
	Was there any observed trend towards restoration of the natural potential as described in ecological site descriptions?
Water	Any observations that reducing the number of juniper trees decreased competition for water and nutrients and improved the vigor of the remaining native shrubs, grasses, and forbs?
	Any observable long-term benefits to water resources, potentially resulting in

Resource	Questions
	improved hydrologic conditions and improved water quality?
Air Quality/Climate	Were there any problems implementing the project with regard to meeting local air quality or public health standards?
	Did Mechanical treatments cause any temporary short-term impacts from dust and exhaust emissions?
	Were projects completed within state standards and done under favorable conditions for dispersal?
	Was there any smoke production that exceeded more than 2-3 days?
	Any human health impacts observed? Emissions from a fire can cause irritation to the eyes, nose, and mouth and can reduce visibility. Reduced visibility, pneumonic irritation, smoke odor
Recreation	Any temporary roads created? Were they reclaimed?
Socio-Economics	Any benefits to the local economy through contracting or hiring through the local workforce?
	Any improvements to livestock forage that were substantial enough to mention?
LWC	Projects predicted to have would have beneficial effects helping to maintain ecological integrity within wilderness, thereby, helping to restore and preserve “natural” conditions and processes.
Public Health and Safety	Was there any smoke production that exceeded more than 2-3 days?
	Any human health impacts observed? Emissions from a fire can cause irritation to the eyes, nose, and mouth and can reduce visibility and cause pneumonic irritation, smoke odor
Soils	Direct ground disturbances associated with this project include, but are not limited to, debris from fallen trees, vehicle traffic, artifacts being broken by heavy machinery, and heat damage (such as burning, spalling, cracking, and the altering of obsidian hydration rims of lithic artifacts) from prescribed fire.
	How much soil disturbance and loss and localized compaction? (acres) Erosion from skidding or heavy equipment?
	Were soils sterilized or damaged from pile burning?
	Was projected conducted when soils were frozen or other mitigation to protect from damage?
Cultural	Were there any indirect impacts resulting from increased human access that lead to artifact collection?
	Was there any accidental damage, vandalism, illegal collection observed?
	Was there any mechanical damage from project activity?
	Was there any more ground visibility resulting from treatments that resulted in greater levels of illegal collecting within cultural resource localities in areas of heavy public use?
LWC	Were there any impacts to lwc such as roads or other any other observed impact to naturalness?
	Did Loss of vegetation screening impact solitude.
Visual Resources	Analysis predicted impacts to short term texture changes. Were there removal of vertical lines and forms and dark green colors attributable to junipers from the landscape, replacing them with horizontal lines and forms? Stumps and color changes? Any long-term impacts from pile/jackpot burning, temporary roads, resource damage etc?
	For both manual and motorized/mechanized treatments, removal of juniper trees would reduce vegetative screening. Was that observed?
	Any pile residue or burn circles observable for longer than to 3 years? Unburned or piled material or general “eyesores” created?
Livestock/Socio-Economics	Were there any Rest requirements needed for livestock grazing?

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Personal Communications

Justin Boeck, Fire Planner, National Interagency Fire Center (NIFC), Boise ID. Telephone conversation on January 7, 2020.

APPENDIX E: GLOSSARY OF TERMS

Expansion pinyon-juniper means pinyon-juniper trees or woodlands established after 1870.

Machine cutting is defined as cutting trees with machines, such as ground-based feller-bunchers and machine-mounted shears.

Manual cutting is defined as hand-cutting trees with chain saws. This category includes "lop and scatter" where the cut wood, limbs, and branches are placed on the ground.

Mastication is a method of on-site tree shredding utilizing equipment such as Bull Hog™ implements, mounted on mobile vehicles such as tractors or front-end loaders. Mastication shreds trees in place and creates woody debris (mulch).

Mulching is the act of spreading woody debris created by mastication over the ground, usually to a thickness of 3-4 inches.

Old-growth means pinyon-juniper trees or woodlands established prior to 1870.

Pile burning means utilizing a controlled (prescribed) fire to ignite hand-piled or machine-piled vegetation (in this case PJ trees, limbs, branches) cut during tree removal activities. Pile burning is conducted by hand, using drip torches and flares.

Piling means stacking cut wood in discrete footprints.

Pinyon-juniper Woodland Stages - Researchers and managers of pinyon-juniper encroachment often refer to Miller's (2005) classification of pinyon-juniper woodland expansion stages. The stage of woodland development affects plant community structure, composition, seed pools, wildlife habitat, and ecological processes. The three stages are defined as follow:

- Phase I woodlands - trees are present but represent less than 1/3 cover in biomass; shrubs and herbs dominate ecological processes
- In Phase II - trees represent between 1/3 and 2/3 cover in biomass; shrubs, herbs and trees share relative dominance, all influence ecological processes
- In Phase III - trees represent over 2/3 cover in biomass; tree canopy dominates ecological processes

Removal means the act of picking up cut wood from piles along existing roads and transporting it on existing roads from the site. For this CX, any cut wood and woody materials to be removed from the site would be yarded and placed next to existing roads, where vehicles would transport it from the site.

Yarding means the act of moving cut trees to common collection points, accomplished by machinery.