BLM

Oregon Greater Sage-Grouse Approved Resource Management Plan Amendment

Attachment 3

From the USDI 2015 Record of Decision and Approved Resource Management Plan Amendments for the Great Basin Region including the Greater Sage-Grouse Sub-Regions of: Idaho and Southwestern Montana, Nevada and Northeastern California, Oregon, and Utah

Prepared by
US Department of the Interior
Bureau of Land Management
Oregon/Washington State Office

September 2015

MISSION STATEMENT

The BLM manages more than 245 million acres of public land, the most of any Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The BLM also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's mission is to manage and conserve the public lands for the use and enjoyment of present and future generations under our mandate of multiple-use and sustained yield. In Fiscal Year 2014, the BLM generated $5.2 billion in receipts from public lands.

BLM/OR/WA/PL-15/051+1792

State Director Recommendation for Approval

We hereby recommend for approval the Oregon Greater Sage-Grouse Resource Management Plan Amendment.

Jerome E. Perez, Oregon/Washington State Director

September 15, 2015.

Date

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ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations	Full Phrase
ACEC	area of critical environmental concern
AML	appropriate management level
APD	application for permit to drill
ARMPA	Approved Resource Management Plan Amendment
BLM	United States Department of the Interior, Bureau of Land Management
BMP	best management practice
BSU	biologically significant unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COT	Conservation Objectives Team
CSU	controlled surface use
DOI	Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
ESA	Endangered Species Act
FIAT	fire and invasives assessment tool
FLPMA	Federal Land Policy Management Act
FWS	United States Fish and Wildlife Service
GDP	geothermal drilling permit
GHMA	general habitat management area
GRSG	Greater Sage-Grouse
HAF	habitat assessment framework
HMA	herd management area
HMAP	herd management area plan
NEPA	National Environmental Policy Act
NSO	no surface occupancy
ODFW	Oregon Department of Fish and Wildlife
OHV	off-highway vehicle
ORV	off-road vehicle
PAC	priority area for conservation
PHMA	priority habitat management area
RDF	required design feature
RFD	reasonably foreseeable development
RMP	resource management plan
RNA	research natural area
ROD	record of decision
ROW	right-of-way
SFA	sage-grouse focal area
SRMA	special recreation management area
TL	timing limitation
USC	United States Code
WAFWA	Western Association of Fish and Wildlife Agencies

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CHAPTER 1
INTRODUCTION

The Federal Land Policy and Management Act of 1976 (FLPMA) directs the US Department of the Interior (DOI), Bureau of Land Management (BLM) to develop and periodically revise or amend its resource management plans (RMPs), which guide management of BLM-administered lands.

This Approved Resource Management Plan Amendment (ARMPA) is the result of the March 2010 US Fish and Wildlife Service (USFWS) 12-Month Finding for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered (75 *Federal Register* 13910, March 23, 2010; USFWS 2010a). In that finding, the USFWS concluded that the Greater Sage-Grouse (GRSG) was "warranted, but precluded" for listing as a threatened or endangered species.

The USFWS reviewed the status of and threats to the GRSG in relation to the five listing factors provided in Section 4(a)(1) of the ESA. The USFWS determined that Factor A, "the present or threatened destruction, modification, or curtailment of the habitat or range of the GRSG," and Factor D, "the inadequacy of existing regulatory mechanisms," posed "a significant threat to the GRSG now and in the foreseeable future" (USFWS 2010a). The USFWS identified the principal regulatory mechanisms for the BLM as conservation measures in RMPs.

1.1 DESCRIPTION OF THE OREGON PLANNING AREA

The ARMPA planning area boundary includes all lands regardless of jurisdiction (see **Figure 1-1**, Oregon Sub-Regional Planning Area, Surface Management and Sub-Surface Estate, and **Figure 1-2**, Oregon Sub-Regional Planning Area, Greater Sage-Grouse Habitat Management Areas across All Jurisdictions). **Table 1-1** outlines the amount of surface acres that are administered by specific federal agencies, states, local governments, and lands that are privately owned in the planning area. The planning area includes other BLM-administered lands that are not allocated as habitat management areas for GRSG. The ARMPAs do not establish any additional management for these lands, which will continue to be managed according to the existing, underlying land use plan for the areas.

The decision area for the ARMPA is BLM-administered lands in GRSG habitat management areas (see **Figure 1-3**, Oregon Decision Area, Greater Sage-Grouse Habitat Management Areas for BLM Administered Lands), including surface and split-estate lands with BLM mineral-estate rights.

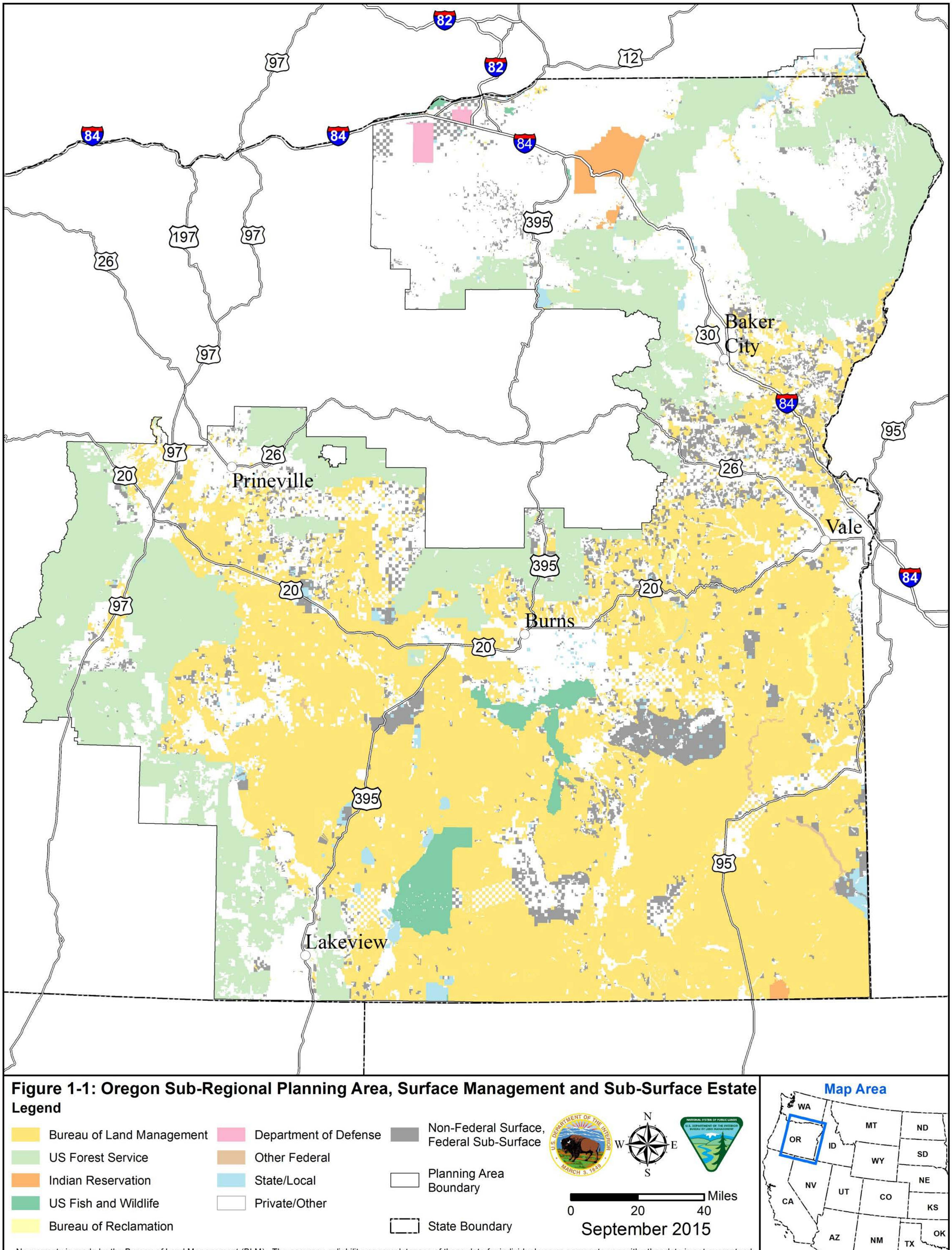

Figure 1-1: Oregon Sub-Regional Planning Area, Surface Management and Sub-Surface Estate

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

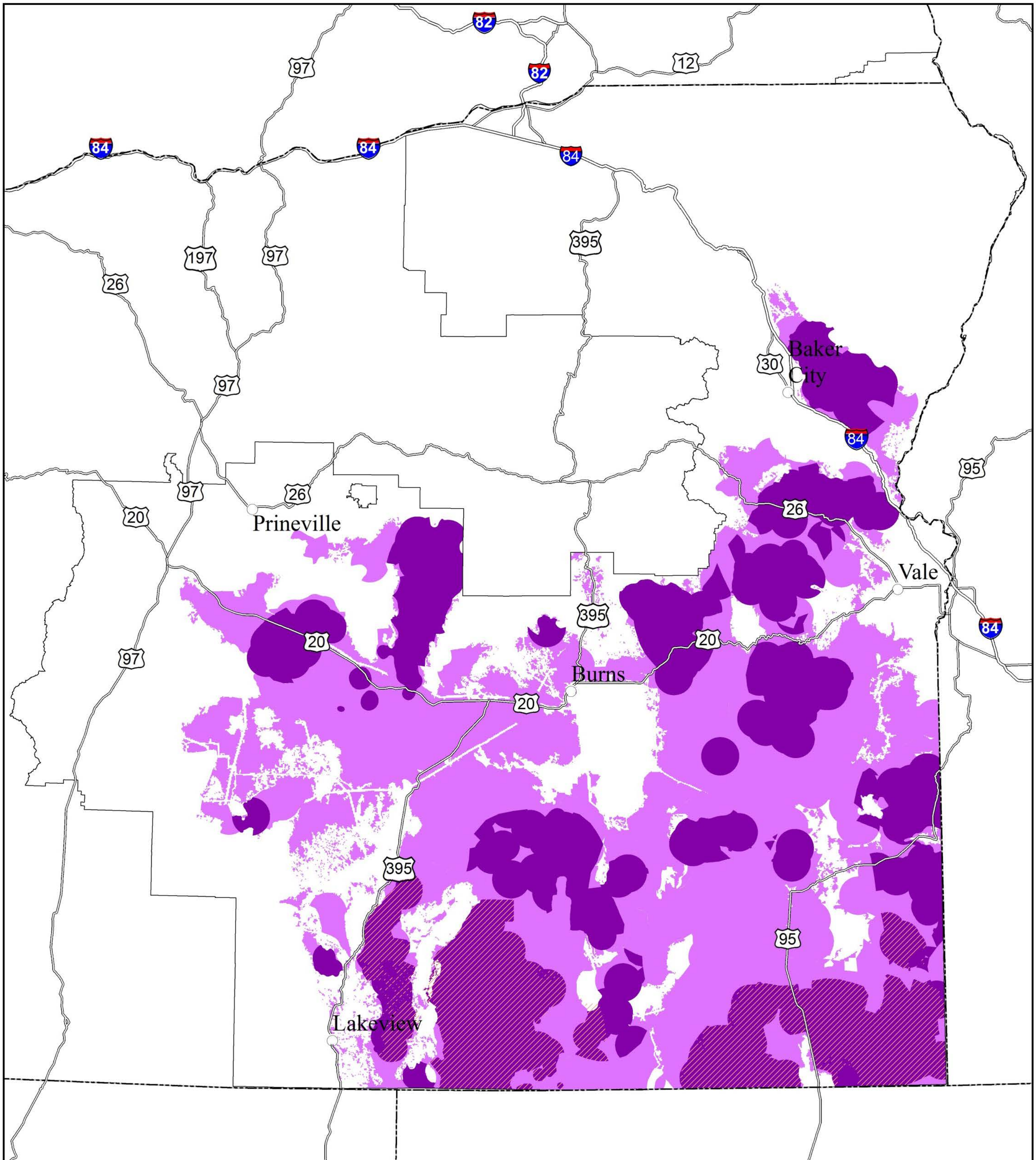

Figure 1-2: Oregon Sub-Regional Planning Area, Greater Sage-Grouse Habitat Management Areas across All Jurisdictions

Legend

- Sagebrush Focal Area (SFA)
- Priority Habitat Management Area (PHMA)
- General Habitat Management Area (GHMA)
- Planning Area Boundary
- State Boundary

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September 2015

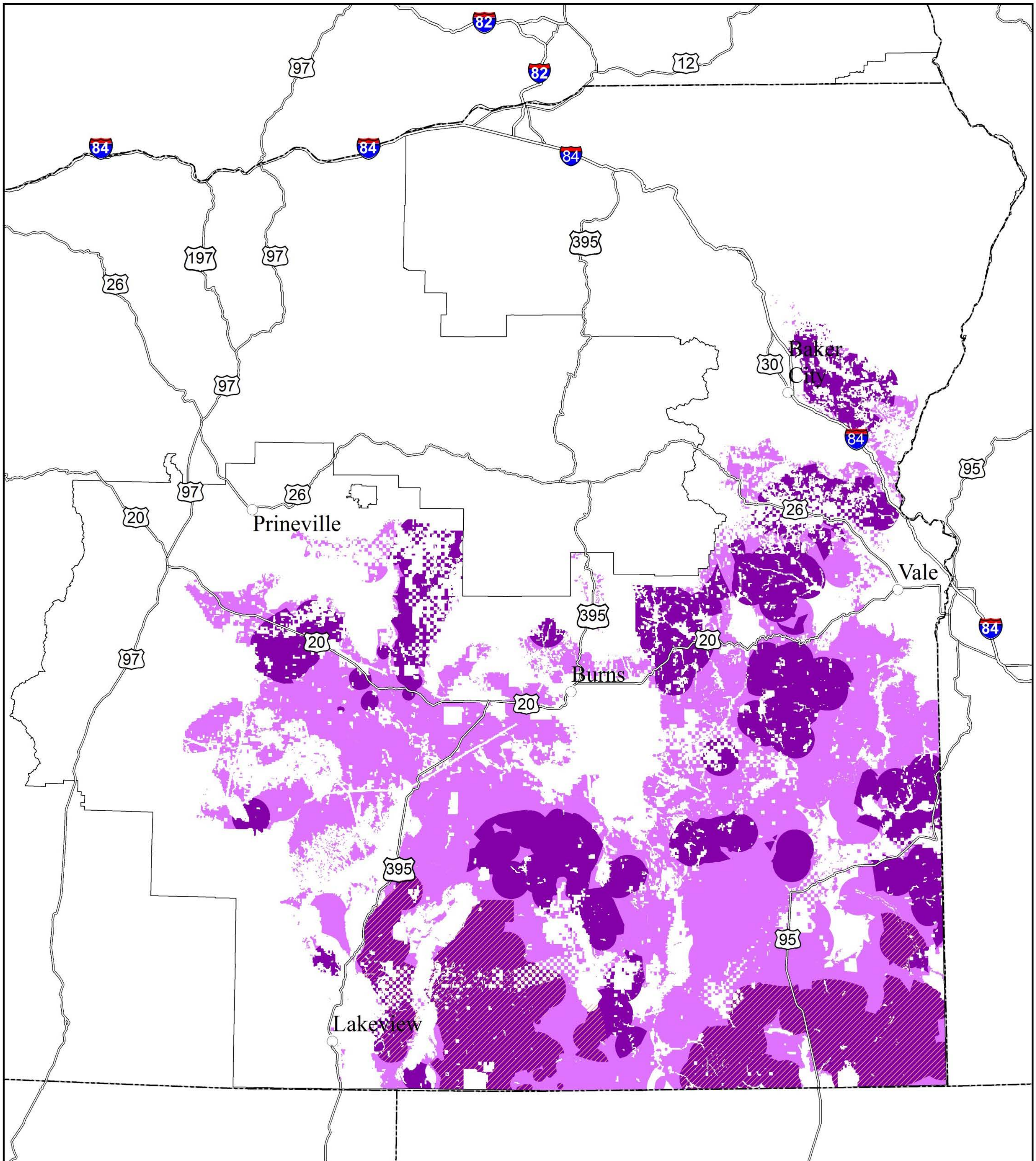

Figure 1-3: Oregon Decision Area, Greater Sage-Grouse Habitat Management Areas for BLM Administered Lands

Legend

- Sagebrush Focal Area (SFA)
- Priority Habitat Management Area (PHMA)
- General Habitat Management Area (GHMA)
- Planning Area Boundary
- State Boundary

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Table 1-1
Land Management in the Planning Area

Surface Land Management	Total Surface Land Management Acres
BLM	12,615,834
Forest Service	6,454,762
Private	10,907,628
Indian reservations	191,940
USFWS	482,527
Other federal	61,260
State	723,091
Bureau of Reclamation	52,714
Local government	868
Department of Defense	64,465
Undetermined	11,331
Water	89,366
Total acres	**31,655,786**

Source: BLM Oregon Corporate GIS Database 2015

Any decisions in the Oregon ARMPA apply only to BLM-administered lands, including split-estate lands within GRSG habitat management areas (the decision area). These decisions are limited to providing land use planning direction specific to conserving GRSG and its habitat.

GRSG habitat on BLM-administered lands in the decision area consists of lands allocated as priority habitat management areas (PHMA) and general habitat management areas (GHMA; see **Table 1-2**).

Table 1-2
Acres of PHMA and GHMA in the Decision Area for the ARMPA

Surface Land Management	PHMA	GHMA	Total Acres
BLM-administered surface estate	4,578,518	5,628,628	10,207,146
BLM-administered mineral estate[1]	5,162,359	6,072,419	11,234,778

Source: Oregon BLM GIS 2015

[1] BLM-administered mineral estate includes BLM surface with mineral estate jurisdiction and non-BLM surface with BLM mineral estate jurisdiction.

PHMA and GHMA are defined as follows:

- PHMA—BLM-administered lands identified as having the highest value to maintaining sustainable GRSG populations. Areas of PHMA largely coincide with areas identified as Priority Areas for Conservation in the USFWS's COT report. These areas include breeding, late brood-rearing, winter concentration areas, and migration or connectivity corridors.
- GHMA—BLM-administered lands where some special management will apply to sustain GRSG populations; areas of occupied seasonal or year-round habitat outside of PHMA.

The ARMPA also identifies specific sagebrush focal areas (SFA), which is a subset of PHMA (see **Figure 1-3**). The SFA was derived from GRSG stronghold areas described by the USFWS in a memorandum to the BLM titled Greater Sage-Grouse: Additional Recommendations to Refine Land Use Allocations in Highly Important Landscapes (USFWS 2014). The memorandum and associated maps provided by the USFWS identify areas that represent recognized strongholds for GRSG that have been noted and referenced as having the highest densities of GRSG and other criteria important for the persistence of the species.

PHMA (including SFA) and GHMA on BLM-administered lands in the decision area fall within eight counties in Oregon (see **Table 1-3**). The habitat management areas also span four BLM Oregon district offices (see **Table 1-4**).

The Burns, Lakeview, Prineville, and Vale BLM Districts administer the eight pertinent RMPs being amended by this ARMPA. The following BLM RMPs are hereby amended to incorporate appropriate GRSG conservation measures:

- Andrews (2005)
- Baker (1989)
- Brothers/La Pine (1989)
- Lakeview (2003)
- Southeastern Oregon (2002)
- Steens (2005)
- Three Rivers (1992)
- Upper Deschutes(2005)

Table 1-3
Acres of GRSG Habitat by County in the Decision Area (BLM-Administered Lands Only)

County Name	PHMA		GHMA	
	BLM-Administered Surface Estate	BLM-Administered Mineral Estate[1]	BLM-Administered Surface Estate	BLM-Administered Mineral Estate[1]
Baker	129,974	207,923	65,572	141,092
Crook	136,942	179,713	70,793	91,987
Deschutes	168,988	181,075	159,043	169,236
Grant	1,184	2,032	9,219	17,435
Harney	1,376,860	1,463,720	2,271,466	2,465,778
Lake	671,021	922,304	1,088,444	1,074,002
Malheur	2,092,865	2,201,814	1,963,780	2,111,463
Union	684	3,778	311	1,427
Grand Total	**4,578,518**	**5,162,359**	**5,628,628**	**6,072,419**

Source: Oregon BLM GIS 2015
[1] BLM mineral estate includes BLM-administered surface with mineral estate jurisdiction and non-BLM surface with BLM mineral estate jurisdiction.

Table 1-4
Acres of GRSG Habitat by BLM District and RMP Area in the Decision Area (BLM-Administered Lands Only)

BLM District	PHMA		GHMA	
BLM-Administered Surface Estate	**BLM-Admin-istered Surface Estate**	**BLM-Admin-istered Mineral Estate[1]**	**BLM-Admin-istered Surface Estate**	**BLM-Admin-istered Mineral Estate[1]**
Burns District	975,965	1,063,317	1,991,855	2,133,140
Andrews Management Unit RMP 2005	398,430	425,748	745,425	768,654
Steens Mountain Cooperative Management and Protection Area RMP 2005	208,080	213,426	198,527	221,397
Three Rivers Resource Area RMP 1992	369,455	424,143	1,047,903	1,143,089
Lakeview District	1,004,613	1,255,369	1,329,511	1,343,703
Lakeview Resource Area RMP Amendment	1,004,613	1,255,369	1,329,511	1,343,703
Prineville District	329,725	387,046	299,924	327,794
Brothers/LaPine RMP 1989	329,520	386,841	210,267	238,967
Upper Deschutes Resource Area RMP 2005	205	205	89,657	88,827
Vale District	2,268,214	2,456,627	2,007,338	2,267,781
Baker Resource Management Plan Revision	139,220	220,916	66,298	142,908
Southeast Oregon RMP Amendment	2,128,994	2,235,711	1,941,040	2,124,873
Grand Total	4,578,518	5,162,359	5,628,628	6,072,419

Source: Oregon BLM GIS 2015.
[1] BLM mineral estate includes BLM-administered surface with mineral estate jurisdiction and non-BLM surface with BLM mineral estate jurisdiction.

1.2 Purpose and Need

The BLM has prepared this ARMPA with an associated EIS to amend RMPs for its field offices and district offices containing GRSG habitat. This planning process is needed to respond to the USFWS's March 2010 "warranted, but precluded" ESA listing petition decision for GRSG. The USFWS identified (1) the present or threatened destruction, modification, or curtailment of habitat or range and (2) the inadequacy of existing regulatory mechanisms as significant threats, and identified the principal regulatory mechanisms for the BLM as conservation measures incorporated into land use plans.

The purpose of the ARMPA is to identify and incorporate appropriate measures in existing land use plans to conserve, enhance, and restore GRSG habitat by avoiding, minimizing, or compensating for unavoidable impacts to GRSG habitat in the context of the BLM's multiple use and sustained yield mission under FLPMA. Changes in management of GRSG habitats are necessary to avoid the continued decline of populations across the species' range. This ARMPA focuses on areas affected by threats to GRSG habitat identified by the USFWS in the March 2010 listing decision and in the USFWS 2013 COT report.

The major threats to GRSG or GRSG habitat on BLM-administered lands in Oregon are the following:

- Wildfire—loss of large areas of GRSG habitat due to wildfire
- Invasive species—spread of invasive annual grasses, such as cheatgrass and medusahead
- Conifer expansion—encroachment of western juniper into GRSG habitat

- Grazing—loss of habitat components due to improper livestock grazing
- Hard rock mining—fragmentation of GRSG habitat due to mineral exploration and development
- Fluid mineral development—fragmentation of GRSG habitat due to mineral exploration and development
- Infrastructure—fragmentation of GRSG habitat due to development, such as roads, pipelines, and communication towers
- Recreation—fragmentation of GRSG habitat or modification of GRSG behavior due to human presence and activities, including travel management
- Wild horses and burros—management of wild horses and burros in sage-grouse habitat
- Sagebrush removal—fragmentation of GRSG habitat from BLM management activities

Because the BLM administers a large portion of GRSG habitat in the affected states, changes in GRSG habitat management are anticipated to have a considerable beneficial impact on present and future GRSG populations.

1.3 Oregon GRSG Conservation Summary

This ARMPA identifies and incorporates conservation measures to protect, restore, and enhance GRSG habitat by avoiding, minimizing, and compensating for unavoidable impacts of threats on GRSG habitat. The ARMPA addresses threats to GRSG and its habitat identified by the GRSG National Technical Team (NTT), by the USFWS in the March 2010 listing decision, as well as those threats described in the USFWS's COT report. In accordance with that report, the USFWS identified threats by GRSG population across the range and stated whether that threat is present and widespread, present but localized, or unknown for that specific population. **Table 1-5** identifies the Oregon GRSG populations and threats identified in the COT report. The Oregon portion of the Klamath population was excluded from this planning effort because GRSG were last recorded there in 1993.

Table 1-6 displays how the ARMPA for Oregon addresses the threats from the COT report.

The ARMPA also identifies and incorporates measures for other uses and resources that are designed to conserve, enhance, and restore GRSG habitat. Specifically, the ARMPA requires the following summarized management decisions, subject to valid existing rights:

- Providing a framework for prioritizing PHMA and GHMA for wildfire, invasive annual grass, and conifer treatments
- Requiring specific design features for certain land and realty uses
- Limiting new development where a disturbance cap has been reached
- Including GRSR habitat objectives in land health standards
- Adjusting grazing practices as necessary, based on GRSG habitat objectives, land health standards, and ecological site potential

Table 1-5
Threats to GRSG in Oregon as Identified by the COT

GRSG Identified Populations from the COT Report Applicable to Oregon	Unit Number	Isolated Small Size	Sagebrush Elimination	Agriculture Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Improper Grazing	Free-Roaming Equids	Recreation	Urbanization
Baker	17	**Y**	**Y**	**Y**	**Y**	L	**Y**	L	**Y**	L	U	N	L	L
Northern Great Basin (Oregon, Idaho, Nevada)	26a	N	L	L	**Y**	**Y**	**Y**	L	L	**Y**	**Y**	L	**Y**	**Y**
Central Oregon	28	**N**	L	L	**Y**	**Y**	**Y**	L	**Y**	L	**Y**	U	L	L
Western Great Basin (Oregon, California, Nevada)	31	N	L	L	**Y**	**Y**	**Y**	L	L	L	**Y**	**Y**	U	N

Source: COT 2013

Threats are characterized as Y = threat is present and widespread, L = threat present but localized, N = threat is not known to be present, and U = unknown.

Table 1-6
Key Components of the Oregon GRSG ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Oregon ARMPA
All threats	• Implement the adaptive management plan, which allows for more restrictive land use allocations and management actions to be implemented if habitat or population hard triggers are met. • Require and ensure mitigation that provides a net conservation gain to GRSG. • Monitor implementation and effectiveness of conservation measures in GRSG habitats according to the GRSG monitoring framework.
All development threats, including mining, infrastructure, and energy development	• PHMA—Implement a human disturbance cap of 3%, not to exceed a 1% increase per decade, within the biologically significant unit (BSU; also known as Oregon priority areas of conservation [PACs]) and proposed project analysis areas, as allowed under current law. • PHMA—As allowed under current law, implement a density cap of an average of one energy and mining facility per 640 acres. • Apply lek buffers, as necessary, based on project type and location to avoid impacts on GRSG and GRSG habitat from BLM-authorized actions. • Apply required design features (RDFs) when authorizing actions that affect GRSG habitat.

Table 1-6
Key Components of the Oregon GRSG ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Oregon ARMPA
	• Minimize the effects of infrastructure projects, including siting, using the best available science, updated as monitoring information on current infrastructure projects becomes available.
Energy development—fluid minerals, including geothermal resources	• PHMA—Open to fluid mineral leasing subject to no surface occupancy (NSO) stipulation without waiver or modification and with limited exception. In SFA, NSO without waiver, modification, or exception. • GHMA—Open to fluid mineral leasing, subject to limited NSO, controlled surface use (CSU), and timing limitation (TL) stipulations. • Prioritize the leasing and development of fluid mineral resources outside GRSG habitat. • Prioritize the leasing and development of fluid mineral resources outside of GRSG habitat.
Energy development—wind energy	• PHMA—Exclusion area (not available for wind energy development under any conditions), except avoidance area in Harney, Lake, and Malheur Counties outside of SFA. • GHMA—Avoidance area (may be available for wind energy development with special stipulations).
Energy development—solar energy	• PHMA—Exclusion area (not available for solar energy development under any conditions), except avoidance area in Harney, Lake, and Malheur Counties outside of SFA. • GHMA—Avoidance area (may be available for solar energy development with special conditions).
Infrastructure—major ROWs	• PHMA—Avoidance area (may be available for major ROWs with special stipulations). • GHMA—Avoidance area (may be available for major ROWs with special stipulations).
Infrastructure—minor ROWs	• PHMA—Avoidance area (may be available for minor ROWs with special stipulations).
Mining—locatable minerals	• SFA—Recommend withdrawal from the Mining Law of 1872, as amended, subject to valid existing rights.
Mining—nonenergy leasable minerals	• PHMA—Closed area (not available for nonenergy leasable minerals).
Mining—salable minerals	• PHMA—Closed area (not available for salable minerals), with a limited exception (may remain open to free use permits and expansion of existing active pits if criteria are met).
Mining—coal	• Not applicable in the Oregon planning area.
Improper livestock grazing	• Prioritize the review and processing of grazing permits and leases in SFA, followed by PHMA. • Include in the NEPA analysis for renewals and modifications of grazing permits and leases specific management thresholds, based on the GRSG habitat objectives table, land health standards, and ecological site potential, to allow grazing adjustments that have already been subjected to NEPA

Table 1-6
Key Components of the Oregon GRSG ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Oregon ARMPA
	analysis. • Prioritize field checks in SFA, followed by PHMA, to ensure compliance with the terms and conditions of grazing permits.
Free-roaming equid (wild horses and burros) management	• Manage herd management areas (HMAs) in GRSG habitat within established appropriate management level (AML) ranges to achieve and maintain GRSG habitat objectives. • Prioritize rangeland health assessment, gathers, and population growth suppression techniques, monitoring, and review and adjustment of AMLs and preparation of HMA plans in GRSG habitat.
Range management structures	• Allow range improvements that do not impact GRSG or that provide a conservation benefit to GRSG, such as fences for protecting important seasonal habitats. • Maintain, enhance, or reestablish riparian areas in PHMA and GHMA. • Remove, modify, or mark fences identified as high risk for GRSG collision.
Recreation	• PHMA—Do not construct new recreation facilities.
Fire	• Identify and prioritize areas that are vulnerable to wildfires and prescribe actions important for GRSG protection. • Prioritize post-fire treatments in PHMA and GHMA.
Nonnative, invasive plant species	• Improve GRSG habitat by treating annual grasses. • Treat sites in PHMA and GHMA that contain invasive species infestations through an integrated pest management approach.
Sagebrush removal	• PHMA—Maintain all lands ecologically capable of producing sagebrush (but no less than 70%) with a minimum of 15% sagebrush cover or as consistent with specific ecological site conditions. • Ensure that all BLM use authorizations contain terms and conditions regarding the actions needed to meet or progress toward meeting the habitat objectives for GRSG.
Pinyon and juniper expansion	• Remove conifers encroaching into sagebrush habitats, in a manner that considers tribal cultural values, prioritizing occupied GRSG habitat.
Agricultural conversion and exurban development	• Retain GRSG habitat in federal management.

The ARMPA also establishes screening criteria and conditions for authorizing new human activities in PHMA and GHMA to ensure a net conservation gain to GRSG. The ARMPA will reduce habitat disturbance and fragmentation by limiting surface-disturbing activities, while addressing changes in resource condition and use by monitoring and adaptive management.

The ARMPA adopts key elements of the Oregon's Sage-Grouse Action Plan and Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and

Habitat (Hagen 2011). It does this by establishing conservation measures and focusing restoration in the same key areas most valuable to GRSG.

For a full description of the BLM Oregon's ARMPA, see **Chapter 2**.

1.4 PLANNING CRITERIA

Planning criteria are based on appropriate laws, regulations, BLM manual and handbook sections, and policy directives. Criteria are also based on public participation and coordination with cooperating agencies, other federal agencies, state and local governments, and Native American tribes.

These criteria are the standards, rules, and factors used as a framework to resolve issues and develop alternatives. They are prepared to ensure decision-making is tailored to the issues and to ensure that the BLM avoid unnecessary data collection and analysis. Preliminary planning criteria were included in the Draft RMPA/Draft EIS and were further refined for the Proposed RMPA/Final EIS.

Planning criteria carried forward for this ARMPA are as follows:

- The BLM used the WAFWA Conservation Assessment of GRSG and Sagebrush Habitats (Connelly et al. 2004) and any other appropriate resources to identify GRSG habitat requirements, best management practices, and required design features.
- The ARMPA is consistent with the BLM's 2011 National GRSG Conservation Strategy.
- The ARMPA complies with BLM direction, such as FLPMA, NEPA, and CEQ regulations at 40 CFR, Parts 1500-1508; DOI regulations at 43 CFR, Parts 4 and 1600; the BLM H-1601-1 Land Use Planning Handbook, "Appendix C: Program-Specific and Resource-Specific Decision Guidance Requirements" for affected resource programs (BLM 2005a); the 2008 BLM NEPA Handbook (H-1790-1; BLM 2008e); and all other applicable BLM policies and guidance.
- The ARMPA is limited to providing direction specific to conserving GRSG and its habitats.
- The BLM considered land allocations, objectives, and management actions to restore, enhance, and improve GRSG habitat.
- The ARMPA recognizes valid existing rights.
- The ARMPA addresses BLM-administered land in GRSG habitats (including surface estate and split-estate lands) in GRSG habitats. Any decisions in the ARMPA apply only to federal lands administered by the BLM.
- The BLM used a collaborative and multi-jurisdictional approach, where appropriate, to determine the desired future condition of BLM-administered lands for the conservation of GRSG and their habitats.
- Predation effects on GRSG are addressed in this ARMPA through habitat management and infrastructure siting and design rather than directly removing or reducing predators.
- As described by law and policy, the BLM ensured that conservation measures are as consistent as possible with other planning jurisdictions within the planning area boundaries.

- The BLM considered a range of reasonable alternatives, including appropriate management prescriptions that focus on the relative values of resources, while contributing to the conservation of GRSG and GRSG habitat.
- The BLM addressed socioeconomic impacts of the alternatives and updated socioeconomic analysis for the Proposed RMPA/Final EIS. Socioeconomic analysis used such tools as the input-output quantitative models IMPLAN and the National Renewable Energy Laboratory's Jobs and Economic Development Impact model (JEDI) for renewable energy analysis, where quantitative data is available.
- The BLM used the current scientific information, research, technologies, and results of inventory, monitoring, and coordination to determine appropriate local and regional management strategies that will enhance or restore GRSG habitats.
- Management of GRSG habitat that intersects with designated wilderness areas on BLM-administered lands is guided by BLM Manual 6340 Management of Designated Wilderness Areas (BLM 2012b). Land use allocations made for GRSG are consistent with BLM Manual 6340 and other laws, regulations, and policies related to wilderness area management. Management of GRSG habitat is also guided by the BLM manuals on wilderness (Manual Section 6340); Steens Mountain Cooperative Management and Protection Area (National Monument/National Conservation Area Manual Section 6220); Wild and Scenic Rivers (Manual Section 6400); and National Historic Trails (Manual Section 6280).
- For BLM-administered lands, all activities and uses in GRSG habitats have followed existing land health standards. Also applicable for BLM-administered lands are Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington (BLM 1997) and other programs that have developed standards and guidelines.
- The BLM has consulted with Native American tribes to identify sites, areas, and objects important to their cultural and religious heritage in GRSG habitats.
- The BLM has coordinated and communicated with state, local, and tribal governments to ensure that the BLM considered provisions of pertinent plans, sought to resolve inconsistencies between state, local, and tribal plans, and provided ample opportunities for state, local, and tribal governments to comment on the development of amendments.
- The BLM developed vegetation management objectives, such as those for managing invasive plant species (including identifying desired future conditions for specific areas) in GRSG habitats.
- The ARMPA is based on the principles of adaptive management.
- The ARMPA was developed using an interdisciplinary approach to prepare RFD scenarios, identifying alternatives, and analyzing resource impacts, including cumulative impacts on natural and cultural resources and the social and economic environment.
- The RFD scenario for geothermal development was sourced from the Geothermal Programmatic Environmental Impact Statement (BLM 2008). RFDs were not completed for other mineral potentials and developments in Oregon. However, the BLM did conduct trend analyses of past activity and development.

- The most current approved BLM corporate spatial data are supported by current metadata and are used to ascertain GRSG habitat extent and quality. Data are consistent with the principle of the Information Quality Act of 2000.
- ODFW's GRSG data and expertise are used to the fullest extent practicable in making management determinations on BLM-administered lands.
- Where more restrictive land use allocations or decisions are made in existing RMPs, they will remain in effect and will not be amended by this ARMPA.

CHAPTER 2
APPROVED RESOURCE MANAGEMENT PLAN AMENDMENT

2.1 APPROVED RESOURCE MANAGEMENT PLAN AMENDMENT INSTRUCTIONS

This ARMPA is now the baseline plan for managing GRSG in Oregon in the Burns, Lakeview, Prineville, and Vale District Offices. The ARMPA adopts the management described in the Oregon Greater Sage-grouse Proposed Resource Management Plan Amendment and Final Environmental Impact Statement (2015), with modifications and clarifications, as described in the *Modifications and Clarifications* section of the ROD.

In the event there are inconsistencies or discrepancies between previously approved RMPs and this ARMPA, the decisions contained in this ARMPA will be followed. The BLM will continue to tier to statewide, national, and programmatic EISs and other NEPA and planning documents, as well as consider and apply RDFs or other management protocols contained in other planning documents after appropriate site-specific analysis.

All future resource authorizations and actions in GRSG habitat will conform to or be consistent with the decisions contained in this ARMPA. They will be followed unless there are more restrictive decisions in the existing plans, in which case, the more restrictive decisions will be implemented. All existing operations and activities authorized under permits, contracts, cooperative agreements, or other authorizations will be modified, as necessary, to conform to this plan amendment, within a reasonable time frame. However, this ARMPA does not repeal valid existing rights on public lands. This is a claim or authorization that takes precedence over the decisions developed in this plan. If such authorizations come up for review and can be modified, they will also be brought into conformance with this plan amendment, as appropriate.

While the Final EIS for the Oregon Proposed GRSG RMPA constitutes compliance with NEPA for the broad-scale decisions made in this ARMPA, the BLM will continue to prepare environmental assessments (EAs) and environmental impact statements (EISs), where appropriate, as part of implementation level planning and decision-making.

2.2 Goals, Objectives, and Management Decisions

This section of the ARMPA presents the goals, objectives, land use allocations, and management actions established for protecting and preserving Greater Sage-grouse and its habitat on public lands managed by the BLM in Oregon for each program. Land use allocations are depicted in **Appendix A**. A *Monitoring Framework* is also included (in **Appendix D**) to describe how the implemented program decisions will be monitored.

This section is organized by program area beginning with the Special Status Species (SSS) program, which identifies specific goals, objectives, and management actions for Greater Sage-grouse and its habitat. For ease of identification into the future, each program area has identified abbreviations (see below) for these program areas and each decision in that program is numbered in coordination with the abbreviation:

- Special Status Species **(SSS)**
- Vegetation **(VEG)**
  - Sagebrush Steppe
  - Conifer Encroachment
  - Invasive Species
  - Riparian and Wetlands
- Fire and Fuels Management **(FIRE)**
  - Pre-Suppression
  - Suppression
  - Fuels Management
  - Post-Fire Management
- Livestock Grazing **(LG)**
- Wild Horses and Burros **(WHB)**
- Minerals Resources **(MR)**
  - Leasable Minerals
  - Locatable Minerals
  - Salable Minerals
  - Non-Energy Leasable Minerals
  - Mineral Split Estate
- Renewable Energy (Wind and Solar) **(RE)**
- Lands and Realty **(LR)**
  - Utility Corridors and Communication Sites
  - Land Use Authorizations
  - Land Tenure

- Recommended Withdrawals

- Recreation **(REC)**
- Travel and Transportation **(TTM)**
- Special Designations **(SD)**

Table 2-1 is a summary of the allocation decisions presented for each GRSG habitat management area.

Table 2-1
Summary of Allocation Decisions by GRSG Habitat Management Areas

Resource	PHMA	GHMA
Land Tenure	Retain	Retain
Solar	Exclusion; Avoidance in Harney, Lake, and Malheur Counties outside of SFA	Avoidance
Wind	Exclusion; Avoidance in Harney, Lake, and Malheur Counties outside of SFA	Avoidance
Major ROWs	Avoidance	Avoidance
Minor ROWs	Avoidance	Open
Oil and Gas	Open with Major Stipulations	Open with Minor Stipulations
Geothermal	Open with Major Stipulations	Open with Minor Stipulations
Non-energy Leasables	Closed	Open
Salable Minerals	Closed, with exceptions	Open
Locatable Minerals	SFA = Recommend Withdrawal Other PHMA = Open	Open
Travel Management	Limited	Limited
Livestock Grazing	Open Exception – closed in subset of RNAs	Open

2.2.1 Special Status Species (SSS)

Goal SSS 1: Conserve, enhance, and restore the sagebrush ecosystem upon which GRSG populations depend in an effort to maintain and/or increase their abundance and distribution, in cooperation with other conservation partners.

Objective SSS 1: Protect PHMA necessary to conserve 90 percent of Oregon's Greater Sage-grouse population with emphasis on highest density and important use areas that provide for breeding, wintering, and connectivity corridors. Protect GHMA necessary to conserve occupied seasonal or year-round habitat outside of PHMA.

Objective SSS 2: Maintain or improve habitat connectivity between PHMA within Oregon and adjoining states to promote Greater Sage-grouse movement and genetic diversity.

Objective SSS 3: In addition to the net conservation gain mitigation requirement, manage Oregon PACs so that: discrete anthropogenic disturbances, whether temporary or permanent, cover less than 3 percent of the total available Greater Sage-grouse habitat, regardless of ownership.

Objective SSS 4: Manage land resource uses in GRSG habitat to meet the desired conditions described in **Table 2-2**, Habitat Objectives for Greater Sage-grouse. Use the desired conditions to evaluate management actions that are proposed in GRSG habitat to ensure that habitat conditions are maintained if they are currently meeting objectives or habitat conditions move toward these objectives if the current conditions do not meet these objectives.

Table 2-2
Habitat Objectives for Greater Sage-grouse

Attribute	Indicators	Desired Condition (Habitat Objectives)	Reference
Breeding Including Lekking, Pre-nesting, Nesting, and Early Brood Rearing (Seasonal Use Period March 1 – June 30			
Lek Security	Proximity of trees or other tall structures	No conifers or tall structures within 1.0 mile of lek center, and confer cover less than 5% within 4.0 miles of lek, excluding old trees, culturally significant, actively used by special status species, and old growth juniper stands.	Connelly et al. 2000; Fresse 2009; Baruch-Mordo et al. 2013; Knick et al. 2013
	Proximity of sagebrush to leks	Lek has adjacent sagebrush cover	Connelly et al. 2000
Cover	Sagebrush cover (%)	10 to 25	Doescher et al. 1986; Gregg et al. 1994; Hanf et al. 1994; Coggins 1998; Crawford and Carver 2000; Bates and Davies 2014; BLM 2015a
	Sagebrush height (inches) Arid sites (warm-dry) Mesic sites (cool-moist)	 11 to 31 15 to 31	Gregg et al. 1994; Hanf et al. 1994; Coggins 1998; Crawford and Carver 2000; Freese 2009.
	Predominant sagebrush shape	Spreading	Connelly et al. 2000
	Perennial grass cover (such as bunchgrass) (%) Arid sagebrush Warm-dry Shallow-dry Mesic sagebrush Cool-moist Warm-moist	 10 to 30 10 to 25 20 to 45 20 to 50	Gregg at al. 1994; Coggins 1998; Crawford and Carver 2000; Freese 2009; NRCS 2015; Bates and Davies 2014; Jon Bates, USDA ARS, pers.comm. 2/10/2015; BLM 2015a; BLM 2015b
	Perennial grass and forb height (inches, including residual grasses) – most important and appropriately measured in nest areas; excludes shallow-dry sites[1] Arid sites (warm-dry) Mesic sites (cool-moist)	 ≥ 7 ≥ 9	Gregg et al. 1994; Hanf et al. 1994; Crawford and Carver 2000; Hagen et al. 2007; Jon Bates, USDA ARS, pers.comm. 2/10/2015

Table 2-2
Habitat Objectives for Greater Sage-grouse

Attribute	Indicators	Desired Condition (Habitat Objectives)	Reference
	Perennial forb cover (%)[2] Arid sagebrush Warm-dry Shallow-dry Mesic sagebrush Cool-moist Warm-moist	 2 to 10 2 to 10 6 to 12 5 to 15	Drut 1992; Drut et al. 1994; Crawford and Carver 2000; Freese 2009; NRCS 2015; Bates and Davies 2014; BLM 2015a; Jon Bates, USDA ARS, pers.comm. 2/10/2015; BLM 2015b
Food	Preferred forb diversity and availability	Preferred forbs are common with 5 to 10 species present[2]	Hanf et al. 1994; Crawford and Carver 2000; Freese 2009; Bates and Davies 2014; BLM 2015a; Jon Bates, USDA ARS, pers.comm. 2/10/2015
Available Suitable Habitat (Landscape Context)	% of seasonal habitat within 4.0 miles of leks meeting a majority of the desired conditions Arid sagebrush Mesic sagebrush	 70 (55-85) 75 (60-90)	Connelly et al. 2000; Karl and Sadowski 2005; Evers 2010; Hagen 2011; NRCS 2015
Brood-rearing/Summer Including Late-brood Rearing, Summering, and Early Autumn (Seasonal Use Period July 1- October 31)			
Cover	Sagebrush cover (%)	10 to 25	Doescher et al. 1986; Drut et al. 1994; Connelly et al. 2000; Crawford and Carver 2000; Bates and Davies 2014; Jon Bates, USDA ARS, pers.comm. 2/10/2015
	Sagebrush height (inches)	15 to 31	Gregg et al. 1994; Hanf et al. 1994; Crawford and Carver 2000; Freese 2009
	Perennial herbaceous (grass and forbs) cover (%) Arid sagebrush Warm-dry Shallow-dry Mesic sagebrush Cool-moist Warm-moist Riparian[3]	 15 to 30 10 to 25 20 to 45 30 to 55 ≥ 50	Drut et al. 1994; Bates and Davies 2014; NRCS 2015; BLM 2015b; Jon Bates, USDA ARS, pers.comm. 2/10/2015
	Riparian areas/mesic meadows	Majority of areas are in PFC	Stiver et al. 2010, or as updated
Food	Upland and riparian perennial forb availability	Preferred forbs are common with 5 to 10 species present[4]	Hanf et al. 1994; Freese 2009; Bates and Davies 2014; BLM 2015b; Jon Bates, USDA ARS, pers.comm. 2/10/2015

Table 2-2
Habitat Objectives for Greater Sage-grouse

Attribute	Indicators	Desired Condition (Habitat Objectives)	Reference
Available Suitable Habitat (Landscape Context)	% of seasonal habitat within 4.0 miles of leks meeting a majority of the desired conditions Arid sagebrush Mesic sagebrush	 70 (55-85) 75 (60-90)	Connelly et al. 2000; Karl and Sadowski 2005; Evers 2010; Hagen 2011; NRCS 2015
Winter Including Late Autumn and Winter (Seasonal Use Period November 1 – February 28)			
Cover and Food	Sagebrush cover above snow (%)	≥ 10	Willis 1990 (in Hagen 2011); Bruce 2011
	Sagebrush height above snow (inches)	≥10	Willis 1990 (in Hagen 2011); Bruce 2011
Available Suitable Habitat (Landscape Context)	% of wintering habitat meeting a majority of the desired conditions Arid sagebrush Mesic sagebrush	 70 (55-85) 85 (68-100)	Connelly et al. 2000; Karl and Sadowski 2005; Evers 2010; NRCS 2015

[1]Perennial grass and forb minimum height may not be achievable in years with below normal precipitation. Other indicators of desired condition may still render the site suitable, however.
[2] In very dry years, forb cover and availability may not be at the desired condition, and in certain plant associations such as Wyoming big sagebrush/Needle and Thread, these indicators may rarely be achieved even in years with normal precipitation.
[3] Riparian includes swales, wet meadows, and intermittent/ephemeral streams.
[4]Sage-grouse preferred forbs are listed in Appendix I.

Objective SSS 5: Manage anthropogenic uses and GRSG predator subsidies on public lands (landfills, transfer stations, predator perches and nest sites) to reduce the effects of predation on GRSG.

Objective SSS 6: The BLM will coordinate with the State of Oregon regarding proposed management changes, the implementation of conservation measures, mitigation, and site-specific monitoring related to adaptive management and anthropogenic disturbance.

Management Decisions (MD)

MD SSS-1: Designate PHMA on 4,578,518 acres and designate GHMA on 5,628,628 acres.

MD SSS-2: Designate Sagebrush Focal Areas (SFA) (1,929,580 acres) as shown on **Figure 1-3**. SFA will be managed as PHMA, with the following additional management:

A. Recommended for withdrawal from the General Mining Law of 1872, as amended, subject to valid existing rights.
B. Managed as NSO, without waiver, exception, or modification, for fluid mineral leasing.
C. Prioritized for vegetation management and conservation actions in these areas, including, but not limited to land health assessments, wild horse and burro management actions, review of livestock grazing permits/leases, and habitat restoration (see specific management sections).

MD SSS-3: If the 3% anthropogenic disturbance cap, not to exceed 1% increase per decade, is exceeded on lands (regardless of landownership) within GRSG Priority Habitat Management Areas in the ***affected Oregon PAC***, then no further discrete anthropogenic disturbances (subject to applicable laws and regulations, such as the General Mining Law of 1872, as amended, valid existing rights, etc.) will be permitted by BLM within GRSG Priority Habitat Management Areas in the affected Oregon PAC until the disturbance has been reduced to less than the cap.

MD SSS-4: If the 3% disturbance cap, not to exceed 1% increase per decade, is exceeded on all lands (regardless of landownership) within a ***proposed project analysis area*** in Priority Habitat Management Areas, then no further anthropogenic disturbance will be permitted by BLM until disturbance in the proposed project analysis area has been reduced to maintain the area under the cap (subject to applicable laws and regulations, such as General Mining Law of 1872, as amended, valid existing rights, etc.). Within existing designated utility corridors, the 3% disturbance cap may be exceeded at the project scale if the site specific NEPA analysis indicates that a net conservation gain to the species will be achieved. This exception is limited to projects which fulfill the use for which the corridors were designated (ex., transmission lines, pipelines) and the designated width of a corridor will not be exceeded as a result of any project co-location.

MD SSS-5: Subject to applicable laws and regulations and valid existing rights, if the average density of one energy and mining facility per 640 acres (the density cap) is exceeded on all lands (regardless of landownership) in the Priority Habitat Management Area within a proposed project analysis area, then no further disturbance from energy or mining facilities will be permitted by BLM: (1) until disturbance in the proposed project analysis area has been reduced to maintain the limit under the cap; or (2) unless the energy or mining facility is co-located into an existing disturbed area, as described in **Appendix E**.

MD SSS-6: Using the habitat disturbance cap calculation methodology (**Appendix E**), in cooperation with ODFW, measure the direct area of influence of infrastructure, facilities, energy, and mining within Oregon PACs (**Figure 2-2** in **Appendix A**) and maintain a current database of anthropogenic disturbance.

MD SSS-7: Verify the accuracy of Greater Sage-grouse habitat data layers at the site/project scale. Consider ecological site potential when assessing habitat suitability for Greater Sage-grouse. Periodically update PHMA and GHMA in cooperation with ODFW using the best available information.

MD SSS-8: When fine and site-scale Greater Sage-grouse habitat assessment and monitoring is needed or required, (e.g., as a component of a rangeland health assessment), measure the Greater Sage-grouse habitat suitability indicators for seasonal habitats identified in **Table 2-2**. Site suitability values may be adjusted regionally where there is scientific justification for doing so. When using the indicators to guide management actions or during land health assessments, consider that the indicators are sensitive to the ecological processes operating at the scale of interest and that a single habitat indicator does not necessarily define habitat suitability for an area or particular scale.

MD SSS-9: Apply buffers and seasonal restrictions in **Table 2-3** to all occupied or pending leks in PHMA and GHMA to avoid direct disturbance to Greater Sage-grouse. In undertaking BLM management actions, and consistent with valid and existing rights and applicable law in authorizing third-party actions, the BLM will apply the lek buffer-distances identified in the USGS Report Conservation Buffer Distance Estimates for Greater Sage-Grouse—A Review (Open File Report 2014-1239) (Manier et al. 2014; **Appendix B**).

Table 2-3
Greater Sage-Grouse Buffers

Resource Program	Activity	Temporal Buffer	Spatial Buffer Miles from Lek PHMA	GHMA
Vegetation - Habitat Restoration MD Veg 3	Sagebrush cutting or removal	Nesting and early brood-rearing (March 1 through June 30)	4	4
Vegetation - Habitat Restoration MD Veg 4	Juniper cutting	Breeding season (March 1 through June 30) - two hours before and after sunrise and sunset.	4	4
Vegetation - Habitat Restoration MD Veg 5	Vegetation management activities that are timing-sensitive for maximum effectiveness	No more than 5 days during the breeding and early brood-rearing period (Mar 1 –June 30; use local information to further refine this period)	4	4
Livestock Grazing and Range Management MD LG 9	Reduce collision risk through fence removal, modification, or marking in areas with "high" collision risk	NA	1.2	1.2
Livestock Grazing and Range Management MD LG 10	Livestock facilities and placement of livestock supplements	NA	1.2	1.2
Special Status Species MD SSS 13	Infrastructure: New anthropogenic disturbance	NA	1	1
Leasable Minerals – Unleased Federal Fluid Mineral Estate (MLS) MD MR 3	Fluid minerals development in GHMA	NA	NA	1
Recreation MD REC 1	New non-motorized SRPs	Breeding season (March 1 to June 30)	3	3
Recreation MD REC2	Motorized and/or race SRPs, or competitive SRPs	Breeding season (March 1 to June 30)	4	4
Travel Management MD TM 8	Upgrading primitive roads	NA	4	4

MD SSS-10: In undertaking BLM management actions, and, consistent with valid existing rights and applicable law, in authorizing third party actions that result in habitat loss and degradation, the BLM will require and ensure mitigation that provides a net conservation gain to the species including accounting for any uncertainty associated with the effectiveness of such mitigation. This will be achieved by avoiding, minimizing, and compensating for impacts by applying beneficial mitigation actions.

MD SSS-11: Anthropogenic disturbances or activities disruptive to GRSG (including scheduled maintenance activities) shall not occur in seasonal GRSG habitats unless the project plan and NEPA document demonstrate the project will not impair the life-cycle or behavioral needs of GRSG populations. Seasonal avoidance periods vary by GRSG seasonal habitat as follows:

- In breeding habitat within four (4) miles of occupied and pending leks from March 1 through June 30. Lek hourly restrictions are from two hours before sunset to two hours after sunrise at the perimeter of an occupied or pending lek.
- Brood-rearing habitat from July 1 to October 31
- Winter habitat from November 1-February 28

The seasonal dates may be modified due to documented local variations (e.g., higher/lower elevations) or annual climactic fluctuations (e.g., early/late spring, long and/or heavy winter) in coordination with ODFW, in order to better protect GRSG.

MD SSS-12: Identify Greater Sage-grouse habitat outside of PHMA that can function as connecting habitat. Consider the habitat connectivity map developed by The Nature Conservancy and BLM for Oregon (Jones and Schindel, 2015). When conducting analysis for project level NEPA, include Greater Sage-grouse habitat and populations in adjoining states within 4 miles of leks in Oregon.

MD SSS-13: All authorized actions in Greater Sage-grouse habitat are subject to RDFs and BMPs in **Appendix C** and these disturbance screening criteria:

Where avoidance is not possible, disturbance will be allowed under the following conditions:

- Development in each Oregon PAC and PHMA does not exceed the disturbance cap at either the Oregon PAC scale or the project scale (**Appendix E**).
- New anthropogenic disturbance does not occur within 1.0 mile of an occupied or pending lek in PHMA or GHMA.
- Development meets noise restrictions in PHMA and GHMA (**Appendix L**).
- Analyze through implementation level NEPA seasonal protection and timing limitations of occupied and pending leks in PHMA and GHMA.
- All disturbance is subject to net conservation gain mitigation to Greater Sage-grouse and its habitat (see **Appendix F**) in PHMA and GHMA.
- All new permitted activities will follow Required Design Features (**Appendix C**) in PHMA and GHMA.
- To the extent feasible, development should only occur in non-habitat areas. If this is not possible, then development must occur in the least suitable habitat for Greater Sage-grouse.
- Apply buffers and seasonal restrictions in **Table 2-3** to all occupied or pending leks in PHMA and GHMA to avoid direct disturbance to Greater Sage-grouse.

Screening criteria and conditions will not be applicable to vegetation treatments being conducted to enhance GRSG habitat, except noise and seasonal restrictions will apply.

MD SSS-14: Assist ODFW and other partners with surveillance and, where appropriate, control of West Nile virus. Report observations of dead or sick Greater Sage-grouse or other bird deaths that could be attributed to disease or parasites.

MD SSS-15: Implement adaptive management responses to hard and soft triggers established in the Adaptive Management Strategy (**Appendix J**). Hard trigger responses will be removed, either through a plan amendment or when the criteria for recovery have been met (see **Appendix J** - Longevity of Responses). Removal of the hard trigger responses returns management direction in the affected Oregon PAC to the plan decisions that are in force within those Oregon PACs that have not tripped a hard trigger.

2.2.2 Vegetation (VEG)

Goal VEG 1: Increase the resistance of Greater Sage-grouse habitat to invasive annual grasses and the resiliency of Greater Sage-grouse habitat to disturbances such as fire and climate change to reduce habitat loss and fragmentation.

Goal VEG 2: Within Greater Sage-grouse habitat, re-establish sagebrush cover, native grasses, and forbs in areas where they have been reduced below desired levels or lost. Use ecological site descriptions to determine appropriate levels of sagebrush cover and appropriate native grasses and forbs.

Goal VEG 3: Use integrated vegetation management to control, suppress, and eradicate invasive plant species per BLM Handbook H-1740-2. Apply ecologically based invasive plant management principles in developing responses to invasive plant species.

Objective VEG 1: Within the boundaries of each Field Office establish a mix of sagebrush classes as identified in **Table 2-4**, Desired Mix of Sagebrush Classes by Sagebrush Type. Evaluate progress toward the objective every 10 years.

Objective VEG 2: Reduce encroaching conifer cover to zero within 1.0 mile of all occupied or pending leks and to less than 5 percent within 4.0 miles of such leks at a rate at least equal to the rate of encroachment. Priorities for treatment are phase I and phase II juniper, and phase III juniper with a grass-forb understory. Retain all old trees, culturally significant trees, and trees in active use by special status species (e.g. nest, den, and roost trees) and all old growth stands of juniper within 4.0 miles of occupied or pending leks. See OSU Technical Bulletin 152, or its successor, for the key characteristics of old trees. Old growth stands are those where the dominant trees in the stand meet the key characteristics for old trees. Pending occupied leks and pending unoccupied leks are hereafter collectively referred to as "pending leks" (see Glossary).

Objective VEG 3: Reduce the area dominated by invasive annual grasses to no more than 5 percent within 4.0 miles of all occupied or pending leks. Manage vegetation to retain resistance to invasion where invasive annual grasses dominate less than 5 percent of the area within 4.0 miles of such leks.

Objective VEG 4: Thin sagebrush stands that exceed 30 percent cover in cool-moist sagebrush and 25 percent cover warm-dry sagebrush to no less than 15 percent cover within 4.0 miles of all occupied or pending leks.

Table 2-4
Desired Mix of Sagebrush Classes by Sagebrush Type

Sagebrush Type	General Description	Characteristic Plant Community	Class 1(A)[2]	Class 2(A)[2]	Class 3 (A, B)[2]	Class 4 (A, B)[2]	Class 5(A)[2]
Shallow-Dry	Very shallow soils and very dry sites not capable of producing at least 600 lb/ac of grass on any sites or in any type of year[1].	Low sagebrush/ Sandberg's bluegrass. Includes the driest Wyoming big sagebrush types.	15% (0-25%)	15% (0-25%)	70% (50-90%)	N/A[3]	N/A[3]
Warm-Dry	Shallow to moderately deep soils and dry sites capable of producing at least 600 lb/ac of grass only on best sites or wet years[1].	Wyoming big sagebrush/bluebunch wheatgrass-Thurber's needlegrass. Includes some moderately productive low sagebrush sites and dry mountain big sagebrush sites.	15% (0-25%)	15% (0-25%)	25% (10-40%)	45% (25-70%)	N/A[3]
Cool-Moist	Moderately deep to deep soils and moist sites capable of producing at least 600 lb/ac of grass on average and high productivity sites or average and wet years[1].	Mountain big sagebrush-Idaho fescue. Includes productive low sagebrush communities and highly productive Wyoming big sagebrush sites. May include antelope bitterbrush as a co-dominant with big sagebrush.	15% (0-25%)	15% (0-25%)	20% (10-30%)	35% (20-60%)	15% (5-25%)

[1] Based on Ecological Site Descriptions
[2] Median value and range
[3] Site not capable of producing this class

Objective VEG 5: Increase native plant diversity (number of species) to at least 50 percent of the potential diversity listed for the relevant ecological site description and sagebrush cover where it is less than 15 percent in half of crested wheatgrass seedings in PHMA. If existing diversity equals or exceeds 50 percent of the potential diversity, no forb restoration is needed.

Objective VEG 6: Conduct vegetation treatments based on the following 10-year (decadal) acreage objectives within four miles of occupied and pending leks, using results of the fire and invasives assessment tool (FIAT; Fire and Invasive Assessment Team 2014) to establish the priority PACs and treatments within PACs

Objective VEG 7: Each Oregon PAC has at least 5 percent sagebrush cover on a minimum of 70 percent of the area within the Oregon PAC that is capable of supporting sagebrush plant communities. Use ecological site descriptions to determine which sites are capable of supporting sagebrush plant communities.

Objective VEG 8: Coordinate vegetation management activities with adjoining landowners.

Objective VEG 9: In all Sagebrush Focal Areas and Priority Habitat Management Areas, the desired condition is to maintain all lands ecologically capable of producing sagebrush (but no less than 70%) with a minimum of 15% sagebrush cover or as consistent with specific ecological site conditions. The attributes necessary to sustain these habitats are described in Interpreting Indicators of Rangeland Health (BLM Tech Ref 1734-6) and in **Table 2-5**.

Table 2-5
Decadal Treatment Objectives for Greater Sage-grouse Habitat

Treatment Objective	Average Annual Acres	Average Decadal Acres
Conifer reduction	40,250	402,500
Sagebrush thinning	53,217	532,170
Invasive plant control*	12,700	127,000
Crested wheatgrass restoration	1,844	18,440

*Principally annual grasses

These acreage estimates represent an objective for treatment over a ten-year (decadal) period to support achievement or progress toward GRSG habitat objectives. These estimates account for variability in funding and do not reflect a maximum or minimum acreage for any one treatment objective should funding and site-specific conditions allow for more or less treatment acreage than described in order to meet habitat objectives.

Management Decisions (MDs)

<u>Habitat Restoration</u>

MD VEG 1: Priority areas for Greater Sage-grouse habitat restoration and maintenance projects are*:

- Sites with a higher probability of success.
- Seasonal habitats thought to be limiting to Greater Sage-grouse populations.
- Connectivity corridors between Greater Sage-grouse populations and subpopulations.
- Following stand-replacing events at least 100 acres in size.

*Not in priority order. Incorporate these priorities in the assessments conducted using the FIAT process detailed in **Appendix H**.

MD VEG 2: Base species composition, function, and structure of sagebrush communities on ecological site descriptions. Use climate change science concerning projected changes in species ranges and changes in site capability to adjust expected and desired native species compositions as that information becomes available.

MD VEG 3: Do not treat sagebrush during nesting and early brood-rearing within 4.0 miles of occupied or pending leks. Conduct pre-treatment lek surveys to determine if the lek is active. Breeding and brood-rearing typically occur from March 1 to June 30; use local information to further refine this period.

MD VEG 4: Cutting of juniper can occur within 4.0 miles of an occupied or pending lek during the breeding season from two hours after sunrise and two hours before sunset.

MD VEG 5: Vegetation management activities that are timing-sensitive for maximum effectiveness, such as herbicide application or seeding operations, can occur during the breeding season within 4.0 miles of occupied or pending leks. Limit operations to no more than 5 days and to the period beginning two hours after sunrise and ending two hours before sunset during the breeding and early brood rearing period. Conduct pre-treatment surveys for nests and do not damage or destroy identified nests during treatment operations. Conduct operations so as to minimize the risk of accidentally killing chicks. Breeding and early-brood-rearing typically occur from March 1 through June 30; use local information to further refine this period.

MD VEG 6: Use adaptive management principles (for example, monitoring and adjusting seed mixes, planting methods or timing of planting to increase success rates) to provide for persistence of seeded or planted species important to Greater Sage-grouse.

MD VEG 7: Do not use non-specific insecticides in brood-rearing habitat during the brood-rearing period. Use instar-specific insecticides to limit impacts on Greater Sage-grouse chick food sources.

MD VEG 8: Use native plant materials for restoration and rehabilitation based on availability, adaptive capacity, and probability of successful establishment (see **Appendix I**). Where native plant material availability or probability of successful establishment is low, use desirable non-native plant materials that are of a similar functional/structural group as native plant species (e.g. deep-rooted, tall perennial bunchgrass, tap-rooted perennial forb).

MD VEG 9: When sufficient native plant materials are available, use native plant materials unless the area is immediately threatened by invasive plant species spread or dominance.

Use non-native plant materials as necessary to:

1. Limit or control invasive plant species spread or dominance.
2. Create fuel breaks along roads and ROWs.
3. Create defensible space within 0.5 mile of human residences.

MD VEG 10: When seedings include non-native plant materials, evaluate post-planting within 10 years to determine the need to increase native species populations or compositions to be more representative of the ecological site description and capability. When existing native herbaceous diversity is less than 50 percent of the potential diversity for the applicable ecological site description, conduct treatments to increase the diversity.

MD VEG 11: Do not conduct forage enhancement solely for domestic livestock in PHMA.

MD VEG 12: Adjust discretionary land uses, such as active use for livestock grazing or recreational uses or seasons, as needed to facilitate attainment and persistence of vegetation restoration objectives.

MD VEG 13: Use provisional and established seed zones identified by the Great Basin Native Plant Project (http://www.fs.fed.us/rm/grassland-shrubland-desert/research/projects/gbnpsip/) to determine appropriate seed sources for grasses, forbs, and shrubs. Identify sagebrush seed collection areas to provide locally adapted sagebrush seed sources.

MD VEG 14: Allowable methods for vegetation treatment include mechanical, biological (including targeted grazing), chemical, or wildland fire or combinations of these general treatment categories.

MD VEG 15: Create mosaics of varying sagebrush density using spot treatments within the treatment area. Sagebrush density shall be equivalent to Classes 1 through 4 in cool-moist sagebrush and Classes 1 through 3 in warm-dry sagebrush (see **Table 2-4**). Maximum stand-replacement patch size shall not exceed 25 acres and total stand-replacement patches shall not exceed 15 percent of the treatment block. See Required Design Features for additional details.

MD VEG 16: Test new potential restoration methods in areas with a sagebrush overstory and an annual grass understory.

MD VEG 17: Remove conifers encroaching into sagebrush habitats, in a manner that considers tribal cultural values. Prioritize treatments closest to occupied GRSG habitats and near occupied leks, and where juniper encroachment is phase 1 or phase 2. Use site-specific analysis and tools such as VDDT and the FIAT process (**Appendix H**), or their successors, to refine the specific locations to be treated.

MD VEG 18: Apply additional restoration treatments, such as seeding or planting, in conjunction with juniper removal in areas with more than trace amounts of invasive annual grasses or where the pre-treatment understory has less than 2 healthy bunchgrass plants per 10 square feet in cool-moist sagebrush or less than 4 healthy bunchgrass plants per 10 square feet in warm-dry sagebrush.

MD VEG 19: Conduct jackpot burning of cut juniper when soils are frozen or snow-covered and moisture content of felled trees is low enough to promote complete or near complete consumption of branches. Leaving the bole portion is acceptable.

<u>Integrated Invasive Species</u>

MD VEG 20: In priority treatment areas for invasive annual grasses, apply early detection-rapid response principles on*:

- New infestations.
- Satellite populations.
- Isolated populations.
- Where invasive annual grasses are still sub-dominant.
- Edges of large infestations
- Where sites are frequently or commonly used for temporary infrastructure such as incident base camps, spike camps, staging areas, and helicopter landing areas.

*Not in priority order. Incorporate these priorities in the assessments conducted using the process detailed in **Appendix H** (FIAT process).

MD VEG 21: Allowable methods of invasive plant control include mechanical, chemical, biological (including targeted grazing, biocides, and bio-controls), or prescribed fire or combinations of these methods. Treat areas that contain cheatgrass and other invasive or noxious species to minimize competition and favor establishment of desired species.

MD VEG 22: Use of approved herbicides, biocides, and bio-controls is allowed on all land allocations currently providing or reasonably expected to provide Greater Sage-grouse habitat. Follow the guidance in the 2010 Record of Decision for Vegetation Treatments Using Herbicides on BLM Lands in Oregon and subsequent step-down decision records, when complete, or successor/subsequent decisions governing the use of additional herbicides and biocides.

MD VEG 23: On Type I through Type III wildfires provide and require the use of weed washing stations and acceptable disposal of subsequent waste water and material to minimize the risk of further spread. Wash all vehicles and equipment arriving from outside the local area before initial use in the fire area and during post-fire emergency stabilization and rehabilitation operations. Wash all vehicles and equipment prior to release from the incident to reduce the probability of transporting invasive plant materials to other locations.

MD VEG 24: Wash vehicles and equipment used in field operations prior to use in areas without known infestations of invasive plants. Wash vehicles and equipment used in areas with known infestations prior to use in another area to limit the further spread of invasive species to other locations.

MD VEG 25: Locate base camps, spike camps, coyote camps, or other temporary infrastructure in areas that lack invasive plant populations. Where no such options are available provide for post-operation invasive plant treatments.

2.2.3 Fire and Fuels Management (FIRE)

Objective FIRE 1: Manage wildland fire and hazardous fuels to protect, enhance, and restore Greater Sage-grouse habitat.

Objective FIRE 2: Use a combination of vegetation management and wildfire response to minimize the probability of a wildfire tripping an adaptive management trigger for habitat within an Oregon PAC. (See **Appendix J** for adaptive management triggers).

Objective FIRE 3: Within 4.0 miles of occupied or pending leks, maintain or develop a mosaic of structure and species of sagebrush consistent with site potential and vegetation management objectives. See Vegetation Objectives section for desired outcomes and conditions.

Management Decisions (MD)

MD FIRE 1: Complete an interagency landscape-scale assessment (**Appendix H**) to prioritize at-risk habitats and identify fuels management, preparedness, suppression, and restoration priorities based on the quality of habitat at risk as directed in the Secretarial Order for Rangeland Fire SO3336. Update these assessments as necessary or when major disturbances occur. Within Greater Sage-grouse habitat, prioritize suppression and fuels management activities based on an assessment of the quality of habitat at risk.

MD FIRE 2: The protection of human life is the single, overriding priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the costs of protection.. Prioritize Greater Sage-grouse habitat commensurate with property values and other habitat to be protected, with the goal to restore, enhance, and maintain these areas.

MD FIRE 3: Within PHMA and GHMA, prioritize fire management activities in order to protect and restore Greater Sage-grouse habitat and reduce the impacts of large wildfires as follows:

1. Habitat within 4.0 miles of an occupied or pending lek.
2. Greater Sage-grouse winter range.

MD FIRE 4: Incorporate locations of priority Greater Sage-grouse protection areas into the dispatch system. Provide local Greater Sage-grouse habitat maps to dispatch offices and initial attack Incident Commanders for use in prioritizing wildfire suppression resources and designing suppression tactics.

MD FIRE 5: During fire management operations, retain unburned areas of sagebrush, including interior islands and patches between roads and the fire perimeter unless there is a compelling safety, resource protection, or wildfire management objective at risk.

MD FIRE 6: Follow established direction in the current Interagency Standards for Fire Operations (Red Book) with respect to use of resource advisors, annual review of fire management plans for updates relevant to Greater Sage-grouse habitat, and contents of the Delegation of Authority letters.

MD FIRE 7: Allow retardant and other fire suppressant chemicals use on all land allocations except where expressly prohibited by land allocation direction. Use of retardant and other fire suppressant chemicals can be specifically allowed by the authorized official when prohibited by land allocation direction. Allow retardant use on all land allocations regardless of management direction when there is imminent threat to human life.

MD FIRE 8: Allow mechanical fire line except:

- Where prohibited by other resource direction (e.g., wilderness, soils, hydrology, and riparian management)
- Where inconsistent with direction for specific land allocations

The authorized official may approve exceptions.

MD FIRE 9: Allow use of naturally ignited wildfires to meet resource management objectives to improve Greater Sage-grouse habitat such as reducing juniper encroachment and creating mosaics of sagebrush classes. When natural ignitions occur, utilize an interdisciplinary process (including a wildlife biologist familiar with GRSG habitat requirements) to determine if the fire could be managed to meet GRSG and vegetation objectives.

MD FIRE 10: Locate base camps, spike camps, drop points, staging areas, helicopter landing areas, and other temporary wildfire infrastructure in areas where physical disturbance to Greater Sage-grouse habitat can be minimized, to the extent feasible.

MD FIRE 11: Develop a system of fuel breaks to protect larger intact blocks of Greater Sage-grouse habitat. Locate these fuel breaks along existing roads and ROWs, where possible.

MD FIRE 12: In Greater Sage-grouse habitat, reduce hazardous fuels created by other management actions, such as establishment of new roads, trails, or ROWs within 3 years of project completion. The reduction should be sufficient to limit fire spread or undesirable fire behavior or fire effects in sagebrush ecosystems.

MD FIRE 13: Use interagency- coordinated fire restrictions and public service announcements to reduce the number of human starts in or near Greater Sage-grouse habitat during periods of elevated fire danger.

MD FIRE 14: Develop annual treatment and fire management programs in coordination with interagency partners and across jurisdictional boundaries based on priorities identified in the local District Landscape Wildfire and Invasive Species Assessment.

MD FIRE 15: Complete an annual review of landscape assessment implementation efforts with interagency partners.

MD FIRE 16: Implement appropriate fire operations and fuels management RDFs identified in **Appendix C**.

MD FIRE 17: Include information on the resource value of Greater Sage-grouse habitat in existing prevention plans.

MD FIRE 18: If prescribed fire is used in Greater Sage-grouse habitat, the NEPA analysis for the Burn Plan will address:

- why alternative techniques were not selected as a viable options;
- how Greater Sage-grouse goals and objectives would be met by its use;
- how the COT Report objectives would be addressed and met;
- a risk assessment to address how potential threats to Greater Sage-grouse habitat would be minimized.

Prescribed fire as a vegetation or fuels treatment shall only be considered after the NEPA analysis for the Burn Plan has addressed the four bullets outlined above. Prescribed fire could be used to meet specific fuels objectives that would protect Greater Sage-grouse habitat in PHMA (e.g., creation of fuel breaks that would disrupt the fuel continuity across the landscape in stands where annual invasive grasses are a minor component in the understory, burning slash piles from conifer reduction treatments, used as a component with other treatment methods to combat annual grasses and restore native plant communities).

Prescribed fire in known winter range shall only be considered after the NEPA analysis for the Burn Plan has addressed the four bullets outlined above. Any prescribed fire in winter habitat would need to be designed to strategically reduce wildfire risk around and/or in the winter range and designed to protect winter range habitat quality.

2.2.4 Livestock Grazing/Range Management (LG)

Objective LG 1: Manage livestock grazing to maintain or improve Greater Sage-grouse habitat by achieving Standards for Rangeland Health (SRH).

Objective LG 2: On BLM-managed lands, 12,083,622 acres will continue to be available for livestock grazing in Greater Sage-grouse habitat. In key RNAs, 22,765 acres will be unavailable to livestock grazing. See **Table 2-6**, Key ACECs and RNAs for ARMPA.

Table 2-6
Key ACECs and RNAs for ARMPA

ACEC/RNA Name	Type	District	ACEC/RNA		
			ACEC/RNA Acres	RNA Acres Unavailable to Grazing	Estimated Reduction of AUMs
Abert Rim	ACEC	Lakeview	18,039	0	0
High Lakes	ACEC	Lakeview	38,952	0	0
Red Knoll	ACEC	Lakeview	11,119	0	0
TOTAL KEY ACEC			**68,110**	**0**	**0**
Black Canyon	RNA	Vale	2,639	2,640	225
Dry Creek Bench	RNA	Vale	1,637	622	101
East Fork Trout Creek	RNA	Burns	361	304	47
Fish Creek Rim	RNA	Lakeview	8,718	2,750	110
Foley Lake	RNA	Lakeview	2,228	1,269	51
Foster Flat *	RNA	Burns	2,687	0	0
Guano Creek—Sink Lakes *	RNA	Lakeview	11,185	0	0
Lake Ridge	RNA	Vale	3,860	769	229
Mahogany Ridge	RNA	Vale	682	155	22
North Ridge Bully Creek	RNA	Vale	1,569	164	46
Rahilly-Gravelly	RNA	Lakeview	18,678	8,282	630
South Bull Canyon	RNA	Vale	790	747	89
South Ridge Bully Creek	RNA	Vale	621	397	166
Spring Mountain	RNA	Vale	996	995	137
Toppin Creek Butte	RNA	Vale	3,998	2,865	504
TOTAL KEY RNA			**60,652**	**21,957**	**2,388**

Objective LG 3: Complete rangeland health assessments for grazing permits/leases that have not been renewed and prioritized by Allotment Categories I, M, and C. The priority order for completing rangeland health assessments in Greater Sage-grouse habitat is:

1. Allotments containing SFA that have never been evaluated.
2. Allotments containing SFA that have not been re-evaluated in 10 or more years.
3. Allotments containing PHMA that have never been evaluated.
4. Allotments containing PHMA that have not been re-evaluated in 10 or more years.
5. Allotments containing GHMA that have never been evaluated.
6. Allotments containing GHMA that have not been re-evaluated in 10 or more years.

Management Decisions (MD)

MD LG 1: All or portions of key RNAs will be unavailable to grazing (**Table 2-6**). Determine whether to remove fences, corrals, or water storage facilities (e.g. reservoirs, catchments, ponds).

MD LG 2: When livestock management practices are determined to not be compatible with meeting or making progress towards achievable habitat objectives following appropriate consultation, cooperating and coordination, implement changes in grazing management through grazing authorization modifications, or allotment management plan implementation. Potential modifications include, but are not limited to, changes in:

1. Season or timing of use;
2. Numbers of livestock;
3. Distribution of livestock use;
4. Duration and/or level of use;
5. Locations of bed grounds, sheep camps, trail routes, and the like;
6. Extended rest or temporary closure from grazing through BLM administrative actions;
7. Make allotment unavailable to grazing;
8. Kind of livestock (e.g., cattle, sheep, horses, or goats) (Briske et al. 2011); and
9. Grazing schedules (including rest or deferment).

*Not in Priority Order

When SRH are being met no changes in current management or activity plans or permits/leases are required, but could occur to meet other resource management objectives.

MD LG 3: The timing and location of livestock turnout and trailing shall not contribute to livestock congregation on occupied or pending leks during the Greater Sage-grouse breeding season of March 1 through June 30.

MD LG 4: When fine and site-scale Greater Sage-grouse habitat assessment and monitoring is needed or required, (e.g., as a component of a rangeland health assessment), measure the Greater Sage-grouse habitat suitability indicators for seasonal habitats identified in **Table 2-2**. Site suitability values may be adjusted regionally where there is scientific justification for doing so. When using the indicators to guide management actions or during land health assessments, consider that the indicators are sensitive to the ecological processes operating at the scale of interest and that a single habitat indicator does not necessarily define habitat suitability for an area or particular scale.

MD LG 5: During drought conditions use a recognized drought indicator, such as the Drought Monitor or Palmer Drought Severity Index, to determine when abnormally dry or drought conditions are developing, present, or easing. When such conditions are developing or present:

1. Conduct pre-season assessments prior to livestock turn out.

2. Monitor vegetation conditions during authorized livestock use periods to determine need for early removal or other changes to meet seasonal PHMA and GHMA objectives.

If livestock grazing is deferred due to drought, reevaluate vegetation and Greater Sage-grouse habitat indicators that measure Greater Sage-grouse habitat prior to reauthorization of grazing.

MD LG 6: Authorize new, relocate, or modify existing range improvements that use seeps or springs as a water source to enhance their year round functionality. Install or retrofit wildlife escape ramps in all livestock water troughs or water storage facilities (e.g., catchments, storage tanks).

Maintain, enhance, or reestablish riparian areas in PHMA and GHMA.

MD LG 7: Identify playas, wetlands, and springs that have been modified for livestock watering within PHMA and GHMA. Identify those water improvements that have Greater Sage-grouse population limiting implications, and develop projects for rehabilitation. Further actions should be instigated for development of water off site; new water should be available before existing water is eliminated.

MD LG 8: Design new and maintain existing water projects to avoid standing pools of shallow water that would spread West Nile Virus.

MD LG 9: Remove, modify, or mark fences identified as high risk for collisions, generally within 1.2 miles of occupied or pending leks.

MD LG 10: Avoid construction of livestock facilities and supplemental feeding of livestock within 1.2 mile of occupied or pending leks in Greater Sage-grouse habitat unless it is part of an approved habitat improvement project or approved by the authorized officer to improve ecological health or to create mosaics in dense sagebrush stands that are needed for optimum Greater Sage-grouse habitat. Supplemental feeding in Greater Sage-grouse habitat must be part of an approved habitat improvement plan or approved by the authorized officer.

MD LG 11: Sagebrush Focal Areas will be prioritized for management and conservation actions, including, but not limited to review of livestock grazing permits/leases.

MD LG 12: The BLM will prioritize (1) the review of grazing permits/leases, in particular to determine if modification is necessary prior to renewal, and (2) the processing of grazing permits/leases in Sagebrush Focal Areas (SFA) followed by PHMA outside of the SFA. In setting workload priorities, precedence will be given to existing permits/leases in these areas not meeting Land Health Standards, with focus on those containing riparian areas, including wet meadows. The BLM may use other criteria for prioritization to respond to urgent natural resource concerns (e.g. fire) and legal obligations.

MD LG 13: The NEPA analysis for renewals and modifications of livestock grazing permits/leases that include lands within SFA and PHMA will include specific management thresholds based on GRSG Habitat Objectives **Table 2-2**, Land Health Standards (43 CFR, Part 4180.2) and ecological site potential, and one or more defined responses that will allow the authorizing officer to make adjustments to livestock grazing that have already been subjected to NEPA analysis.

MD LG 14: Allotments within SFA, followed by those within PHMA, and focusing on those containing riparian areas, including wet meadows, will be prioritized for field checks to help ensure compliance with the terms and conditions of the grazing permits. Field checks could include monitoring for actual use, utilization, and use supervision.

MD LG 15: At the time a permittee or lessee voluntarily relinquishes a permit or lease, the BLM will consider whether the public lands where that permitted use was authorized should remain available for livestock grazing or be used for other resource management objectives, such as reserve common allotments. This does not apply to or impact grazing preference transfers, which are addressed in 43 CFR, Part 4110.2-3.

2.2.5 Wild Horses and Burros (WHB)

Objective WHB 1: Manage wild horses and burros as components of BLM-administered lands in a manner that preserves and maintains a thriving natural ecological balance in a multiple use relationship.

Objective WHB 2: Manage wild horse and burro population levels within established appropriate management levels (AML).

Objective WHB 3: Complete assessments of Greater Sage-grouse habitat indicators for HMAs containing PHMA and GHMA. The priorities for conducting evaluations are:

1. HMAs containing SFA.
2. HMAs containing PHMA.
3. HMAs containing GHMA.
4. HMAs without GRSG Habitat.

Management Decisions (MD)

MD WHB 1: Manage herd management areas (HMAs) in GRSG habitat within established AML ranges to achieve and maintain GRSG habitat objectives (**Table 2-2**).

MD WHB 2: Complete rangeland health assessments for HMAs containing GRSG habitat using an interdisciplinary team of specialists (e.g. range, wildlife, and riparian). The priorities for conducting assessments are:

1. HMAs containing SFA;
2. HMAs containing PHMA;
3. HMAs containing only GHMA;
4. HMAs containing sagebrush habitat outside of PHMA and GHMA mapped habitat;
5. HMAs without GRSG habitat.

MD WHB 3: Prioritize gathers and population growth suppression techniques in HMAs in GRSG habitat, unless removals are necessary in other areas to address higher priority environmental issues, including herd health impacts. Place higher priority on Herd Areas not allocated as Herd Management Areas and occupied by wild horses and burros in SFA followed by PHMA.

MD WHB 4: In SFA and PHMA outside of SFA, assess and adjust AMLs through the NEPA process within HMAs when wild horses or burros are identified as a significant causal factor in not meeting land health standards, even if current AML is not being exceeded.

MD WHB 5: In SFA and PHMA outside of SFA, monitor the effects of WHB use in relation to GRSG seasonal habitat objectives on an annual basis to help determine future management actions.

MD WHB 6: Develop or amend herd management area plans (HMAPs) to incorporate GRSG habitat objectives and management considerations for all HMAs within GRSG habitat, with emphasis placed on SFA and other PHMA.

MD WHB 7: Consider removals or exclusion of WHB during or immediately following emergency situations (such as fire, floods, and drought) to facilitate meeting GRSG habitat objectives where HMAs overlap with GRSG habitat.

MD WHB 8: When conducting NEPA analysis for wild horse/burro management activities, water developments, or other rangeland improvements for wild horses, address the direct and indirect effects on GRSG populations and habitat. Implement any water developments or rangeland improvements using the criteria identified for domestic livestock.

MD WHB 9: Coordinate with professionals from other federal and state agencies, researchers at universities, and others to utilize and evaluate new management tools (e.g., population growth suppression, inventory techniques, and telemetry) for implementing the WHB program.

MD WHB 10: When WHB are a factor in not meeting Greater Sage-grouse habitat objectives or influence declining Greater Sage-grouse populations in PHMA, Oregon's gather priority for consideration by the Washington Office is as follows:

1. Response to an emergency. (e.g., fire, insect infestation, disease or other events of unanticipated nature).
2. Greater Sage-grouse habitat.
3. Maintain a thriving natural ecological balance.

MD WHB 11: In PHMA, design any new and modify existing structural WHB improvements to conserve, enhance, or restore Greater Sage-grouse habitat.

2.2.6 Mineral Resources (MR)

Leasable Minerals

Objective MR 1: Priority will be given to leasing and development of fluid mineral resources, including geothermal, outside of PHMA and GHMA. When analyzing leasing and authorizing development of fluid mineral resources, including geothermal, in PHMA and GHMA, and subject to applicable stipulations for the conservation of Greater Sage-grouse, priority will be given to development in non-habitat areas first and then in the least suitable habitat for Greater Sage-grouse. The implementation of these priorities will be subject to valid existing rights and any applicable law or regulation, including, but not limited to, 30 USC 226(p) and 43 CFR, Part 3162.3-1(h).

Objective MR 2: Where a proposed fluid mineral development project on an existing lease could adversely affect GRSG populations or habitat, the BLM will work with the lessees, operators, or other project proponents to avoid, minimize, and provide compensatory mitigation to reduce adverse impacts on GRSG to the extent compatible with lessees' rights to drill and produce fluid mineral resources. The BLM will work with the lessee, operator, or project proponent in developing an Application for Permit to Drill (APD) or Geothermal Drilling Permit (GDP) on the lease to avoid and minimize impacts on GRSG or its habitat and will ensure that the best information about the GRSG and its habitat informs and helps to guide development of such Federal leases.

Management Decisions (MD)

<u>Unleased Fluid Minerals</u>

MD MR 1: Stipulate all leases within PHMA as NSO. No waivers or modifications to a fluid mineral lease no-surface-occupancy stipulation will be granted. The authorized officer may grant an exception to a fluid mineral lease no-surface-occupancy stipulation only where the proposed action:

i. Would not have direct, indirect, or cumulative effects on Greater Sage-grouse or its habitat; or

ii. Is proposed to be undertaken as an alternative to a similar action occurring on a nearby parcel, and would provide a clear conservation gain to GRSG.

Exceptions based on conservation gain (ii) may only be considered in (a) PHMA of mixed ownership where federal minerals underlie less than fifty percent of the total surface, or (b) areas of the public lands where the proposed exception is an alternative to an action occurring on a nearby parcel subject to a valid Federal fluid mineral lease existing as of the date of this RMP amendment. Exceptions based on conservation gain must also include measures, such as enforceable institutional controls and buffers, sufficient to allow the BLM to conclude that such benefits will endure for the duration of the proposed action's impacts.

Any exceptions to this lease stipulation may be approved by the Authorized Officer only with the concurrence of the State Director. The Authorized Officer may not grant an exception unless the applicable state wildlife agency, the USFWS, and the BLM unanimously find that the proposed action satisfies (i) or (ii). Such finding shall initially be made by a team of one field biologist or other GRSG expert from each respective agency. In the event the initial finding is not unanimous, the finding may be elevated to the appropriate BLM State Director, USFWS State Ecological Services Director, and state wildlife agency head for final resolution. In the event their finding is not unanimous, the exception will not be granted. Approved exceptions will be made publically available at least quarterly.

MD MR 2: Stipulate all leases within Sagebrush Focal Areas as NSO, without waiver, exception, or modification.

MD MR 3: GHMA is considered open for unleased fluid minerals with moderate constraints, including CSU and TL. Areas within 1.0 mile of an occupied or pending lek within GHMA will be open to leasing fluid minerals subject to NSO stipulations. Apply Fluid Mineral Stipulations, identified in **Appendix G**.

MD MR 4: Allow geophysical exploration within PHMA and GHMA subject to seasonal restrictions, see **Appendix G.**

Leased Fluid Minerals

MD MR 5: In PHMA, apply the conservation measures through RMP implementation decisions (e.g., approval of a Geothermal Drilling Permit (GDP)) and upon completion of the environmental record of review (43 CFR, Part 3162.5), including appropriate documentation of compliance with NEPA. In this process evaluate, among other things:

1. Whether the conservation measure is "reasonable" (43 CFR, Part 3101.1-2) with the valid existing rights.
2. Whether the action is in conformance with the approved RMP.

Additionally, apply the 3 percent disturbance cap for development within Oregon PACs and PHMA (see **Appendix E**).

Issue written orders of the authorized office requiring reasonable protective measures consistent with the lease terms where necessary to avoid or minimize impacts on Greater Sage-grouse populations and its habitat in accordance with the project habitat mitigation plan.

MD MR 6: Implement RDFs in PHMA and GHMA as detailed in **Appendix C**, as allowed by law for existing leases.

MD MR 7: Complete Master Leasing Plans in lieu of APD/GDP by APD/GDP or Operations/Utilization plans for fluid mineral lease development processing within PHMA.

MD MR 8: Within an Oregon PAC, when permitting APDs or GDPs on existing leases that are not yet developed, the proposed anthropogenic disturbance must be under the 3 percent cap for that area, to the extent allowed by law.

MD MR 9: Require unitization when the BLM determines it is necessary for proper development and operation of an area according to the Federal Lease Form, 3100-11 Sections 4 and 6. Where 10 percent or less of the land is federal, encourage rather than require unitization to minimize adverse impacts on Greater sage-grouse.

MD MR 10: Identify areas where land acquisitions including mineral rights or conservation easements would benefit Greater Sage-grouse habitat. Proceed with acquisition process where appropriate.

Locatable Minerals

MD MR 11: To the extent consistent with the rights of a mining claimant under existing laws and regulations, limit surface disturbance, and provide recommendations for net conservation gain of Greater Sage-grouse habitat.

MD MR 12: If a 3809 Plan of Operation is filed on mining claims in PHMA or GHMA, identify and evaluate mitigation measures to avoid or minimize adverse effects on PHMA and GHMA, through the Plan of Operation NEPA process, as appropriate and to the extent allowable by law. For notice and casual use levels of activity, apply RDFs (to the extent consistent with applicable law) in **Appendix C**.

MD MR 13: Sagebrush Focal Areas are recommended for withdrawal from the General Mining Law of 1872, as amended, subject to valid existing rights.

Salable Minerals

MD MR 14: PHMA are closed to new mineral material sales. However, these areas remain "open" to free use permits and the expansion of existing active pits, only if the following criteria are met:

- The activity is within the Oregon PAC (also called BSU, and is the same footprint as PHMA) and project area disturbance cap.
- The activity is subject to the provisions set forth in the mitigation framework in **Appendix F**.
- All applicable required design features are applied and the activity is permissible under screening criteria (see SSS 13).

Federal Highway Act material sites are a ROW and not subject to mineral sale requirements. See ROW section for management (MD LR 7).

MD MR 15: GHMA remains open subject to stipulations that will protect Greater Sage-grouse and its habitat; see RDFs and BMPs in **Appendix C**.

Nonenergy Leasable Minerals

MD MR 16: Close PHMA to new leases and permits. Consider expansion of existing operations if the disturbance is within the cap and subject to compensatory mitigation.

MD MR 17: GHMA remains open to new leases subject to stipulations that would protect Greater Sage-grouse and its habitat; see RDFs and BMPs in **Appendix C**.

Mineral Split Estate

MD MR 18: Where the federal government owns the mineral estate in PHMA and GHMA, and the surface is in non-federal ownership, apply the same stipulations, COAs, and/or conservation measures and RDFs as applied if the mineral estate is developed on BLM-administered lands in that management area, to the maximum extent permissible under existing authorities, and in coordination with the landowner.

MD MR 19: Where the federal government owns the surface and the mineral estate is in non-federal ownership in PHMA and GHMA, apply appropriate surface use COAs, stipulations, and mineral RDFs through ROW grants or other surface management instruments, to the maximum extent permissible under existing authorities, in coordination with the mineral estate owner/lessee.

2.2.7 Renewable Energy (Wind and Solar) (RE)

Management Decisions (MD)

MD RE 1: Designate PHMA as an exclusion area for new utility/commercial scale development of wind or solar ROWs, except in Lake, Harney, and Malheur Counties.

MD RE 2: Designate PHMA outside of sagebrush focal areas (SFA) in Lake, Harney, and Malheur Counties as an avoidance area for new utility/commercial scale wind or solar ROWs. In Harney, Lake and Malheur counties, priority would be placed on locating commercial scale wind and solar energy development in non-habitat areas first (i.e., outside of PHMA and GHMA) before approving development in PHMA. Where an Oregon PAC (PHMA) occurs in more than one county, the allocation for each Oregon PAC is determined by the county in which it occurs. For example, the Cow Valley PAC is located in Malheur and Baker Counties; the Baker County portion would be exclusion, and the Malheur portion would be avoidance.

MD RE 3: Designate Sagebrush Focal Areas as exclusion areas for new utility/commercial scale wind or solar ROWs development.

MD RE 4: Designate GHMA as an avoidance area for new utility/commercial scale wind or solar rights-of-way. If new utility/commercial scale wind or solar development in GHMA is unavoidable apply the following measures:

1. If possible, construct meteorological towers without guy wires.
2. If guy wires are necessary, mark with anti-strike devices.
3. Analyze potential alternative site locations with known wind or solar potential outside of Greater Sage-grouse habitat in NEPA documents for ROW applications.

2.2.8 Lands and Realty (LR)

Objective LR 1: Effects of infrastructure projects, including siting, will be minimized using the best available science, updated as monitoring information on current infrastructure projects becomes available.

Management Decisions (MD)

<u>Utility Corridors and Communication Sites</u>

MD LR 1: All Lands and Realty actions shall comport with SSS 13 disturbance screening criteria.

MD LR 2: Designated existing utility corridors will remain open in PHMA and GHMA to utility rights-of-way.

MD LR 3: Designate other ROWs (including permits and leases) in PHMA as avoidance areas:

Road ROWs

- New road ROWs will be authorized only when necessary for public safety, administrative access, or subject to valid existing rights. If the new ROW is necessary for public safety, administrative access, or subject to valid existing rights and creates new surface disturbance, mitigate the impacts on protect the Greater Sage-grouse or their habitat. New road ROWs will be allowed if the ROW applicant is pursuing a Title V FLPMA ROW grant and will create no new surface disturbance.
- Only allow use of existing roads, or realignment of existing roads, when renewing or amending existing authorizations.
- Co-locate new ROWs as close as technically possible to existing ROWs or where the ROW best minimize Greater Sage-grouse impacts. Use existing roads, or realignments, to access valid existing rights that are not yet developed. If valid existing rights cannot be

accessed via existing roads, then construct any new road to the minimum standard necessary.

- Existing Federal Highway Act (FHWA) appropriation ROWs are valid existing rights and new FHWA ROWs will continue to be considered subject to all disturbance screening criteria. See disturbance screening criteria in SSS 13.

New proposals for power lines, access roads, pump storage, and other hydroelectric facilities licensed by FERC will be subject to all Greater Sage-grouse ROW screening criteria.

Communication Sites:

Locate new communication towers within an existing communication site where technically feasible. If not feasible, new sites will be considered where necessary for public safety but shall adhere to the ROW disturbance screening criteria as listed in SSS 13.

MD LR 4: Renewing, Amending or Terminating ROW Grants in PHMA and GHMA:

- Conduct rehabilitation when FLPMA ROW grant expires, is relinquished, or terminated, rehabilitation is required in compliance with 43 CFR, Part 2805.12(i).
- Remove overhead lines and other infrastructure to eliminate existing avian predator nesting opportunities (e.g. remove power line and communication facilities no longer in service) when a ROW grant expires or is relinquished or terminated.
- Add additional stipulations, if necessary, when renewal or amendment of existing ROW grants.

Mitigate impacts on GRSG or their habitats during amendment of an existing ROW grant. Mitigation could include the disturbance screening criteria.

MD LR 5: Designated ROW Corridors in PHMA and GHMA:

- Manage existing designated ROW corridors as open.
- Allow placement of new ROWs in existing designated corridors. Construct new ROWs as close as technically feasible to existing linear ROW infrastructure to limit disturbance to the smallest footprint.
- Within existing designated utility corridors, the 3% disturbance cap may be exceeded at the project scale if the site specific NEPA analysis indicates that a net conservation gain to the species will be achieved. This exception is limited to projects which fulfill the use for which the corridors were designated (ex., transmission lines, pipelines) and the designated width of a corridor will not be exceeded as a result of any project co-location.

MD LR 10: Consider the likelihood of development of not-yet-constructed surface-disturbing activities – as defined in Table 2 of the Monitoring Framework (**Appendix D**)−under valid existing rights prior to authorizing new projects in PHMA.

Land Use Authorizations

MD LR 6: Priority Habitat Management Areas (PHMA) and General Habitat Management Areas (GHMA) are designated as avoidance areas for high voltage (100kV or greater) transmission lines and major pipelines (24" or greater in diameter) ROWs (including permits and leases). All authorizations in these areas, other than the following identified projects, shall comply with the conservation measures outlined in this Approved Plan, including the RDFs (**Appendix C**) and screening criteria (see SSS 13) of this document. The BLM is currently processing an application for Boardman to Hemingway Transmission Line Project and the NEPA review for this project is well underway. Conservation measures for GRSG are being analyzed through the project's NEPA review process, which should achieve a net conservation benefit for the GRSG.

Place new high voltage transmission lines in designated utility corridors where technically feasible; where not technically feasible, locate lines adjacent to existing infrastructure.

If an existing transmission line is upgraded to a higher voltage the following is required:

- The existing transmission line shall be removed within a reasonable amount of time after the new line is installed and energized.
- The new line shall be constructed in the same alignment (ROW boundary) as the existing line unless an alternate route would benefit Greater Sage-grouse or its habitat.

Outside of designated corridors, bury new transmission lines where technically and financially feasible.

- Where burying transmission lines is not technically and financially feasible, locate new transmission lines adjacent to existing transmission lines, and would be subject to Greater Sage-grouse ROW screening criteria.
- Where determined to have a negative impact on Greater Sage-grouse or its habitat, remove existing guy wires or mark with bird flight diverters to make them more visible to Greater Sage-grouse in flight.

Outside of designated corridors, bury new pipelines where technically and financially feasible. Pipelines should be located adjacent to existing infrastructure.

MD LR 7: GHMA is open to other ROWs/Land Use Authorization/Permits but must adhere to screening criteria in SSS 13.

- Existing Federal Highway Act (FHWA) Appropriation ROWs are valid existing rights. New FHWA ROWs will be subject to all Greater Sage-grouse screening criteria.
- Construct new high-voltage transmission lines and new pipelines in GHMA as close as technically feasible to existing infrastructure (e.g. roads, distribution/transmission lines and pipelines) to limit disturbance to the smallest footprint.

Land Tenure

MD LR 8: Designate PHMA and GHMA as Z-1 and retain public ownership. Lands classified as priority habitat and general habitat for Greater Sage-grouse will be retained in federal management. Exception:

(1) the agency can demonstrate that disposal of the lands, including land exchanges, will provide a net conservation gain to the Greater Sage-grouse or (2) the agency can demonstrate that the disposal, including land exchanges, of the lands will have no direct or indirect adverse impact on conservation of the Greater Sage-grouse.

Withdrawals

MD LR 9: Recommend SFA for withdrawal from the General Mining Act of 1872, as amended; subject to valid existing rights.

2.2.9 Recreation and Visitor Services (REC)

Management Decisions (MD)

MD REC 1: Do not issue new non-motorized special recreation permits (SRPs) in PHMA or GHMA within 3.0 miles of occupied or pending leks from March 1 to June 30. Limited exceptions (e.g. river permits) are allowed and shall be based on site-specific rationale that biological impacts on Greater Sage-grouse are being avoided.

Evaluate and modify existing SRPs lacking Greater Sage-grouse stipulations in PHMA.

MD REC 2: Do not issue motorized and/or race SRPs or competitive SRPs within 4.0 miles of occupied or pending leks during breeding season from March 1 to June 30.

MD REC 3: Evaluate and modify, if necessary, recreation sites in PHMA and GHMA to reduce avian predator perch sites.

MD REC 4: In PHMA, do not construct new recreation facilities (e.g., campgrounds, trails, trailheads, staging areas) unless the development will have a net conservation gain to GRSG habitat (such as concentrating recreation, diverting use away from important areas, etc.), or unless the development is required for visitor health and safety or resource protection.

MD REC 5: Evaluate recreation SRMAs for consistency with the Adaptive Management Strategy (**Appendix J**).

For existing SRMAs, recreation facilities or sites in all PHMA and GHMA, apply one or more of the following to get a neutral or positive response from Greater Sage-grouse populations using the adaptive management actions. Potential actions include, but are not limited to:

- Seasonally close areas from March 1 to June 30 annually, and limit to existing roads, primitive roads, and trails, then designated routes upon completion of travel management plans.
- Re-locate SRMAs in whole or in part, through land use plan amendments, in order to reduce negative effects on GRSG.

MD REC 6: Promote and encourage education and outreach regarding Greater Sage-grouse at kiosks and other public education sites. Promote, publish and engage public regarding the American Birding Association Principles of Birding Ethics.

2.2.10 Travel and Transportation (TTM)

Objective TTM 1: Manage OHV/ORV designations (open, limited, and closed) to conserve Greater Sage-grouse habitat and populations by taking actions that create neutral or positive responses.

Objective TTM 2: Reduce disturbance to Greater Sage-grouse by evaluating or modifying OHV/ORV designations and route selection in accordance with minimization criteria.

Management Decisions (MD)

MD TTM 1: Unless already designated limited or closed all PHMA and GHMA shall be designated as limited to existing roads, primitive roads, and trails, including existing SRMAs. Where areas are currently designated "closed" under existing applicable RMPs the closed designations shall be maintained.

Travel management planning will be deferred to future implementation/activity level planning or concurrent with future RMP planning.

In addition to the minimization criteria, districts will adopt the following Greater Sage-grouse specific planning elements only for BLM administered roads during implementation level planning.

- During travel management planning, avoid designating roads, primitive roads, and motorized trails within 1.0 mile of occupied or pending leks when road traffic volume is greater than 8 vehicle trips per 24 hour period in accordance with the ODFW mitigation framework.
- When existing high traffic roads and primitive roads are closer than 1.0 mile to an occupied or pending lek, and are the only access, consider a seasonal restriction from March 1 to June 30.
- When an existing road or primitive road is found to have an effect on Greater Sage-grouse population trends, work with the interdisciplinary team and ODFW to determine the best reroute or closure point for a section of an existing road.

In addition, implementation level travel planning efforts will be guided by the goals, objectives and guidelines outlined in the SSS section, relevant National and Oregon specific guidance, and the following:

- A timeline to complete travel planning efforts in will be identified, prioritized and updated annually in all relevant planning areas to accelerate the accomplishment of: data collection, route evaluation and selection, and on the ground implementation efforts including signing, monitoring and rehabilitation.
- During subsequent travel management planning, consultation "with interested user groups, Federal, State, county and local agencies, local landowners, and other parties in a manner that provides an opportunity for the public to express itself and have its views given consideration." Consequently, a public outreach plan to fully engage all interested stakeholders will be incorporated into future travel management plans.
- Among other designation criteria from "areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats. Special attention would be given to protect endangered or threatened species and their habitats."

- During subsequent travel management planning, all routes will undergo a route evaluation to determine its purpose and need and the potential resource and/or user conflicts from motorized travel. Where resource and/or user conflicts outweigh the purpose and need for the route, the route will be considered for closure or considered for relocation outside of sensitive GRSG habitat.
  - During subsequent travel planning, threats to GRSG and their habitat will be considered when evaluating route designations and/or closures.
  - During subsequent travel management planning, routes that do not have a purpose or need would be considered for closure.
  - During subsequent travel management planning, routes that are duplicative, parallel, or redundant will be considered for closure.
  - During subsequent travel management planning, seasonal restrictions on OHV use will be considered in important seasonal habitats where OHV use is a threat. During subsequent travel management planning, consider limiting over snow vehicles (OSV) designed for use over snow and that runs on a track or tracks and/or a ski or skis, while in use over snow to designated routes or consider seasonal closures in GRSG wintering areas from November 1 through March 31.
  - During subsequent travel management planning, routes not required for public access or recreation with a current administrative/agency purpose or need will be evaluated for administrative access only.
  - During subsequent travel management planning, consider prioritizing restoration of routes not designated in a Travel Management Plan.
  - During subsequent travel management plan implementation, consider using seed mixes or transplant techniques that will maintain or enhance GRSG habitat when rehabilitating linear disturbances.

During subsequent travel management plan implementation, consider scheduling road maintenance to avoid disturbance during sensitive periods and times to the extent practicable. Consider using time of day limits (exclude activities from 2 hours before sunset to 2 hours after sunrise) to reduce impacts on GRSG during breeding periods.

MD TTM 2: ORV-OHV designations that are "closed" will be maintained as closed to motorized vehicles. OHV Areas designated as "limited to existing" within PHMA and GHMA will be managed as "limited to existing roads, primitive roads, and trails" until the completion of an implementation level travel planning (travel management planning).

Individual route designations will occur during subsequent implementation level travel management planning efforts. Upon the completion of implementation level travel management plans OHV areas designated as "Limited" will transition to "limited to designated roads, primitive roads and trails."

MD TTM 3: Avoid upgrading existing roads or construction of new roads that are found to contribute to Greater Sage-grouse mortality or lek abandonment.

MD TTM 4: In PHMA and GHMA complete transportation plans in accordance with National BLM Travel Management guidance, requiring the BLM to maintain a current action plan and planning schedule to most effectively target available resources. The following GRSG population areas are Oregon's top priority areas to designate comprehensive travel management plans:

1. In Oregon PACs with declining population trends.
2. In all other Oregon PACs.
3. In all GHMA.

In PHMA and GHMA, travel systems will be managed with an emphasis on improving the sustainability of the travel network in a comprehensive manner to minimize impacts on GRSG, maintain motorist safety, and prevent unauthorized cross country travel while meeting access needs. To do so, it may be necessary to improve portions of existing routes, close existing routes or create new routes that meet user group needs, thereby reducing the potential for pioneering unauthorized routes. The emphasis of the comprehensive travel and transportation planning will be placed on having a neutral or positive effect on GRSG habitat.

MD TTM 5: Initiate travel management planning within 5 years of RMP revisions.

MD TTM 6: In PHMA and GHMA, limit route construction or realignment of existing designated routes to result in net conservation gain for PHMA and GHMA.

MD TTM 7: Eliminate parallel roads travelling to the same destination when the destination can be accessed from the same direction and topography in PHMA and GHMA.

MD TTM 8: Within 4.0 miles of occupied or pending leks, do not allow any upgrading of primitive roads that would change the maintenance level except for public safety, administrative use, and valid existing rights.

MD TTM 9: Use proactive methods when necessary to reclaim roads. See BMPs in **Appendix C**.

MD TTM 10: In PHMA and GHMA, temporary closures will be considered in accordance with 43 CFR, Part 8364 (Closures and Restrictions); 43 CFR, Part 8351 (Designated National Area); 43 CFR, Part 6302 (Use of Wilderness Areas, Prohibited Acts, and Penalties); 43 CFR, Part 8341 (Conditions of Use).

Temporary closure or restriction orders under these authorities are enacted at the discretion of the authorized officer to resolve management conflicts and protect persons, property, and public lands and resources. Where an authorized officer determines that off-highway vehicles are causing or will cause considerable adverse effects upon soil, vegetation, wildlife, wildlife habitat, cultural resources, historical resources, threatened or endangered species, wilderness suitability, other authorized uses, or other resources, the affected areas shall be immediately closed to the type(s) of vehicle causing the adverse effect until the adverse effects are eliminated and measures implemented to prevent recurrence. (43 CFR, Part 8341.2) A closure or restriction order shall be considered only after other management strategies and alternatives have been explored. The duration of temporary closure or restriction orders shall be limited to 24 months or less; however, certain situations may require longer closures and/or iterative temporary closures. This may include closure of routes or areas.

2.2.11 Special Designations – Areas of Critical Environmental Concern (SD)

Objective SD 1: Provide for Conservation of Greater Sage-grouse within Key Existing Areas of Critical Environmental Concern (ACECs) (**Table 2-6**) and Research Natural Areas (RNAs).

Objective SD 2: Manage all ACECs and RNAs for the values for which they were designated, per district resource management plans, following existing management actions, and consistent with proposed actions for PHMA and GHMA.

Objective SD 3: Manage habitat maintenance and restoration, and conservation actions in key ACECs for Greater Sage-grouse consistent with the values the areas were designated.

Objective SD 4: Manage key RNAs, or large areas within the RNAs, as undisturbed baseline reference areas for the sagebrush plant communities they represent that are important for Greater Sage-grouse. Manage key RNAs for minimum human disturbance allowing natural succession to proceed.

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CHAPTER 3
CONSULTATION, COORDINATION, AND PUBLIC INVOLVEMENT

The BLM land use planning activities are conducted in accordance with NEPA requirements, CEQ regulations, and Department of the Interior and BLM policies and procedures implementing NEPA. The NEPA and associated laws, regulations, and policies require the BLM to seek public involvement early in, and throughout, the planning process. Public involvement and agency consultation and coordination, which have been at the heart of the planning process leading to this ARMPA, were achieved through *Federal Register* notices, public and informal meetings, individual contacts, media releases, planning bulletins, and the Oregon GRSG website (http://www.blm.gov/or/energy/opportunity/finaleis.php).

3.1 CONSULTATION AND COORDINATION

The BLM collaborated with numerous agencies, municipalities, and tribes throughout the preparation of this ARMPA. The BLM outreach efforts and collaboration with cooperating agencies are described in Section 6.3 of the Proposed RMPA and Final EIS. Twelve agencies[1] accepted the offer to participate in the BLM planning process as cooperating agencies. The BLM formally invited them to participate in developing the alternatives for the RMPA and EIS and to provide data and other information related to their agency responsibilities, goals, mandates, and expertise.

3.1.1 Section 7 Consultation

In accordance with Section 7 of the Endangered Species Act of 1973 (ESA), as amended, the BLM sent a letter to the USFWS and National Marine Fisheries Service (NMFS) identifying the species the BLM intended to assess on October 22, 2013. The USFWS response letter dated November 13, 2013, confirmed this list and recommended adding the North American wolverine, yellow-billed cuckoo, and Columbia spotted frog to the biological assessment. Over the ensuing months, regular meetings were held to address which actions could affect those species and to determine whether implementing the proposed plan may affect the species. The most recent list can be found in **Appendix K** of the ARMPA.

[1] Crook County, Deschutes County, Harney County, Lake County, Malheur County, Oregon Department of Fish and Wildlife, Oregon State University, Federal Energy Regulatory Commission, Natural Resources Conservation Service, USFWS, USFS, and Harney Soil and Water Conservation District

In May 2015, the BLM notified the USFWS and NMFS it had completed the biological assessment with the determination of "no effects" to federally listed and proposed species and designated and proposed critical habitat.

3.1.2 Native American Consultation

In accordance with FLPMA and BLM guidance, the BLM consulted with Native American representatives for the RMPA planning process. It began by requesting a meeting with area tribes to discuss the details of GRSG planning. The BLM State Director initiated the consultation in a letter in the fall of 2011 and followed up this letter to the tribes during the following time frames:

- Summer 2012, expressing interest in meeting with tribes and initiating government-to-government consultation
- Summer 2013, an update on the planning process and initiating government-to-government consultation
- Fall/winter 2014, expressing interest in meeting with tribal representatives to discuss the draft proposed plan

In addition to sending letters, BLM Vale District staff held meetings with the Fort McDermitt Paiute Tribe in 2014. On February 10, 2015, the BLM Prineville District Manager and the GRSG project staff met with the Confederated Tribes of the Warm Springs.

Each of the tribes was also invited to participate in planning as cooperating agencies. The list of tribes contacted is as follows:

- Burns Paiute Tribe
- Confederated Tribes of the Warm Springs
- Modoc Tribe of Oklahoma
- Confederated Tribes of the Colville Reservation
- Shoshone-Bannock Tribes of Fort Hall
- Fort McDermitt Paiute Tribe
- Nez Perce Tribe
- Shoshone-Paiute Tribes of Duck Valley
- Confederated Tribes of the Umatilla Indian Reservation
- Fort Bidwell Indian Community
- Klamath Tribes

As part of the NEPA scoping and consultation process, and as an opportunity to provide comment in accordance with Section 106 of the NHPA, the BLM notified the Oregon State Historic Preservation Officer (SHPO) seeking information on concerns with historic properties and land use planning direction in this ARMPA. The BLM incorporated the information it received into the Proposed RMPAs and considered such information in making the land use plan amendment decisions. The BLM has met its obligations under Section 106 of the NHPA, 54 USC, Section 306108, as outlined in the National PA and the state protocols.

3.2 Public Involvement

The public involvement process, consultation, and coordination conducted for the RMPA are described in Chapter 6 of the Proposed RMPA and Final EIS. As required by regulation, public scoping meetings were conducted following the publication in the *Federal Register* on December 9, 2011, of the notice of intent to prepare an EIS.

A notice of availability (NOA) for the Draft RMPA/EIS was published in the *Federal Register* on November 26, 2013, which initiated a 90-day public comment period. The BLM held seven open houses in Oregon for public comment on the Draft RMPA/EIS, as follows:

- Prineville on January 6, 2014
- Burns on January 7, 2014
- Ontario on January 8, 2014
- Baker City on January 9, 2014
- Lakeview on January 13, 2014
- Jordan Valley on January 22, 2014
- Durkee on January 23, 2014

All meetings were scheduled from 5:30 to 7:30 p.m. The goal was to inform the public about the Draft RMPA/EIS and to obtain further input on the alternatives that were developed and analyzed. In addition, the BLM sought comments on potential impacts resulting from the six alternatives.

The NOA for the Proposed RMP and Final EIS was published on May 29, 2015, initiating a 30-day public protest period and a 60-day governor's consistency review period. The 30-day protest period ended on June 29, 2015. The BLM received thirty protest letters.

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CHAPTER 4
PLAN IMPLEMENTATION

4.1 IMPLEMENTING THE PLAN

After a BLM RMP or RMP amendment is approved, implementation is a continuous and active process. Management decisions can be characterized as *immediate* or *one-time future* decisions.

Immediate decisions—These decisions are the land use planning decisions that go into effect when the ROD is signed. They include goals, objectives, and allowable uses and management direction, such as designating lands as open or closed for salable mineral sales, as open with stipulations for oil and gas leasing, and lands for OHV use. These decisions require no additional analysis and guide future land management actions and subsequent site-specific implementation decisions in the planning area. Proposals for future actions, such as oil and gas leasing, land adjustments, and other allocation-based actions, will be reviewed against these land use plan decisions to determine if the proposal is in conformance with the plan.

One-time future decisions—These are the decisions that are not implemented until additional decision-making and site-specific analysis is completed. Examples are implementation of the recommendations to withdraw lands from locatable mineral entry or development of travel management plans. Future one-time decisions require additional analysis and decision-making and are prioritized as part of the BLM budget process. Priorities for implementing one-time RMP decisions will be based on the following criteria:

- National BLM management direction
- Available resources

General implementation schedule of one-time decisions—Future decisions discussed in this ARMPA will be implemented over a period of years, depending on budget and staff availability. After issuing the ROD, the BLM will prepare implementation plans that establish tentative time frames for completing one-time decisions identified in the ARMPA. These actions require additional site-specific decision-making and analysis.

This schedule will assist BLM managers and staff in preparing budget requests and in scheduling work. However, the proposed schedule must be considered tentative and will be affected by future funding, nondiscretionary workloads, and cooperation by partners and the public. Yearly review of the plan will provide consistent tracking of accomplishments and information that can be used to develop annual budget requests to continue implementation.

4.2 Maintaining the Plan

The ARMPA can be maintained as necessary to reflect minor changes in data. Plan maintenance is limited to further refining or documenting a previously approved decision incorporated in the plan or clarifying previously approved decisions.

The BLM expects that new information gathered from field inventories and assessments, research, other agency studies, and other sources will update baseline data or support new management techniques, BMPs, and scientific principles. Where monitoring shows land use plan actions or BMPs are not effective, the plan may be maintained or amended, as appropriate.

Plan maintenance will be documented in supporting records. Plan maintenance does not require formal public involvement, interagency coordination, or the NEPA analysis required for making new land use plan decisions.

4.3 Changing the Plan

The ARMPA may be changed, should conditions warrant, through a plan amendment or plan revision process. A plan amendment may become necessary if major changes are needed or to consider a proposal or action that is not in conformance with the plan. The results of monitoring, evaluation of new data, or policy changes and changing public needs might also provide a need for a plan amendment. If several areas of the plan become outdated or otherwise obsolete, a plan revision may become necessary. Plan amendments and revisions are accomplished with public input and the appropriate level of environmental analysis conducted according to the Council on Environmental Quality procedures for implementing NEPA.

The BLM, in cooperation with the ODFW and USFWS, will use monitoring data and best available scientific information to verify GRSG habitat suitability and PHMA and GHMA. Habitat suitability maps can be updated without changing habitat management areas. The ODFW plans to update and revise its core area and low-density maps. This will be done as new information is acquired on winter habitat use, lek distribution, disturbance thresholds to various types of development, and success of mitigation measures (Hagen 2011). The BLM will use this and other information to determine if adjustments to PHMA and GHMA are needed. Management area adjustments will be made periodically through plan maintenance or amendment or revision, as appropriate.

4.4 Plan Evaluation, Monitoring, and Adaptive Management

Plan evaluation is the process by which the plan and monitoring data are reviewed to determine if management goals and objectives are being met and if management direction is sound. Land use plan evaluations determine if decisions are being implemented, if mitigation measures are satisfactory, if there are significant changes in the related plans of other entities, if there is new data of significance to the plan, and if decisions should be amended or revised. Monitoring data gathered over time is examined and used to draw conclusions on whether management actions are meeting stated objectives, and if not, why not. Conclusions are then used to make recommendations on whether to continue current management or to identify what changes need to be made in management practices to meet objectives.

The BLM will use land use plan evaluations to determine if the decisions in the ARMPA, supported by the accompanying NEPA analysis, are still valid in light of new information and monitoring data. Evaluations will follow the protocols established by the BLM Land Use Planning Handbook (H-1601-1) or other appropriate guidance in effect at the time the evaluation is initiated. The monitoring framework for this ARMPA can be found in **Appendix D**.

The ARMPA also includes an adaptive management strategy that includes soft and hard triggers and responses. These triggers are not specific to any particular project but identify habitat and population thresholds. Triggers are based on the two key metrics that are being monitored during the life of the ARMPA: habitat loss and population declines. Soft triggers represent an intermediate threshold indicating that management changes are needed at the implementation level to address habitat or population losses. If a soft trigger were tripped during the life of the plans, the BLM's response would be to apply more conservative or restrictive conservation measures to mitigate for the specific cause in the decline of populations or habitats, with consideration of local knowledge and conditions. These adjustments will be made to preclude tripping a "hard" trigger (which signals more severe habitat loss or population declines). Hard triggers represent a threshold indicating that immediate action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the ARMPA.

In the event that new scientific information becomes available demonstrating that the response to the hard trigger would be insufficient to stop a severe deviation from GRSG conservation objectives set forth in the ARMPA, the BLM would implement interim management direction to ensure that conservation options are not foreclosed. The BLM would also undertake any appropriate plan amendments or revision if necessary. More information regarding the ARMPA's adaptive management strategy can be found in **Appendix J**.

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CHAPTER 5
GLOSSARY

Acquisition. Lands can be acquired to facilitate various resource management objectives. Acquisitions, including easements, can be completed through exchange, Land and Water Conservation Fund purchases, donations, or receipts from the Federal Land Transaction Facilitation Act sales or exchanges.

Activity plan. A type of implementation plan (see *Implementation plan*), this usually describes multiple projects and applies best management practices to meet land use plan objectives. Examples of activity plans are interdisciplinary management plans, habitat management plans, recreation area management plans, and grazing plans.

Actual use. The amount of animal unit months consumed by livestock based on the numbers of livestock and grazing dates submitted by the livestock operator and confirmed by periodic field checks by the BLM.

Adaptive management. A type of natural resource management in which decisions are made as part of an ongoing science-based process. Adaptive management involves testing, monitoring, and evaluating applied strategies and incorporating new knowledge into management approaches that are based on scientific findings and the needs of society. Results are used to modify management policy, strategies, and practices.

Additionality. The conservation benefits of compensatory mitigation are demonstrably new and would not have resulted without the compensatory mitigation project (adopted and modified from BLM Manual Section 1794).

Administrative Access: A term used to describe access for resource management and administrative purposes, such as fire suppression, cadastral surveys, permit compliance and for law enforcement and the military in the performance of their official duty, or other access needed to administer BLM-administered lands or uses.

Administrative use. Administrative use includes BLM, county, municipal, BLM permittee, human health and safety, and valid existing rights.

Allotment. An area of land in which one or more livestock operators graze their livestock. Allotments generally consist of BLM-administered lands but may include other federally managed, state-owned, and private lands. An allotment also may include one or more separate pastures. Livestock numbers and periods of use are specified for each allotment.

Allotment Category I. Allotments where current livestock grazing management or level of use on public land is, or is expected to be, a significant cause in not achieving land health standards, or where a chance in mandatory terms and conditions in the grazing authorization is or may be necessary. When identifying category I allotments, the BLM reviews the condition of critical habitat and conflicts with sage-grouse and whether projects have been proposed specifically for implementing the Healthy Lands Initiative.

Allotment Category M. Allotments where land health standards are met or where livestock grazing on public land is not a significant cause for not meeting the standards and where current livestock management is in conformance with guidelines developed by the State Directors in consultation with Resource Advisory Councils. Allotments are where an evaluation of land health standards has not been completed but existing monitoring data indicates that resource conditions are satisfactory.

Allotment Category C. Allotments where public lands produce less than 10 percent of the forage or are less than 10 percent of the land area. An allotment generally should not be designated Category C if the public land in the allotment contains critical habitat for a threatened or endangered species or wetlands negatively affected by livestock grazing.

Allotment management plan (AMP). A concisely written program of livestock grazing management, including supportive measures if required, designed to attain specific, multiple-use management goals in a grazing allotment. An AMP is prepared in consultation with the permittees, lessees, and other affected interests. Livestock grazing is considered in relation to other uses of the range (such as watershed, vegetation, and wildlife) and to renewable resources. An AMP establishes seasons of use, the number of livestock to be permitted, the range improvements needed, and the grazing system.

Amendment. The process for considering or making changes in the terms, conditions, and decisions of approved resource management plans or management framework plans. Usually, only one or two issues are considered that involve only a portion of the planning area.

Animal unit month. The amount of forage necessary for the sustenance of one cow or its equivalent for one month.

Anthropogenic disturbance. Features include paved highways, graded gravel roads, transmission lines, substations, wind turbines, oil and gas wells, geothermal wells and associated facilities, pipelines, landfills, agricultural conversion, homes, and mines.

Area of Critical Environmental Concern (ACEC). Special area designation established through the BLM's land use planning process (43 CFR, Part 1610.7-2). An ACEC is designated where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. The level of allowable use within an ACEC is established through the collaborative planning process. Designating an ACEC allows for resource use limitations in order to protect identified resources or values.

Authorized/authorized use. This is an activity (i.e., resource use) occurring on the BLM-administered lands that is explicitly or implicitly recognized and legalized by law or regulation. This term may refer to those activities occurring on the public lands for which the BLM, Forest Service, or other appropriate authority (e.g., Congress for Revised Statutes 2477 rights-of-way [ROWs] and Federal Energy Regulatory Commission for major interstate ROWs) has issued a formal authorization document, such as a livestock grazing lease or permit, ROW grant, coal lease, or oil and gas permit to drill. Formally authorized uses typically involve some type of commercial activity, facility placement, or event. These formally authorized uses are often limited by area and time. Unless constrained or bound by statute, regulation, or an approved LUP decision, legal activities involving public enjoyment and use of the public lands, such as for hiking, camping, and hunting, require no formal BLM or Forest Service authorization.

Avoidance/avoidance area. These terms usually address mitigation of some activity (i.e., resource use). Paraphrasing the CEQ regulations (40 CFR, Part 1508.20), avoidance means to circumvent or bypass an impact altogether by not taking a certain action or parts of an action. Therefore, avoidance does not necessarily prohibit a proposed activity, but it may require the relocation of an action, or the total redesign of an action to eliminate any potential impacts resulting from it. Also see the definition of *right-of-way avoidance area.*

Avoidance mitigation. Avoiding the impact altogether by not taking a certain action or parts of an action (40 CFR, Part 1508.20[a]); for example, it may also include avoiding the impact by moving the proposed action to a different time or location.

Baseline. The preexisting condition of a defined area or resource that can be quantified by an appropriate measurement. During environmental reviews, the baseline is considered the affected environment that exists at the time of the review's initiation and is used to compare predictions of the effects of the proposed action or a reasonable range of alternatives.

Best management practices (BMPs). A suite of techniques that guide or may be applied to management actions to aide in achieving desired outcomes. BMPs are often developed in conjunction with land use plans, but they are not considered a planning decision unless the plans specify that they are mandatory.

Big game. Indigenous, ungulate (hoofed) wildlife species that are hunted, such as elk, deer, bison, bighorn sheep, and pronghorn antelope.

Biologically significant unit: A geographic unit of PHMA within GRSG habitat that contains relevant and important habitats. In Oregon, BSUs are synonymous with Oregon Priority Area for Conservation, which is used in calculating the human disturbance threshold and in the adaptive management habitat trigger.

BLM-administered land. Land or interest in land owned by the United States and administered by the Secretary of the Interior through the BLM without regard to how the United States acquired ownership, except lands on the outer continental shelf and lands held for the benefit of Native Americans, Aleuts, and Eskimos (H-1601-1, BLM Land Use Planning Handbook).

BLM sensitive species. Those species that are not federally listed as endangered, threatened, or proposed under the Endangered Species Act but that are designated by the BLM State Director under 16 USC, Section 1536(a)(2), for special management consideration. By national policy, federally listed candidate species are automatically included as sensitive species. Sensitive species are managed so they will not need to be listed as proposed, threatened, or endangered under the Endangered Species Act.

Breeding habitat. Leks and the sagebrush habitat surrounding leks that are collectively used for pre-laying, breeding, nesting, and early brood-rearing, from approximately March through June (Connelly et al. 2004).

Candidate species. A species for which the USFWS has sufficient information on status and threats to propose it for listing as endangered or threatened under the Endangered Species Act but for which issuing a proposed rule is precluded by higher priority listing actions. Separate lists for plants, vertebrate animals, and invertebrate animals are published periodically in the *Federal Register* (BLM Manual 6840, Special Status Species Manual).

Casual use. Casual use means activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. For casual use examples for rights-of-ways, see 43 CFR, Part 2801.5; for casual use examples for locatable minerals, see 43 CFR, Part 3809.5.

Chemical vegetation treatment. Application of herbicides to control invasive species/noxious weeds or unwanted vegetation. To meet resource objectives the preponderance of chemical treatments would be used in areas where cheatgrass or noxious weeds have invaded sagebrush steppe.

Climate change. Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for decades or longer. Climate change may result from any of the following:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun
- Natural processes within the climate system (e.g., changes in ocean circulation)
- Human activities that change the atmosphere's composition (e.g., driving automobiles) and the land surface (e.g., deforestation, reforestation, urbanization, or desertification)

Closed area. An area where off-road vehicles (also known as OHVs) are prohibited. Use of off-road vehicles in closed areas may be allowed for certain reasons, but such use would be made only with the approval of the BLM Authorized Officer (43 CFR, Part 8340.0-5 [h]).

Collaboration. A cooperative process in which interested parties, often with widely varied interests, work together to seek solutions with broad support for managing public and other lands. Collaboration may take place with any interested parties, whether or not they are a cooperating agency.

Collocate. To locate or be collocated in a common area, immediately adjacent, or together, such as two or more roads, transmission lines, or the like; share or designate to share the same place.

Communication site. Sites that include broadcast types of uses (e.g., television, AM/FM radio, cable television, and broadcast translator) and non-broadcast uses (e.g., commercial or private mobile radio service, cellular telephone, microwave, local exchange network, and passive reflector).

Compensatory mitigation: Compensating for the (residual) impact by replacing or providing substitute resources or environments (40 CFR, Part 1508.20).

Compensatory mitigation project. The restoration, creation, enhancement, or preservation of impacted resources (adopted and modified from 33 CFR, Part 332), such as on-the-ground actions to improve or protect habitats, such as chemical vegetation treatments, land acquisitions, and conservation easements (adopted and modified from BLM Manual Section 1794).

Compensatory mitigation site. The durable area where compensatory mitigation projects will occur (adopted and modified from BLM Manual Section 1794).

Comprehensive trails and travel management. The proactive interdisciplinary planning, this is on-the-ground management and administration of travel networks (both motorized and nonmotorized) to ensure that public access, natural resources, and regulatory needs are considered. It consists of inventory, planning, designation, implementation, education, enforcement, monitoring, easement acquisition, mapping and signing, and other measures necessary to provide access to public lands for a variety of uses, such as recreational, traditional, casual, agricultural, commercial, educational, aeronautical, and other purposes.

Condition class (fire regime). This is a measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, canopy closure, and fuel loadings. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, insects, or disease, or other management activities.

Condition of approval. Condition or requirement under which an application for a permit to drill or sundry notice is approved.

Conformance. A proposed action would be specifically provided for in the LUP or, if not specifically mentioned, would be clearly consistent with the goals, objectives, or standards of the approved land use plan.

Conservation measure. A measure to conserve, enhance, or restore GRSG habitat by reducing, eliminating, or minimizing threats. Conservation measures considered during land use plan revisions or amendments in GRSG habitat were developed by the Sage-Grouse National Technical Team (NTT), a group of resource specialists, land use planners, and scientists from the BLM, state fish and wildlife agencies, USFWS, NRCS, and USGS. The NTT report, A Report on National Greater Sage-Grouse Conservation Measures, provides the latest science and best biological judgment to assist in making management decisions relating to GRSG.

Conservation strategy. A strategy outlining current activities or threats that are contributing to the decline of a species, along with the actions or strategies needed to reverse or eliminate such a decline or threat. Conservation strategies are generally developed for species of plants and animals that are designated as BLM sensitive species or that have been determined by the USFWS or National Oceanographic and Atmospheric Administration-Fisheries to be federal candidates under the ESA.

Conserve. To cause no degradation or loss of GRSG habitat. The term can also refer to maintaining intact sagebrush steppe by fine-tuning livestock use, watching for and treating new invasive species, and maintaining existing range improvements that benefit GRSG.

Controlled surface use. This is a category of moderate constraint stipulations that allows some use and occupancy of public land, while protecting identified resources or values and is applicable to fluid mineral leasing and all activities associated with fluid mineral leasing, such as truck-mounted drilling and geophysical exploration equipment off designated routes, and construction of wells or pads. CSU areas are open to fluid mineral leasing, but the stipulation allows the BLM to require special operational constraints, or the activity can be shifted more than 656 feet to protect the specified resource or value.

Cooperating agency. Assists the lead federal agency in developing an environmental assessment or environmental impact statement. This can be any agency with jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR, Part 1501.6). Any tribe or federal, state, or local government jurisdiction with such qualifications may become a cooperating agency by agreement with the lead agency.

Core area habitat. The Oregon Department of Fish and Wildlife's (ODFW's) Sage-Grouse Conservation Assessment and Strategy for Oregon (2011) identified core areas necessary to conserve 90 percent of Oregon's GRSG population. It emphasized areas with the highest density and most important for breeding and wintering and that may serve as connectivity corridors. Core area habitat encompasses the following areas

- Those of very high, high, and moderate lek density strata
- Those where low lek density strata overlap local connectivity corridors
- Those where winter habitat use overlaps with either low lek density strata, connectivity corridors, or occupied habitat

Core area habitats encompass approximately 90 percent of the known breeding populations of GRSG on 38 percent of the species' range. However, not all lek locations are known, and some likely occur outside of the core areas.

Council on Environmental Quality (CEQ). An advisory council to the president, established by NEPA. The CEQ reviews federal programs to analyze and interpret environmental trends and information.

Cultural resources. Locations of human activity, occupation, or use. Cultural resources are archaeological, historical, or architectural sites, structures, or places with important public and scientific uses and locations of traditional cultural or religious importance to specified social or cultural groups.

Cumulative effects. The direct and indirect effects of a proposed project alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the action.

Decision area. The area where management directions and actions outlined in this ARMPA will apply. This includes only BLM-administered surface lands in the planning area and BLM-administered federal mineral estate that may lie beneath other surface ownership, often referred to as split-estate lands.

Defer. To set aside or postpone a particular resource use or activity on BLM-administered lands to a later time. When this term is used, the period of the deferral is specified. They sometimes follow the sequence time frame of associated serial actions (e.g., action B will be deferred until action A is completed).

Designation criteria. Among other designation criteria from 43 CFR, Part 8342.1(b), "areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats. Special attention will be given to protect endangered or threatened species and their habitats."

Designated roads and trails. Specific roads and trails identified by the BLM where some type of motorized/nonmotorized use is appropriate and allowed, either seasonally or year-long (H-1601-1, BLM Land Use Planning Handbook).

Desired future condition. For rangeland vegetation, the condition of rangeland resources on a landscape scale that meet management objectives. It is based on ecological, social, and economic considerations during the land planning process. It is usually expressed as ecological status or management status of vegetation (species composition, habitat diversity, and age and size class of species) and desired soil qualities (soil cover, erosion, and compaction). In a general context, desired future condition is a portrayal of the land or resource conditions that are expected to result if goals and objectives are fully achieved.

Desired outcomes. A type of land use plan decision expressed as a goal or objective.

Development. Active drilling and production of wells.

Disposal. Transfer of BLM-administered land out of federal ownership to another party through sale, exchange, Recreation and Public Purposes Act of 1926, Desert Land Entry, or other land statutes.

Disruptive activities. Those public land resource uses and activities that are likely to alter the behavior, displace, or cause excessive stress to animal or human populations at a specific location or during a specific time. In this context, disruptive activities refers to those actions that alter behavior or displace individuals such that reproductive success is negatively affected or an individual's physiological ability to cope with environmental stress is compromised. This term does not apply to the physical disturbance of the land surface, vegetation, or features. When administered as a land use restriction, such as no disruptive activities, this term may prohibit or limit the physical presence of sound above ambient levels, light beyond background levels, or the nearness of people and their activities. The term is commonly used in conjunction with protecting wildlife during crucial life stages, such as breeding, nesting, and birthing, although it could apply to any resource value on public lands. This land use restriction is not intended to prohibit all activity or authorized uses.

Diversity. The relative abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area.

Easement. A right afforded a person or agency to make limited use of another's real property for access or other purposes.

Ecological site. A distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

Effectiveness monitoring. The process of collecting data and information in order to determine whether desired outcomes (expressed as goals and objectives in the land use plan) are being met (or progress is being made toward meeting them) as the allowable uses and management actions are being implemented. A monitoring strategy must be developed as part of the land use plan that identifies indicators of change, acceptable thresholds, methods, protocols, and time frames that will be used to evaluate and determine if desired outcomes are being achieved.

Emergency stabilization. Planned actions to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property from the effects of a fire, or to repair/replace/construct physical improvements necessary to prevent degradation of land or resources. Emergency stabilization actions must be taken within one year following containment of a wildfire.

Endangered species. Any species that is in danger of extinction throughout all or a significant portion of its range. Under the Endangered Species Act in the United States, endangered status is more protective than threatened status. Designation as endangered (or threatened) is determined by the USFWS, as directed by the Endangered Species Act (16 USC, Sections 1531-1544).

Endangered Species Act of 1973 (as amended). Designed to protect critically imperiled species from extinction as a consequence of economic growth and development untempered by adequate concern and conservation. The ESA is administered by two federal agencies, the USFWS and the National Oceanic and Atmospheric Administration. Its purpose is to protect species and also the ecosystems they depend on (16 USC, Sections 1531-1544).

Enhance. To improve habitat by increasing missing or modifying unsatisfactory components or attributes of the plant community to meet GRSG objectives. Examples are modifying livestock grazing systems to improve the quantity and vigor of desirable forbs, improving water flow in riparian areas by modifying existing spring developments to return more water to the riparian area below the development, or marking fences to minimize GRSG hits and mortality.

Environmental assessment. A concise public document prepared to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. It includes a brief discussion of the need for the proposal, alternatives considered, environmental impact of the proposed action and alternatives, and a list of agencies and individuals consulted.

Environmental impact statement. A detailed statement prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action are provided, and effects are analyzed (BLM National Management Strategy for Off-Highway Vehicle [OHV] Use on Public Lands).

Evaluation (plan evaluation). The process of reviewing the land use plan and the periodic plan monitoring reports to determine whether the land use plan decisions and NEPA analysis are still valid and whether the plan is being implemented.

Exchange. A transaction whereby the federal government receives land or interests in land in exchange for other land or interests in land.

Exclusion areas. An area on the BLM-administered lands where a certain activity is prohibited to ensure the protection of other resource values. The term is frequently used in reference to lands and realty actions and proposals (e.g., ROWs) but is not unique to them. This restriction is functionally analogous to no surface occupancy, a term used by the oil and gas program and applied as an absolute condition to those affected activities. The less restrictive analogous term is avoidance area. Also see *right-of-way exclusion area* definition.

Existing routes. The roads, trails, or ways that are used by motorized vehicles, such as jeeps, all-terrain vehicles, and motorized dirt bikes, mechanized uses, such as mountain bikes, wheelbarrows, and game carts, pedestrians (hikers), and horseback riders and that are, to the best of the BLM's knowledge, in existence at the time of RMPA/EIS publication.

Exploration. Active drilling and geophysical operations to determine the presence of a mineral resource or the extent of the reservoir or mineral deposit.

Extensive Recreation Management Area (ERMA). An administrative unit that requires specific management consideration in order to address recreation use, demand or Recreation & Visitor Services program investments. ERMAs are managed to support and sustain the principal recreation activities and the associated qualities and conditions of the ERMA. Management of ERMA areas is commensurate with the management of other resources and resource uses.

Facility. Any physical development, including land treatments and improvements, constructed on land or water, to aid the management of public lands (BLM Manual Section 9100).

Facility, energy or mining. Human-constructed assets designed and created to serve a particular function and to afford a particular convenience or service that is affixed to a specific locations, such as oil and gas well pads and associated infrastructure.

Federal Land Policy and Management Act of 1976. Public Law 94-579, October 21, 1976, often referred to as the BLM's "organic act," which provides most of the BLM's legislated authority, direction policy, and basic management guidance.

Federal mineral estate. Subsurface mineral estate owned by the United States and administered by the BLM. Federal mineral estate under BLM jurisdiction is composed of mineral estate underlying BLM-administered lands, privately owned lands, and state-owned lands.

Fire management plan (FMP). A plan that identifies and integrates all wildland fire management and related activities within the context of approved land and resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans, including preparedness plans, dispatch plans, and prevention plans. FMPs ensure that wildland fire management goals and components are coordinated.

Fire Regime Condition Classification System (FRCCS). Measures the extent to which vegetation departs from reference conditions, or how the current vegetation differs from a particular reference condition.

Fire suppression. All work and activities connected with control and fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fluid minerals. Oil, gas, coal bed natural gas, and geothermal resources.

Forage. All browse and herbaceous foods that are available to grazing animals.

Free use permit. The BLM's authority to dispose of sand, gravel, and other mineral and vegetative materials, not subject to mineral leasing or location under the mining laws, from public lands without charge. Free use permits are allowed only for governmental and nonprofit use. Other uses under a free use permit are prohibited.

General sage-grouse habitat. Seasonally or year-round occupied habitat outside of priority habitat. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Geographic information system. A system of computer hardware, software, data, people, and applications that capture, store, edit, analyze, and display a potentially wide array of geospatial information.

Geophysical exploration. Activity to locate deposits of oil and gas resources and to better define the subsurface.

Geothermal energy. Natural heat from within the Earth captured for production of electric power, space heating, or industrial steam.

Goal. A broad statement of a desired outcome that is usually not quantifiable and may not have established time frames for achievement.

Grazing preference. A superior or priority position for the purpose of receiving a grazing permit or lease. This priority is attached to base property owned or controlled by a permittee or lessee.

Grazing relinquishment. The voluntary and permanent surrender by an existing permittee or lessee, (with concurrence of any base property lienholder), of their priority (preference) to use a livestock forage allocation on public land as well as their permission to use this forage. Relinquishments do not require the BLM’s consent or approval. The BLM’s receipt of a relinquishment is not a decision to close areas to livestock grazing.

Guidelines. Actions or management practices that may be used to achieve desired outcomes, sometimes expressed as best management practices. Guidelines may be identified during the land use planning process, but they are not considered a land use plan decision unless the plan specifies that they are mandatory. Guidelines for grazing administration must conform to 43 CFR, Part 4180.2.

Habitat. An environment that meets a specific set of physical, biological, temporal, or spatial characteristics that satisfy the requirements of a plant or animal species or group of species for part or all of their life cycle.

Habitat suitability. The relative appropriateness of a certain ecological area for meeting the life requirements of an organism: food, shelter, water, and space.

Impact. The effect, influence, alteration, or imprint caused by an action.

Implementation decision. A decision that takes action to implement land use planning; generally it is appealable to the Interior Board of Land Appeals under 43 CFR, Part 4.410.

Implementation monitoring. The process of tracking and documenting the implementation (or the progress toward implementation) of land use plan decisions. This should be done at least annually and should be documented on a tracking log or report. The report must be available for public review.

Implementation plan. An area or site-specific plan written to implement decisions made in a land use plan. Includes both activity plans and project plans.

Indicators. Factors that describe resource condition and change and can help the BLM determine trends over time.

Intermittent stream. A stream that flows only at certain times of the year when it receives water from springs or from some surface sources, such as melting snow in mountainous areas. During the dry season and throughout minor droughts, these streams do not flow. Geomorphological characteristics are not well defined and are often inconspicuous. In the absence of external limiting factors, such as pollution and thermal modifications, species are scarce and adapted to the wet and dry conditions of the fluctuating water level.

Interstate highways. Freeways and highways with multiple lanes.

Jackpot burning. Burning oanly concentrations of fuels, as opposed to broadcast burning, which refers to burning across all or most surface fuels.

Key areas of critical environmental concern. Special management areas that have been identified as having a high utility for GRSG conservation. These land allocations were designated in previous RMPs to protect other relevant and important resource values; however, they also contain quality GRSG habitat, are within PHMA, and contain leks. GRSG in these areas are proposed as an additional relevant/important value, and they will be managed for such. They should be priority areas for GRSG management; site-specific ACEC management plans will be prepared at the implementation level that will address special management for GRSG, as well as the other values for which the ACEC was originally designated.

Key research natural area. A special type of ACEC that was designated in a previous RMP to protect specific intact representative native plant communities. These areas are in PHMA and are used for long-term vegetation monitoring for native plant communities important for GRSG in the absence of BLM actions and human disturbance. These areas provide baseline vegetation information to document successional changes, to serve as areas for comparison to treated areas, and to document future vegetation shifts in the plant communities from changes in precipitation and temperature (climate change). Key RNAs either contain GRSG leks or are within 0.1 to 4 miles of leks and are, or likely are, used for nesting, brood-rearing, foraging, breeding or wintering.

Land tenure adjustments. Landownership or jurisdictional changes. To improve the manageability of the BLM-administered lands and their usefulness to the public, the BLM has numerous authorities for repositioning lands into a more consolidated pattern, disposing of lands, and entering into cooperative management agreements. These land pattern improvements are completed primarily through the use of land exchanges but also through land sales, through jurisdictional transfers to other agencies, and through the use of cooperative management agreements and leases.

Land use allocation. The identification in a land use plan of the activities and foreseeable development that are allowed, restricted, or excluded for all or part of the planning area, based on desired future conditions (H-1601-1, BLM Land Use Planning Handbook).

Land use plan (LUP). A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of FLPMA; an assimilation of LUP-level decisions developed through the planning process outlined in 43 CFR, Part 1600, regardless of the scale at which the decisions were developed. The term includes both RMPs and management framework plans (from H-1601-1, BLM Land Use Planning Handbook).

Land use plan decision. Establishes desired outcomes and actions needed to achieve them. Decisions are reached using the planning process in 43 CFR, Part 1600. When they are presented to the public as proposed decisions, they can be protested to the BLM Director. They are not appealable to the Interior Board of Land Appeals.

Late brood-rearing habitat. A variety of GRSG habitats used from July through September. Habitat includes mesic sagebrush and mixed shrub communities, wet meadows, and riparian areas, as well as some agricultural lands, such as alfalfa fields.

Leasable minerals. Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. These include energy-related mineral resources, such as oil, natural gas, coal, and geothermal, and some nonenergy minerals, such as phosphate, sodium, potassium, and sulfur. Geothermal resources are also leasable under the Geothermal Steam Act of 1970.

Lease. Section 302 of the FLPMA provides the BLM's authority to issue leases for the use, occupancy, and development of BLM-administered lands. Leases are issued for such purposes as commercial filming, advertising displays, commercial or noncommercial croplands, apiaries, livestock holding or feeding areas not related to grazing permits and leases, native or introduced species harvesting, temporary or permanent facilities for commercial purposes (does not include mining claims), residential occupancy, ski resorts, construction equipment storage sites, assembly yards, oil rig stacking sites, mining claim occupancy if the residential structures are not incidental to the mining operation, and water pipelines and well pumps related to irrigation and non-irrigation facilities. The regulations establishing procedures for processing these leases and permits are found in 43 CFR, Part 2920.

Lease stipulation. A modification of the terms and conditions on a standard lease form at the time of the lease sale.

Lek. An area where male sage-grouse display during the breeding season to attract females (also referred to as strutting ground). Each state may have a slightly different definition of lek, active lek, inactive lek, occupied lek, and unoccupied leks.

Lek complex. A collection of lek sites, typically with small numbers of males, that are associated with a larger lek site in the vicinity (less than or equal to a mile). A count of a lek complex generally includes systematically acquiring and recording information about all displaying males in a series of leks where no two lek sites are more than a mile apart.

Lek Status Definitions:

- **Annual status.** Lek status based on the following definitions of annual activity (Hagen 2011):
  - **Active lek—**A lek attended by 1 male sage-grouse or more during the breeding season. Acceptable documentation of sage-grouse presence includes observation of birds using the site or recent signs of lek attendance, such as fresh droppings or feathers. New leks found during ground counts or surveys are given an annual status of active.
  - **Inactive lek—**A lek with sufficient survey data to suggest that there was no male attendance throughout a breeding season. (Absence of male GRSG during a single visit is insufficient documentation to establish that a lek is inactive.) This designation requires documentation of an absence of birds on the lek during at least two ground surveys separated by at least seven days. These surveys must be conducted under acceptable weather conditions (clear to partly cloudy and winds less than 10 miles per hour) and in the absence of obvious disturbance. Alternatively, there must be a ground check of the exact known lek site late in the strutting season that fails to find any sign of attendance, such as fresh droppings or feathers. Data collected by aerial surveys alone may not be used to designate inactive status.
  - **Unknown lek—**Lek status has not been documented during the course of a breeding season. New leks found during aerial surveys in the current year are given an annual status of unknown, unless they are confirmed on the ground or observed more than once by air.
- **Conservation status.** Based on its annual status, a lek is assigned to one of the following categories for conservation or mitigation actions (Hagen 2011):
  - **Occupied lek—**A regularly visited lek that has had one male or more counted in one or more of the last seven years. Surrounding areas are designated and protected as Category 1 habitat.
  - **Occupied-pending—**A lek not counted regularly in the last seven years, but birds were present at last visit. Designate and protect surrounding area as Category 1 habitat. These leks should be resurveyed at a minimum of two additional years to confirm activity.

- **Pending lek—**A lek not counted regularly in the last seven years, but birds were present one or more years of that period.
- **Unoccupied lek—**A lek that has been counted annually and has had no birds for eight or more consecutive years. Mitigation category is based on habitat type and condition.
- **Unoccupied-pending—**A lek not counted regularly in a seven-year period, but birds were not present at last visit. Designate and protect surrounding area as Category 1 habitat. These leks should be resurveyed at a minimum of two additional years to confirm activity
- **Historic lek—**A lek that has been unoccupied prior to 1980 and remains so. Mitigation category based on habitat type and condition (1980 serves as the baseline for evaluating population objectives under ODFW's Sage-grouse Conservation Strategy; thus, leks unoccupied prior to 1980 are not included in the baseline for population abundance and distribution.)

Livestock facilities. These include livestock water troughs, dirt tanks, dugouts, storage tanks, wells, fences, corrals, dusting bags, and handling facilities used in managing livestock grazing.

Local Implementation Team. Implementation of conservation guidelines outlined in *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and Habitats* will be guided by Local Implementation Teams comprised of ODFW, land managers, and landowners. Because these groups are not mutually exclusive and include a mix of public and private entities, the BLM is the primary land manager; local groups are based on BLM district boundaries (and in some cases on resource areas).

Locatable minerals. Minerals subject to exploration, development, and disposal by staking mining claims, as authorized by the Mining Law of 1872, as amended. This includes deposits of gold, silver, and other uncommon minerals not subject to lease or sale.

Long-term effect. The effect could occur for an extended period after implementation of the alternative, several years or more.

Maintenance level. Operation guidance to field personnel on the appropriate intensity, frequency, and type of maintenance activities that should be undertaken to keep the route in acceptable condition and provide guidance for the minimum standard of care for the annual maintenance of a route.

Major roads. Federal and state highways that are not interstate highways.

Master development plans. A set of information common to multiple planned wells, including drilling plans, surface use plans of operations, and plans for future production.

Mineral. Any naturally formed inorganic material, solid or fluid inorganic substance that can be extracted from the earth; any of various naturally occurring homogeneous substances (such as stone, coal, salt, sulfur, sand, petroleum, water, or natural gas) obtained usually from the ground. Under federal laws, considered as locatable (subject to the general mining laws), leasable (subject to the Mineral Leasing Act of 1920), and salable (subject to the Materials Act of 1947).

Mineral entry. The filing of a claim on BLM-administered land to obtain the right to any locatable minerals it may contain.

Mineral estate. The ownership of minerals, including rights necessary for access, exploration, development, mining, ore dressing, and transportation operations.

Mineral materials. Common varieties of mineral materials, such as soil, sand and gravel, stone, pumice, pumicite, and clay, that are not obtainable under the mining or leasing laws but that can be acquired under the Materials Act of 1947, as amended.

Minimization mitigation. Minimizing impacts by limiting the degree or magnitude of the action and its implementation (40 CFR, Part 1508.20 [b]).

Mining claim. A parcel of land that a miner takes and holds for mining purposes, having acquired the right of possession by complying with the Mining Law and local laws and rules. A mining claim may contain as many adjoining locations as the locator may make or buy. There are four categories of mining claims: lode, placer, mill site, and tunnel site.

Mining Law of 1872. Provides for claiming and gaining title to locatable minerals on BLM-administered lands. Also referred to as the General Mining Law or Mining Law.

Minor Roads. All transportation routes with maintenance level 3, 4, or 5 on BLM-administered lands or its equivalent on lands not administered by the BLM.

Mitigation. Includes specific means, measures, or practices that could reduce, avoid, or eliminate adverse impacts. Mitigation can include avoiding the impact altogether by not taking a certain action or parts of an action, minimizing the impact by limiting the degree of magnitude of the action and its implementation, rectifying the impact by repairing, rehabilitating, or restoring the affected environment, reducing or eliminating the impact over time using preservation and maintenance operations during the life of the action, and compensating for the impact by replacing or providing substitute resources or environments.

Modification. A change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Depending on the specific modification, the stipulation may or may not apply to all sites within the leasehold to which the restrictive criteria are applied.

Monitoring (plan monitoring). The process of tracking the implementation of land use plan decisions and collecting and assessing data necessary to evaluate the effectiveness of land use planning decisions.

Motorized vehicles or uses. Vehicles that are motorized, including jeeps, all-terrain vehicles (such as four-wheelers and three-wheelers), trail motorcycles or dirt bikes, and aircraft.

Multiple-use. The management of the BLM-administered lands and their various resource values so that they are used in a combination that will best meet the present and future needs of the American people. Multiple-use is implemented by the following:

- Making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to changing needs and conditions
- The use of some land for less than all of the resources
- A combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific, and historical values
- Harmonious and coordinated management of the various resources without permanently impairing the productivity of the land and the quality of the environment and giving consideration to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output (FLPMA)

National Environmental Policy Act of 1969 (NEPA). Public Law 91-190. Establishes environmental policy for the nation. Among other items, NEPA requires federal agencies to consider environmental values in decision-making.

Net conservation gain. The actual benefit or gain above baseline conditions. Actions that result in habitat loss and degradation are those identified as threats that contribute to GRSG disturbance, as identified by the USFWS in its 2010 listing decision (75 FR 13910) and shown in Table 2 in the attached Monitoring Framework (**Appendix D**).

Nonenergy leasable minerals. Those minerals or materials designated as leasable under the Mineral Leasing Act of 1920. Nonenergy minerals include such resources as phosphate, sodium, potassium, and sulfur.

No surface occupancy. A major constraint where use or occupancy of the land surface for fluid mineral exploration or development and surface-disturbing activities is prohibited to protect identified resource values. Areas identified as NSO are open to fluid mineral leasing, but surface-disturbing activities cannot be conducted. Access to fluid mineral deposits will require directional drilling from outside the boundaries of the NSO. NSO areas are treated as avoidance areas for rights-of-way, which would not be granted unless there were no feasible alternatives. The NSO stipulation includes stipulations that may be worded as No Surface Use/Occupancy, No Surface Disturbance, Conditional NSO, or Surface Disturbance or Surface Occupancy Restriction (by location).

Objective. A description of a desired outcome for a resource. An objective can be quantified and measured and, where possible, can have established time frames for achievement.

Occupied habitat. Area of suitable habitat (i.e., sagebrush cover 5% or greater and tree cover <5%) known to be used by GRSG within the last 10 years. Areas of suitable habitat contiguous with areas of known use that do not have effective barriers to GRSG movement from known use areas may be considered occupied habitat, unless specific information exists that documents the lack of GRSG use. Occupancy can be verified with telemetry locations, sightings of GRSG or their sign (e.g., droppings or feathers), local biological expertise, GIS data, or other data sources recognized by the BLM and ODFW.

Off-highway vehicle. Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding the following:

- Any nonamphibious registered motorboat
- Any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes
- Any vehicle whose use is expressly authorized by the authorized officer or otherwise officially approved
- Vehicles in official use where official use is by an employee, agent, or designated representative of the federal government or one of its contractors, in the course of employment, agency, or representation
- Any combat or combat support vehicle when used in times of national defense emergencies (43 CFR, Part 8340.0 5)

Open. Denotes that an area is available for a particular use or uses. Refers to specific program definitions found in law, regulations, or policy guidance for application to individual programs. For example, 43 CFR, Part 8340.0-5, defines the specific meaning of open as it relates to OHV use.

Oregon Priority Area for Conservation. A geographic unit of PHMA that the ODFW mapped from the priority areas of conservation (PACs) initially created by the USFWS in 2013. There are 20 Oregon PACs, each with a unique name. Oregon PACs are used in calculating the human disturbance threshold and in the adaptive management habitat trigger. Other planning efforts may call a similar unit a BSU.

Parallel road. A road that follows the same topography and sight lines and ends at the same destination as another. Parallel roads are usually user created and occur because of the lack of maintenance on an existing road.

Permitted use. The forage allocated by, or under the guidance of, an applicable land use plan for livestock grazing in an allotment under a permit or lease and expressed in AUMs (43 CFR, Part 4100.0-5).

Permittee. A person or company permitted to graze livestock on BLM-administered land.

Plan of operations. A plan required for all mining exploration on greater than five acres or surface disturbance greater than casual use on certain special category lands. Special category lands are described under 43 CFR, Part 3809.11(c), and include such lands as designated ACECs, lands within the National Wilderness Preservation System, and areas closed to off-road vehicles. In addition, a plan of operations is required for activity greater than casual use on lands patented under the Stock Raising Homestead Act with federal minerals, where the operator does not have the written consent of the surface owner (43 CFR, Part 3814). The plan of operations needs to be filed in the BLM field office with jurisdiction over the land involved. It does not need to be on a particular form but must address the information required by 43 CFR, Part 3809.401(b).

Planning area. The geographic area for which resource management plans are developed and maintained. The planning area boundary includes all lands regardless of jurisdiction that contain mapped preliminary priority habitat and preliminary general habitat. For this ARMPA, the planning area is the entire Oregon subregion and covers all or portions of 17 counties in Oregon and 1 county in Washington; however, PPH and PGH are only found in Baker, Crook, Deschutes, Grant, Harney, Lake, Malheur, and Union Counties in Oregon. Lands within the planning area include a mix of private, federal, and state lands.

Planning criteria. The standards, rules, and other factors developed by managers and interdisciplinary teams for their use in forming judgments about decision-making, analysis and data collection during planning. Planning criteria streamlines and simplifies the resource management planning actions.

Planning issues. Concerns, conflicts, and problems with the existing management of BLM-administered lands. Frequently, issues are based on how land uses affect resources. Some issues are concerned with how land uses can affect other land uses or how the protection of resources affects land uses.

Policy. This is a statement of guiding principles, or procedures, designed and intended to influence planning decisions, operating actions, or other affairs of the BLM or Forest Service. Policies are established interpretations of legislation, executive orders, regulations, or other presidential, secretarial, or management directives.

Prescribed fire. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist and NEPA requirements, where applicable, must be met before it is ignited.

Primitive road. A linear route managed for use by four-wheel drive or high clearance vehicles. Primitive roads do not normally meet any BLM road design standards.

Priority area for conservation. A term introduced by the USFWS to encompass the most important areas needed for maintaining GRSG representation, redundancy, and resilience across the landscape (USFWS 2013a).

Priority sage-grouse habitat. Areas that have been identified as having the highest conservation value to maintaining sustainable GRSG populations. These areas include breeding, late brood-rearing, and winter concentration areas. The BLM has identified them in coordination with respective state wildlife agencies.

Range improvement. Any activity, structure, or program on or relating to rangelands that is designed for the following:

- Improve production of forage
- Change vegetative composition
- Control patterns of use
- Provide water
- Stabilize soil and water conditions
- Provide habitat for livestock and wildlife

The term includes structures, treatment projects, and mechanical means to accomplish the desired results.

Reasonably foreseeable development scenario. The prediction of the type and amount of oil and gas activity that would occur in a given area. The prediction is based on geologic factors, past history of drilling, projected demand for oil and gas, and industry interest.

Recreation management area. Includes special recreation management areas (SRMAs) and extensive recreation management areas (ERMAs); see SRMA and ERMA definitions.

Renewable energy. Energy resources that constantly renew themselves or that are regarded as practically inexhaustible, for example, solar, wind, geothermal, hydro, and biomass. Although particular geothermal formations can be depleted, the natural heat in the Earth is a virtually inexhaustible reserve of potential energy.

Required design features (RDFs). These are required for certain activities in all GRSG habitat. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. However, the applicability and overall effectiveness of each RDF cannot be fully assessed until the project begins, when the project location and design are known. Because of site-specific circumstances, some RDFs may not apply to some projects (e.g., a resource is not present on a given site) or may require slight variations (e.g., a larger or smaller protective area). All variations in RDFs will require that at least one of the following be demonstrated in the NEPA analysis associated with the project or activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project or activity (e.g., due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
- An alternative RDF, state-implemented conservation measure, or plan-level protection is determined to provide equal or better protection for GRSG or its habitat.
- A specific RDF will provide no additional protection to GRSG or its habitat.

Reserve common allotment. An area that is designated in the land use plan as available for livestock grazing but reserved for use as an alternative to grazing in another allotment in order to facilitate rangeland restoration treatments and recovery from natural disturbances such as drought or wildfire. It would provide needed flexibility that would help the agency apply temporary rest from grazing where vegetation treatments or management would be most effective.

Resistance to invasion. The ability of a site to retain its fundamental plant community species composition, ecological processes, and functioning when exposed to invasive plant species.

Resource Management Plan. A land use plan, as prescribed by the FLPMA, that establishes land use allocations, coordination guidelines for multiple-use, objectives, and actions to be achieved for a given area of land.

Restoration. Implementation of a set of actions that promotes plant community diversity and structure that allows plant communities to be more resilient to disturbance and invasive species over the long term. The long-term goal is to create functional high quality habitat that is occupied by GRSG. The short-term goals may be to restore the landform, soils, and hydrology and to increase the percentage of preferred vegetation, seeding of desired species, or treatment of undesired species.

Restriction. A limitation or constraint on BLM-administered land uses and operations. Restrictions can be of any kind but most commonly apply to certain types of vehicle use, temporal or spatial constraints, or certain authorizations.

Revision. The process of completely rewriting a land use plan due to changes in the planning area affecting major portions of the plan or the entire plan.

Right-of-way (ROW). A ROW grant is an authorization to use a specific piece of BLM-administered land for a certain project, such as roads, pipelines, transmission lines, and communication sites. A ROW grant authorizes rights and privileges for a specific use of the land for a specific period. Generally, a BLM ROW is granted for a term appropriate for the life of the project. Minor ROWs are typically less than about 15 miles in length and are not to exceed about 52 acres of disturbance.

ROW avoidance area. An area identified through resource management planning to be avoided but may be available for ROW location with special stipulations.

ROW exclusion area. An area identified through resource management planning that is not available for ROW location under any conditions.

Riparian area. A form of wetland transition between permanently saturated wetlands and upland areas. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas are lands along perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.

Road. 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.

Routes. Multiple roads, trails, and primitive roads; a group of roads, trails, and primitive roads that represents less than 100 percent of the BLM transportation system. Generically, components of the transportation system are described as routes.

Sagebrush focal areas. Areas identified by the USFWS that represent recognized strongholds for GRSG. They have been noted and referenced by the conservation community as having the highest densities of GRSG and other criteria important for the persistence of GRSG.

Sale (BLM-administered land). A method of land disposal allowed by Section 203 of FLPMA, whereby the United States receives a fair-market payment for the transfer of land from federal ownership. BLM-administered lands determined suitable for sale are offered on the initiative of the BLM. Lands suitable for sale must be identified in the RMP. Any lands to be disposed of by sale that are not identified in the current RMP or that meet the disposal criteria identified in the RMP require a plan amendment before a sale can occur.

Scoping process. An early and open public participation process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

Season of use. The time during which livestock grazing is permitted on a given range area, as specified in the grazing lease.

Seeding. A vegetation treatment that includes the application of grass, forb, or shrub seed, either by air or from the ground. In areas of gentle terrain, seed is often applied on the ground with a rangeland drill. Seeding allows the establishment of native species or placeholder species and restoration of disturbed areas to a perennial-dominated cover type, thereby decreasing the risk of subsequent invasion by exotic plant species. Seeding would be used primarily as a follow-up treatment in areas where disturbance or the previously described treatments have removed exotic plant species and their residue.

Significant factor. This principal factor in the failure to achieve the land health standards and to conform with the guidelines. A significant factor would typically be a use that, if modified, would enable an area to achieve or make significant progress toward achieving the land health standards. To be a significant factor, a use may be one of several factors contributing to less-than-healthy conditions; it need not be the sole factor inhibiting progress toward the standard.

Special recreation management area (SRMA). An administrative unit identified in land use plans where the existing or proposed recreation opportunities and recreation setting characteristics are recognized for their unique value, importance, or distinctiveness, especially as compared to other areas used for recreation.

Special recreation permit (SRP). Authorization that allows for recreation on BLM-administered lands and related waters. Issued as a means to control visitor use, to protect recreational and natural resources, and to provide for the health and safety of visitors. Commercial SRPs are also issued as a mechanism to provide a fair return for the commercial use of BLM-administered lands.

Special status species: BLM special status species are those listed, candidate, or proposed for listing under the Endangered Species Act and those requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. They are designated as BLM sensitive by the BLM State Directors. All federally listed candidate species, proposed species, and delisted species in the five years following delisting are conserved as BLM sensitive species.

Split-estate. A circumstance where the surface of a particular parcel of land is owned by a different party than the one that owns the minerals below. Split-estates may have any combination of surface/subsurface owners: federal/state, federal/private, state/private, or percentage ownerships. When referring to the split-estate ownership on a particular parcel of land, it is generally necessary to describe the surface/subsurface ownership pattern of the parcel.

Standard. A description of the physical and biological conditions or degree of function required for healthy sustainable lands (e.g., land health standards). To be expressed as a desired outcome (goal).

Standards for Rangeland Health. Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of

Oregon and Washington (August 1997) are found at http://www.blm.gov/or/resources/recreation/csnm/files/rangeland_standards.pdf.

Strongholds. Large areas of intact habitat where populations appear stable (Wisdom et al. 2011).

Stipulation (general). A term or condition in an agreement or contract.

Stipulation (oil and gas). A provision that modifies standard oil and gas lease terms and conditions in order to protect other resource values or land uses and is attached to and made a part of the lease. Typical lease stipulations NSO, TL, and CSU. Lease stipulations are developed through the land use planning (RMP) process.

Suitable Habitat. The area provides environmental conditions necessary for successful survival and reproduction to sustain stable populations. Suitable habitat commonly has sagebrush cover of 5 percent or greater and tree cover of less than 5 percent.

Surface disturbance. Suitable habitat is considered disturbed when it is removed and unavailable for immediate GRSG use.

- Long-term removal occurs when habitat is physically removed through activities that replace suitable habitat with long-term occupancy of unsuitable habitat, such as a roads, power lines, well pads, or active mines. Long-term removal may also result from any activities that cause soil mixing, removal, and exposure to erosive processes.
- Short-term removal occurs when vegetation is removed in small areas but is restored to suitable habitat in less than five years of disturbance, such as a successfully reclaimed pipeline or a successfully reclaimed drill hole or pit.
- Suitable habitat is rendered unusable due to numerous anthropogenic disturbances.
- Anthropogenic surface disturbance are surface disturbances meeting the above definitions and that result from human activities.

Surface disruption. Resource uses and activities that are likely to alter the behavior of, displace, or cause stress to GRSG at a specific location or time. Surface disruption includes those actions that alter behavior or cause the displacement of GRSG such that reproductive success is negatively affected or the physiological ability to cope with environmental stress is compromised. Examples of disruptive activities are noise, vehicle traffic, or other human presence regardless of the associated activity.

Surface use. This is all the various activities that may be present on the surface or near-surface (e.g., pipelines) of the BLM-administered lands. It does not refer to subterranean activities (e.g., underground mining) on BLM-administered lands or federal mineral estate. When administered as a use restriction (e.g., no surface use), this phrase prohibits all but specified resource uses and activities in a certain area to protect particular sensitive resource values and property. This designation typically applies to small acreage sensitive resource sites (e.g., plant community study exclosure) or administrative sites (e.g., government ware-yard), where only authorized agency personnel are admitted.

Sustained yield. The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the BLM-administered lands consistent with multiple uses.

Technically/economically feasible. Actions that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant. It is the BLM's sole responsibility to determine what actions are technically and economically feasible. The BLM considers whether implementation of the proposed action is likely, given past and current practice and technology; this consideration does not necessarily require a cost-benefit analysis or speculation about an applicant's costs and profit. (Modified from the CEQ's 40 Most Asked Questions and BLM NEPA Handbook, Section 6.6.3).

Temporary/temporary use. This is a relative term and has to be considered in the context of the resource values affected and the nature of the resource use/activity taking place. Generally, a temporary activity is considered to be one that is not fixed in place and is of short duration.

Threatened species. Any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (BLM Manual 6840, Special Status Species Management). Under the ESA, threatened is the lesser protected of the two categories. Designation as threatened or endangered is determined by the USFWS under the ESA.

Thriving natural ecological balance. Wild horses and burros are managed to ensure that significant progress is made toward achieving the land health standards for upland vegetation and riparian plant communities, watershed function, and habitat quality for animal populations, as well as other site-specific or landscape-level objectives, including those necessary to protect and manage threatened, endangered, and sensitive species.

Timing limitation (TL). The TL stipulation, a moderate constraint, is applicable to fluid mineral leasing, all activities associated with fluid mineral leasing (e.g., truck-mounted drilling and geophysical exploration equipment off designated routes, construction of wells or pads), and other surface-disturbing activities, such as those not related to fluid mineral leasing. Areas identified for TL are closed to fluid mineral exploration and development, surface-disturbing activities, and intensive human activity during identified time frames. This stipulation does not apply to operation and basic maintenance activities, including associated vehicle travel, unless otherwise specified. Construction, drilling, completions, and other operations considered to be intensive are not allowed. Intensive maintenance, such as work overs on wells, is not permitted. TLs can overlap spatially with NSO and CSU, as well as with areas that have no other restrictions. Administrative activities are allowed at the discretion of the BLM Authorized Officer.

Trail. A linear route managed for human power (e.g., hiking or bicycling), stock (e.g., equestrian), or OHV forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Transfer of grazing preference. The BLM's approval of an application to transfer grazing preference from one party to another or from one base property to another or both. Grazing preference means a superior or priority position against others for the purpose of receiving a grazing permit or lease. This priority is attached to base property owned or controlled by the permittee or lessee.

Transition. A shift between two states. Transitions are not reversible by simply altering the intensity or direction of factors that produced the change. Instead, they require new inputs such as revegetation or shrub removal. Practices such as these that accelerate succession are often expensive.

Travel management area. Polygons or delineated areas where a rational approach has been taken to classify areas open, closed, or limited and have identified or designated a network of roads, trails, ways, landing strips, and other routes that provide for public access and travel across the planning area. All designated travel routes within travel management areas should have a clearly identified need and purpose and clearly defined activity types, modes of travel, and seasons or time frames for allowable access or other limitations (BLM Handbook H-1601-1, Land Use Planning Handbook).

Trespass. Any unauthorized use of BLM-administered land.

Tribal interests. Native American or Native Alaskan economic rights, such as Indian trust assets, resource uses, and access guaranteed by treaty rights and subsistence uses.

Understory. That portion of a plant community growing underneath the taller plants on the site.

Unitization. Operation of multiple leases as a single lease under a single operator.

Utility corridor. A designated parcel of land that is either linear or areal in character. Utility corridors are not usually wider than five miles, are limited by technological, environmental, and topographical factors, and are set in width as identified by the special use permit or ROW issued. Designation criteria are set forth in Section 503 of FLPMA for special use permits and ROWs and 43 CFR, Part 2802.11, for ROWs.

Valid existing rights. Documented, legal rights or interests in the land that allow a person or entity to use said land for a specific purpose and that are still in effect. Such rights include fee title ownership, mineral rights, ROWs, easements, permits, and licenses. Such rights may have been reserved, acquired, leased, granted, permitted, or otherwise authorized over time.

Vegetation treatments. Management practices that change the vegetation structure to a different stage of development. Vegetation treatment methods include managed fire, prescribed fire, chemical, mechanical, and seeding.

Vegetation type. A plant community with immediately distinguishable characteristics based on and named after the apparent dominant plant species.

Warranted but precluded. When the public files a petition with the USFWS to have a species listed under the Endangered Species Act, the USFWS can make one of three findings: listing is warranted, listing is not warranted, or listing is warranted but precluded. The warranted by precluded listing indicates that a species should be listed based on the available science, but listing other species takes priority because they are more in need of protection.

West Nile virus. A virus that is found in temperate and tropical regions of the world and most commonly transmitted by mosquitos. West Nile virus can cause flu-like symptoms in humans and can be lethal to birds, including GRSG.

Western Association of Fish and Wildlife Agencies (WAFWA) Management Zones. GRSG management zones established based on populations across its entire range. Oregon falls into WAFWA Management Zones IV and V. WAFWA management zones are used in the cumulative effects analysis. WAFWA management zones will be used to identify and address cross-state issues, such as regional mitigation and adaptive management monitoring response, through WAFWA Management Zone GRSG Conservation Teams (Teams). These Teams will convene and respond to issues at the appropriate scale, and will utilize existing coordination and management structures to the extent possible.

Wildfires (separate from Wildland Fire) from NWCG #024-2010 Memorandum, April 30, 2010. Unplanned ignitions or prescribed fires that are declared wildfires. Wildfires may be managed to meet one or more objectives as specified in the RMP, and these objectives can change as the fire spreads across the landscape.

Wildland fire. Any non-structure fire that occurs in the vegetation or natural fuels. Includes both prescribed fire and wildfire (NWCG Memo #024-2010 April 30, 2010. www.nwcg.gov).

Wilderness. A congressionally designated area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions and that (1) generally appears to have been affected mainly by the forces of nature, with human imprints substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres or is large enough to make practical its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value. The definition is contained in Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891).

Wilderness characteristics. These attributes include the area's size, its apparent naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. They may also include supplemental values. Lands with wilderness characteristics are those that the BLM has inventoried and determined to contain wilderness characteristics, as defined in section 2(c) of the Wilderness Act.

Wilderness Study Area (WSA). A designation made through the land use planning process of a roadless area found to have wilderness characteristics, as described in Section 2(c) of the Wilderness Act of 1964.

Withdrawal. An action that restricts the use of BLM-administered land and segregates it from the operation of some or all of the BLM-administered land and mineral laws. Withdrawals are also used to transfer jurisdiction of management of BLM-administered lands to other federal agencies.

Winter concentration areas. GRSG winter habitats that they occupy annually and that provide sufficient sagebrush cover and food to support birds throughout the entire winter (especially periods with above-average snow cover). Many of these areas support several different breeding populations of GRSG. The species typically shows high fidelity for these areas, and loss or fragmentation can result in significant population impacts.

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CHAPTER 6
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Appendices

Appendix A
Approved RMP Amendment Maps

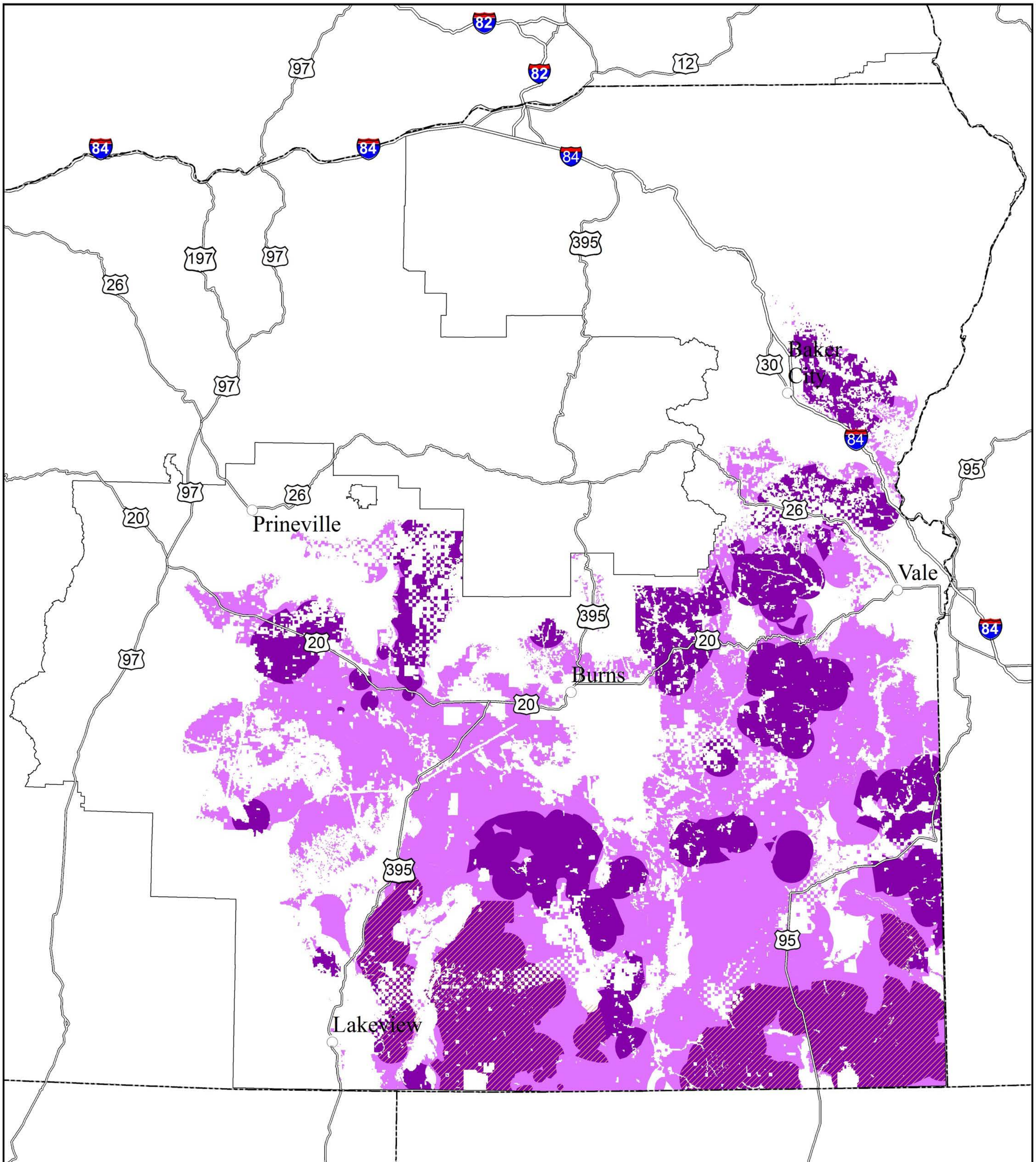

Figure 2-1: Oregon Habitat Management Areas

Legend

- Sagebrush Focal Area (SFA)
- Priority Habitat Management Area (PHMA)
- General Habitat Management Area (GHMA)
- Planning Area Boundary
- State Boundary

Miles
0 20 40

September 2015

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

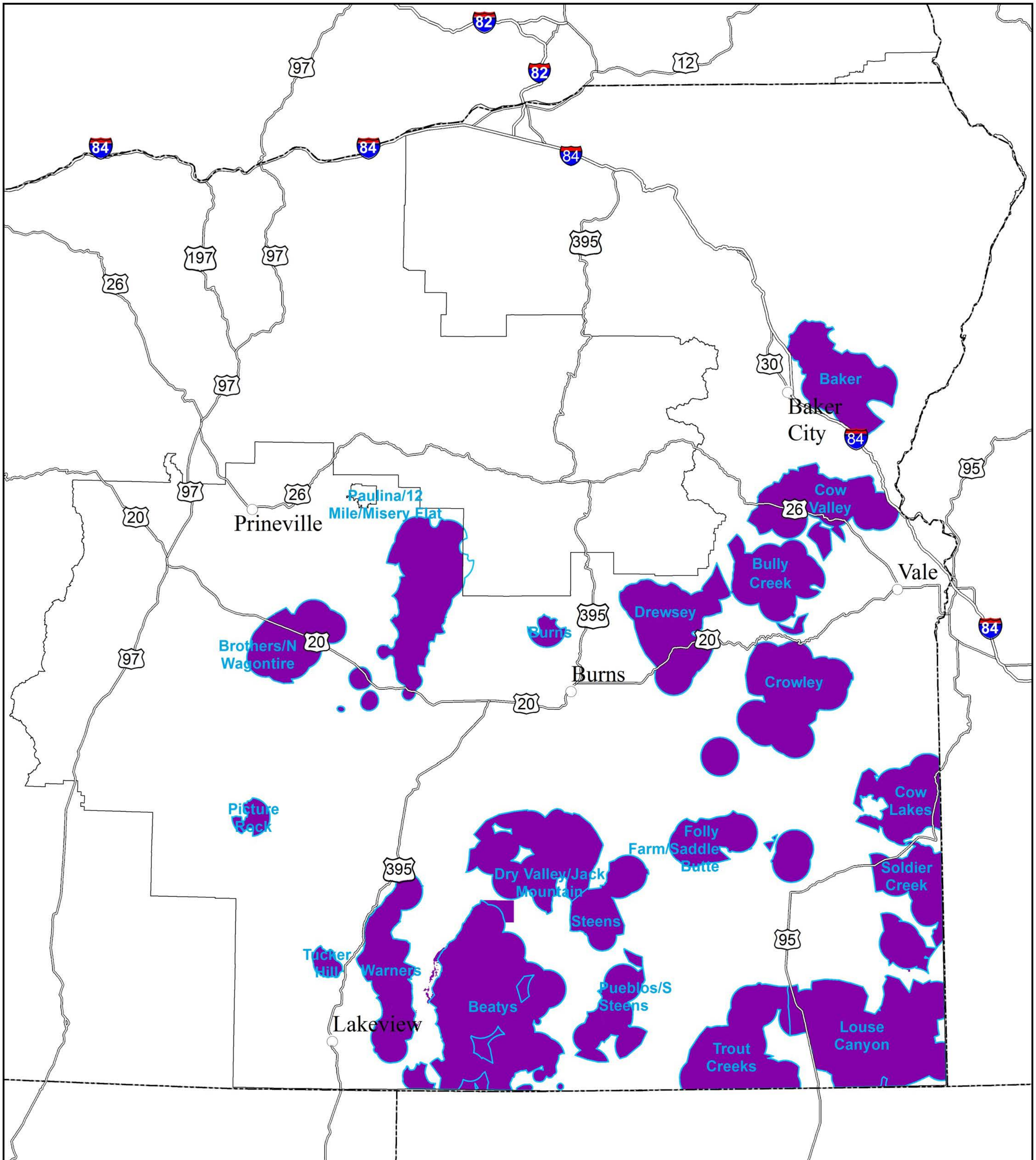

Figure 2-2: Oregon GRSG Biologically Significant Units (Oregon PACs) and Priority Habitat Management Areas

Legend

- Biologically Significant Unit
- Priority Habitat Management Area (PHMA)
- Planning Area Boundary
- State Boundary

Miles 0 20 40

September 2015

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Map Area

WA MT ND OR ID SD WY NE NV UT CO CA KS AZ NM OK TX

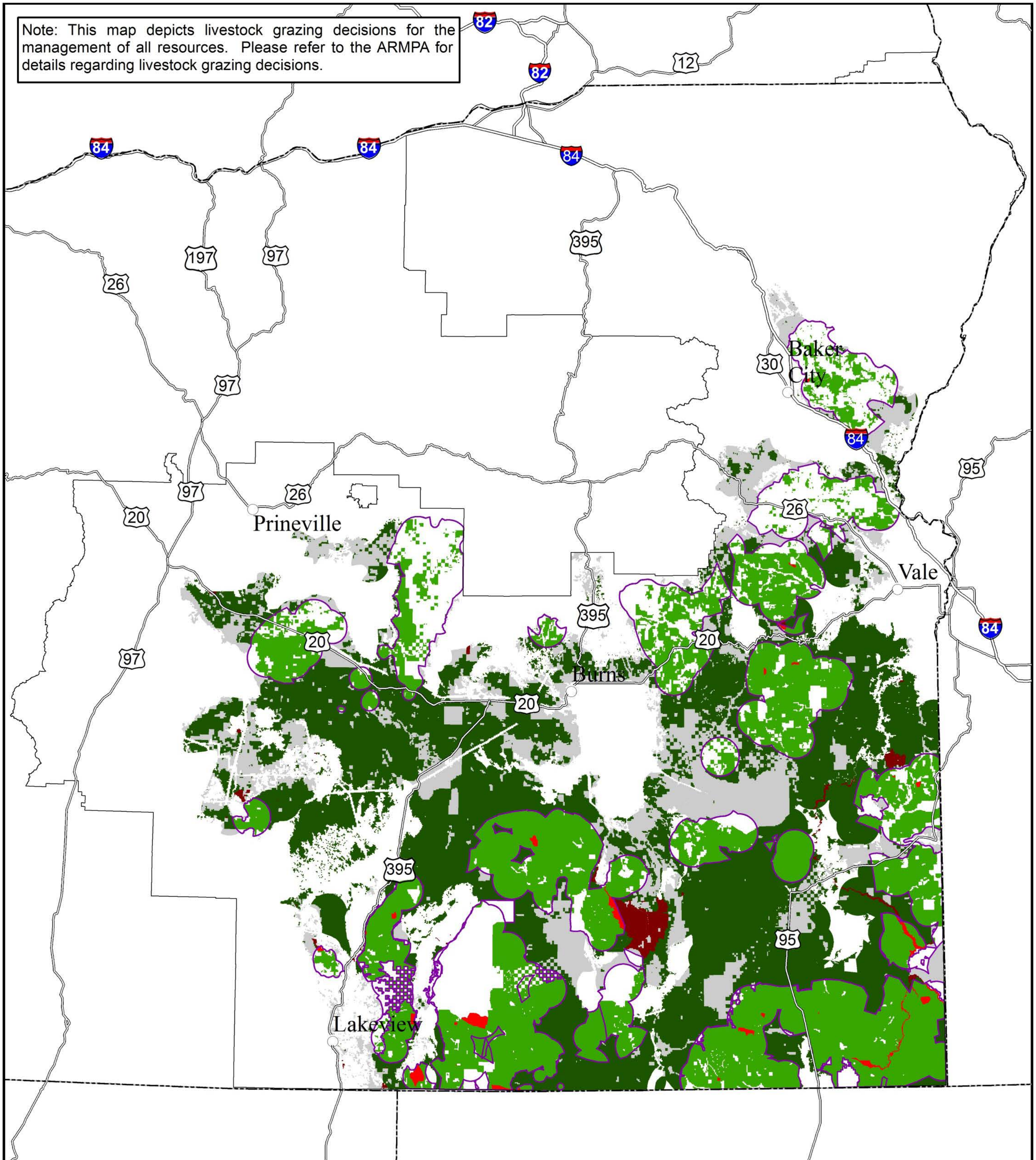


Figure 2-3: Oregon Livestock Grazing

PHMA GHMA

Outside of BLM Decision Area

Areas Unavailable for Livestock Grazing

Areas Available for Livestock Grazing

Planning Area Boundary

State Boundary

0 20 40 Miles

September 2015

Map Area

WA, OR, ID, MT, ND, SD, WY, NE, NV, UT, CO, KS, CA, AZ, NM, TX, OK

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

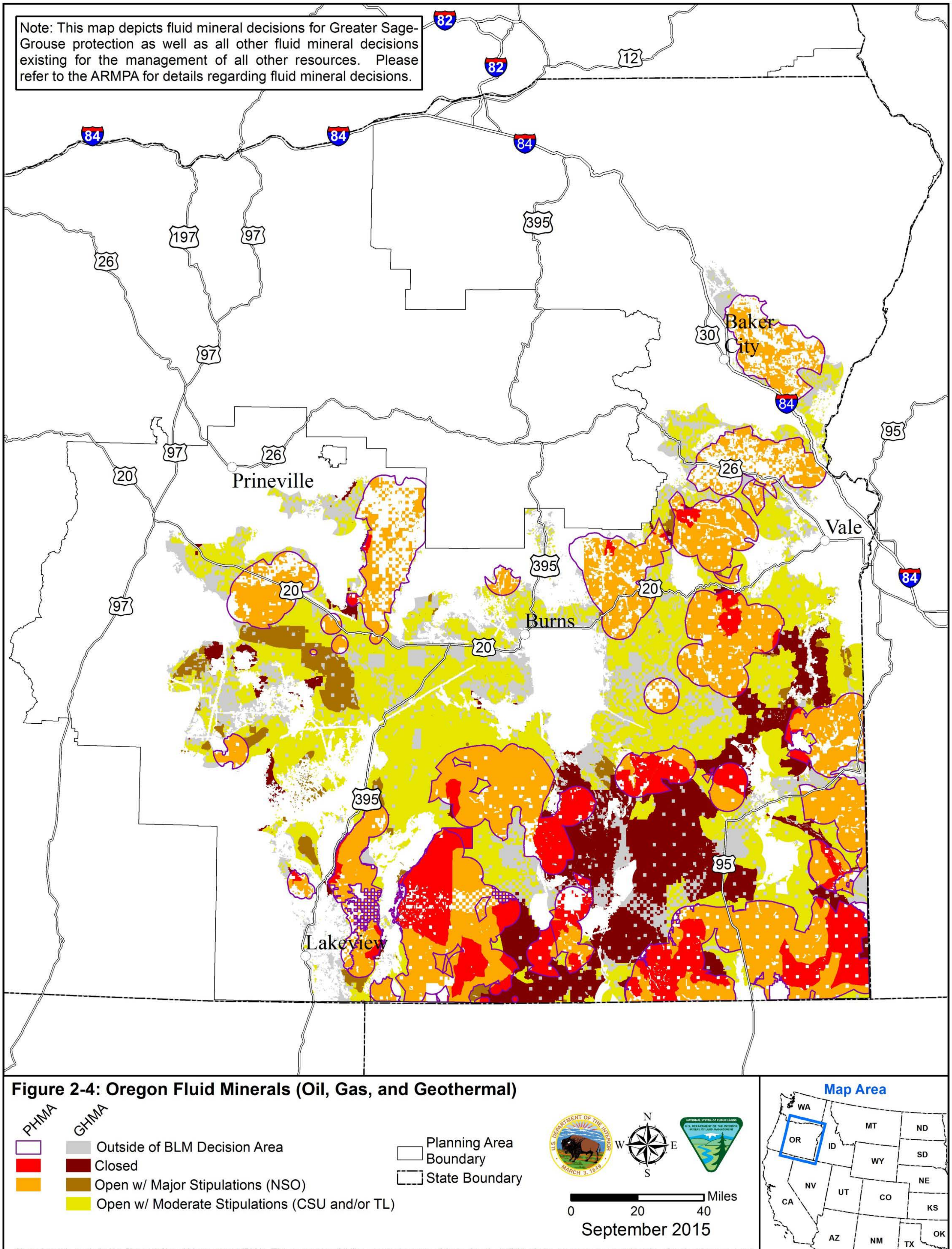


Figure 2-4: Oregon Fluid Minerals (Oil, Gas, and Geothermal)

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

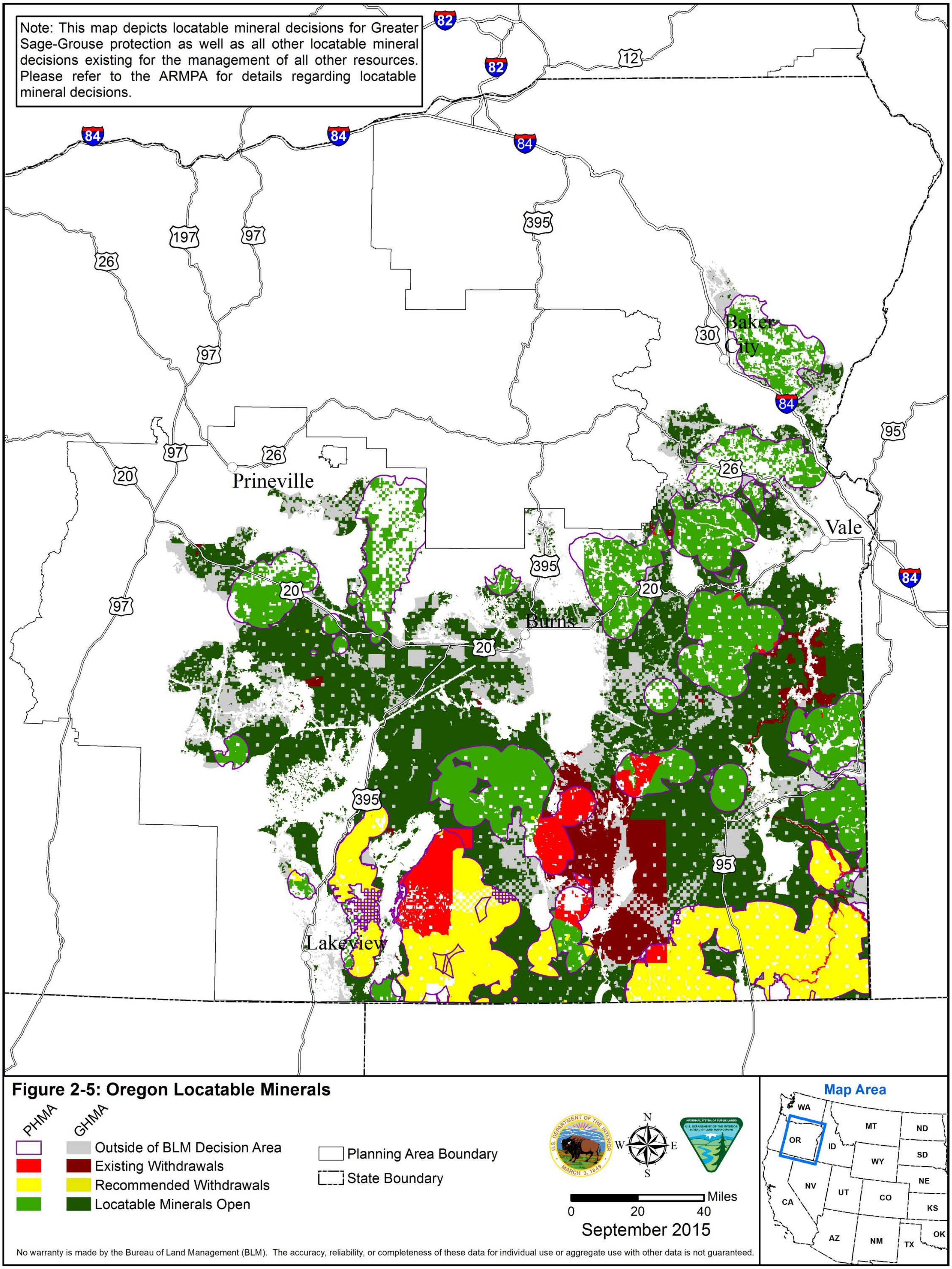


Figure 2-5: Oregon Locatable Minerals

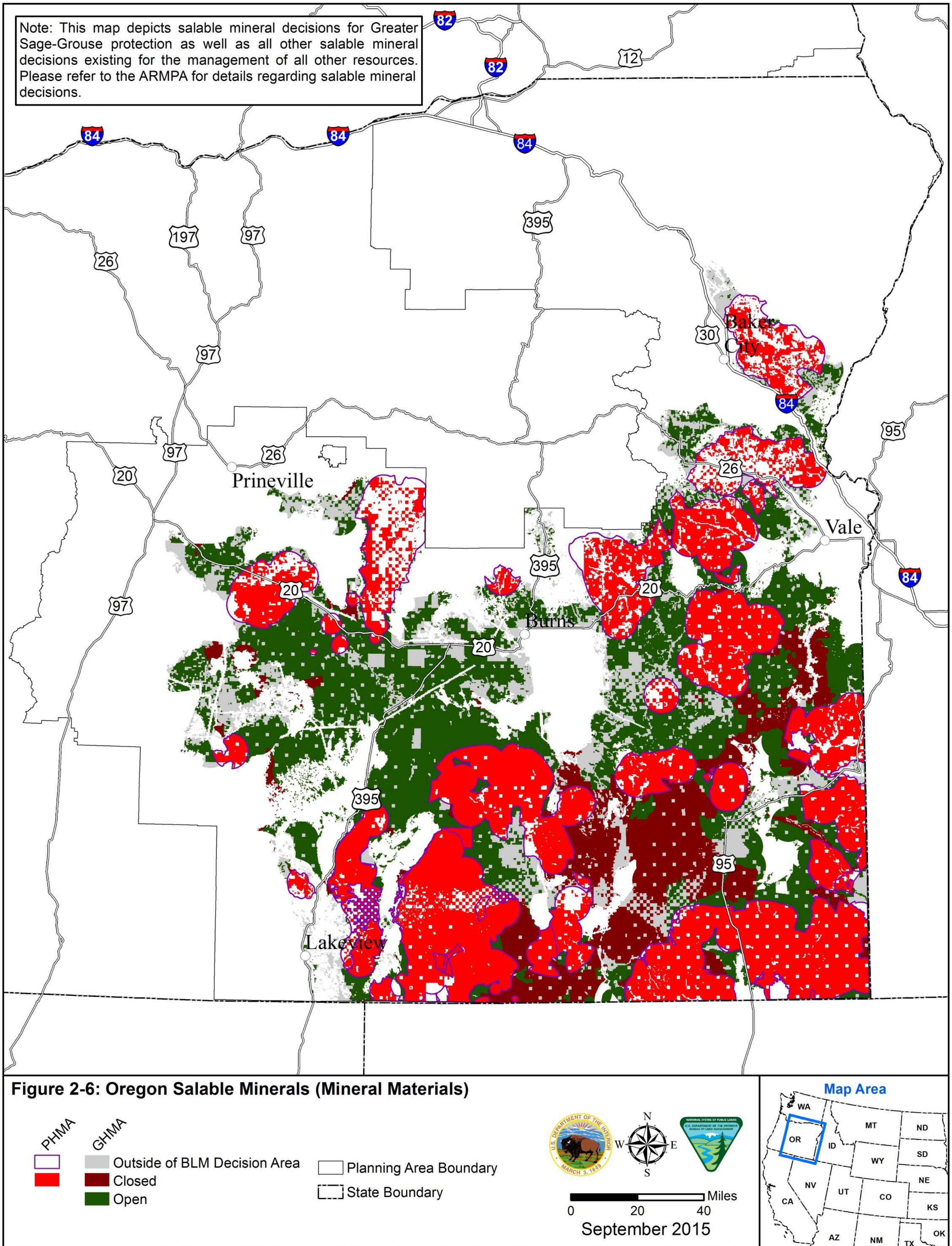
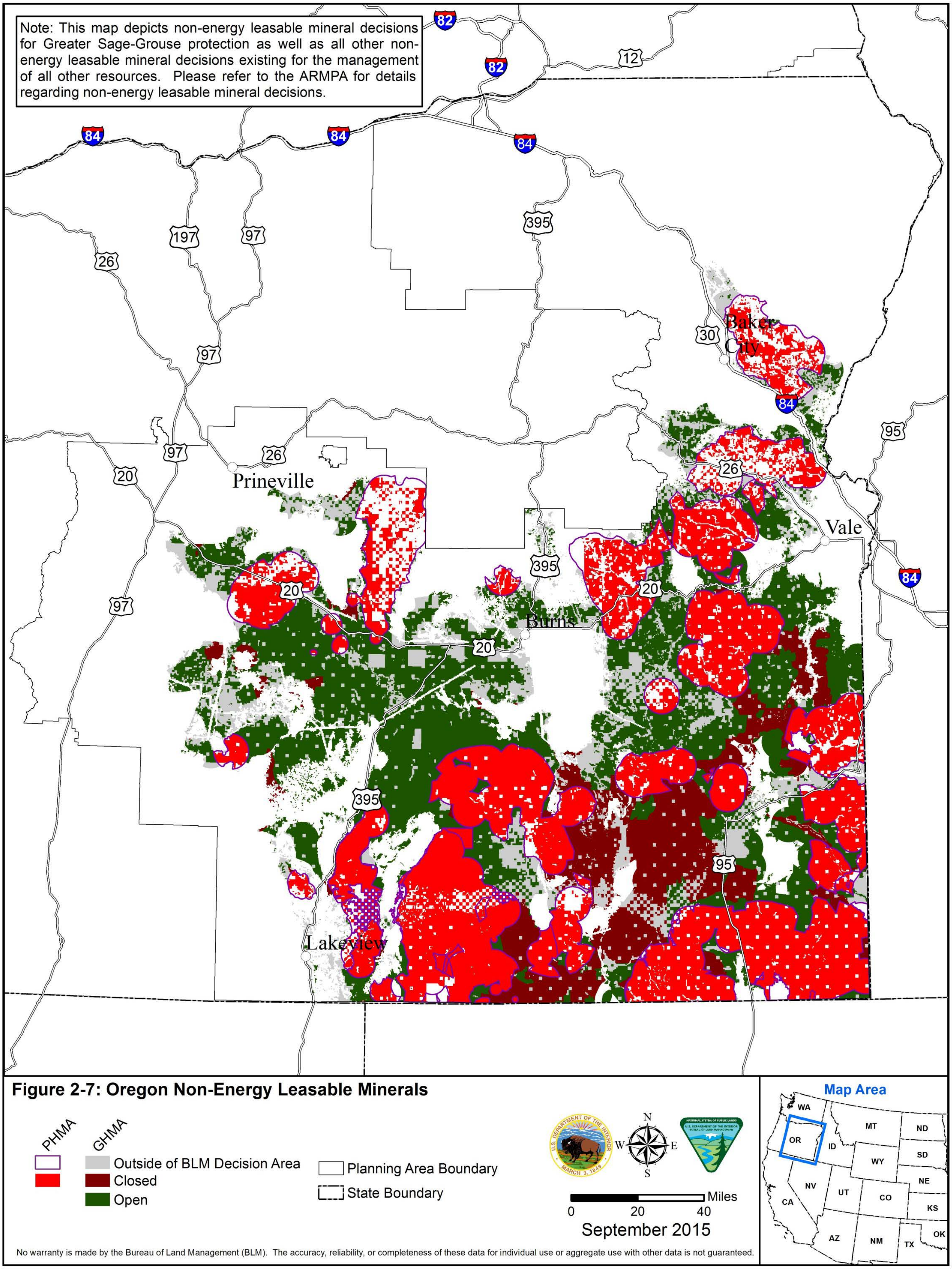
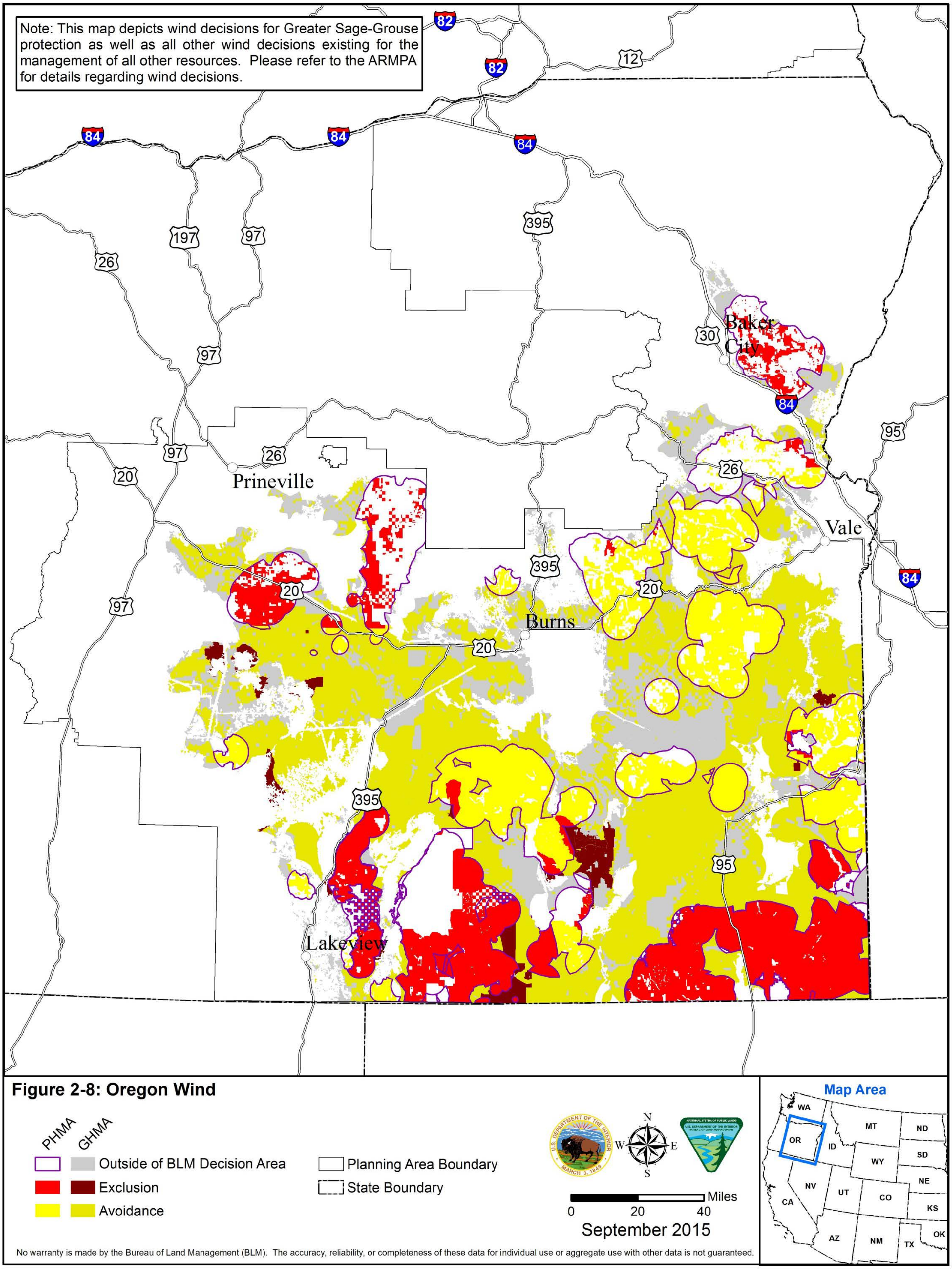
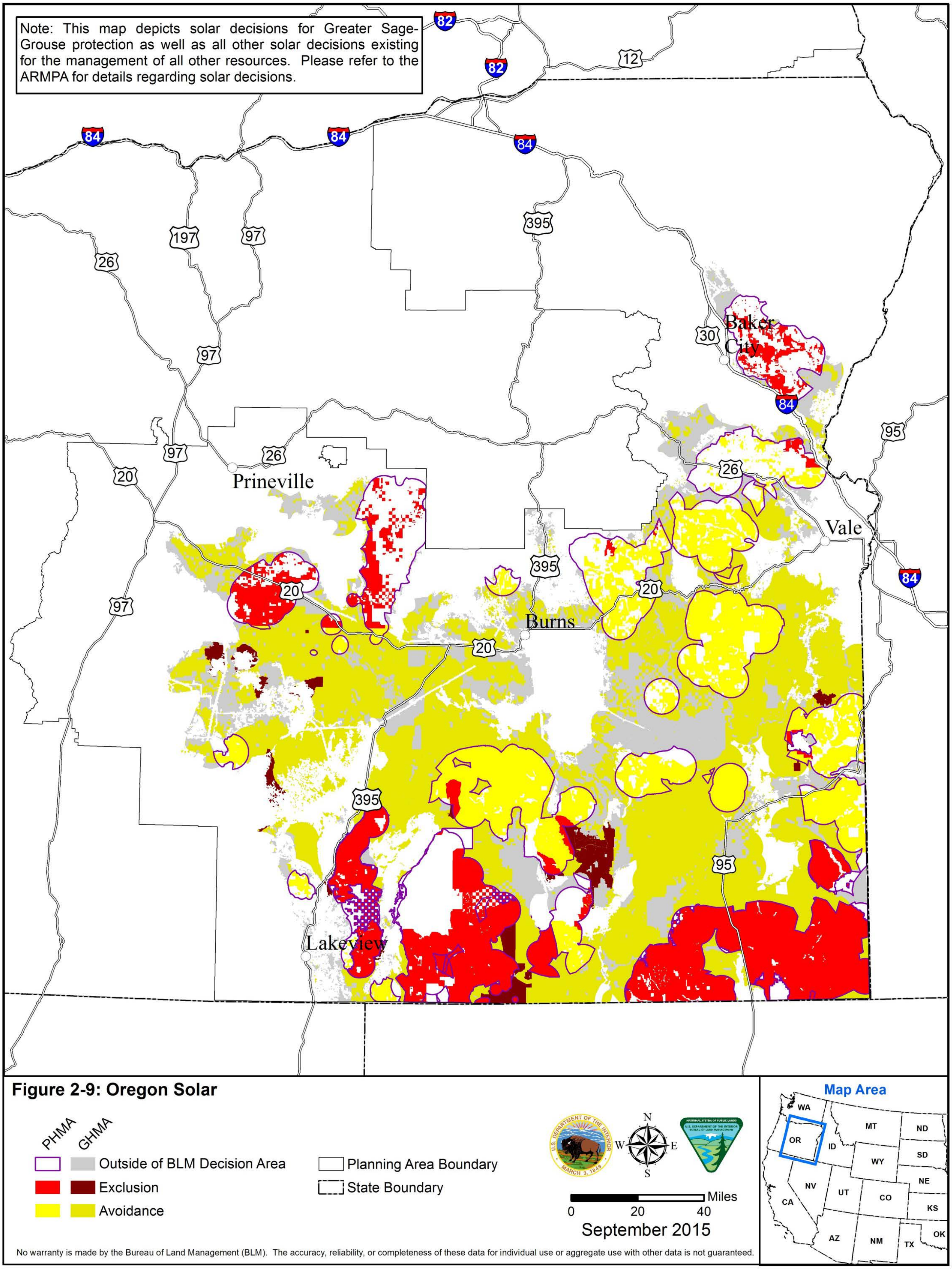


Figure 2-6: Oregon Salable Minerals (Mineral Materials)

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.


Note: This map depicts non-energy leasable mineral decisions for Greater Sage-Grouse protection as well as all other non-energy leasable mineral decisions existing for the management of all other resources. Please refer to the ARMPA for details regarding non-energy leasable mineral decisions.
Baker City
Prineville
Vale
Burns
Lakeview
Figure 2-7: Oregon Non-Energy Leasable Minerals
PHMA
GHMA
Outside of BLM Decision Area
Closed
Open
Planning Area Boundary
State Boundary
Miles
0
20
40
September 2015
Map Area
WA
OR
ID
MT
ND
SD
WY
NE
NV
UT
CO
KS
CA
AZ
NM
TX
OK
No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.


Note: This map depicts wind decisions for Greater Sage-Grouse protection as well as all other wind decisions existing for the management of all other resources. Please refer to the ARMPA for details regarding wind decisions.
82
12
84
395
197
97
26
30
Baker City
95
20
Prineville
Vale
Burns
Lakeview
Figure 2-8: Oregon Wind
PHMA
GHMA
Outside of BLM Decision Area
Exclusion
Avoidance
Planning Area Boundary
State Boundary
N
S
E
W
Miles
0
20
40
September 2015
Map Area
WA
OR
ID
MT
ND
SD
WY
NE
NV
UT
CO
CA
KS
AZ
NM
TX
OK
No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.


Note: This map depicts solar decisions for Greater Sage-Grouse protection as well as all other solar decisions existing for the management of all other resources. Please refer to the ARMPA for details regarding solar decisions.
Baker City
Prineville
Vale
Burns
Lakeview
82
12
84
395
197
97
26
30
95
20
Figure 2-9: Oregon Solar
PHMA
GHMA
Outside of BLM Decision Area
Exclusion
Avoidance
Planning Area Boundary
State Boundary
Miles
0
20
40
September 2015
Map Area
WA
OR
ID
MT
ND
SD
WY
NE
NV
UT
CO
KS
CA
AZ
NM
TX
OK
No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

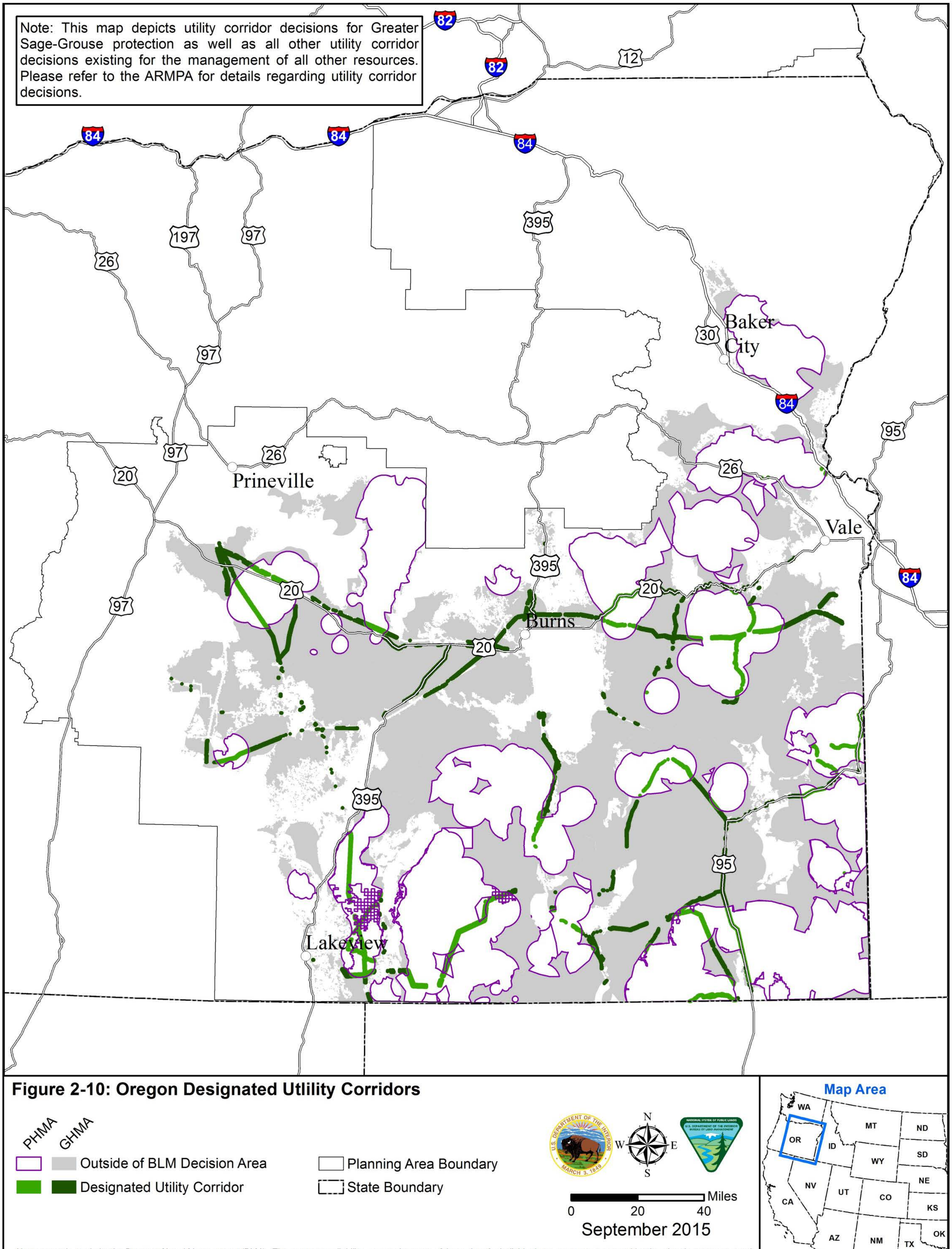


Figure 2-10: Oregon Designated Utlility Corridors

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

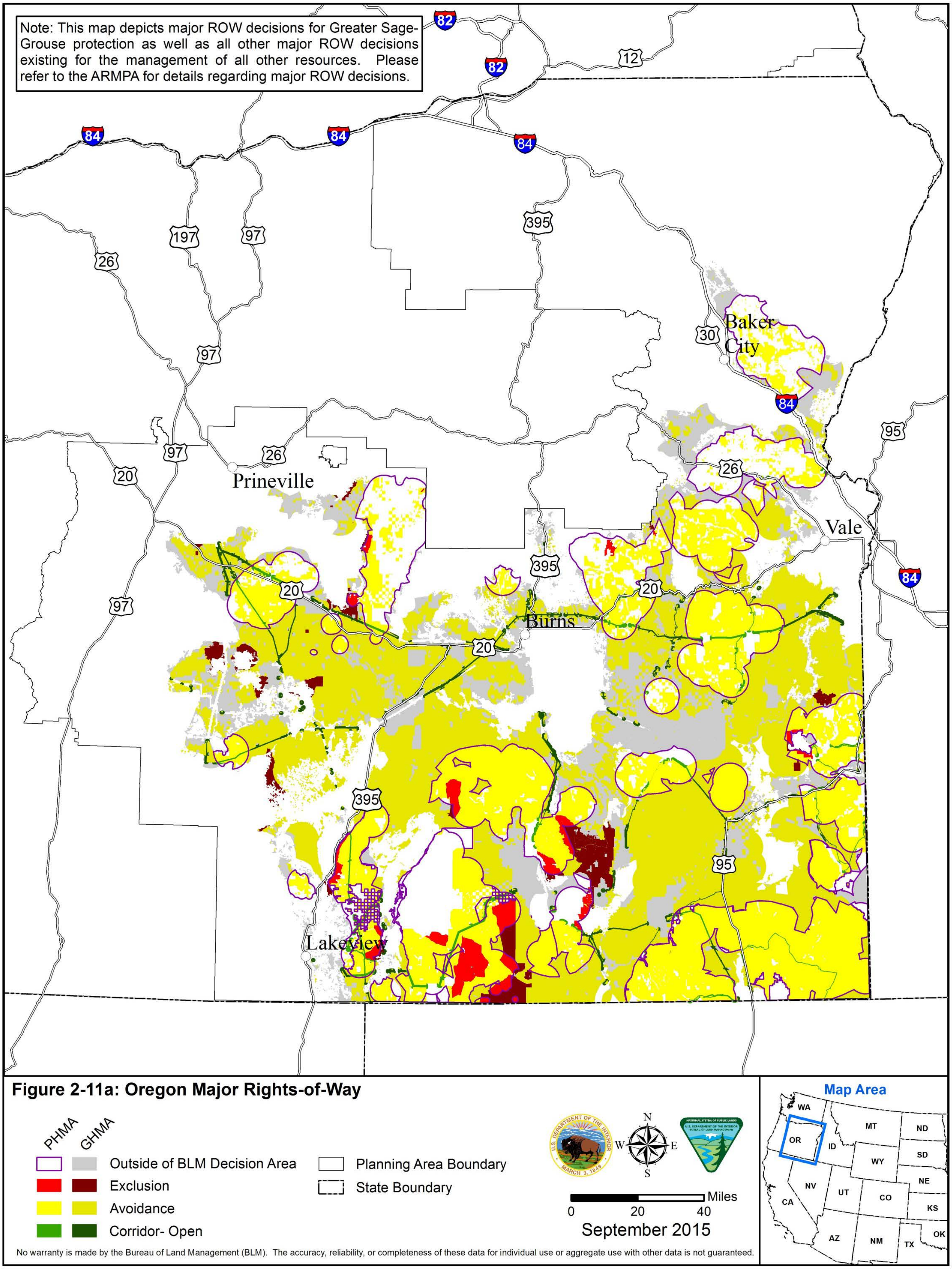


Figure 2-11a: Oregon Major Rights-of-Way

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

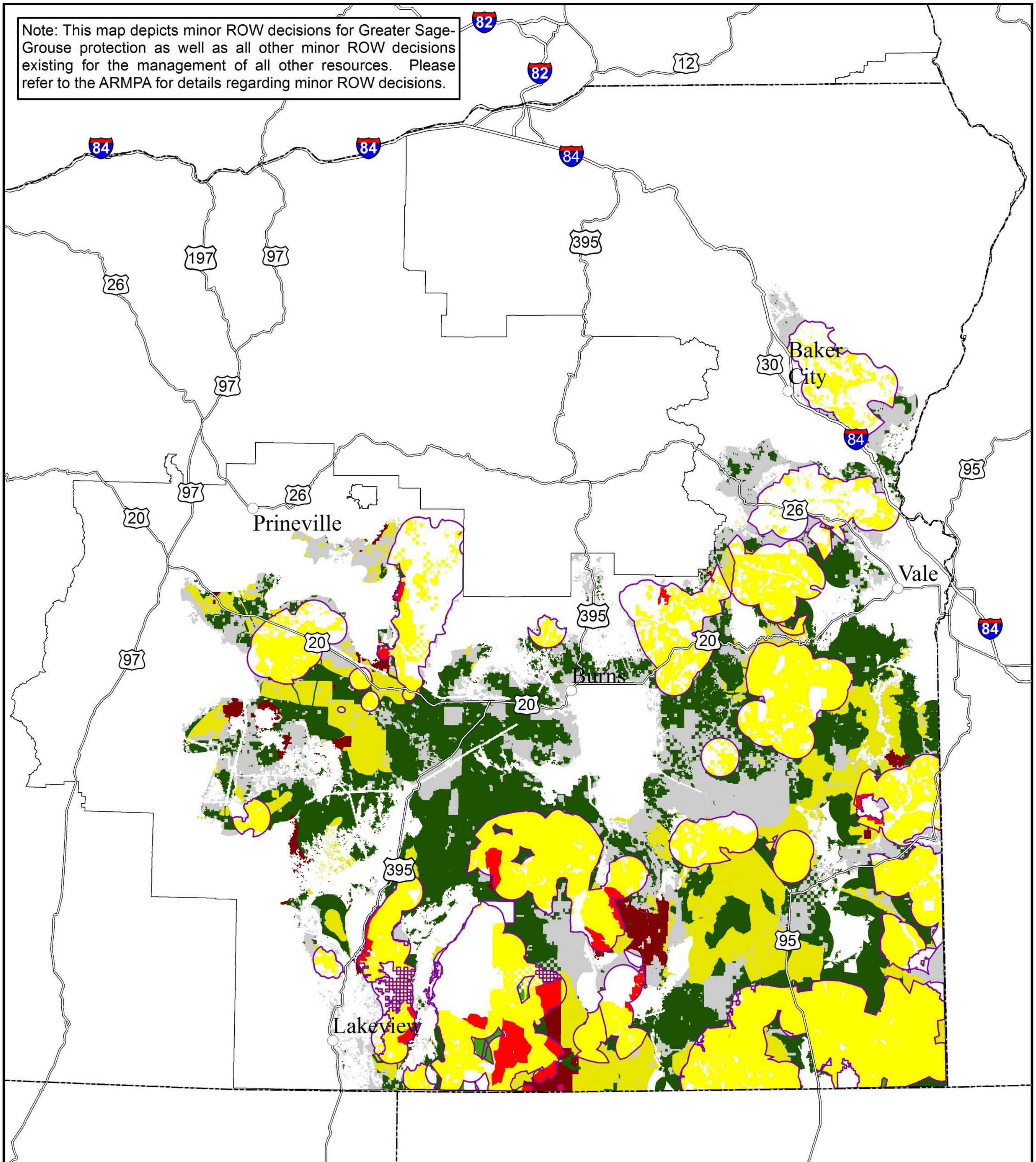


Figure 2-11b: Oregon Minor Rights-of-Way

PHMA GHMA
Outside of BLM Decision Area
Exclusion
Avoidance
Open

Planning Area Boundary
State Boundary

Miles
0 20 40

September 2015

Map Area
WA OR ID MT ND SD WY NE NV UT CO CA KS AZ NM TX OK

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

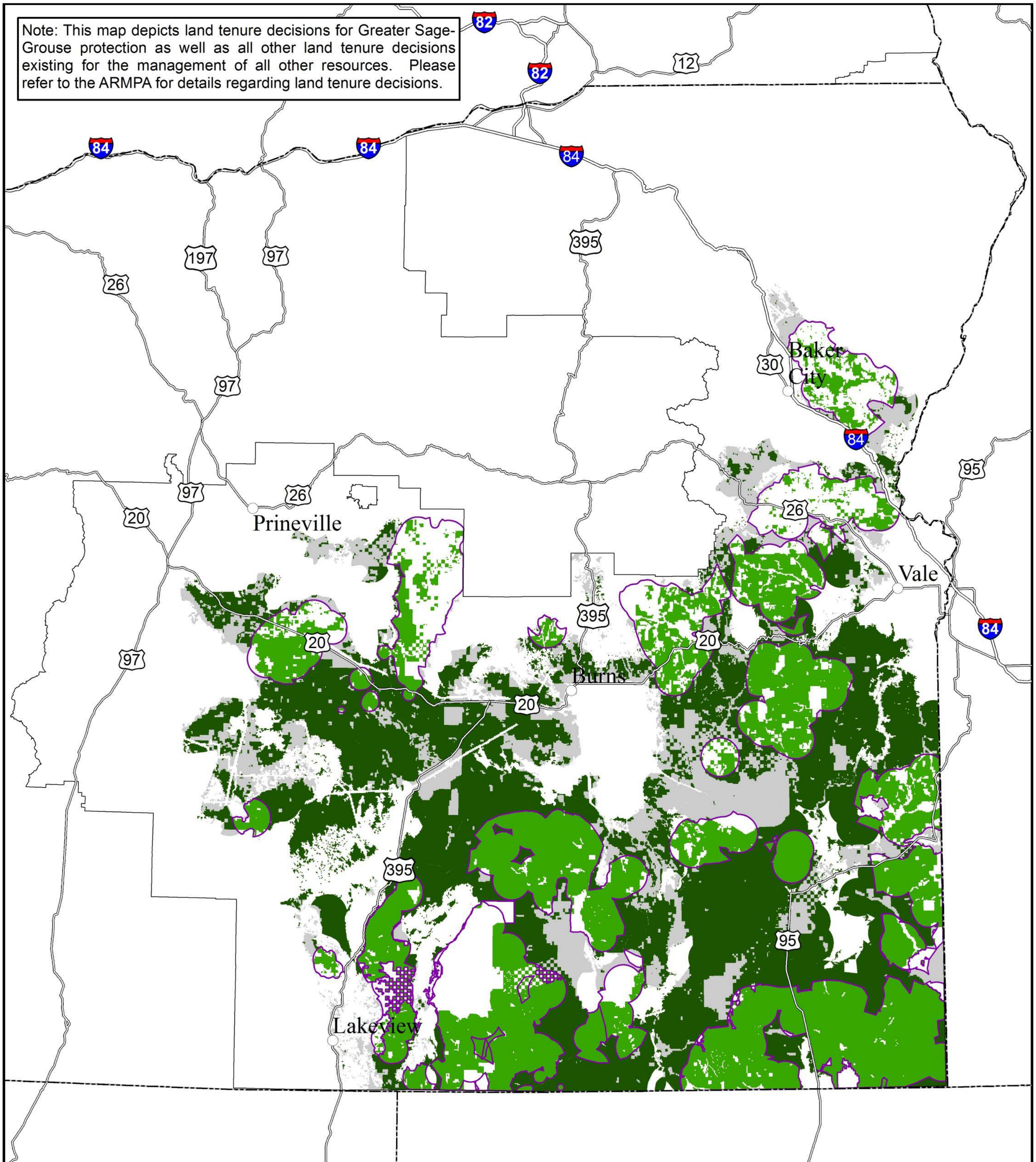


Figure 2-12: Oregon Land Tenure

PHMA GHMA

Outside of BLM Decision Area

Retention

Planning Area Boundary

State Boundary

Miles 0 20 40

September 2015

Map Area

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

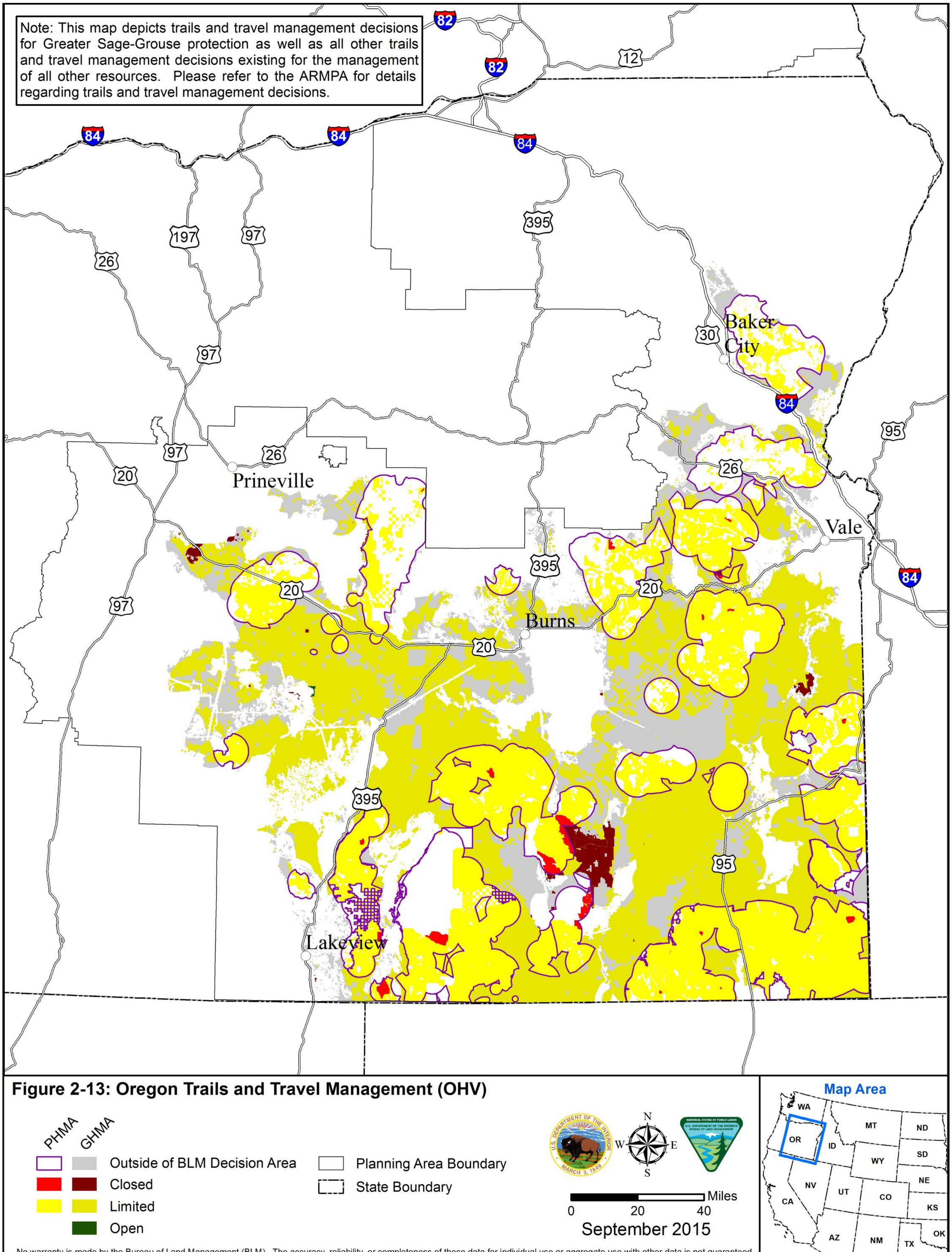


Figure 2-13: Oregon Trails and Travel Management (OHV)

No warranty is made by the Bureau of Land Management (BLM). The accuracy, reliability, or completeness of these data for individual use or aggregate use with other data is not guaranteed.

Appendix B

Lek Buffer Distances

APPENDIX B
LEK BUFFER DISTANCES

APPLYING LEK BUFFER DISTANCES WHEN APPROVING ACTIONS

Buffer Distances and Evaluation of Impacts to Leks

Evaluate impacts to leks from actions requiring NEPA analysis. In addition to any other relevant information determined to be appropriate (e.g. State wildlife agency plans), the BLM will assess and address impacts from the following activities using the lek buffer-distances as identified in the USGS Report *Conservation Buffer Distance Estimates for Greater Sage-Grouse – A Review* (Open File Report 2014-1239). The BLM will apply the lek buffer-distances specified as the lower end of the interpreted range in the report unless justifiable departures are determined to be appropriate (see below). The lower end of the interpreted range of the lek buffer-distances is as follows:

- Linear features (roads) within 3.1 miles of leks.
- Infrastructure related to energy development within 3.1 miles of leks.
- Tall structures (e.g., communication or transmission towers, transmission lines) within 2 miles of leks.
- Low structures (e.g., fences, rangeland structures) within1.2 miles of leks.
- Surface disturbance (continuing human activities that alter or remove the natural vegetation) within 3.1 miles of leks.
- Noise and related disruptive activities including those that do not result in habitat loss (e.g., motorized recreational events) at least 0.25 miles from leks.

Justifiable departures to decrease or increase from these distances, based on local data, best available science, landscape features, and other existing protections (e.g., land use allocations, state regulations) may be appropriate for determining activity impacts. The USGS report recognized "that because of variation in populations, habitats, development patterns, social context, and other factors, for a particular disturbance type, there is no single distance that is an appropriate buffer for all populations and habitats across the sage-grouse range". The USGS report also states that "various protection measures have been developed and implemented… [which have] the ability (alone or in concert with others) to protect important habitats, sustain populations, and support multiple-use demands for public lands". All variations in lek buffer-distances will require appropriate analysis and disclosure as part of activity authorization.

In determining lek locations, the BLM will use the most recent active or occupied lek data available from the state wildlife agency.

For Actions in GHMA
The BLM will apply the lek buffer-distances identified above as required conservation measures to fully address the impacts to leks as identified in the NEPA analysis. Impacts should first be avoided by locating the action outside of the applicable lek buffer-distance(s) identified above.

If it is not possible to relocate the project outside of the applicable lek buffer-distance(s) identified above, the BLM may approve actions in GHMA that are within the applicable lek buffer-distance identified above only if:

- Based on best available science, landscape features, and other existing protections, (e.g., land use allocations, state regulations), the BLM determines that a lek buffer-distance other than the applicable distance identified above offers the same or a greater level of protection to GRSG and its habitat, including conservation of seasonal habitat outside of the analyzed buffer area; or
- The BLM determines that impacts to GRSG and its habitat are minimized such that the project will cause minor or no new disturbance (ex. co-location with existing authorizations); and
- Any residual impacts within the lek buffer-distances are addressed through compensatory mitigation measures sufficient to ensure a net conservation gain, as outlined in the Mitigation Strategy (Appendix E).

For Actions in PHMA
The BLM will apply the lek buffer-distances identified above as required conservation measures to fully address the impacts to leks as identified in the NEPA analysis. Impacts should be avoided by locating the action outside of the applicable lek buffer-distance(s) identified above.

The BLM may approve actions in PHMA that are within the applicable lek buffer-distance identified above only if:

- The BLM, with input from the state fish and wildlife agency, determines, based on best available science, landscape features, and other existing protections, that a buffer distance other than the distance identified above offers the same or greater level of protection to GRSG and its habitat, including conservation of seasonal habitat outside of the analyzed buffer area.

Range improvements which do not impact GRSG, or, range improvements which provide a conservation benefit to GRSG such as fences for protecting important seasonal habitats, meet the lek buffer requirement.

The BLM will explain its justification for determining the approved buffer distances meet these conditions in its project decision.

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Appendix C
Required Design Features and Best Management Practices

APPENDIX C
REQUIRED DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

REQUIRED DESIGN FEATURES

Required Design Features (RDFs) are required for certain activities in all GRSG habitat. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. However, the applicability and overall effectiveness of each RDF cannot be fully assessed until the project level when the project location and design are known. Because of site-specific circumstances, some RDFs may not apply to some projects (e.g., a resource is not present on a given site) or may require slight variations (e.g., a larger or smaller protective area). All variations in RDFs would require that at least one of the following be demonstrated in the NEPA analysis associated with the project or activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project or activity, for example, due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable.
- An alternative RDF, state-implemented conservation measure, or plan-level protection is determined to provide equal or better protection for GRSG or its habitat.
- A specific RDF will provide no additional protection to GRSG or its habitat.

In addition, state-implemented conservation measures or protections may be considered as an alternative in the application of RDFs, as appropriate, on a site specific basis.

The RDFs are applicable to PHMA and GHMA, unless otherwise indicated in the RMPA/EIS alternatives.

Common to All

1. Cluster disturbances, operations and facilities.
2. Minimize authorizations to reduce disturbance to sagebrush habitats.
3. Restrict the construction of fences and tall structures to the minimum number and amount needed. Tall structures are any man-made structure that has the potential to disrupt lekking

or nesting birds by creating perching and nesting opportunities for predators (e.g., raptors and ravens) or that decrease the use of an area by GRSG. This includes communication towers, meteorological towers, electrical transmission or distribution towers, power poles, wind turbines, and associated structures.

4. Design or site permanent structures that create movement (e.g., a pump jack) to minimize impacts on GRSG.
5. Construct new ROWs, tanks, and other structures with perch deterrents or other anti-perching devices, and with structures or devices that discourage raptors and corvids from nesting.
6. Refer to the model by Bryan Stevens (2011) to identify fences that pose a threat to GRSG. Remove any unneeded or unused fences and mark needed fences with anti-strike markers if they pose a threat to the GRSG. Remove or mark fences within 1.2 mile of newly discovered leks that were not included in the model. Update the model when new leks are found (PHMA only).
7. Place new utility developments (power lines and pipelines, for example) and transportation routes in existing utility or transportation corridors.
8. Clean up refuse and eliminate subsidized food sources for GRSG predators.
9. Train all personnel and contractors on GRSG biology, habitat requirements, and identification of local areas used by the birds.
10. Locate on-site work/project camps and staging areas outside of priority habitat (PHMA only).
11. Power wash all vehicles and equipment involved in land and resource management activities prior to allowing them to enter the project area to minimize the introduction and spread of invasive plant species.
12. Use native plant species, locally sourced where available, recognizing that use of nonnative species may be necessary, depending on the availability of native seed and prevailing site conditions.
13. Ensure proposed sagebrush treatments are planned with interdisciplinary input from the BLM or state wildlife agency biologist and promote use by GRSG.
14. Reduce encroaching conifer cover to zero within one mile of all occupied or pending leks and to less than 5 percent within 4 miles of such leks. Retain all trees that originated prior to 1850 (old trees), those that are culturally significant, and trees in active use by special status species (e.g. nest,, den, and roost trees) and all old-growth stands of juniper within 4.0 miles of occupied or pending leks. See OSU Technical Bulletin 152 or its successor for the key characteristics of old trees. Old growth stands are those where the dominant trees in the stand meet the key characteristics for old trees.
15. Focus restoration outward from existing intact habitat.
16. Consider using available organic material or mats to reduce vegetation disturbance for activities and for roads between closely spaced authorizations to reduce soil compaction and maintain soil structure for increasing the likelihood of vegetation reestablishment.

Remove or incorporate cover at the decommissioning stage of the project or authorized use period.

17. Cover, for example, with fine mesh netting or use other effective techniques, all pits and tanks regardless of size to reduce GRSG deaths.
18. Minimize unnecessary cross-country vehicle travel during field and fire operations in GRSG habitat.
19. There will be no disruptive activities two hours before sunset to two hours after sunrise from March 1 through June 30 within 1.0 mile of the perimeter of occupied leks, unless brief occupancy is essential for routine ranch activities (e.g., herding or trailing livestock into or out of an area at the beginning or end of the grazing season). Disruptive activities are those that are likely to alter GRSG behavior or displace birds such that reproductive success is negatively affected or an individual's physiological ability to cope with environmental stress is compromised. Examples of disruptive activities are noise, human foot or vehicle traffic, or other human presence.
20. Remove all branches on cut juniper stumps to prevent regrowth. Remove branches on cut trees that extend more than four feet above the ground or more than one foot above the general height of the sagebrush to eliminate potential perch sites for GRSG predators.

Roads

1. Construct road crossings at a right angle to ephemeral drainages and any stream crossings.
2. Use existing roads or realignments of existing roads to the extent possible.
3. Coordinate road construction and use among ROW holders.
4. Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
5. Locate and build new roads to avoid important areas and habitats.
6. Restrict vehicle traffic on newly constructed project access routes to authorized users, such as through the use of signs and gates, in PHMA only.
7. Use dust abatement practices on roads and pads when authorizing activities where dust abatement is necessary.
8. Eliminate parallel roads travelling to the same destination when the destination can be accessed from the same direction and topography.

Reclamation

1. Maximize the area of interim reclamation on long-term access roads and other disturbances, including reshaping, top soiling, and revegetating cut and fill slopes.
2. Restore disturbed areas at final reclamation and duplicate roads to the predisturbance landforms and desired plant community.
3. Irrigate sites during interim reclamation, if necessary, for the purpose of establishing seedlings more quickly.
4. Use mulching techniques to expedite reclamation and to protect soils.

5. Include restoration objectives to meet GRSG habitat needs during reclamation (Pyke 2011). Address post-reclamation management in reclamation plan so that clear goals and objectives are known to enhance or restore their habitat.

Lands and Realty

Bury distribution power lines and communication lines, preferably within existing disturbance (PHMA only).

Fluid Minerals Development

1. Establish trip restrictions (Lyon and Anderson 2003) or minimization through use of telemetry and remote well control (e.g., supervisory control and data acquisition).
2. Use directional and horizontal drilling to reduce surface disturbance.
3. Apply a phased development approach with concurrent reclamation.
4. Use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use.
5. Use only closed-loop systems for drilling operations and no reserve pits.
6. Remove or reinject produced water to reduce habitat for mosquitoes that vector West Nile virus. If surface disposal of produced water continues, refer to the West Nile virus RDFs, below.
7. Place pipelines, transmission lines, or other infrastructure under or next to a road or other infrastructure first, before locating them with other ROWs.

Fire, Fuels and Vegetation

Vegetation and Fuels Management

1. Where applicable, design treatment objectives to protect existing sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patterns that most benefit GRSG habitat.
2. When treating dense sagebrush with prescribed fire:
    a. Design burn prescriptions to limit fire spread
    b. Target individual sagebrush plants or small patches of sagebrush with at least 50 percent dead crown
    c. Ensure burn patches are well distributed through the treatment block
    d. In warm-dry sagebrush, do not count burn patches of less than a quarter-acre toward the maximum allowed stand replacement area
    e. In cool-moist sagebrush, do not count burn patches of less than half an acre toward the maximum allowed stand replacement area
3. Use burning prescriptions that minimize undesirable effects on vegetation or soils (e.g., minimize destruction of desirable perennial plant species and reduce risk of annual grass invasion by retaining biological crusts).

4. Use native plant species, locally sourced where available, recognizing that use of nonnative species may be necessary to achieve site-specific management objectives.
5. Fuel Breaks:
    a. Incorporate roads and natural fuel breaks into fuel break design, where applicable
    b. Design fuel breaks in areas of high fire frequency to facilitate firefighter safety, reduce the potential acres burned, and reduce the fire risk to GRSG habitat
    c. Develop maps of existing fuel breaks in relation to GRSG habitat to assist wildfire response activities
    d. Use perennial vegetation (e.g., green strips) paralleling road rights-of-way
    e. Incorporate key habitats or important restoration areas (such as where investments in restoration have already been made) in fuel break design

Fire Operations

1. Compile BLM District level GRSG information into state-wide tool boxes. Tool boxes should contain maps, a list of resource advisors, contact information, local guidance, and other relevant information for each BLM District, which will be aggregated into a state-wide document.
2. Assign a resource advisor with GRSG expertise, or who has access to GRSG expertise, to all extended attack fires in or near GRSG habitat. Prior to the fire season, provide training to GRSG resource advisors on wildfire suppression organization, objectives, tactics, and procedures to develop a cadre of qualified individuals. Involve ODFW in fire operations through use of the following:
    a. Instructing resource advisors during preseason trainings
    b. Ascertaining their qualification as resource advisors
    c. Coordinating with resource advisors during fires
    d. Contributing to incident planning with such information as habitat features or other key data useful in fire decision-making
3. On critical fire weather days, position additional fire suppression resources to optimize a quick and efficient response in GRSG habitat areas.
4. Use existing fuel breaks, such as roads or discrete changes in fuel type, as control lines in order to minimize fire spread.
5. During periods of multiple fires, ensure line officers are involved in setting priorities.
6. Minimize burnout operations in key GRSG habitat areas by constructing direct fire lines whenever safe and practical to do so.
7. Use retardant, mechanized equipment, and other available resources to minimize burned acreage.
8. When safe, maintain and protect areas of unburned islands and fingers of sagebrush and treat these areas as a highly valued resource to be protected. Safe and risk-based use of

aircraft and mechanized equipment should be considered in order to keep fire from burning out these islands.

9. On all fires, clearly document the following as they apply:
    a. Locations and sizes of burnout operations, mechanical fire lines, and retardant drops
    b. Interagency coordination concerning the strategy and tactics used
    c. Resource advisors used (name and whether GRSG qualified; see RDF #2, above)
    d. Summaries of weather and fire behavior, particularly during major fire growth events
    e. Whether ES&R is anticipated to occur
10. Coordinate with rangeland fire protection associations (RFPAs) and rural fire protection districts (RFPDs) to increase initial attack and extended attack capability and effectiveness.
    a. Establish minimum requirements for personal protective equipment (PPE), training, experience and qualifications, physical fitness levels, and currency standards for wildland fire positions, which all participating agencies agree to meet (NWCG 310-1)
    b. Assist RFPAs and RFPDs in meeting agreed on minimum standards by providing joint training and development opportunities.
    c. Develop interagency training exercises with local, state, and federal agencies to enhance safety, coordination, communication, and effectiveness during fire management operations
    d. Within 5 years, incorporate RFPAs into the interagency "closest forces" protocol for dispatching qualified firefighting resources to initial attack wildfires.
11. Locate wildfire suppression facilities—base camps, spike camps, drop points, staging areas, and helicopter landing areas—in areas where physical disturbance to GRSG habitat can be minimized. These include disturbed areas, grasslands, near roads/trails, or in other areas where there is existing disturbance or minimal sagebrush cover.

Livestock Grazing

1. Do not place salt or mineral supplements within 1.2 miles of the perimeter of an occupied lek.
2. Do not concentrate livestock in nesting habitat or leks from March 1 through June 30. The timing and location of livestock turnout and trailing should not contribute to livestock concentrations on leks during the GRSG breeding season.
3. Locate new or relocate existing livestock water developments within GRSG habitat to maintain or enhance habitat quality.
4. Construct or modify spring developments to maintain their free-flowing, natural, and wet meadow characteristics.
5. Fence wetlands (e.g., springs, seeps, wet meadows, and riparian areas) to maintain or foster progress toward PFC and to facilitate management of GRSG habitat objectives. Where

constructing fences or exclosures to improve riparian or upland management, incorporate fence marking or other BMPs/RDFs as appropriate.

6. Ensure wildlife accessibility to water and install escape ramps in all new and existing water troughs.
7. Construct new livestock facilities, such as livestock troughs, fences, corrals, handling facilities, and "dusting bags," at least 1.2 miles from leks or other important areas of GRSG habitat (i.e., wintering and brood-rearing areas) to avoid concentrating livestock, collision hazards to flying birds, or avian predator perches.
8. Place new taller structures, including corrals, loading facilities, water storage tanks, windmills, out of the line of sight or at least 1.2 miles from occupied leks, where such structures would increase the risk of avian predation.

Noise (RDFs apply to all activities)

1. Limit noise at the perimeter of occupied or pending leks from two hours before to two hours after sunrise and sunset during the breeding season to less than 10 decibels above ambient sound levels.
2. Require noise shields for noise creating authorizations, such as drilling.
3. Locate new compressor stations and other authorized noise-creating equipment outside priority habitats and design them to reduce noise that may be directed toward priority habitat.

West Nile Virus

1. Restrict pit and impoundment construction to reduce or eliminate threats from West Nile virus (Doherty 2007).
2. Use the following steps for reservoir design to limit favorable mosquito habitat:
    a. Overbuild size of ponds for muddy and unvegetated shorelines
    b. Build steep shorelines to decrease vegetation and increase wave actions
    c. Avoid flooding terrestrial vegetation in flat terrain or low-lying areas
    d. Construct dams or impoundments that restrict downslope seepage or overflow
    e. Line the channel where discharge water flows into the pond with crushed rock
    f. Construct spillways with steep sides and line them with crushed rock
    g. In areas experiencing a West Nile virus outbreak, treat waters with larvicides to reduce mosquito production

Locatable Minerals Development (RDFs apply to locatable minerals to the extent consistent with applicable law)

Roads

1. Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
2. Locate and build new roads to avoid important areas and habitats.

3. Coordinate road construction and use among ROW holders.
4. Construct road crossing at right angles to ephemeral drainages and any stream crossings.
5. Restrict vehicle traffic on newly constructed project access routes to authorized users, such as through the use of signs and gates in PHMA only.
6. Use dust abatement practices on roads and pads when authorizing activities where dust abatement is necessary.
7. Eliminate parallel roads travelling to the same destination when the destination can be accessed from the same direction and topography.

Operations

1. Cluster disturbances, operations, and facilities.
2. Place pipelines, transmission lines, or other infrastructure under or next to a road or other infrastructure first, before collocating them with other ROWs.
3. Restrict the construction of fences and tall facilities to the minimum number needed. Tall structures are any man-made structure that could disrupt lekking or nesting birds by creating perching/nesting opportunities for predators, such as raptors and ravens, or decrease the use of an area by GRSG. This includes communication towers, meteorological towers, electrical transmission or distribution towers, power poles, wind turbines, and associated structures.
4. Minimize authorizations to reduce disturbance to sagebrush habitats.
5. Place new utility developments, such as power lines and pipelines, and transportation routes in existing utility or transportation corridors.
6. Bury distribution power and communication lines, preferably within existing disturbed areas (PHMA only).
7. Cover, for example, with fine-mesh netting, or use other effective techniques on all pits (mining-related water filled impoundment) and tanks regardless of size to reduce GRSG deaths.
8. Construct new ROWs, tanks, and other structures with perch deterrents or other anti-perching devices and with structures or devices that discourage nesting raptors and corvids.
9. Use native plant species, locally sourced where available, recognizing that use of nonnative species may be necessary, depending on the availability of native seed and prevailing site conditions.
10. Restrict pit and impoundment construction to reduce or eliminate threats from West Nile virus (Doherty 2007).
11. Remove or reinject produced water to reduce habitat for mosquitoes that vector West Nile virus. If surface disposal of produced water continues, use the following steps for reservoir design to limit favorable mosquito habitat:
    a. Overbuild size of ponds for muddy and unvegetated shorelines
    b. Build steep shorelines to decrease vegetation and increase wave actions

c. Avoid flooding terrestrial vegetation in flat terrain or low-lying areas

d. Construct dams or impoundments that restrict downslope seepage or overflow

e. Line the channel where discharge water flows into the pond with crushed rock

f. Construct spillways with steep sides and line them with crushed rock

g. In areas experiencing a West Nile virus outbreak, treat waters with larvicides to reduce mosquito production

12. Require GRSG-safe fences around sumps.

13. Clean up refuse and eliminate subsidized food sources for GRSG predators.

14. Locate on-site work/project camps outside of priority GRSG (PHMA only).

Reclamation

1. Include restoration objectives to meet GRSG habitat needs during reclamation. Address post-reclamation management in reclamation plan so that goals and objectives are to enhance and restore GRSG habitat.

2. Maximize the area of interim reclamation on long-term access roads and well pads, including reshaping, top soiling, and revegetating cut and fill slopes.

3. Restore disturbed areas at final reclamation to predisturbance landform and desired plant community.

4. Irrigate sites during interim reclamation, if necessary, to establish seedlings more quickly.

5. Use mulch to expedite reclamation and protect soils.

BEST MANAGEMENT PRACTICES

Most management actions and practices specifically applicable to GRSG and the purpose and need of this document are addressed in the RDF portion of this appendix. The following best management practices (BMPs) are additional management actions and practices. They were developed from the National Technical Team (NTT) Report and other sources and are also BMPs for Alternatives B, C, D, and F, and the Proposed Plan in the RMPA/EIS.

The BMPs are applicable to PHMA and GHMA unless otherwise indicated.

Post-Fire and Restoration Seeding

1. Use ecological site descriptions to determine appropriate seed mixes. Seed mixes should include a diversity of forbs that maximize blooming times when pollinators are most active and include nectar and pollen-producing plants.

2. When using locally collected seed, handle and store it properly to maintain maximum viability.

3. When using nonnative grasses, do not mix crested wheatgrass (*Agropyron cristatum* or *A. desertorum*) with native perennial grass species. If crested wheatgrass is needed to compete with invasive annual grasses, use a nonnative grass mix.

4. Prefer minimum-till and standard drill seeding to aerial or broadcast seeding, particularly to control invasive annual grasses. Where possible, prefer minimum-till drill seeding to standard drill seeding.
5. Where live Sandberg bluegrass (*Poa secunda*) is well distributed post-fire or after vegetation treatment, do not drill seed; this is because drill seeding reduces surviving Sandberg bluegrass with little concomitant establishment of seeded grass species.
6. In areas where average annual precipitation is less than 10 to 12 inches, test alternative and experimental methods, such as use of coated seed, to establish perennial grasses, particularly when using native species. Limit seeding to priority areas within these low precipitation zones to meet vegetation objectives, and favor drought-tolerant forbs and grasses.
7. Prefer planting sagebrush and other shrubs to aerial or drill seeding until alternative methods for seeding are developed. Plant on microsites with a higher probability of success, such as at higher elevation, on northerly aspects, higher precipitation zones, or in deeper soils to create sagebrush patches rather than uniform spacing of individuals.
8. In large burn areas or similar settings, where all or nearly all sagebrush has been lost and where annual grass dominance is considered unlikely, plant sagebrush as scattered islands. Exclude such areas from grazing by domestic livestock and wild horses and burros until sagebrush establishment objectives are met.
9. Focus seeding treatments within 4 miles of occupied and pending leks and lek complexes with designated PHMA as a higher priority than designated GHMA. Within PHMA, higher priority areas to treat are leks or lek complexes with a higher number of birds, on average, and leks or lek complexes with stable or increasing GRSG populations.
10. Perennial grass should be seeded at no more than 3 to 5 pounds per acre as pure live seed if big sagebrush establishment is one of the treatment objectives.
11. Limit forage kochia use to fuel breaks, road edges, under power lines and other areas expected to see regular disturbance, such as mowing, as part of the maintenance needed to maintain the function of the site. Forage kochia may be used in other areas on a case-by-case basis; document the rationale for why forage kochia is needed and why a native species cannot be used instead.
12. Rest seeded and planted areas from grazing by livestock for at least two growing seasons. When possible, exclude seeded or planted areas from wild horses and burros as well. Grazing should not resume until vegetation objectives have been met. Plans must clearly describe the vegetation objectives and how attainment will be measured and determined.

West Nile Virus

Fence pond site to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure, and create hoof print pockets of water that are attractive to breeding mosquitoes.

Livestock Grazing

Restrict off-trail vehicle use, where authorized, to areas more than 2 miles from leks during the breeding season, unless travel is essential for routine ranch activities, such as repairing fence, "doctoring" livestock, and finding lost livestock.

Travel Management

1. Allow primitive roads to be reclaimed naturally and where necessary use pitting, water bars, or vertical mulch to create physical structures that accelerate native vegetation growth.
2. If possible, attempt to disguise road entrances to discourage use, by using vertical mulch, native seeding, and natural barriers that blend in with the natural surroundings.
3. Inspect closed roads to ensure that vegetation stabilization measures are operating as planned, drainage structures are operational, and noxious weeds are not providing erosion control. Conduct vegetation treatments and drainage structure maintenance as needed.
4. Fully decommission or obliterate temporary roads on completion of use.
5. Consider decommissioning low-volume permanent roads not needed for future resource management located in or draining into wetlands, riparian management areas, floodplains, or Waters of the State.
6. Prevent vehicular traffic, using such methods as gates, guardrails, or earth/log barricades, to reduce or eliminate erosion and sedimentation due to traffic on roads, when possible.
7. Convert existing drainage structures, such as ditches and cross drain culverts, to a long-term maintenance-free drainage configuration, such as out-sloped road surface and water bars.
8. Remove stream crossing culverts and entire in-channel fill material during any ODFW instream work period.
9. Place excavated material from removed stream crossings on stable ground outside of wetlands, riparian management areas, floodplains, and Waters of the State. In some cases, use material for recontouring old road cuts or spread it across roadbeds and treat them to prevent erosion.
10. Reestablish stream crossings to the natural stream gradient. Excavate sideslopes back to the natural bank profile. Reestablish natural channel width and floodplain.
11. On each side of a stream crossing, construct water bars or cross ditches that will remain maintenance free.
12. Following culvert removal and prior to the wet season, apply erosion control and sediment trapping measures (e.g., seeding, mulching, straw bales, jute netting, native vegetative cuttings) where sediment can be delivered into wetlands, riparian management areas, floodplains, and Waters of the State.[1] Implement decompaction measures, including ripping or subsoiling to an effective depth. Treat compacted areas, including the roadbed, landings, construction areas, and spoils sites.

[1] Be aware that some desert soils do better with no decompaction, such as aridisoils. These soils often have near surface layers that retain water, while physical treatments, such as ripping may disturb those layers; always consult your soils scientist.

13. After decompacting the road surface, pull back unstable road fill and either end-haul or recontour to the natural slopes.
14. On active haul roads, during the wet season, use durable rock surfacing and sufficient surface depth to resist rutting or development of sediment on road surfaces that drain directly to wetlands, floodplains, and Waters of the State.
15. Prior to winter hauling, implement structural road treatments; examples of this are increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and cleaning and armoring ditchlines.
16. Suspend commercial use where the road surface is deeply rutted or covered by a layer of mud or when runoff from the road surface is visibly increasing stream turbidity in the receiving stream.

Appendix D
Monitoring Framework

THE GREATER SAGE-GROUSE MONITORING FRAMEWORK

Bureau of Land Management
U.S. Forest Service

The Greater Sage-Grouse Monitoring Framework

Developed by the Interagency Greater Sage-Grouse Disturbance and Monitoring Subteam

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INTRODUCTION

The purpose of this U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS) Greater Sage-Grouse Monitoring Framework (hereafter, monitoring framework) is to describe the methods to monitor habitats and evaluate the implementation and effectiveness of the BLM's national planning strategy (attachment to BLM Instruction Memorandum 2012-044), the BLM resource management plans (RMPs), and the USFS's land management plans (LMPs) to conserve the species and its habitat. The regulations for the BLM (43 CFR 1610.4-9) and the USFS (36 CFR part 209, published July 1, 2010) require that land use plans establish intervals and standards, as appropriate, for monitoring and evaluations based on the sensitivity of the resource to the decisions involved. Therefore, the BLM and the USFS will use the methods described herein to collect monitoring data and to evaluate implementation and effectiveness of the Greater Sage-Grouse (GRSG) (hereafter, sage-grouse) planning strategy and the conservation measures contained in their respective land use plans (LUPs). A monitoring plan specific to the Environmental Impact Statement, land use plan, or field office will be developed after the Record of Decision is signed. For a summary of the frequency of reporting, see Attachment A, An Overview of Monitoring Commitments. Adaptive management will be informed by data collected at any and all scales.

To ensure that the BLM and the USFS are able to make consistent assessments about sage-grouse habitats across the range of the species, this framework lays out the methodology—at multiple scales—for monitoring of implementation and disturbance and for evaluating the effectiveness of BLM and USFS actions to conserve the species and its habitat. Monitoring efforts will include data for measurable quantitative indicators of sagebrush availability, anthropogenic disturbance levels, and sagebrush conditions. Implementation monitoring results will allow the BLM and the USFS to evaluate the extent that decisions from their LUPs to conserve sage-grouse and their habitat have been implemented. State fish and wildlife agencies will collect population monitoring information, which will be incorporated into effectiveness monitoring as it is made available.

This multiscale monitoring approach is necessary, as sage-grouse are a landscape species and conservation is scale-dependent to the extent that conservation actions are implemented within seasonal habitats to benefit populations. The four orders of habitat selection (Johnson 1980) used in this monitoring framework are described by Connelly et al. (2003) and were applied specifically to the scales of sage-grouse habitat selection by Stiver et al. (*in press)* as first order (broad scale), second order (mid scale), third order (fine scale), and fourth order (site scale). Habitat selection and habitat use by sage-grouse occur at multiple scales and are driven by multiple environmental and behavioral factors. Managing and monitoring sage-grouse habitats are complicated by the differences in habitat selection across the range and habitat use by individual birds within a given season. Therefore, the tendency to look at a single indicator of habitat suitability or only one scale limits managers' ability to identify the threats to sage-grouse and to respond at the appropriate scale. For descriptions of these habitat suitability indicators for each scale, see "Sage-Grouse Habitat Assessment Framework: Multiscale Habitat Assessment Tool" (HAF; Stiver et al. *in press*).

Monitoring methods and indicators in this monitoring framework are derived from the current peer-reviewed science. Rangewide, best available datasets for broad- and mid-scale monitoring will be acquired. If these existing datasets are not readily available or are inadequate, but they are necessary to inform the indicators of sagebrush availability, anthropogenic disturbance levels, and sagebrush conditions, the BLM and the USFS will strive to develop datasets or obtain information to fill these data gaps. Datasets that are not readily available to inform the fine- and site-scale indicators will be developed. These data will be used to generate monitoring reports at the appropriate and applicable geographic scales, boundaries, and analysis units: across the range of sage-grouse as defined by Schroeder et al. (2004), and clipped by Western Association of Fish and Wildlife Agencies (WAFWA) Management Zone (MZ) (Stiver et al. 2006) boundaries and other areas as appropriate for size (e.g., populations based on Connelly et al. 2004). (See Figure 1, Map of Greater Sage-Grouse range, populations, subpopulations, and Priority Areas for Conservation as of 2013.) This broad- and mid-scale monitoring data and analysis will provide context for RMP/LMP areas; states; GRSG Priority Habitat, General Habitat, and other sage-grouse designated management areas; and Priority Areas for Conservation (PACs), as defined in "Greater Sage-grouse *(Centrocercus urophasianus)* Conservation Objectives: Final Report" (Conservation Objectives Team [COT] 2013). Hereafter, all of these areas will be referred to as "sage-grouse areas."

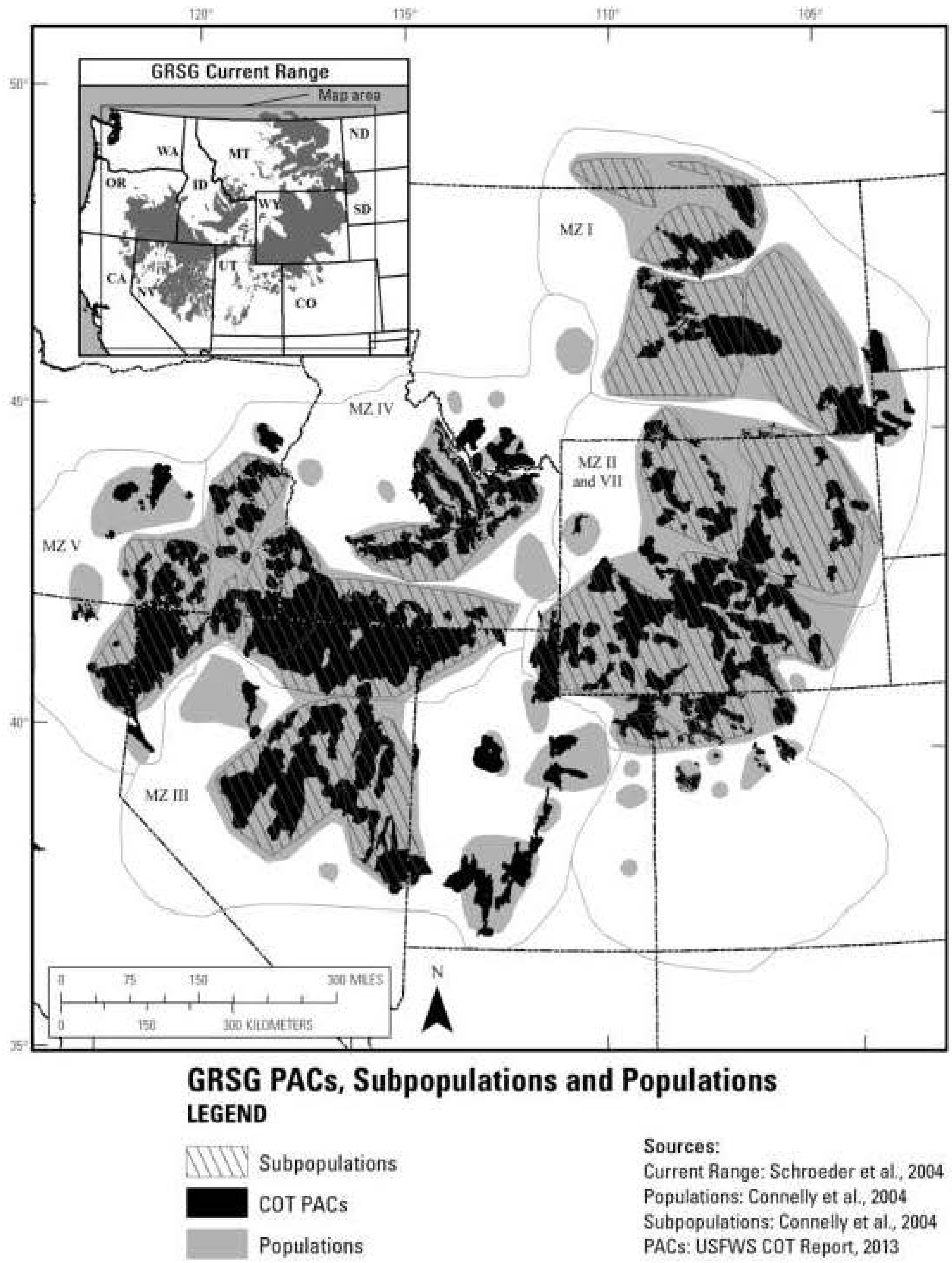

Figure 1. Map of Greater Sage-Grouse range, populations, subpopulations, and Priority Areas for Conservation as of 2013.

This monitoring framework is divided into two sections. The broad- and mid-scale methods, described in Section I, provide a consistent approach across the range of the species to monitor implementation decisions and actions, mid-scale habitat attributes (e.g., sagebrush availability and habitat degradation), and population changes to determine the effectiveness of the planning strategy and management decisions. (See Table 1, Indicators for monitoring implementation of the national planning strategy, RMP/LMP decisions, sage-grouse habitat, and sage-grouse populations at the broad and mid scales.) For sage-grouse habitat at the fine and site scales, described in Section II, this monitoring framework describes a consistent approach (e.g., indicators and methods) for monitoring sage-grouse seasonal habitats. Funding, support, and dedicated personnel for broad- and mid-scale monitoring will be renewed annually through the normal budget process. For an overview of BLM and USFS multiscale monitoring commitments, see Attachment A.

Table 1. Indicators for monitoring implementation of the national planning strategy, RMP/LMP decisions, sage-grouse habitat, and sage-grouse populations at the broad and mid scales.

	Implementation	Habitat		Population (State Wildlife Agencies)
Geographic Scales		Availability	Degradation	Demographics
Broad Scale: From the range of sage-grouse to WAFWA Management Zones	BLM/USFS National planning strategy goal and objectives	Distribution and amount of sagebrush within the range	Distribution and amount of energy, mining, and infrastructure facilities	WAFWA Management Zone population trend
Mid Scale: From WAFWA Management Zone to populations; PACs	RMP/LMP decisions	Mid-scale habitat indicators (HAF; Table 2 herein, e.g., percent of sagebrush per unit area)	Distribution and amount of energy, mining, and infrastructure facilities (Table 2 herein)	Individual population trend

I. BROAD AND MID SCALES

First-order habitat selection, the broad scale, describes the physical or geographical range of a species. The first-order habitat of the sage-grouse is defined by populations of sage-grouse associated with sagebrush landscapes, based on Schroeder et al. 2004, and Connelly et al. 2004, and on population or habitat surveys since 2004. An intermediate scale between the broad and mid scales was delineated by WAFWA from floristic provinces within which similar environmental factors influence vegetation communities. This scale is referred to as the WAFWA Sage-Grouse Management Zones (MZs). Although no indicators are specific to this scale, these MZs are biologically meaningful as reporting units.

Second-order habitat selection, the mid-scale, includes sage-grouse populations and PACs. The second order includes at least 40 discrete populations and subpopulations (Connelly et al. 2004). Populations range in area from 150 to 60,000 mi^2 and are nested within MZs. PACs range from 20 to 20,400 mi^2 and are nested within population areas.

Other mid-scale landscape indicators, such as patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (Stiver et al. *in press*) will also be assessed. The methods used to calculate these metrics will be derived from existing literature (Knick et al. 2011, Leu and Hanser 2011, Knick and Hanser 2011).

A. Implementation (Decision) Monitoring

Implementation monitoring is the process of tracking and documenting the implementation (or the progress toward implementation) of RMP/LMP decisions. The BLM and the USFS will monitor implementation of project-level and/or site-specific actions and authorizations, with their associated conditions of approval/stipulations for sage-grouse, spatially (as appropriate) within Priority Habitat, General Habitat, and other sage-grouse designated management areas, at a minimum, for the planning area. These actions and authorizations, as well as progress toward completing and implementing activity-level plans, will be monitored consistently across all planning units and will be reported to BLM and USFS headquarters annually, with a summary report every 5 years, for the planning area. A national-level GRSG Land Use Plan Decision Monitoring and Reporting Tool is being developed to describe how the BLM and the USFS will consistently and systematically monitor and report implementation-level activity plans and implementation actions for all plans within the range of sage-grouse. A description of this tool for collection and reporting of tabular and spatially explicit data will be included in the Record of Decision or approved plan. The BLM and the USFS will provide data that can be integrated with other conservation efforts conducted by state and federal partners.

B. Habitat Monitoring

The U.S. Fish and Wildlife Service (USFWS), in its 2010 listing decision for the sage-grouse, identified 18 threats contributing to the destruction, modification, or curtailment of sage-grouse habitat or range (75 FR 13910 2010). The BLM and the USFS will, therefore, monitor the relative extent of these threats that remove sagebrush, both spatially and temporally, on all lands within an analysis area, and will report on amount, pattern, and condition at the appropriate and applicable geographic scales and boundaries. These 18 threats have been aggregated into three broad- and mid-scale measures to account for whether the threat predominantly removes sagebrush or degrades habitat. (See Table 2, Relationship between the 18 threats and the three habitat disturbance measures for monitoring.) The three measures are:

Measure 1: Sagebrush Availability (percent of sagebrush per unit area)

Measure 2: Habitat Degradation (percent of human activity per unit area)

Measure 3: Energy and Mining Density (facilities and locations per unit area)

These three habitat disturbance measures will evaluate disturbance on all lands, regardless of land ownership. The direct area of influence will be assessed with the goal of accounting for actual removal of sagebrush on which sage-grouse depend (Connelly et al. 2000) and for habitat degradation as a surrogate for human activity. Measure 1 (sagebrush availability) examines where disturbances have removed plant communities that support sagebrush (or have broadly removed sagebrush from the landscape). Measure 1, therefore, monitors the change in sagebrush availability—or, specifically, where and how much of the sagebrush community is available within the range of sage-grouse. The sagebrush community is defined as the ecological systems that have the capability of supporting sagebrush vegetation and seasonal sage-grouse habitats within the range of sage-grouse (see Section I.B.1., Sagebrush Availability). Measure 2 (see Section I.B.2., Habitat Degradation Monitoring) and Measure 3 (see Section I.B.3., Energy and Mining Density) focus on where habitat degradation is occurring by using the footprint/area of direct disturbance and the number of facilities at the mid scale to identify the relative amount of degradation per geographic area of interest and in areas that have the capability of supporting sagebrush and seasonal sage-grouse use. Measure 2 (habitat degradation) not only quantifies footprint/area of direct disturbance but also establishes a surrogate for those threats most likely to have ongoing activity. Because energy development and mining activities are typically the most intensive activities in sagebrush habitat, Measure 3 (the density of active energy development, production, and mining sites) will help identify areas of particular concern for such factors as noise, dust, traffic, etc. that degrade sage-grouse habitat.

Table 2. Relationship between the 18 threats and the three habitat disturbance measures for monitoring**.**

Note: Data availability may preclude specific analysis of individual layers. See the detailed methodology for more information.

USFWS Listing Decision Threat	**Sagebrush Availability**	**Habitat Degradation**	**Energy and Mining Density**
Agriculture	X		
Urbanization	X		
Wildfire	X		
Conifer encroachment	X		
Treatments	X		
Invasive Species	X		
Energy (oil and gas wells and development facilities)		X	X
Energy (coal mines)		X	X
Energy (wind towers)		X	X
Energy (solar fields)		X	X
Energy (geothermal)		X	X
Mining (active locatable, leasable, and saleable developments)		X	X
Infrastructure (roads)		X	
Infrastructure (railroads)		X	
Infrastructure (power lines)		X	
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Other developed rights-of-way		X	

The methods to monitor disturbance found herein differ slightly from methods used in Manier et al. 2013, which provided a baseline environmental report (BER) of datasets of disturbance across jurisdictions. One difference is that, for some threats, the BER data were for federal lands only. In addition, threats were assessed individually, using different assumptions from those in this monitoring framework about how to quantify the location and magnitude of threats. The methodology herein builds on the BER methodology and identifies datasets and procedures to use the best available data across the range of the sage-grouse and to formulate a consistent approach to quantify impact of the threats through time. This methodology also describes an approach to combine the threats and calculate each of the three habitat disturbance measures.

B.1. Sagebrush Availability (Measure 1)

Sage-grouse populations have been found to be more resilient where a percentage of the landscape is maintained in sagebrush (Knick and Connelly 2011), which will be determined by sagebrush availability. Measure 1 has been divided into two submeasures to describe sagebrush availability on the landscape:

> Measure 1a: the current amount of sagebrush on the geographic area of interest, and
>
> Measure 1b: the amount of sagebrush on the geographic area of interest compared with the amount of sagebrush the landscape of interest could ecologically support.

Measure 1a (the current amount of sagebrush on the landscape) will be calculated using this formula: [the existing updated sagebrush layer] divided by [the geographic area of interest]. The appropriate geographic areas of interest for sagebrush availability include the species' range, WAFWA MZs, populations, and PACs. In some cases these sage-grouse areas will need to be aggregated to provide an estimate of sagebrush availability with an acceptable level of accuracy.

Measure 1b (the amount of sagebrush for context within the geographic area of interest) will be calculated using this formula: [existing sagebrush divided by [pre-EuroAmerican settlement geographic extent of lands that could have supported sagebrush]. This measure will provide information to set the context for a given geographic area of interest during evaluations of monitoring data. The information could also be used to inform management options for restoration or mitigation and to inform effectiveness monitoring.

The sagebrush base layer for Measure 1 will be based on geospatial vegetation data adjusted for the threats listed in Table 2. The following subsections of this monitoring framework describe the methodology for determining both the current availability of sagebrush on the landscape and the context of the amount of sagebrush on the landscape at the broad and mid scales.

a. Establishing the Sagebrush Base Layer

The current geographic extent of sagebrush vegetation within the rangewide distribution of sage-grouse populations will be ascertained using the most recent version of the Existing Vegetation Type (EVT) layer in LANDFIRE (2013). LANDFIRE EVT was selected to serve as the sagebrush base layer for five reasons: 1) it is the only nationally consistent vegetation layer that has been updated multiple times since 2001; 2) the ecological systems classification within LANDFIRE EVT includes multiple sagebrush type classes that, when aggregated, provide a more accurate (compared with individual classes) and seamless sagebrush base layer across jurisdictional boundaries; 3) LANDFIRE performed a rigorous accuracy assessment from which to derive the rangewide uncertainty of the sagebrush base layer; 4) LANDFIRE is consistently used in several recent analyses of sagebrush habitats (Knick et al. 2011, Leu and Hanser 2011, Knick and Hanser 2011); and 5) LANDFIRE EVT can be compared against the geographic extent of lands that are believed to have had the capability of supporting sagebrush vegetation pre-EuroAmerican settlement [LANDFIRE Biophysical Setting (BpS)]. This fifth reason provides a reference point for understanding how much sagebrush currently remains in a defined geographic area of interest compared with how much sagebrush existed historically (Measure 1b). Therefore, the BLM and the USFS have determined that LANDFIRE provides the best available data at broad and mid scales to serve as a sagebrush base layer for monitoring changes in the geographic extent of sagebrush. The BLM and the USFS, in addition to aggregating the sagebrush types into the sagebrush base layer, will aggregate the accuracy assessment reports from LANDFIRE to document the cumulative accuracy for the sagebrush base layer. The BLM—through its Assessment, Inventory, and Monitoring (AIM) program and, specifically, the BLM's landscape monitoring framework (Taylor et al. 2014)—will provide field data to the LANDFIRE program to support continuous quality improvements of the LANDFIRE EVT layer. The sagebrush layer based on LANDFIRE EVT will allow for the mid-scale estimation of the existing percent of sagebrush across a variety of reporting units. This sagebrush base layer will be adjusted by changes in land cover and successful restoration for future calculations of sagebrush availability (Measures 1a and 1b).

This layer will also be used to determine the trend in other landscape indicators, such as patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (Stiver et al. *in press*). In the future, changes in sagebrush availability, generated annually, will be included in the sagebrush base layer. The landscape metrics will be recalculated to examine changes in pattern and abundance of sagebrush at the various geographic boundaries. This information will be included in effectiveness monitoring (See Section I.D., Effectiveness Monitoring).

Within the USFS and the BLM, forest-wide and field office–wide existing vegetation classification mapping and inventories are available that provide a much finer level of data than what is provided through LANDFIRE. Where available, these finer-scale products will be useful for additional and complementary mid-scale indicators and local-scale analyses (see Section II, Fine and Site Scales). The fact that these products are not available everywhere limits their utility for monitoring at the broad and mid scale, where consistency of data products is necessary across broader geographies.

Data Sources for Establishing and Monitoring Sagebrush Availability

There were three criteria for selecting the datasets for establishing and monitoring the change in sagebrush availability (Measure 1):

- Nationally consistent dataset available across the range
- Known level of confidence or accuracy in the dataset
- Continual maintenance of dataset and known update interval

Datasets meeting these criteria are listed in Table 3, Datasets for establishing and monitoring changes in sagebrush availability.

LANDFIRE Existing Vegetation Type (EVT) Version 1.2

LANDFIRE EVT represents existing vegetation types on the landscape derived from remote sensing data. Initial mapping was conducted using imagery collected in approximately 2001. Since the initial mapping there have been two update efforts: version 1.1 represents changes before 2008, and version 1.2 reflects changes on the landscape before 2010. Version 1.2 will be used as the starting point to develop the sagebrush base layer.

Sage-grouse subject matter experts determined which of the ecological systems from the LANDFIRE EVT to use in the sagebrush base layer by identifying the ecological systems that have the capability of supporting sagebrush vegetation and that could provide suitable seasonal habitat for the sage-grouse. (See Table 4, Ecological systems in BpS and EVT capable of supporting sagebrush vegetation and capable of providing suitable seasonal habitat for Greater Sage-Grouse.) Two additional vegetation types that are not ecological systems were added to the EVT: *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance and *Quercus gambelii* Shrubland Alliance. These alliances have species composition directly related to the Rocky Mountain Lower Montane-Foothill Shrubland ecological system and the Rocky Mountain Gambel Oak-Mixed Montane Shrubland ecological system, both of which are ecological systems in LANDFIRE BpS. In LANDFIRE EVT, however, in some map zones, the Rocky Mountain Lower Montane-Foothill Shrubland ecological system and the Rocky Mountain Gambel Oak-Mixed Montane Shrubland ecological system were named *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance and *Quercus gambelii* Shrubland Alliance, respectively.

Table 3. Datasets for establishing and monitoring changes in sagebrush availability.

Dataset	Source	Update Interval	Most Recent Version Year	Use
BioPhysical Setting v1.1	LANDFIRE	Static	2008	Denominator for sagebrush availability
Existing Vegetation Type v1.2	LANDFIRE	Static	2010	Numerator for sagebrush availability
Cropland Data Layer	National Agricultural Statistics Service	Annual	2012	Agricultural updates; removes existing sagebrush from numerator of sagebrush availability
National Land Cover Dataset Percent Imperviousness	Multi-Resolution Land Characteristics Consortium (MRLC)	5-Year	2011 (next available in 2016)	Urban area updates; removes existing sagebrush from numerator of sagebrush availability
Fire Perimeters	GeoMac	Annual	2013	< 1,000-acre fire updates; removes existing sagebrush from numerator of sagebrush availability
Burn Severity	Monitoring Trends in Burn Severity	Annual	2012 (2-year delay in data availability)	> 1,000-acre fire updates; removes existing sagebrush from numerator of sagebrush availability except for unburned sagebrush islands

Table 4. Ecological systems in BpS and EVT capable of supporting sagebrush vegetation and capable of providing suitable seasonal habitat for Greater Sage-Grouse.

Ecological System	Sagebrush Vegetation that the Ecological System has the Capability of Producing
Colorado Plateau Mixed Low Sagebrush Shrubland	*Artemisia arbuscula* ssp. *longiloba* *Artemisia bigelovii* *Artemisia nova* *Artemisia frigida* *Artemisia tridentata* ssp. *wyomingensis*
Columbia Plateau Low Sagebrush Steppe	*Artemisia arbuscula* *Artemisia arbuscula* ssp. *longiloba* *Artemisia nova*

Columbia Plateau Scabland Shrubland	*Artemisia rigida*
Columbia Plateau Steppe and Grassland	*Artemisia* spp.
Great Basin Xeric Mixed Sagebrush Shrubland	*Artemisia arbuscula* ssp. *longicaulis* *Artemisia arbuscula* ssp. *longiloba* *Artemisia nova* *Artemisia tridentata* ssp. *wyomingensis*
Inter-Mountain Basins Big Sagebrush Shrubland	*Artemisia tridentata* ssp. *tridentata* *Artemisia tridentata* ssp. *xericensis* *Artemisia tridentata* ssp. *vaseyana* *Artemisia tridentata* ssp. *wyomingensis*
Inter-Mountain Basins Big Sagebrush Steppe	*Artemisia cana* ssp. *cana* *Artemisia tridentata* ssp. *tridentata* *Artemisia tridentata* ssp. *xericensis* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia tripartita* ssp. *tripartita* *Artemisia frigida*
Inter-Mountain Basins Curl-Leaf Mountain Mahogany Woodland and Shrubland	*Artemisia tridentata* ssp. *vaseyana* *Artemisia arbuscula* *Artemisia tridentata*
Inter-Mountain Basins Mixed Salt Desert Scrub	*Artemisia tridentata* ssp. *wyomingensis* *Artemisia spinescens*
Inter-Mountain Basins Montane Sagebrush Steppe	*Artemisia tridentata* ssp. *vaseyana* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia nova* *Artemisia arbuscula* *Artemisia tridentata* ssp. *spiciformis*
Inter-Mountain Basins Semi-Desert Shrub-Steppe	*Artemisia tridentata* *Artemisia bigelovii* *Artemisia tridentata* ssp. *wyomingensis*
Northwestern Great Plains Mixed Grass Prairie	*Artemisia cana* ssp. *cana* *Artemisia tridentata* ssp. *vaseyana* *Artemisia frigida*
Northwestern Great Plains Shrubland	*Artemisia cana* ssp. *cana* *Artemisia tridentata* ssp. *tridentata* *Artemisia tridentata* ssp. *wyomingensis*
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	*Artemisia tridentata*
Rocky Mountain Lower Montane-Foothill Shrubland	*Artemisia nova* *Artemisia tridentata* *Artemisia frigida*
Western Great Plains Floodplain Systems	*Artemisia cana* ssp. *cana*
Western Great Plains Sand Prairie	*Artemisia cana* ssp. *cana*
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	*Artemisia arbuscula* ssp. *longiloba* *Artemisia nova* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia tripartita* ssp. *rupicola*
Artemisia tridentata ssp. *vaseyana* Shrubland Alliance (EVT only)	*Artemisia tridentata* ssp. *vaseyana*
Quercus gambelii Shrubland Alliance (EVT only)	*Artemisia tridentata*

Accuracy and Appropriate Use of LANDFIRE Datasets

Because of concerns over the thematic accuracy of individual classes mapped by LANDFIRE, all ecological systems listed in Table 4 will be merged into one value that represents the sagebrush base layer. With all ecological systems aggregated, the combined accuracy of the sagebrush base layer (EVT) will be much greater than if all categories were treated separately.

LANDFIRE performed the original accuracy assessment of its EVT product on a map zone basis. There are 20 LANDFIRE map zones that cover the historical range of sage-grouse as defined by Schroeder (2004). (See Attachment B, User and Producer Accuracies for Aggregated Ecological Systems within LANDFIRE Map Zones.) The aggregated sagebrush base layer for monitoring had user accuracies ranging from 57.1% to 85.7% and producer accuracies ranging from 56.7% to 100%.

LANDFIRE EVT data are not designed to be used at a local level. In reports of the percent sagebrush statistic for the various reporting units (Measure 1a), the uncertainty of the percent sagebrush will increase as the size of the reporting unit gets smaller. LANDFIRE data should never be used at the 30m pixel level (900m^2 resolution of raster data) for any reporting. The smallest geographic extent for using the data to determine percent sagebrush is at the PAC level; for the smallest PACs, the initial percent sagebrush estimate will have greater uncertainties compared with the much larger PACs.

Agricultural Adjustments for the Sagebrush Base Layer

The dataset for the geographic extent of agricultural lands will come from the National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) (http://www.nass.usda.gov/research/Cropland/Release/index.htm). CDL data are generated annually, with estimated producer accuracies for "large area row crops ranging from the mid 80% to mid-90%," depending on the state (http://www.nass.usda.gov/research/Cropland/sarsfaqs2.htm#Section3_18.0). Specific information on accuracy may be found on the NASS metadata website (http://www.nass.usda.gov/research/Cropland/metadata/meta.htm). CDL provided the only dataset that matches the three criteria (nationally consistent, known level of accuracy, and periodically updated) for use in this monitoring framework and represents the best available agricultural lands mapping product.

The CDL data contain both agricultural classes and nonagricultural classes. For this effort, and in the baseline environmental report (Manier et al. 2013), nonagricultural classes were removed from the original dataset. The excluded classes are:

> Barren (65 & 131), Deciduous Forest (141), Developed/High Intensity (124), Developed/Low Intensity (122), Developed/Med Intensity (123), Developed/Open Space (121), Evergreen Forest (142), Grassland Herbaceous (171), Herbaceous Wetlands (195), Mixed Forest (143), Open

Water (83 & 111), Other Hay/Non Alfalfa (37), Pasture/Hay (181), Pasture/Grass (62), Perennial Ice/Snow (112), Shrubland (64 & 152), Woody Wetlands (190).

The rule set for adjusting the sagebrush base layer for agricultural lands (and for updating the base layer for agricultural lands in the future) is that once an area is classified as agriculture in any year of the CDL, those pixels will remain out of the sagebrush base layer even if a new version of the CDL classifies that pixel as one of the nonagricultural classes listed above. The assumption is that even though individual pixels may be classified as a nonagricultural class in any given year, the pixel has not necessarily been restored to a natural sagebrush community that would be included in Table 4. A further assumption is that once an area has moved into agricultural use, it is unlikely that the area would be restored to sagebrush. Should that occur, however, the method and criteria for adding pixels back into the sagebrush base layer would follow those found in the sagebrush restoration monitoring section of this monitoring framework (see Section I.B.1.b., Monitoring Sagebrush Availability).

Urban Adjustments for the Sagebrush Base Layer

The National Land Cover Database (NLCD) (Fry et al. 2011) includes a percent imperviousness dataset that was selected as the best available dataset to be used for urban adjustments and monitoring. These data are generated on a 5-year cycle and are specifically designed to support monitoring efforts. Other datasets were evaluated and lacked the spatial specificity that was captured in the NLCD product. Any new impervious pixel in NLCD will be removed from the sagebrush base layer through the monitoring process. Although the impervious surface layer includes a number of impervious pixels outside of urban areas, this is acceptable for the adjustment and monitoring for two reasons. First, an evaluation of national urban area datasets did not reveal a layer that could be confidently used in conjunction with the NLCD product to screen impervious pixels outside of urban zones. This is because unincorporated urban areas were not being included, thus leaving large chunks of urban pixels unaccounted for in this rule set. Second, experimentation with setting a threshold on the percent imperviousness layer that would isolate rural features proved to be unsuccessful. No combination of values could be identified that would result in the consistent ability to limit impervious pixels outside urban areas. Therefore, to ensure consistency in the monitoring estimates, all impervious pixels will be used.

Fire Adjustments for the Sagebrush Base Layer

Two datasets were selected for performing fire adjustments and updates: GeoMac fire perimeters and Monitoring Trends in Burn Severity (MTBS). An existing data standard in the BLM requires that all fires of more than 10 acres are to be reported to GeoMac; therefore, there will be many small fires of less than 10 acres that will not be accounted for in the adjustment and monitoring attributable to fire. Using fire perimeters from GeoMac, all sagebrush pixels falling within the perimeter of fires less than 1,000 acres will be used to adjust and monitor the sagebrush base layer.

For fires greater than 1,000 acres, MTBS was selected as a means to account for unburned sagebrush islands during the update process of the sagebrush base layer. The MTBS program (http://www.mtbs.gov) is an ongoing, multiyear project to map fire severity and fire perimeters consistently across the United States. One of the burn severity classes within MTBS is an unburned to low-severity class. This burn severity class will be used to represent unburned islands of sagebrush within the fire perimeter for the sagebrush base layer. Areas within the other severity classes within the fire perimeter will be removed from the base sagebrush layer during the update process. Not all wildfires, however, have the same impacts on the recovery of sagebrush habitat, depending largely on soil moisture and temperature regimes. For example, cooler, moister sagebrush habitat has a higher potential for recovery or, if needed, restoration than does the warmer, dryer sagebrush habitat. These cooler, moister areas will likely be detected as sagebrush in future updates to LANDFIRE.

Conifer Encroachment Adjustment for the Sagebrush Base Layer

Conifer encroachment into sagebrush vegetation reduces the spatial extent of sage-grouse habitat (Davies et al. 2011, Baruch-Mordo et al. 2013). Conifer species that show propensity for encroaching into sagebrush vegetation resulting in sage-grouse habitat loss include various juniper species, such as Utah juniper *(Juniperus osteosperma),* western juniper *(Juniperus occidentalis),* Rocky Mountain juniper *(Juniperus scopulorum),* pinyon species, including singleleaf pinyon *(Pinus monophylla)* and pinyon pine *(Pinus edulis),* ponderosa pine *(Pinus ponderosa),* lodgepole pine *(Pinus contorta),* and Douglas fir *(Pseudotsuga menziesii)* (Gruell et al. 1986, Grove et al. 2005, Davies et al. 2011).

A rule set for conifer encroachment was developed to adjust the sagebrush base layer. To capture the geographic extent of sagebrush that is likely to experience conifer encroachment, ecological systems within LANDFIRE EVT version 1.2 (NatureServe 2011) were identified if they had the capability of supporting both the conifer species (listed above) and sagebrush vegetation. Those ecological systems were deemed to be the plant communities with conifers most likely to encroach into sagebrush vegetation. (See Table 5, Ecological systems with conifers most likely to encroach into sagebrush vegetation.) Sagebrush vegetation was defined as including sagebrush species or subspecies that provide habitat for the Greater Sage-Grouse and that are included in the HAF. (See Attachment C, Sagebrush Species and Subspecies Included in the Selection Criteria for Building the EVT and BpS Layers.) An adjacency analysis was conducted to identify all sagebrush pixels that were directly adjacent to these conifer ecological systems, and these pixels were removed from the sagebrush base layer.

Table 5. Ecological systems with conifers most likely to encroach into sagebrush vegetation.

EVT Ecological Systems	Coniferous Species and Sagebrush Vegetation that the Ecological System has the Capability of Producing
Colorado Plateau Pinyon-Juniper Woodland	*Pinus edulis* *Juniperus osteosperma* *Artemisia tridentata* *Artemisia arbuscula* *Artemisia nova* *Artemisia tridentata* ssp. *tridentata* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia tridentata* ssp. *vaseyana* *Artemisia bigelovii* *Artemisia pygmaea*
Columbia Plateau Western Juniper Woodland and Savanna	*Juniperus occidentalis* *Pinus ponderosa* *Artemisia tridentata* *Artemisia arbuscula* *Artemisia rigida* *Artemisia tridentata* ssp. *vaseyana*
East Cascades Oak-Ponderosa Pine Forest and Woodland	*Pinus ponderosa* *Pseudotsuga menziesii* *Artemisia tridentata* *Artemisia nova*
Great Basin Pinyon-Juniper Woodland	*Pinus monophylla* *Juniperus osteosperma* *Artemisia arbuscula* *Artemisia nova* *Artemisia tridentata* *Artemisia tridentata* ssp. *vaseyana*
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	*Pinus ponderosa* *Artemisia tridentata* *Artemisia arbuscula* *Artemisia tridentata* ssp. *vaseyana*
Rocky Mountain Foothill Limber Pine-Juniper Woodland	*Juniperus osteosperma* *Juniperus scopulorum* *Artemisia nova* *Artemisia tridentata*
Rocky Mountain Poor-Site Lodgepole Pine Forest	*Pinus contorta* *Pseudotsuga menziesii* *Pinus ponderosa* *Artemisia tridentata*
Southern Rocky Mountain Pinyon-Juniper Woodland	*Pinus edulis* *Juniperus monosperma* *Artemisia bigelovii* *Artemisia tridentata* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia tridentata* ssp. *vaseyana*
Southern Rocky Mountain Ponderosa Pine Woodland	*Pinus ponderosa* *Pseudotsuga menziesii*

	Pinus edulis *Pinus contorta* *Juniperus* spp. *Artemisia nova* *Artemisia tridentata* *Artemisia arbuscula* *Artemisia tridentata* ssp. *vaseyana*

Invasive Annual Grasses Adjustments for the Sagebrush Base Layer

There are no invasive species datasets from 2010 to the present (beyond the LANDFIRE data) that meet the three criteria (nationally consistent, known level of accuracy, and periodically updated) for use in the determination of the sagebrush base layer. For a description of how invasive species land cover will be incorporated in the sagebrush base layer in the future, see Section I.B.1.b., Monitoring Sagebrush Availability.

Sagebrush Restoration Adjustments for the Sagebrush Base Layer

There are no datasets from 2010 to the present that could provide additions to the sagebrush base layer from restoration treatments that meet the three criteria (nationally consistent, known level of accuracy, and periodically updated); therefore, no adjustments were made to the sagebrush base layer calculated from the LANDFIRE EVT (version 1.2) attributable to restoration activities since 2010. Successful restoration treatments before 2010 are assumed to have been captured in the LANDFIRE refresh.

b. Monitoring Sagebrush Availability

Monitoring Sagebrush Availability

Sagebrush availability will be updated annually by incorporating changes to the sagebrush base layer attributable to agriculture, urbanization, and wildfire. The monitoring schedule for the existing sagebrush base layer updates is as follows:

> ***2010 Existing Sagebrush Base Layer*** = [Sagebrush EVT] minus [2006 Imperviousness Layer] minus [2009 and 2010 CDL] minus [2009/10 GeoMac Fires that are less than 1,000 acres] minus [2009/10 MTBS Fires that are greater than 1,000 acres, excluding unburned sagebrush islands within the perimeter] minus [Conifer Encroachment Layer]
>
> ***2012 Existing Sagebrush Update*** = [2010 Existing Sagebrush Base Layer] minus [2011 Imperviousness Layer] minus [2011 and 2012 CDL] minus [2011/12 GeoMac Fires < 1,000 acres] minus [2011/12 MTBS Fires that are greater than 1,000 acres, excluding unburned sagebrush islands within the perimeter]
>
> ***Monitoring Existing Sagebrush post 2012*** = [Previous Existing Sagebrush Update Layer] minus [Imperviousness Layer (if new data are available)] minus [Next 2 years of CDL] minus [Next 2 years of GeoMac Fires < 1,000 acres] minus [Next 2 years of MTBS Fires that are greater than

1,000 acres, excluding unburned sagebrush islands within the perimeter] plus [restoration/monitoring data provided by the field]

Monitoring Sagebrush Restoration

Restoration after fire, after agricultural conversion, after seedings of introduced grasses, or after treatments of pinyon pine and/or juniper are examples of updates to the sagebrush base layer that can add sagebrush vegetation back into sagebrush availability in the landscape. When restoration has been determined to be successful through rangewide, consistent, interagency fine- and site-scale monitoring, the polygonal data will be used to add sagebrush pixels back into the broad- and mid-scale sagebrush base layer.

Measure 1b: Context for Monitoring the Amount of Sagebrush in a Geographic Area of Interest

Measure 1b describes the amount of sagebrush on the landscape of interest compared with the amount of sagebrush the landscape of interest could ecologically support. Areas with the potential to support sagebrush were derived from the BpS data layer that describes sagebrush pre-EuroAmerican settlement (v1.2 of LANDFIRE).

The identification and spatial locations of natural plant communities (vegetation) that are believed to have existed on the landscape (BpS) were constructed based on an approximation of the historical (pre-EuroAmerican settlement) disturbance regime and how the historical disturbance regime operated on the current biophysical environment. BpS is composed of map units that are based on NatureServe (2011) terrestrial ecological systems classification.

The ecological systems within BpS used for this monitoring framework are those ecological systems that are capable of supporting sagebrush vegetation and of providing seasonal habitat for sage-grouse (Table 4). Ecological systems selected included sagebrush species or subspecies that are included in the HAF and listed in Attachment C.

The BpS layer does not have an associated accuracy assessment, given the lack of any reference data. Visual inspection of the BpS data, however, reveals inconsistencies in the labeling of pixels among LANDFIRE map zones. The reason for these inconsistencies is that the rule sets used to map a given ecological system will vary among map zones based on different physical, biological, disturbance, and atmospheric regimes of the region. These variances can result in artificial edges in the map. Metrics will be calculated, however, at broad spatial scales using BpS potential vegetation type, not small groupings or individual pixels. Therefore, the magnitude of these observable errors in the BpS layer will be minor compared with the size of the reporting units. Since BpS will be used to identify broad landscape patterns of dominant vegetation, these inconsistencies will have only a minor impact on the percent sagebrush availability calculation. *As with the LANDFIRE EVT, LANDFIRE BpS data are not designed to be used at a local level*. LANDFIRE data should never be used at the 30m pixel level for reporting.

In conclusion, sagebrush availability data will be used to inform effectiveness monitoring and initiate adaptive management actions as necessary. The 2010 estimate of sagebrush availability will serve as the base year, and an updated estimate for 2012 will be reported in 2014 after all datasets become available. The 2012 estimate will capture changes attributable to wildfire, agriculture, and urban development. Subsequent updates will always include new fire and agricultural data and new urban data when available. Restoration data that meet the criteria for adding sagebrush areas back into the sagebrush base layer will be factored in as data allow. Given data availability, there will be a 2-year lag (approximately) between when the estimate is generated and when the data used for the estimate become available (e.g., the 2014 sagebrush availability will be included in the 2016 estimate).

Future Plans

Geospatial data used to generate the sagebrush base layer will be available through the BLM's EGIS web portal and geospatial gateway or through the authoritative data source. Legacy datasets will be preserved so that trends may be calculated. Additionally, accuracy assessment data for all source datasets will be provided on the portal either spatially, where applicable, or through the metadata. Accuracy assessment information was deemed vital to help users understand the limitation of the sagebrush estimates; it will be summarized spatially by map zone and will be included in the portal.

LANDFIRE plans to begin a remapping effort in 2015. This remapping has the potential to improve the overall quality of data products greatly, primarily through the use of higher-quality remote sensing datasets. Additionally, the BLM and the Multi-Resolution Land Characteristics Consortium (MRLC) are working to improve the accuracy of vegetation map products for broad- and mid-scale analyses through the Grass/Shrub mapping effort. The Grass/Shrub mapping effort applies the Wyoming multiscale sagebrush habitat methodology (Homer et al. 2009) to depict spatially the fractional percent cover estimates for five components rangewide and West-wide. These five components are percent cover of sagebrush vegetation, percent bare ground, percent herbaceous vegetation (grass and forbs combined), annual vegetation, and percent shrubs. A benefit of the design of these fractional cover maps is that they facilitate monitoring "within" class variation (e.g., examination of declining trend in sagebrush cover for individual pixels). This "within" class variation can serve as one indicator of sagebrush quality that cannot be derived from LANDFIRE's EVT information. The Grass/Shrub mapping effort is not a substitute for fine-scale monitoring but will leverage fine-scale data to support the validation of the mapping products. An evaluation will be conducted to determine if either dataset is of great enough quality to warrant replacing the existing sagebrush layers. At the earliest, this evaluation will occur in 2018 or 2019, depending on data availability.

B.2. Habitat Degradation Monitoring (Measure 2)

The measure of habitat degradation will be calculated by combining the footprints of threats identified in Table 2. The footprint is defined as the direct area of influence of "active" energy and infrastructure; it is used as a surrogate for human activity. Although these analyses will try to summarize results at the aforementioned meaningful geographic areas of interest, some may be too small to report the metrics appropriately and may be combined (smaller populations, PACs within a population, etc.). Data sources for each threat are found in Table 6, Geospatial data sources for habitat degradation. Specific assumptions (inclusion criteria for data, width/area assumptions for point and line features, etc.) and methodology for each threat, and the combined measure, are detailed below. All datasets will be updated annually to monitor broad- and mid-scale year-to-year changes and to calculate trends in habitat degradation to inform adaptive management. A 5-year summary report will be provided to the USFWS.

a. Habitat Degradation Datasets and Assumptions

Energy (oil and gas wells and development facilities)

This dataset will compile information from three oil and gas databases: the proprietary IHS Enerdeq database, the BLM Automated Fluid Minerals Support System (AFMSS) database, and the proprietary Platts (a McGraw-Hill Financial Company) GIS Custom Data (hereafter, Platts) database of power plants. Point data from wells active within the last 10 years from IHS and producing wells from AFMSS will be considered as a 5-acre (2.0ha) direct area of influence centered on the well point, as recommended by the BLM WO-300 (Minerals and Realty Management). Plugged and abandoned wells will be removed if the date of well abandonment was before the first day of the reporting year (i.e., for the 2015 reporting year, a well must have been plugged and abandoned by 12/31/2014 to be removed). Platts oil and gas power plants data (subset to operational power plants) will also be included as a 5-acre (2.0ha) direct area of influence.

Additional Measure: Reclaimed Energy-related Degradation. This dataset will include those wells that have been plugged and abandoned. This measure thereby attempts to measure energy-related degradation that has been reclaimed but not necessarily fully restored to sage-grouse habitat. This measure will establish a baseline by using wells that have been plugged and abandoned within the last 10 years from the IHS and AFMSS datasets. Time lags for lek attendance in response to infrastructure have been documented to be delayed 2–10 years from energy development activities (Harju et al. 2010). Reclamation actions may require 2 or more years from the Final Abandonment Notice. Sagebrush seedling establishment may take 6 or more years from the point of seeding, depending on such variables as annual precipitation, annual temperature, and soil type and depth (Pyke 2011). This 10-year period is conservative and assumes some level of habitat improvement 10 years after plugging. Research by Hemstrom et al. (2002), however, proposes an even longer period—more than 100 years—for recovery of sagebrush habitats, even with active restoration approaches. Direct area of influence will be considered 3 acres (1.2ha) (J. Perry, personal communication, February 12, 2014). This additional layer/measure could be used at the broad and mid scale to identify areas where sagebrush habitat and/or potential sagebrush habitat is likely still degraded. This layer/measure could also be used where further investigation at the fine or site scale would be warranted to: 1) quantify the level of reclamation already conducted, and 2) evaluate the amount of restoration still required for sagebrush habitat recovery. At a particular level (e.g., population, PACs), these areas and the reclamation efforts/success could be used to inform reclamation standards associated with future developments. Once these areas have transitioned from reclamation standards to meeting *restoration* standards, they can be added back into the sagebrush availability layer using the same methodology as described for adding restoration treatment areas lost to wildfire and agriculture conversion (see Monitoring Sagebrush Restoration in Section I.B.1.b., Monitoring Sagebrush Availability). This dataset will be updated annually from the IHS dataset.

Energy (coal mines)

Currently, there is no comprehensive dataset available that identifies the footprint of active coal mining across all jurisdictions. Therefore, point and polygon datasets will be used each year to identify coal mining locations. Data sources will be identified and evaluated annually and will include at a minimum: BLM coal lease polygons, U.S. Energy Information Administration mine occurrence points, U.S. Office of Surface Mining Reclamation and Enforcement coal mining permit polygons (as available), and U.S. Geological Survey (USGS) Mineral Resources Data System mine occurrence points. These data will inform where active coal mining may be occurring. Additionally, coal power plant data from Platts power plants database (subset to operational power plants) will be included. Aerial imagery will then be used to digitize manually the active coal mining and coal power plants surface disturbance in or near these known occurrence areas. While the date of aerial imagery varies by scale, the most current data available from Esri and/or Google will be used to locate (generally at 1:50,000 and below) and digitize (generally at 1:10,000 and below) active coal mine and power plant direct area of influence. Coal mine location data source and imagery date will be documented for each digitized coal polygon at the time of creation. Subsurface facility locations (polygon or point location as available) will also be collected if available, included in density calculations, and added to the active surface activity layer as appropriate (if an actual direct area of influence can be located).

Energy (wind energy facilities)

This dataset will be a subset of the Federal Aviation Administration (FAA) Digital Obstacles point file. Points where “Type_” = “WINDMILL” will be included. Direct area of influence of these point features will be measured by converting to a polygon dataset as a direct area of influence of 3 acres (1.2ha) centered on each tower point. See the BLM's "Wind Energy Development Programmatic Environmental Impact Statement" (BLM 2005). Additionally, Platts power plants database will be used for transformer stations associated with wind energy sites (subset to operational power plants), also with a 3-acre (1.2ha) direct area of influence.

Energy (solar energy facilities)

This dataset will include solar plants as compiled with the Platts power plants database (subset to operational power plants). This database includes an attribute that indicates the operational capacity of each solar power plant. Total capacity at the power plant was based on ratings of the in-service unit(s), in megawatts. Direct area of influence polygons will be centered over each point feature representing 7.3ac (3.0ha) per megawatt of the stated operational capacity, per the report of the National Renewable Energy Laboratory (NREL), "Land-Use Requirements for Solar Power Plants in the United States" (Ong et al. 2013).

Energy (geothermal energy facilities)

This dataset will include geothermal wells in existence or under construction as compiled with the IHS wells database and power plants as compiled with the Platts database (subset to operational power plants). Direct area of influence of these point features will be measured by converting to a polygon dataset of 3 acres (1.2ha) centered on each well or power plant point.

Mining (active developments; locatable, leasable, saleable)

This dataset will include active locatable mining locations as compiled with the proprietary InfoMine database. Aerial imagery will then be used to digitize manually the active mining surface disturbance in or near these known occurrence areas. While the date of aerial imagery varies by scale, the most current data available from Esri and/or Google will be used to locate (generally at 1:50,000 and below) and digitize (generally at 1:10,000 and below) active mine direct area of influence. Mine location data source and imagery date will be documented for each digitized polygon at the time of creation. Currently, there are no known compressive databases available for leasable or saleable mining sites beyond coal mines. Other data sources will be evaluated and used as they are identified or as they become available. Point data may be converted to polygons to represent direct area of influence unless actual surface disturbance is available.

Infrastructure (roads)

This dataset will be compiled from the proprietary Esri StreetMap Premium for ArcGIS. Dataset features that will be used are: Interstate Highways, Major Roads, and Surface Streets to capture most paved and "crowned and ditched" roads while not including "two-track" and 4-wheel-drive routes. These minor roads, while not included in the broad- and mid-scale monitoring, may support a volume of traffic that can have deleterious effects on sage-grouse leks. It may be appropriate to consider the frequency and type of use of roads in a NEPA analysis for a proposed project. This fine- and site-scale analysis will require more site-specific data than is identified in this monitoring framework. The direct area of influence for roads will be represented by 240.2ft, 84.0ft, and 40.7ft (73.2m, 25.6m, and 12.4m) total widths centered on the line feature for Interstate Highways, Major Roads, and Surface Streets, respectively (Knick et al. 2011). The most current dataset will be used for each monitoring update. *Note: This is a related but different dataset than what was used in BER (Manier et al. 2013). Individual BLM/USFS planning units may use different road layers for fine- and site-scale monitoring.*

Infrastructure (railroads)

This dataset will be a compilation from the Federal Railroad Administration Rail Lines of the USA dataset. Non-abandoned rail lines will be used; abandoned rail lines will not be used. The direct are of influence for railroads will be represented by a 30.8ft (9.4m) total width (Knick et al. 2011) centered on the non-abandoned railroad line feature.

Infrastructure (power lines)

This line dataset will be derived from the proprietary Platts transmission lines database. Linear features in the dataset attributed as "buried" will be removed from the disturbance calculation. Only "In Service" lines will be used; "Proposed" lines will not be used. Direct area of influence will be determined by the kV designation: 1–199 kV (100ft/30.5m), 200–399 kV (150ft/45.7m), 400–699 kV (200ft/61.0m), and 700-or greater kV (250ft/76.2m) based on average right-of-way and structure widths, according to BLM WO-300 (Minerals and Realty Management).

Infrastructure (communication towers)

This point dataset will be compiled from the Federal Communications Commission (FCC) communication towers point file; all duplicate points will be removed. It will be converted to a polygon dataset by using a direct area of influence of 2.5 acres (1.0ha) centered on each communication tower point (Knick et al. 2011).

Infrastructure (other vertical structures)

This point dataset will be compiled from the FAA's Digital Obstacles point file. Points where "Type_" = "WINDMILL" will be removed. Duplicate points from the FCC communication towers point file will be removed. Remaining features will be converted to a polygon dataset using a direct area of influence of 2.5 acres (1.0ha) centered on each vertical structure point (Knick et al. 2011).

Other Developed Rights-of-Way

Currently, no additional data sources for other rights-of-way have been identified; roads, power lines, railroads, pipelines, and other known linear features are represented in the categories described above. The newly purchased IHS data do contain pipeline information; however, this database does not currently distinguish between above-ground and underground pipelines. If additional features representing human activities are identified, they will be added to monitoring reports using similar assumptions to those used with the threats described above.

b. Habitat Degradation Threat Combination and Calculation

The threats targeted for measuring human activity (Table 2) will be converted to direct area of influence polygons as described for each threat above. These threat polygon layers will be combined and features dissolved to create one overall polygon layer representing footprints of active human activity in the range of sage-grouse. Individual datasets, however, will be preserved to indicate which types of threats may be contributing to overall habitat degradation.

This measure has been divided into three submeasures to describe habitat degradation on the landscape. Percentages will be calculated as follows:

> Measure 2a. Footprint by geographic area of interest: Divide area of the active/direct footprint by the total area of the geographic area of interest (% disturbance in geographic area of interest).
>
> Measure 2b. Active/direct footprint by historical sagebrush potential: Divide area of the active footprint that coincides with areas with historical sagebrush potential (BpS calculation from habitat availability) within a given geographic area of interest by the total area with sagebrush potential within the geographic area of interest (% disturbance on potential historical sagebrush in geographic area of interest).
>
> Measure 2c. Active/direct footprint by current sagebrush: Divide area of the active footprint that coincides with areas of existing sagebrush (EVT calculation from habitat availability) within a given geographic area of interest by the total area that is current sagebrush within the geographic area of interest (% disturbance on current sagebrush in geographic area of interest).

B.3. Energy and Mining Density (Measure 3)

The measure of density of energy and mining will be calculated by combining the locations of energy and mining threats identified in Table 2. This measure will provide an estimate of the intensity of human activity or the intensity of habitat degradation. The number of energy facilities and mining locations will be summed and divided by the area of meaningful geographic areas of interest to calculate density of these activities. Data sources for each threat are found in Table 6. Specific assumptions (inclusion criteria for data, width/area assumptions for point and line features, etc.) and methodology for each threat, and the combined measure, are detailed below. All datasets will be updated annually to monitor broad- and mid-scale year-to-year changes and 5-year (or longer) trends in habitat degradation.

Table 6. Geospatial data sources for habitat degradation (Measure 2).

Degradation Type	Subcategory	Data Source	Direct Area of Influence	Area Source
Energy (oil & gas)	Wells	IHS; BLM (AFMSS)	5.0ac (2.0ha)	BLM WO-300
	Power Plants	Platts (power plants)	5.0ac (2.0ha)	BLM WO-300
Energy (coal)	Mines	BLM; USFS; Office of Surface Mining Reclamation and Enforcement; USGS Mineral Resources Data System	Polygon area (digitized)	Esri/ Google Imagery
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Energy (wind)	Wind Turbines	Federal Aviation Administration	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	3.0ac (1.2ha)	BLM WO-300
Energy (solar)	Fields/Power Plants	Platts (power plants)	7.3ac (3.0ha)/MW	NREL
Energy (geothermal)	Wells	IHS	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Mining	Locatable Developments	InfoMine	Polygon area (digitized)	Esri Imagery
Infrastructure (roads)	Surface Streets (Minor Roads)	Esri StreetMap Premium	40.7ft (12.4m)	USGS
	Major Roads	Esri StreetMap Premium	84.0ft (25.6m)	USGS
	Interstate Highways	Esri StreetMap Premium	240.2ft (73.2m)	USGS
Infrastructure (railroads)	Active Lines	Federal Railroad Administration	30.8ft (9.4m)	USGS
Infrastructure (power lines)	1-199kV Lines	Platts (transmission lines)	100ft (30.5m)	BLM WO-300
	200-399 kV Lines	Platts (transmission lines)	150ft (45.7m)	BLM WO-300
	400-699kV Lines	Platts (transmission lines)	200ft (61.0m)	BLM WO-300
	700+kV Lines	Platts (transmission lines)	250ft (76.2m)	BLM WO-300
Infrastructure (communication)	Towers	Federal Communications Commission	2.5ac (1.0ha)	BLM WO-300

a. Energy and Mining Density Datasets and Assumptions

Energy (oil and gas wells and development facilities)

(See Section I.B.2., Habitat Degradation Monitoring.)

Energy (coal mines)

(See Section I.B.2., Habitat Degradation Monitoring.)

Energy (wind energy facilities)

(See Section I.B.2., Habitat Degradation Monitoring.)

Energy (solar energy facilities)

(See Section I.B.2., Habitat Degradation Monitoring.)

Energy (geothermal energy facilities)

(See Section I.B.2., Habitat Degradation Monitoring.)

Mining (active developments; locatable, leasable, saleable)

(See Section I.B.2., Habitat Degradation Monitoring.)

b. Energy and Mining Density Threat Combination and Calculation

Datasets for energy and mining will be collected in two primary forms: point locations (e.g., wells) and polygon areas (e.g., surface coal mining). The following rule set will be used to calculate density for meaningful geographic areas of interest including standard grids and per polygon:

1) Point locations will be preserved; no additional points will be removed beyond the methodology described above. Energy facilities in close proximity (an oil well close to a wind tower) will be retained.
2) Polygons will not be merged, or features further dissolved. Thus, overlapping facilities will be retained, such that each individual threat will be a separate polygon data input for the density calculation.
3) The analysis unit (polygon or 640-acre section in a grid) will be the basis for counting the number of mining or energy facilities per unit area. Within the analysis unit, all point features will be summed, and any individual polygons will be counted as one (e.g., a coal mine will be counted as one facility within population). Where polygon features overlap multiple units (polygons or pixels), the facility will be counted as one in each unit where the polygon occurs (e.g., a polygon crossing multiple 640-acre

sections would be counted as one in each 640-acre section for a density per 640-acre-section calculation).

4) In methodologies with different-sized units (e.g., MZs, populations, etc.) raw facility counts will be converted to densities by dividing the raw facility counts by the total area of the unit. Typically this will be measured as facilities per 640 acres.
5) For uniform grids, raw facility counts will be reported. Typically this number will also be converted to facilities per 640 acres.
6) Reporting may include summaries beyond the simple ones above. Zonal statistics may be used to smooth smaller grids to help display and convey information about areas within meaningful geographic areas of interest that have high levels of energy and/or mining activity.
7) Additional statistics for each defined unit may also include adjusting the area to include only the area with the historical potential for sagebrush (BpS) or areas currently sagebrush (EVT).

Individual datasets and threat combination datasets for habitat degradation will be available through the BLM's EGIS web portal and geospatial gateway. Legacy datasets will be preserved so that trends may be calculated.

C. Population (Demographics) Monitoring

State wildlife management agencies are responsible for monitoring sage-grouse populations within their respective states. WAFWA will coordinate this collection of annual population data by state agencies. These data will be made available to the BLM according to the terms of the forthcoming Greater Sage-Grouse Population Monitoring Memorandum of Understanding (MOU) (2014) between WAFWA and the BLM. The MOU outlines a process, timeline, and responsibilities for regular data sharing of sage-grouse population and/or habitat information for the purposes of implementing sage-grouse LUPs/amendments and subsequent effectiveness monitoring. Population areas were refined from the "Greater Sage-grouse *(Centrocercus urophasianus)* Conservation Objectives: Final Report" (COT 2013) by individual state wildlife agencies to create a consistent naming nomenclature for future data analyses. These population data will be used for analysis at the applicable scale to supplement habitat effectiveness monitoring of management actions and to inform the adaptive management responses.

D. Effectiveness Monitoring

Effectiveness monitoring will provide the data needed to evaluate BLM and USFS actions toward reaching the objective of the national planning strategy (BLM IM 2012-044)—to conserve sage-grouse populations and their habitat—and the objectives for the land use planning area. Effectiveness monitoring methods described here will encompass multiple larger scales, from areas as large as the WAFWA MZ to the scale of this LUP. Effectiveness data used for these larger-scale evaluations will include all lands in the area of interest, regardless of surface ownership/management, and will help inform where finer-scale evaluations are needed, such as population areas smaller than an LUP or PACs within an LUP (described in Section II, Fine and Site Scales). Data will also include the trend of disturbance within these areas of interest to inform the need to initiate adaptive management responses as described in the land use plan.

Effectiveness monitoring reported for these larger areas provides the context to conduct effectiveness monitoring at finer scales. This approach also helps focus scarce resources to areas experiencing habitat loss, degradation, or population declines, without excluding the possibility of concurrent, finer-scale evaluations as needed where habitat or population anomalies have been identified through some other means.

To determine the effectiveness of the sage-grouse national planning strategy, the BLM and the USFS will evaluate the answers to the following questions and prepare a broad- and mid-scale effectiveness report:

1) Sagebrush Availability and Condition:
    a. What is the amount of sagebrush availability and the change in the amount and condition of sagebrush?
    b. What is the existing amount of sagebrush on the landscape and the change in the amount relative to the pre-EuroAmerican historical distribution of sagebrush (BpS)?
    c. What is the trend and condition of the indicators describing sagebrush characteristics important to sage-grouse?
2) Habitat Degradation and Intensity of Activities:
    a. What is the amount of habitat degradation and the change in that amount?
    b. What is the intensity of activities and the change in the intensity?
    c. What is the amount of reclaimed energy-related degradation and the change in the amount?
3) What is the population estimation of sage-grouse and the change in the population estimation?
4) How are the BLM and the USFS contributing to changes in the amount of sagebrush?
5) How are the BLM and the USFS contributing to disturbance?

The compilation of broad- and mid-scale data (and population trends as available) into an effectiveness monitoring report will occur on a 5-year reporting schedule (see Attachment A), which may be accelerated to respond to critical emerging issues (in consultation with the USFWS and state wildlife agencies). In addition, effectiveness monitoring results will be used to identify emerging issues and research needs and inform the BLM and the USFS adaptive management strategy (see the adaptive management section of this Environmental Impact Statement).

To determine the effectiveness of the sage-grouse objectives of the land use plan, the BLM and the USFS will evaluate the answers to the following questions and prepare a plan effectiveness report:

1) Is this plan meeting the sage-grouse habitat objectives?
2) Are sage-grouse areas within the LUP meeting, or making progress toward meeting, land health standards, including the Special Status Species/wildlife habitat standard?
3) Is the plan meeting the disturbance objective(s) within sage-grouse areas?
4) Are the sage-grouse populations within this plan boundary and within the sage-grouse areas increasing, stable, or declining?

The effectiveness monitoring report for this LUP will occur on a 5-year reporting schedule (see Attachment A) or more often if habitat or population anomalies indicate the need for an evaluation to facilitate adaptive management or respond to critical emerging issues. Data will be made available through the BLM's EGIS web portal and the geospatial gateway.

Methods

At the broad and mid scales (PACs and above) the BLM and the USFS will summarize the vegetation, disturbance, and (when available) population data. Although the analysis will try to summarize results for PACs within each sage-grouse population, some populations may be too small to report the metrics appropriately and may need to be combined to provide an estimate with an acceptable level of accuracy. Otherwise, they will be flagged for more intensive monitoring by the appropriate landowner or agency. The BLM and the USFS will then analyze monitoring data to detect the trend in the amount of sagebrush; the condition of the vegetation in the sage-grouse areas (MacKinnon et al. 2011); the trend in the amount of disturbance; the change in disturbed areas owing to successful restoration; and the amount of new disturbance the BLM and/or the USFS has permitted. These data could be supplemented with population data (when available) to inform an understanding of the correlation between habitat and PACs within a population. This overall effectiveness evaluation must consider the lag effect response of populations to habitat changes (Garton et al. 2011).

Calculating Question 1, National Planning Strategy Effectiveness: The amount of sagebrush available in the large area of interest will use the information from Measure 1a (I.B.1., Sagebrush Availability) and calculate the change from the 2012 baseline to the end date of the reporting period. To calculate the change in the amount of sagebrush on the landscape to compare with the historical areas with potential to support sagebrush, the information from Measure 1b (I.B.1., Sagebrush Availability) will be used. To calculate the trend in the condition of sagebrush at the mid scale, three sources of data will be used: the BLM's Grass/Shrub mapping effort (Future Plans in Section I.B.1., Sagebrush Availability); the results from the calculation of the landscape indicators, such as patch size (described below); and the BLM's Landscape Monitoring Framework (LMF) and sage-grouse intensification effort (also described below). The LMF and sage-grouse intensification effort data are collected in a statistical sampling framework that allows calculation of indicator values at multiple scales.

Beyond the importance of sagebrush availability to sage-grouse, the mix of sagebrush patches on the landscape at the broad and mid scale provides the life requisite of space for sage-grouse dispersal needs (see the HAF). The configuration of sagebrush habitat patches and the land cover or land use between the habitat patches at the broad and mid scales also defines suitability. There are three significant habitat indicators that influence habitat use, dispersal, and movement across populations: the size and number of habitat patches, the connectivity of habitat patches (linkage areas), and habitat fragmentation (scope of unsuitable and non-habitats between habitat patches). The most appropriate commercial software to measure patch dynamics, connectivity, and fragmentation at the broad and mid scales will be used, along with the same data layers derived for sagebrush availability.

The BLM initiated the LMF in 2011 in cooperation with the Natural Resources Conservation Service (NRCS). The objective of the LMF effort is to provide unbiased estimates of vegetation and soil condition and trend using a statistically balanced sample design across BLM lands. Recognizing that sage-grouse populations are more resilient where the sagebrush plant community has certain characteristics unique to a particular life stage of sage-grouse (Knick and Connelly 2011, Stiver et al. *in press*), a group of sage-grouse habitat and sagebrush plant community subject matter experts identified those vegetation indicators collected at LMF sampling points that inform sage-grouse habitat needs. The experts represented the Agricultural Research Service, BLM, NRCS, USFWS, WAFWA, state wildlife agencies, and academia. The common indicators identified include: species composition, foliar cover, height of the tallest sagebrush and herbaceous plant, intercanopy gap, percent of invasive species, sagebrush shape, and bare ground. To increase the precision of estimates of sagebrush conditions within the range of sage-grouse, additional plot locations in occupied sage-grouse habitat (Sage-Grouse Intensification) were added in 2013. The common indicators are also collected on sampling locations in the NRCS National Resources Inventory Rangeland Resource Assessment (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=stelprdb1041620).

The sage-grouse intensification baseline data will be collected over a 5-year period, and an annual sage-grouse intensification report will be prepared describing the status of the indicators. Beginning in year 6, the annual status report will be accompanied with a trend report, which will be available on an annual basis thereafter, contingent on continuation of the current monitoring budget. This information, in combination with the Grass/Shrub mapping information, the mid-scale habitat suitability indicator measures, and the sagebrush availability information will be used to answer Question 1 of the National Planning Strategy Effectiveness Report.

Calculating Question 2, National Planning Strategy Effectiveness: Evaluations of the amount of habitat degradation and the intensity of the activities in the area of interest will use the information from Measure 2 (Section I.B.2., Habitat Degradation Monitoring) and Measure 3 (Section I.B.3., Energy and Mining Density). The field office will collect data on the amount of reclaimed energy-related degradation on plugged and abandoned and oil/gas well sites. The data are expected to demonstrate that the reclaimed sites have yet to meet the habitat restoration objectives for sage-grouse habitat. This information, in combination with the amount of habitat degradation, will be used to answer Question 2 of the National Planning Strategy Effectiveness Report.

Calculating Question 3, National Planning Strategy Effectiveness: The change in sage-grouse estimated populations will be calculated from data provided by the state wildlife agencies, when available. This population data (Section I.C., Population [Demographics] Monitoring) will be used to answer Question 3 of the National Planning Strategy Effectiveness Report.

Calculating Question 4, National Planning Strategy Effectiveness: The estimated contribution by the BLM or the USFS to the change in the amount of sagebrush in the area of interest will use the information from Measure 1a (Section I.B.1., Sagebrush Availability). This measure is derived from the national datasets that remove sagebrush (Table 3). To determine the relative contribution of BLM and USFS management, the current Surface Management Agency geospatial data layer will be used to differentiate the amount of change for each management agency for this measure in the geographic areas of interest. This information will be used to answer Question 4 of the National Planning Strategy Effectiveness Report.

Calculating Question 5, National Planning Strategy Effectiveness: The estimated contribution by the BLM or the USFS to the change in the amount of disturbance in the area of interest will use the information from Measure 2a (Section I.B.2., Monitoring Habitat Degradation) and Measure 3 (Section I.B.3., Energy and Mining Density). These measures are all derived from the national disturbance datasets that degrade habitat (Table 6). To determine the relative contribution of BLM and USFS management, the current Surface Management Agency geospatial data layer will be used to differentiate the amount of change for each management agency for these two measures in the geographic areas of interest. This information will be used to answer Question 5 of the National Planning Strategy Effectiveness Report.

Answers to the five questions for determining the effectiveness of the national planning strategy will identify areas that appear to be meeting the objectives of the strategy and will facilitate identification of population areas for more detailed analysis. Conceptually, if the broad-scale monitoring identifies increasing sagebrush availability and improving vegetation conditions, decreasing disturbance, and a stable or increasing population for the area of interest, there is evidence that the objectives of the national planning strategy to maintain populations and their habitats have been met. Conversely, where information indicates that sagebrush is decreasing and vegetation conditions are degrading, disturbance in sage-grouse areas is increasing, and/or populations are declining relative to the baseline, there is evidence that the objectives of the national planning strategy are not being achieved. Such a determination would likely result in a more detailed analysis and could be the basis for implementing more restrictive adaptive management measures.

With respect to the land use plan area, the BLM and the USFS will summarize the vegetation, disturbance, and population data to determine if the LUP is meeting the plan objectives. Effectiveness information used for these evaluations includes BLM/USFS surface management areas and will help inform where finer-scale evaluations are needed, such as seasonal habitats, corridors, or linkage areas. Data will also include the trend of disturbance within the sage-grouse areas, which will inform the need to initiate adaptive management responses as described in the land use plan.

Calculating Question 1, Land Use Plan Effectiveness: The condition of vegetation and the allotments meeting land health standards (as articulated in "BLM Handbook 4180-1, Rangeland Health Standards") in sage-grouse areas will be used to determine the LUP's effectiveness in meeting the vegetation objectives for sage-grouse habitat set forth in the plan. The field office/ranger district will be responsible for collecting this data. In order for this data to be consistent and comparable, common indicators, consistent methods, and an unbiased sampling framework will be implemented following the principles in the BLM's AIM strategy (Taylor et al. 2014; Toevs et al. 2011; MacKinnon et al. 2011), in the BLM's Technical Reference "Interpreting Indicators of Rangeland Health" (Pellant et al. 2005), and in the HAF (Stiver et al. *in press*) or other approved WAFWA MZ–consistent guidance to measure and monitor sage-grouse habitats. This information will be used to answer Question 1 of the Land Use Plan Effectiveness Report.

Calculating Question 2, Land Use Plan Effectiveness: Sage-grouse areas within the LUP that are achieving land health stands (or, if trend data are available, that are making progress toward achieving them)—particularly the Special Status Species/wildlife habitat land health standard—will be used to determine the LUP's effectiveness in achieving the habitat objectives set forth in the plan. Field offices will follow directions in "BLM Handbook 4180-1, Rangeland Health Standards," to ascertain if sage-grouse areas are achieving or making progress toward achieving land health standards. One of the recommended criteria for evaluating this land health standard is the HAF indicators.

Calculating Question 3, Land Use Plan Effectiveness: The amount of habitat disturbance in sage-grouse areas identified in this LUP will be used to determine the LUP's effectiveness in meeting the plan's disturbance objectives. National datasets can be used to calculate the amount of disturbance, but field office data will likely increase the accuracy of this estimate. This information will be used to answer Question 3 of the Land Use Plan Effectiveness Report.

Calculating Question 4, Land Use Plan Effectiveness: The change in estimated sage-grouse populations will be calculated from data provided by the state wildlife agencies, when available, and will be used to determine LUP effectiveness. This population data (Section I.C., Population [Demographics] Monitoring) will be used to answer Question 4 of the Land Use Plan Effectiveness Report.

Results of the effectiveness monitoring process for the LUP will be used to inform the need for finer-scale investigations, initiate adaptive management actions as described in the land use plan, initiate causation determination, and/or determine if changes to management decisions are warranted. The measures used at the broad and mid scales will provide a suite of characteristics for evaluating the effectiveness of the adaptive management strategy.

II. FINE AND SITE SCALES

Fine-scale (third-order) habitat selected by sage-grouse is described as the physical and geographic area within home ranges during breeding, summer, and winter periods. At this level, habitat suitability monitoring should address factors that affect sage-grouse use of, and movements between, seasonal use areas. The habitat monitoring at the fine and site scale (fourth order) should focus on indicators to describe seasonal home ranges for sage-grouse associated with a lek or lek group within a population or subpopulation area. Fine- and site-scale monitoring will inform LUP effectiveness monitoring (see Section I.D., Effectiveness Monitoring) and the hard and soft triggers identified in the LUP's adaptive management section.

Site-scale habitat selected by sage-grouse is described as the more detailed vegetation characteristics of seasonal habitats. Habitat suitability characteristics include canopy cover and height of sagebrush and the associated understory vegetation. They also include vegetation associated with riparian areas, wet meadows, and other mesic habitats adjacent to sagebrush that may support sage-grouse habitat needs during different stages in their annual cycle.

As described in the Conclusion (Section III), details and application of monitoring at the fine and site scales will be described in the implementation-level monitoring plan for the land use plan. The need for fine- and site-scale-specific habitat monitoring will vary by area, depending on proposed projects, existing conditions, habitat variability, threats, and land health. Examples of fine- and site-scale monitoring include: habitat vegetation monitoring to assess current habitat conditions; monitoring and evaluation of the success of projects targeting sage-grouse habitat enhancement and/or restoration; and habitat disturbance monitoring to provide localized disturbance measures to inform proposed project review and potential mitigation for project impacts. Monitoring plans should incorporate the principles outlined in the BLM's AIM strategy (Toevs et al. 2011) and in "AIM-Monitoring: A Component of the Assessment, Inventory, and Monitoring Strategy" (Taylor et al. 2014). Approved monitoring methods are:

- "BLM Core Terrestrial Indicators and Methods" (MacKinnon et al. 2011);
- The BLM's Technical Reference "Interpreting Indicators of Rangeland Health" (Pellant et al. 2005); and,
- "Sage-Grouse Habitat Assessment Framework: Multiscale Assessment Tool" (Stiver et al. *in press*).

Other state-specific disturbance tracking models include: the BLM's Wyoming Density and Disturbance Calculation Tool (http://ddct.wygisc.org/) and the BLM's White River Data Management System in development with the USGS. Population monitoring data (in cooperation with state wildlife agencies) should be included during evaluation of the effectiveness of actions taken at the fine and site scales.

Fine- and site-scale sage-grouse habitat suitability indicators for seasonal habitats are identified in the HAF. The HAF has incorporated the Connelly et al. (2000) sage-grouse guidelines as well as many of the core indicators in the AIM strategy (Toevs et al. 2011). There may be a need to develop adjustments to height and cover or other site suitability values described in the HAF; any such adjustments should be ecologically defensible. To foster consistency, however, adjustments to site suitability values at the local scale should be avoided unless there is strong, scientific justification for making those adjustments. That justification should be provided. WAFWA MZ adjustments must be supported by regional plant productivity and habitat data for the floristic province. If adjustments are made to the site-scale indicators, they must be made using data from the appropriate seasonal habitat designation (breeding/nesting, brood-rearing, winter) collected from sage-grouse studies found in the relevant area and peer-reviewed by the appropriate wildlife management agency(ies) and researchers.

When conducting land heath assessments, the BLM should follow, at a minimum, "Interpreting Indicators of Rangeland Health" (Pellant et. al. 2005) and the "BLM Core Terrestrial Indicators and Methods" (MacKinnon et al. 2011). For assessments being conducted in sage-grouse designated management areas, the BLM should collect additional data to inform the HAF indicators that have not been collected using the above methods. Implementation of the principles outlined in the AIM strategy will allow the data to be used to generate unbiased estimates of condition across the area of interest; facilitate consistent data collection and rollup analysis among management units; help provide consistent data to inform the classification and interpretation of imagery; and provide condition and trend of the indicators describing sagebrush characteristics important to sage-grouse habitat (see Section I.D., Effectiveness Monitoring).

III. CONCLUSION

This Greater Sage-Grouse Monitoring Framework was developed for all of the Final Environmental Impact Statements involved in the sage-grouse planning effort. As such, it describes the monitoring activities at the broad and mid scales and provides a guide for the BLM and the USFS to collaborate with partners/other agencies to develop the land use plan- specific monitoring plan.

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Attachment A. An Overview of Monitoring Commitments

	Broad and Mid Scales					Fine and Site Scales
	Implemen-tation	**Sagebrush Availability**	**Habitat Degradation**	**Population**	**Effectiveness**	
How will the data be used?	Track and document implementation of land use plan decisions and inform adaptive management	Track changes in land cover (sagebrush) and inform adaptive management	Track changes in disturbance (threats) to sage-grouse habitat and inform adaptive management	Track trends in sage-grouse populations (and/or leks; as determined by state wildlife agencies) and inform adaptive management	Characterize the relationship among disturbance, implementation actions, and sagebrush metrics and inform adaptive management	Measure seasonal habitat, connectivity at the fine scale, and habitat conditions at the site scale, calculate disturbance, and inform adaptive management
Who is collecting the data?	BLM FO and USFS Forest	NOC and NIFC	National datasets (NOC), BLM FOs, and USFS Forests as applicable	State wildlife agencies through WAFWA	Comes from other broad- and mid-scale monitoring types, analyzed by the NOC	BLM FO and SO, USFS Forests and RO (with partners)
How often are the data collected, reported, and made available to USFWS?	Collected and reported annually; summary report every 5 years	Updated and changes reported annually; summary report every 5 years	Collected and changes reported annually; summary report every 5 years	State data reported annually per WAFWA MOU; summary report every 5 years	Collected and reported every 5 years (coincident with LUP evaluations)	Collection and trend analysis ongoing, reported every 5 years or as needed to inform adaptive management
What is the spatial scale?	Summarized by LUP with flexibility for reporting by other units	Summarized by PACs (size dependent) with flexibility for reporting by other units	Summarized by PACs (size dependent) with flexibility for reporting by other units	Summarized by PACs (size dependent) with flexibility for reporting by other units	Summarized by MZ and LUP with flexibility for reporting by other units (e.g., PAC)	Variable (e.g., projects and seasonal habitats)
What are the potential personnel and budget impacts?	Additional capacity or re-prioritization of ongoing monitoring work and budget realignment	At a minimum, current skills and capacity must be maintained; data management costs are TBD	At a minimum, current skills and capacity must be maintained; data management and data layer purchase cost are TBD	No additional personnel or budget impacts for the BLM or the USFS	Additional capacity or re-prioritization of ongoing monitoring work and budget realignment	Additional capacity or re-prioritization of ongoing monitoring work and budget realignment

Who has primary and secondary responsi-bilities for reporting?	1) BLM FO & SO; USFS Forest & RO 2) BLM & USFS Planning	1) NOC 2) WO	1) NOC 2) BLM SO, USFS RO, & appropriate programs	1) WAFWA & state wildlife agencies 2) BLM SO, USFS RO, NOC	1) Broad and mid scale at the NOC, LUP at BLM SO, USFS RO	1) BLM FO & USFS Forests 2) BLM SO & USFS RO
What new processes/ tools are needed?	National implementation datasets and analysis tools	Updates to national land cover data	Data standards and rollup methods for these data	Standards in population monitoring (WAFWA)	Reporting methodologies	Data standards data storage; and reporting

FO (field office); NIFC (National Interagency Fire Center); NOC (National Operations Center); RO (regional office); SO (state office); TBD (to be determined); WO (Washington Office)

Attachment B. User and Producer Accuracies for Aggregated Ecological Systems within LANDFIRE Map Zones

LANDFIRE Map Zone Name	User Accuracy	Producer Accuracy	% of Map Zone within Historical Schroeder
Wyoming Basin	76.9%	90.9%	98.5%
Snake River Plain	68.8%	85.2%	98.4%
Missouri River Plateau	57.7%	100.0%	91.3%
Grand Coulee Basin of the Columbia Plateau	80.0%	80.0%	89.3%
Wyoming Highlands	75.3%	85.9%	88.1%
Western Great Basin	69.3%	75.4%	72.9%
Blue Mountain Region of the Columbia Plateau	85.7%	88.7%	72.7%
Eastern Great Basin	62.7%	80.0%	62.8%
Northwestern Great Plains	76.5%	92.9%	46.3%
Northern Rocky Mountains	72.5%	89.2%	42.5%
Utah High Plateaus	81.8%	78.3%	41.5%
Colorado Plateau	65.3%	76.2%	28.8%
Middle Rocky Mountains	78.6%	73.3%	26.4%
Cascade Mountain Range	57.1%	88.9%	17.3%
Sierra Nevada Mountain Range	0.0%	0.0%	12.3%
Northwestern Rocky Mountains	66.7%	60.0%	7.3%
Southern Rocky Mountains	58.6%	56.7%	7.0%
Northern Cascades	75.0%	75.0%	2.6%
Mogollon Rim	66.7%	100.0%	1.7%
Death Valley Basin	0.0%	0.0%	1.2%

There are two anomalous map zones with 0% user and producer accuracies, attributable to no available reference data for the ecological systems of interest.

User accuracy is a map-based accuracy that is computed by looking at the reference data for a class and determining the percentage of correct predictions for these samples. For example, if I select any sagebrush pixel on the classified map, what is the probability that I'll be standing in a sagebrush stand when I visit that pixel location in the field? ***Commission Error*** equates to including a pixel in a class when it should have been excluded (i.e., commission error = 1 – user's accuracy).

Producer accuracy is a reference-based accuracy that is computed by looking at the predictions produced for a class and determining the percentage of correct predictions. In other words, if I know that a particular area is sagebrush (I've been out on the ground to check), what is the probability that the digital map will correctly identify that pixel as sagebrush? ***Omission Error*** equates to excluding a pixel that should have been included in the class (i.e., omission error = 1 – producer's accuracy).

Attachment C. Sagebrush Species and Subspecies Included in the Selection Criteria for Building the EVT and BpS Layers

- *Artemisia arbuscula* subspecies *longicaulis*
- *Artemisia arbuscula* subspecies *longiloba*
- *Artemisia bigelovii*
- *Artemisia nova*
- *Artemisia papposa*
- *Artemisia pygmaea*
- *Artemisia rigida*
- *Artemisia spinescens*
- *Artemisia tripartita* subspecies *rupicola*
- *Artemisia tripartita* subspecies *tripartita*
- *Tanacetum nuttallii*
- *Artemisia cana* subspecies *bolanderi*
- *Artemisia cana* subspecies *cana*
- *Artemisia cana* subspecies *viscidula*
- *Artemisia tridentata* subspecies *wyomingensis*
- *Artemisia tridentata* subspecies *tridentata*
- *Artemisia tridentata* subspecies *vaseyana*
- *Artemisia tridentata* subspecies *spiciformis*
- *Artemisia tridentata* subspecies *xericensis*
- *Artemisia tridentata* variety *pauciflora*
- *Artemisia frigida*
- *Artemisia pedatifida*

Appendix E
Disturbance Cap Calculation Method

APPENDIX E
DISTURBANCE CAP CALCULATION METHOD

In the USFWS's 2010 listing decision for sage-grouse (75 FR 13910 2010), the USFWS identified 18 threats contributing to the destruction, modification, or curtailment of the sage-grouse's habitat or range. The 18 threats have been aggregated into three measures (**Table E-1**):

- Sagebrush Availability (percent of sagebrush per unit area)
- Habitat Degradation (percent of human activity per unit area)
- Density of Energy and Mining (facilities and locations per unit area)

Habitat Degradation and Density of Energy and Mining will be evaluated under the Disturbance Cap and Density Cap, respectively, and are further described in this appendix. The three measures, in conjunction with other information, will be considered during the NEPA process for projects authorized or undertaken by the BLM.

DISTURBANCE CAP

This land use plan has incorporated a 3% disturbance cap within Greater Sage-Grouse (GRSG) Priority Habitat Management Areas (PHMAs) and the subsequent land use planning actions if the cap is met:

> *If the 3% anthropogenic disturbance cap is exceeded, not to exceed 1% per decade, on lands (regardless of land ownership) within GRSG Priority Habitat Management Areas (PHMA) in any given **Oregon PAC**, then no further discrete anthropogenic disturbances (subject to applicable laws and regulations, such as the General Mining Law of 1872, as amended, valid existing rights, etc.) will be permitted by BLM within GRSG PHMAs in any given Oregon PAC until the disturbance has been reduced to less than the cap.*
>
> *If the 3% disturbance cap, not to exceed 1% per decade, is exceeded on all lands (regardless of land ownership) within a **proposed project analysis area** in a PHMA, then no further anthropogenic disturbance will be permitted by BLM until disturbance in the proposed project analysis area has been reduced to maintain the area under the cap (subject to applicable laws and regulations, such as the General Mining Law of 1872, as amended, valid existing rights, etc.).*

Table E-1
Relationship Between the 18 Threats and the Three Habitat Disturbance Measures for Monitoring and Disturbance Calculations

USFWS Listing Decision Threat	Sagebrush Availability	Habitat Degradation	Energy and Mining Density
Agriculture	X		
Urbanization	X		
Wildfire	X		
Conifer encroachment	X		
Treatments	X		
Invasive Species	X		
Energy (oil and gas wells and development facilities)		X	X
Energy (coal mines)		X	X
Energy (wind towers)		X	X
Energy (solar fields)		X	X
Energy (geothermal)		X	X
Mining (active locatable, leasable, and saleable developments)		X	X
Infrastructure (roads)		X	
Infrastructure (railroads)		X	
Infrastructure (power lines)		X	
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Other developed rights-of-way		X	

The disturbance cap applies to the PHMA within both Oregon Priority Areas for Conservation (Oregon PACs) and at the project authorization scale. For the Oregon PACs, west-wide habitat degradation (disturbance) data layers (**Table E-2**) will be used at a minimum to calculate the amount of disturbance and to determine if the disturbance cap has been exceeded as the land use plans (LUP) are being implemented. Locally collected disturbance data will be used to determine if the disturbance cap has been exceeded for project authorizations, and may also be used to calculate the amount of disturbance in the Oregon PACs. Although locatable mine sites are included in the degradation calculation, mining activities under the 1872 mining law may not be subject to the 3% disturbance cap. Details about locatable mining activities will be fully disclosed and analyzed in the NEPA process to assess impacts to sage-grouse and their habitat as well as to BLM goals and objectives, and other BLM programs and activities.

Oregon PACs are based on current boundaries of ODFW Core Areas established in Hagen (2011). ODFW plans to update its Core Area maps as new information is obtained on winter habitat use, lek distribution, disturbance thresholds from various types of development, and success of mitigation measures (Hagen et al. 2011). These changes could affect Oregon PACs and measurements of anthropogenic disturbance. However, BLM does not anticipate ODFW will make substantial changes to Core Area boundaries.

Table E-2
Anthropogenic Disturbance Types for Disturbance Calculations
Data Sources are Described for the West-Wide Habitat Degradation Estimates
(Table copied from the GRSG Monitoring Framework)

Degradation Type	Subcategory	Data Source	Direct Area of Influence	Area Source
Energy (oil & gas)	Wells	IHS; BLM (AFMSS)	5.0ac (2.0ha)	BLM WO-300
	Power Plants	Platts (power plants)	5.0ac (2.0ha)	BLM WO-300
Energy (coal)	Mines	BLM; USFS; Office of Surface Mining Reclamation and Enforcement; USGS Mineral Resources Data System	Polygon area (digitized)	Esri/ Google Imagery
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Energy (wind)	Wind Turbines	Federal Aviation Administration	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	3.0ac (1.2ha)	BLM WO-300
Energy (solar)	Fields/Power Plants	Platts (power plants)	7.3ac (3.0ha)/MW	NREL
Energy (geothermal)	Wells	IHS	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Mining	Locatable Developments	InfoMine	Polygon area (digitized)	Esri Imagery
Infrastructure (roads)	Surface Streets (Minor Roads)[1]	Esri StreetMap Premium	40.7ft (12.4m)	USGS
	Major Roads	Esri StreetMap Premium	84.0ft (25.6m)	USGS
	Interstate Highways	Esri StreetMap Premium	240.2ft (73.2m)	USGS
Infrastructure (railroads)	Active Lines	Federal Railroad Administration	30.8ft (9.4m)	USGS
Infrastructure (power lines)	1-199kV Lines	Platts (transmission lines)	100ft (30.5m)	BLM WO-300
	200-399 kV Lines	Platts (transmission lines)	150ft (45.7m)	BLM WO-300
	400-699kV Lines	Platts (transmission lines)	200ft (61.0m)	BLM WO-300
	700+kV Lines	Platts (transmission lines)	250ft (76.2m)	BLM WO-300
Infrastructure (communication)	Towers	Federal Communications Commission	2.5ac (1.0ha)	BLM WO-300

[1]Minor roads include transportation routes with maintenance level 3, 4, or 5 on BLM lands or its equivalent on non-BLM lands.

Formulas for calculations of the amount of disturbance in the PHMA in an Oregon PAC and/or in a proposed project area are as follows:

- For the Oregon PACs:

  % Degradation Disturbance = (combined acres of the 12 degradation threats[1]) ÷ (acres of all lands within the PHMAs in an Oregon PAC) x 100.

- For the Project Analysis Area:

  % Degradation Disturbance = (combined acres of the 12 degradation threats[2] plus the 7 site scale threats[3]) ÷ (acres of all lands within the PHMA in the project analysis area) x 100.

The denominator in the disturbance calculation formula consists of all acres of lands classified as PHMA within the analysis area (Oregon PAC or project area). Areas that are not sage-grouse seasonal habitats, or are not currently supporting sagebrush cover (e.g., due to wildfire), are not excluded from the acres of PHMA in the denominator of the formula. Information regarding sage-grouse seasonal habitats, sagebrush availability, and areas with the potential to support sage-grouse populations will be considered along with other local conditions that may affect sage-grouse during the analysis of the proposed project area.

Agency Coordination

The BLM will cooperate with State of Oregon agencies to calculate baseline disturbance, develop a disturbance data base, and co-manage the disturbance cap to ensure BLM does not authorize new disturbance above the cap. The BLM will monitor disturbance and the adaptive management triggers identified in the Greater Sage-Grouse Adaptive Management Strategy (Appendix D).

Decadal Disturbance Cap

Research indicates leks are absent from historic range with relatively low levels of anthropogenic development and infrastructure (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). Because the level of disturbance at which leks are abandoned varies across the species range and cannot be accurately predicted, the rate of new disturbance permitted in Oregon PACs will be metered to allow for further research, support adaptive management, and provide incentives for restoration and recovery from non-anthropogenic impacts such as fire and invasive species. In the first 10 years of this metering approach, a maximum 1 percent new discretionary disturbance may be allowed in Oregon PACs with existing disturbance below 3 percent. After the initial 10-year period, and at 10-year intervals thereafter, additional 1 percent discretionary disturbance may be permitted in Oregon PACs. New discretionary disturbance on BLM administered lands will not be allowed to result in 3 percent or greater total disturbance within an Oregon PAC or project authorization area at any time.

Example Calculation of Decadal Disturbance

In this example, the Oregon PAC contains 400,000 acres. Using the procedures described above, BLM calculates existing disturbance in the Oregon PAC, regardless of land ownership, totals 2,000 acres, or 0.5 percent. To remain below the 3 percent disturbance cap, no more than 9,960 acres (2.49% of

[1] See **Table E-1**
[2] See **Table E-1**
[3] See **Table E-3**

400,000) of new surface disturbance may be allowed over the 30-year period. In the first ten year period (starting with the first new approved disturbance), up to 4,000 acres (1% of 400,000 acres) of new disturbance may be allowed in this Oregon PAC.

A development is proposed in the Oregon PAC that would result in 1,000 acres of new disturbance. Since total disturbance in the PAC would remain below 3 percent, the BLM may consider this proposal. However, the proposed project also must not exceed the 3 percent disturbance cap at the project-analysis level scale. If BLM approves the proposal, it may consider additional proposals for new disturbance in this PAC up to but not exceeding 3,000 acres in the first 10 years. In this example, maximum total surface disturbance at the end of the first decade would be 6,000 acres or 1.5 percent. At no time will the 3 percent total disturbance cap be exceeded within the Oregon PAC and within the project-analysis area.

In the next 10-year period (beginning 10 years after the first approved new disturbance in the Oregon PAC), an additional 4,000 acres of new disturbance (1% of 400,000 acres) may be authorized. Maximum total surface disturbance by the end of the second decade would be 10,000 acres or 2.5 percent. In the final decade, no more than 1,960 acres or 0.49 percent new disturbance may be authorized to prevent total disturbance in this Oregon PAC from reaching 3.0 percent.

At no point can BLM authorize discretionary disturbance that would result in more than 1 percent new disturbance in an Oregon PAC within a 10-year period, or authorize disturbance to exceed 3 percent in an Oregon PAC and project-analysis area, regardless of land ownership. If less than 1 percent new disturbance occurs in a 10-year period, disturbance will not exceed 1 percent in the following 10-year period (there is no "carry over"). Existing disturbance may be removed or reduced to provide "decision space" for authorizing new disturbance. For example, a utility provider could remove or relocate an existing power line to avoid Oregon PACs or co-locate the line with another existing line in the same Oregon PAC. Another example would be removing a communication tower, mine development, or redundant roadway. Treatments that restore natural vegetation to achieve GRSG habitat objectives also may reduce total surface disturbance.

DENSITY CAP

This land use plan has also incorporated a cap on the density of energy and mining facilities at an average of one facility per 640 acres in the PHMA in a project authorization area. If the disturbance density in the PHMA in a proposed project area is on average less than 1 facility per 640 acres, the analysis will proceed through the NEPA process incorporating mitigation measures into an alternative. If the disturbance density is greater than an average of 1 facility per 640 acres, the proposed project will either be deferred until the density of energy and mining facilities is less than the cap or co-located into existing disturbed areas (subject to applicable laws and regulations, such as the 1872 Mining Law, valid existing rights, etc.). Facilities included in the density calculation (**Table E-1**) are:

- Energy (oil and gas wells and development facilities)
- Energy (coal mines)
- Energy (wind towers)
- Energy (solar fields)
- Energy (geothermal)

- Mining (active locatable, leasable, and saleable developments)

Project Analysis Area Method for Permitting Surface Disturbance Activities

- Determine potentially affected occupied leks by placing a four mile boundary around the proposed area of physical disturbance related to the project. All occupied and pending leks located within the four mile project boundary and within PHMA will be considered affected by the project.
- Next, place a four mile boundary around each of the affected leks.
- The PHMA within the four mile lek boundary and the four mile project boundary creates the project analysis area for each individual project. If there are no occupied or pending leks within the four-mile project boundary, the project analysis area will be that portion of the four-mile project boundary within the PHMA.
- Digitize all existing anthropogenic disturbances identified in **Table E-2** and the 7 additional features that are considered threats to sage-grouse (**Table E-3**). Using 1 meter resolution NAIP imagery is recommended. Use existing local data if available.
- Calculate percent existing disturbance using the formula above. If existing disturbance is less than 3% and the rate of increase per decade since implementing the cap is less than 1%, proceed to next step. If existing disturbance is greater than 3% and/or exceeds 1% increase per decade, defer the project.
- Add proposed project disturbance footprint area and recalculate the percent disturbance. If disturbance is less than 3% and less than 1% increase per decade, proceed to next step. If disturbance is greater than 3% and/or exceeds 1% increase per decade, defer project.
- Calculate the disturbance density of energy and mining facilities (listed above). If the disturbance density is less than 1 facility per 640 acres, averaged across project analysis area, proceed to the NEPA analysis incorporating mitigation measures into an alternative. If the disturbance density is greater than 1 facility per 640 acres, averaged across the project analysis area, either defer the proposed project or co-locate it into existing disturbed area.
- If a project that would exceed the degradation cap or density cap cannot be deferred due to valid existing rights or other existing laws and regulations, fully disclose the local and regional impacts of the proposed action in the associated NEPA.

Table E-3
The Seven Site Scale Features Considered Threats to Sage-Grouse Included in the Disturbance Calculation for Project Authorizations

1. Coalbed Methane Ponds
2. Meteorological Towers
3. Nuclear Energy Facilities
4. Airport Facilities and Infrastructure
5. Military Range Facilities & Infrastructure
6. Hydroelectric Plants
7. Recreation Areas Facilities and Infrastructure
Definitions:
1. Coalbed Methane and other Energy-related Retention Ponds – The footprint boundary will follow the fenceline and includes the area within the fenceline surrounding the impoundment. If the pond is not fenced, the impoundment itself is the footprint. Other infrastructure associated with the containment ponds (roads, well pads, etc.) will be captured in other disturbance categories.
2. Meteorological Towers – This feature includes long-term weather monitoring and temporary meteorological towers associated with short-term wind testing. The footprint boundary includes the area underneath the guy wires.
3. Nuclear Energy Facilities – The footprint boundary includes visible facilities (fence, road, etc.) and undisturbed areas within the facility's perimeter.
4. Airport Facilities and Infrastructure (public and private) – The footprint boundary will follow the boundary of the airport or heliport and includes mowed areas, parking lots, hangars, taxiways, driveways, terminals, maintenance facilities, beacons and related features. Indicators of the boundary, such as distinct land cover changes, fences and perimeter roads, will be used to encompass the entire airport or heliport.
5. Military Range Facilities & Infrastructure – The footprint boundary will follow the outer edge of the disturbed areas around buildings and includes undisturbed areas within the facility's perimeter.
6. Hydroelectric Plants – The footprint boundary includes visible facilities (fence, road, etc.) and undisturbed areas within the facility's perimeter.
7. Recreation Areas & Facilities – This feature includes all sites/facilities larger than 0.25 acres in size. The footprint boundary will include any undisturbed areas within the site/facility.

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Appendix F
Mitigation

APPENDIX F
MITIGATION

GENERAL

In undertaking BLM management actions, and, consistent with valid existing rights and applicable law, in authorizing third party actions that result in habitat loss and degradation, the BLM will require and ensure mitigation that provides a net conservation gain to the species including accounting for any uncertainty associated with the effectiveness of such mitigation. This will be achieved by avoiding, minimizing, and compensating for impacts by applying beneficial mitigation actions. Mitigation will follow the regulations from the White House Council on Environmental Quality (CEQ) (40 CFR 1508.20; e.g. avoid, minimize, and compensate), hereafter referred to as the mitigation hierarchy. If impacts from BLM management actions and authorized third party actions that result in habitat loss and degradation remain after applying avoidance and minimization measures (i.e. residual impacts), then compensatory mitigation projects will be used to provide a net conservation gain to the species. Any compensatory mitigation will be durable, timely, and in addition to that which would have resulted without the compensatory mitigation (see glossary).

The BLM, via the WAFWA Management Zone Greater Sage-Grouse Conservation Team, will develop a WAFWA Management Zone Regional Mitigation Strategy that will inform the NEPA decision making process including the application of the mitigation hierarchy for BLM management actions and third party actions that result in habitat loss and degradation. A robust and transparent Regional Mitigation Strategy will contribute to greater sage-grouse habitat conservation by reducing, eliminating, or minimizing threats and compensating for residual impacts to greater sage-grouse and its habitat.

The BLM's Regional Mitigation Manual MS-1794 serves as a framework for developing and implementing a Regional Mitigation Strategy. The following sections provide additional guidance specific to the development and implementation of a WAFWA Management Zone Regional Mitigation Strategy.

DEVELOPING A WAFWA MANAGEMENT ZONE REGIONAL MITIGATION STRATEGY

The BLM, via the WAFWA Management Zone Greater Sage-Grouse Conservation Team, will develop a WAFWA Management Zone Regional Mitigation Strategy to guide the application of the mitigation hierarchy for BLM management actions and third party actions that result in habitat loss and degradation. The Strategy should consider any State-level greater sage-grouse mitigation guidance that is consistent with the requirements identified in this Appendix. The Regional Mitigation Strategy should be developed in a transparent manner, based on the best science available and standardized metrics.

As described in Chapter 2, the BLM will establish a WAFWA Management Zone Greater Sage-Grouse Conservation Team (hereafter, Team) to help guide the conservation of greater sage-grouse, within 90 days of the issuance of the Record of Decision. The Strategy will be developed within one year of the issuance of the Record of Decision. BLM Oregon will ensure that coordination within with ODFW, USFWS, NRCS, and local government occurs through participation in the State of Oregon's consistency review or similar process. This will occur prior to participation at the Team level to facilitate a coordinated proposal from Oregon to the Team.

The Regional Mitigation Strategy should include mitigation guidance on avoidance, minimization, and compensation, as follows:

- Avoidance
  - Include avoidance areas (e.g. right-of-way avoidance/exclusion areas, no surface occupancy areas) already included in laws, regulations, policies, and/or land use plans (e.g. Resource Management Plans or State Plans); and,
  - Include any potential, additional avoidance actions (e.g. additional avoidance best management practices) with regard to greater sage-grouse conservation.
- Minimization
  - Include minimization actions (e.g. required design features, best management practices) already included in laws, regulations, policies, land use plans, and/or land-use authorizations; and,
  - Include any potential, additional minimization actions (e.g. additional minimization best management practices) with regard to greater sage-grouse conservation.
- Compensation
  - Include discussion of impact/project valuation, compensatory mitigation options, siting, compensatory project types and costs, monitoring, reporting, and program administration. Each of these topics is discussed in more detail below.
    - Residual Impact and Compensatory Mitigation Project Valuation Guidance
      - A common standardized method should be identified for estimating the value of the residual impacts and value of the compensatory mitigation projects, including accounting for any uncertainty associated with the effectiveness of the projects.
      - This method should consider the quality of habitat, scarcity of the habitat, and the size of the impact/project.
      - For compensatory mitigation projects, consideration of durability (see glossary), timeliness (see glossary), and the potential for failure (e.g. uncertainty associated with effectiveness) may require an upward adjustment of the valuation.

    - The resultant compensatory mitigation project will, after application of the above guidance, result in proactive conservation measures for Greater Sage-grouse (consistent with BLM Manual 6840 – Special Status Species Management, section .02).
- Compensatory Mitigation Options
    - Options for implementing compensatory mitigation should be identified, such as:
        - Utilizing certified mitigation/conservation bank or credit exchanges.
        - Contributing to an existing mitigation/conservation fund.
        - Authorized-user conducted mitigation projects.
    - For any compensatory mitigation project, the investment must be additional (i.e. additionality: the conservation benefits of compensatory mitigation are demonstrably new and would not have resulted without the compensatory mitigation project).
- Compensatory Mitigation Siting
    - Sites should be in areas that have the potential to yield a net conservation gain to the greater sage-grouse, regardless of land ownership.
    - Sites should be durable (see glossary).
    - Sites identified by existing plans and strategies (e.g. fire restoration plans, invasive species strategies, healthy land focal areas) should be considered, if those sites have the potential to yield a net conservation gain to greater sage-grouse and are durable.
- Compensatory Mitigation Project Types and Costs
    - Project types should be identified that help reduce threats to greater sage-grouse (e.g. protection, conservation, and restoration projects).
    - Each project type should have a goal and measurable objectives.
    - Each project type should have associated monitoring and maintenance requirements, for the duration of the impact.
    - To inform contributions to a mitigation/conservation fund, expected costs for these project types (and their monitoring and maintenance), within the WAFWA Management Zone, should be identified.
- Compensatory Mitigation Compliance and Monitoring
    - Mitigation projects should be inspected to ensure they are implemented as designed, and if not, there should be methods to enforce compliance.

    - Mitigation projects should be monitored to ensure that the goals and objectives are met and that the benefits are effective for the duration of the impact.
- Compensatory Mitigation Reporting
    - Standardized, transparent, scalable, and scientifically-defensible reporting requirements should be identified for mitigation projects.
    - Reports should be compiled, summarized, and reviewed in the WAFWA Management Zone in order to determine if greater sage-grouse conservation has been achieved and/or to support adaptive management recommendations.
- Compensatory Mitigation Program Implementation Guidelines
    - Guidelines for implementing the State-level compensatory mitigation program should include holding and applying compensatory mitigation funds, operating a transparent and credible accounting system, certifying mitigation credits, and managing reporting requirements.

Incorporating the Regional Mitigation Strategy into NEPA Analyses

The BLM will include the avoidance, minimization, and compensatory recommendations from the Regional Mitigation Strategy in one or more of the NEPA analysis' alternatives for BLM management actions and third party actions that result in habitat loss and degradation and the appropriate mitigation actions will be carried forward into the decision.

Implementing a Compensatory Mitigation Program

The BLM needs to ensure that compensatory mitigation is strategically implemented to provide a net conservation gain to the species, as identified in the Regional Mitigation Strategy. In order to align with existing compensatory mitigation efforts, this compensatory mitigation program will be managed at a State-level (as opposed to a WAFWA Management Zone or a Field Office), in collaboration with our partners (e.g. Federal, Tribal, and State agencies).

To ensure transparent and effective management of the compensatory mitigation funds, the BLM will enter into a contract or agreement with a third-party to help manage the State-level compensatory mitigation funds, within one year of the issuance of the Record of Decision. The selection of the third-party compensatory mitigation administrator will conform to all relevant laws, regulations, and policies. The BLM will remain responsible for making decisions that affect Federal lands.

Oregon Sub-region Mitigation Procedures

Introduction

The steps below identify a sequential screening process for review of proposed anthropogenic activities. This process applies to all BLM authorizations including those proposed by applicants, as well as BLM originated proposals. The goal of the process is to provide a consistent approach regardless of the administrative location of the project and to ensure that authorization of these projects will not contribute to the decline of GRSG.

Step 1
For applicant proposals: the screening process is initiated upon formal submittal of a proposal for authorization for use of BLM-administered lands. The actual documentation would include, at a minimum, a description of the location, size of the project, and timing of the disturbance and would be consistent with existing protocol and procedures for the specific type of use. BLM anticipates that third parties (e.g. rural electric cooperatives) would be submitting the proposals.

For BLM proposals: the screening process would be incorporated into the NEPA analysis for the proposal.

Step 2
Evaluate whether the proposal could be allowed as prescribed in the applicable RMP. For example, certain activities are prohibited in PHMA such as wind or solar energy development. If the proposal is an activity that is specifically prohibited, inform the submitter that the proposal is rejected since it is not consistent with the applicable RMP, regardless of the project design.

In addition to consistency with program allocations, the GRSG RMP amendment identifies a limit on the amount of new discretionary disturbance that is allowed within an Oregon Priority Area for Conservation (Oregon PAC). If current disturbance within the affected unit exceeds this threshold, the project would be deferred until the amount of disturbance within the area has been reduced to the identified level. Similarly, if a population or habitat adaptive management trigger is reached; the proposed project may be deferred.

Step 3
Determine if the project would have a direct or indirect impact on population or habitat (regardless of ownership). This can be done by:

1. Reviewing habitat maps.
2. Reviewing the Summary of science, activities, programs, and policies that influence the rangewide conservation of Greater Sage-Grouse (Manier, 2013) which identifies the area of direct and indirect effects for various anthropogenic activities.
3. Consultation with, USFWS, or State Agency wildlife biologist.
4. Reviewing the decisions in the plan amendments (such as required design features for the proposed activity).
5. Other methods acceptable to the BLM/authorized officer.

If the proposal will not have a direct or indirect impact on either the habitat or population, proceed with the appropriate process for review, decision, and implementation of the project.

Step 4
If the project could have a direct or indirect impact to sage-grouse habitat or population, evaluate whether the proposal can be relocated to not have the impact and still achieve the intent of the proposal. If the project can be relocated so as to not have an impact on sage-grouse and still achieve objectives of the proposal, inform applicant and proceed with the appropriate process for review, decision, and implementation of the relocated project.

Step 5

For applicant proposals: If the preliminary review of the proposal concludes that there may be impacts to sage-grouse habitat and/or population, and the project cannot be effectively relocated to eliminate these impacts; evaluate whether the agency has the authority to modify or deny the project. If the agency does NOT have the discretionary authority to modify or deny the proposal, proceed with the authorization process (decision) and include appropriate mitigation requirements that minimize impacts to sage-grouse habitat and populations. Mitigation (to achieve a net conservation gain to sage-grouse) would be the financial responsibility of the applicant and could include a combination of actions such as timing of disturbance, design modifications of the proposal, site disturbance restoration, and compensatory mitigation actions.

Step 6

If this is a BLM originated proposal or the agency has the discretionary authority to deny the applicant proposed project and after careful screening of the proposal (Steps 1-4) has determined that direct and indirect cannot be eliminated, evaluate the proposal to determine if the adverse impacts can be mitigated with a net conservation gain. If the impacts cannot be effectively mitigated to a net conservation gain, select the no action alternative for BLM proposals; for applicant proposals, reject or defer the proposal. The criteria for determining this situation would include but are not limited to:

- Disturbance within the Oregon PAC is substantial and allowing additional activities within the area would adversely impact the species (See habitat and population triggers in the adaptive management strategy).
- The population or habitat trend within the Oregon PAC is down and allowing additional impacts, whether mitigated or not, could lead to further decline of the species or habitat (See habitat and population triggers in the adaptive management strategy).
- Monitoring or current research indicates the proposed mitigation is ineffective, insufficient, or unproven.
- The additional impacts, after applying effective mitigation, would exceed the disturbance threshold for the Oregon PAC.
- The project would impact habitat that has been determined, through monitoring, to be a limiting factor for species sustainability within the Oregon PAC.
- Other site-specific criteria that determined the project would lead to a downward trend to the current species population or habitat with the Oregon PAC.

If the project can be mitigated to provide for a net conservation gain to the species, as determined through coordination with ODFW and FWS, proceed with the design of the mitigation plan and authorization (through NEPA analysis and decision) of the project. The authorization process could identify issues that may require additional mitigation or denial/deferring of the project based on site specific impacts to the Greater Sage-grouse.

Glossary Terms

Additionality: The conservation benefits of compensatory mitigation are demonstrably new and would not have resulted without the compensatory mitigation project. (adopted and modified from BLM Manual Section 1794).

Avoidance mitigation: Avoiding the impact altogether by not taking a certain action or parts of an action. (40 CFR 1508.20(a)) (e.g. may also include avoiding the impact by moving the proposed action to a different time or location.)

Compensatory mitigation: Compensating for the (residual) impact by replacing or providing substitute resources or environments. (40 CFR 1508.20)

Compensatory mitigation projects: The restoration, creation, enhancement, and/or preservation of impacted resources (adopted and modified from 33 CFR 332), such as on-the-ground actions to improve and/or protect habitats (e.g. chemical vegetation treatments, land acquisitions, conservation easements). (adopted and modified from BLM Manual Section 1794).

Compensatory mitigation sites: The durable areas where compensatory mitigation projects will occur. (adopted and modified from BLM Manual Section 1794).

Durability (protective and ecological): The maintenance of the effectiveness of a mitigation site and project for the duration of the associated impacts, which includes resource, administrative/legal, and financial considerations. (adopted and modified from BLM Manual Section 1794).

Minimization mitigation: Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (40 CFR 1508.20 (b))

Residual impacts: Impacts that remain after applying avoidance and minimization mitigation; also referred to as unavoidable impacts.

Timeliness: The lack of a time lag between impacts and the achievement of compensatory mitigation goals and objectives (BLM Manual Section 1794).

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Appendix G

Fluid Mineral Leasing Stipulations

APPENDIX G
FLUID MINERAL LEASING STIPULATIONS

This appendix identifies surface stipulations for geothermal and oil and gas leasing referred to throughout this Approved Resource Management Plan Amendment (ARMPA) and Environmental Impact Statement (EIS). These surface stipulations would also apply, where appropriate and practical, to other surface-disturbing activities and occupancy associated with land use authorizations, permits, and leases issued on BLM-administered lands. The stipulations would not apply to other activities and uses where they are contrary to laws, regulations, or policy for specific land use authorizations. The intent is to manage other activities and uses as consistently as possible with geothermal and oil and gas leasing.

Surface-disturbing activities are those that normally result in more than negligible disturbance to public lands. These activities normally involve disturbance to soils and vegetation to the extent that reclamation is required. They include the following:

- Use of mechanized earth-moving equipment
- Truck-mounted drilling equipment
- Geophysical exploration
- Off-road vehicle travel in areas designated as limited or closed to off-highway vehicle (OHV) use
- Placement of surface facilities, such as utilities, pipelines, structures, and oil and gas wells
- New road construction
- Use of pyrotechnics, explosives, and hazardous chemicals

Surface-disturbing activities would not include livestock grazing, cross-country hiking, driving on designated routes, and minimum impact filming permits.

DESCRIPTION OF SURFACE STIPULATIONS

Table G-1 shows the stipulations for the approved plan, including exceptions, modifications, and waivers. Three surface stipulations could be applied to land use authorizations:

- No surface occupancy (NSO)
- Timing limitations (TL)
- Controlled surface use (CSU)

All stipulations for other resources, besides GRSG, included in the existing land use plans would still be applicable.

Areas identified as NSO would be closed to surface-disturbing activities for fluid minerals.

Areas identified as TL would be closed to surface-disturbing activities during identified time frames. TL areas would be open to operational and maintenance activities, including associated vehicle travel, during the closed period unless otherwise specified in the stipulation.

Areas identified as CSU would require proposals to be authorized only according to the controls or constraints specified. The controls would be applicable to all surface-disturbing activities.

Exceptions, Modifications, and Waivers

Surface stipulations could be excepted, modified, or waived by the BLM Authorized Officer. An exception exempts the holder of the land use authorization document from the stipulation on a one-time basis. A modification changes the language or provisions of a surface stipulation, either temporarily or permanently. A waiver permanently exempts the surface stipulation.

The environmental analysis document prepared for site-specific proposals, such as geothermal and oil and gas development (i.e., applications for permit to drill [APD] or sundry notices), also would need to address proposals to exempt, modify, or waive a surface stipulation. This would require the environmental analysis document to show that the following:

- That the circumstances or relative resource values in the area had changed following issuance of the lease
- That less restrictive requirements could be developed to protect the resource of concern
- That operations could be conducted without causing unacceptable impacts

Standard Terms and Conditions

All surface-disturbing activities are subject to standard terms and conditions. These include the stipulations that are required for proposed actions in order to comply with the Endangered Species Act (ESA). Standard terms and conditions for geothermal and oil and gas leasing provide for relocation of proposed operations up to 200 meters and for prohibiting surface-disturbing operations for a period not to exceed 60 days. The stipulations addressed in **Table G-1** that are within the parameters of 200 meters and 60 days are considered open to geothermal and oil and gas leasing subject to standard terms and conditions.

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	Stipulation Description
NSO within sagebrush focal areas (SFA)	**Purpose:** To maintain and enhance SFA to achieve the desired conditions of maintaining a minimum of 70% of lands capable of producing sagebrush with 10 to 30% sagebrush cover. The attributes necessary to sustain these habitats are described in Interpreting Indicators of Rangeland Health (BLM Tech Ref 1734-6) and **Table 2-2**. In accordance with its October 27, 2014, memorandum, the USFWS identifies areas that represent recognized strongholds for GRSG that have been noted by the conservation community as having the highest densities of GRSG and other criteria important for the persistence of the species. **Exception:** None **Waiver:** None **Modification:** None
NSO in PHMA	**Purpose:** To protect key seasonal habitat, life history requirements, or behavioral needs of GRSG near leks from habitat fragmentation and loss and GRSG populations from disturbance inside priority habitat areas and connectivity habitat areas **Exception:** The BLM Authorized Officer may grant an exception to a fluid mineral lease NSO stipulation only where the proposed action: (i) Would not have direct, indirect, or cumulative effects on GRSG or its habitat or (ii) Is proposed to be undertaken as an alternative to a similar action occurring on a nearby parcel and would provide a clear conservation gain to GRSG Exceptions based on conservation gain (ii) may only be considered in (a) PHMAs of mixed ownership where federal minerals underlie less than fifty percent of the total surface or (b) areas of the public lands where the proposed exception is an alternative to an action occurring on a nearby parcel subject to a valid federal fluid mineral lease existing as of the date of this ARMPA. Exceptions based on conservation gain must also include such measures as enforceable institutional controls and buffers, sufficient to allow the BLM to conclude that such benefits would last for the duration of the proposed action's impacts. The BLM Authorized Officer may approved any exceptions to this lease stipulation but only with the concurrence of the State Director. The BLM Authorized Officer may not grant an exception unless the ODFW, the USFWS, and the BLM

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	Stipulation Description
	unanimously find that the proposed action satisfies (i) or (ii) above. Such finding would initially be made by a team of one GRSG expert from each respective agency. In the event the initial finding is not unanimous, it may be elevated to the BLM State Director, the USFWS State Ecological Services Director, and the ODFW Director for final resolution. In the event their finding is not unanimous, the exception would not be granted. Approved exceptions would be made publically available at least quarterly. **Modification:** None **Waiver:** None
No surface disturbance within one mile of a pending or occupied lek in GHMA.	**Purpose:** To protect GRSG leks and the life history needs of GRSG near the lek from habitat loss and GRSG populations from disturbance inside and out of GHMA **Exception:** The BLM Authorized Officer may grant an exception, in coordination with the ODFW, during project implementation and if BMPs (e.g., anti-perch devices for raptors) are implemented. **Modification:** None **Waiver:** The BLM Field Manager may waive application of the above use restrictions and meeting objectives within general habitat if off-site mitigation were successfully completed in priority habitat or opportunity areas, following discussions with the BLM and ODFW. Even in situations where use restrictions are waived in general habitat, to avoid direct disturbance or mortality of GRSG, disturbances would not be approved during the sensitive seasons.
NSO in areas outside of PHMA but within one mile of a pending or occupied lek, when the lek is in PHMA	**Purpose:** To protect occupied GRSG leks and the life-history needs of GRSG near the lek from habitat loss, GRSG from disturbance inside and out of priority habitat areas, and PHMA leks when they occur near PHMA boundary **Exception:** The BLM Authorized Officer may grant an exception to a fluid mineral lease NSO stipulation only where the proposed action: (i) Would not have direct, indirect, or cumulative effects on GRSG or its habitat or (ii) Is proposed to be undertaken as an alternative to a similar action occurring on a nearby parcel and would provide a clear conservation gain to GRSG Exceptions based on conservation gain (ii) may be considered only in (a) PHMAs of mixed ownership where federal minerals

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	Stipulation Description
	underlie less than fifty percent of the total surface or (b) on public lands where the proposed exception is an alternative to an action on a nearby parcel subject to a valid federal fluid mineral lease as of the date of this ARMPA. Exceptions based on conservation gain must also include such measures as enforceable institutional controls and buffers sufficient to allow the BLM to conclude that such benefits will last for the duration of the proposed action's impacts. Any exceptions to this lease stipulation may be approved by the BLM Authorized Officer only with the concurrence of the State Director. The BLM Authorized Officer may not grant an exception unless the ODFW, the USFWS, and the BLM unanimously find that the proposed action satisfies (i) or (ii) above. Such finding would initially be made by a team of one GRSG expert from each respective agency. In the event the initial finding is not unanimous, the finding may be elevated to the BLM State Director, the USFWS State Ecological Services Director, and the ODFW Director for final resolution. In the event their finding is not unanimous, the exception would not be granted. Approved exceptions would be made publically available at least quarterly. **Modification:** None **Waiver:** None
Required design features (RDFs)	RDFs for fluid minerals, as found in Appendix C, would be applied during the permitting process, unless at least one of the following can be demonstrated in the NEPA analysis associated with the specific project: • A specific design feature is documented to not be applicable to the site-specific conditions of the project or activity • A proposed design feature or BMP is determined to provide equal or better protection for GRSG or its habitat • Analysis shows that following a specific feature would provide no more protection to GRSG or its habitat than not following it, for the specific project being proposed
GHMA beyond 1 mile of an occupied lek, if the lek is within general habitat, would be designated as open to oil and gas leasing subject to CSU stipulations and the following timing stipulations: • Winter habitat from November 1 to February 28	See Exceptions, Modifications, and Waivers below.

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	**Stipulation Description**
• Breeding, nesting, and early-brood-rearing habitat from March 1 to June 30 • Brood rearing/summer habitat from July 1 to October 31 Where lease surface development is allowed within GHMA, development could occur only if it adheres to the following controlled surface use stipulations: • The development meets noise restrictions (noise at occupied lek less than 10 decibels above ambient sound levels from 2 hours before to 2 hours after sunrise and sunset during breeding season) • The development meets tall structure restrictions (e.g., tall structures are any man-made structure within GHMA that could disrupt lekking or nesting birds by creating perching or nesting opportunities for predators (e.g., raptors and ravens) or decrease the use of an area by GRSG) • Operators must submit a site-specific plan of development for roads, wells, pipelines, and other infrastructure before any development is authorized; this plan should outline how development on the lease would limit habitat fragmentation GHMA within and beyond the 1-mile NSO area would require coordination with the ODFW during project and BMP implementation.	
GHMA beyond 1-mile NSO; **Winter Habitat TL**: No surface	**Purpose:** To seasonally protect winter GRSG habitat from

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	**Stipulation Description**
disturbance allowed between November 1 and February 28	disruptive activity in GHMA **Exception:** The BLM Field Manager could grant exceptions to the seasonal restrictions and use restrictions if the project plan and NEPA document demonstrate that impacts from the proposed action can be adequately mitigated. **Modification:** Additionally, the BLM Field Manager may modify the seasonal restrictions and use restrictions under the following conditions: • If portions of the area do not include winter habitat (lacking the principle habitat components of winter GRSG habitat, as defined in GRSG habitat indicators **Table 2-2**) or are outside the current defined winter habitat area, as determined by the BLM in discussion with the ODFW, and indirect impacts would be mitigated • If documented local variations (e.g., higher or lower elevations) or annual climate fluctuations (e.g., early or late spring, long or heavy winter) reflect a need to change the given dates to better protect GRSG in a given area and the proposed activity would not take place beyond the season being excepted **Waiver:** None
GHMA beyond 1-mile NSO: **Breeding, Nesting, and Early Brood-Rearing Habitat TL—**No surface disturbance allowed between March 1 and June 30	**Purpose:** To seasonally protect breeding, nesting, and early brood-rearing GRSG habitat from disruptive activity in GHMA **Exception:** The BLM Field Manager could grant exceptions to the seasonal and use restrictions under the following conditions: • If surveys determine there are no active or occupied leks within 4 miles of the proposed project during the year (based on ODFW lek survey protocol) and the proposed activity would not take place beyond the season being excepted • If the project plan and NEPA document demonstrate that impacts from the proposed action could be adequately mitigated **Modification:** Additionally, the BLM Field Manager may modify the seasonal and use restrictions under the following conditions: • If portions of the area do not include habitat (lacking the principle components of GRSG habitat, as defined in the GRSG habitat indicators **Table 2-2**) or are outside the current defined breeding, nesting, and early brood-rearing habitat area, as determined by the BLM in discussion with the ODFW, and indirect impacts would be mitigated

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	Stipulation Description
	• If documented local variations (e.g., higher or lower elevations) or annual climate fluctuations (e.g., early or late spring, long or heavy winter) reflect a need to change the given dates in order to better protect GRSG in a given area and the proposed activity would not take place beyond the season being excepted **Waiver:** None
GHMA beyond 1-mile NSO: **Brood-Rearing and Summer Habitat TL—**No surface disturbance allowed between July 1 and October 31	**Purpose:** To seasonally protect brood-rearing and summer GRSG habitat from disruptive activity in GHMA **Exception:** The BLM Field Manager could grant exceptions to the seasonal and use restrictions under the following conditions: • If surveys determine there are no active or occupied leks within 4 miles of the proposed project during the year (based on ODFW lek survey protocol) and the proposed activity would not take place beyond the season being excepted • If the project plan and NEPA document demonstrate that impacts from the proposed action could be adequately mitigated **Modification:** Additionally, the BLM Field Manager may modify the seasonal and use restrictions under the following conditions: • If portions of the area do not include habitat (lacking the principle components of GRSG habitat, as defined in the GRSG habitat indicators **Table 2-2**) or are outside the current defined breeding, nesting, and early brood-rearing habitat area, as determined by the BLM in discussion with the ODFW, and indirect impacts would be mitigated • If documented local variations (e.g., higher or lower elevations) or annual climate fluctuations (e.g., early or late spring, long or heavy winter) reflect a need to change the given dates in order to better protect GRSG in a given area and the proposed activity would not take place beyond the season being excepted **Waiver:** None
• Surface-disturbing activities within GHMA would require coordination with the ODFW during project and BMP implementation.	**Purpose:** To minimize disturbance to GRSG within GHMA **Exception:** None **Modification:** None **Waiver:** The BLM Field Manager could waive application of the above use restrictions and meeting objectives within GHMA if off-site mitigation were successfully completed in priority habitat

Table G-1
Fluid Mineral Stipulations and Exceptions, Modifications, and Waiver Criteria of This ARMPA

Stipulation	Stipulation Description
	or opportunity areas, following discussion with the BLM and ODFW. Even in situations where use restrictions are waived in general habitat, to avoid direct disturbance and mortality of birds, disturbances would not be approved during the sensitive seasons.

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Appendix H

Fire and Invasives Assessment Tool

Appendix H
Fire and Invasives Assessment Tool

In the Great Basin Region (WAFWA Management Zones III, IV, and V), the US Fish and Wildlife Service (2013a) identified wildfire as a primary threat to Greater Sage-Grouse (GRSG) and its habitat. In particular, it identified wildfire in response to invasive annual grasses and conifer expansion. The Fire and Invasives Assessment Tool (FIAT) (Fire and Invasive Assessment Team 2014) provides the BLM and other land management agencies with a framework for prioritizing wildfire management and GRSG habitat conservation.

Supported by US Forest Service General Technical Report 326 (Chambers et. al. 2014c; see **Attachment 1**), FIAT provides the BLM and other agencies with a mechanism to collaboratively identify and prioritize areas within GRSG habitat for potential treatment based on their resistance and resilience characteristics. In the cold desert ecosystem typical throughout the Great Basin, soil moisture and temperature fundamentally influence a landscape's ability to resist environmental change. These factors also influence the landscape's ability to be resilient after long-term ecosystem shifts following a disturbance event, such as wildfire. Low resistance and resilience landscapes are typically characterized by low elevations, south-facing slopes, and porous soils. These areas will likely respond differently to fuels management, wildfire, and subsequent rehabilitation compared to more resistant and resilient landscapes, such as those at higher elevations or on north-facing slopes.

At the resource management planning level, FIAT consists of the following parts:

- The identification of areas at the landscape level, based on national datasets and scientific literature, where the threat to GRSG and its habitat from conifer expansion and wildfire/invasive annual grass is highest.
- The identification of regional and local areas where focused wildfire and habitat management is critical to GRSG conservation efforts.
- The identification of overarching management strategies for conifer expansion and invasive annual grasses in the areas of habitat recovery/restoration, fuels management, fire operations, and post-fire emergency stabilization and rehabilitation (ESR).

Attachment 2 outlines the FIAT landscape-level framework and describes the anticipated process for implementing the resource management strategies in the BLM District Office and National Forest Unit. Ultimately, the outcomes of the FIAT process will provide land managers with spatially defined priorities and management protocols for the following:

- Preparedness and operational decision-making prior to and during wildfires.
- Implementation of NEPA projects for fuels management, habitat restoration and ESR efforts in key GRSG habitat.

Attachment 1—Using Resistance and Resilience Concepts to Reduce Impacts of Invasive Annual Grasses and Altered Fire Regimes on the Sagebrush Ecosystem and Greater Sage-Grouse: A Strategic Multi-Scale Approach

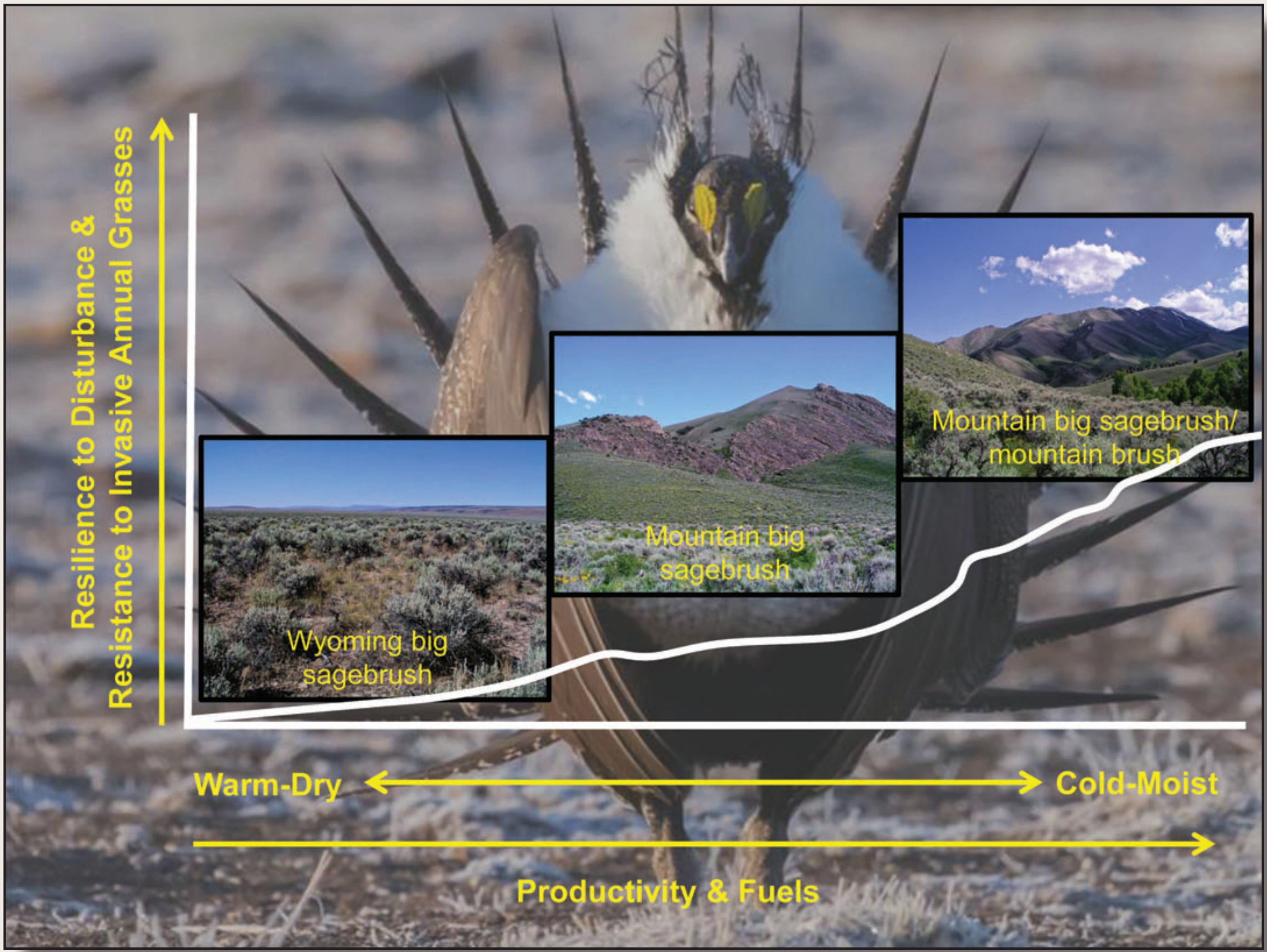
Attachment 2—Greater Sage-Grouse Wildfire, Invasive Annual Grasses, and Conifer Expansion Assessment

Appendix H – Attachment 1

United States Department of Agriculture

Using Resistance and Resilience Concepts to Reduce Impacts of Invasive Annual Grasses and Altered Fire Regimes on the Sagebrush Ecosystem and Greater Sage-Grouse: A Strategic Multi-Scale Approach

Jeanne C. Chambers, David A. Pyke, Jeremy D. Maestas, Mike Pellant, Chad S. Boyd, Steven B. Campbell, Shawn Espinosa, Douglas W. Havlina, Kenneth E. Mayer, and Amarina Wuenschel



Forest Service **Rocky Mountain Research Station** General Technical Report RMRS-GTR-326 September 2014

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Abstract

This Report provides a strategic approach for conservation of sagebrush ecosystems and Greater Sage-Grouse (sage-grouse) that focuses specifically on habitat threats caused by invasive annual grasses and altered fire regimes. It uses information on factors that influence (1) sagebrush ecosystem resilience to disturbance and resistance to invasive annual grasses and (2) distribution, relative abundance, and persistence of sage-grouse populations to develop management strategies at both landscape and site scales. A sage-grouse habitat matrix links relative resilience and resistance of sagebrush ecosystems with sage-grouse habitat requirements for landscape cover of sagebrush to help decision makers assess risks and determine appropriate management strategies at landscape scales. Focal areas for management are assessed by overlaying matrix components with sage-grouse Priority Areas for Conservation (PACs), breeding bird densities, and specific habitat threats. Decision tools are discussed for determining the suitability of focal areas for treatment and the most appropriate management treatments.

Keywords: sagebrush habitat, Greater Sage-Grouse, fire effects, invasive annual grasses, management prioritization, conservation, prevention, restoration

Cover photos: *Greater Sage-grouse photo by Rick McEwan; sagebrush habitat photos by Jeanne Chambers.*

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Using Resistance and Resilience Concepts to Reduce Impacts of Invasive Annual Grasses and Altered Fire Regimes on the Sagebrush Ecosystem and Greater Sage-Grouse: A Strategic Multi-Scale Approach

Jeanne C. Chambers, David A. Pyke, Jeremy D. Maestas, Mike Pellant, Chad S. Boyd, Steven B. Campbell, Shawn Espinosa, Douglas W. Havlina, Kenneth E. Mayer, and Amarina Wuenschel

Introduction

An unprecedented conservation effort is underway across 11 States in the western United States to reduce threats to Greater Sage-Grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) and the sagebrush ecosystems on which they depend (fig. 1). Recent efforts were accelerated by the March 2010 determination that sage-grouse warrant protection under the Federal Endangered Species Act, and by increased emphasis on broad collaboration among state and Federal partners to proactively identify and implement actions to reverse current trends (USFWS 2010, 2013). Conservation success hinges on being able to achieve "the long-term conservation of sage-grouse and healthy sagebrush shrub and native perennial grass and forb communities by maintaining viable, connected, and well-distributed populations and habitats across their range, through threat amelioration, conservation of key habitats, and restoration activities" (USFWS 2013). While strides are being made to curtail a host of threats across the range, habitat loss and fragmentation due to wildfire and invasive plants remain persistent challenges to

Figure 1. Greater Sage-Grouse (*Centrocercus urophasianus*) (photo by Charlotte Ganskopp).

achieving desired outcomes – particularly in the western portion of the range (Miller et al. 2011; USFWS 2010; 2013). Management responses to date have not been able to match the scale of this problem. Natural resource managers are seeking coordinated approaches that focus appropriate management actions in the right places to maximize conservation effectiveness (Wisdom and Chambers 2009; Murphy et al. 2013).

Improving our ability to manage for resilience to disturbance and resistance to invasive species is fundamental to achieving long-term sage-grouse conservation objectives. Resilient ecosystems have the capacity to ***regain*** their fundamental structure, processes, and functioning when altered by stressors like drought and disturbances like inappropriate livestock grazing and altered fire regimes (Holling 1973; Allen et al. 2005). Species resilience refers to the ability of a species to recover from stressors and disturbances (USFWS 2013), and is closely linked to ecosystem resilience. Resistant ecosystems have the capacity to ***retain*** their fundamental structure, processes, and functioning when exposed to stresses, disturbances, or invasive species (Folke et al. 2004). Resistance to invasion by nonnative plants is increasingly important in sagebrush ecosystems; it is a function of the abiotic and biotic attributes and ecological processes of an ecosystem that limit the population growth of an invading species (D'Antonio and Thomsen 2004**)**. A detailed explanation of the factors that influence resilience and resistance in sagebrush ecosystems is found in Chambers et al. 2014.

In general, species are likely to be more resilient if large populations exist in large blocks of high quality habitat across the full breadth of environmental variability to which the species is adapted (Redford et al. 2011). Because sage-grouse are a broadly distributed and often wide-ranging species that may move long-distances between seasonal habitats (Connelly et al. 2011a,b), a strategic approach that integrates both landscape prioritization and site-scale decision tools is needed. This document develops such an approach for the conservation of sagebrush habitats across the range of sage-grouse with an emphasis on the western portion of the range. In recent years, information and tools have been developed that significantly increase our understanding of factors that influence the resilience of sagebrush ecosystems and the distribution of sage-grouse populations, and that allow us to strategically prioritize management activities where they are most likely to be effective and to benefit the species. Although the emphasis of this Report is on the western portion of the sage-grouse range, the approach has management applicability to other sagebrush ecosystems.

In this report, we briefly review causes and effects of invasive annual grasses and altered fire regimes, and then discuss factors that determine resilience to disturbances like wildfire and resistance to invasive annual grasses in sagebrush ecosystems. We illustrate how an understanding of resilience and resistance, sagebrush habitat requirements for sage-grouse, and consequences that invasive annual grasses and wildfire have on sage-grouse populations can be used to develop management strategies at both landscape and site scales. A sage-grouse habitat matrix is provided that links relative resilience and resistance with habitat requirements for landscape cover of sagebrush to both identify priority areas for management and determine effective management strategies at landscape scales. An approach for assessing focal areas for sage-grouse habitat management is described that overlays Priority Areas for Conservation (PACs) and breeding bird densities with resilience and resistance and habitat suitability to spatially link sage-grouse populations with habitat conditions and risks. The use of this approach is illustrated for the western portion of the range and for a diverse area in the northeast corner of Nevada. It concludes with a discussion of the tools available for determining the suitability of focal areas for treatment and the most appropriate management treatments. Throughout the document, the emphasis is on using this approach to guide and assist fire operations, fuels management, post-fire rehabilitation, and habitat restoration activities to maintain or enhance sage-grouse habitat.

Threats of Invasive Annual Grasses and Altered Fire Regimes to Sagebrush Ecosystems and Sage-Grouse

Effects on Sagebrush Ecosystems

Sage-grouse habitat loss and fragmentation due to wildfire and invasive plants are widely recognized as two of the most significant challenges to conservation of the species, particularly in the western portion of the range (Miller et al. 2011; USFWS 2010, 2013). During pre-settlement times, sagebrush-dominated ecosystems had highly variable fire return intervals that ranged from decades to centuries (Frost 1998; Brown and Smith 2000; Miller et al. 2011). At coarse regional scales, fire return intervals in sagebrush ecological types were determined largely by climate and its effects on fuel abundance and continuity. Consequently, fire frequency was higher in sagebrush types with greater productivity at higher elevations and following periods of increased precipitation than in lower elevation and less productive ecosystems (West 1983b; Mensing et al. 2006). At local scales within sagebrush types, fire return intervals likely were determined by topographic and soil effects on productivity and fuels and exhibited high spatial and temporal variability (Miller and Heyerdahl 2008).

Euro-American arrival in sagebrush ecosystems began in the mid-1800s and initiated a series of changes in vegetation composition and structure that altered fire regimes and resulted in major changes in sagebrush habitats. The first major change in fire regimes occurred when inappropriate grazing by livestock led to a decrease in native perennial grasses and forbs and effectively reduced the abundance of fine fuels (Knapp 1996; Miller and Eddleman 2001; Miller et al. 2011). Decreased competition from perennial herbaceous species, in combination with ongoing climate change and favorable conditions for woody species establishment at the turn of the twentieth century, resulted in increased abundance of shrubs (primarily *Artemisia* species) and trees, including juniper (*Juniperus occidentalis*, *J. osteosperma*) and piñon pine (*Pinus monophylla*), at mid to high elevations (Miller and Eddleman 2001; Miller et al. 2011). The initial effect of these changes in fuel structure was a reduction in fire frequency and size. The second major change in fire regimes occurred when non-native annual grasses (e.g., *Bromus tectorum, Taeniatherum caput-medusa*) were introduced from Eurasia in the late 1800s and spread rapidly into low to mid-elevation ecosystems with depleted understories (Knapp 1996). The invasive annual grasses increased the amount and continuity of fine fuels in many lower elevation sagebrush habitats and initiated annual grass/fire cycles characterized by shortened fire return intervals and larger, more contiguous fires (fig. 2; D'Antonio and Vitousek 1992; Brooks et al. 2004). Since settlement of the region, cheatgrass came to dominate as much as 4 million hectares (9.9 million acres) in the states of Nevada and Utah alone (fig. 3; Bradley and Mustard 2005). The final change in fire regimes occurred as a result of expansion of juniper and piñon pine trees into sagebrush types at mid to high elevations and a reduction of the grass, forb, and shrub species associated with these types. Ongoing infilling of trees is increasing woody fuels, but reducing fine fuels and resulting in less frequent fires (fig. 4; Miller et al. 2013). Extreme burning conditions (high winds, high temperatures, and low relative humidity) in high density (Phase III) stands are resulting in large and severe fires that result in significant losses of above- and below-ground organic matter (sensu Keeley 2009) and have detrimental ecosystem effects (Miller et al. 2013). Based on tree-ring analyses at several Great Basin sites, it is estimated that the extent of piñon and/or juniper woodland increased two to six fold since settlement, and most of that area will exhibit canopy closure within the next 50 years (Miller et al. 2008).

Figure 2. A wildfire that burned through a Wyoming big sagebrush ecosystem with an invasive annual grass understory in southern Idaho (top) (photo by Douglas J. Shinneman), and a close-up of a fire in a Wyoming big sagebrush ecosystem (bottom) (photo by Scott Schaff).

Figure 3. A wildfire that started in invasive annual grass adjacent to a railroad track and burned upslope into a mountain big sagebrush and Jeffrey pine ecosystem in northeast Nevada (top). A big sagebrush ecosystem that has been converted to invasive annual grass in north central Nevada (bottom) (photos by Nolan E. Preece).

Figure 4. Expansion of Utah juniper trees into a mountain big sagebrush ecosystem in east central Utah (top) that is resulting in progressive infilling of the trees and exclusion of native understory species (bottom) (photos by Bruce A. Roundy).

Effects on Sage-Grouse Habitat Selection and Population Dynamics

Understanding the effects of landscape changes on sage-grouse habitat selection and population dynamics can help managers apply more strategic and targeted conservation actions to reduce risks. Two key land cover shifts resulting from invasive annual grasses and altered fire regimes are affecting the ability to achieve the range-wide goal of stable-to-increasing population trends − large-scale reduction of sagebrush cover and conversion of sagebrush ecosystems to annual grasslands.

Sage-grouse are true sagebrush obligates that require large and intact sagebrush landscapes. Consequently, wildfires occurring at the extremes of the natural range of variability that remove sagebrush, even temporarily, over large areas and over short time periods often have negative consequences for sage-grouse. Several range-wide studies have identified the proportion of sagebrush-dominated land cover as a key indicator of sage-grouse population persistence and, importantly, have revealed critical levels of sagebrush landscape cover required by sage-grouse (see Appendix 2 for a description of landscape cover and how it is derived). Knick et al. (2013) found that 90% of active leks in the western portion of the range had more than 40% landscape cover of sagebrush within a 5-km (3.1-mi) radius of leks. Another range-wide analysis documented a high risk of extirpation with <27% sagebrush landscape cover and high probability of persistence with >50% sagebrush landscape cover within 18-km (11.2-mi) of leks (Wisdom et al. 2011). Similarly, Aldridge et al. (2008) found long-term sage-grouse persistence required a minimum of 25%, and preferably at least 65%, sagebrush landscape cover at the 30-km (18.6-mi) scale. Considered collectively, cumulative disturbances that reduce the cover of sagebrush to less than a quarter of the landscape have a high likelihood of resulting in local population extirpation, while the probability of maintaining persistent populations goes up considerably as the proportion of sagebrush cover exceeds two-thirds or more of the landscape. Reduction of sagebrush cover is most critical in low to mid elevations where natural recovery of sagebrush can be very limited within timeframes important to sage-grouse population dynamics (Davies et al. 2011).

Nonnative annual grasses and forbs have invaded vast portions of the sage-grouse range, reducing both habitat quantity and quality (Beck and Mitchell 2000; Rowland et al. 2006; Miller et al. 2011; Balch et al. 2013). Due to repeated fires, some low- to mid-elevation native sagebrush communities are shifting to novel annual grassland states resulting in habitat loss that may be irreversible with current technologies (Davies et al. 2011; Miller et al. 2011; Chambers et al. 2014). At the broadest scales, the presence of non-native annual grasslands on the landscape may be influencing both sage-grouse distribution and abundance. In their analysis of active leks, Knick et al. (2013) found that most leks had very little annual grassland cover (2.2%) within a 5-km (3.1-mi) radius of the leks; leks that were no longer used had almost five times as much annual grassland cover as active leks. Johnson et al. (2011) found that lek use became progressively less as the cover of invasive annual species increased at both the 5-km (3.1-mi) and 18-km (11.2-mi) scales. Also, few leks had >8% invasive annual vegetation cover within both buffer distances.

Patterns of nest site selection also suggest local impacts of invasive annual grasses on birds. In western Nevada, Lockyer (2012) found that sage-grouse selected large expanses of sagebrush-dominated areas and, within those areas, sage-grouse selected microsites with higher shrub canopy cover and lower cheatgrass cover. Average cheatgrass cover at selected locations was 7.1% compared to 13.3% at available locations. Sage-grouse hens essentially avoided nesting in areas with higher cheatgrass cover. Kirol et al. (2012) also found nest-site selection was negatively correlated with the presence of cheatgrass in south-central Wyoming.

Sage-grouse population demographic studies in northern Nevada show that recruitment and annual survival also are affected by presence of annual grasslands at larger scales. Blomberg et al. (2012) analyzed land cover within a 5-km (3.1-mi) radius of leks and found that leks impacted by annual grasslands experienced lower recruitment than non-impacted leks, even following years of high precipitation. Leks that were not affected by invasive annual grasslands exhibited recruitment rates nearly twice as high as the population average and nearly six times greater than affected leks during years of high precipitation.

Piñon and juniper expansion at mid to upper elevations into sagebrush ecosystems also has altered fire regimes and reduced sage-grouse habitat availability and suitability over large areas with population-level consequences (Miller et al. 2011; Baruch-Mordo et al. 2013; Knick et al. 2013). Conifer expansion results in non-linear declines in sagebrush cover and reductions in perennial native grasses and forbs as conifer canopy cover increases (Miller et al. 2000) and this has direct effects on the amount of available habitat for sagebrush-obligate species. Sites in the late stage of piñon and juniper expansion and infilling (Phase III from Miller et al. 2005) have reduced fire frequency (due to decreased fine fuels), but are prone to higher severity fires (due to increased woody fuels) which significantly reduces the likelihood of sagebrush habitat recovery (fig. 5) (Bates et al. 2013). Even before direct habitat loss occurs, sage-grouse avoid or are negatively associated with conifer cover during all life stages (i.e., nesting, brood-rearing, and wintering; Doherty et al. 2008, 2010a; Atamian et al. 2010; Casazza et al. 2011). Also, sage-grouse incur population-level impacts at a very low level of conifer encroachment. The ability to maintain active leks is severely compromised when conifer canopy exceeds 4% in the immediate vicinity of the lek (Baruch-Mordo et al. 2013), and most active leks average less than 1% conifer cover at landscape scales (Knick et al. 2013).

Figure 5. A post-burn, Phase III, singleleaf piñon and Utah juniper dominated sagebrush ecosystem in which soils are highly erosive and few understory plants remain (photo by Jeanne C. Chambers).

Resilience to Disturbance and Resistance to Invasive Annual Grasses in Sagebrush Ecosystems

Our ability to address the changes occurring in sagebrush habitats can be greatly enhanced by understanding the effects of environmental conditions on resilience to stress and disturbance, and resistance to invasion (Wisdom and Chambers 2009; Brooks and Chambers 2011; Chambers et al. 2014). In cold desert ecosystems, resilience of native ecosystems to stress and disturbance changes along climatic and topographic gradients. In these ecosystems, Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), mountain big sagebrush (*A. t.* spp. *vaseyana*), and mountain brush types (e.g., mountain big sagebrush, snowberry [*Symphorocarpus* spp.], bitterbrush [*Purshia tridentata*]) occur at progressively higher elevations and are associated with decreasing temperatures and increasing amounts of precipitation, productivity, and fuels (fig. 6; West and Young 2000). Piñon pine and juniper woodlands are typically associated with mountain big sagebrush types, but can occur with relatively cool and moist Wyoming big sagebrush types and warm and moist mountain brush types (Miller et al. 2013). Resilience to disturbance, including wildfire, has been shown to increase along these elevation gradients (fig. 7A) (Condon et al. 2011; Davies et al. 2012; Chambers et al. 2014; Chambers et al. *in press*). Higher precipitation and cooler temperatures, coupled with greater soil development and plant productivity at mid to high elevations, can result in greater resources and more favorable environmental conditions for plant growth and reproduction (Alexander et al. 1993; Dahlgren et al. 1997). In contrast, minimal precipitation and high temperatures at low elevations result in lower resource availability for plant growth (West 1983a,b;

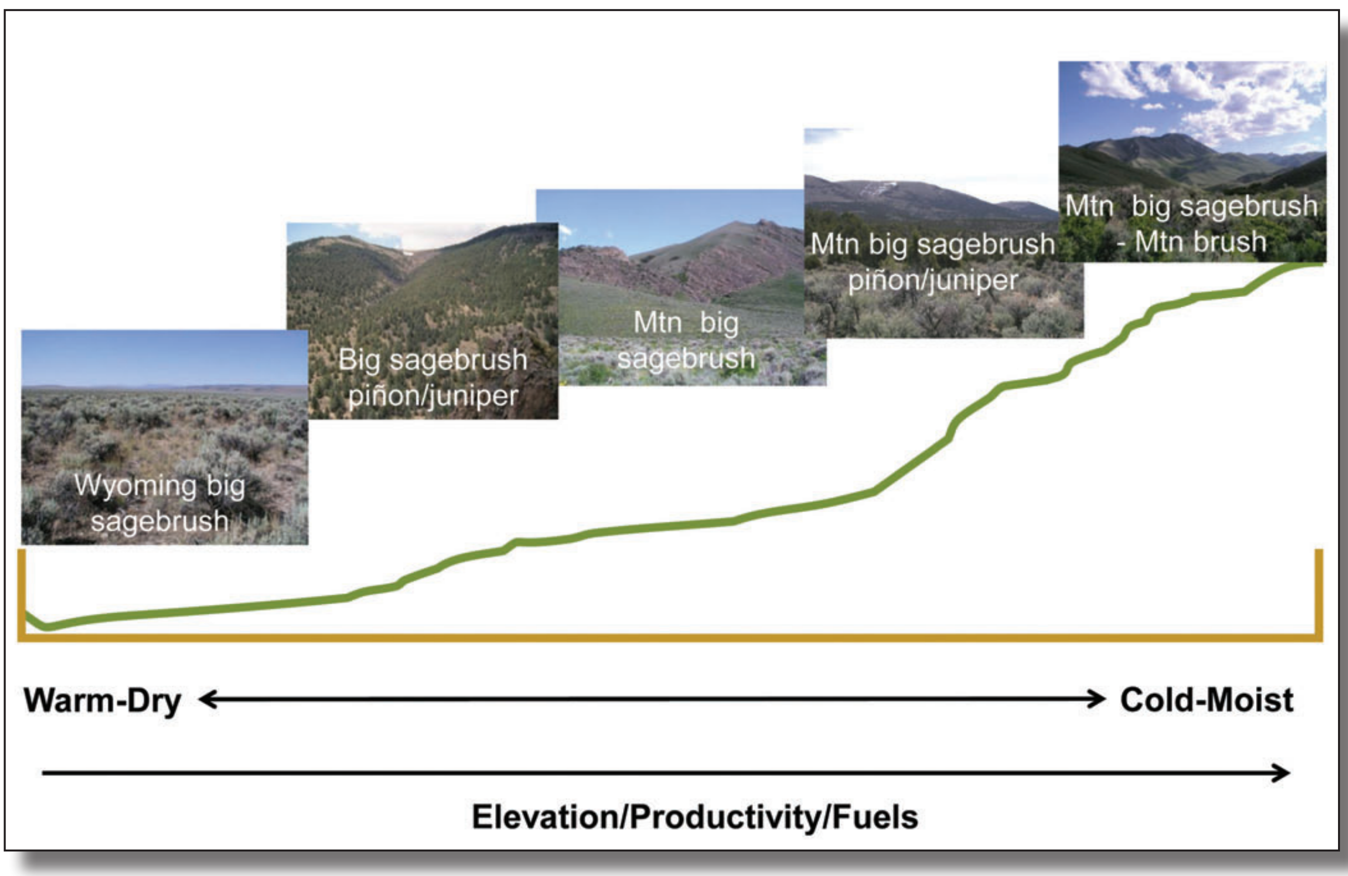

Figure 6. The dominant sagebrush ecological types that occur along environmental gradients in the western United States. As elevation increases, soil temperature and moisture regimes transition from warm and dry to cold and moist and vegetation productivity and fuels become higher.

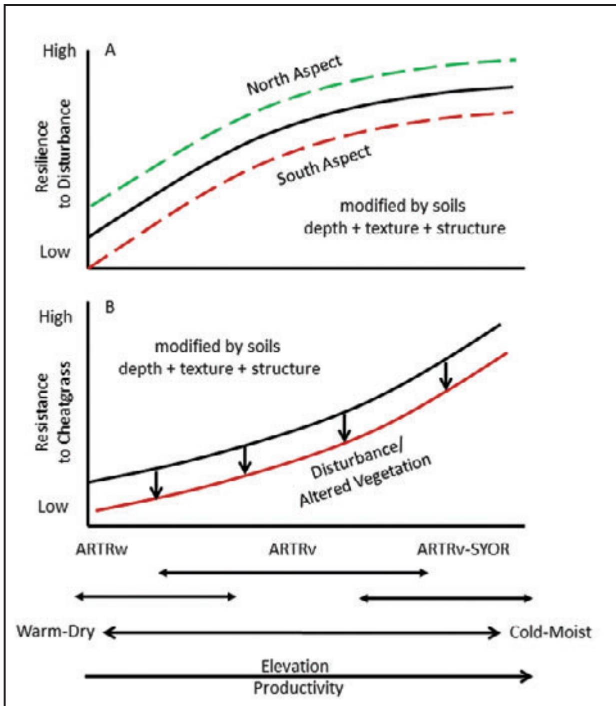

Figure 7. (**A)** Resilience to disturbance and (**B)** resistance to cheatgrass over a typical temperature/precipitation gradient in the cold desert. Dominant ecological sites occur along a continuum that includes Wyoming big sagebrush on warm and dry sites, to mountain big sagebrush on cool and moist sites, to mountain big sagebrush and root-sprouting shrubs on cold and moist sites. Resilience increases along the temperature/precipitation gradient and is influenced by site characteristics like aspect. Resistance also increases along the temperature/precipitation gradient and is affected by disturbances and management treatments that alter vegetation structure and composition and increase resource availability (modified from Chambers et al. 2014; Chambers et al. *in press*).

Smith and Nowak 1990). These relationships also are observed at local plant community scales where aspect, slope, and topographic position affect solar radiation, erosion processes, effective precipitation, soil development and vegetation composition and structure (Condon et al. 2011; Johnson and Miller 2006).

Resistance to invasive annual grasses depends on environmental factors and ecosystem attributes and is a function of (1) the invasive species' physiological and life history requirements for establishment, growth, and reproduction, and (2) interactions with the native perennial plant community including interspecific competition and response to herbivory and pathogens. In cold desert ecosystems, resistance is strongly influenced by soil temperature and moisture regimes (Chambers et al. 2007; Meyer et al. 2001). Germination, growth, and/or reproduction of cheatgrass is physiologically limited at low elevations by frequent, low precipitation years, constrained at high elevations by low soil temperatures, and optimal at mid elevations under relatively moderate temperature and water availability (fig. 7B; Meyer et al. 2001; Chambers et al. 2007). Slope, aspect, and soil characteristics modify soil temperature and moisture and influence resistance to cheatgrass at landscape to plant community scales (Chambers et al. 2007; Condon et al. 2011; Reisner et al. 2013). Genetic variation in cheatgrass results in phenotypic traits that increase survival and persistence in populations from a range of environments, and is likely contributing to the recent range expansion of this highly inbreeding species into marginal habitats (Ramakrishnan et al. 2006; Merrill et al. 2012).

The occurrence and persistence of invasive annual grasses in sagebrush habitats is strongly influenced by interactions with the native perennial plant community (fig. 7B). Cheatgrass, a facultative winter annual that can germinate from early fall through early spring, exhibits root elongation at low soil temperatures, and has higher nutrient uptake and growth rates than most native species (Mack and Pyke 1983; Arredondo et al. 1998; James et al. 2011). Seedlings of native, perennial plant species are generally poor competitors with cheatgrass, but adults of native, perennial grasses and forbs, especially those with similar growth forms and phenology, can be highly effective competitors with the invasive annual (Booth et al. 2003; Chambers et al. 2007; Blank and Morgan 2012).

Also, biological soil crusts, which are an important component of plant communities in warmer and drier sagebrush ecosystems, can reduce germination or establishment of cheatgrass (Eckert et al. 1986; Kaltenecker et al. 1999). Disturbances or management treatments that reduce abundance of native perennial plants and biological soil crusts and increase the distances between perennial plants often are associated with higher resource availability and increased competitive ability of cheatgrass (Chambers et al. 2007; Reisner et al. 2013; Roundy et al. *in press*).

The type, characteristics, and natural range of variability of stress and disturbance strongly influence both resilience and resistance (Jackson 2006). Disturbances like overgrazing of perennial plants by livestock, wild horses, and burros and more frequent or more severe fires are typically outside of the natural range of conditions and can reduce the resilience of sagebrush ecosystems. Reduced resilience is triggered by changes in environmental factors like temperature regimes, abiotic attributes like water and nutrient availability, and biotic attributes such as vegetation structure, composition, and productivity (Chambers et al. 2014) and cover of biological soil crusts (Reisner et al. 2013). Resistance to an invasive species can change when changes in abiotic and biotic attributes result in increased resource availability or altered habitat suitability that influences an invasive species' ability to establish and persist and/or compete with native species. Progressive losses of resilience and resistance can result in the crossing of abiotic and/or biotic thresholds and an inability of the system to recover to the reference state (Beisner et al. 2003; Seastedt et al. 2008).

Interactions among disturbances and stressors may have cumulative effects (Chambers et al. 2014). Climate change already may be shifting fire regimes outside of the natural range of occurrence (i.e., longer wildfire seasons with more frequent and longer duration wildfires) (Westerling et al. 2006). Sagebrush ecosystems generally have low productivity, and the largest number of acres burned often occurs a year or two after warm, wet conditions in winter and spring that result in higher fine fuel loads (Littell et al. 2009). Thus, annual grass fire cycles may be promoted by warm, wet winters and a subsequent increase in establishment and growth of invasive winter annuals. These cycles may be exacerbated by rising atmospheric CO_2 concentrations, N deposition, and increases in human activities that result in soil surface disturbance and invasion corridors (Chambers et al. 2014). Modern deviations from historic conditions will likely continue to alter disturbance regimes and sagebrush ecosystem response to disturbances; thus, management strategies that rely on returning to historical or "pre-settlement" conditions may be insufficient, or even misguided, given novel ecosystem dynamics (Davies et al. 2009).

Integrating Resilience and Resistance Concepts With Sage-Grouse Habitat Requirements to Manage Wildfire and Invasive Annual Grass Threats at Landscape Scales

The changes in sagebrush ecosystem dynamics due to invasive annual species and longer, hotter, and drier fire seasons due to a warming climate make it unlikely that these threats can be ameliorated completely (Abatzoglou and Kolden 2011; USFWS 2013). Consequently, a strategic approach is necessary to conserve sagebrush habitat and sage-grouse (Wisdom et al. 2005; Meinke et al. 2009; Wisdom and Chambers 2009; Pyke 2011). This strategic approach requires the ability to (1) identify those locations that provide current or potential habitat for sage-grouse and (2) prioritize management actions based on the capacity of the ecosystem to respond in the desired manner and to effectively allocate resources to achieve desired objectives. Current understanding of the relationship of landscape cover of sagebrush to sage-grouse habitat provides the capacity to identify those locations on the landscape that have a high probability of sage-grouse persistence (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). Similarly, knowledge of the relationships of environmental characteristics, specifically soil temperature and moisture regimes, to ecological types and their inherent resilience and resistance gives us the capacity to prioritize management actions based on probable effectiveness of those actions (Wisdom and Chambers 2009; Brooks and Chambers 2011; Miller et al. 2013; Chambers et al. 2014; Chambers et al. *in press,*).

In this section, we discuss the use of landscape cover of sagebrush as an indicator of sage-grouse habitat, and the use of soil temperature and moisture regimes as an indicator of resilience to disturbance, resistance to invasive annual grasses and, ultimately, the capacity to achieve desired objectives. We then show how these two concepts can be coupled in a sage-grouse habitat matrix and used to determine potential management strategies at the landscape scales on which sage-grouse depends.

Landscape Cover of Sagebrush as an Indicator of Sage-Grouse Habitat

Landscape cover of sagebrush is closely related to the probability of maintaining active sage-grouse leks, and is used as one of the primary indicators of sage-grouse habitat potential at landscape scales (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). Landscape cover of sagebrush less than about 25% has a low probability of sustaining active sage-grouse leks (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). Above 25% landscape cover of sagebrush, the probability of maintaining active sage-grouse leks increases with increasing sagebrush landscape cover. At landscape cover of sagebrush ranging from 50 to 85%, the probability of sustaining sage-grouse leks becomes relatively constant (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). For purposes of prioritizing landscapes for sage-grouse habitat management, we use 25% as the level below which there is a low probability of maintaining sage-grouse leks and 65% as the level above which there is little additional increase in the probability of sustaining active leks with further increases of landscape cover of sagebrush (fig. 8; Knick et al. 2013). Between about 25% and 65% landscape sagebrush cover, increases in landscape cover of sagebrush have a constant positive relationship with sage-grouse lek probability (fig. 8; Knick et al. 2013). Restoration and management activities that result in an increase in the amount of sagebrush dominated landscape within areas of pre-existing landscape cover between 25% and 65% likely will result in a higher probability of sage-grouse persistence, while declines in landscape cover of sagebrush likely will result in reductions in sage-grouse (Knick et al. 2013). It is important to note that

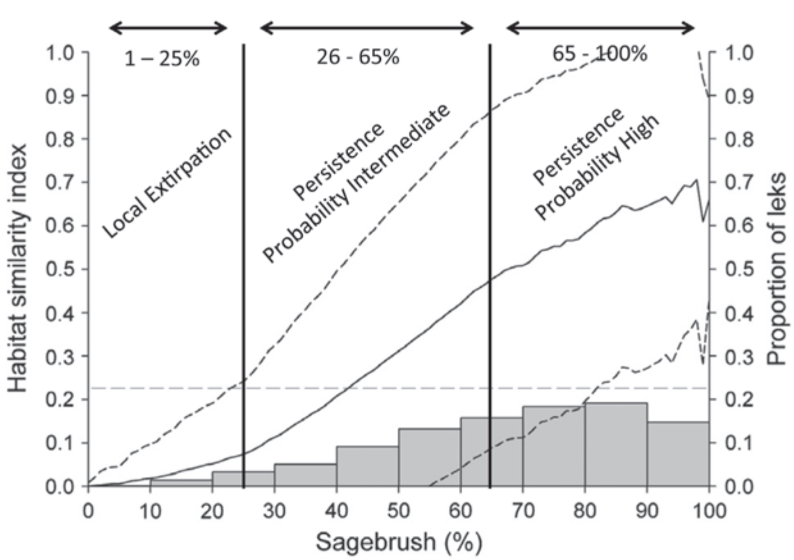

Figure 8. The proportion of sage-grouse leks and habitat similarity index (HSI) as related to the percent landscape cover of sagebrush. The HSI indicates the relationship of environmental variables at map locations across the western portion of the range to minimum requirements for sage-grouse defined by land cover, anthropogenic variables, soil, topography, and climate. HSI is the solid black line ± 1 SD (stippled lines). Proportion of leks are the grey bars. Dashed line indicates HSI values above which characterizes 90% of active leks (0.22). The categories at the top of the figure and the interpretation of lek persistence were added based on Aldridge et al. 2008; Wisdom et al. 2011; and Knick et al. 2013 (figure modified from Knick et al. 2013).

these data and interpretations relate only to persistence (i.e., whether or not a lek remains active) and it is likely that higher proportions of sagebrush cover or improved condition of sagebrush ecosystems may be required for population growth.

For the purposes of delineating sagebrush habitat relative to sage-grouse requirements for landscape cover of sagebrush, we calculated the percentage landscape sagebrush cover within each of the selected categories (1-25%, 26-65%, >65%) for the range of sage-grouse (fig. 9, 10). An explanation of how landscape cover of sagebrush is derived is in Appendix 2. Large areas of landscape sagebrush cover >65% are found primarily in Management Zones (MZ) II (Wyoming Basin), IV (Snake River Plains), and V (Northern Great Basin). In contrast, relatively small areas of landscape sagebrush cover >65% are located in MZ I (Great Plains), III (Southern Great Basin), VI (Columbia Basin), and VII (Colorado Plateau). Sagebrush is naturally less common in the Great Plains region compared to other parts of the range and previous work suggested that sage-grouse populations in MZ I may be more vulnerable to extirpation with further reductions in sagebrush cover (Wisdom et al. 2011). In the western portion of the range, where the threat of invasive annual grasses and wildfire is greatest, the area of sagebrush cover >65% differs among MZs. MZ III is a relatively arid and topographically diverse area in which the greatest extent of sagebrush cover >65% is in higher elevation, mountainous areas. MZs IV and V have relatively large extents of sagebrush cover >65% in relatively cooler and wetter areas, and MZs IV and VI have lower extents of sagebrush cover >65% in warmer and dryer areas and in areas with significant agricultural development. These differences in landscape cover of sagebrush indicate that different sets of management strategies may apply to the various MZs.

Soil Temperature and Moisture Regimes as Indicators of Ecosystem Resilience and Resistance

Potential resilience and resistance to invasive annual grasses reflect the biophysical conditions that an area is capable of supporting. In general, the highest potential resilience and resistance occur with ***cool*** to ***cold*** (frigid to cryic) soil temperature regimes and relatively ***moist*** (xeric to ustic) soil moisture regimes, while the lowest potential resilience and resistance occur with ***warm*** (mesic) soil temperatures and relatively ***dry*** (aridic) soil moisture regimes (Chambers et al. 2014, Chambers et al. *in press*). Definitions of soil temperature and moisture regimes are in Appendix 3. Productivity is elevated by high soil moisture and thus resilience is increased (Chambers et al. 2014); annual grass growth and reproduction is limited by cold soil temperatures and thus resistance is increased (Chambers et al. 2007). The timing of precipitation also is important because cheatgrass and many other invasive annual grasses are particularly well-adapted to Mediterranean type climates with cool and wet winters and warm and dry summers (Bradford and Lauenroth 2006; Bradley 2009). In contrast, areas that receive regular summer precipitation (ustic soil moisture regimes) often are dominated by warm and/or cool season grasses (Sala et al. 1997) that likely create a more competitive environment and result in greater resistance to annual grass invasion and spread (Bradford and Lauenroth 2006; Bradley 2009).

Much of the remaining sage-grouse habitat in MZs I (Great Plains), II (Wyoming Basin), VII (Colorado Plateau), and cool-to-cold or moist sites scattered across the range, are characterized by moderate to high resilience and resistance as indicated by soil temperature and moisture regimes (fig. 11). Sagebrush habitats across MZ I are unique from a range-wide perspective because soils are predominantly cool and ustic, or bordering on ustic as a result of summer precipitation; this soil moisture regime appears to result in higher resilience and resistance (Bradford and Lauenroth 2006).

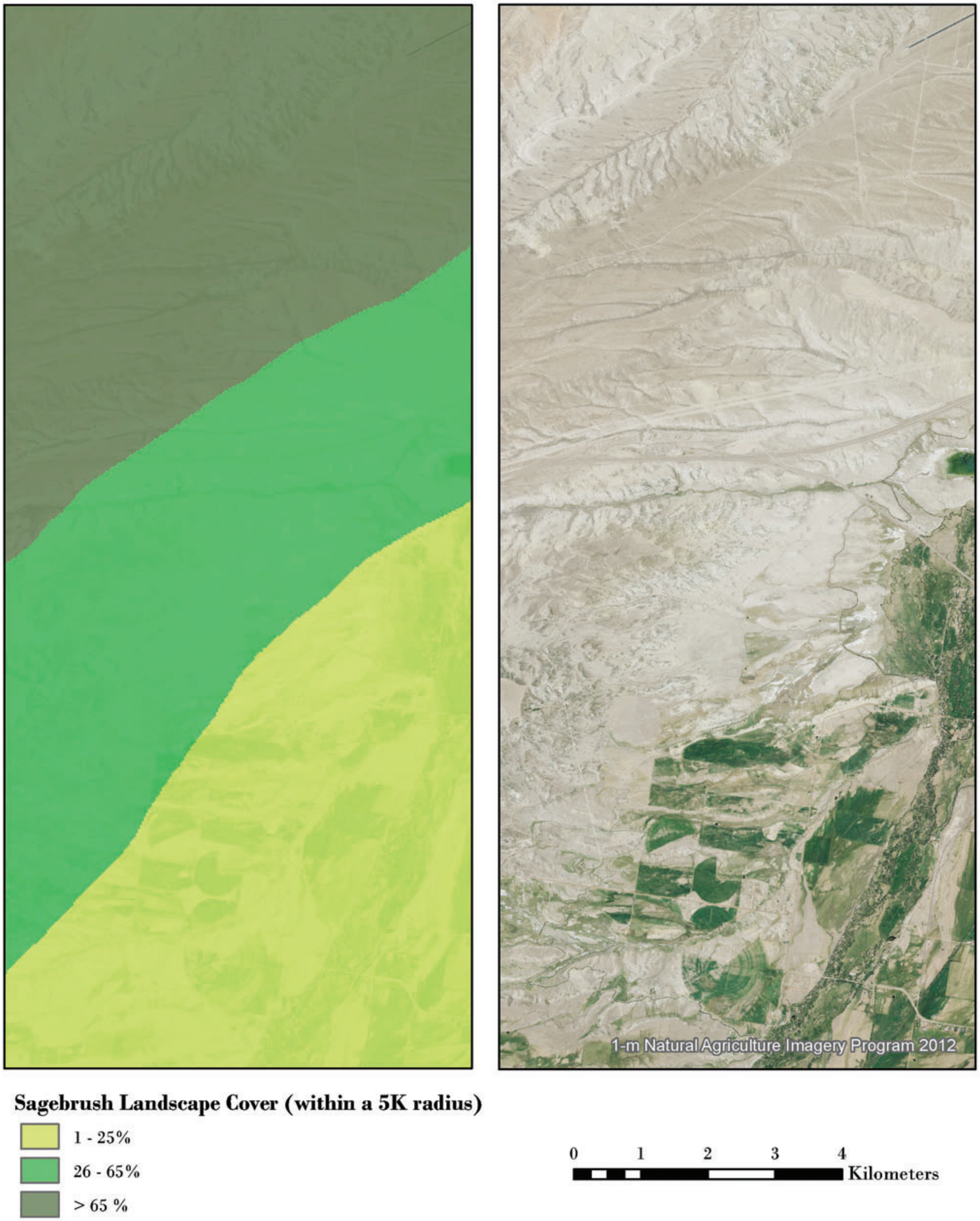

Figure 9. Landscape cover of sagebrush from 1-m National Agricultural Imagery (right) and the corresponding sagebrush landscape cover for the 1-25%, 26-65%, and >65% categories (left). See Appendix 2 for an explanation of how the categories are determined.

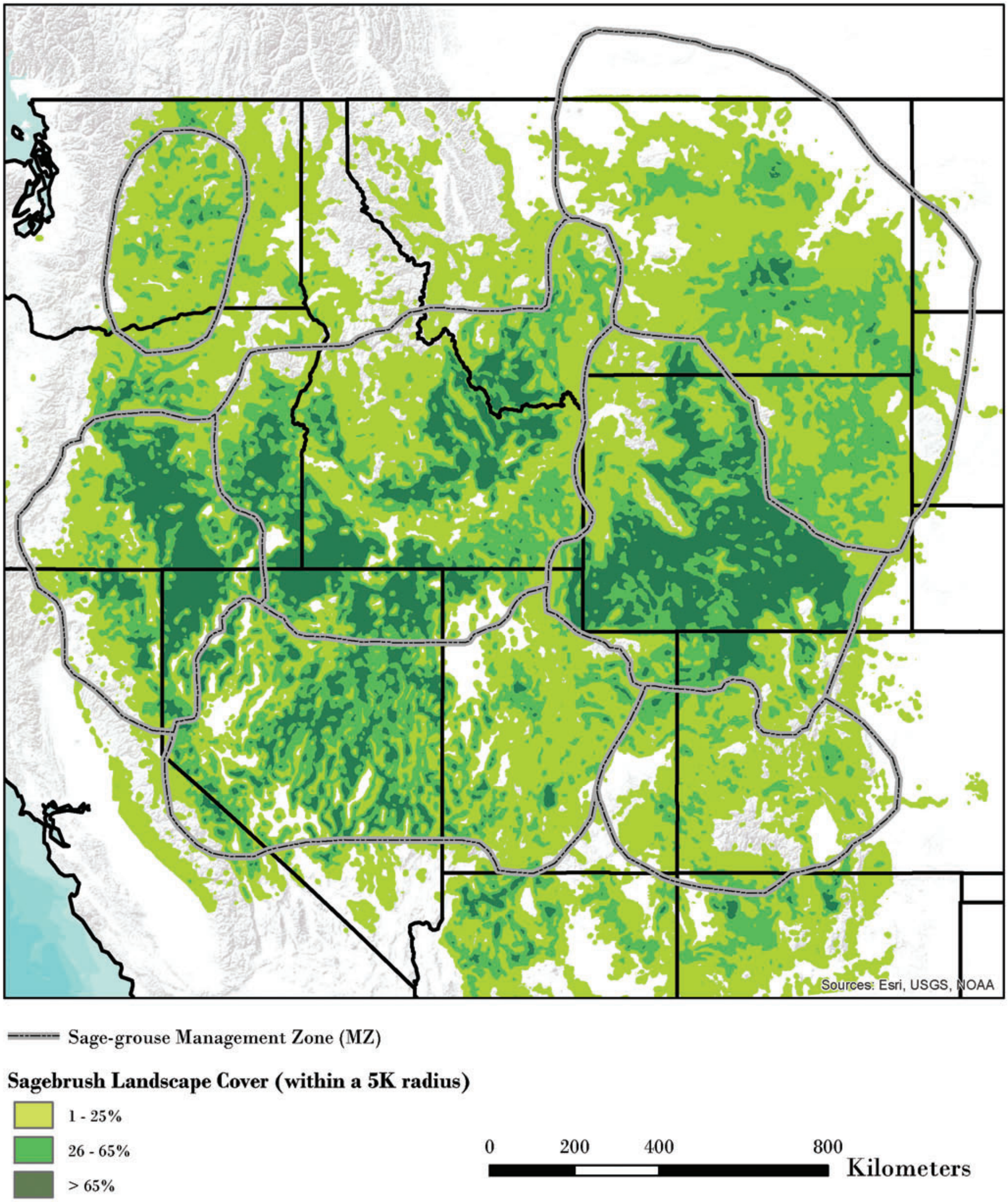

Figure 10. The landscape cover of sagebrush within each of three selected categories (1-25%, 26-65%, >65%) for the range of sage-grouse (Management Zones I – VII; Stiver et al. 2006). The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land cover types for locations with sagebrush cover.

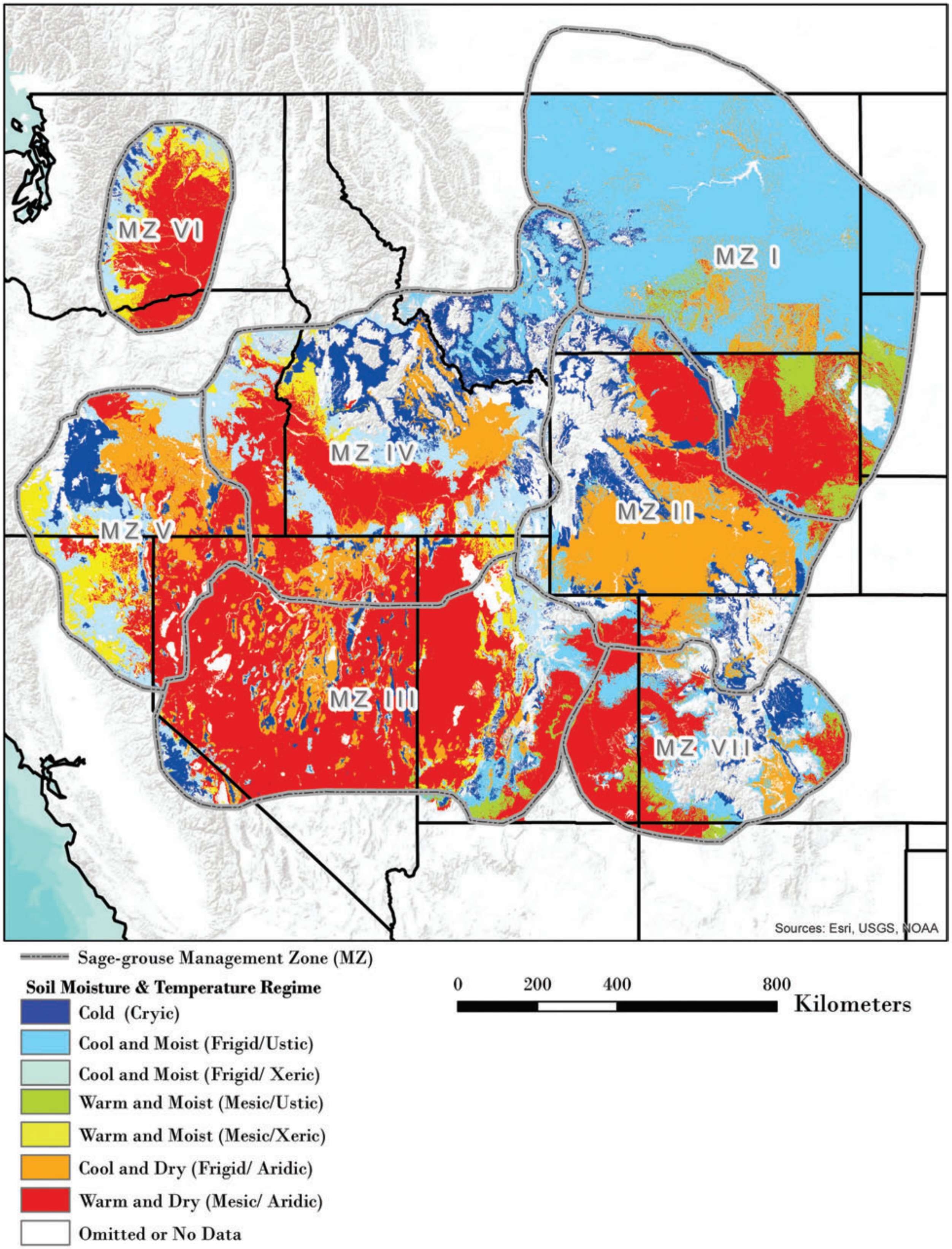

Figure 11. The soil temperature and moisture regimes for the range of sage-grouse (Management Zones I – VII; Stiver et al. 2006). Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). Gaps in that dataset were filled in with the NRCS State Soil Geographic Database (STATSGO) (Soil Survey Staff 2014b).

However, significant portions of MZs III (Southern Great Basin), much of IV (Snake River Plains), V (Northern Great Basin), and VI (Columbia Basin) are characterized largely by either warm and dry, or warm to cool and moist ecological types with moderate to low resilience and resistance (fig. 11; table 1). Areas within these MZs that have warm and dry soils are typically characterized by Wyoming big sagebrush ecosystems with low to moderately low resilience and resistance and are currently of greatest concern for sage-grouse conservation (fig. 12A). Areas with warm to cool soil temperature regimes and moist precipitation regimes are typically characterized by either Wyoming or mountain big sagebrush, have moderate to moderately low resilience and resistance,

Table 1. Predominant sagebrush ecological types in Sage-Grouse Management Zones III, IV, V, and VI based on soil temperature and soil moisture regimes, typical characteristics, and resilience to disturbance and resistance to invasive annual grasses (modified from Miller et al. 2014 a,b). Relative abundance of sagebrush species and composition of understory vegetation vary depending on Major Land Resource Area and ecological site type.

Ecological type	Characteristics	Resilience and resistance
Cold and Moist (Cryic/Xeric)	Ppt: 14 inches + Typical shrubs: *Mountain big sagebrush, snowfield sagebrush, snowberry, serviceberry, silver sagebrush, and/or low sagebrushes*	*Resilience* – **Moderately high**. Precipitation and productivity are generally high. Short growing seasons can decrease resilience on coldest sites. *Resistance*– **High**. Low climate suitability to invasive annual grasses
Cool and Moist (Frigid/Xeric)	Ppt: 12-22 inches Typical shrubs: *Mountain big sagebrush, antelope bitterbrush, snowberry, and/or low sagebrushes* Piñon pine and juniper potential in some areas	*Resilience* – **Moderately high**. Precipitation and productivity are generally high. Decreases in site productivity, herbaceous perennial species, and ecological conditions can decrease resilience. *Resistance* – **Moderate**. Climate suitability to invasive annual grasses is moderate, but increases as soil temperatures increase.
Warm and Moist (Mesic/Xeric)	Ppt: 12-16 inches Typical shrubs: *Wyoming big sagebrush, mountain big sagebrush, Bonneville big sagebrush, and/or low sagebrushes* Piñon pine and juniper potential in some areas	*Resilience* – **Moderate**. Precipitation and productivity are moderately high. Decreases in site productivity, herbaceous perennial species, and ecological conditions can decrease resilience. *Resistance* – **Moderately low**. Climate suitability to invasive annual grasses is moderately low, but increases as soil temperatures increase.
Cool and Dry (Frigid/Aridic)	Ppt: 6-12 inches Typical shrubs: *Wyoming big sagebrush, black sagebrush, and/or low sagebrushes*	*Resilience* – **Low**. Effective precipitation limits site productivity. Decreases in site productivity, herbaceous perennial species, and ecological conditions further decrease resilience. *Resistance* – **Moderate**. Climate suitability to invasive annual grasses is moderate, but increases as soil temperatures increase.
Warm and Dry (Mesic/Aridic, bordering on Xeric)	Ppt: 8-12 inches Typical shrubs: *Wyoming big sagebrush, black sagebrush and/or low sagebrushes*	*Resilience* – **Low.** Effective precipitation limits site productivity. Decreases in site productivity, herbaceous perennial species, and ecological conditions further decrease resilience. Cool season grasses susceptibility to grazing and fire, along with hot dry summer fire conditions, promote cheatgrass establishment and persistence. *Resistance* – **Low.** High climate suitability to cheatgrass and other invasive annual grasses. Resistance generally decreases as soil temperature increases, but establishment and growth are highly dependent on precipitation.

and have the potential for piñon and juniper expansion (Miller et al. 2014a; Chambers et al. *in press*). Many of these areas also are of conservation concern because piñon and juniper expansion and tree infilling can result in progressive loss of understory species and altered fire regimes (Miller et al. 2013). In contrast, areas with cool to cold soil temperature regimes and moist precipitation regimes have moderately high resilience and high resistance and are likely to recover in a reasonable amount of time following wildfires and other disturbances (Miller et al. 2013) (fig. 12B)

Figure 12. A Wyoming big sagebrush ecosystem with warm and dry soils in southeast Oregon (top) (photo by Richard F. Miller), compared to a mountain big sagebrush ecosystem with cool and moist soils in central Nevada (bottom) (photo by Jeanne C. Chambers).

Management Strategies Based on Landscape Cover of Sagebrush and Ecosystem Resilience and Resistance: The Sage-Grouse Habitat Matrix

Knowledge of the potential resilience and resistance of sagebrush ecosystems can be used in conjunction with sage-grouse habitat requirements to determine priority areas for management and identify effective management strategies at landscape scales (Wisdom and Chambers 2009). The sage-grouse habitat matrix (table 2) illustrates the relative resilience to disturbance and resistance to invasive annual grasses of sagebrush ecosystems in relation to the proportion of sagebrush cover on the landscape. As resilience and resistance go from high to low, as indicated by the rows in the matrix, decreases in sagebrush regeneration and abundance of perennial grasses and forbs progressively limit the capacity of a sagebrush ecosystem to recover after fire or other disturbances. The risk of annual invasives increases and the ability to successfully restore burned or otherwise disturbed areas decreases. As sagebrush cover goes from low to high within these same ecosystems, as indicated by the columns in the matrix, the capacity to provide adequate habitat cover for sage-grouse increases. Areas with less than 25% landscape cover of sagebrush are unlikely to provide adequate habitat for sage-grouse; areas with 26-65% landscape cover of sagebrush can provide habitat for sage-grouse but are at risk if sagebrush loss occurs without recovery; and areas with >65% landscape cover of sagebrush provide the necessary habitat conditions for sage-grouse to persist. Potential landscape scale management strategies can be determined by considering (1) resilience to disturbance, (2) resistance to invasive annuals, and (3) sage-grouse land cover requirements. Overarching management strategies to maintain or increase sage-grouse habitat at landscape scales based on these considerations are conservation, prevention, restoration, and monitoring and adaptive management (table 3; see Chambers et al. 2014). These strategies have been adapted for each of the primary agency programs including fire operations, fuels management, post-fire rehabilitation, and habitat restoration (table 4). Because sagebrush ecosystems occur over continuums of environmental conditions, such as soil temperature and moisture, and have differing land use histories and species composition, careful assessment of the area of concern always will be necessary to determine the relevance of a particular strategy (Pyke 2011; Chambers et al. 2014; Miller et al. 2014 a, b). The necessary information for conducting this type of assessment is found in the "Putting It All Together" section of this report.

Although the sage-grouse habitat matrix (table 2) can be viewed as partitioning land units into spatially discrete categories (i.e., landscapes or portions thereof can be categorized as belonging to one of nine categories), it is not meant to serve as a strict guide to spatial allocation of resources or to prescribe specific management strategies. Instead, the matrix should serve as a decision support tool for helping managers implement strategies that consider both the resilience and resistance of the landscape and landscape sagebrush cover requirements of sage-grouse. For example, low elevation Wyoming big sagebrush plant communities with relatively low resilience and resistance may provide important winter habitat resources for a given sage-grouse population. In a predominantly Wyoming big sagebrush area comprised of relatively low sagebrush landscape cover, a high level of management input may be needed to realize conservation benefits for sage-grouse. This doesn't mean that management activities should not be undertaken if critical or limiting sage-grouse habitat resources are present, but indicates that inputs will be intensive, potentially more expensive, and less likely to succeed relative to more resilient landscapes. It is up to the user of the matrix to determine how such tradeoffs influence management actions.

Table 2. Sage-grouse habitat matrix based on resilience and resistance concepts from Chambers et al. 2014, and sage-grouse habitat requirements from Aldridge et al. 2008, Wisdom et al. 2011, and Knick et al. 2013. Rows show the ecosystems relative resilience to disturbance and resistance to invasive annual grasses derived from the sagebrush ecological types in table 1 (1 = high resilience and resistance; 2 = moderate resilience and resistance; 3 = low resilience and resistance). Columns show the current proportion of the landscape (5-km rolling window) dominated by sagebrush (A = 1-25% land cover; B = 26-65% land cover; 3 = >65% land cover). Use of the matrix is explained in text. Overarching management strategies that consider resilience and resistance and landscape cover of sagebrush are in table 3. Potential management strategies specific to agency program areas, including fire operations, fuels management, post-fire rehabilitation, and habitat restoration are in table 4.

<table>
<tr><th rowspan="2">Ecosystem Resilience to Disturbance and Resistance to Invasive Annual Grasses</th><th colspan="3">Proportion of Landscape Dominated by Sagebrush</th></tr>
<tr><th>Low 1-25%
Too little sagebrush on the landscape significantly threatens likelihood of sage-grouse persistence.</th><th>Moderate 26-65%
Sage-grouse are sensitive to the amount of sagebrush remaining on the landscape and populations could be at-risk with additional disturbances that remove sagebrush.</th><th>High >65%
Sufficient sagebrush exists on the landscape and sage-grouse are highly likely to persist.</th></tr>
<tr><td rowspan="2">High</td><td>1A
Natural sagebrush recovery is likely to occur, but if large, contiguous areas lack sagebrush, the time required for recovery may be too great.</td><td>1B
Natural sagebrush recovery is likely to occur, but certain areas may lack connectivity.</td><td>1C
Natural sagebrush recovery is likely to occur.</td></tr>
<tr><td colspan="3">Perennial herbaceous species are typically sufficient for recovery.
Risk of annual invasives is low.
Seeding/transplanting success is high.
Recovery following inappropriate livestock use is often possible given changes in management.</td></tr>
<tr><td rowspan="2">Moderate</td><td>2A
Natural sagebrush recovery is likely on cooler and moister sites, but if large, contiguous areas lack sagebrush, the time required for recovery may be too great.</td><td>2B
Natural sagebrush recovery is likely on cooler and moister sites, but certain areas may lack connectivity.</td><td>2C
Natural sagebrush recovery is likely on cooler and moister sites.</td></tr>
<tr><td colspan="3">Perennial herbaceous species are usually adequate for recovery on cooler and moister sites.
Risk of annual invasives is moderately high on warmer and drier sites.
Seeding-transplanting success depends on site characteristics, and more than one intervention may be required especially on warmer and drier sites.
Recovery following inappropriate livestock use depends on site characteristics and management.</td></tr>
<tr><td rowspan="2">Low</td><td>3A
Natural sagebrush recovery is not likely.</td><td>3B
Natural sagebrush recovery may occur, but the time required will likely be too great and certain areas may lack connectivity.</td><td>3C
Natural sagebrush recovery may occur, but the time required will likely be too great.</td></tr>
<tr><td colspan="3">Perennial herbaceous species are typically inadequate for recovery.
Risk of annual invasives is high.
Seeding/transplanting success depends on site characteristics, annual invasives, and post-treatment precipitation but is often low. More than one intervention likely will be required.
Recovery following inappropriate livestock use is unlikely.</td></tr>
</table>

Table 3. Potential management strategies based on resilience to disturbance, resistance to annual grass invasion, and sage-grouse habitat requirements based on Aldridge et al. 2008; Wisdom et al. 2011; and Knick et al. 2013 (adapted from Chambers et al. 2014).

Conserve – maintain or increase resilience to disturbance and resistance to invasive annuals in areas with high conservation value	
Priorities	• Ecosystems with low to moderate resilience to fire and resistance to invasive species that still have large patches of landscape sagebrush cover and adequate perennial grasses and forbs – *ecological types with warm and dry and cool and dry soil temperature/moisture regimes.* • Ecosystems with a high probability of providing habitat for sage-grouse, especially those with >65% landscape cover of sagebrush and adequate perennial herbaceous species – *all ecological types.*
Objective	• Minimize impacts of current and future human-caused disturbances and stressors.
Activities	• Immediately suppress fire in moderate to low resilience and resistance sagebrush and wooded shrublands to prevent an invasive annual grass-fire cycle. Large sagebrush patches are high priority for protection from wildfires. • Implement strategic fuel break networks to provide anchor points for suppression and reduce losses when wildfires escape initial attack. • Manage livestock grazing to prevent loss of perennial native grasses and forbs and biological soil crusts and allow natural regeneration. • Limit anthropogenic activities that cause surface disturbance, invasion, and fragmentation. (e.g., road and utility corridors, urban expansion, OHV use, and mineral/energy projects). • Detect and control new weed infestations.
Prevent – maintain or increase resilience and resistance of areas with declining ecological conditions that are at risk of conversion to a degraded, disturbed, or invaded state	
Priorities	• Ecosystems with moderate to high resilience and resistance – *ecological types with relatively cool and moist soil temperature and moisture regimes*. ○ Prioritize landscape patches that exhibit declining conditions due to annual grass invasion and/or tree expansion (e.g., at risk phase in State and Transition Models). • Ecosystems with a moderate to high probability of providing sage-grouse habitat, especially those with 26-65% landscape cover of sagebrush and adequate perennial native grasses and forbs – *all ecological types*.
Objectives	• Reduce fuel loads and decrease the risk of high intensity and high severity fire. • Increase abundance of perennial native grasses and forbs and of biological soil crusts where they naturally occur. • Decrease the longer-term risk of annual invasive grass dominance.
Activities	• Use mechanical treatments like cut and leave or mastication to remove trees, decrease woody fuels, and release native grasses and forbs in warm and moist big sagebrush ecosystems with relatively low resistance to annual invasive grasses that are in the early to mid-phase of piñon and/or juniper expansion. • Use prescribed fire or mechanical treatments to remove trees, decrease woody fuels, and release native grasses and forbs in cool and moist big sagebrush ecosystems with relatively high resistance to annual invasive grass that are in early to mid-phase of piñon and/or juniper expansion. • Actively manage post-treatment areas to increase perennial herbaceous species and minimize secondary weed invasion. • Consider the need for strategic fuel breaks to help constrain fire spread or otherwise augment suppression efforts.
Restore – increase resilience and resistance of disturbed, degraded, or invaded areas	
Priorities	• Areas burned by wildfire – *all ecological types* ○ Prioritize areas with low to moderate resilience and resistance, and that have a reasonable expectation of recovery. ○ Prioritize areas where perennial grasses and forbs have been depleted. ○ Prioritize areas that experienced high severity fire.

(continued)

Table 3. (Continued).

	• Sage-grouse habitat – *all ecological types*
	  ○ Prioritize areas where restoration of sagebrush and/or perennial grasses is needed to create large patches of landscape cover of sagebrush or connect existing patches of sagebrush habitat.
	  ○ Prioritize areas with adequate landscape cover of sagebrush where restoration of perennial grasses and forbs is needed.
	• Areas affected by anthropogenic activities that cause surface disturbance, invasion, and fragmentation. (e.g., road and utility corridors, urban expansion, OHV use, and mineral/energy projects) – *all ecological types.*

Objectives	• Increase soil stability and curtail dust. • Control/suppress invasive annual grasses and other invasive plants. • Increase landscape cover of sagebrush. • Increase perennial grasses and forbs and biological soil crusts where they naturally occur. • Reduce the risk of large fires that burn sage-grouse habitat.
Activities	• Use integrated strategies to control/suppress annual invasive grass and other annual invaders. • Establish and maintain fuel breaks or greenstrips in areas dominated by invasive annual grasses that are adjacent to areas with >25% landscape sagebrush cover and adequate perennial native grasses and forbs. • Seed perennial grasses and forbs that are adapted to local conditions to increase cover of these species in areas where they are depleted. • Seed and/or transplant sagebrush to restore large patches of sagebrush cover and connect existing patches. • Repeat restoration treatments if they fail initially to ensure restoration success especially in warm and dry soil temperature moisture regimes where weather is often problematic for establishment. • Actively manage restored/rehabilitated areas to increase perennial herbaceous species and minimize secondary weed invasion.

Monitoring and Adaptive Management– implement comprehensive monitoring to track landscape change and management outcomes and provide the basis for adaptive management

Priorities	• Regional environmental gradients to track changes in plant community and other ecosystem attributes and expansion or contraction of species ranges – *all ecological types.* • Assess treatment effectiveness – *all ecological types.*
Objectives	• Understand effects of wildfire, annual grass invasion, piñon and juniper expansion, climate change and other global stressors in sagebrush ecosystems • Increase understanding of the long- and short-term outcomes of management treatments.
Activities	• Establish a regional network of monitoring sites that includes major environmental gradients. • Collect pre- and post-treatment monitoring data for all major land treatments activities. • Collect data on ecosystem status and trends (for example, land cover type, ground cover, vegetation cover and height [native and invasive], phase of tree expansion, soil and site stability, oddities). • Use consistent methods to monitor indicators. • Use a cross-boundary approach that involves all major land owners. • Use a common data base for all monitoring results (e.g., Land Treatment Digital Library; http://greatbasin.wr.usgs.gov/ltdl/). • Develop monitoring products that track change and provide management implications and adaptations for future management. • Support and improve information sharing on treatment effectiveness and monitoring results across jurisdictional boundaries (e.g., Great Basin Fire Science Delivery Project; www.gbfiresci.org).

Table 4. Specific management strategies by agency program area for the cells within the sage-grouse habitat matrix (table 2). The rows indicate relative resilience and resistance (numbers) and the columns indicate landscape cover of sagebrush by category (letters). Resilience and resistance are based on soil temperature and moisture regimes (fig. 11) and their relationship to ecological types (table 1). Percentage of the landscape dominated by sagebrush is based on the capacity of large landscapes to support viable sage-grouse populations over the long term (fig. 8). Note that these guidelines are related to the sage-grouse habitat matrix, and do not preclude other factors from consideration when determining management priorities for program areas. The "Fire Operations" program area includes preparedness, prevention, and suppression activities.

High Resilience to Disturbance and Resistance to Invasive Annual Grasses (1A, 1B, 1C)

Natural sagebrush recovery is likely to occur. Perennial herbaceous species are sufficient for recovery. Risk of invasive annual grasses is typically low.

Fire Operations	• Fire suppression is typically third order priority, but varies with large fire risk and landscape condition (cells 1A, 1B, 1C). Scenarios requiring higher priority may include: ○ Areas of sagebrush that bridge large, contiguous expanses of sagebrush and that are important for providing connectivity for sage-grouse (cells 1B, 1C). ○ Areas where sagebrush communities have been successfully reestablished through seedings or other rehabilitation investments (cells 1A, 1B, 1C) ○ Areas with later phase (Phase III) post-settlement piñon and juniper that have high resistance to control, are subject to large and/or severe fires, and place adjacent sage-grouse habitat at risk (cells 1A, 1B). ○ All areas when critical burning environment conditions exist. These conditions may be identified by a number of products including, but not limited to: Predictive Services 7-Day Significant Fire Potential Forecasts; National Weather Service Fire Weather Watches and Red Flag Warnings; fire behavior forecasts or other local knowledge.
Fuels Management	• Fuels management to reduce large sagebrush stand losses is a second order priority, especially in cells 1B and 1C. Management activities include: ○ Strategic placement of fuel breaks to reduce loss of large sagebrush stands by wildfire. Examples include linear features or other strategically placed treatments that serve to constrain fire spread or otherwise augment suppression efforts. ○ Tree removal in early to mid-phase (Phases I, II), post-settlement piñon and juniper expansion areas to maintain shrub/herbaceous cover and reduce fuel loads. ○ Tree removal in later phase (Phase III), post-settlement piñon and juniper areas to reduce risks of large or high severity fires. Because these areas represent non-sage-grouse habitat, prescribed fire may be appropriate on cool and moist sites, but invasive plant control and restoration of sagebrush and perennial native grasses and forbs may be necessary.
Post-Fire Rehabilitation	• Post-fire rehabilitation is generally low priority (cells 1A, 1B, 1C). Areas of higher priority include: ○ Areas where perennial herbaceous cover, density, and species composition is inadequate for recovery. ○ Areas where seeding or transplanting sagebrush is needed to maintain habitat connectivity for sage-grouse. ○ Steep slopes and soils with erosion potential.
Habitat Restoration and Recovery	• Restoration is typically passive and designed to increase or maintain perennial herbaceous species, biological soil crusts and landscape cover of sagebrush (cells 1A, 1B, 1C). Areas to consider for active restoration include: ○ Areas where perennial herbaceous cover density, or composition is inadequate for recovery after surface disturbance. ○ Areas where seeding or transplanting sagebrush is needed to maintain habitat connectivity for sage-grouse.

Moderate Resilience to Disturbance and Resistance to Invasive Annuals (2A, 2B, 2C)

Natural sagebrush recovery is likely to occur on cooler and moister sites, but the time required may be too great if large, contiguous areas lack sagebrush. Perennial herbaceous species are usually adequate for recovery on cooler and moister sites. Risk of invasive annual grasses is moderately high on warmer and drier sites.

Fire Operations	• Fire suppression is typically second order priority (cells 2A, 2B, 2C). Scenarios requiring higher priority may include: ○ Areas of sagebrush that bridge large, contiguous expanses of sagebrush and that are important for providing connectivity for sage-grouse (cells 2B, 2C).

(continued)

Table 4. (Continued).

	○ Areas where sagebrush communities have been successfully reestablished through seedings or other rehabilitation investments (cells 2A, 2B, 2C) ○ Areas with later phase (Phase III), post-settlement piñon and juniper that have high resistance to control, are subject to large and/or severe fires, and place adjacent sage-grouse habitat at risk (cells 2A, 2B). ○ Areas where annual grasslands place adjacent sage-grouse habitat at risk (cell 2A). ○ All areas when critical burning environment conditions exist. These conditions may be identified by a number of products including, but not limited to: Predictive Services 7-Day Significant Fire Potential Forecasts; National Weather Service Fire Weather Watches and Red Flag Warnings; fire behavior forecasts or other local knowledge.
Fuels Management	• Fuels management to reduce large sagebrush stand losses is a first order priority, especially in cells 2B and 2C. Management activities include: ○ Strategic placement of fuel breaks to reduce loss of large sagebrush stands by wildfire. Examples include linear features or other strategically placed treatments that serve to constrain fire spread or otherwise augment suppression efforts. ○ Tree removal in early to mid-phase (Phase I, II), post-settlement piñon and juniper expansion areas to maintain shrub/herbaceous cover and reduce fuel loads. ○ Tree removal in later phase (Phase III), post-settlement piñon and juniper areas to reduce risks of large or high severity fires. Because these areas represent non-sage-grouse habitat, prescribed fire may be appropriate on cool and moist sites, but restoration of sagebrush and perennial native grasses and forbs may be necessary.
Post-Fire Rehabilitation	• Post-fire rehabilitation is generally low priority (cells 2A, 2B, 2C) in cooler and moister areas. Areas of higher priority include: ○ Areas where perennial herbaceous cover, density, and species composition is inadequate for recovery. ○ Areas where seeding or transplanting sagebrush is needed to maintain habitat connectivity for sage-grouse. ○ Relatively warm and dry areas where annual invasives are expanding. ○ Steep slopes with erosion potential.
Habitat Restoration and Recovery	• Restoration is typically passive on cooler and moister areas and is designed to increase or maintain perennial herbaceous species, biological soil crusts, and landscape cover of sagebrush (cells 2A, 2B, 2C). Areas to consider for active restoration include: ○ Areas where perennial herbaceous cover, density, and species composition is inadequate for recovery after surface disturbance. ○ Areas where seeding or transplanting sagebrush is needed to maintain habitat connectivity for sage-grouse. ○ Relatively warm and dry areas where annual invasives are expanding.

Low Resilience to Disturbance and Resistance to Invasive Annuals (3A, 3B, 3C)

Natural sagebrush recovery is not likely. Perennial herbaceous species are typically inadequate for recovery. Risk of invasive annual grasses is high.

Fire Operations	• Fire suppression priority depends on the landscape cover of sagebrush: ○ Areas with <25% landscape cover of sagebrush are typically third order priority (cell 3A). These areas may be a higher priority if they are adjacent to intact sage-grouse habitat or are essential for connectivity. ○ Areas with 26-65% landscape cover of sagebrush are typically second order priority (cell 3B). These areas are higher priority if they have intact understories and if they are adjacent to sage-grouse habitat. ○ Areas with >65% landscape cover of sagebrush are first order priority (cell 3C). ○ Areas where sagebrush communities have been successfully reestablished through seedings or other rehabilitation investments (cells 3A, 3B, 3C).

(continued)

Table 4. (Continued).

Fuels Management	• Fuels management priority and management activities depend on the landscape cover of sagebrush: ○ Areas with <25% landscape cover of sagebrush are typically third order priority (cell 3A). Strategic placement of fuel breaks may be needed to reduce loss of adjacent sage-grouse habitat by wildfire. Examples include linear features or other strategically placed treatments that serve to constrain fire spread or otherwise augment suppression efforts. ○ Areas with 26-65% landscape cover of sagebrush are typically second order priority (cell 3B). These areas are higher priority if they have intact understories and if they are adjacent to sage-grouse habitat. Strategic placement of fuel breaks may be needed to reduce loss of large sagebrush stands by wildfire. ○ Areas with >65% landscape cover of sagebrush are first order priority (cell 3C). Strategic placement of fuel breaks may be needed to reduce loss of large sagebrush stands by wildfire. ○ Areas where sagebrush communities have been successfully reestablished through seedings or other rehabilitation investments (cells 3A, 3B, 3C). Strategic placement of fuel breaks may be needed to protect investments from repeated loss to wildfire.
Post-Fire Rehabilitation	• Post-fire rehabilitation priority and management activities depend on the landscape cover of sagebrush: ○ Areas with <25% landscape cover of sagebrush are typically third order priority (cell 3A). Exceptions include (1) sites that are relatively cool and moist and (2) areas adjacent to sage-grouse habitat where seeding can be used to increase connectivity and prevent annual invasive spread. In highly invaded areas, integrated strategies that include seeding of perennial herbaceous species and seeding and/or transplanting sagebrush will be required. Success will likely require more than one intervention due to low and variable precipitation. ○ Areas with 26-65% landscape cover of sagebrush are typically second order priority (cell 3B). Exceptions include (1) sites that are relatively cool and moist or that are not highly invaded, and (2) areas adjacent to sage-grouse habitat where seeding can be used to increase connectivity and prevent annual invasive spread. Seeding of perennial herbaceous species will be required where cover, density and species composition of these species is inadequate for recovery. Seeding and/or transplanting sagebrush as soon as possible is necessary for rehabilitating sage-grouse habitat. Success will likely require more than one intervention due to low and variable precipitation. ○ Areas with >65% landscape cover of sagebrush are first order priority, especially if they are part of a larger, contiguous area of sagebrush (cell 3C). Seeding of perennial herbaceous species will be required where cover, density and species composition of these species is inadequate for recovery. Seeding and/or transplanting sagebrush as soon as possible is necessary for rehabilitating sage-grouse habitat. Success will likely require more than one intervention due to low and variable precipitation.
Habitat Restoration and Recovery	• Restoration priority and management activities depends on the landscape cover of sagebrush: ○ Areas with <25% landscape cover of sagebrush are typically third order priority. Exceptions include (1) surface disturbances and (2) areas adjacent to sage-grouse habitat where seeding can be used to prevent annual invasive spread (cell 3A). In highly invaded areas, integrated strategies that include seeding of perennial herbaceous species and seeding and/or transplanting sagebrush will be required. Success will likely require more than one intervention due to low and variable precipitation. ○ Areas with 26-65% landscape cover of sagebrush are typically second order priority (cell 3B). Exceptions include (1) surface disturbances, (2) sites that are relatively cool and moist or that are not highly invaded, and (3) areas adjacent to sage-grouse habitat where seeding can be used to increase connectivity and prevent annual invasive spread. Seeding of perennial herbaceous species may be required where cover, density and species composition of these species is inadequate. Seeding and/or transplanting sagebrush as soon as possible is necessary for restoring sage-grouse habitat. Success will likely require more than one intervention due to low and variable precipitation. ○ Areas with >65% landscape cover of sagebrush are first order priority, especially if they are part of a larger, contiguous area of sagebrush (cell 3C). Seeding of perennial herbaceous species may be required where cover, density, and species composition of these species is inadequate. Seeding and/or transplanting sagebrush as soon as possible is necessary for restoring sage-grouse habitat. Success will likely require more than one intervention due to low and variable precipitation.

Another important consideration is that ecological processes such as wildfire can occur either within or across categories in the sage-grouse habitat matrix and it is necessary to determine the appropriate spatial context when evaluating management opportunities based on resilience and resistance and sage-grouse habitat. For example, if critical sage-grouse habitat occurs in close proximity to landscapes comprised mainly of annual grass-dominated plant communities, then fire risk to adjacent sage-grouse habitat can increase dramatically (Balch et al. 2013). In this scenario, management actions could include reducing the influence of invasive annual grasses with a strategic fuel break on the perimeter of intact sagebrush. Thus, management actions may have value to sustaining existing sage-grouse habitat, even if these measures are applied in locations that are currently not habitat; the spatial relationships of sagebrush and invasive annual grasses should be considered when prioritizing management actions and associated conservation measures.

Informing Wildfire and Fuels Management Strategies to Conserve Sage-Grouse

Collectively, responses to wildfires and implementation of fuels management projects are important contributors to sage-grouse conservation. Resilience and resistance concepts provide a science-based background that can inform fire operations and fuels management strategies and allocation of scarce assets during periods of high fire activity. In fire operations, firefighter and public safety is the overriding objective in all decisions. In addition, land managers consider numerous other values at risk, including the Wildland-Urban Interface (WUI), habitats, and infrastructure when allocating assets and prioritizing efforts. Resilience and resistance concepts are especially relevant for evaluating tradeoffs related to current ecological conditions and rates of recovery and possible ecological consequences of different fire management activities. For example, prioritizing initial attack efforts based on ecological types and their resilience and resistance at fire locations is a possible future application of resilience and resistance concepts. Also, fire prevention efforts can be concentrated where human ignitions have commonly occurred near intact, high quality habitats that also have inherently low resilience and resistance.

Fuels management projects are often applied to (1) constrain or minimize fire spread; (2) alter species composition; (3) modify fire intensity, severity, or effects; or (4) create fuel breaks or anchor points that augment fire management efforts (fig. 13). These activities are selectively used based on the projected ecosystem response, anticipated fire patterns, and probability of success. For example, in areas that are difficult to restore due to low to moderate resilience, fuel treatments can be placed to minimize fire spread and conserve sagebrush habitat. In cooler and moister areas with moderate to high resilience and resistance, mechanical or prescribed fire treatments may be appropriate to prevent conifer expansion and dominance. Given projected climate change and longer fire seasons across the western United States, fuels management represents a proactive approach for modifying large fire trends. Fire operations and fuels management programs contribute to a strategic, landscape approach when coupled with data that illustrate the likelihood of fire occurrence, potential fire behavior, and risk assessments (Finney et al. 2010; Oregon Department of Forestry 2013). In tandem with resilience and resistance concepts, these data can further inform fire operations and fuels management decisions.

Figure 13. Fuel breaks may include roads, natural features, or other management imposed treatments intended to modify fire behavior or otherwise augment suppression efforts at the time of a fire. Such changes in fuel type and arrangement may improve suppression effectiveness by modifying flame length and fire intensity, and allow fire operations to be conducted more safely. The top photo shows a burnout operation along an existing road to remove available fuels ahead of an oncoming fire and constrain overall fire growth (photo by BLM Idaho Falls District). The bottom photo shows fuel breaks located along a road, which complimented fire control efforts when a fire intersected the fuel break and road from the right (photo by Ben Dyer, BLM).

Putting it all Together

Effective management and restoration of sage-grouse habitat will benefit from a collaborative approach that prioritizes the best management practices in the most appropriate places. This section describes an approach for assessing focal areas for sage-grouse habitat management based on widely available data, including (1) Priority Areas for Conservation (PACs), (2) breeding bird densities, (3) habitat suitability as indicated by the landscape cover of sagebrush, (4) resilience and resistance and dominant ecological types as indicated by soil temperature and moisture regimes, and (5) habitat threats as indicated by cover of cheatgrass, cover of piñon and juniper, and by fire history. Breeding bird density data are overlain with landscape cover of sagebrush and with resilience and resistance to spatially link sage-grouse populations with habitat conditions and risks. We illustrate the use of this step-down approach for evaluating focal areas for sage-grouse habitat management across the western portion of the range, and we provide a detailed example for a diverse area in the northeast corner of Nevada that is comprised largely of PACs with mixed land ownership. The sage-grouse habitat matrix (table 2) is used as a tool in the decision process, and guidelines are provided to assist in determining appropriate management strategies for the primary agency program areas (fire operations, fuels management, post-fire rehabilitation, habitat restoration) for each cell of the matrix.

We conclude with discussions of the tools available to aid in determining the suitability of an area for treatment and the most appropriate management treatments such as ecological site descriptions and state and transition models and of monitoring and adaptive management. Datasets used to compile the maps in the following sections are in Appendix 4.

Assessing Focal Areas for Sage-Grouse Habitat Management: Key Data Layers

Priority areas for conservation: The recent identification of sage-grouse strongholds, or Priority Areas for Conservation (PACs), greatly improves the ability to target management actions towards habitats expected to be critical for long-term viability of the species (fig. 14; USFWS 2013). Understanding and minimizing risks of large-scale loss of sagebrush and conversion to invasive annual grasses or piñon and juniper in and around PACs will be integral to maintaining sage-grouse distribution and stabilizing population trends. PACs were developed by individual states to identify those areas that are critical for ensuring adequate representation, redundance, and resilience to conserve sage-grouse populations. Methods differed among states; in general, PAC boundaries were identified based on (1) sage-grouse population data including breeding bird density, lek counts, telemetry, nesting areas, known distributions, and sightings/observations; and (2) habitat data including occupied habitat, suitable habitat, seasonal habitat, nesting and brood rearing areas, and connectivity areas or corridors. Sage-grouse habitats outside of PACs also are important in assessing focal areas for management where they provide connectivity between PACs (genetic and habitat linkages), seasonal habitats that may have been underestimated due to emphasis on lek sites to define priority areas, habitat restoration and population expansion opportunities, and flexibility for managing habitat changes that may result from climate change (USFWS 2013). If PAC boundaries are adjusted, they will need to be updated for future analyses.

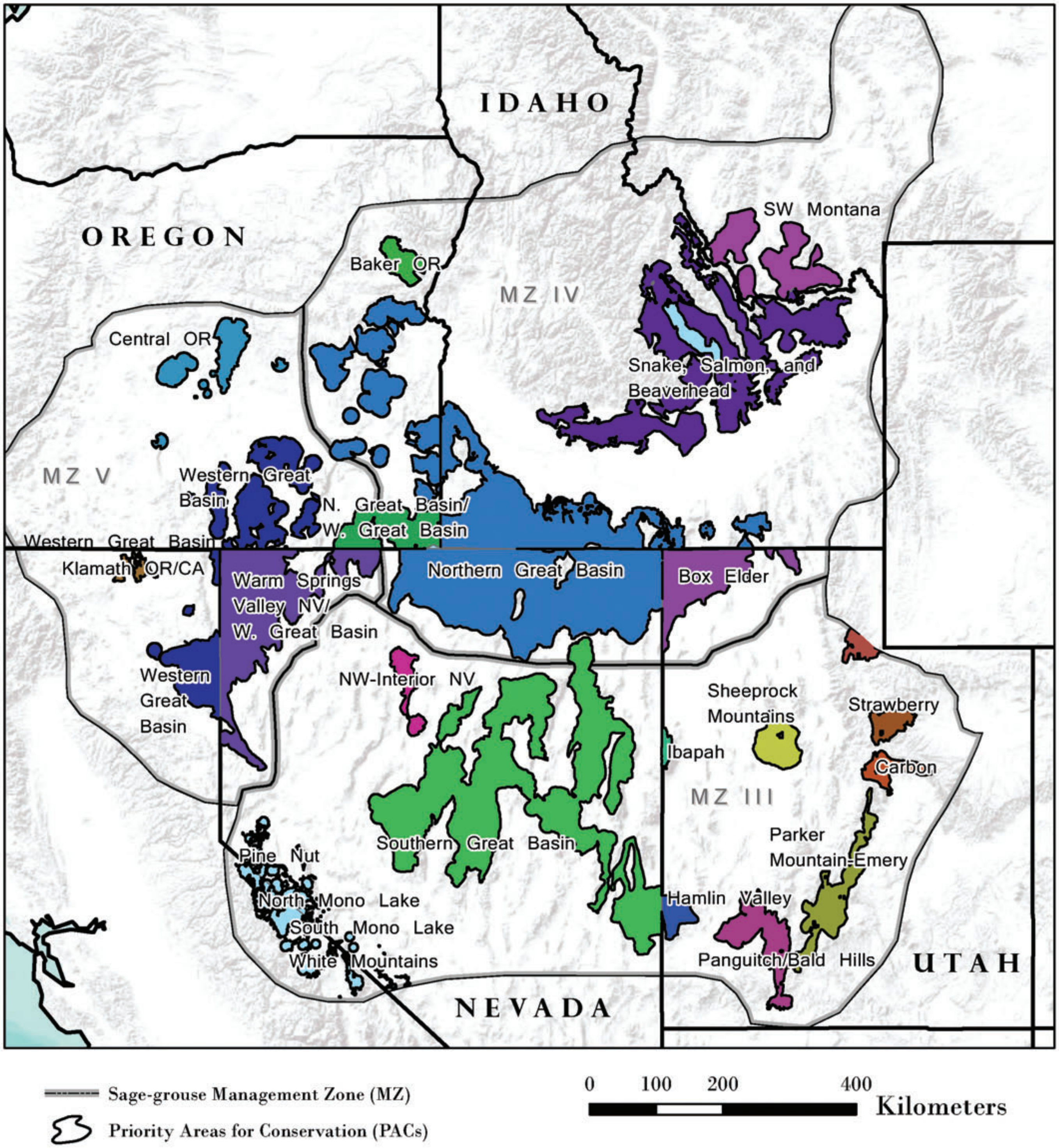

Figure 14. Priority Areas for Conservation (PACs) within the range of sage-grouse (USFWS 2013). Colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

Breeding bird density: Range-wide breeding bird density areas provide one of the few accessible data sets for further prioritizing actions within and adjacent to PACs to maintain species distribution and abundance. Doherty et al. (2010b) developed a useful framework for incorporating population data in their range-wide breeding bird density analysis, which used maximum counts of males on leks (n = 4,885) to delineate breeding bird density areas that contain 25, 50, 75, and 100% of the known breeding population (fig. 15). Leks were mapped according to these abundance values and buffered by a 6.4 to 8.5 km (4.0 to 5.3 mi) radius to delineate nesting areas. Findings showed that while sage-grouse occupy extremely large landscapes, their breeding distribution is highly aggregated in comparably smaller identifiable population centers; 25% of the known population occurs within 3.9% (2.9 million ha; 7.2 million ac) of the species range, and 75% of birds are within 27.0% of the species range (20.4 million ha; 50.4 million ac) (Doherty et al. 2010b). The Doherty et al. (2010b) analysis emphasized breeding habitats primarily because little broad scale data exist for summer and winter habitat use areas. Even though the current breeding bird density data provide the most comprehensive data available, they do not include all existing sage-grouse populations. Incorporating finer scale seasonal habitat use data at local levels where it is available will ensure management actions encompass all seasonal habitat requirements.

For this assessment, we chose to use State-level breeding bird density results from Doherty et al. (2010b) instead of range-wide model results to ensure that important breeding areas in MZs III, IV, and V were not underweighted due to relatively higher bird densities in the eastern portion of the range. It is important to note that breeding density areas were identified using best available information in 2009, so these range-wide data do not reflect the most current lek count information or changes in conditions since the original analysis. Also, breeding density areas should not be viewed as rigid boundaries but rather as the means to prioritize landscapes regionally where step-down assessments and actions may be implemented quickly to conserve the most birds.

Landscape cover of sagebrush: Landscape cover of sagebrush is one of the key determinants of sage-grouse population persistence and, in combination with an understanding of resilience to disturbance and resistance to invasive annuals, provides essential information both for determining priority areas for management and appropriate management actions (fig. 10; tables 2 and 3). Landscape cover of sagebrush is a measure of large, contiguous patches of sagebrush on the landscape and is calculated from remote sensing databases such as LANDFIRE (see Appendix 4). We used the three cover categories of sagebrush landscape cover discussed previously to predict the likelihood of sustaining sage-grouse populations (1-25%, 25-65%, >65%). The sagebrush landscape cover datasets were created using a moving window to summarize the proportion of area (5-km [3.1-mi] radius) dominated by sagebrush surrounding each 30-m pixel and then assigned those areas to the three categories (see Appendix 2). Because available sagebrush cover from sources such as LANDFIRE does not exclude recent fire perimeters, it was necessary to either include these in the analysis of landscape cover of sagebrush or display them separately. Although areas that have burned since 2000 likely do not currently provide desired sage-grouse habitat, areas with the potential to support sagebrush ecological types can provide conservation benefits in the overall planning effort especially within long-term conservation areas like PACs. The landscape cover of sagebrush and recent fire perimeters are illustrated for the western portion of the range (fig.16) and northeast Nevada (fig. 17).

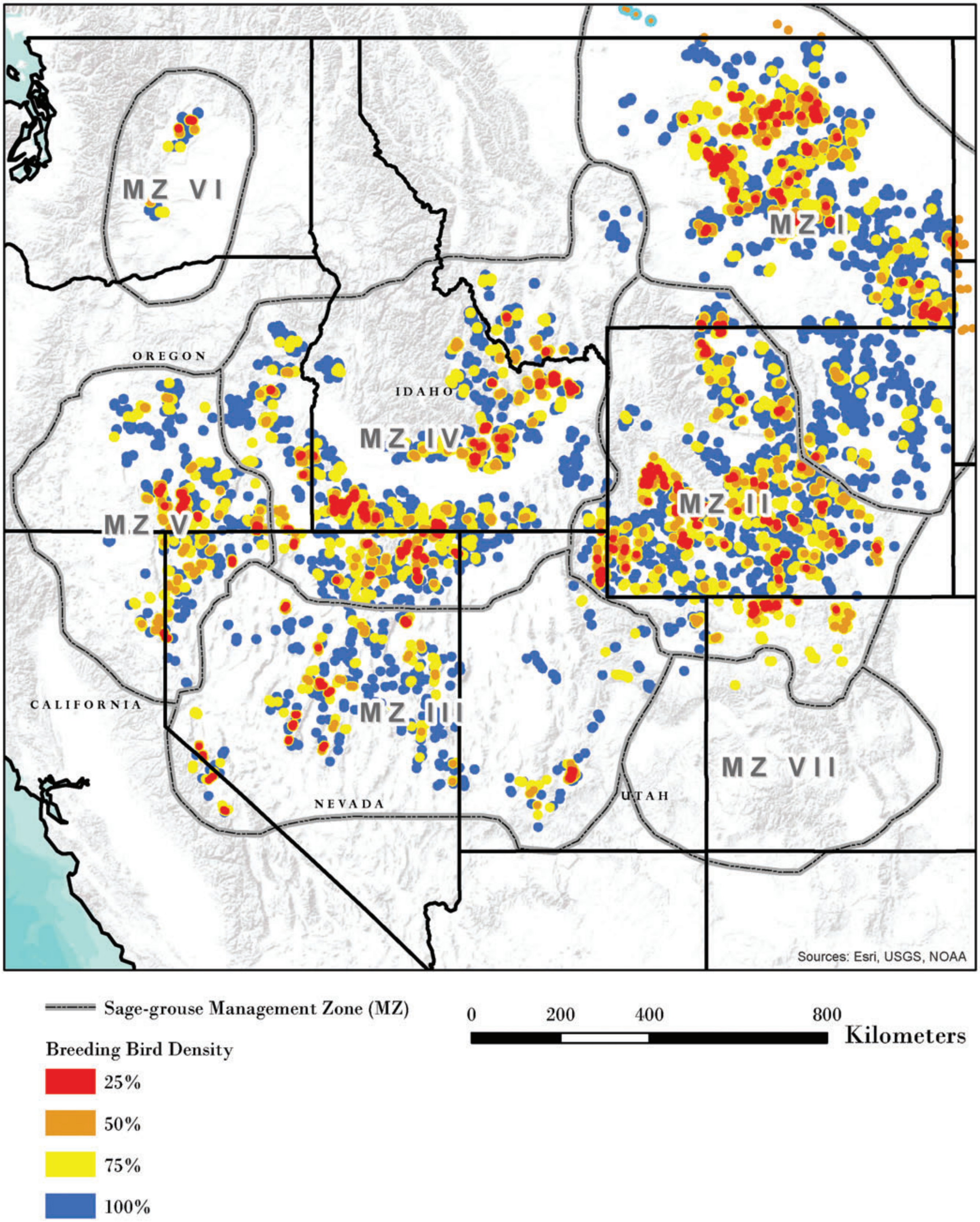

Figure 15. Range-wide sage-grouse breeding bird densities from Doherty et al. 2010. Points illustrate breeding bird density areas that contain 25, 50, 75, and 100% of the known breeding population and are based on maximum counts of males on leks (n = 4,885). Leks were mapped according to abundance values and buffered by 6.4 to 8.5 km (4.0 to 5.2 mi) to delineate nesting areas.

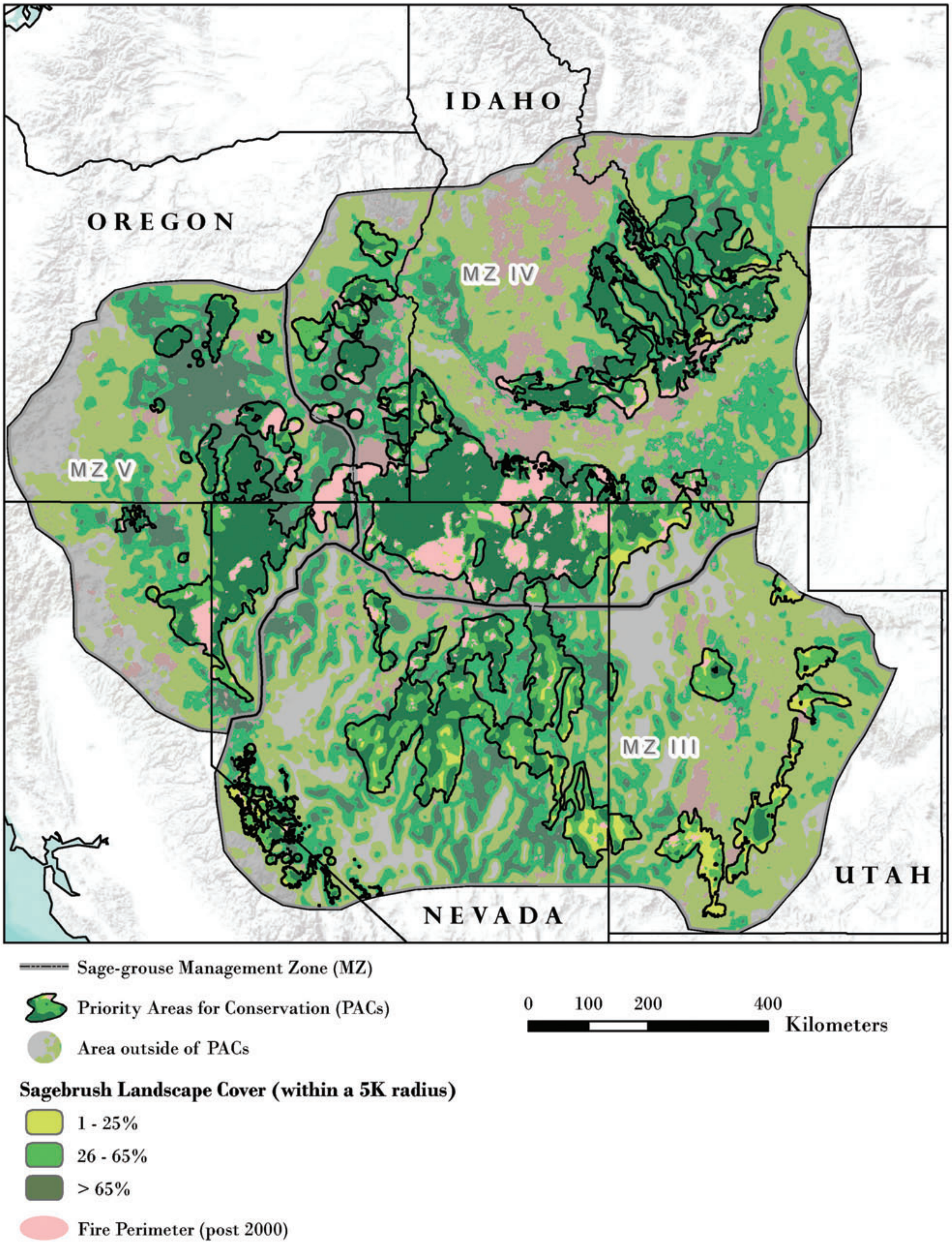

Figure 16. The landscape cover of sagebrush within each of three selected categories (1-25%, 26-65%, >65%) for Management Zones III, IV, and V (Stiver et al. 2006). The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land cover types for locations with sagebrush cover. Darker colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

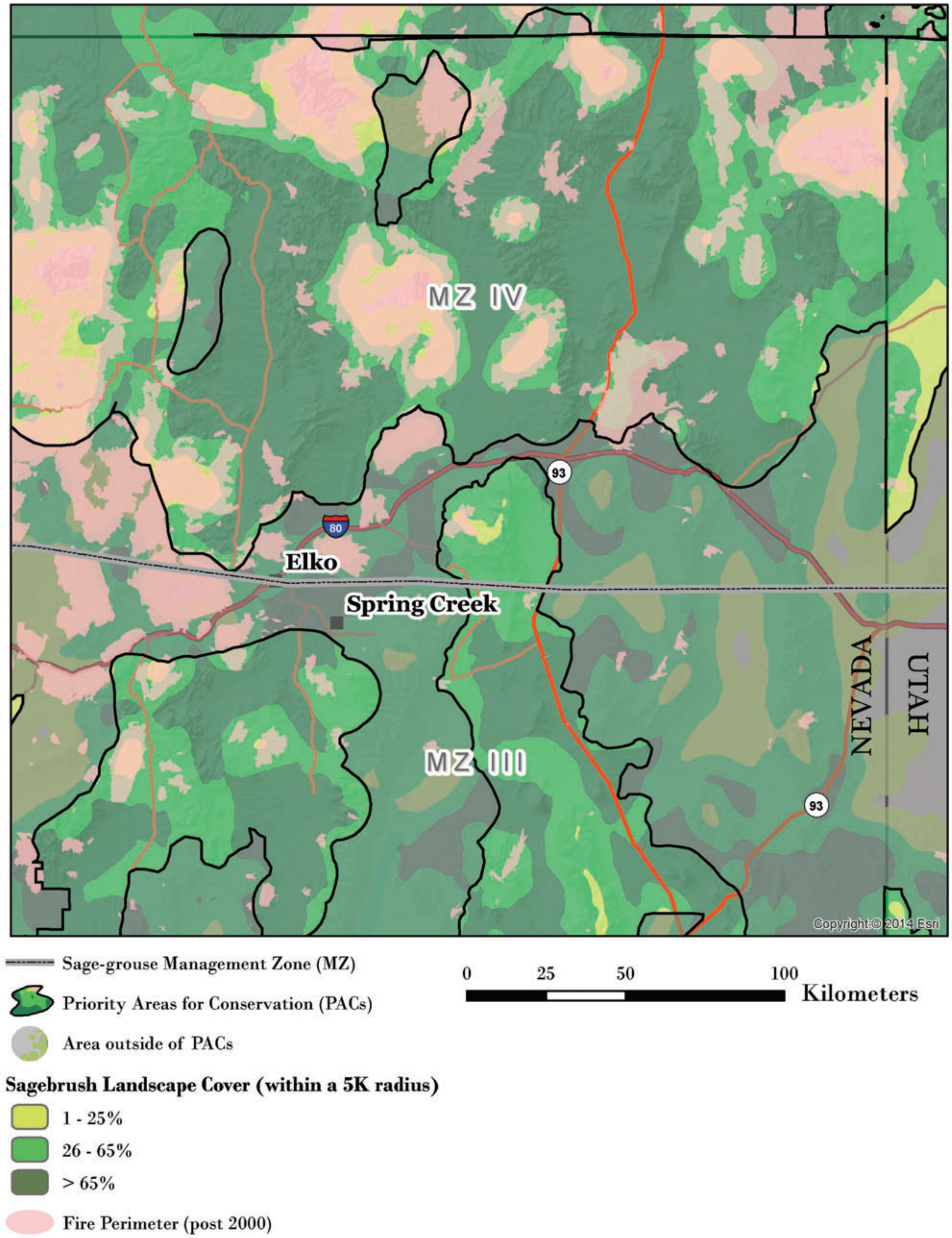

Figure 17. The landscape cover of sagebrush within each of the selected categories (1-25%, 26-65%, >65%) for the north-eastern portion of Nevada. The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land cover types for locations with sagebrush cover. Darker colored polygons delineate Priority Areas for Conservation (USFWS 2013).

Resilience to disturbance and resistance to annuals: Soil temperature and moisture regimes are a strong indicator of ecological types and of resilience to disturbance and resistance to invasive annual plants (fig. 11; table 1). Resilience and resistance predictions coupled with landscape cover of sagebrush can provide critical information for determining focal areas for targeted management actions (tables 2, 3, and 4). The available data for the soil temperature and moisture regimes were recently compiled to predict resilience and resistance (see Appendix 3). These data, displayed for the western portion of the range and northeast Nevada (figs. 18 and 19), illustrate the spatial variability within the focal areas. Soil temperature and moisture regimes are two of the primary determinants of ecological types and of more detailed ecological site descriptions, which are described in the section on "Determining the Most Appropriate Management Treatments at the Project Scale."

Habitat threats: Examining additional land cover data or models of invasive annual grasses and piñon and/or juniper, can provide insights into the current extent of threats in a planning area (e.g., Manier et al. 2013). In addition, evaluating data on fire occurrence and size can provide information on fire history and the rate and pattern of change within the planning area. Data layers for cheatgrass cover have been derived from Landsat imagery (Peterson 2006, 2007) and from model predictions based on species occurrence, climate variables, and anthropogenic disturbance (e.g., the Bureau of Land Management [BLM] Rapid Ecoregional Assessments [REAs]). The REAs contain a large amount of geospatial data that may be useful in providing landscape scale information on invasive species, disturbances, and vegetation types across most of the range of sage-grouse (http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas.html). Similarly, geospatial data for piñon and/or juniper have been developed for various States (e.g., Nevada and Oregon) and are becoming increasingly available rangewide. In addition, more refined data products are often available at local scales. Land managers can evaluate the available land cover datasets and select those land covers with the highest resolution and accuracy for the focal area. Land cover of cheatgrass and piñon and/or juniper and the fire history of the western portion of the range and northeast Nevada are in figures 20-25.

Assessing Focal Areas for Sage-Grouse Habitat Management: Integrating Data Layers

Combining resilience and resistance concepts with sage-grouse habitat and population data can help land managers further gauge relative risks across large landscapes and determine where to focus limited resources to conserve sage-grouse populations. Intersecting breeding bird density areas with soil temperature and moisture regimes provides a spatial tool to depict landscapes with high bird concentrations that may have a higher relative risk of being negatively affected by fire and annual grasses (figs. 26, 27). For prioritization purposes, areas supporting 75% of birds (6.4 to 8.5 km [4.0 to 5.2 mi] buffer around leks) can be categorized as high density while remaining breeding bird density areas (75-100% category; 8.5-km [5.2-mi] buffer around leks) can be categorized as low density. Similarly, warm and dry types can be categorized as having relatively low resilience to fire and resistance to invasive species and all other soil temperature and moisture regimes can be categorized as having relatively moderate to high resilience and resistance. Intersecting breeding bird density areas with landscape cover of sagebrush provides another spatial component revealing large and intact habitat blocks and areas in need of potential restoration to provide continued connectivity (fig. 28).

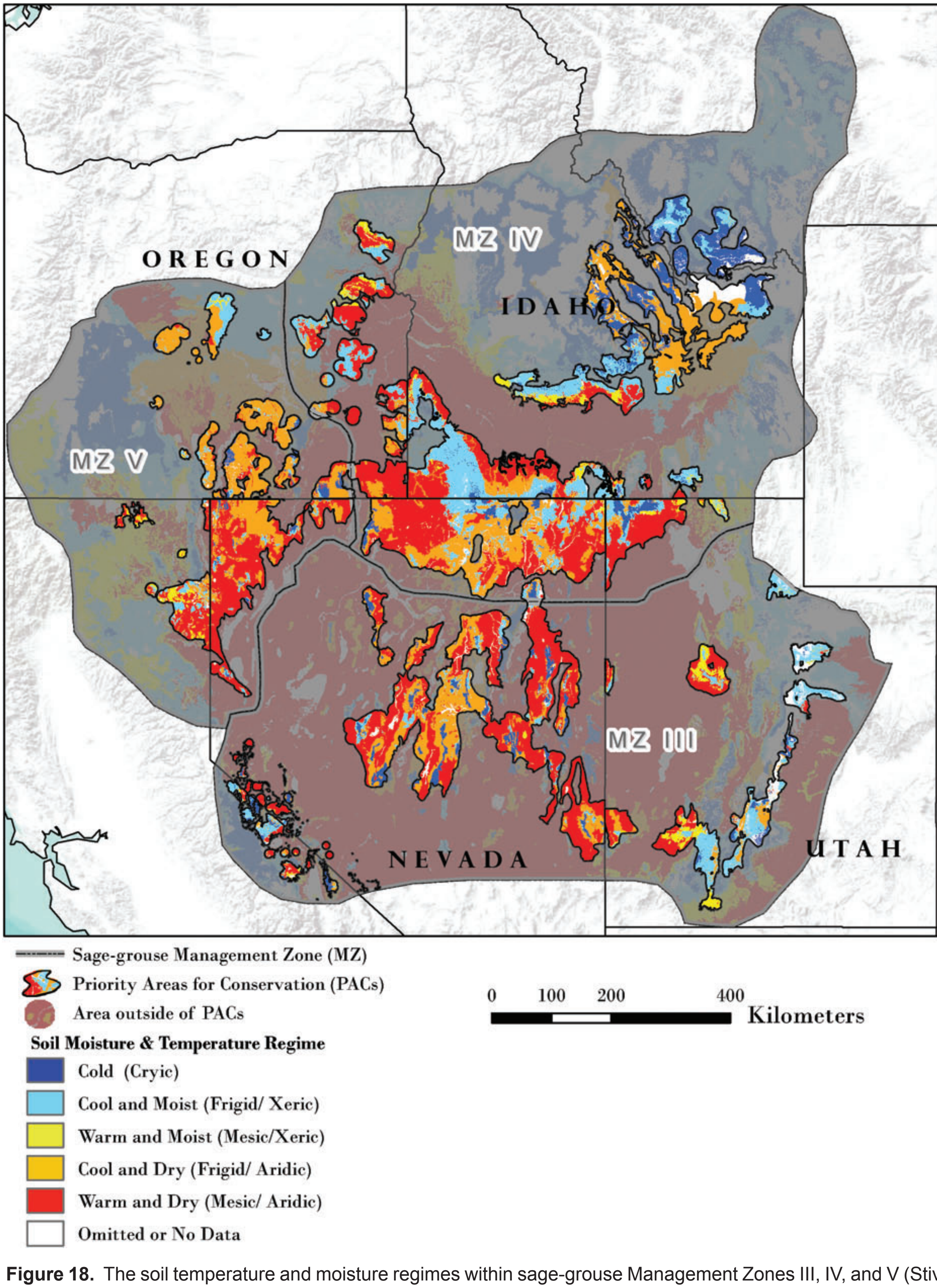

Figure 18. The soil temperature and moisture regimes within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). Gaps in that dataset were filled in with the NRCS State Soil Geographic Database (STATSGO) (Soil Survey Staff 2014b). Darker colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

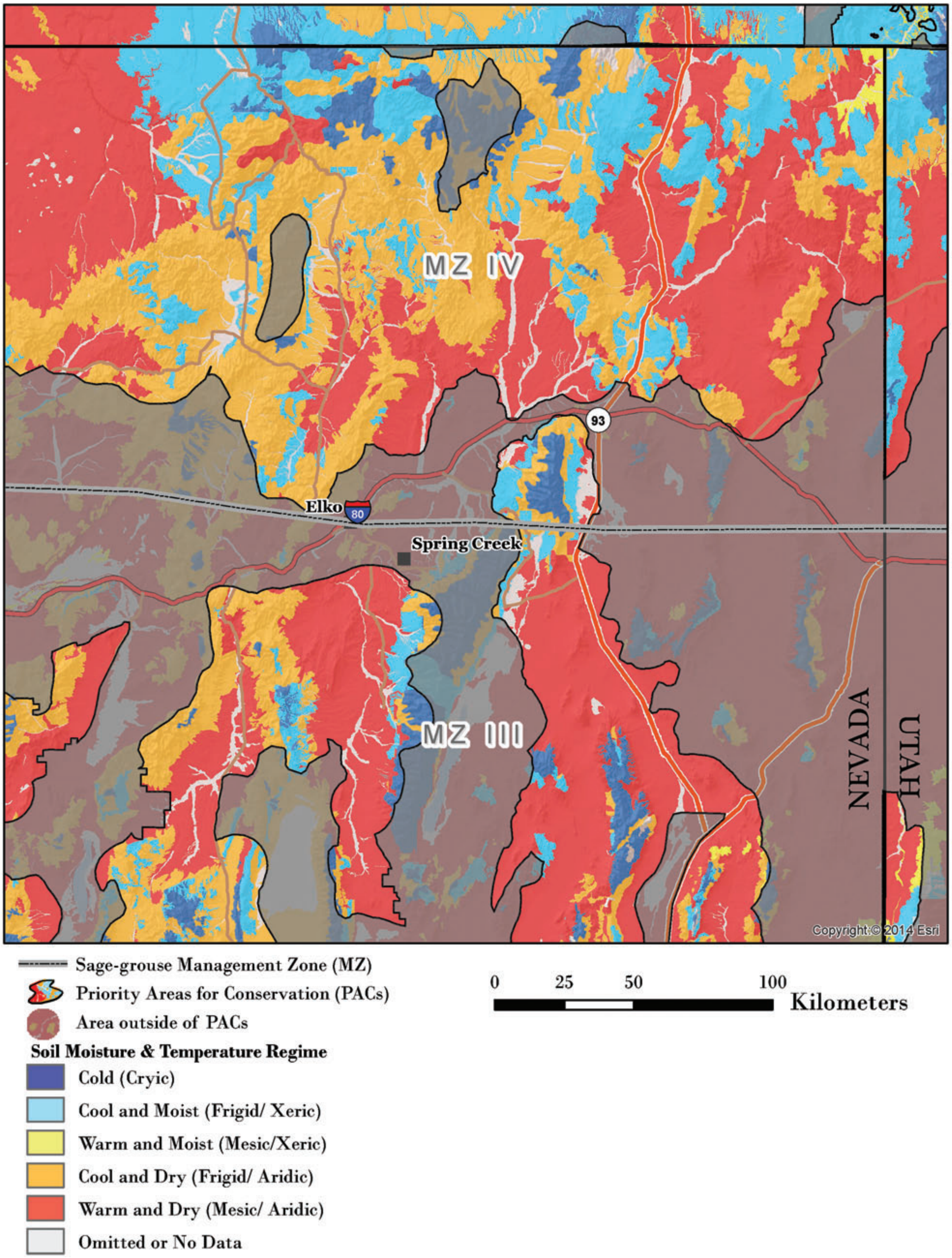

Figure 19. The soil temperature and moisture regimes for the northeast corner of Nevada. Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). Gaps in that dataset were filled in with the NRCS State Soil Geographic Database (STATSGO) (Soil Survey Staff 2014b). Darker colored polygons delineate Priority Areas for Conservation (USFWS 2013).

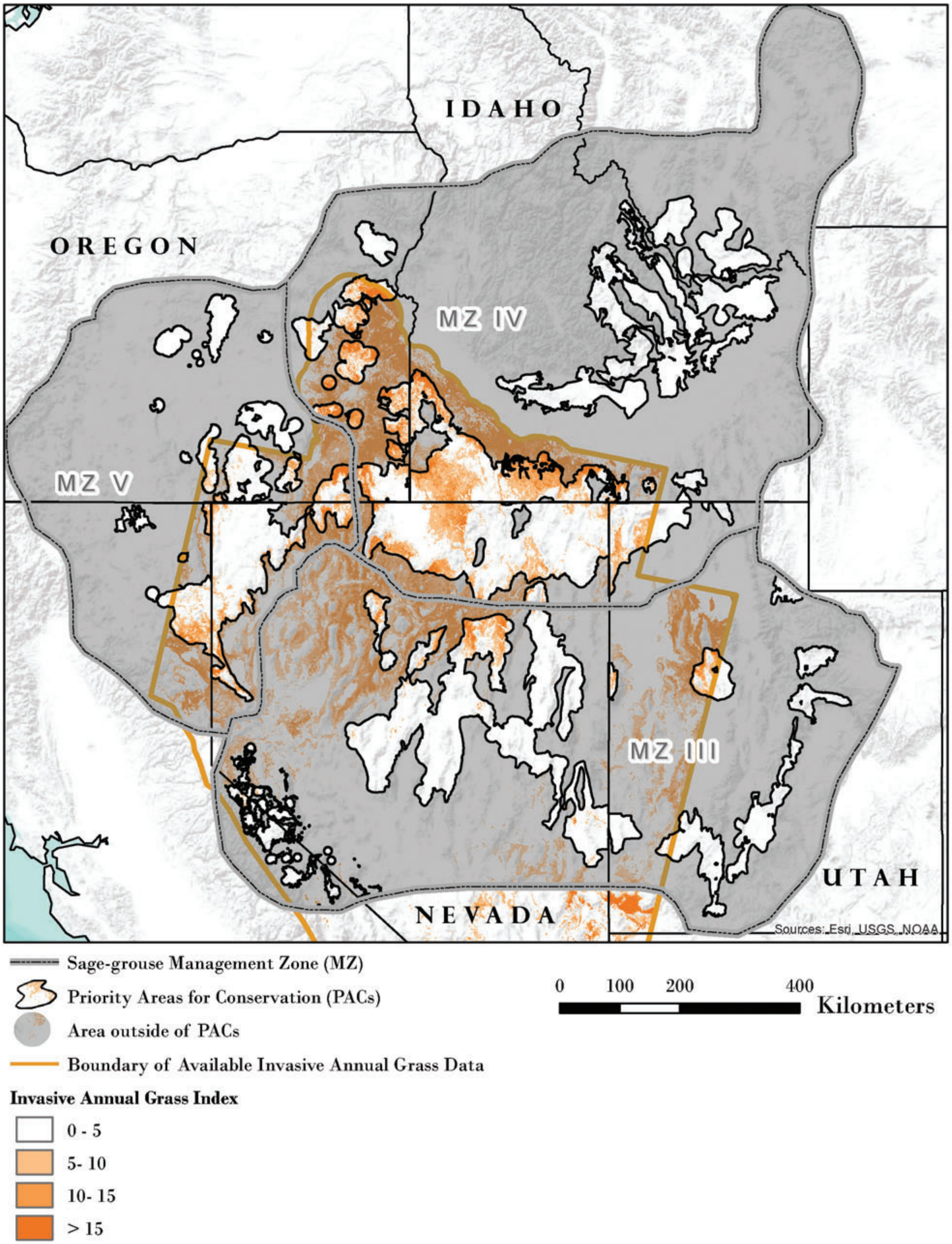

Figure 20. Invasive annual grass index for Nevada (Peterson 2006) and the Owhyee uplands (Peterson 2007) displayed for sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

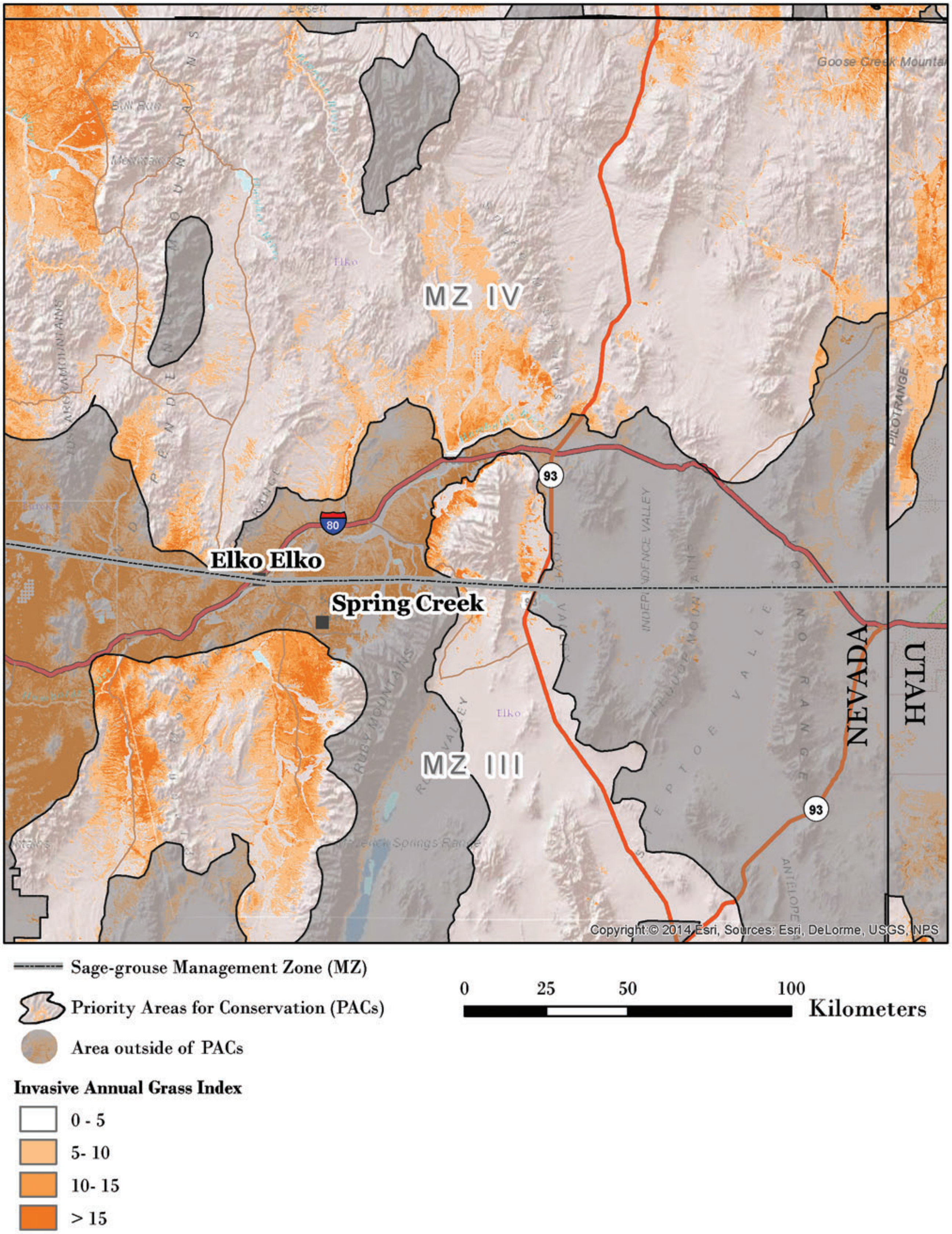

Figure 21. Invasive annual grass index for Nevada (Peterson 2006) and the Owhyee uplands (Peterson 2007) displayed for the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

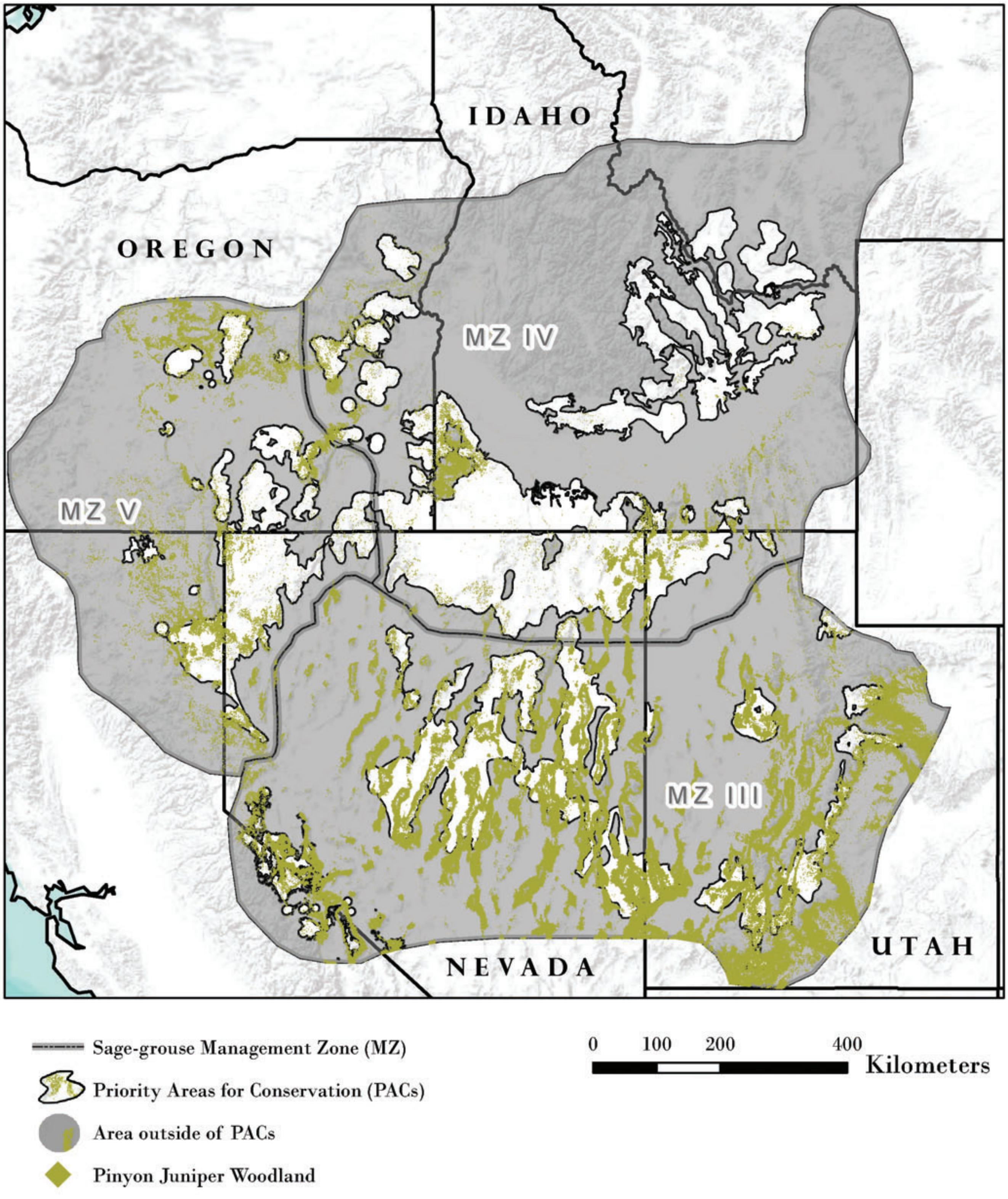

Figure 22. Piñon and/or juniper woodlands (USGS 2004; USGS 2013) within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

Figure 23. Piñon and/or juniper woodlands (USGS 2004; USGS 2013) within the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

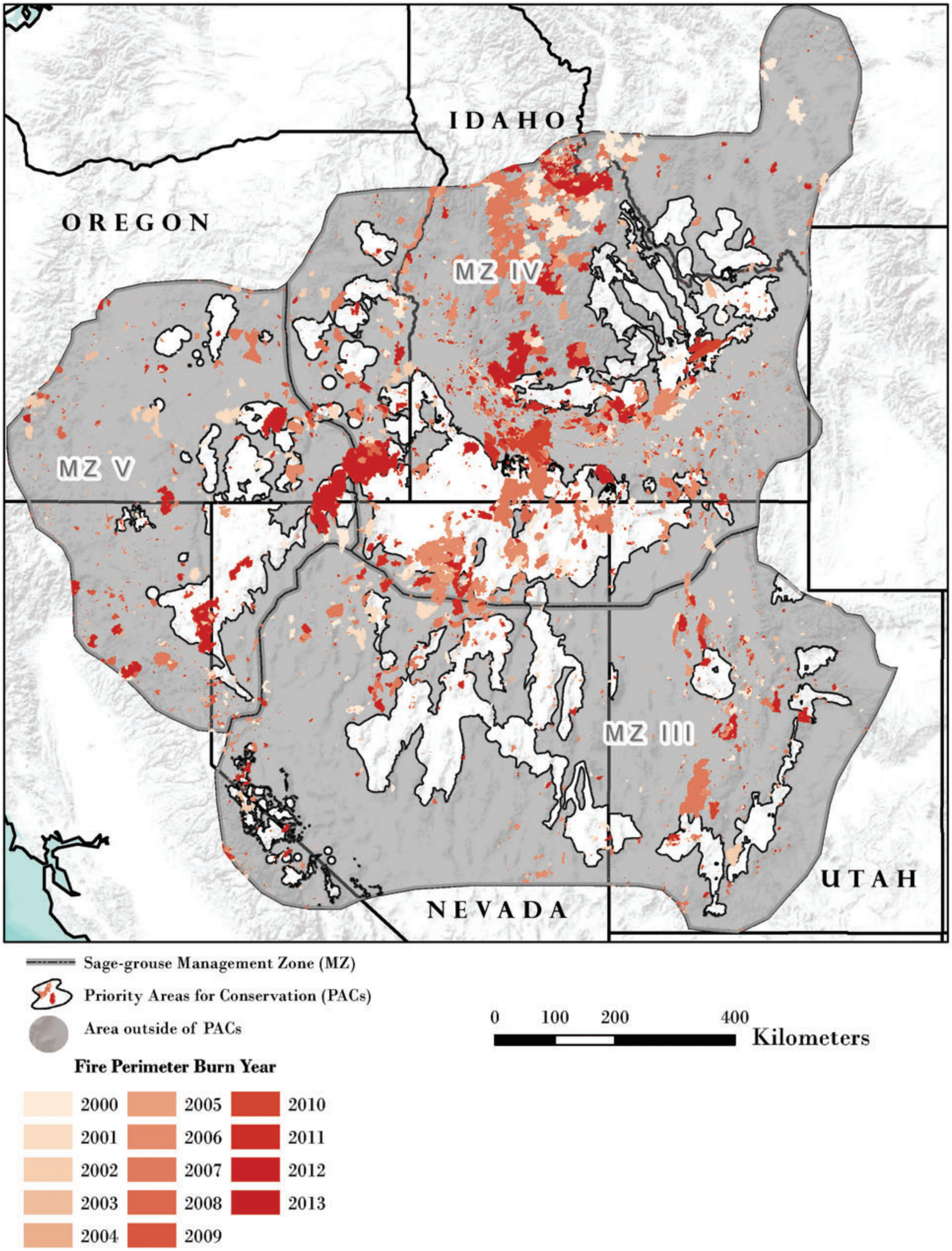

Figure 24. Fire perimeters (Walters et al. 2011; Butler and Bailey 2013) within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Ligher colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

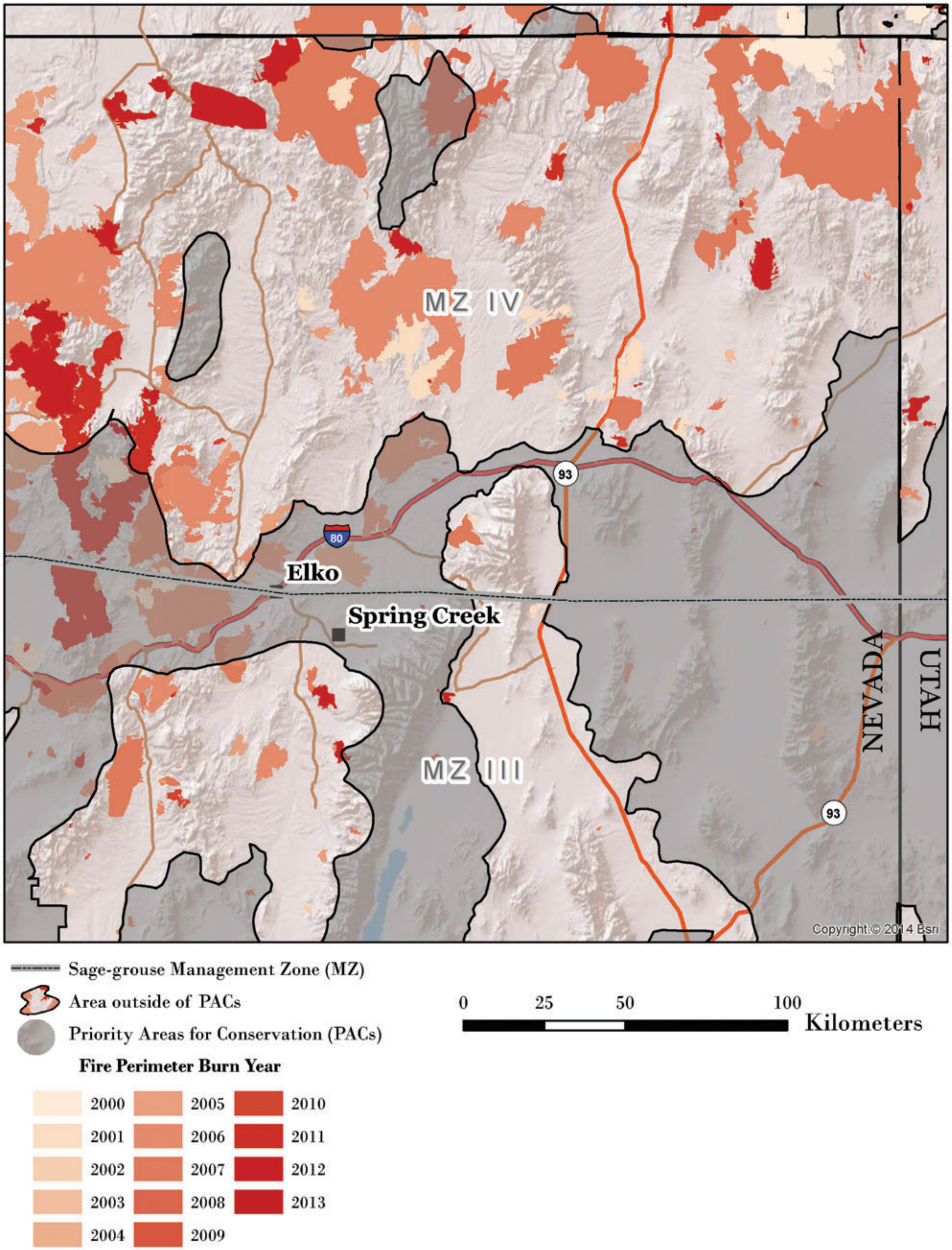

Figure 25. Fire perimeters (Walters et al. 2011; Butler and Bailey 2013) within the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

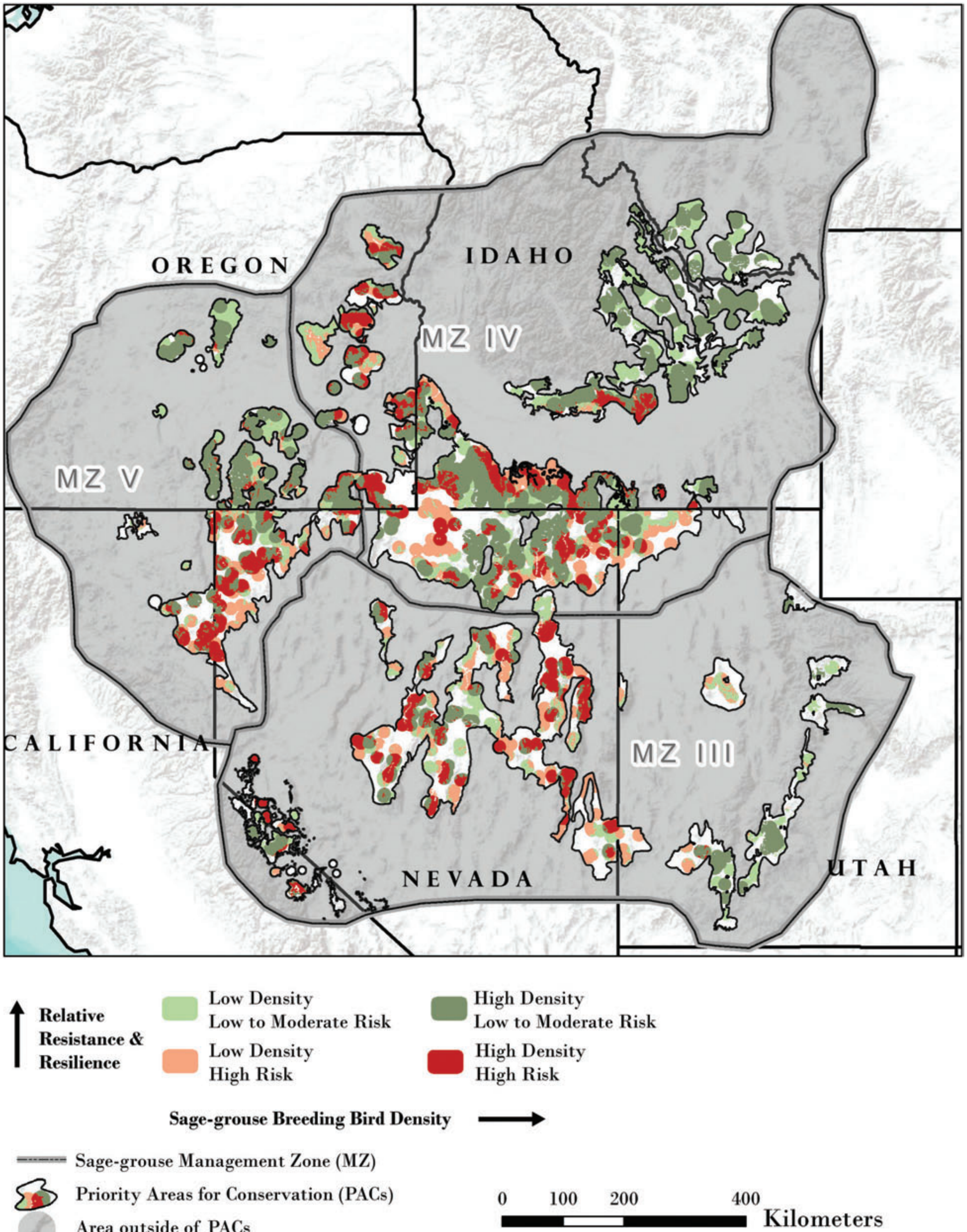

Figure 26. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to resilience and resistance within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Relative resilience and resistance groups are derived from soil moisture and temperature classes (Soil Survey Staff 2014a, b) as described in text, and indicate risk of invasive annual grasses and wildfire. Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

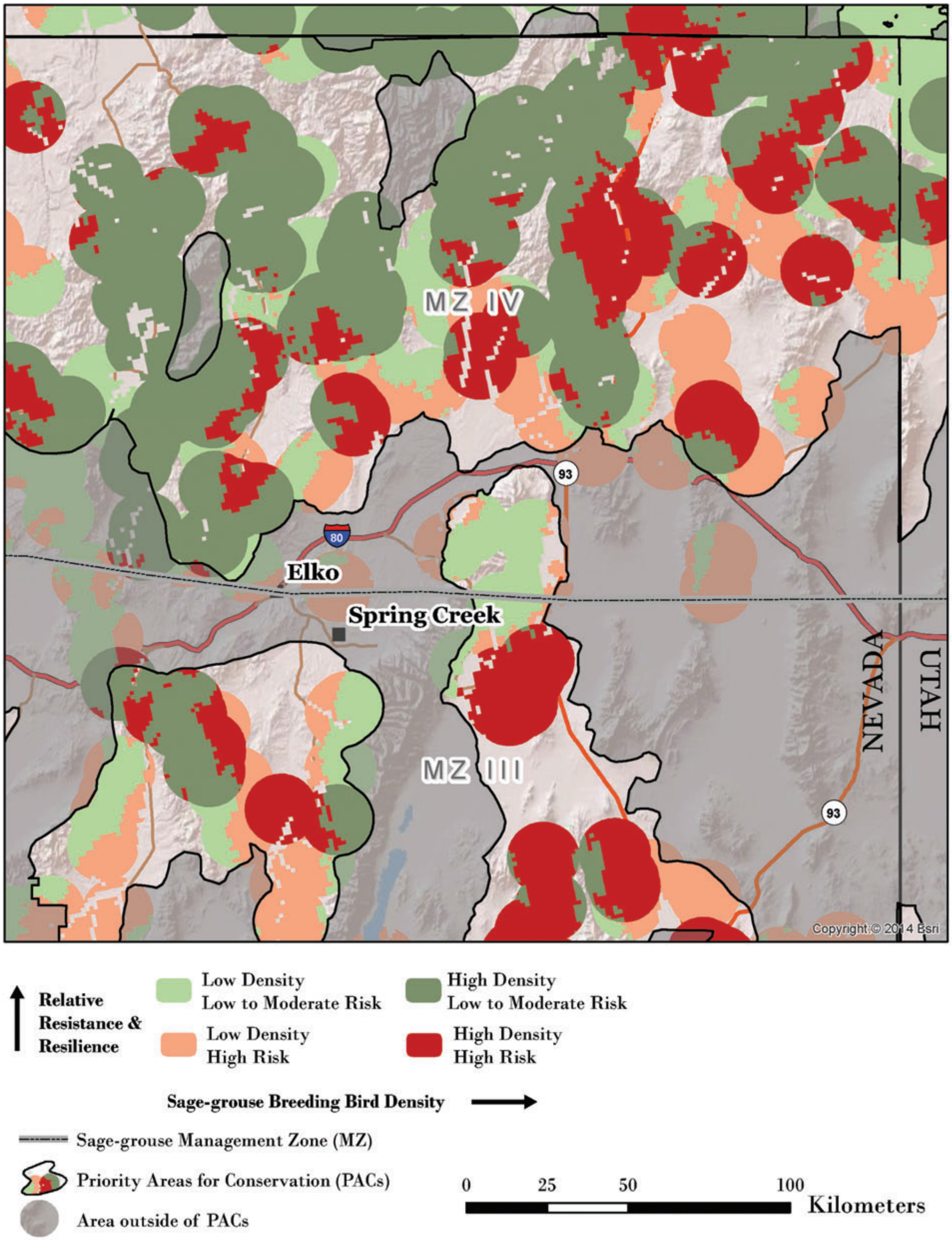

Figure 27. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to resilience and resistance in the northeast corner of Nevada. Relative resilience and resistance groups are derived from soil moisture and temperature classes (Soil Survey Staff 2014a, b) as described in text, and indicate risk of invasive annual grasses and wildfire. Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

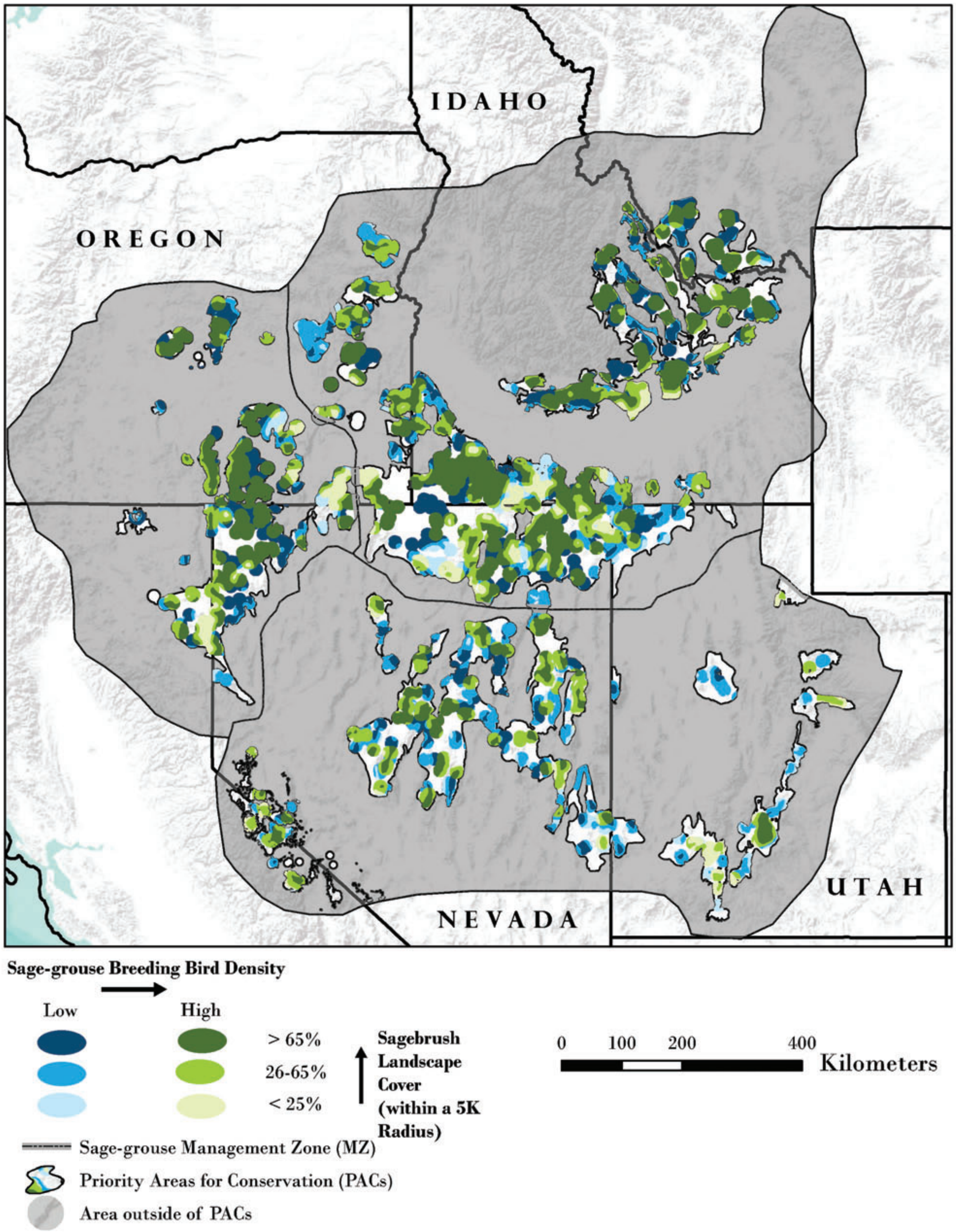

Figure 28. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to sagebrush cover. Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

Resilience and resistance and sagebrush cover combined with bird population density data provide land managers a way to evaluate trade-offs of particular management options at the landscape scale. For example, high density, low resilience and resistance landscapes with >65% sagebrush landscape cover may require immediate attention for conservation efforts because they currently support a high concentration of birds but have the lowest potential to recover to desired conditions post-fire and to resist invasive plants when disturbed. Similarly, high density but moderate-to-high resilience and resistance landscapes with 26-65% sagebrush cover may be priorities for preventative actions like conifer removal designed to increase the proportion of sagebrush cover and maintain ecosystem resilience and resistance. Mapping relative resilience and resistance and landscape cover of sagebrush for sage-grouse breeding areas should be viewed as a component of the assessment process that can help local managers allocate resources to accelerate planning and implementation.

Interpretations at the Management Zone (MZ) Scale: Western Portion of the Range

An examination of land cover and additional data layers for the western portion of the range reveals large differences among Management Zones (MZs) III, IV and V. MZs IV and V have larger areas with sagebrush cover >65% than MZ III (fig. 16). This may be partly explained by basin and range topography in MZ III, which is characterized by large differences in both environmental conditions and ecological types over relatively short distances. However, the cover of piñon and juniper in and adjacent to PACs in MZ III also is higher than in either MZ IV or V (fig. 22). The greater cover of piñon and juniper in MZ III appears to largely explain the smaller patches of sagebrush cover in the 26-65% and >65% categories.

Our capacity to quantify understory vegetation cover using remotely sensed data is currently limiting, but a visual examination of estimates for invasive annual grass (fig. 20; Peterson 2006, 2007) suggests a higher index (greater cover) in areas with relatively low resistance (warm soil temperatures) in all MZs (see fig. 18). This is consistent with current understanding of resistance to cheatgrass (Chambers et al. 2014; Chambers et al. *in press*). It is noteworthy that the invasive annual grass index is low for most of the central basin and range (central Nevada). Several factors may be contributing to the low index for this area including climate, the stage of piñon and juniper expansion and linked decrease in fire frequency, the relative lack of human development, and the relative lack of management treatments in recent decades (Wisdom et al. 2005; Miller et al. 2011). Not surprisingly, areas with a high annual grass index are outside or on the periphery of current PACs. However, it is likely that invasive annual grasses are present on many warmer sites and that they may increase following fire or other disturbances. In areas with low resistance to invasive annual grasses, they often exist in the understory of sagebrush ecosystems and are not detected by remote sensing platforms such as Landsat.

The number of hectares burned has been highest in MZ IV, adjacent areas in MZ V, and in areas with relatively low resilience and resistance in the northern portion of MZ III that have a high invasive annual grass index (figs. 18, 20, 24). A total of over 1.1 million hectares (2.7 million acres) burned in 2000 and 2006, while over 1.7 million hectares (4.2 million acres) burned in 2007 and 2012 and almost three quarters of these acres were in MZ IV (table 5). In some cases, these fires appear to be linked to the annual invasive grass index, but in others it clearly is not. At this point, there appears to be little relationship between cover of piñon and juniper and wildfire. Mega-fires comprised of hundreds of thousands of acres have burned in recent years, especially in MZ IV. These fires have occurred primarily in areas with low to moderate resilience and resistance and during periods with extreme burning conditions.

Table 5. The number of hectares (acres) burned in Management Zones III, IV, and V each year from 2000 to 2013.

Year	Management Zone III		Management Zone IV		Management Zone V		Total	
2000	155,159	(383,405)	868,118	(2,145,165)	88,871	(219,606)	1,112,148	(2,748,176)
2001	164,436	(406,330)	272,870	(674,276)	141,454	(349,541)	578,760	(1,430,147)
2002	85,969	(212,433)	100,308	(247,867)	113,555	(280,601)	299,833	(740,902)
2003	21,869	(54,038)	127,028	(313,892)	27,597	(68,192)	176,493	(436,123)
2004	20,477	(50,600)	11,344	(28,032)	13,037	(32,216)	44,858	(110,847)
2005	45,130	(111,520)	374,894	(926,382)	22,039	(54,458)	442,063	(1,092,360)
2006	198,762	(491,150)	860,368	(2,126,014)	117,452	(290,230)	1,176,582	(2,907,394)
2007	371,154	(917,140)	1,240,303	(3,064,853)	134,520	(332,406)	1,745,977	(4,314,399)
2008	14,015	(34,632)	109,151	(269,717)	43,949	(108,599)	167,115	(412,949)
2009	43,399	(107,242)	12,250	(30,271)	47,918	(118,408)	103,568	(255,921)
2010	31,597	(78,078)	280,662	(693,531)	21,940	(54,216)	334,200	(825,825)
2011	83,411	(206,114)	283,675	(700,977)	22,909	(56,608)	389,995	(963,699)
2012	203,680	(503,303)	946,514	(2,338,885)	574,308	(1,419,144)	1,724,501	(4,261,331)
2013	45,976	(113,610)	368,434	(910,419)	15,852	(39,170)	430,262	(1,063,199)
Total	1,485,034	(3,669,595)	5,855,920	(14,470,281)	1,385,400	(3,423,396)	8,726,354	(21,563,271)

Coupling breeding bird densities with landscape cover of sagebrush indicates that populations with low densities tend to occur in areas where sagebrush cover is in the 26-65% category, and few populations occur in areas with <25% sagebrush cover (fig. 27) (Knick et al. 2013). Combining the breeding bird densities with resilience and resistance indicates significant variability in risks among high density populations within PACs (fig. 26). A large proportion of remaining high density centers within PACs occurs on moderate-to-high resilience and resistance habitats, while low density/low resilience and resistance areas tend to occur along the periphery of PACs or are disproportionately located in MZ III and southern parts of MZ V.

Examination of other data layers suggests that different wildfire and invasive species threats exist across the western portion of the range, and that management should target the primary threats to sage-grouse habitat within focal areas. In MZs IV and V invasive annual grasses—especially on the periphery of the PACs—and wildfire are key threats. However, recent wildfires are not necessarily linked to invasive annual grasses. This suggests that management strategies for these MZs emphasize fire operations, fuels management focused on decreasing fire spread, and integrated strategies to control annual grasses and increase post-fire rehabilitation and restoration success. Differences in piñon and/or juniper landscape cover exist among MZs with 5,131,900 ha (12,681,202 ac) in MZ III, 528,377ha (1,305,649 ac) in MZ IV, and 558,880 ha (1,381,024 ac) in MZ V. Portions of MZs IV and V are still largely in early stages of juniper expansion indicating a need to address this threat before woodland succession progresses. Because of generally low resilience and resistance in MZ III, greater emphasis is needed on habitat conservation, specifically minimizing or eliminating stressors. Also, greater emphasis on reducing cover of piñon and juniper is needed to reduce woody fuels and increase sagebrush ecosystem resilience to fire by increasing the recovery potential of native understory species.

Interpretations at Regional and Local Land Management Scales: Northeast Nevada Example

The same land covers and data layers used to assess focal areas for sage-grouse habitat within MZs in the western portion of the species range can be used to evaluate focal areas for management in regional planning areas and land management planning units. The emphasis at the scale of the land planning area or management planning unit is on maintaining or increasing large contiguous areas of sagebrush habitat with covers in the 26-65% and especially >65% category. Resilience to disturbance and resistance to invasive annual grasses as indicated by soil temperature and moisture regimes is used to determine the most appropriate activities within the different cover categories. The sage-grouse habitat matrix in table 2 describes the capacity of areas with differing resilience and resistance to recover following disturbance and resist annual invasive grasses and provides the management implications for each of the different cover categories. Table 4 provides potential management strategies for the different sagebrush cover and resilience and resistance categories (cells) in the sage-grouse habitat matrix by agency program areas (fire operations, fuels management, post-fire rehabilitation, habitat restoration). Note that the guidelines in table 4 are related to the sage-grouse habitat matrix, and do not preclude other factors from consideration when determining management priorities for program areas.

Here, we provide an example of how to apply the concepts and tools discussed in this report by examining an important region identified in the MZ scale assessment. The northeastern corner of Nevada was selected to illustrate the diversity of sage-grouse habitat within planning areas and the need for proactive collaboration both within agencies and across jurisdictional boundaries in devising appropriate management strategies (figs. 17, 19, 21, 23, 25). This part of Nevada has large areas of invasive annual grasses and areas with piñon and juniper expansion, and it has experienced multiple large fires in the last decade. It includes a BLM Field Office, Forest Service (FS) land, State land, multiple private owners, and borders two States (fig. 29), which results in both complex ownership and natural complexity.

In the northeast corner of Nevada, an area 5,403,877 ha (13,353,271 ac) in size, numerous large fires have burned in and around PACs (fig. 25). Since 2000, a total of 1,144,317 ha (2,827,669 ac) have burned with the largest fires occurring in 2000, 2006, and 2007. This suggests that the primary management emphasis be on retaining existing areas of sagebrush in the 26-65% and especially >65% categories and promoting recovery of former sagebrush areas that have burned. Fire suppression in and around large, contiguous areas of sagebrush and also in and around successful habitat restoration or post-fire rehabilitation treatments is a first order priority. Fuels management also is a high priority and is focused on strategic placement of fuel breaks to reduce loss of large sagebrush stands by wildfire without jeopardizing existing habitat quality. Also, in the eastern portion of the area, piñon and juniper land cover comprises 471,645 ha (1,165,459 ac) (fig. 23). In this area, management priorities include (1) targeted tree removal in early to mid-phase (Phase I and II), post-settlement piñon and juniper expansion areas to maintain shrub/herbaceous cover and reduce fuel loads, and (2) targeted tree removal in later phase (Phase III) post-settlement piñon and juniper areas to reduce risk of high severity fire. In areas with moderate to high resilience and resistance, post-fire rehabilitation focuses on accelerating sagebrush establishment and recovery of perennial native herbaceous species. These areas often are capable of unassisted recovery and seeding is likely needed only in areas where perennial native herbaceous species have been depleted (Miller et al. 2013). Seeding introduced species can retard recovery of native perennial grasses and forbs that are important to sage-grouse and should be avoided in these areas (Knutson et al. 2014). Seeding or transplanting of sagebrush may be needed to accelerate establishment in focal areas.

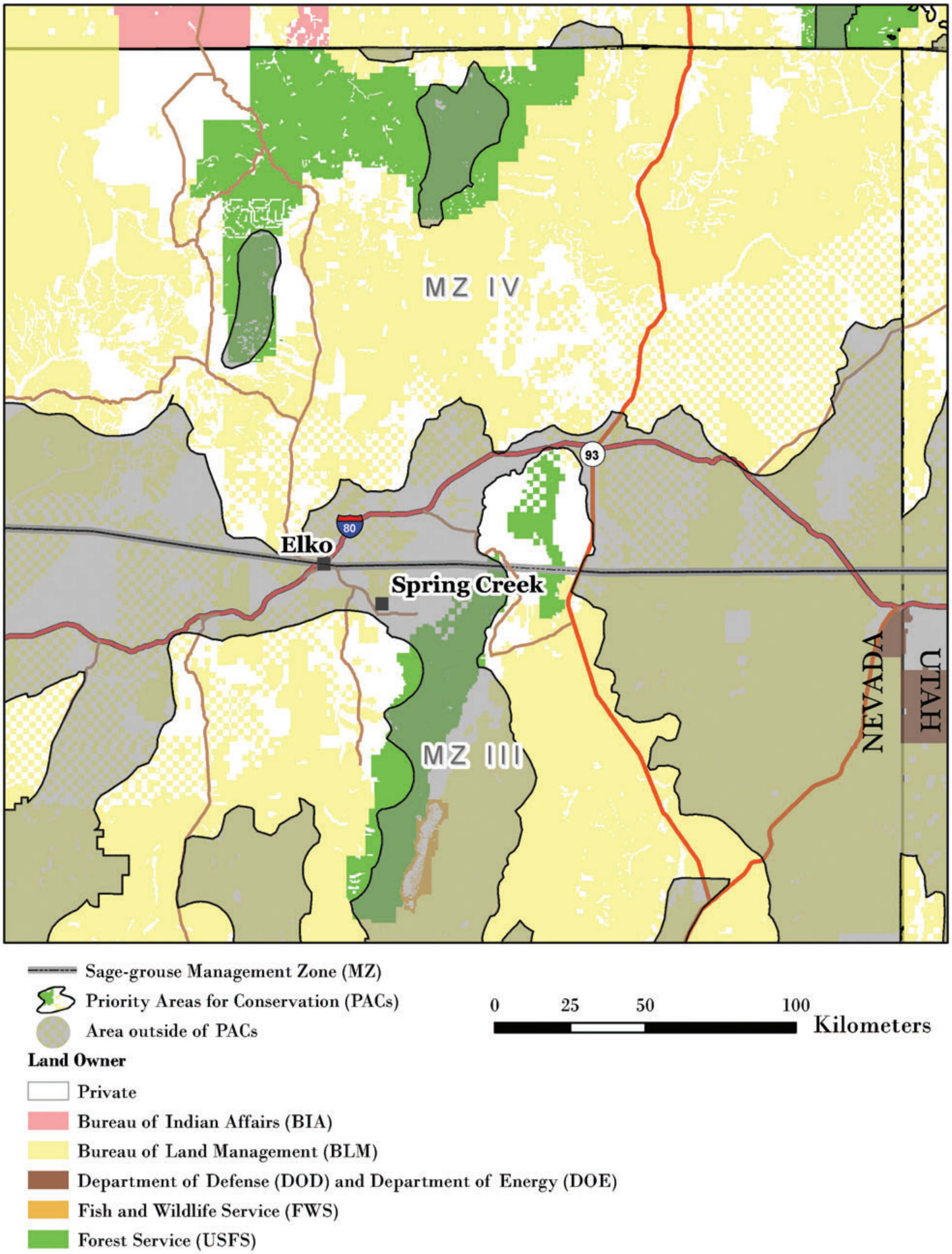

Figure 29. Land ownership for the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

In areas with lower resilience and resistance and high breeding bird densities, large, contiguous areas of sagebrush with intact understories are a high priority for conservation (figs. 17, 19, 27). In these areas, emphasis is on maintaining or increasing habitat conditions by minimizing stressors and disturbance. Post-fire rehabilitation and restoration activities focus on areas that increase connectivity among existing large areas of sagebrush. Because of low and variable precipitation, more than one intervention may be required to achieve restoration or rehabilitation goals. Appropriately managing livestock, wild horse and burro use (if applicable), and recreational use in focal areas is especially important to promote native perennial grass and forb growth and reproduction and to maintain or enhance resilience and resistance.

Determining the Most Appropriate Management Treatments at the Project Scale

Once focal areas and management priorities have been determined, potential treatment areas can be assessed to determine treatment feasibility and appropriate treatment methods. Different treatment options exist (figs. 30, 31) that differ in both suitability for a focal area and likely effectiveness. Field guides for sagebrush ecosystems and piñon and juniper expansion areas that incorporate resilience and resistance concepts are being developed to help guide managers through the process of determining both the suitability of an area for treatment and the most appropriate treatment. These guides are aligned with the different program areas and emphasize (1) fuel treatments (Miller et al. 2014a), (2) post-fire rehabilitation (Miller et al. 2014b), and (3) restoration (Pyke et al., in preparation). Additional information on implementing these types of management treatments is synthesized in Monsen et al. (2004) and Pyke (2011); additional information on treatment response is synthesized in Miller et al. (2013). In this section, we summarize the major steps in the process for determining the suitability of an area for treatment and the most appropriate treatment. We then provide an overview of two of the primary tools in the assessment process – ecological site descriptions (ESDs) and state and transition models (STMs). We conclude with a discussion of the importance of monitoring and adaptive management.

Steps in the process*:* Logical steps in the process of determining the suitability of an area for treatment and the most appropriate treatment(s) include (1) assessing the potential treatment area and identifying ecological sites, (2) determining the current successional state of the site, (3) selecting the appropriate action(s), and (4) monitoring and evaluation to determine post-treatment management. A general approach that uses questions to identify the information required in each step was developed (table 6). These questions can be modified to include the specific information needed for each program area and for treating different ecological sites. This format is used in the field guides described above.

Figure 30. Common vegetation treatments for sagebrush dominated ecosystems with relatively low resilience and resistance include seeding after wildfire in areas that lack sufficient native perennial grasses and forbs for recovery (top) (photo by Chad Boyd), and mowing sagebrush to reinvigorate native perennial grasses and forbs in the understory (bottom) (photo by Scott Schaff). Success of mowing treatments depends on having adequate perennial grasses and forbs on the site to resist invasive annual grasses and to promote recovery.

Figure 31. Vegetation treatments for sagebrush ecosystems exhibiting piñon and juniper expansion include cutting the trees with chainsaws and leaving them in place (top) (photo by Jeremy Roberts) and shredding them with a “bullhog” (middle) (photo by Bruce A. Roundy) on sites with relatively warm soils and moderately low resistance to cheatgrass. Prescribed fire (bottom) (photo by Jeanne C. Chambers) can be a viable treatment on sites with relatively cool and moist soils that have higher resilience to disturbance and resistance to invasive annual grasses. Treatment success depends on having adequate perennial grasses and forbs on the site to resist invasive annual grasses and promote recovery and will be highest on sites with relatively low densities of trees (Phase I to Phase II woodlands).

Table 6. General guidelines for conducting fuels management, fire rehabilitation, and restoration treatments (modified from Miller et al. 2007; Tausch et al. 2009; Pyke 2011; Chambers et al. 2013).

Steps in the process	Questions and considerations
I. Assess potential treatment area and identify ecological sites	1. Where are priority areas for fuels management, fire rehabilitation or restoration within the focal area? Consider sage-grouse habitat needs and resilience and resistance. 2. What are the topographic characteristics and soils of the area? Verify soils mapped to the location and determine soil temperature/moisture regimes. Collect information on soil texture, depth and basic chemistry for restoration projects. 3. How will topographic characteristics and soils affect vegetation recovery, plant establishment and erosion? Evaluate erosion risk based on topography and soil characteristics. 4. What are the potential native plant communities for the area? Match soil components to their correlated ESDs. This provides a list of potential species for the site(s).
II. Determine current state of the site	5. Is the area still within the reference state for the ecological site(s)?
III. Select appropriate action	6. How far do sites deviate from the reference state? How will treatment success be measured? 7. Do sufficient perennial shrubs and perennial grasses and forbs exist to facilitate recovery? 8. Are invasive species a minor component? 9. Do invasive species dominate the sites while native life forms are missing or severely under represented? If so, active restoration is required to restore habitat. 10. Are species from drier or warmer ecological sites present? Restoration with species from the drier or warmer sites should be considered. 11. Have soils or other aspects of the physical environment been altered? Sites may have crossed a threshold and represent a new ecological site type requiring new site-specific treatment/restoration approaches.
IV. Determine post-treatment management	12. How long should the sites be protected before land uses begin? In general, sites with lower resilience and resistance should be protected for longer periods. 13. How will monitoring be performed? Treatment effectiveness monitoring includes a complete set of measurements, analyses, and a report. 14. Are adjustments to the approach needed? Adaptive management is applied to future projects based on consistent findings from multiple locations.

Ecological site descriptions: ESDs and their associated STMs provide essential information for determining treatment feasibility and type of treatment. ESDs are part of a land classification system that describes the potential of a set of climate, topographic, and soil characteristics and natural disturbances to support a dynamic set of plant communities (Bestelmeyer et al. 2009; Stringham et al. 2003). NRCS soil survey data (http://soils.usda.gov/survey/), including soil temperature/moisture regimes and other soil characteristics, are integral to ESD development. ESDs have been developed by the NRCS and their partners to assist land management agencies and private land owners with making resource decisions, and are widely available for the Sage-grouse MZs except where soil surveys have not been completed (for a detailed description of ESDs and access to available ESDs see: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/ecoscience/desc/). ESDs assist managers to step-down generalized vegetation dynamics, including the concepts of resilience and resistance, to local scales. For example, variability in soil characteristics and the local environment (e.g., average annual precipitation as indicated by soil moisture regime) can strongly influence both plant community resilience to fire as well as the resistance of a plant community to invasive annual grasses after fire (table 1). Within a particular ESD, there is a similar level of resilience to disturbance and resistance to invasive annuals and this information can be used to determine the most appropriate management actions.

State and transition models: STMs are a central component of ecological site descriptions that are widely used by managers to illustrate changes in plant communities and associated soil properties, causes of change, and effects of management interventions (Stringham et al. 2003; Briske et al. 2005; USDA NRCS 2007) including in sagebrush ecosystems (Forbis et al. 2006; Barbour et al. 2007; Boyd and Svejcar 2009; Holmes and Miller 2010; Chambers et al. *in press*). These models use ***state*** (a relatively stable set of plant communities that are resilient to disturbance) and ***transition*** (the drivers of change among alternative states) to describe the range in composition and function of plant communities within ESDs (Stringham and others 2003; see Appendix 1 for definitions). The reference state is based on the natural range of conditions associated with natural disturbance regimes and often includes several plant communities (***phases***) that differ in dominant plant species relative to type and time since disturbance (Caudle et al. 2013). Alternative states describe new sets of communities that result from factors such as inappropriate livestock use, invasion by annual grasses, or changes in fire regimes. Changes or transitions among states often are characterized by ***thresholds*** that may persist over time without active intervention, potentially causing irreversible changes in community composition, structure, and function. ***Restoration pathways*** are used to identify the environmental conditions and management actions required for return to a previous state. Detailed STMs that follow current interagency guidelines (Caudle et al. 2013), are aligned with the ecological types (table 1), and are generally applicable to MZs III (Southern Great Basin), IV (Snake River Plains), V (Northern Great Basin), and VI (Columbia Basin) are provided in Appendix 5.

A generalized STM to illustrate the use of STMs is shown in figure 32 for the warm and dry Wyoming big sagebrush ecological type. This ecological type occurs at relatively low elevations in the western part of the range and has low to moderate resilience to disturbance and management treatments and low resistance to invasion (table 1). This type is abundant in the western portion of the range, but as the STM suggests, it is highly susceptible to conversion to invasive annual grass and repeated fire and is difficult to restore. Intact sagebrush areas remaining in the reference state within this ecological type are a high priority for conservation. Invaded states or locations with intact sagebrush that lack adequate native perennial understory are a high priority for restoration where they bridge large, contiguous areas of sagebrush. However, practical methods to accomplish this are largely experimental and/or costly and further development, including adaptive science and management, is needed.

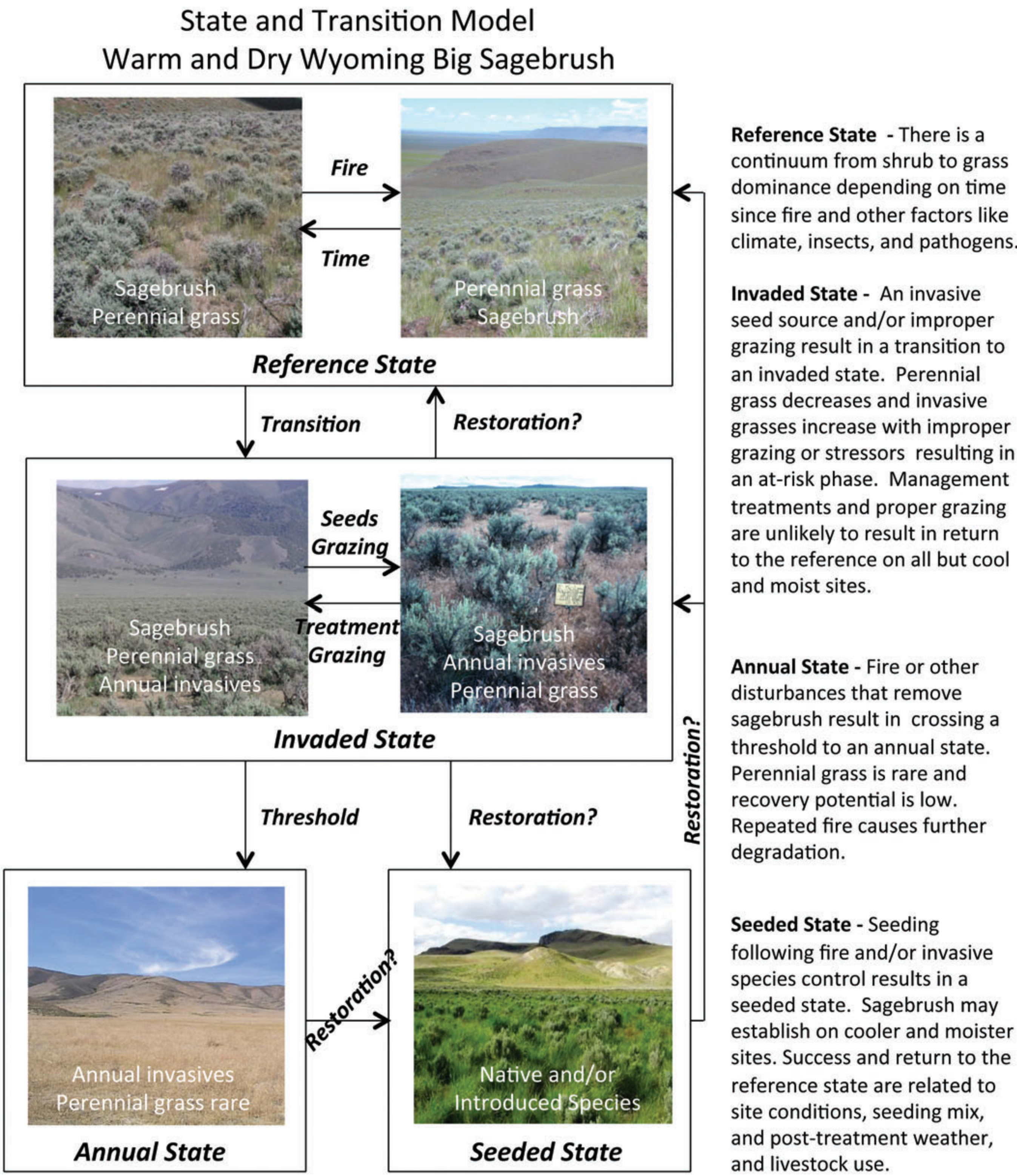

Figure 32. A state and transition model that illustrates vegetation dynamics and restoration pathways for the warm and dry, Wyoming big sagebrush ecological type. This ecological type occurs at relatively low elevations in the western part of the range and has low to moderate resilience to disturbance and management treatments and low resistance to invasion.

Monitoring and adaptive management: Monitoring programs designed to track ecosystem changes in response to both stressors and management actions can be used to increase understanding of ecosystem resilience and resistance, realign management approaches and treatments, and implement adaptive management (Reever-Morghan et al. 2006; Herrick et al. 2012). Information is increasing on likely changes in sagebrush ecosystems with additional stress and climate warming, but a large degree of uncertainty still exits. Currently, the NRCS National Resource Inventory is being used on private lands and is being implemented on public lands managed by BLM to monitor trends in vegetation attributes and land health at the landscape scale under the AIM (Assessment Inventory and Monitoring) strategy. Strategic placement of monitoring sites and repeated measurements of ecosystem status and trends (e.g., land cover type, ground cover, vegetation cover and height of native and invasive species, phase of tree expansion, soil and site stability, oddities) can be used to decrease uncertainty and increase effectiveness of management decisions. Ideally, monitoring sites span environmental/productivity gradients and sagebrush ecological types that characterize sage-grouse habitat. Of particular importance are (1) ecotones between ecological types where changes in response to climate are expected to be largest (Loehle 2000; Stohlgren et al. 2000), (2) ecological types with climatic conditions and soils that are exhibiting invasion and repeated fires, and (3) ecological types with climatic conditions and soils that are exhibiting tree expansion and increased fire risk. Monitoring the response of sagebrush ecosystems to management treatments, including both pre- and post-treatment data, is a first order priority because it provides information on treatment effectiveness that can be used to adjust methodologies.

Monitoring activities are most beneficial when consistent approaches are used among and within agencies to collect, analyze, and report monitoring data. Currently, effectiveness monitoring databases that are used by multiple agencies do not exist. However, several databases have been developed for tracking fire-related and invasive-species management activities. The National Fire Plan Operations and Reporting System (NFPORS) is an interdepartmental and interagency database that accounts for hazardous fuel reduction, burned area rehabilitation and community assistance activities. To our knowledge, NFPORS is not capable of storing and retrieving the type of effectiveness monitoring information that is needed for adaptive management. The FEAT FIREMON Integrated (FFI; https://www.frames.gov/partner-sites/ffi/ffi-home/) is a monitoring software tool designed to assist managers with collection, storage and analysis of ecological information. It was constructed through a complementary integration of the Fire Ecology Assessment Tool (FEAT) and FIREMON. This tool allows the user to select among multiple techniques for effectiveness monitoring. If effectiveness monitoring techniques were agreed on by the agencies, FFI does provide databases with standard structures that could be used in inter-agency effectiveness monitoring. Also, the National Invasive Species Information Management System (NISIMS) is designed to reduce redundant data entry regarding invasive species inventory, management and effectiveness monitoring with the goal of providing information that can be used to determine effective treatments for invasive species. However, NISIMS is currently available only within the BLM.

Common databases can be used by agency partners to record and share monitoring data. The Land Treatment Digital Library (LTDL [USGS 2010]) provides a method of archiving and collecting common information for land treatments and might be used as a framework for data storage and retrieval. Provided databases are relational (maintain a common field for connecting them), creating single corporate databases is not necessary. However, barriers that hinder database access within and among agencies and governmental departments may need to be lowered while still maintaining adequate data security. The LTDL has demonstrated how this can work by accessing a variety of databases to populate useful information relating to land treatments.

For effectiveness of treatments to be easily useable for adaptive management, the agencies involved will need to agree on monitoring methods and a common data storage and retrieval system. Once data can be retrieved, similar treatment projects can be evaluated to determine how well they achieve objectives for sage-grouse habitat, such as the criteria outlined in documents like the Habitat Assessment Framework (Stiver et al. 2006). Results of monitoring activities on treatment effectiveness are most useful when shared across jurisdictional boundaries, and several mechanisms are currently in place to improve information sharing (e.g., the Great Basin Fire Science Delivery Project; www.gbfiresci.org).

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Appendix 1. Definitions of Terms Used in This Document

At-Risk Community Phase — A community phase that can be designated within the reference state and also in alternative states. This community phase is the most vulnerable to transition to an alternative state (Caudle et al. 2013).

Community Phase — A unique assemblage of plants and associated soil properties that can occur within a state (Caudle et al. 2013).

Ecological Site (ES) — An Ecological Site (ES) is a conceptual division of the landscape that is defined as a distinctive kind of land based on recurring soil, landform, geological, and climate characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond similarly to management actions and natural disturbances (Caudle et al. 2013).

Ecological Site Descriptions (ESD) — The documentation of the characteristics of an ecological site. The documentation includes the data used to define the distinctive properties and characteristics of the ecological site; the biotic and abiotic characteristics that differentiate the site (i.e., climate, topography, soil characteristics, plant communities); and the ecological dynamics of the site that describes how changes in disturbance processes and management can affect the site. An ESD also provides interpretations about the land uses and ecosystem services that a particular ecological site can support and management alternatives for achieving land management (Caudle et al. 2013).

Ecological Type — A category of land with a distinctive (i.e., mappable) combination of landscape elements. The elements making up an ecological type are climate, geology, geomorphology, soils, and potential natural vegetation. Ecological types differ from each other in their ability to produce vegetation and respond to management and natural disturbances (Caudle et al. 2013).

Historical Range of Variability — Range of variability in disturbances, stressors, and ecosystem attributes that allows for maintenance of ecosystem resilience and resistance and that can be used to provide management targets (modified from Jackson 2006).

Resilience — Ability of a species and/or its habitat to recover from stresses and disturbances. Resilient ecosystems regain their fundamental structure, processes, and functioning when altered by stresses like increased CO_2 , nitrogen deposition, and drought and to disturbances like land development and fire (Allen et al. 2005; Holling 1973).

Resistance — Capacity of an ecosystem to retain its fundamental structure, processes and functioning (or remain largely unchanged) despite stresses, disturbances, or invasive species (Folke et al. 2004).

Resistance to Invasion — Abiotic and biotic attributes and ecological processes of an ecosystem that limit the population growth of an invading species (D'Antonio and Thomsen 2004).

Restoration Pathways — Restoration pathways describe the environmental conditions and practices that are required for a state to recover that has undergone a transition (Caudle et al. 2013).

State — A state is a suite of community phases and their inherent soil properties that interact with the abiotic and biotic environment to produce persistent functional and structural attributes associated with a characteristic range of variability (adapted from Briske et al. 2008).

State-and-Transition Model — A method to organize and communicate complex information about the relationships between vegetation, soil, animals, hydrology, disturbances (fire, lack of fire, grazing and browsing, drought, unusually wet periods, insects and disease), and management actions on an ecological site (Caudle et al. 2013).

Thresholds — Conditions sufficient to modify ecosystem structure and function beyond the limits of ecological resilience, resulting in the formation of alternative states (Briske et al. 2008).

Transition — Transitions describe the biotic or abiotic variables or events, acting independently or in combination, that contributes directly to loss of state resilience and result in shifts between states. Transitions are often triggered by disturbances, including natural events (climatic events or fire) and/or management actions (grazing, burning, fire suppression). They can occur quickly as in the case of catastrophic events like fire or flood, or over a long period of time as in the case of a gradual shift in climate patterns or repeated stresses like frequent fires (Caudle et al. 2013).

Appendix 2. An Explanation of the Use of Landscape Measures to Describe Sagebrush Habitat

Understanding landscape concepts of plant cover relative to typical management unit concepts of plant cover is important for prioritizing lands for management of sage-grouse. Ground cover measurements of sagebrush made at a management unit (for example, line-intercept measurements) should not be confused for landscape cover and may not relate well to landscape cover since the areas of examination differ vastly (square meters for management units and square kilometers for landscapes).

A landscape is defined rather arbitrarily as a large area in total spatial extent, somewhere in size between sites (acres or square miles) and regions (100,000s of square miles). The basic unit of a landscape is a patch, which is defined as a bounded area characterized by a similar set of conditions. A habitat patch, for example, may be the polygonal area on a map representing a single land cover type. Landscapes are composed of a mosaic of patches. The arrangement of these patches (the landscape configuration or pattern) has a large influence on the way a landscape functions and for landscape species, such as sage-grouse, sagebrush habitat patches are extremely important for predicting if this bird will be present within the area (Connelly et al. 2011).

Remotely sensed data of land cover is typically used to represent landscapes. These data may combine several sources of data and may include ancillary data, such as elevation, to improve the interpretation of data. These data are organized into pixels that contain a size or grain of land area. For example, LandSat Thematic Mapper spectral data used in determining vegetation cover generally have pixels that represent ground areas of 900 m^2 (30- x 30-m). Each pixel's spectral signature can be interpreted to determine what type of vegetation dominates that pixel. Groups of adjacent pixels with the same dominant vegetation are clustered together into polygons that form patches.

Landscape cover of sagebrush is determined initially by using this vegetation cover map, but a 'rolling window' of a predetermined size (e.g., 5 km^2 or 5,556 pixels that are 30- by 30-m in size) is moved across the region one pixel at a time. The central pixel of the 'window' is reassigned a value for the proportion of pixels where sagebrush is the dominant vegetation. The process is repeated until pixels within the region are completely reassigned to represent the landscape cover of sagebrush within for the region drawn from a 5 km^2 window.

Appendix 3. An Explanation of Soil Temperature and Moisture Regimes Used to Describe Sagebrush Ecosystems

Soil climate regimes (temperature and moisture) are used in Soil Taxonomy to classify soils; they are important to consider in land management decisions, in part, because of the significant influence on the amounts and kinds of vegetation that soils support. Soil temperature and moisture regimes are assigned to soil map unit components as part of the National Cooperative Soil Survey program. Soil survey spatial and tabular data for the Sage-grouse Management Zones (Stiver et al. 2006) were obtained for each State within the zones at the Geospatial Data Gateway (http://datagateway.nrcs.usda.gov/). Gridded Soil Survey Geographic (gSSURGO) file geodatabases were used to display a 10-meter raster dataset. Multiple soil components made up a soil map unit, and soil moisture and temperature regimes were linked to individual soil map components. Soil components with the same soil moisture and temperature class regime were aggregated, and the dominant soil moisture and temperature regime within each soil map unit was used to characterize the temperature and moisture regime. Only temperature and moisture regimes applicable to sagebrush ecosystems were displayed.

Abbreviated definitions of each soil temperature and moisture regime class are listed below. Complete descriptions can be found in *Keys to Soil Taxonsomy, 11th edition*, available at ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/keys/2010_Keys_to_Soil_Taxonomy.pdf.

Soil temperature regimes	
Cryic (Cold)	Soils that have a mean annual soil temperature of <8 °C, and do not have permafrost, at a depth of 50 cm below the surface or at a restrictive feature, whichever is shallower.
Frigid (Cool)	Soils that have a mean annual soil temperature of <8 °C and the difference between mean summer and mean winter soil temperatures is >6 °C at a depth of 50 cm below the surface or at a restrictive feature, whichever is shallower.
Mesic (Warm)	Soils that have a mean annual soil temperature of 8-15 °C and the difference between mean summer and mean winter soil temperatures is >6 °C at a depth of 50 cm below the surface or at a restrictive feature, whichever is shallower.
Soil moisture regimes	
Ustic (summer precipitation)	Generally there is some plant-available moisture during the growing season, although significant periods of drought may occur. Summer precipitation allows presence of warm season plant species.
Xeric (Moist; generally mapped at >12 inches mean annual precipitation)	Characteristic of arid regions. The soil is dry for at least half the growing season and moist for less than 90 consecutive days.
Aridic (Dry; generally mapped at <12 inches mean annual precipitation)	Characteristic of arid regions. The soil is dry for at least half the growing season and moist for less than 90 consecutive days.

Note: Soil moisture regimes are further divided into moisture subclasses, which are often used to indicate soils that are transitional to another moisture regime. For example, a soil with an Aridic moisture regime and a Xeric moisture subclass may be described as "Aridic bordering on Xeric." Understanding these gradients becomes increasingly important when making interpretations and decisions at the site scale where aspect, slope, and soils affect the actual moisture regime on that site. More information on taxonomic moisture subclasses is available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053576.

Appendix 4. Data Sources for the Maps in This Report

Dataset	Citation	Link
Geomac fire perimeters	Walters, S.P.; Schneider, N.J.; Guthrie, J.D. 2011. Geospatial Multi-Agency Coordination (GeoMAC) wildland fire perimeters, 2008. Data Series 612. Washington, DC: U.S. Department of the Interior, U.S. Geological Survey.6 p.	http://pubs.er.usgs.gov/publication/ds612
WFDSS fire perimeters	Butler, B. B.; Bailey, A. 2013. Disturbance history (Historical wildland fires). Updated 8/9/2013. Wildland Fire Decision Support System. Online: https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml [Accessed 5 March 2014].	https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml or https://wfdss.usgs.gov/wfdss/WFDSSData_Downloads.shtml
Piñon and juniper land cover	U.S. Geological Survery (USGS) National Gap Analysis Program. 2004. Provisional digital land cover map for the southwestern United States. Version 1.0. Logan, UT: Utah State University, College of Natural Resources, RS/GIS Laboratory.	http://earth.gis.usu.edu/swgap/landcover.html
Piñon and juniper land cover	U.S. Geological Survey (USGS). 2013: LANDFIRE 1.2.0 Existing Vegetation Type layer. Updated 3/13/2013. Washington, DC: U.S. Department of the Interior, Geological Survey. Online: http://landfire.cr.usgs.gov/viewer/. [Accessed 13 March 2014].	http://www.landfire.gov/NationalProductDescriptions21.php
Nevada invasive annual grass index	Peterson, E. B. 2006. A map of invasive annual grasses in Nevada derived from multitemporal Landsat 5 TM imagery. Carson City, NV: State of Nevada, Department of Conservation and Natural Resources, Nevada Natural Heritage Program.	http://heritage.nv.gov/node/167
Owhyee upland annual grass index	Peterson, E. B. 2007. A map of annual grasses in the Owyhee Uplands, Spring 2006, derived from multitemporal Landsat 5 TM imagery. Carson City, NV: State of Nevada, Department of Conservation and Natural Resources, Nevada Natural Heritage Program.	http://heritage.nv.gov/sites/default/files/library/anngrowy_text_print.pdf
Soil data (SSURGO)	Soil Survey Staff. 2014a. Soil Survey Geographic (SSURGO) Database. United States Department of Agriculture, Natural Resources Conservation Service. Online: http://sdmdataaccess.nrcs.usda.gov/. [Accessed 3 March 2014a].	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_053627
Soil data (STATSGO)	Soil Survey Staff. 2014b. U.S. General Soil Map (STATSGO2) Database. United States Department of Agriculture, Natural Resources Conservation Service. Online: http://sdmdataaccess.nrcs.usda.gov/. [Accessed 3 March 2014b].	

Soil temperature and moisture regime data	Campbell, S. B. 2014. Soil temperature and moisture regime data for the range of greater sage-grouse. Data product. Portland, OR: USDA Natural Resources Conservation Service. Online: https://www.sciencebase.gov/catalog/folder/537f8be5e4b021317a872f1b?community=LC+MAP+-+Landscape+Conservation+Management+and+Analysis+Portal [Accessed 17 June 2014].	https://www.sciencebase.gov/catalog/folder/537f8be5e4b021317a872f1b?community=LC+MAP+-+Landscape+Conservation+Management+and+Analysis+Portal
Sage-grouse management zones	Stiver, S. J.; Apa, A. D.; Bohne, J. R.; Bunnell, S. D.; Deibert, P. A.; Gardner, S. C.; Hilliard, M. A.; McCarthy, C. W.; Schroeder, M. A. 2006. Greater Sage-grouse Comprehensive Conservation Strategy. Unpublished report on file at: Western Association of Fish and Wildlife Agencies, Cheyenne, WY.	
Breeding bird densities	Doherty, K. E.; Tack, J. D.; Evans, J. S.; Naugle, D. E. 2010. Mapping breeding densities of greater sage-grouse: A tool for range-wide conservation planning. BLM completion report: Agreement # L10PG00911.	http://scholar.google.com/scholar?q=doherty+2010+breeding+bird&hl=en&as_sdt=0&as_vis=1&oi=scholart&sa=X&ei=JqQbU7HUAqfD2QW8xYFY&ved=0CCUQgQMwAA
Sagebrush land cover	U.S. Geological Survey (USGS). 2013: LANDFIRE 1.2.0 Existing Vegetation Type layer. Updated 3/13/2013. Washington, DC: U.S. Department of the Interior, Geological Survey. Online: http://landfire.cr.usgs.gov/viewer/. [Accessed 13 March 2014].	http://www.landfire.gov/NationalProductDescriptions21.php

Appendix 5. State-and-transition models (STMs) for five generalized ecological types for big sagebrush (from Chambers et al. *in press*; Miller et al. 2014 a, b)

These STMs represent groupings of ecological sites that are characterized by Wyoming or mountain big sagebrush, span a range of soil moisture/temperature regimes (warm/dry to cold/moist), and characterize a large portion of Management Zones III (Southern Great Basin), IV (Snake River Plains), V (Northern Great Basin), and VI (Columbia Basin). Large boxes illustrate states that are comprised of community phases (smaller boxes). Transitions among states are shown with arrows starting with T; restoration pathways are shown with arrows starting with R. The "at risk" community phase is most vulnerable to transition to an alternative state. Precipitation Zone is designated as PZ.

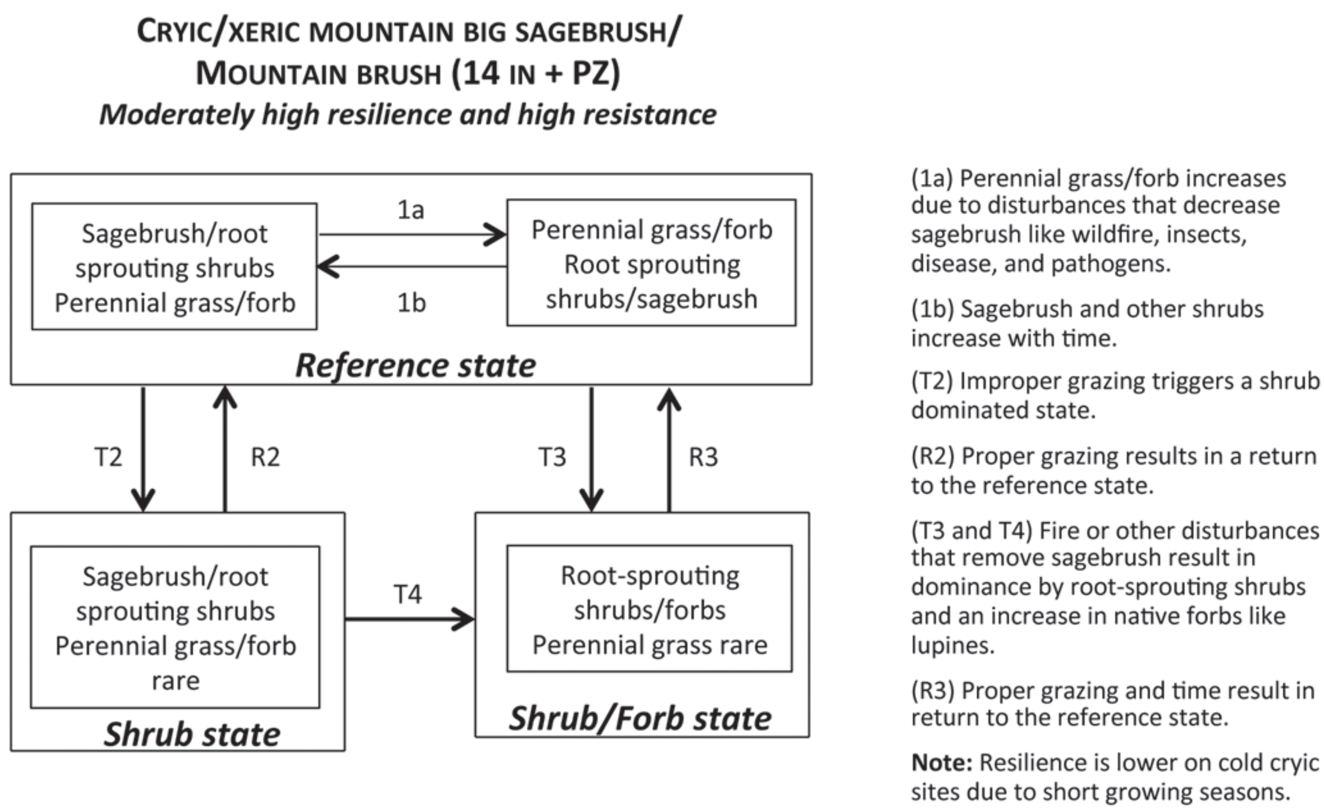
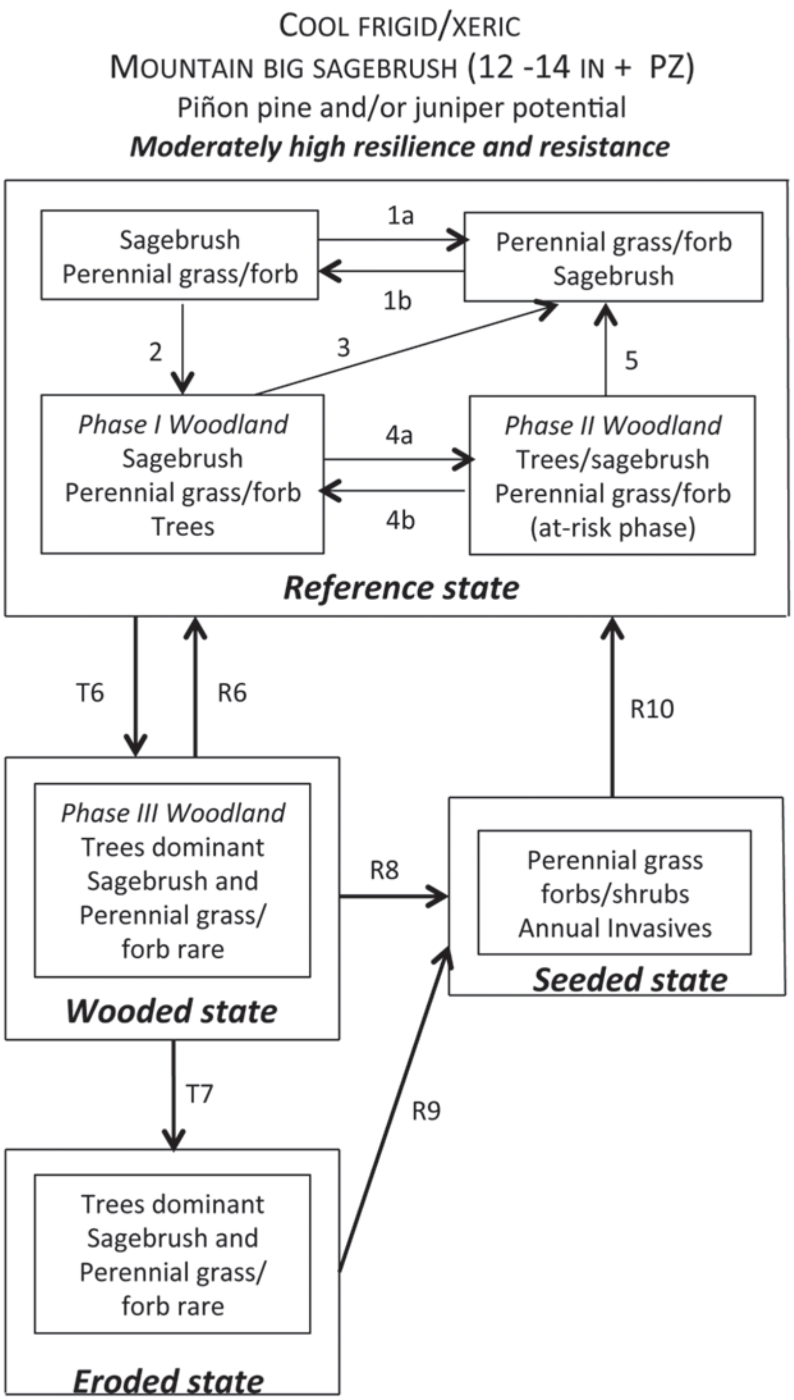


Figure A.5A. STM for a cryic/xeric mountain big sagebrush/mountain brush ecological type characterized by moderately high resilience and high resistance.



(1a) Disturbances such as wildfire, insects, disease, and pathogens result in less sagebrush and more perennial grass/forb.

(1b) Sagebrush increases with time .

(2) Time combined with seed sources for piñon and/or juniper trigger a Phase I Woodland.

(3 and 5) Fire and or fire surrogates (herbicides and/or mechanical treatments) that remove trees may restore perennial grass/forb and sagebrush dominance.

(4a) Increasing tree abundance results in a Phase II woodland with depleted perennial grass/forb and shrubs and an at-risk phase.

(4b) Fire surrogates (herbicides and/or mechanical treatments) that remove trees may restore perennial grass/forb and sagebrush dominance.

(T6) Infilling of trees and/or improper grazing can result in a biotic threshold crossing to a wooded state with increased risk of high severity crown fires .

(R6) Fire, herbicides and/or mechanical treatments that remove trees may restore perennial grass/forb and sagebrush dominance.

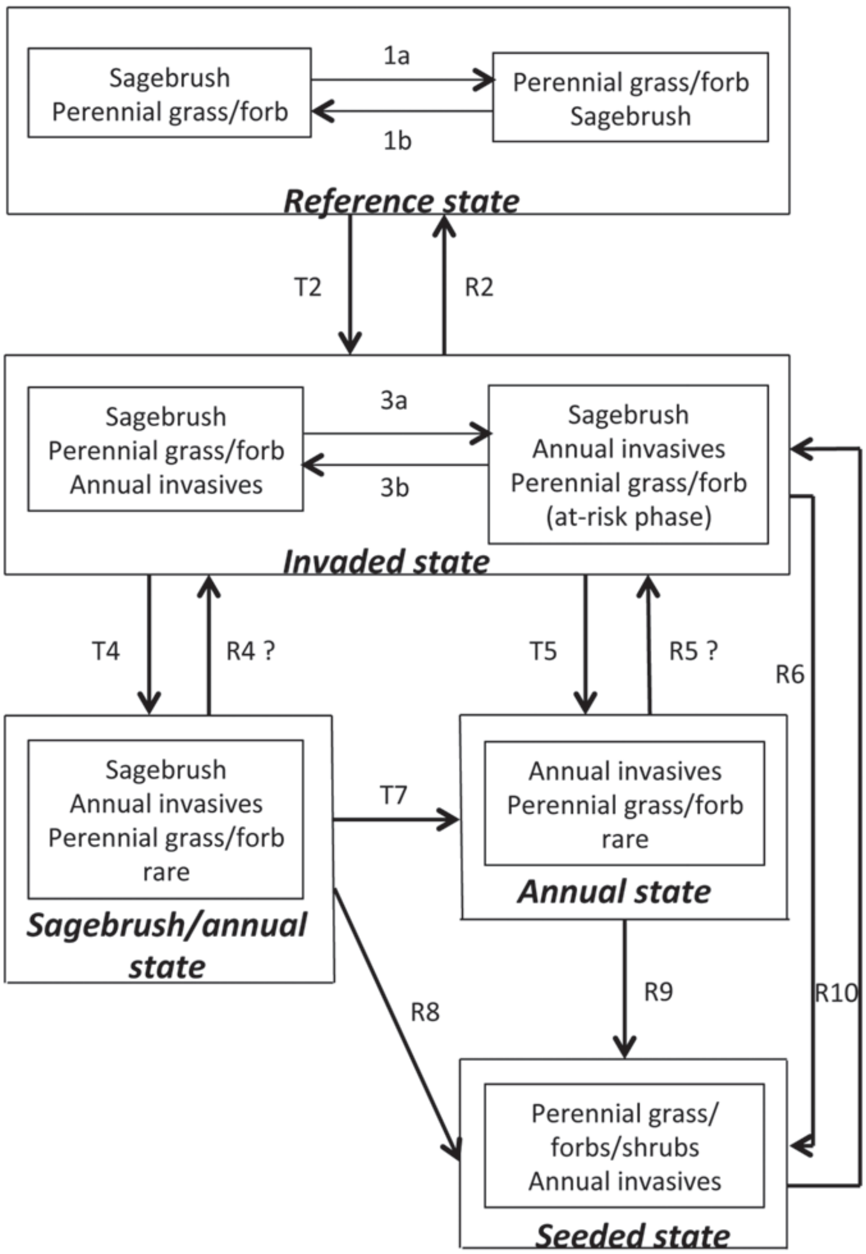
(T7) An irreversible abiotic threshold crossing to an eroded state can occur depending on soils, slope, and understory species.

(R8 and R9) Seeding after fire may be required on sites with depleted perennial grass/forb, but seeding with aggressive introduced species can decrease native perennial grass/forb. Annual invasives are typically rare. Seeded eroded states may have lower productivity.

(R10) Depending on seed mix and grazing, return to the reference state may be possible if an irreversible threshold has not been crossed.

Figure A.5B. STM for a cool frigid/xeric mountain big sagebrush ecological type that has piñon pine and/or juniper potential and is characterized by moderately high resilience and resistance.

Cool mesic to cool frigid/xeric Mountain big sagebrush (12-14 in PZ)
Moderate resilience and resistance



(1a) Perennial grass/forb increases due to disturbances that decrease sagebrush like wildfire, insects, disease, and pathogens.

(1b) Sagebrush increases with time .

(T2) An invasive seed source and/or improper grazing trigger an invaded state.

(R2) Proper grazing, fire, herbicides, and/or mechanical treatments may restore perennial grass/forb and sagebrush dominance with few invasives.

(3a) Perennial grass/forb decreases and sagebrush and invasives increase with improper grazing by livestock resulting in an at-risk phase. Decreases in sagebrush due to insects, disease or pathogens can further increase invasives.

(3b) Proper grazing, herbicides, or mechanical treatments that reduce sagebrush may increase perennial grass/forb and decrease invasives.

(T4) Improper grazing results in a sagebrush/annual state.

(R4) Proper grazing may facilitate return to the invaded state on cooler/wetter sites if sufficient grass/forb remains .

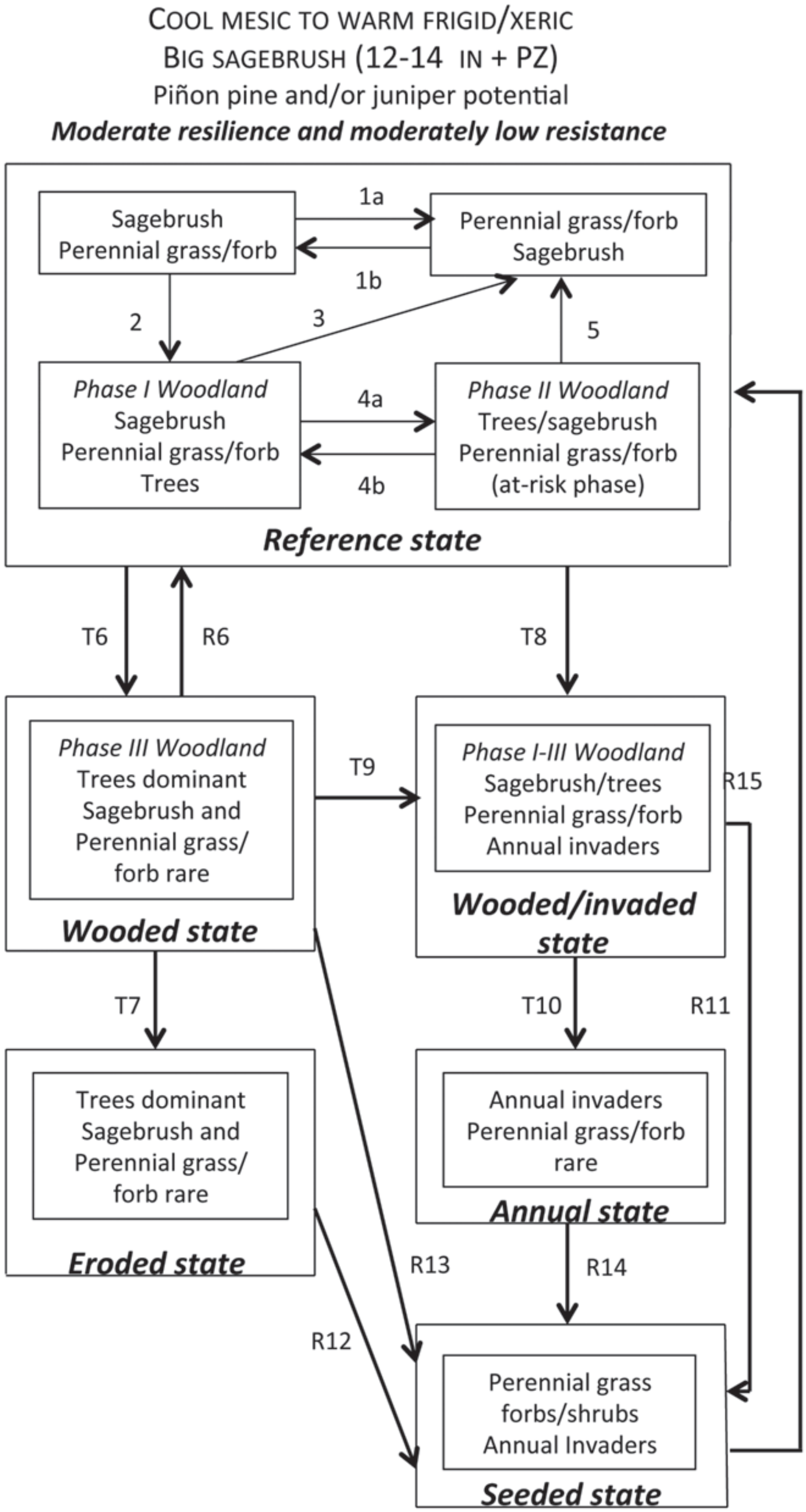
(T5 and T7) Fire or other disturbances that remove sagebrush result in an annual state. Perennial grass/forb are rare and recovery potential is reduced. Repeated fire can result in a biotic threshold crossing to annual dominance on warmer/drier sites, and root-sprouting shrubs may increase.

(R5) Cooler and wetter sites may return to the invaded or reference state with lack of fire, proper grazing, and favorable weather.

(R6, R8 and R9) Seeding following fire and/or invasive species control results in a seeded state. Sagebrush may recolonize depending on patch size, but annual invaders are still present.

(R10) Cooler and wetter sites may return to the invaded or possibly reference state depending on seeding mix, grazing and weather.

Figure A.5C. STM for a cool mesic to cool frigid/xeric mountain big sagebrush ecological type that is characterized by moderate resilience and resistance.



(1a) Disturbances such as wildfire, insects, disease, and pathogens result in less sagebrush and more perennial grass/forb.

(1b) Sagebrush increases with time .

(2) Time combined with seed sources for piñon and/or juniper trigger a Phase I Woodland.

(3 and 5) Fire and or fire surrogates (herbicides and/or mechanical treatments) that remove trees may restore perennial grass/forb and sagebrush dominance on cooler/wetter sites. On warmer/drier sites with low perennial grass/forb abundance resistance to invasion is moderately low.

(4a) Increasing tree abundance results in a Phase II woodland with depleted perennial grass/forb and shrubs and an at-risk phase.

(4b) Fire surrogates (herbicides and/or mechanical treatments) that remove trees may restore sagebrush and perennial grass/forb dominance .

(T6) Infilling of trees and improper grazing can result in a biotic threshold crossing to a wooded state with increased risk of high severity crown fires.

(R6) Fire, herbicides and/or mechanical treatments that remove trees may restore perennial grass/forb and sagebrush dominance on cooler/wetter sites.

(T7) An irreversible abiotic threshold crossing to an eroded state can occur depending on soils, slope, and understory species.

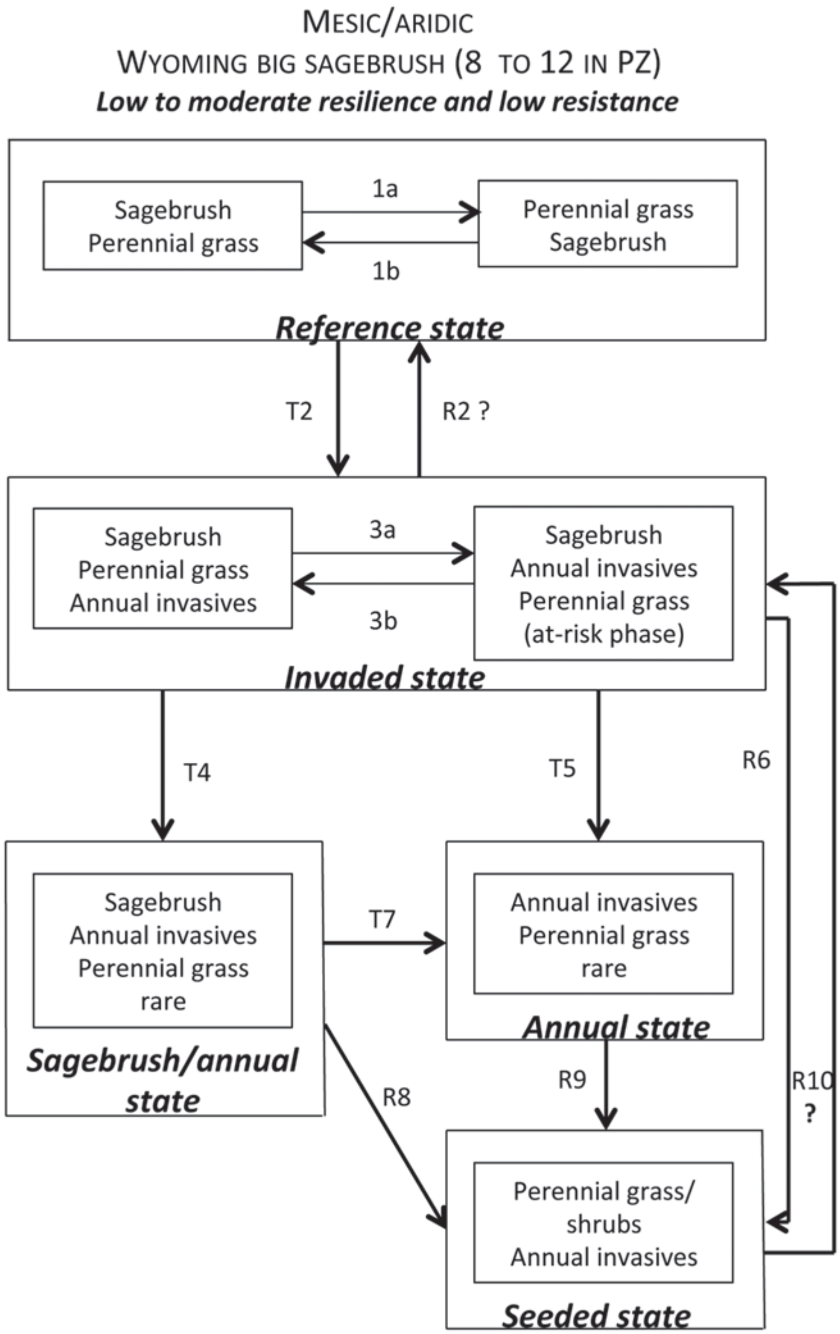
(T8 and T9) An invasive seed source and/or improper grazing can trigger a wooded/invaded state.

(T10) Fire or other disturbances that remove trees and sagebrush can result in a biotic threshold crossing to annual dominance on warmer/drier sites with low resilience.

(R11, R12, R13, and R14) Seeding after fire and/or invasive species control increases perennial grass/forb. Sagebrush may recolonize depending on seed sources, but annual invaders are still present. Seeded eroded states may have lower productivity.

(R15) Depending on seed mix , grazing, and level of erosion, return to the reference state may occur on cooler and wetter sites if an irreversible threshold has not been crossed.

Figure A.5D. STM for a cool mesic to warm frigid/xeric mountain big sagebrush ecological type type that has piñon pine and/or juniper potential and is characterized by moderate resilience and moderately low resistance.



(1a) Perennial grass increases due to disturbances that decrease sagebrush like wildfire, insects, disease, and pathogens.
(1b) Sagebrush increases with time .
(T2) An invasive seed source and/or improper grazing trigger an invaded state.
(R2) Proper grazing, fire, herbicides and/or mechanical treatments are unlikely to result in return to the reference state on all but the coolest and wettest sites.
(3a) Perennial grass decreases and both sagebrush and invasives increase with improper grazing resulting in an at-risk phase. Decreases in sagebrush due to insects, disease or pathogens can further increase invasives.
(3b) Proper grazing and herbicides or mechanical treatments that reduce sagebrush may restore perennial grass and decrease invaders on wetter sites (10-12”). Outcomes are less certain on drier sites (8-10”) and/or low abundance of perennial grass.
(T4) Improper grazing triggers a largely irreversible threshold to a sagebrush/annual state.
(T 5 and T7) Fire or other disturbances that remove sagebrush result in an annual state. Perennial grass is rare and recovery potential is low due to low precipitation, mesic soil temperatures, and competition from annual invasives. Repeated fire can cause further degradation.
(R6, R8 and R9) Seeding following fire and/or invasive species control results in a seeded state. Sagebrush may recolonize depending on patch size, but annual invasives are still present.
(R10) Seeding effectiveness and return to the invaded state are related to site conditions, seeding mix, and post-treatment weather.

Figure A.5E. STM for a mesic/aridic Wyoming big sagebrush ecological type with low to moderate resilience and low resistance.

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Appendix H – Attachment 2

Greater Sage-Grouse Wildfire, Invasive Annual Grasses & Conifer Expansion Assessment

June 2014

Suggested Citation:

Greater Sage-Grouse Wildfire, Invasive Annual Grasses & Conifer Expansion Assessment (Fire and Invasive Assessment Tool (FIAT)). June 2014. Prepared by Fire and Invasive Assessment Team (Appendix 5). 43 pages.

Introduction and Background

The purpose of this assessment is to identify priority habitat areas and management strategies to reduce the threats to Greater Sage-Grouse resulting from impacts of invasive annual grasses, wildfires, and conifer expansion. The Conservation Objectives Team (COT) report (USFWS 2013) and other scientific publications identify wildfire and conversion of sagebrush habitat to invasive annual grass dominated vegetative communities as two of the primary threats to the sustainability of Greater Sage-Grouse (*Centrocercus urophasianus*, hereafter sage-grouse) in the western portion of the species range. For the purposes of this assessment protocol, invasive species are limited to, and hereafter referred to, as **invasive annual grasses** (e.g., primarily cheatgrass [*Bromus tectorum*]). Conifer expansion (also called encroachment) is also addressed in this assessment.

The United States Fish and Wildlife Service (USFWS) will consider the amelioration of impacts, location and extent of treatments, degree of fire risk reduction, locations for suppression priorities, and other proactive measures to conserve sage-grouse in their 2015 listing decision. This determination will be made based in part upon information contained in the United States (US) Department of the Interior, Bureau of Land Management (BLM) resource management plan (RMP) amendments and Forest Service land resource management plan (LRMP) amendments, including this assessment.

This assessment is based in part on National Resources Conservation Service (NRCS) soil surveys that include geospatial information on soil temperature and moisture regimes associated with resistance and resiliency properties (see following section on *Soil Temperature and Moisture Regimes)*. While this assessment is applicable across the range of sage-grouse, the analysis is limited to Western Association of Fish and Wildlife Management Agencies' (WAFWA) Management Zones III, IV, and V (roughly the Great Basin region) because of the significant issues associated with invasive annual grasses and the high level of wildfires in this region. The utility of this assessment process is dependent on incorporating improved information and geospatial data as it becomes available. Although the resistance and resilience concepts have broad applications (e.g., infrastructure development), this assessment is limited to developing strategies to reduce threats to sage-grouse habitat (e.g., invasive annual grasses and wildfires).

Draft Greater Sage-Grouse Environmental Impact Statements (EISs) contain a suggested framework in the appendices ("Draft Greater Sage-Grouse Wildland Fire and Invasive Species Assessment") that provided a consistent approach to conduct these assessments. The current protocol was developed by the Fire and Invasive Species Team (FIAT), a team of wildland fire specialists and other resource specialists and managers, to specifically incorporate resistance to invasive annual grasses and resilience after disturbance principles into the assessment protocol. This protocol is also referred to as the Fire and Invasive Tool. In October 2013, the BLM, Forest Service, and USFWS agreed to incorporate this approach into the final EISs.

The cornerstone of the FIAT protocol is recent scientific research on resistance and resilience of Great Basin ecosystems (Chambers et al. 2014) and the USFWS-sponsored project with the Western Association of Fish and Wildlife Agencies (WAFWA) to assemble an interdisciplinary team to provide additional information on wildland fire and invasive plants and to develop strategies for addressing these issues. This interagency collaboration between rangeland scientists, fire specialists, and sage-grouse biologists resulted in the development of a strategic, multi-scale approach for employing ecosystem resilience and resistance concepts to manage threats to sage-grouse habitats from wildfire and invasive annual grasses (Chambers et al. 2014). This paper has been published as a Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-326 and is posted online at http://www.fs.fed.us/rm/pubs/rmrs_gtr326.pdf. It serves as the reference and basis for the protocol described in this assessment.

The assessment process sets the stage for:

- Identifying important sage-grouse occupied habitats and baseline data layers important in defining and prioritizing sage-grouse habitats
- Assessing the resistance to invasive annual grasses and resilience after disturbance and prioritizing focal habitats for conservation and restoration
- Identifying geospatially explicit management strategies to conserve sage-grouse habitats

Management strategies are types of actions or treatments that managers typically implement to resolve resource issues. They can be divided into proactive approaches (e.g., fuels management and habitat recovery/restoration) and reactive approaches (e.g., fire operations and post-fire rehabilitation). Proactive management strategies can favorably modify wildfire behavior and restore or improve desirable habitat with greater resistance to invasive annual grasses and/or resilience after disturbances such as wildfires. Reactive management strategies are employed to reduce the loss of sage-grouse habitat from wildfires or stabilize soils and reduce impacts of invasive annual grasses in sage-grouse habitat after wildfires. Proactive management strategies will result in long-term sage-grouse habitat improvement and stability, while reactive management strategies are essential to reducing current impacts of wildfires on sage-grouse habitat, thus maintaining long-term habitat stability. Management strategies include:

Proactive Strategies-

1. **Fuels Management** includes projects that are designed to change vegetation composition and/or structure to modify fire behavior characteristics for the purpose of aiding in fire suppression and reducing fire extent.

2. **Habitat Restoration/Recovery**
    a. Recovery, referred to as passive restoration (Pyke 2011), is focused on changes in land use (e.g., improved livestock grazing practices) to achieve a desired outcome where the plant community has not crossed a biotic or physical threshold.
    b. Restoration is equivalent to active restoration (Pyke 2011) and is needed when desired species or structural groups are poorly represented in the community and reseeding, often preceded by removal of undesirable species, is required. Note: The Fuels Management program supports recovery/restoration projects through its objective to restore and maintain resilient landscapes.

Reactive Strategies-

3. **Fire Operations** includes preparedness, prevention, and suppression activities. When discussing specific components of fire operations, the terms fire preparedness, fire prevention and fire suppression are used.

4. **Post-Fire Rehabilitation** includes the BLM's Emergency Stabilization and Rehabilitation (ES&R) Program and the Forest Service's Burned Area Emergency Response (BAER) Program. Policy limits application of funds from 1 to 3 years, thus treatments to restore or enhance habitat after this period of time are considered habitat recovery/restoration.

The assessment process included two steps with sub-elements. First, important Priority Areas for Conservation (PACs) and focal habitats are identified (**Step 1a**). Second, potential management **strategies** (described above) are identified to conserve or restore focal habitats threatened by wildfires, invasive annual grasses, and conifer expansion (primarily pinyon pine and/or juniper species; **Step 1b**). Focal habitats are the portions of a PAC with important habitat characteristics, bird populations, and threats (e.g., wildfires, invasive annual grasses, and conifer expansion) where this assessment will be applied. Areas adjacent to or near the focal habitats can be considered for management treatments such as fire control and fuels management if these locations can reduce wildfire impacts to focal habitats. Soil temperature and moisture regimes are used to characterize capacity for resistance to invasive annual grasses and resilience after disturbance (primarily wildfires) within focal habitats to assist in identifying appropriate management strategies, especially in areas with good habitat characteristics that have low recovery potential following disturbance. Soil moisture and temperature regime relationships have not been quantified to the same degree as for conifer expansion; however, Chambers et al. 2014) discuss preliminary correlations between these two variables.

The results of Steps 1a and 1b, along with associated geospatial data files, are available to local management units to complete Step 2 of the assessment process. Step 2 is conducted by local management units to address wildfire, invasive annual grasses, and conifer expansion in or near focal habitat areas. First, local information and geospatial data are collected and evaluated to apply and improve on Step 1 focal habitat area geospatial data (**Step 2a**). Second, focal habitat activity and implementation plans are developed and include prioritized management **tactics and treatments** to implement effective, fuels management, habitat recovery/restoration, fire operations, and post-fire rehabilitation strategies (**Step 2b**). This assessment will work best if Step 2b is done across management units (internal and externally across BLM and Forest Service administrative units and with other entities). **Figure 1**, Assessment Flow Chart, contains an illustration of the steps in the assessment process.

This analysis does not necessarily address the full suite of actions needed to maintain the current distribution and connectivity of sage-grouse habitats across the Great Basin because resources available to the federal agencies are limited at this time. Future efforts designed to maintain and connect habitats across the range will be needed as current focal areas are addressed and additional resources become available.

Step 1 – Sage-Grouse Landscape Context

Wildfire/Invasive Annual Grass Threat

- Priority Areas for Conservation
- 75% Breeding Bird Density Areas
- Sagebrush Landscape Cover
- Resistance to invasive annual grasses and resilience to disturbance

Conifer Expansion Threat

- Priority Areas for Conservation
- 75% Breeding Bird Density Areas
- Sagebrush Landscape Cover
- Conifer Expansion Map

Step 1a - Select Priority Areas for Conservation and focal habitats

Priority Areas for Conservation: Figure 6, Tables 1 &2

Focal habitats: Figure 6 and Table 2

Emphasis areas are habitats where resistance to invasive annual grasses and resiliency after disturbance are low within and around focal habitats.

Priority Areas for Conservation: Figure 7, Tables 3&4

Focal habitats: Figure 7 and Table 4

Emphasis areas are conifer expansion in association with 75% Breeding Bird Density areas with landscape sagebrush cover greater tjam 25%

Step 1b. Potential Management Strategies and Examples

Management Strategies to Address Wildfires and Invasive Annual Grasses

- Habitat Recovery/Restoration
- Fuels Management
- Fire Operations
- Post-Fire Rehabilitation

Utilize Table 4 in Chambers et al. 2014 to develop management strategies for each Priority Area for Conservation.

Management Strategies to Address Conifer Expansion

- Habitat Recovery/Restoration
- Fuels Management
- Fire Operations
- Post-Fire Rehabilitation

Utilize Table 4 in Chambers et al. 2014 to develop management strategies for each Priority Area for Conservation.

Step 2 – Management Unit Applications for Invasive Annual Grasses and Conifer Expansion

Step 2a

1) Evaluate the accuracy and utility of Step 1 geospatial layers and incorporate relevant local information.
2) Develop framework for incorporating management strategies to initiate implementation/activity plans.

Step 2b

Develop collaborative implementation/activity plans to address threats to focal habitats in Priority Areas for Conservation.

Figure 1, Assessment Flow Chart

Step 1

The first component of the Wildfire and Invasive Annual Grasses Assessment describes the factors that collectively provide the sage-grouse landscape context. Step 1a provides this context by discussing PACs, breeding bird density (BBD), soil temperature and moisture regimes (indicators of resistance to annual grasses and resilience after disturbance), landscape sagebrush cover, and conifer expansion. See Chambers et al. 2014) for a detailed description of Invasive Annual Grass and Wildfire threats to sage-grouse habitat. Priority PACs and focal habitats are derived from the information provided in this sage-grouse landscape context section.

Step 1a- Sage-grouse landscape context

This component of the assessment identifies important PACs and associated focal habitats where wildfire, invasive annual grasses, and conifer expansion pose the most significant threats to sage-grouse.

The primary focus of this assessment is on sage-grouse populations across the WAFWA Management Zones III, IV, and V (**Figure 2**, Current PACs for WAFWA Management Zones III, IV, and V). Sage-grouse are considered a landscape species that require very large areas to meet their annual life history needs. Sage-grouse are highly clumped in their distribution (Doherty et al. 2010), and the amount of landscape cover in sagebrush is an important predictor of sage-grouse persistence in these population centers (Knick et al. 2013). States have used this information combined with local knowledge to identify PACs to help guide long-term conservation efforts. FIAT used data sets that were available across the three management zones as an initial step for prioritizing selected PACs and identifying focal habitats for fire and invasive annual grasses and conifer expansion assessments. These data sets (also described in Chambers et al. 2014) include:

<u>Priority Areas for Conservation (PACs)</u>

PACs have been identified by states as key areas that are necessary to maintain redundant, representative, and resilient sage-grouse populations (USFWS 2013; see Figure 2). A primary objective is to minimize threats within PACs (e.g., wildfire and invasive annual grasses impacts) to ensure the long-term viability of sage-grouse and its habitats. A secondary priority is to conserve sage-grouse habitats outside of PACs since they may also be important for habitat connectivity between PACs (genetic and habitat linkages), habitat restoration and population expansion opportunities, and flexibility for managing habitat changes that may result from climate change. PACs have also been identified by the USFWS as one of the reporting geographic areas that will be considered during listing determinations for sage-grouse.

The combination of PACs with BBD data (described below) assists us in identifying connectivity between populations. PAC boundaries may be modified in the future requiring adjustments in focal habitat areas and management strategy priorities.

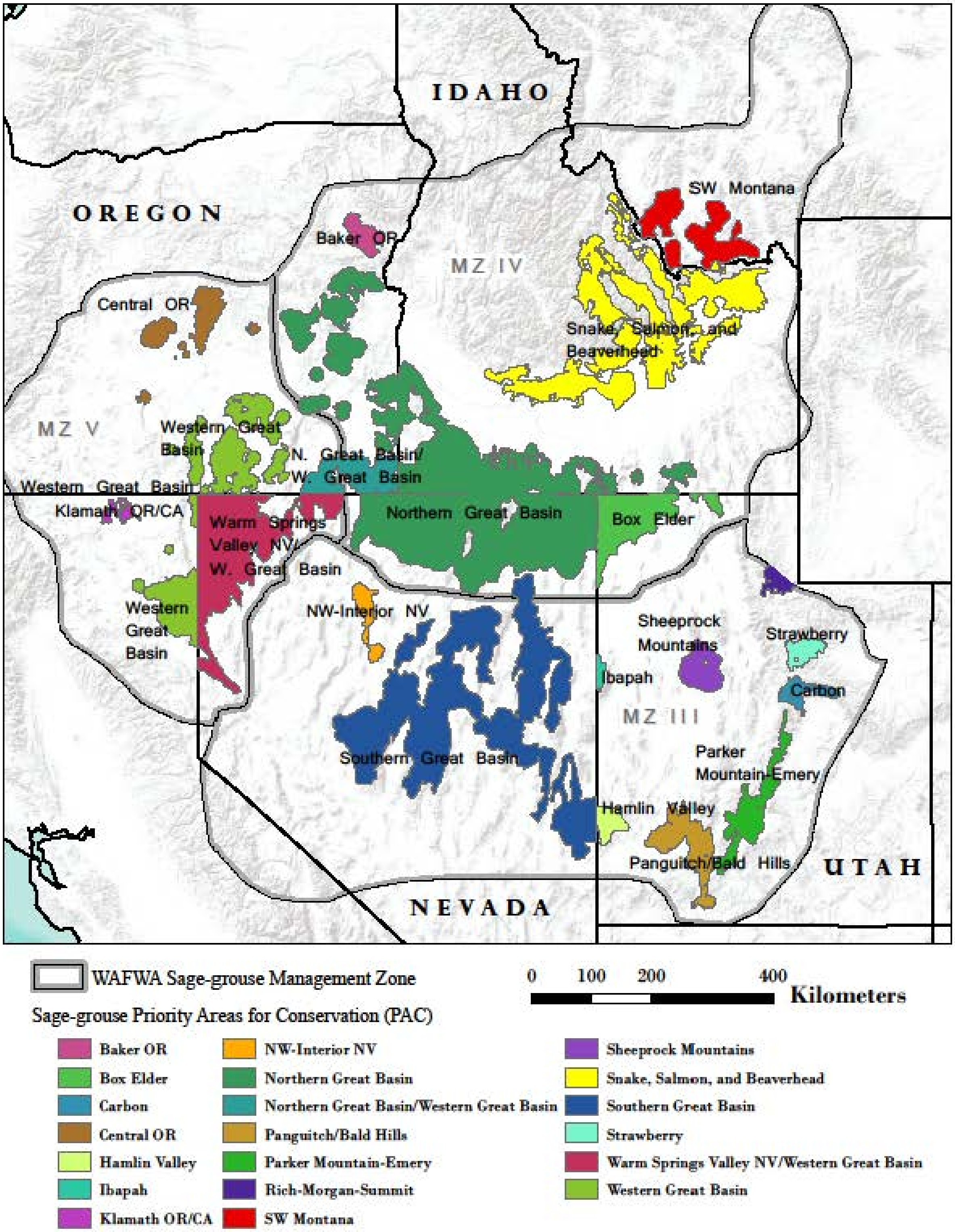

Figure 2, Current PACs for WAFWA Management Zones III, IV, and V. Bi-State sage-grouse populations were not included for this analysis and are being addressed in separate planning efforts.

Breeding Bird Density

Doherty et al. (2010) provided a useful framework for identifying population concentration centers in their range-wide BBD mapping. FIAT used maximum counts of males on leks (4,885 males) to delineate breeding bird density areas that contain 25, 50, 75, and 100 percent of the known breeding population. Leks were then mapped according to abundance values and buffered by 4 to 5.2 miles (6.4 to 8.5 kilometers) to delineate nesting areas. Findings showed that while sage-grouse occupy extremely large landscapes, their breeding distribution is highly aggregated in comparably smaller identifiable population centers; 25 percent of the known population occurs within 3.9 percent (7.2 million acres [2.92 million hectares]) of the species range, and 75 percent of birds are within 27 percent of the species range (50.5 million acres [20.4 million hectares]; Doherty et al. 2010). See **Figures 3**, Sage-Grouse Breeding Bird Density Thresholds.

This analysis places emphasis on breeding habitats because little broad/mid-scale data exists for associated brood-rearing (summer) and winter habitat use areas. Finer scale seasonal habitat use data should be incorporated (or, if not available studies, should be conducted) at local levels to ensure management actions encompass all seasonal habitat requirements. Federal administrative units should consult with state wildlife agencies for additional seasonal habitat information.

For this assessment, FIAT chose to use the 75 percent BBD as an indicator of high bird density areas that informed the approach used by state wildlife agencies to initially identify PACs. Range-wide BBD areas provide a means to further prioritize actions within relatively large PACs to maintain bird distribution and abundance. FIAT used state level BBD data from Doherty et al. (2010) instead of range-wide model results to ensure important breeding areas in Management Zones III, IV, and V were not underweighted due to relatively higher bird densities in the eastern portion of the range. BBD areas of 75 to 100 percent are included in Appendix 1 to provide context for local management units when making decisions concerning connectivity between populations and PACs.

Note that breeding density areas were identified using best available information in 2009, so this range-wide data does not reflect the most current lek count information and changes in conditions since the original analysis. Subsequent analysis should use the most current information available. Also, BBD areas should not be viewed as rigid boundaries but rather as a means to regionally prioritize landscapes where step down assessments and actions should be implemented quickly to conserve the most birds.

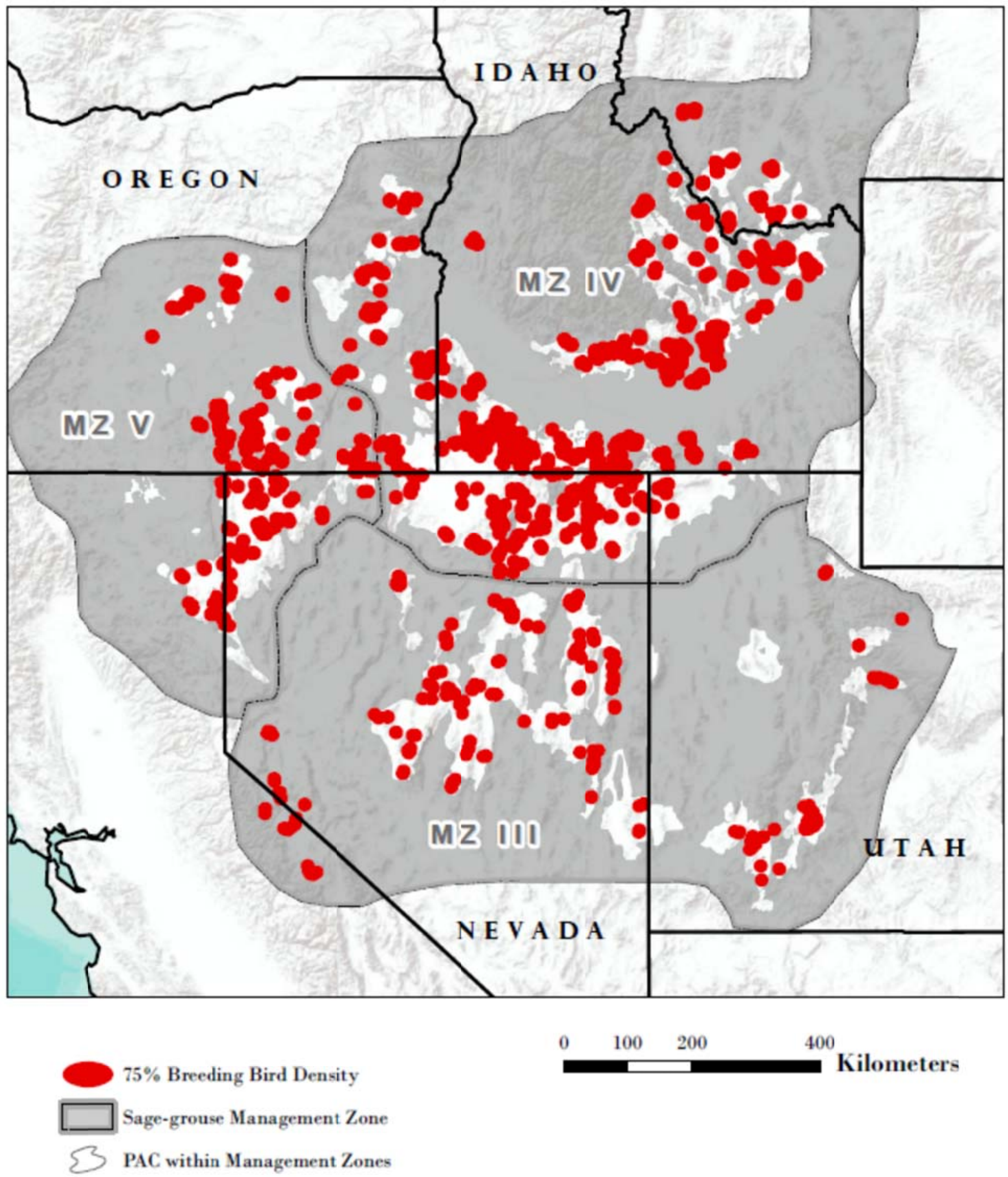

Figure 3, Sage-Grouse Breeding Bird Density Thresholds for 75% of the breeding birds, Management Zones, and PACs. Breeding bird density of 75 to 100% is shown in Appendix 1 to provide context for local management units when making decisions concerning connectivity between populations and PACs.

Soil Temperature and Moisture Regimes

Invasive annual grasses and wildfires can be tied to management strategies through an understanding of resistance and resilience concepts. Invasive annual grasses has significantly reduced sage-grouse habitat throughout large portions of its range (Miller et al. 2011). While abandoned leks were linked to increased nonnative annual grass presence, active leks were associated with less annual grassland cover than in the surrounding landscape (Knick et al. 2013). Invasive annual grasses also increases fire frequency, which directly threatens sage-grouse habitat and further promotes the establishment of invasive annual grasses (Balch et al. 2013). This nonnative annual grass and fire feedback loop can result in conversion from sagebrush shrublands to annual grasslands (Davies 2011).

In cold desert shrublands, vegetation community resistance to invasive annual grasses and resilience following disturbance is strongly influenced by soil temperature and moisture regimes (Chambers et al. 2007; Meyer et al. 2001). Generally, colder soil temperature regimes and moister soil moisture regimes are associated with more resilient and resistant vegetation communities. While vegetation productivity and ability to compete and recover from disturbance increase along a moisture gradient, cooler temperatures limit invasive annual grass growth and reproduction (Chambers et al. 2007; Chambers et al. 2014). Conversely, warm and dry soil temperature and moisture regimes and to a lesser degree cool and dry soil temperature and moisture regimes, are linked to less resistant and resilient communities (see Figure 9 in Chambers et al. 2014). A continuum in resistance and resilience exists between the warm and dry and cool and dry soil temperature and moisture regimes that will need to be considered in Step 2 in developing implementation or activity plans. These relationships can be used to prioritize management actions within sage-grouse habitat using broadly available data.

To capture relative resistance and resilience to disturbance and invasive annual grasses across the landscape, soil temperature and moisture regime information (described in greater detail in Chambers et al. 2014) were obtained from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) data. Where gaps in this coverage existed, the NRCS US General Soil Map (STATSGO2) data was used (Soil Survey Staff 2014; see Appendix 1). The STATSGO2 database includes soils mapped at a 1:250,000-scale; the SSURGO database includes soils mapped at the 1:20,000 scale. Interpretations made from soil temperature and moisture regimes from the STATSGO2 database will not have the same level of accuracy as those made from the SSURGO database.

Areas characterized by warm and dry soil temperature and moisture regimes (low relative resistance and resilience) were intersected with sage-grouse breeding habitat and sagebrush landscape cover to identify candidate areas (emphasis areas) for potential management actions that mitigate threats from invasive annual grasses and wildfire (**Figure 4**, Soil Moisture and Temperature Regimes for Management Zones III, IV, and V, and **Figure 5**, Intersection of High Density (75% BBD) Populations). These data layers provide the baseline information considered important in prioritizing areas where conservation and management actions could be developed to address invasive annual grasses in a scientifically defensible manner (see Table 4 in Chambers et al. 2014).

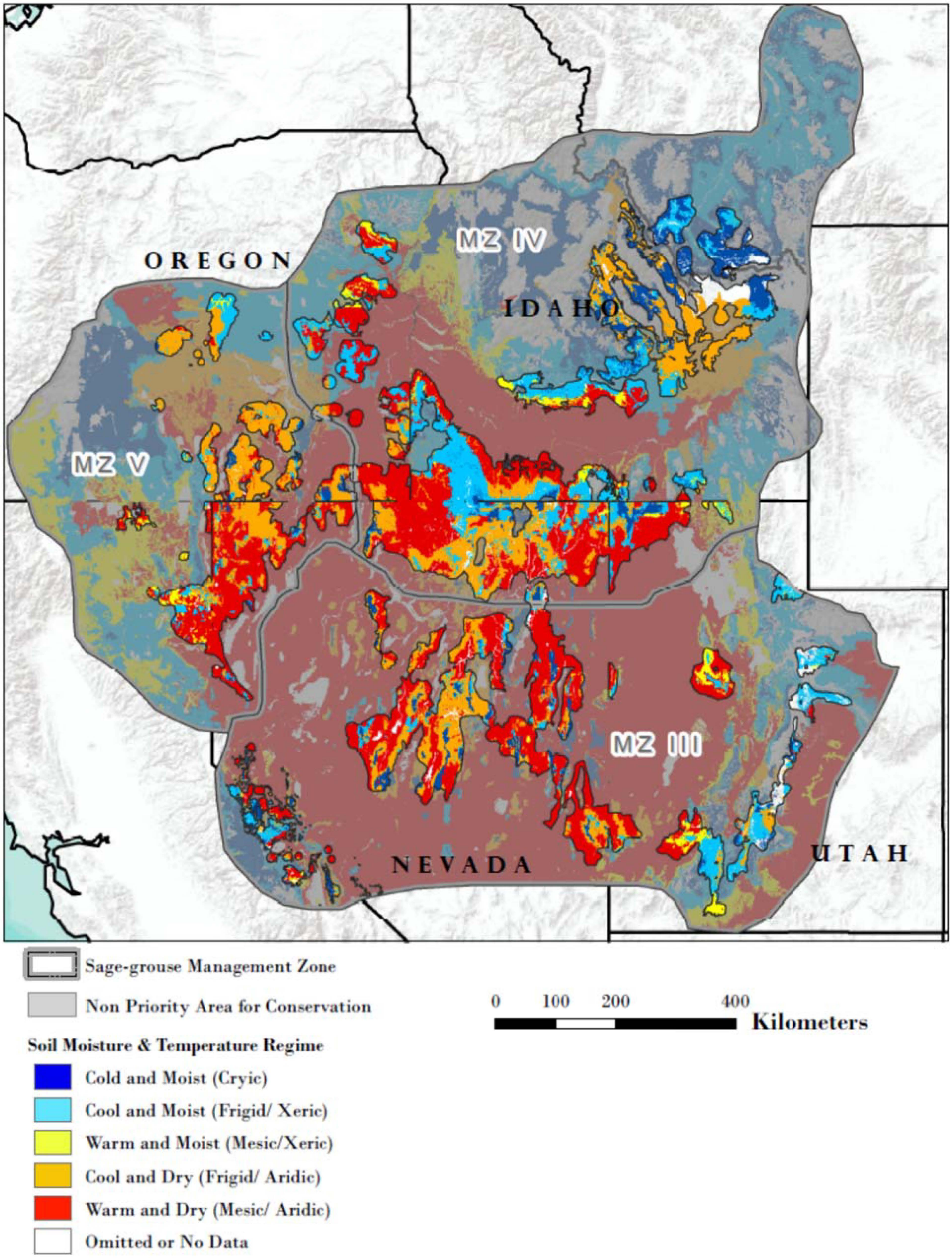

Figure 4, Soil Moisture and Temperature Regimes for Management Zones III, IV, and V

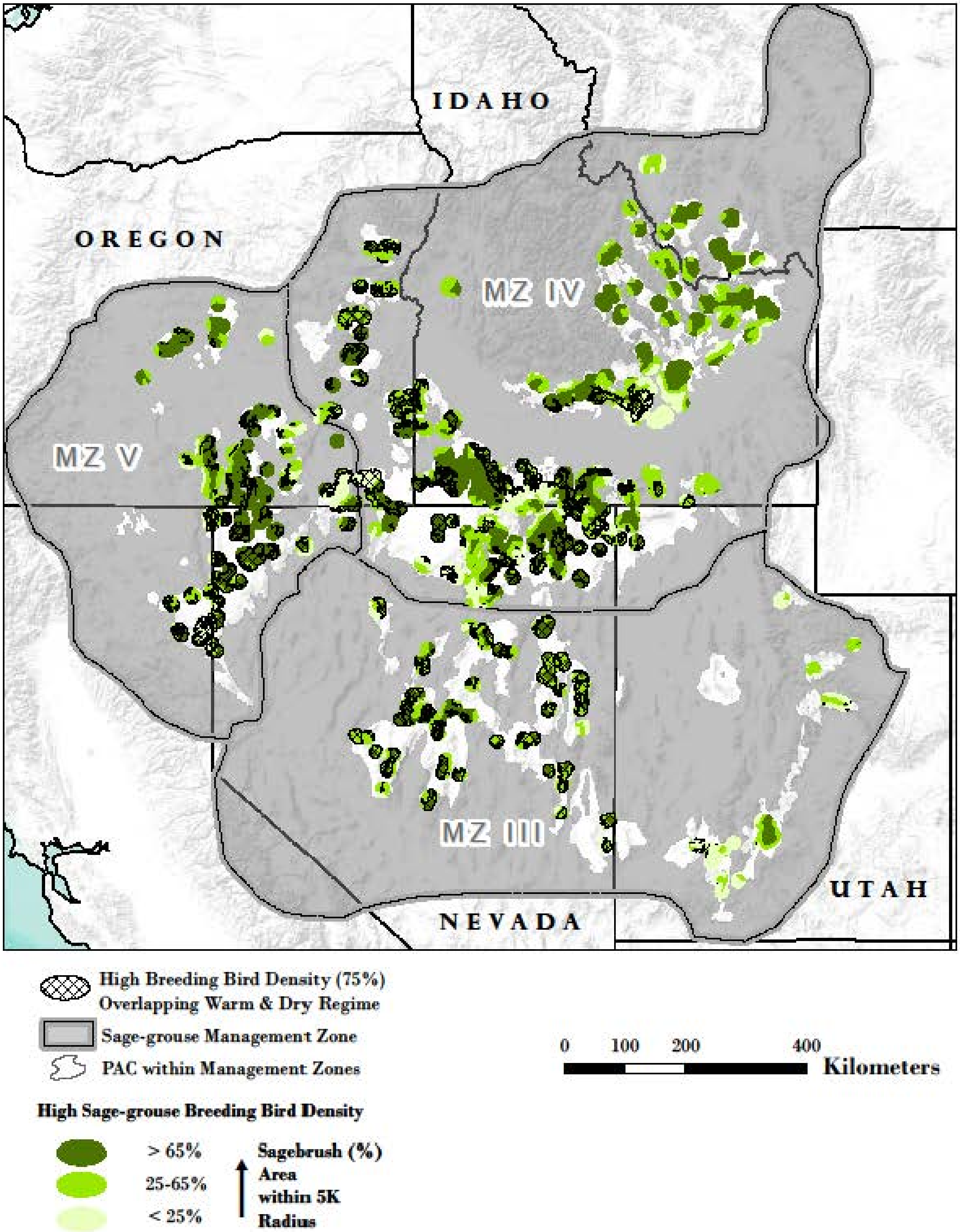

Figure 5, Intersection of High Density (75% BBD) Populations. The warm and dry sites and the proportion of these habitats in the three sagebrush landscape cover classes by management zone, and PACs within the Great Basin.

Sagebrush Landscape Cover

The amount of the landscape in sagebrush cover is closely related to the probability of maintaining active sage-grouse leks, and is used as one of the primary indicators of sage-grouse habitat potential at landscape scales (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). For purposes of prioritizing landscapes for sage-grouse habitat management, FIAT used less than or equal to 25 percent sagebrush landscape cover as a level below which there is a low probability of maintaining sage-grouse leks, and greater than or equal to 65 percent as the level above which there is a high probability of sustaining sage-grouse populations with further increases of landscape cover of sagebrush (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013). Increases in landscape cover of sagebrush have a constant positive relationship with sage-grouse lek probability at between about 25 percent and 65 percent landscape sagebrush cover (Knick et al. 2013). It is important to note that these data and interpretations relate only to persistence (i.e., whether or not a lek remains active), and it is likely that higher proportions of sagebrush cover may be required for population growth.

For the purposes of delineating sagebrush habitat relative to sage-grouse requirements for landscape cover of sagebrush, FIAT calculated the percentage of landscape sagebrush cover (Landfire 2013) within a 3-mile (5-kilometer) radius of each 98-foot by 98-foot (30 meter by 30 meter) pixel in Management Zones III, IV, and V (see Appendix 2 in Chambers et al. 2014) for how landscape sagebrush cover was calculated). FIAT then grouped the percentage of landscape sagebrush cover into each of the selected categories (0 to 25 percent, 25 to 65 percent, 65 to 100 percent; **Figure 6**, Sagebrush Landscape Cover and Fire Perimeters for the Analysis Area). Landfire data was based on 2000 satellite imagery so wildfire perimeters after that date were incorporated into this layer to better reflect landscape sagebrush cover. Burned areas were assumed to fall into the 0 to 25 percent landscape cover class.

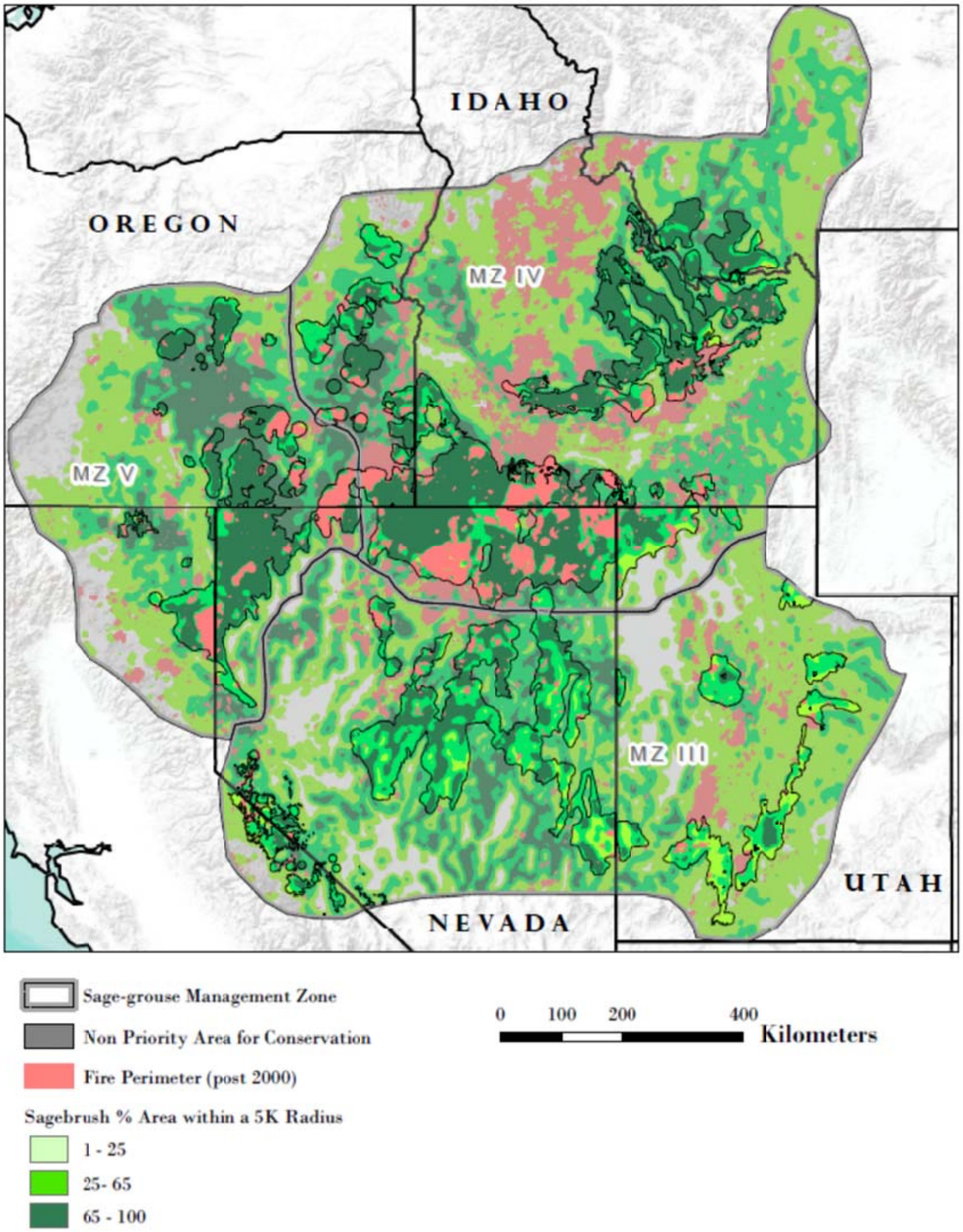

Figure 6, Sagebrush Landscape Cover and Fire Perimeters (post-2000) for the Analysis Area

Conifer Expansion

Conifer expansion into sagebrush landscapes also directly reduces sage-grouse habitat by displacing shrubs and herbaceous understory as well as by providing perches for avian predators. Conifer expansion also leads to larger, more severe fires in sagebrush systems by increasing woody fuel loads (Miller 2013). Sage-grouse populations have been shown to be impacted by even low levels of conifer expansion (Baruch-Mordo et al. 2013). Active sage-grouse leks persist in regions of relatively low conifer woodland and are threatened by conifer expansion (Baruch-Mordo et al. 2013; Knick et al. 2013).

To estimate where sage-grouse breeding habitat faces the largest threat of conifer expansion, FIAT used a risk model developed by Manier et al. (2013) that locates regions where sagebrush landscapes occur within 250 meters of conifer woodland (**Figure 7**, Modeled Conifer Expansion for PACs with Greater Than 25% Sagebrush Landscape Cover In and Around 75% BBD). Although the model is coarse, it is available for the entirety of the three sage-grouse management zones analyzed. FIAT encourages using more accurate conifer expansion data in Step 2.

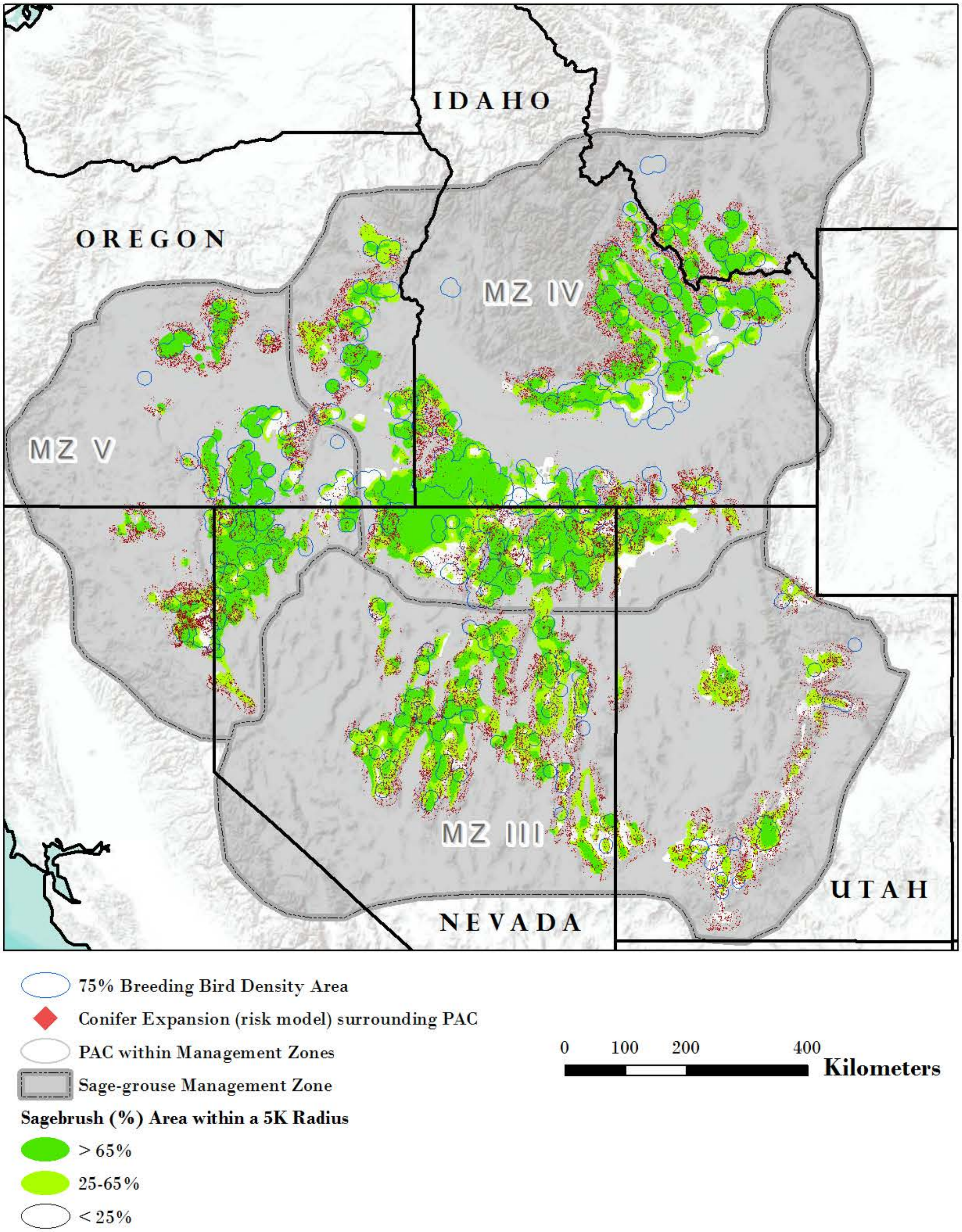

Figure 7, Modeled Conifer Expansion for PACs with Greater Than 25% Sagebrush Landscape Cover In and Around 75% BBD

Step 1a. Identifying PACs and focal habitats

A primary goal for the conservation of sage-grouse populations is the identification of important habitats needed to ensure the persistence and recovery of the species. Loss of habitat, and by inference populations, in these habitats would likely imperil the species in the Great Basin. The first objective is to protect and restore those habitats that provide assurances for retaining large well connected populations.

PACs and the 75 percent BBD maps were used to provide a first-tier stratification (e.g., focal habitats) for prioritizing areas where conservation actions could be especially important for sage-grouse populations. Although these areas are a subset of the larger sage-grouse habitats, they are readily identifiable and include habitats (e.g., breeding and nesting habitats that are considered critical for survival; Connelly et al. 2000; Holloran et al. 2005; Connelly et al. 2011) and necessary for the recovery of the species across its range.

The prioritization of habitats for conservation purposes was based on the several primary threats to remaining sage-grouse populations in the Great Basin including the loss of sagebrush habitats to wildfire and invasive annual grasses, and conifer expansion. The first, and probably the most urgent threat for sage-grouse, is the loss of sagebrush habitat due to wildfire and invasive annual species (e.g., cheatgrass; See Figure 11 in Chambers et al. 2014). Areas of highest concern are those with low resistance to cheatgrass and low resilience after disturbance (warm/dry and some cool/dry temperature and moisture regimes sites) that are either **within or in close proximity** to remaining high density populations of sage-grouse (Figure 5). Sagebrush habitats (greater than 25 percent sagebrush landscape cover) prone to conifer expansion, particularly pinyon pine and/or juniper, are also a management concern when within or adjacent to high density sage-grouse populations (Figure 7).

Because these two threats occur primarily at different points along an elevational gradient and are associated with different soil temperature and moisture regimes, separate approaches are used to select PACs and focal habitats for each.

High Density Populations at Highest Risk from <u>Wildfire and Invasive Annual Grasses</u>
PACs in Management Zones III, IV, and V. were evaluated on the basis of high density (75 percent) BBDs, sagebrush landscape cover, and soil temperature and moisture regimes to identify initial PACs that are a priority for assessments and associated focal habitats. **Figure 8**, High Priority PACs with High Density Sage-Grouse Populations (75% BBD), displays the results of the analysis focusing on the intersection of high density (75 percent BBD) populations, the warm and dry sites, and the proportion of these habitats in the three sagebrush landscape cover classes by management zone, and PACs within the Great Basin. **Table 1**, Relative Ranking of PACs Based on High Density (75% BBD) Populations, Warm/ Dry Sites, and Percentage of Habitat in Sagebrush Landscape Cover Classes, displays quantitative outputs of this analysis. The table allows a comparison of these data, and assists in selecting five PACs that provide the greatest contribution to high density sage-grouse populations, and the amounts (acres and proportion) within those PACs of sagebrush cover classes associated with warm and dry soil temperature and moisture regimes.

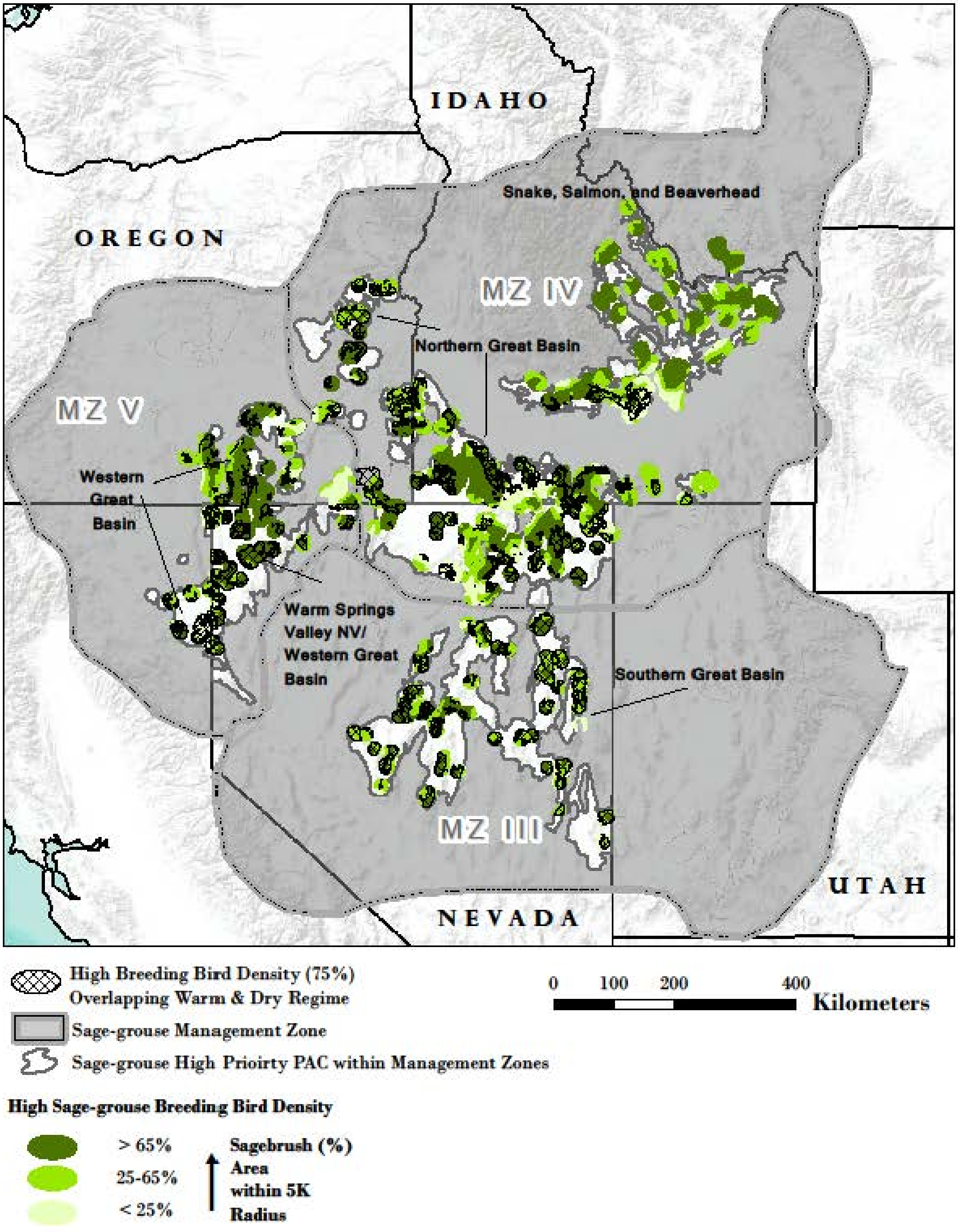

Figure 8, High Priority PACs with High Density Sage-Grouse Populations (75% BBD) sagebrush landscape cover classes, and areas with low resistance and resilience relative to wildfires and invasive annual species.

Table 1, Relative Ranking of PACs Based on High Density (75% BBD) Populations, Warm/ Dry Sites, and Percentage of Habitat in Sagebrush Landscape Cover Classes

Sage-grouse Management Zone	Sage-grouse Priority Area for Conservation (PAC) Name	Total PAC Acres	Breeding Bird Density (75%) Acres	Percent of Breeding Bird Density (75%) Area within PAC	Warm and Dry Soil Moisture & Temperature Regime within Breeding Bird Density (75%) Acres*		
					0-25% Sagebrush Landscape Cover	25%-65% Sagebrush Landscape Cover	65%+ Sagebrush Landscape Cover
4	Northern Great Basin	13045515	7383442	57%	179551 (2%)	674554 (9%)	1745163 (24%)
3	Southern Great Basin	9461355	3146056	33%	42596 (1%)	792780 (25%)	1062091 (34%)
4	Snake, Salmon, and Beaverhead	5477014	2823205	52%	68107 (2%)	89146 (3%)	95970 (3%)
5	Western Great Basin	3177253	2084626	66%	149399 (7%)	140141 (7%)	202767 (10%)
5	Warm Springs Valley NV/Western Great Basin	3520937	1558166	44%	31458 (2%)	207365 (13%)	741353 (48%)
4	SW Montana	1369076	659475	48%	0 (0%)	0 (0%)	0 (0%)
4	Northern Great Basin/Western Great Basin	1065124	624581	59%	114222 (18%)	85258 (14%)	116513 (19%)
5	Central OR	813699	451755	56%	0 (0%)	6211 (1%)	16463 (4%)
3	Panguitch/Bald Hills	1135785	352258	31%	6883 (2%)	5821 (2%)	0 (0%)
3	Parker Mountain-Emery	1122491	308845	28%	0 (0%)	127 (0%)	0 (0%)
4	Box Elder	1519454	292658	19%	22 (0%)	43325 (15%)	23913 (8%)
4	Baker OR	336540	184813	55%	0 (0%)	46459 (25%)	36214 (20%)
3	NW-Interior NV	371557	108256	29%	576 (1%)	17117 (16%)	25173 (23%)
3	Carbon	355723	97734	27%	255 (0%)	180 (0%)	0 (0%)
3	Strawberry	323219	52635	16%	0 (0%)	0 (0%)	0 (0%)
3	Rich-Morgan-Summit	217033	37005	17%	0 (0%)	0 (0%)	0 (0%)
3	Hamlin Valley	341270	3244	1%	0 (0%)	139 (4%)	3105 (96%)
3	Ibapah	98574	0	0%	0 (NA)	0 (NA)	0 (NA)
3	Sheeprock Mountains	611374	0	0%	0 (NA)	0 (NA)	0 (NA)
5	Klamath OR/CA	162667	0	0%	0 (NA)	0 (NA)	0 (NA)

* Numbers in parenthesis indicate the percent of acres relative to total acres of breeding bird density (75%)

These five PACs comprise 90 percent and 95 percent of remaining PAC sagebrush landscape cover in the 25 to 65 percent and greater than or equal to 65 percent sagebrush landscape cover classes, respectively, of the 75 percent BBD associated with low resistance/resilience habitats. The 75 percent BBD habitats in the Northern, Southern Great Basin, and Warm Spring PACs appear particularly important for two reasons. They represent a significant part of the remaining habitats for the Great Basin metapopulation, and they have the greatest amount of low resiliency habitat remaining that still functions as sage-grouse habitat.

An examination of the 5 selected PACs shows that the sum of the 75 percent BBD within these PACs is 16,995,496 acres (**Table 2**, PACs with the Highest Acres and Proportions of 75% BBD acres, and Acres and Proportions of 75% BBD Acres within the Warm/Dry Soil Temperature and Moisture Class). These are the **focal habitats**. These five PACs constitute 84 percent of the 75 percent BBD low resiliency habitats for all Management Zones III, IV, and V PACs. Within and immediately around these focal habitats, 5,751,293 acres are in high BBD areas with landscape sagebrush cover in the 25-65 percent and ≥ 65 percent classes and in the warm and dry soil temperature and moisture regimes. These are the habitats in the most danger to loss due to their low resistance to invasive annual grasses and low resilience following wildfire. Within the focal habitats in the high priority PACs, low resistance and resilience areas (cross-hatched areas in Figure 8) are a high priority (emphasis area) for implementing management strategies. Applying management strategies outside the emphasis areas are appropriate if the application of fire operations and fuels management activities will be more effective in addressing wildfire threats.

Table 2, PACs with the Highest Acres and Proportions of 75% BBD acres, and Acres and Proportions of 75% BBD Acres within the Warm/Dry Soil Temperature and Moisture Class (see Figure 8)

PAC	PAC Acres	Acres of 75% BBD in PAC (**focal habitat**)	Proportion of 75% BBD within PACs	Warm & Dry Soils within 75% BBD by Sagebrush Landscape Cover Classes Greater Than 25%*	
				25-65%	>65%
Northern Great Basin	13,045,515	7,383,442	0.57	674,517(9%)	1,745,163(24%)
Southern Great Basin	9,461,355	3,146,056	0.33	792,780(25%)	1,062,091(34%)
Snake, Salmon, and Beaverhead	5,477,014	2,823,205	0.52	89,146(3%)	95,970(3%)
Warm Springs Valley NV/Western Great Basin	3,520,937	1,558,166	0.44	207,365(13%)	741,353(48%)
Western Great Basin	3,177,253	2,084,626	0.66	140,141(7%)	202,767(10%)
Total for 5 PACS	**34,682,074**	**16,995,496**	**0.49**	**1,903,949**	**3,847,344**

***** This category represents the emphasis areas for applying appropriate management strategies in or near the focal habitats due to the lower probability of recovery after disturbance and higher probability of invasive annual grasses and existing wildfire threats.

High Density Sage-Grouse Habitats at Risk from Conifer Expansion

PACs, sagebrush landscape cover, and the 75 percent BBD data were also used in conjunction with the conifer expansion data (Mainer et al. 2013) to provide an initial stratification to determine PACs where conifer removal would benefit important sagebrush habitats. Conifer expansion threats are primarily western juniper in the northern Great Basin and pinyon pine/Utah juniper in the southern Great Basin.

Figure 7 displays results of the analysis focusing on the intersection of the 75 percent BBD, and modeled conifer expansion areas within two sagebrush landscape cover classes by management zone and PACs within the Great Basin. To identify high density sage-grouse areas affected by conifer expansion, the amount and proportion of acres estimated to be affected were calculated by sagebrush cover class to assist in the identification of the focal habitats (**Table 3)**. **Table 4**, displays quantitative outputs of this analysis using the 25 to 65 percent and greater than 65 percent landscape sagebrush cover classes for the PACs. Thus, **focal habitats** for addressing conifer expansion are the areas within and near conifer expansion in sagebrush landscape cover classes of 25 to 65 percent and greater than 65 percent. Conifer expansion in these two sagebrush landscape cover classes in the 75 percent BBD areas constitutes an emphasis area for treatments to address conifer expansion. Landscapes with less than 25 percent sagebrush cover may require significant additional management actions to restore sagebrush on those landscapes and therefore were considered a lower priority for this analysis. Focal habitats are identified in Table 4 and displayed in **Figure 9**.

Table 3 assists in identifying those PACs that provide the greatest contribution to high density sage-grouse populations, and the amounts (acres and proportion) within those PACs of sagebrush cover classes associated with modelled conifer expansion areas. Although there are uncertainties associated with the model, the results help managers identify specific geographic areas where treatments in conifer (pinyon and/or juniper) could benefit existing important sage-grouse populations.

The results of the screening revealed 5 PACs that contribute substantially to the 75 percent BBD habitats and are currently impacted most by conifer expansion (primarily pinyon pine and/or juniper; Table 4 and Figure 9). Four of the five PACs identified as high priority for conifer expansion treatments were also high priorities for wildfires and invasive annual grass threats. This is likely due to the size of the PACs and the relative importance of these PACs for maintaining the Great Basin sage-grouse meta-populations. As expected, the locations of high density sage-grouse habitats affected by conifer expansion differ spatially from those associated with low resilience habitats within and among the PACs, primarily due to differences in the biophysical settings (e.g., elevation and rainfall) that contribute to threats from invasive annual grasses and wildfires.

Three PACs (Snake/Salmon/Beaverhead, Southwest Montana, and Northern Great Basin/Western Great Basin) ranked high due to their relatively large proportion of high density breeding habitats (Table 3), but were not selected since the threat of conifer expansion was relatively low. One PAC, (Snake/Salmon/Beaverhead, was identified as a potential high priority area but was dismissed because results of the conifer expansion model likely overestimated impacts due to the adjacent conifer forests in this region. The COT Report also identified conifers as a “threat present but localized” in these areas, whereas, the top five PACs prioritized all have conifers identified as a widespread priority threat to address (USFWS 2013).

Table 3, Relative Ranking of PACs Based on High Density (75% BBD) Populations, Modeled Conifer Expansion, and Percentage of Habitats in Sagebrush Landscape Cover Classes

Sage-grouse Management Zone	Sage-grouse Priority Area for Conservation (PAC) Name	PAC acres	Breeding Bird Density (75%) Acres	Relative Proportion of Breeding Bird Density Area within PAC	Conifer Expansion (Modeled) Acres*		
					0-25% Sagebrush Landscape Cover	25%-65% Sagebrush Landscape Cover	65%+ Sagebrush Landscape Cover
4	Northern Great Basin	13045515	7383442	0.57	188502 (1%)	512949 (4%)	442480 (3%)
3	Southern Great Basin	9461355	3146056	0.33	108657 (1%)	738624 (8%)	237828 (3%)
4	Snake, Salmon, and Beaverhead	5477014	2823205	0.52	4209 (0%)	92173 (2%)	216803 (4%)
5	Western Great Basin	3177253	2084626	0.66	87963 (3%)	184618 (6%)	126177 (4%)
5	Warm Springs Valley NV/Western Great I	3520937	1558166	0.44	37148 (1%)	107025 (3%)	217101 (6%)
4	SW Montana	1369076	659475	0.48	1428 (0%)	34765 (3%)	39215 (3%)
4	Northern Great Basin/Western Great Bas	1065124	624581	0.59	12101 (1%)	2247 (0%)	6161 (1%)
5	Central OR	813699	451755	0.56	3191 (0%)	44937 (6%)	59624 (7%)
3	Panguitch/Bald Hills	1135785	352258	0.31	89141 (8%)	75157 (7%)	2563 (0%)
3	Parker Mountain-Emery	1122491	308845	0.28	84719 (8%)	83441 (7%)	7469 (1%)
4	Box Elder	1519454	292658	0.19	8531 (1%)	114376 (8%)	57645 (4%)
4	Baker OR	336540	184813	0.55	945 (0%)	15263 (5%)	195 (0%)
3	NW-Interior NV	371557	108256	0.29	7929 (2%)	29440 (8%)	11813 (3%)
3	Carbon	355723	97734	0.27	15968 (4%)	34446 (10%)	283 (0%)
3	Strawberry	323219	52635	0.16	7916 (2%)	27340 (8%)	1075 (0%)
3	Rich-Morgan-Summit	217033	37005	0.17	11685 (5%)	14280 (7%)	238 (0%)
3	Hamlin Valley	341270	3244	0.01	11321 (3%)	29960 (9%)	6243 (2%)
3	Ibapah	98574	0	0.00	195 (0%)	6770 (7%)	1039 (1%)
5	Klamath OR/CA	162667	0	0.00	1 (0%)	1533 (1%)	15302 (9%)
3	Sheeprock Mountains	611374	0	0.00	16744 (3%)	78580 (13%)	11878 (2%)

* Numbers in parenthesis indicate the proportion of acres relative to total PAC acres

Table 4, PACS with the Highest Acres and Proportions of 75% BBD acres and Estimated Conifer Expansion within Sagebrush Landscape Cover Classes (25-65 percent and ≥65 percent; see Figure 9)

PAC	PAC Acres	Acres 75% BBD in PAC	Prop. 75% BBD within PACs	Conifer Expansion by Landscape Sagebrush Cover Classes 25-65% and ≥65%* Focal Habitat	
				25-65%	≥65%
Northern Great Basin	13,045,515	7,383,442	0.57	512,949 (4%)	442,480 (3%)
Southern Great Basin	9,461,355	3,146,056	0.33	738,624 (8%)	237,828 (3%)
Warm Springs Valley NV/Western Great Basin	3,520,937	1,558,166	0.44	107,025 (3%)	217,101 (6%)
Western Great Basin	3,177,253	2,084,626	0.66	184,618 (6%)	126,177 (4%)
Central Oregon	813,699	451,755	0.56	44,937 (6%)	59,624 (7%)
Total for 5 PACS	**30,018,759**	**14,624,045**	**0.49**	**1,588,153 (5%)**	**1,083,210 (4%)**

*Numbers in parenthesis represent the percent of total PAC acres for each class.

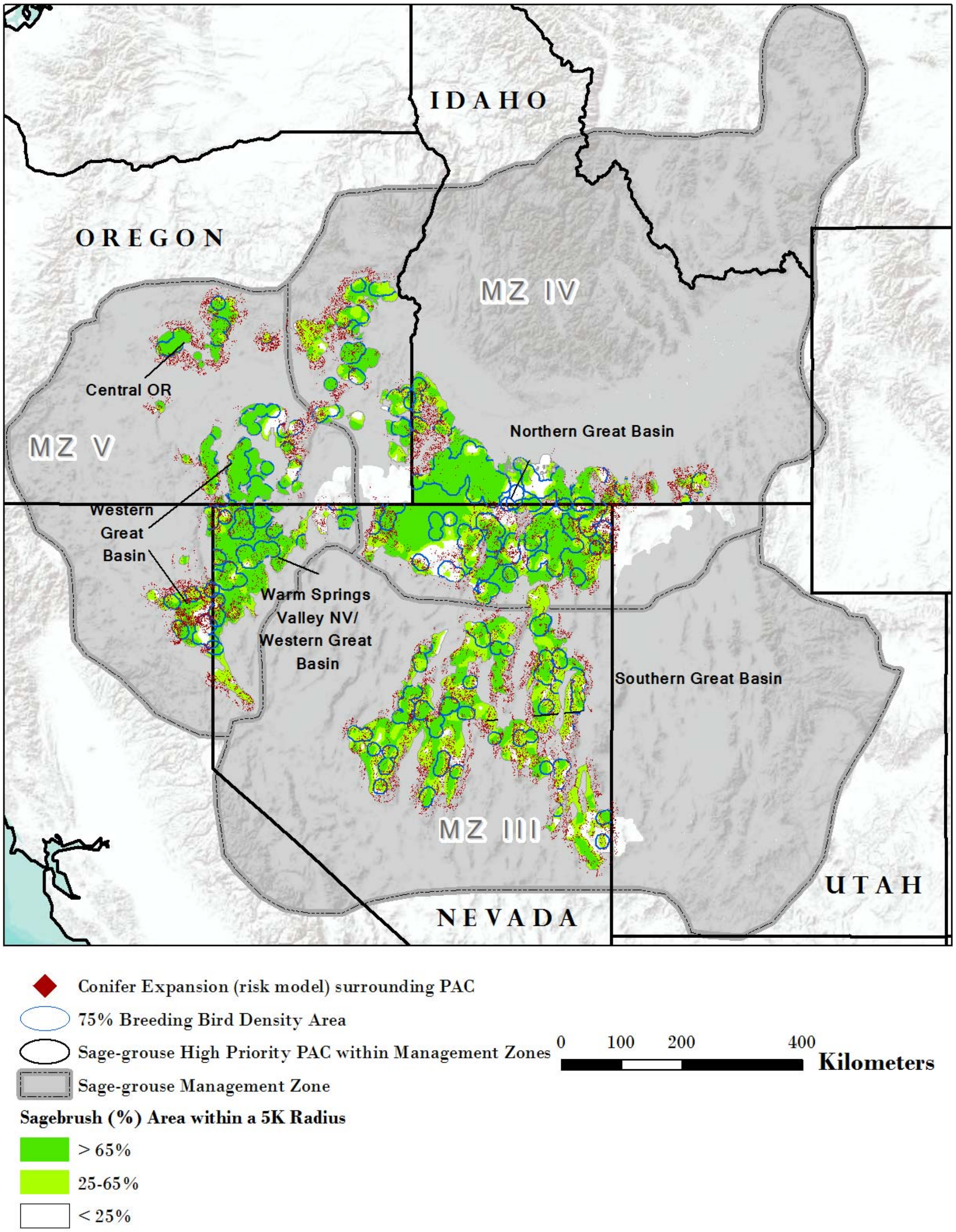

Figure 9, Five PACs Significantly Impacted by Conifer Expansion that contribute substantially to the 75% BBD and that have sagebrush landscape cover greater than 25%.

While the coarse-scale conifer expansion data used in this analysis likely over estimates the extent of the pinyon pine and/or juniper threat, results suggest that far fewer acres are currently affected by conifers than might be at risk from fire and invasive annual grasses impacts. Conifer expansion into sage-grouse habitats occurs at a slower rate, allowing more time for treatment, but early action may be needed to prevent population level impacts on sage-grouse (Baruch-Mordo et al. 2013). Furthermore, conifer expansion is primarily occurring on cooler and moister sites that are more resilient and where restoration is more likely to be effective (Miller et al. 2011), providing managers the opportunity to potentially offset at least some habitat loss expected to continue in less resilient ecosystems. While the available data set used to estimate conifer expansion provides only a coarse assessment of the problem, considerable efforts are currently underway to map conifers across sage-grouse range. These maps are expected to be available in the near future and should be used by land managers to better target project level conifer removal.

FIAT cautions against using the plotted locations of estimated conifer expansion for local management decisions due to the coarse-scale nature of this range-wide data set. Conifer expansion estimates are primarily provided here to aid in judging the relative scope of the threat in each PAC.

Step 1b. Potential Management Strategies

Potential management **strategies** (e.g., fuels management, habitat recovery/restoration, fire operations, post-fire rehabilitation) to conserve or restore Step 1 focal habitats are described below to assist local management units to initiate Step 2. These examples are illustrative and do not contain the full range of management strategies that may be required to address wildfires, invasive annual grasses, and conifer expansion within PACs and associated focal habitats. In general, the priority for applying management strategies is to first maintain or conserve intact habitat and second to strategically restore habitat (after a wildfire or proactively to reconnect habitat). Management strategies will differ when applying the protocol to:

Wildfire and Invasive Annual Grass. (See PACs identified in Table 2 and focal habitats shown in Figure 8). Focal habitats, as they relate to wildfires and invasive annual grasses, are defined as sage-grouse habitat in priority PACs within 75 percent BBD. Within these focal habitats, sagebrush communities with low resilience to disturbance and resistance to invasive annual grasses (warm and dry soil temperature and moisture regimes) are an emphasis area for management actions. Appendix 5 (A) in Chambers et al. 2014) includes a generalized state and transition model with an invasive annual grass component and warm and dry soil temperature and moisture regime associated with 8 to 12 inches of annual precipitation. This state and transition models is useful in developing management strategies to deal with annual grass issues as it contains useful restoration pathways.

Burn Probability is another tool that can be used to assist managers to identify the relative likelihood of large fire occurrence across the landscape within PACs and focal habitats. Burn probability raster data were generated by the Missoula Fire Lab using the large fire simulator - FSim - developed for use in the national Interagency **Fire Program Analysis (FPA)** project. FSim uses historical weather data and LANDFIRE fuel model data to simulate fires burning. Using these simulated fires, an overall burn probability is returned by FSim for each 270m pixel. The burn probability data was overlaid spatially with PACs, soil data, and shrub cover data. The majority of the high and very high burn probability acres lie within the top 5 PACs and are within areas with >25% sagebrush cover. Several of the other PACs have a greater overall percentage of the warm/dry soil regime with high/very high burn probability (northern great basin, baker, and NW interior NV) but the total acres are relatively few. Areas identified with high and very high burn probability are most likely to experience large fires given fire history, fuels, weather and topography. Results are displayed in the table 5 and Figure 10.

Table 5, Percentages of sage-grouse PAC areas with high and very high burn probability, 75% BBD within PAC, 75% BBD and warm dry/temperature regime, and 75% BBD and warm dry/temperature and warm dry/temperature with high and very high burn probability.

Sage Grouse Mangement Zone	*Sage-grouse Priority Area for Conservation (PAC) Name*	*Total PAC Acres*	*High, very high burn probability (percent of PAC acres)*	*75% BBD within PAC (percent PAC acres)*	*75% BBD and warm and dry soil/temperature regime ~~acres~~ (percent PAC acres)*	*75% BBD and warm and dry soil/temperature regime with high, very high burn probability (percent PAC acres)*
4	*Northern Great basin*	*13,045,415*	*86%*	*57%*	*19%*	*17%*
3	*Southern Great Basin*	*9,461,355*	*48%*	*33%*	*20%*	*9%*
4	*Snake, Salmon, and Beaverhead*	*5,477,014*	*68%*	*52%*	*5%*	*4%*
5	*Western Great Basin*	*3,177,253*	*61%*	*66%*	*15%*	*12%*
5	*Warm Springs Valley /Western Great Basin*	*3,520,937*	*30%*	*44%*	*28%*	*9%*
4	*SW Montana*	*1,369,076*	*1%*	*48%*	*0%*	*0%*
4	*Northern Great Basin/Western Great Basin*	*1,065,124*	*82%*	*59%*	*30%*	*22%*
5	*Central Oregon*	*813,699*	*71%*	*56%*	*3%*	*2%*
3	*Panguitch/Bald Hills*	*1,135,785*	*70%*	*31%*	*1%*	*1%*
3	*Parker Mountain-Emery*	*1,122,491*	*28%*	*28%*	*0%*	*0%*
4	*Box Elder*	*1,519,454*	*61%*	*19%*	*4%*	*2%*
4	*Baker Oregon*	*336,540*	*74%*	*55%*	*25%*	*21%*
3	*NW-Interior NV*	*371,557*	*99%*	*29%*	*12%*	*11%*
3	*Carbon*	*355,723*	*22%*	*27%*	*0%*	*0%*
3	*Strawberry*	*323,219*	*26%*	*16%*	*0%*	*0%*
3	*Rich-Morgan-Summit*	*217,033*	*79%*	*17%*	*0%*	*0%*
3	*Hamlin Valley*	*341,270*	*60%*	*1%*	*1%*	*0%*
3	*Ibapah*	*98,574*	*0%*	*0%*	*0%*	*0%*
3	*Sheeprock Mountains*	*611,374*	*98%*	*0%*	*0%*	*0%*
5	*Klamath OR/CA*	*162,667*	*98%*	*0%*	*0%*	*0%*

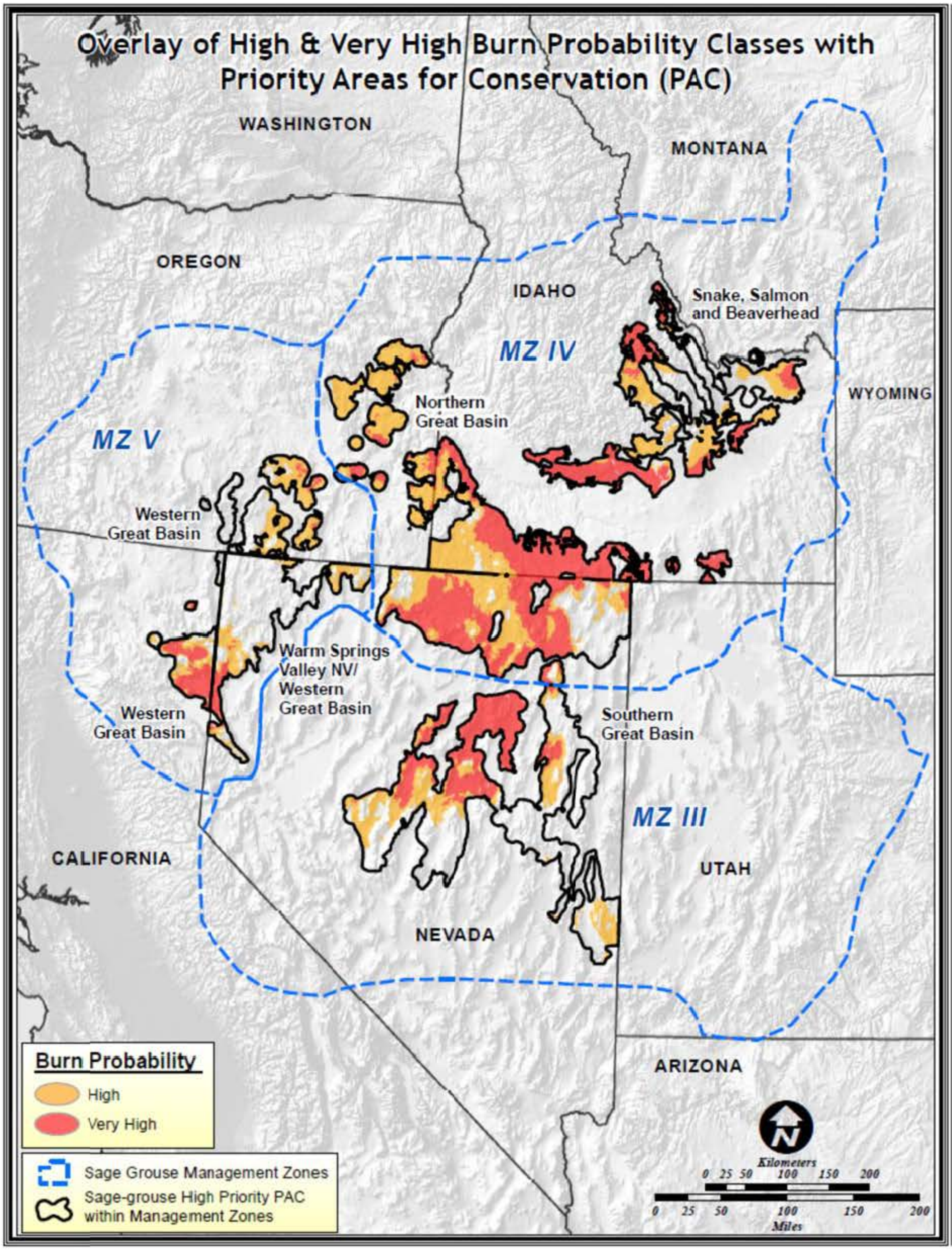

Figure 10, Burn Probability (high and very high) in priority invasive annual grass and wildfire PACs. .

Conifer Expansion. (See priority PACs for assessment identified in Table 4 and focal habitats shown in Figure 9). Focal habitats, as they relate to conifer expansion, are defined as sage-grouse habitat in a priority PAC with sagebrush landscape cover between 25 and 100 percent that is either near or in a conifer expansion area. The relationship between conifer expansion and resilience to disturbance and resistance to expansion is not documented to the same degree as with invasive annual grasses. However, Appendix 5 (D. and E.) in Chambers et al. 2014) includes two generalized state and transition models for conifer expansion with warm to cool and soil temperature regimes associated with precipitation ranges from 12 to 14 or more inches of annual precipitation. These state and transition models are useful in developing management strategies to deal with conifer expansion as they contain useful restoration pathways.

Chambers et al. 2014) is recommended for review at this point for information on applying resistance and resilience concepts along with sage-grouse habitat characteristics to develop management strategies to address wildfires, invasive annual grasses, and conifer expansion. The following tables are recommended for use in developing management strategies in or near focal habitats:

Table 1. Soil temperature and moisture regimes relationship to vegetation types and resistance and resilience.
Table 2. Sage-grouse habitat matrix showing the relationship between landscape sagebrush cover and resistance and resilience.
Table 3. Potential management strategies based on sage-grouse habitat requirements and resistance and resilience.
Table 4. Management strategies (fire suppression, fuels management, post-fire rehabilitation, and habitat restoration) associated with each cell in the sage-grouse habitat matrix (Table 2).

The "Putting it all together" section of the Chambers et al. 2014) also contains a case study from Northeast Nevada illustrating applications of management strategies to address the conservation, protection, and restoration of sage-grouse habitat.

To further assist in understanding Step 1b, examples of general priorities for management strategies are provided below and illustrated in Appendix 3 and 4:

1. Fuels Management: Projects that are designed to change vegetation composition and/or structure to modify potential fire behavior for the purpose of improving fire suppression effectiveness and limiting fire spread and intensity.
    a. Identify priorities and potential measures to reduce the threats to sage-grouse habitat resulting from changes in invasive annual grasses (primary focus on exotic annual grasses and conifer encroachment) and wildland fires. Place high priority on areas dominated by invasive annual grasses that are near or adjacent to low resistance and resilience habitats that are still intact.
    b. Areas on or near perimeter of successful post-fire rehabilitation and habitat restoration projects where threats of subsequent fire are present are important for consideration.

    c. Fuels management can be a high priority in large tracts of intact sagebrush if impacts on sage-grouse populations are minimal and outweighed by the potential benefits of reduced wildfire impacts in area being protected.

2. Habitat Recovery/Restoration Recovery (passive restoration) is a high priority in intact sagebrush stands to improve resistance and resilience before a disturbance. For example, where understory perennial herbaceous species are limited, improved livestock grazing practices can increase the abundance of these species and promote increased resistance to annual grasses.
    a. Habitat restoration is important where habitat connectivity issues are present within focal habitats.
    b. Pinyon pine and/or juniper removal in Phase I and II stands adjacent to large, contiguous areas of sagebrush (greater than 25 percent sagebrush landscape cover) is a priority.

3. Fire Operations (includes preparedness, prevention and suppression activities).
    a. Higher priority should be placed on areas with greater than 65 percent cover than on areas with 25 to 65 percent cover, followed by 0 to 25 percent cover (these categories are continuums not discrete thresholds).
    b. Higher priority should be placed on lower resistance/resilience habitats compared with higher resistance/resilience habitats.
    c. Fire operations in areas restored or post-fire rehabilitation treatment where subsequent wildfires can have detrimental effect on investment and recovery of habitat are important for consideration.
    d. Fire operations (suppression) are especially important in low elevation winter sagebrush habitat with low resistance and resiliency.
4. Post-Fire Rehabilitation
    a. High priority should be placed on supporting short-term natural recovery and long-term persistence in higher resistance and resiliency habitats (with appropriate management applied).
    b. High priority should be placed on reseeding in moderate to low resistance and resiliency habitats, but only if competition from invasive annual grasses, if present, can be controlled prior to seeding.

Step 2

Step 2 is carried out by local management units using the Step 1 geospatial data, focal habitats, and the associated management strategies. Step 2 includes evaluating the availability and accuracy of local information and geospatial data used to develop local management strategies in or near focal habitats (Step 2a).

It also involves developing focal habitat activity/implementation plans that include prioritized management tactics and treatments to implement effective fuels management, habitat recovery/restoration, fire operations, and post-fire rehabilitation (Step 2b). These activity/implementation plans will serve as the basis for NEPA analysis of site-specific projects.

Step 2a- Review of Step 1 Data and Incorporation of Local Information

Evaluate the accuracy and utility of Step 1 geospatial layers for focal habitats by incorporating more accurate or locally relevant:

- Vegetation maps (especially sagebrush cover)
- Updated or higher resolution conifer expansion layers (if applicable)
- Soil survey and ecological site descriptions
- Weather station, including Remote Automatic Weather Stations, data
- PACs, focal habitats, winter habitats, sage-grouse population distributions (i.e., more recent BBD surveys)
- Maps of cheatgrass and other invasive annual grasses that degrade sage-grouse habitat
- Wildfire polygons including perimeters and unburned islands within burn polygons
- Treatment locations and success (consult US Geological Survey Land Treatment Digital Library at http://ltdl.wr.usgs.gov/). The Land Treatment Digital Library allows the user to search on treatment results on an ecological site basis.
- Models and tools to help inform management strategies. For example, data which characterizes wildfire potential can help identify risk to focal habitats and help plan fire suppression and fuels management strategies to address these risks.
- Rapid Ecoregional Assessments
- Land Use Plans
- Appropriate monitoring or inventory information
- Any other geospatial data or models that could improve the accuracy of the assessment process

It is essential that subregional or local information and geospatial data be subjected to a quality control assessment to ensure that it is appropriate to use in developing Step 2b activity and implementation plans. Since PACs and focal habitats usually transcend multiple administrative boundaries, a collaborative approach is highly recommended for Step 2a.

A series of questions tied to the management strategies described in the Introduction section follows to assist managers in developing the framework to complete Step 2b (development of activity/implementation plans). The questions that follow apply to the focal habitats (and buffer areas around focal areas where management strategies may be more effectively applied) and will help in developing coordinated implementation/activity plans. These questions should not limit the scope of the assessment and additional questions relative to local situations are encouraged. These questions portray the minimum degree of specificity for focal habitats in order for offices to complete Step 2a.

Fuels Management

1. Where are the priority fuels management areas (spatially defined treatment opportunity areas that consider fire risk, fuels conditions, and focal habitats [including areas adjacent to focal habitats])?
2. Based on fire risk to focal habitats, what types of fuels treatments should be implemented to reduce this threat (for example, linear features that can be used as anchors during suppression operations)?
3. Considering resistance/resilience concepts and the landscape context from Step 1, where should treatments be applied in and around focal habitats to:
   a. Constrain fire spread?
   b. Reduce the extent of conifer expansion?
   c. Augment future suppression efforts by creating fuel breaks or anchors for suppression?
4. Based on opportunities for fire to improve/restore focal habitats, what types of fuels treatments should be implemented to compliment managed wildfire by modifying fire behavior and effects?
5. Are there opportunities to utilize a coordinated fuels management approach across jurisdictional boundaries?
6. What fuel reduction techniques will be most effective that are within acceptable impact ranges of local sage-grouse populations, including but not limited to grazing, prescribed fire, chemical, and biological and mechanical treatments? Will combinations of these techniques improve effectiveness (e.g., using livestock to graze fine fuels in a mowed fuel break in sagebrush)?

Habitat Recovery/Restoration

1. Are there opportunities for habitat restoration treatments to protect, enhance or maintain sage-grouse focal habitat especially to restore connectivity of focal area habitat?
2. Considering the resistance and resilience GIS data layer (Figure 4) and the Sage-Grouse Habitat Matrix (Chambers et al. 2014; Table 2), where and why would passive or active restoration treatments be used?
3. What are the risks and opportunities of restoring habitat with low resistance and resilience including the warm/dry and cool/dry soil moisture/temperature regime areas?
4. Are there opportunities to utilize a coordinated approach across jurisdictional boundaries to effectively complete habitat restoration in focal habitats?

Fire Operations

1. Where are priority fire management areas (spatially defined polygons having the highest need for preparedness and suppression action)?

2. Where are the greatest wildfire risks to focal habitats considering trends in fire occurrence and fuel conditions (see Figure 10)?
3. Where do opportunities exist that could enhance or improve suppression capability in and around focal habitats?
    a) For example, increased water availability through installation of helicopter refill wells or water storage tanks.
    b) Decreased response time through pre-positioned resources or staffing remote stations.
4. Should wildfire be managed (per land use plan objectives) for improving focal habitat (e.g., reducing conifer expansion), and if so where, and under what conditions?
5. How can fire management be coordinated across jurisdictional boundaries to reduce risk or to improve focal habitats?

Post-fire Rehabilitation

1. Where are areas that are a high priority for post-fire rehabilitation to improve habitat connectivity if a wildfire occurs?
2. Which areas are more conducive (higher resistance and/or resilience) to recovery and may not need reseeding after a wildfire?
3. What opportunities to build in fire resistant fuel breaks to reduce the likelihood of future wildfires impacts on seeded or recovering areas?
4. Are there opportunities to utilize a coordinated approach across jurisdictional boundaries to implement rehabilitation practices?

The outcome of Step 2a is the assembly of the pertinent information and GIS layers to assist managers in developing implementation or activity plans to address wildfires, invasive annual grasses, and conifer expansion in focal habitats. Activity plans generally refer to plans where management of a resource is changed (livestock grazing plans) whereas implementation plans are generally associated with treatments.

Step 2b- Preparation of Activity/Implementation Plans

Activity/implementation plans are prepared to implement the appropriate management strategies within and adjacent to focal habitats. Since focal habitats cross jurisdictional boundaries, it is especially important that a collaborative approach be used to develop implementation/activity plans. The process of identifying partners and creating collaborative teams to develop these plans is a function of state, regional, and local managers and is not addressed as part of this step.

Implementation/activity plans are required to:

1. Address issues in and around focal habitats related to wildfires, invasive annual grasses, and conifer expansion

2. Use resistance to invasive annual grasses and resilience after disturbance (where appropriate) as part of the selection process for implementing management strategies
3. Emphasize application of management strategies within or near focal habitats with low resistance and resilience (warm/dry and cool/dry soil moisture/temperature regimes) invasive annual grasses and wildfires
4. Use the best available local information to inform the assessment process
5. Encourage collaboration and coordination with focal habitats across jurisdictional boundaries
6. Be adaptive to changing conditions, disturbances, and modifications of PAC boundaries

FIAT recommends considering other factors, such as adaptive management for climate change, local sagebrush mortality due to aroga moth or other pests, and cheatgrass die-off areas in developing activity/implementation plans. The latter two factors could influence where and what kind of management strategies may be needed to address the loss of habitat or changes in fuel characteristics (e.g., load and flammability) associated with these mortality events.

The following recommendations are provided to assist in the preparation of activity/implementation plans:

Fuels Management

1. Spatially delineate priority areas for fuel management treatments per Step 2a information considering:
    a. Linear fuel breaks along roads
    b. Other linear fuel breaks to create anchor points
    c. Prescribed burning which would meet objectives identified in the Fish and Wildlife Service's Conservation Objectives Team (COT) report
    d. Mechanical (e.g., treatment of conifer expansion into sagebrush communities)
    e. Other mechanical, biological, or chemical treatments
    f. If they exist, spatially delineated areas where fuel treatments would increase the ability to use fire to improve/enhance focal habitats.
2. Identify coordination needed between renewable resource, fire management, and fuels management staff to facilitate planning and implementation of fuels treatments.
3. Quantify a projected level of treatment within or near focal habitats.
    a. Identify treatments (projects) to be planned within or near focal habitats.
    b. Include a priority and proposed work plan for proposed treatments.

Habitat Recovery/Restoration

1. Spatially delineate priority areas for restoration, using criteria established in Step 2a. Priority areas for restoration should be delineated by treatment methods:
    a. Seeding priority areas
    b. Invasive annual grasses priority treatment areas (herbicide, mechanical, biological, combination)

   c. Priority areas requiring combinations of treatments (e.g., herbicide followed by seeding).
   d. Include tables, maps or appropriate info.
2. Identify coordination needed between renewable resource, fire management, and fuels management staff to facilitate planning and implementation of restoration treatments.
3. Include a priority or implementation schedule for proposed restoration treatment

Fire Operations

1. Spatially delineate priority areas for fire suppression, based upon criteria established in Step 2a. Priority areas for fire operations should be delineated by type, such as:
   a. Initial attack priority areas
   b. Resource pre-positioning and staging priority areas
2. Spatially delineate areas where opportunities exist to enhance or improve suppression capability.
3. Spatially delineate areas where wildfire can be managed to achieve land use plan and COT objectives.

Post-Fire Rehabilitation

1. Spatially delineate priority areas for post-fire rehabilitation using criteria in Step 2a.
2. Priority areas for post-fire rehabilitation should be based on resistance and resiliency and pre-fire landscape sagebrush cover and include consideration of:
   a. Seeding priority areas
   b. Invasive annual grasses priority treatment areas (herbicide, mechanical, biological (herbivory or seeding),
   c. Priority areas requiring combinations of treatments (e.g., herbicide followed by seeding)
3. Identify coordination needed between renewable resource, fire management, and fuels management staff to facilitate planning and implementation of post-fire rehabilitation treatments.

This completes the assessment process and sets the stage for more detailed project planning and NEPA associated with implementing on-the-ground treatments and management changes.

Members of the FIAT Development and Review teams are listed in Appendix 5.

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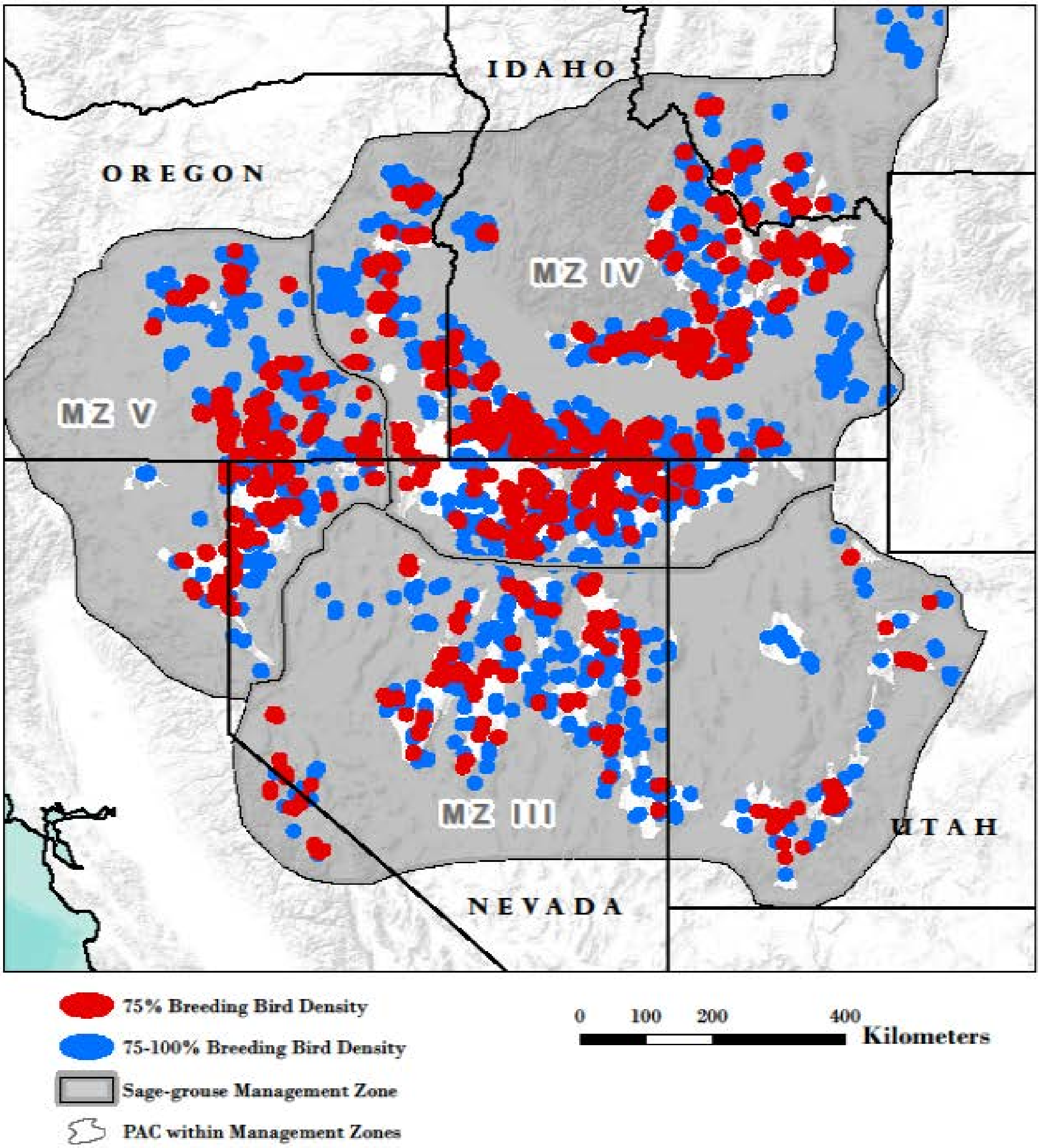
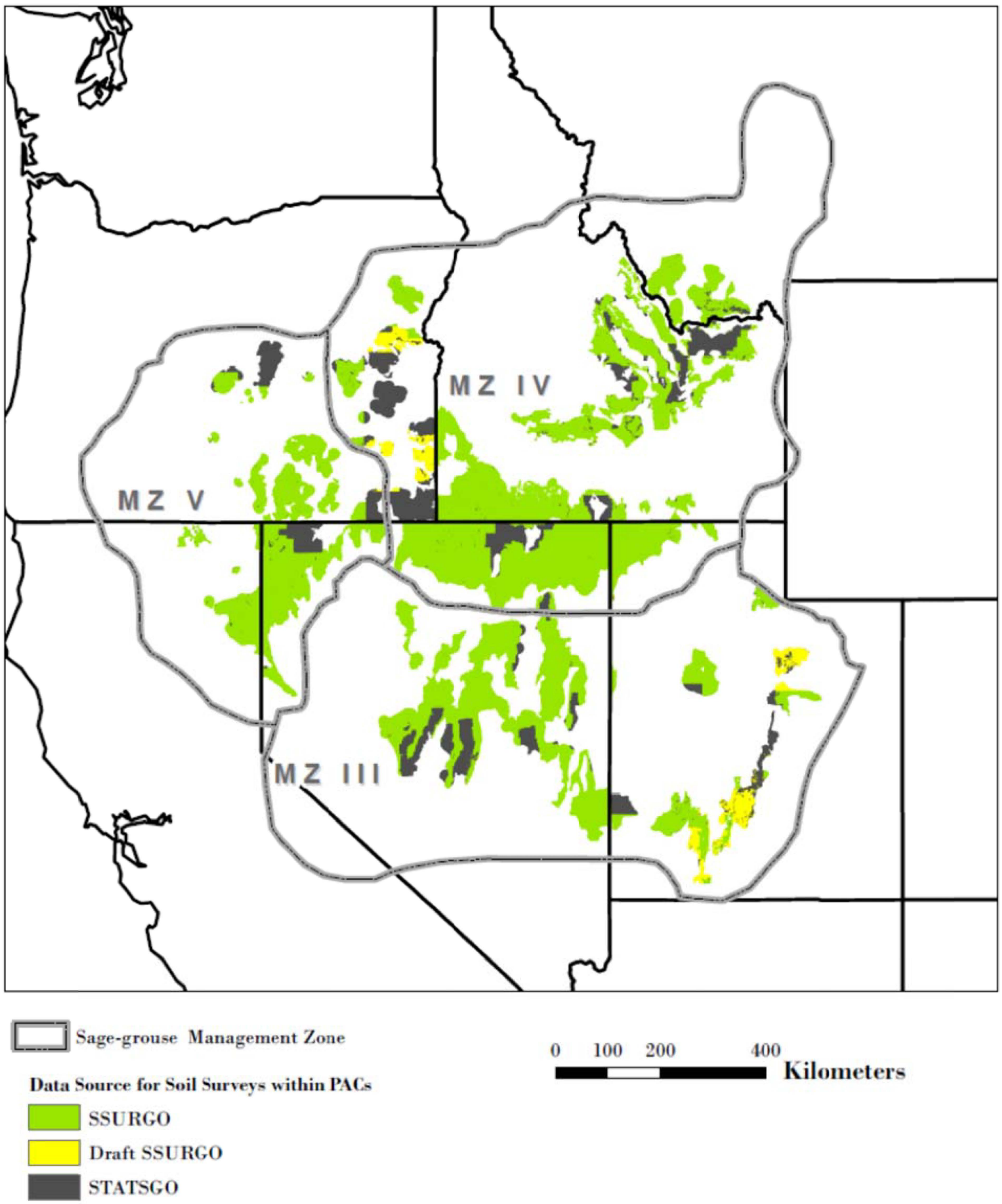
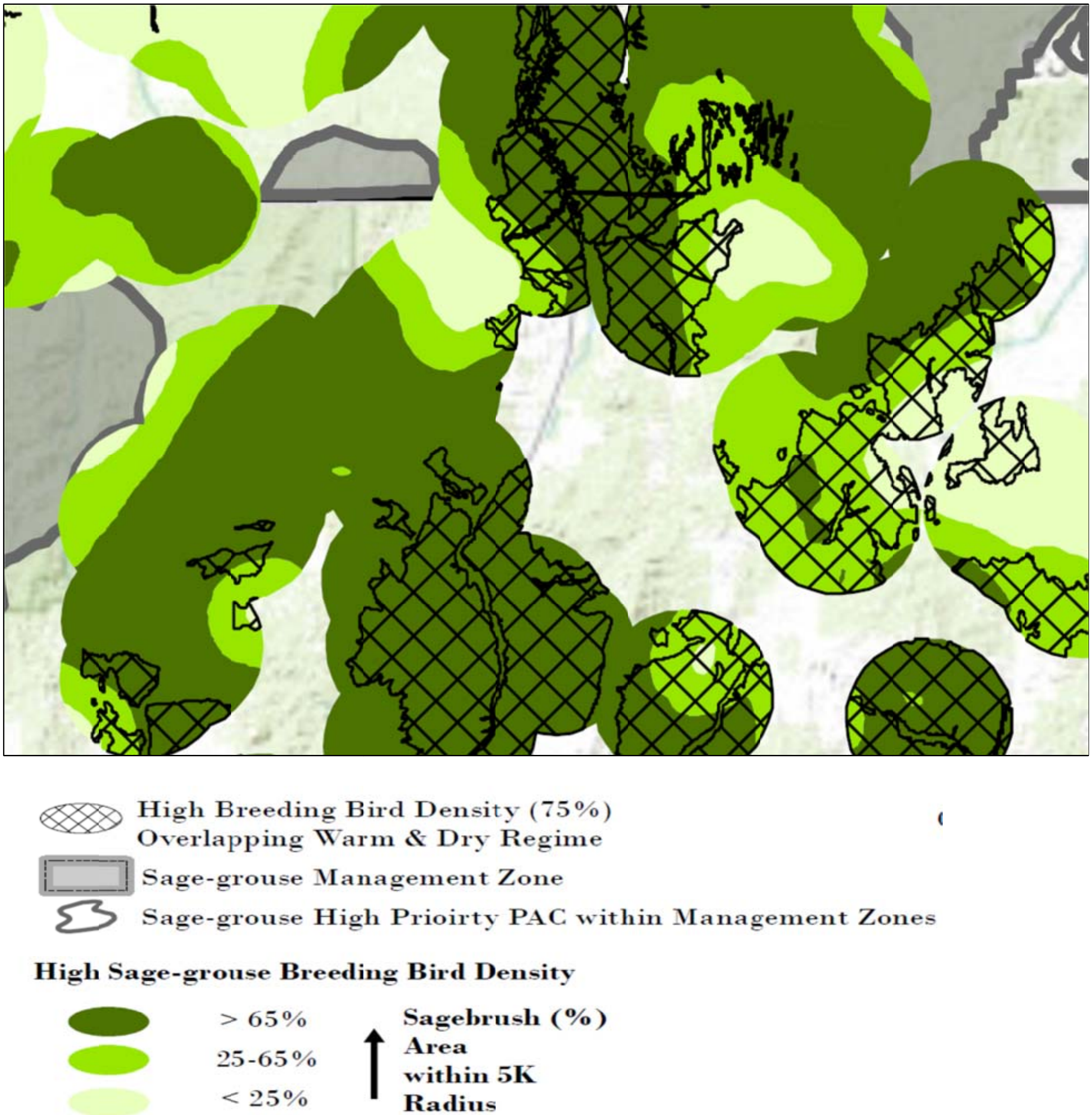
Appendix 1. Sage-grouse breeding bird density thresholds for 75% and 100% of the breeding birds, Management Zones, and PACs. Breeding bird density of 75 to 100% is included in this figure to provide context for local management units when making decisions concerning connectivity between populations and PACs.



Appendix 2. Gaps in SSURGO soil survey data in Management Zones III, IV, and V. STATSGO2 soil survey data used to fill these gaps.



Appendix 3. Example of potential management strategies applied to Wildfire/Invasive Annual Grass Scenario.

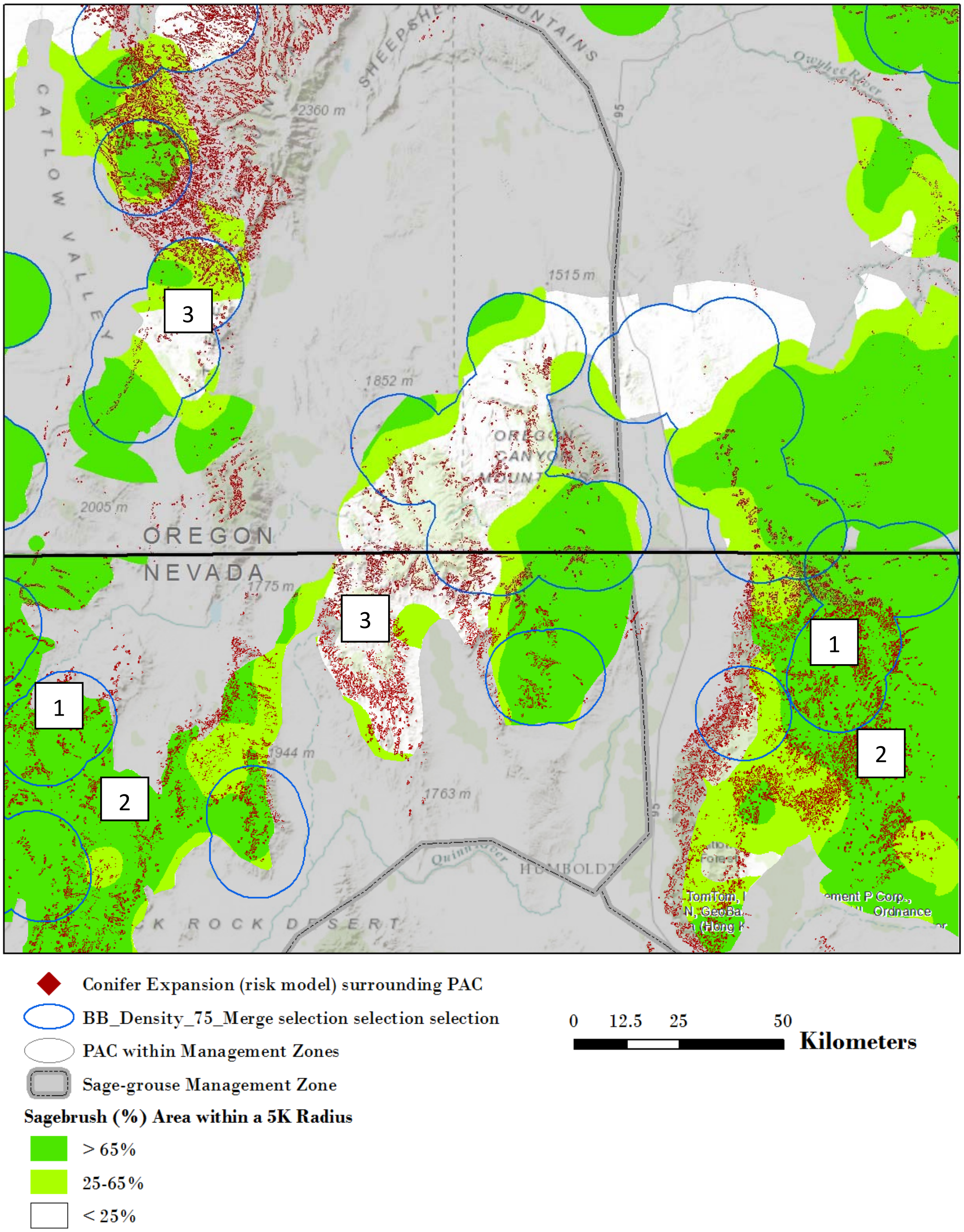


1 High priority for habitat restoration and post-fire rehabilitation to restore connectivity.

2 High priority for fire suppression within and around area given >65% sagebrush landscape cover and low resistance/resilience.

3 **High priority for fuels management to reduce likelihood of wildfires in low resistance/resilience habitat** with >65% landscape cover.

Appendix 4. Management strategy example for Western Juniper expansion.



1 High priority (emphasis area) for juniper control (>25% landscape sagebrush cover & 75% BBD)

2 Moderate priority (emphasis area) for juniper control (>25% landscape sagebrush cover)

3 Very low priority (<25% landscape sagebrush cover)

Appendix 5. Members of FIAT Development and Review Team

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Appendix I

Sage-grouse Plant List

APPENDIX I
SAGE-GROUSE PLANT LIST

Table I-1
Native Plant Species Important for Greater Sage-grouse in Oregon

Family	Common name	Latin name	Lifeform	Food or Cover
Amaranthaceae	Nuttall monolepis	*Monolepis nuttalliana*	Forb	Food
Amaranthaceae	Dwarf monolepis	*M. pusilla*	Forb	Food
Apiaceae	Biscuitroot	*Lomatium cous*	Forb	Food
Apiaceae	Donnell's desert parsely	*L. donnellii*	Forb	Food
Apiaceae	Bigseed biscuitroot	*L. macrocarpum*	Forb	Food
Apiaceae	Nineleaf biscuitroot	*L. triternatum*	Forb	Food
Asteraceae	Common yarrow	*Achillea millefolium*	Forb	Food
Asteraceae	Mountain dandelion	*Agoseris glauca*	Forb	Food
Asteraceae	Annual agroseris	*A. heterophylla*	Forb	Food
Asteraceae	Pearly everlasting	*Anaphalis margaritacea*	Forb	Food
Asteraceae	Low pussytoes	*Antennaria dimorpha*	Forb	Food
Asteraceae	Narrow-leaved pussytoes	*A. stenophylla*	Forb	Food
Asteraceae	Long-leaved aster	*Aster ascendens*	Forb	Food
Asteraceae	Hairy balsamroot	*Balsamorhiza hookeri*	Forb	Food and cover
Asteraceae	Arrowleaf balsamroot	*B. sagittata*	Forb	Food and cover
Asteraceae	Rough eyelashweed	*Blepharipappus scaber*	Forb	Food
Asteraceae	Long-leaved hawksbeard	*Crepis acuminata*	Forb	Food
Asteraceae	Slender hawksbeard	*C. atribarba*	Forb	Food
Asteraceae	Modoc hawksbeard	*C. modocensis*	Forb	Food
Asteraceae	Western hawksbeard	*C. occidentalis*	Forb	Food
Asteraceae	Hoary aster	*Dieteria canescens*	Forb	Food
Asteraceae	Foothill daisy	*Erigeron corymbosus*	Forb	Food
Asteraceae	Threadleaf fleabane	*E. filifolius*	Forb	Food
Asteraceae	Desert daisy	*E. linearis*	Forb	Food
Asteraceae	Shaggy daisy	*E. pumilus*	Forb	Food
Asteraceae	Curlycup gumweed	*Grindelia squarrosa*	Forb	Food
Asteraceae	Nodding microseris	*Microseris nutans*	Forb	Food
Asteraceae	Sagebrush false dandelion	*Nothocalais troximoides*	Forb	Food

Table I-1
Native Plant Species Important for Greater Sage-grouse in Oregon

Family	Common name	Latin name	Lifeform	Food or Cover
Boraginaceae	Leafy bluebells	*Mertensia longiflora*	Forb	Food
Boraginaceae	Sagebrush bluebells	*M. oblongifolia*	Forb	Food
Fabaceae	Threadstalk milk vetch	*Astragalus filipes*	Forb	Food
Fabaceae	Freckled milk vetch	*A. lentiginosus*	Forb	Food
Fabaceae	Arcane milk vetch	*A. obscurus*	Forb	Food
Fabaceae	Wooly pod milk vetch	*A. purshii*	Forb	Food
Fabaceae	Western prairie-clover	*Dalea ornata*	Forb	Food
Fabaceae	Velvet lupine	*Lupinus leucophyllus*	Forb	Food and Cover
Fabaceae	Rock lupine	*L. polyphyllus* var. *saxosus*	Forb	Food and cover
Fabaceae	Silky lupine	*L. sericeus*	Forb	Food and cover
Fabaceae	Big-head clover	*Trifolium macrocephalum*	Forb	Food
Liliaceae	Green-banded mariposa	*Calochortus macrocarpus*	Forb	Food
Linaceae	Western blue flax	*Linum lewisii*	Forb	Food
Malvaceae	Gooseberry-leaved globemallow	*Sphaeralcea grossularifolia*	Forb	Food and cover
Malvaceae	Scarlet globemallow	*S. munroana*	Forb	Food and cover
Orobanchaceae	Violet desert paintbrush	*Castilleja angustifolia*	Forb	Food
Orobanchaceae	Desert paintbrush	*C. chromosa*	Forb	Food
Phrymaceae	Dwarf monkeyflower	*Mimulus nanas*	Forb	Food
Plantaginaceae	Giant Blue-eyed mary	*Collinsia grandiflora*	Forb	Food
Plantaginaceae	Blue-eyed mary	*C. parviflora*	Forb	Food
Polemoniaceae	Harkness gilia	*Linanthus harknessii*	Forb	Food
Polemoniaceae	Annual phlox	*Phlox gracilis*	Forb	Food
Polemoniaceae	Longleaf phlox	*P. longifolia*	Forb	Food
Polygonaceae	Creamy buckwheat	*Eriogonum heracleoides*	Forb	Food
Polygonaceae	Round-headed desert buckwheat	*E. sphaerocephalum*	Forb	Food
Polygonaceae	Thyme buckwheat	*E. thymoides*	Forb	Food
Ranunculaceae	Sagebrush buttercup	*Ranunculus glaberrimus*	Forb	Food
Poaceae	Indian ricegrass	*Achnatherum hymenoides*	Grass	Cover
Poaceae	Thurber needlegrass	*A. thurberianum*	Grass	Cover
Poaceae	Bottlebrush squirreltail	*Elymus elymoides*	Grass	Cover
Poaceae	Slender wheatgrass	*E. trachycaulus*	Grass	Cover
Poaceae	Idaho fescue	*Festuca idahoensis*	Grass	Cover
Poaceae	Needle and thread grass	*Heterostipa comata*	Grass	Cover
Poaceae	June grass	*Koeleria micrantha*	Grass	Cover
Poaceae	Great basin wildrye	*Leymus cinereus*	Grass	Cover
Poaceae	Western wheatgrass	*Pascopyrum smithii*	Grass	Cover
Poaceae	Sandberg's bluegrass	*Poa secunda*	Grass	Cover
Poaceae	Blue bunch wheatgrass	*Pseudoroegneria spicata*	Grass	Cover
Poaceae	Hair dropseed	*Sporobolus airoides*	Grass	Cover
Poaceae	Sand dropseed	*S. cryptandrus*	Grass	Cover
Amaranthaceae	Fourwing saltbush	*Atriplex canescens*	Shrub	Cover
Amaranthaceae	Shadscale	*A. confertifolia*	Shrub	Cover
Amaranthaceae	Black greasewood	*Sarcobatus vermiculatus*	Shrub	Cover

Table I-1
Native Plant Species Important for Greater Sage-grouse in Oregon

Family	Common name	Latin name	Lifeform	Food or Cover
Asteraceae	Low sagebrush	*Artemisia arbuscula*	Shrub	Food and cover
Asteraceae	Silver sagebrush	*A. cana*	Shrub	Food and cover
Asteraceae	Black sagebrush	*A. nova*	Shrub	Food and cover
Asteraceae	Fuzzy sagebrush	*A. papposa*	Shrub	Food and cover
Asteraceae	Scabland sagebrush	*A. rigida*	Shrub	Food and Cover
Asteraceae	Basin big sagebrush	*A. tridentata* spp. *tridentata*	Shrub	Food and cover
Asteraceae	Mountain big sagebrush	*A. t.* spp. *vaseyana*	Shrub	Food and cover
Asteraceae	Wyoming big sagebrush	*A. t.* spp. *wyomingensis*	Shrub	Food and cover
Asteraceae	Threetip sagebrush	*A. tripartita*	Shrub	Food and cover
Asteraceae	Gray rabbitbrush	*Ericameria nauseosa*	Shrub	Food and cover
Asteraceae	Lanceleaf rabbitbrush	*E. viscidiflora*	Shrub	Food and cover
Rosaceae	Curl-leaf mountain mahogany	*Cercocarpus ledifolius*	Shrub	Cover
Rosaceae	Bitterbrush	*Purshia tridentata*	Shrub	Cover

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Appendix J
Adaptive Management Strategy

APPENDIX J
ADAPTIVE MANAGEMENT STRATEGY

INTRODUCTION

Adaptive management is a process that promotes flexible resource management decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps with adjusting resource management directions.

Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a trial and error process, but rather emphasizes learning while doing. It is not an end in itself, but rather a means to more effective decisions and enhanced benefits.

On February 1, 2008, the Department of the Interior published its Adaptive Management Implementation Policy (522 DM 1) and in 2009 a technical guide (Williams et al. 2009). The adaptive management strategy in this EIS complies with this policy and direction.

In relation to the BLM and Forest Service's National Greater Sage-Grouse Planning Strategy (BLM 2012), adaptive management will help identify if GRSG conservation measures in this EIS contain the needed level of certainty for effectiveness. Incorporating principles of adaptive management into the conservation measures in this plan amendment increases the likelihood that the conservation measures will be effective in reducing threats to GRSG.

The following provides the adaptive management strategy for the Oregon Subregion RMP Amendment.

ADAPTIVE MANAGEMENT OBJECTIVES

The overarching goal for this RMP amendment is to maintain or increase GRSG abundance and distribution by conserving, enhancing, or restoring the sagebrush ecosystem on which populations depend, in cooperation with other landowners and partners. This strategy has two overarching objectives:

- Habitat—Seventy percent of the landscape within each Oregon PAC[1] that is capable of supporting sagebrush has at least five percent sagebrush canopy cover[2] and less than five percent tree canopy cover. The remaining 30 percent can include areas of juniper encroachment, non-sagebrush shrubland, and grassland that should be managed to increase available habitat within GRSG range.
- Population—GRSG population trends within Oregon PACs as indicated by counts of males at lek complexes are stable or growing.[3]

Project-level effects analysis will identify an individual project's contribution toward either objective and whether a given project, as initially designed, would fail to meet either the habitat or population objective above, thus tripping an adaptive management trigger. When an individual project would trip a trigger, the project proponent should consider modifying the project to avoid tripping the trigger, dropping the project, or providing mitigation to address the trigger along with justification for why the project should proceed.

Adaptive Management Thresholds (Triggers)

Adaptive management triggers are essential for identifying when potential management changes are needed to continue meeting GRSG conservation objectives. The BLM will use soft triggers and hard triggers for specific populations and responses. These triggers are not specific to any particular project but identify habitat and population thresholds.

Soft triggers represent an intermediate threshold, indicating that management changes are needed at the implementation level to address habitat or population losses. If a soft trigger is tripped, the BLM would apply more conservative or restrictive implementation (project-level) conservation measures to mitigate for the causes of the decline of populations or habitats, with consideration of local knowledge and conditions.

These types of adjustments would be made to reduce the likelihood of tripping a hard trigger, which signals more severe habitat loss or population declines. While there should be no expectation of hitting a hard trigger, if unforeseen circumstances were to occur that trip either a habitat or population hard trigger, more restrictive management would be required.

Hard triggers represent a threshold indicating that immediate and more restrictive plan-level action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the resource management plan amendment. What follows are the adaptive management hard and soft triggers (thresholds).

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[1] Oregon Department of Fish and Wildlife, in cooperation with the SageCon Partnership, grouped the PACs within a WAFWA population initially created by the USFWS (2013a) into 20 individual units and gave each a unique name. The BLM Oregon refers to these units as Oregon PACs.

[2] While minimum sagebrush cover for productive GRSG habitat is 10 percent (Connelly et al. 2000), the vegetation and habitat management objective is based on providing sagebrush structural classes 3, 4, and 5 (Karl and Sadowski 2005; Hagen 2011). Class 3 is greater than 5 percent to 15 percent sagebrush canopy cover.

[3] For smaller Oregon PACs, the only applicable scale may be the entire PAC. For larger Oregon PACs, both scales may apply.

Habitat Trigger Thresholds

Two critical thresholds have been defined, based on GRSG response to the amount of sagebrush in the landscape (Chambers et al. 2014b), as follows:

- Soft trigger—When the area with at least 5 percent sagebrush canopy cover and less than 5 percent tree canopy cover (Baruch-Mordo et al. 2013) drops below 65 percent of the sagebrush capable area within an individual Oregon PAC but remains above 30 percent (see also **Figure 2-3**)
- Hard trigger—When the area with at least 5 percent sagebrush canopy cover and less than 5 percent tree cover drops below 30 percent of the sagebrush capable area within an individual Oregon PAC or when the area supporting at least 5 percent sagebrush canopy cover and less than 5 percent tree cover drops 5 percent or more in one year in the sagebrush capable area of an Oregon PAC (see also **Figure 2-3**)

The above percentages are based on the area within each Oregon PAC that is capable of producing a sagebrush plant community, such as big sagebrush (*Artemisia tridentata*), low sagebrush (*A. arbuscula*), silver sagebrush (*A. cana*), threetip sagebrush (*A. tripartita*), black sagebrush (*A. nova*) and stiff sagebrush (*A. rigida*) community types. Other plant community types within each Oregon PAC, such as salt desert scrub, mountain brush, aspen, marsh, and historical juniper woodland, are not included in the calculations.

Table J-1 lists the percentage of each Oregon PAC that currently supports sagebrush cover equal to or greater than 5 percent and tree cover less than 5 percent. These data were derived from two datasets developed by the Integrated Landscape Analysis Program (ILAP 2013). Current vegetation is derived from 2011/2013 Landsat Thematic Mapper data, updated with information obtained from newer, post-fire plots and imagery, including the large areas burned in 2012.

Potential vegetation types developed from state-and-transition models include burned areas, juniper encroachment, crested wheatgrass plantings, agriculture, and other vegetation types capable of supporting sagebrush but not currently suitable for GRSG.

Population Trigger Thresholds

The BLM based the population thresholds on both interannual changes and a five-year running mean in the estimated minimum number of males. It used the state-provided data on lek counts and procedures similar to what the ODFW uses to fill in missing data and to estimate the minimum number of male birds each year (see *Population Analysis Process* for a detailed description).

Although the ODFW has GRSG population estimates as far back as the 1940s (Hagen 2011, p. 18), only a small number of leks were monitored prior to the 1980s. Monitored leks did not exceed 100 until the 1990s and now approach 300 leks or lek complexes per year. By the mid-1990s, the ODFW considered the data robust enough to calculate five-year running means. Data quantity and quality are sufficient to calculate this for most Oregon PACs, although data remain limited for a small number of Oregon PACs. Available data for the Burns PAC is too sparse to draw any conclusions about current populations or population trends. The Louse Canyon and Trout Creeks PACs do not have enough data to develop five-year running means, requiring that the BLM use only a limited level of interannual change to assess population status. As a result, the BLM developed a special hard trigger based on annual population trends for these two PACs.

Table J-1
Acres and Percent of Existing and Potential Sage-grouse Habitat in Oregon PACs as of 2014

Oregon PAC	Existing Habitat Acres			Potential Habitat Acres			Total Habitat Acres	Total PAC Acres
	BLM	Other	Percent	BLM	Other	Percent		
12 Mile	113,751	220,890	83.2	25,643	41,866	16.8	402,149	431,001
Baker	89,980	153,279	75.9	20,807	56,627	24.1	320,693	336,539
Beatys	496,470	262,261	93.2	24,944	30,228	6.8	813,903	840,792
Brothers/N Wagontire	164,003	71,370	86.5	18,463	18,382	13.5	272,218	293,461
Bully Creek	145,164	48,232	73.1	51,895	19,281	26.9	264,571	279,854
Burns	13,440	8,684	68.4	6,621	3,619	31.6	32,364	35,769
Cow Lakes	115,916	33,176	62.1	67,007	24,057	37.9	240,156	249,732
Cow Valley	71,242	229,366	83.2	16,003	44,823	16.8	361,433	368,615
Crowley	314,003	82,832	81.7	68,787	20,107	18.3	485,730	491,050
Drewsey	146,114	103,072	74.4	43,038	42,677	25.6	334,901	368,707
Dry Valley/ Jack Mtn.	323,954	11,111	75.1	102,374	8,737	24.9	446,175	449,389
Folly Farm/ Saddle Butte	129,440	29,802	68.5	58,442	14,696	31.5	232,381	251,558
Louse Canyon	475,389	28,097	71.4	192,900	8,930	28.6	705,317	707,150
Picture Rock	28,084	3,416	84.7	4,828	870	15.3	37,199	42,592
Pueblos/ S Steens	126,359	53,502	87.5	15,844	9,844	12.5	205,549	208,793
Soldier Creek	166,261	46,270	73.5	59,775	16,667	26.5	288,973	295,424
Steens	80,322	26,415	64.3	53,004	6,323	35.7	166,064	185,730
Trout Creeks	195,719	17,428	62.1	120,114	10,052	37.9	343,312	358,167
Tucker Hill	14,985	12,229	89.5	1,027	2,159	10.5	30,401	31,531
Warners	199,202	54,354	80.4	42,391	19,568	19.6	315,515	330,088
Total	**3,409,798**	**1,495,787**	**77.9**	**993,906**	**399,513**	**22.1**	**6,299,004**	**6,555,941**

Source: ILAP 2013

The hard and soft trigger thresholds calculated using data through 2014 will remain fixed for a minimum of five years. After that, the BLM, ODFW, and USFWS will evaluate whether these values should be recalculated and new thresholds established. Establishing new thresholds may require a plan amendment.

Based on observed fluctuations in both annual population and the five-year running mean of population (**Figure J-1**), the following soft and hard triggers have been defined:

- Soft trigger (all PACs)
  - Annual population drops by 40 percent or greater in a single year OR
  - Annual population drops by 10 percent or greater for three consecutive years OR

  - The five-year running mean population drops below the lower 95 percent confidence interval value
- Hard trigger
  - For PACs with adequate population data, the five-year running mean population drops below the lower standard deviation value
  - For PACs with inadequate population data (Louse Canyon and Trout Creeks), the annual population declines by a total of 60 percent or more over two consecutive years
  - When soft triggers for both population and habitat are met within the same PAC

For the five-year running mean criteria, the population trigger would be tripped the first year the mean dropped below the identified threshold. Generally, the trigger response area would be the seasonal habitat and use locations within four miles of the lek or lek complex specifically affected or the entire Oregon PAC, depending on the size and the percentage of the PAC affected. However, the response area, with the exception of the immediate hard trigger responses, could include the GHMA linking the affected Oregon PAC to the nearest unaffected Oregon PAC, as needed.

MONITORING

Monitoring is essential to adaptive management, both to identify when a trigger has been tripped and whether management actions taken, including adaptive responses, are effective. This ARMPA/EIS contains a monitoring framework plan (**AppendixD**, Greater Sage-Grouse Monitoring Framework), that includes an effectiveness monitoring component.

To determine when a soft or hard trigger for habitat has been reached, the BLM intends to use the data collected from the effectiveness monitoring to identify any changes in habitat conditions related to the goals and objectives of the plan and other range-wide conservation strategies (US DOI 2004; Stiver et al. 2006; USFWS 2013a). The BLM intends to use the remotely sensed data collected from the effectiveness monitoring at the mid-scale (Oregon PAC), supplemented with local data where needed and available at the lek-scale to identify when a soft or hard trigger for habitat has been reached. The BLM will make its determination concerning habitat in the fall, after the wildfire season ends.

To determine when a soft or hard trigger for population has been reached, the BLM will rely on population data collected by the ODFW; it is responsible for monitoring GRSG populations and typically finalizes population estimates in the fall. Then the BLM, in conjunction with the ODFW, will calculate the latest five-year running mean of population and the degree of population change for each Oregon PAC; after that, the BLM will evaluate whether population changes and the five-year running mean reach a soft or hard trigger.

The hard and soft trigger data will be analyzed as soon as it becomes available after the ROD is signed and then, at a minimum, annually thereafter.

The State of Oregon is not developing as adaptive management strategy and has no plans to do so.

Adaptive Management Responses

Ensuring meaningful adaptive responses to a soft or hard trigger for an individual Oregon PAC requires that the BLM conduct a cause analysis. This may take three to six months to complete (see discussion under *Soft Trigger Responses* and *Hard Trigger Responses*, below). While the cause analysis is underway, the BLM will consider whether certain actions should proceed as planned on a case-by-case basis to limit further loss of GRSG habitat or populations. Types of actions the BLM could evaluate or consider applying in or near the affected Oregon PAC during the analysis include the following:

- Halting or delaying planned broadcast burning
- Increasing fire prevention patrols and messages
- Increasing fire prevention inspections of motorized equipment
- Prohibiting open campfires outside of established fire pits and outside of stoves in designated recreation areas
- Halting or delaying planned vegetation treatments that reduce sagebrush canopy cover
- Increasing inspections to ensure BMPs for limiting the spread of invasive plants are followed on construction projects
- Increasing surveys to detect and treat new infestations of invasive plants, especially invasive annual grasses
- Delaying any planned vegetation treatments until after the breeding and early brood-rearing period
- Halting or delaying planned fuels treatments in GRSG winter range
- Delaying issuance of new authorizations for minerals and energy development, including geothermal exploration
- Delaying issuance of permits for mineral material disposal
- Installing anti-perching devices on tall structures
- Installing bird flight diverters on guy wires and fences
- Delaying issuance of new or pending ROWs outside of existing designated corridors or where not collocated within previously authorized ROWs, including Federal Highway Act authorizations
- Delaying authorizations of new tall structures outside of designated corridors
- Adjusting grazing practices to ensure retention of adequate residual plant cover and diversity in the understory
- Delaying planned construction of new recreation facilities (e.g., kiosks, toilets, and signs) within two miles of occupied or pending leks
- Increasing litter patrols in and around heavily used recreation areas
- Increasing educational contacts with visitors concerning the role of litter and garbage in attracting GRSG predators
- Increasing enforcement efforts on travel restrictions

The BLM Authorizing Officer will provide formal documentation for the record on what measures or actions were taken during the cause analysis period.

Soft Trigger Responses

A key part of adaptive management is to identify the potential causes of the observed change in order to develop potential adaptive responses. For this adaptive management strategy, a cause is most likely tied to a threat that the USFWS (2010) identified in its listing determination. While one or more causes can be linked to a habitat or population decline, this does not assume a cause-and-effect relationship. Many factors has been suggested as affecting GRSG populations and habitats throughout the species' range. These factors can interact in many complex relationships that can be difficult to tease apart. It can be difficult to separate proximate factors from ultimate factors leading to population declines.

On determining that a soft trigger has been reached, the BLM will convene an adaptive management working team at the district level. It will consist of local experts for the affected resource programs and field personnel from local ODFW and USFWS offices to conduct the cause analysis. This team will convene as soon as possible, but within one month of determining that a soft trigger has been reached.

Subject to the provisions of Federal Advisory Committee Act, the team may contact potentially affected stakeholders for suggestions and comments on potential adaptive responses. They will develop a list of recommended actions as soon as possible, but no later than within three months of convening. The selected responses will be formally documented as a BLM District Office memorandum. Additional project-level NEPA analyses may be required to implement some responses, such as a temporary closure. Soft trigger adaptive responses may consist of the following actions:

- Prioritizing the affected Oregon PAC for restoration treatments, construction or maintenance of fuel breaks, mapping vegetation in high resolution to inform project planning, closing and rehabilitating unauthorized roads, installing bird flight diverters on fences, assessing rangeland health, modifying new and existing water projects to reduce West Nile virus risks, or establishing wild horse and burro gathers
- Providing additional guidance for the types and timing of vegetation treatments
- Providing additional guidance on the location and design of fuel breaks
- Reevaluating seed mixes and native seed sources for post-fire restoration work
- Cancelling planned recreational site improvements or developments or vegetation treatments
- Reevaluating the location or design of recreational improvements or new developments (may require additional NEPA analysis)
- Allowing only those special recreation permits in PHMA that have neutral or beneficial effects on PHMA (43 CFR, Part 2031.3)
- Modifying seasons of use, location of use, or activities allowed in a SRMA located within the affected Oregon PAC (43 CFR, Part 8364.1
- Moving wild horses and burros to other areas within the applicable herd management area
- Disallowing any exceptions to the NSO requirement

- Temporarily closing areas to certain uses, such as OHV travel, mineral and energy development, geothermal exploration, and mineral materials disposal, up to 24 months (requires a *Federal Register* notice and additional analysis under NEPA [43 CFR, Parts 8364.1 and 8341.2)
- Applying new travel restrictions (requires a *Federal Register* notice and additional NEPA analysis under
- Developing alternative right-of-way routes that avoid the affected Oregon PAC for new requests

The BLM may also choose to conduct certain actions while the cause analysis is underway, such as increased fire prevention and litter patrols, educational efforts, and enforcement of existing regulations, permit stipulations, and laws.

Hard Trigger Responses

As noted above, hard triggers represent a threshold indicating that immediate and more restrictive action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the resource management plan amendment. Once the BLM, in consultation with USFWS and ODFW, has determined that a hard trigger has been reached, it will immediately implement the responses below within the affected Oregon PAC. These responses consist of more restrictive conservation actions from one or more other alternatives analyzed in the FEIS (the applicable action from another alternative is identified in parentheses).

- Do not use prescribed fire to treat sagebrush in less than 12-inch precipitation zones. As a last resort and after all other treatment options have been explored and as site-specific variables allow, consider using prescribed fire for fuel breaks in stands where annual grass is a very minor component in the understory (Action B-WFM 1).
- Do not conduct mechanical sagebrush treatments in known GRSG winter habitat (Action E-VG 15).
- Limit broadcast burning of juniper-invaded sagebrush to no more than 160 acres per treatment block in PHMA (Action E-VG 26).
- Issue no new geophysical exploration permits in PHMA (Action C-MLS 8).
- Make PHMA exclusion areas for new ROW authorizations (Action B-LR 1).
- Restrict OHV use to areas greater than 2 miles from leks during the breeding season (March 1 through June 30) (Action E-TM 1; 43 CFR, Parts 8364.1 and 8341.2).
- When reseeding closed roads, primitive roads, and trails, use appropriate native seed mixes and require use of transplanted sagebrush (Action F-TM 6).
- Prohibit new road construction within 4 miles of active GRSG leks, subject to valid existing rights and to protect human health and safety (Action F-TM 2; 43 CFR 8364.1).
- Prohibit construction of recreational facilities (e.g., kiosks, toilets, and signs) within 2 miles of leks (Action E-RC 8).

After the immediate hard trigger response is put in place, the BLM State Director will convene a statewide adaptive management working team at the consisting of experts for the affected resource programs and personnel from ODFW and USFWS offices. This team will convene as soon as possible, but within one month of determining that a hard trigger has been reached.

Subject to the provisions of FACA, the team will also contact potentially affected stakeholders for suggestions and comments on potential additional responses. The team will develop recommendations for additional responses as soon as possible, but no later than within six months of convening.

If the ultimate cause cannot be determined, the adaptive response would be based on the proximate causes. If the final recommendations include any additional adaptive management responses beyond those in the list above, the BLM State Director would issue a memorandum listing these additional responses and would identify which responses require a plan amendment or additional plan-level analysis under NEPA. For example, an additional hard trigger response may be permanent closure to a particular use within the affected Oregon PAC.

Responses may include continuation of certain actions taken while the cause analysis is underway, such as increased fire prevention and litter patrols, as well as site-specific project-level responses typically associated with soft triggers; an example of this is providing additional guidance on the types and timing of vegetation treatments.

When a hard trigger is hit in the Beatys, Trout Creeks, Louse Canyon, Soldier Creek, or Cow Lakes Oregon PACs (BSU; see **Figure 2-3**), the WAFWA Management Zone Greater Sage-Grouse Conservation Team will convene to determine the cause, will put project-level responses in place, as appropriate, and will discuss further appropriate actions to be applied. The team will also investigate the status of the hard triggers in adjoining BSUs in other states and will invoke the appropriate plan response.

Exception to Hard Trigger Response

When the cause for a hard trigger is wildfire or insect outbreak, more restrictive allocations or management actions will be implemented (see bulleted list above) within the affected Oregon PAC. However, pending and new authorizations could continue within the affected Oregon PAC if the disturbance cap has not been reached and one of the following occurs:

- As designed, the project would have no direct or indirect impact on the GRSG population or habitat
- The project has been modified so that it would not have direct or indirect impacts on the GRSG population or habitat

Developing Responses

Adaptive Management Working Team

On determining that a hard trigger has been reached, and in addition to the hard trigger response that is put in place, the BLM will convene the statewide adaptive management working team. This team will help the BLM identify the cause that may have tripped the adaptive management trigger and will recommend adaptive responses to the appropriate BLM Authorized Officer (decision-maker).

Team members will consist of, at minimum, a wildlife biologist, a fuels specialist, a weed coordinator or botanist, and a range management specialist from the BLM and representatives at the state or regional level from the USFWS and ODFW. Other specialists will be added depending on the nature of the hard trigger and the probable ultimate causes.

Adaptive management requires stakeholder involvement as well as agency involvement in order to succeed. The adaptive management working team will contact representatives from other federal agencies, research, environmental groups, producer groups, user groups, tribes, and local government as needed for suggestions and comments on potential final responses. The provisions under FACA may apply to input from nongovernmental organizations.

The BLM would develop a new adaptive response through a plan amendment or site specific NEPA as appropriate, based on the new information, to protect GRSG and its habitat and to ensure that conservation options are not foreclosed. This would be the case if new scientific information were to become available, demonstrating that one or more of the immediate hard trigger responses would be insufficient to stop the severe degradation. This would initiate recovery toward the GRSG conservation objectives set forth in the resource management plans. As a result, after a cause analysis is complete, implementing additional hard trigger responses could take one year or longer to complete the necessary environmental analysis or analyses.

Causal Factor Analysis

Identifying the ultimate cause of crossing a threshold and appropriate responses requires answering a series of questions, usually about the proximate cause, since that is often more easily observed. These questions should examine the factors supporting the proximate cause in order to better identify whether a portion of the resource management plan failed and which part and whether an adjustment is needed. For example, a large wildfire is a likely proximate cause for tripping both a habitat and population trigger. However, the plan includes several objectives, actions, and RDFs in the vegetation and wildland fire sections intended to reduce or minimize the potential to trigger an adaptive management response.

The review should examine the relevant plan direction and answer a series of questions, such as the following:

- Had all or some of the plan direction been implemented in the affected area?
- Did the plan direction perform as intended?
- Did the conditions associated with the event or activity exceed the design standards?
- What role did factors and events outside the affected area play in the event or activity outcomes?
- Did the event or outcome arise from the interaction of more than one potentialcausal factor?

Determining the appropriate adaptive response also requires asking a series of questions, such as the following:

- What is the magnitude of the impact?

- Is the impact temporary or permanent?
- Can habitat or population recover on its own without intervention?
- What is the expected length of the recovery period?
- Can the management actions already included in the plan accelerate recovery or are different actions necessary?

LONGEVITY OF RESPONSES

All immediate hard trigger responses will remain in place until a plan amendment is completed to remove them or when one of the following relevant conditions is met:

- If the hard trigger tripped was for habitat, the immediate hard trigger responses can be removed when 70 percent of the affected Oregon PAC capable of supporting sagebrush has at least 5 percent sagebrush canopy cover and less than 5 percent tree canopy cover, exclusive of retained old juniper (see vegetation management objectives and actions for details on retention of old juniper).
- If the hard trigger tripped was for population and the affected Oregon PAC has adequate population data (see the *Population Trigger Development Process* for which PACs have adequate data), the immediate hard trigger responses can be removed when the five-year running mean for population rises above the lower 95th percentile confidence interval value and is on an upward trend.
- If the hard trigger tripped was for population and the affected Oregon PAC did not have adequate population data, additional criteria apply. Once the criteria below are met, the immediate hard trigger responses can be removed if the five-year running mean for population is above or rises above the lower 95th percentile confidence interval value and is on an upward trend.
  - A minimum of 12 years of population data are available
  - At least one lek/lek complex has been monitored for the full 12 years
  - A five-year running mean and 95th percentile confidence interval have been calculated
- If the hard triggers for both habitat and population were tripped, then the immediate hard trigger responses can be removed once both the habitat and population criteria above are met.

Removal of the immediate hard trigger responses returns management direction in the affected Oregon PAC to the plan decisions that are in force within those Oregon PACs that have not tripped a hard trigger.

Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers

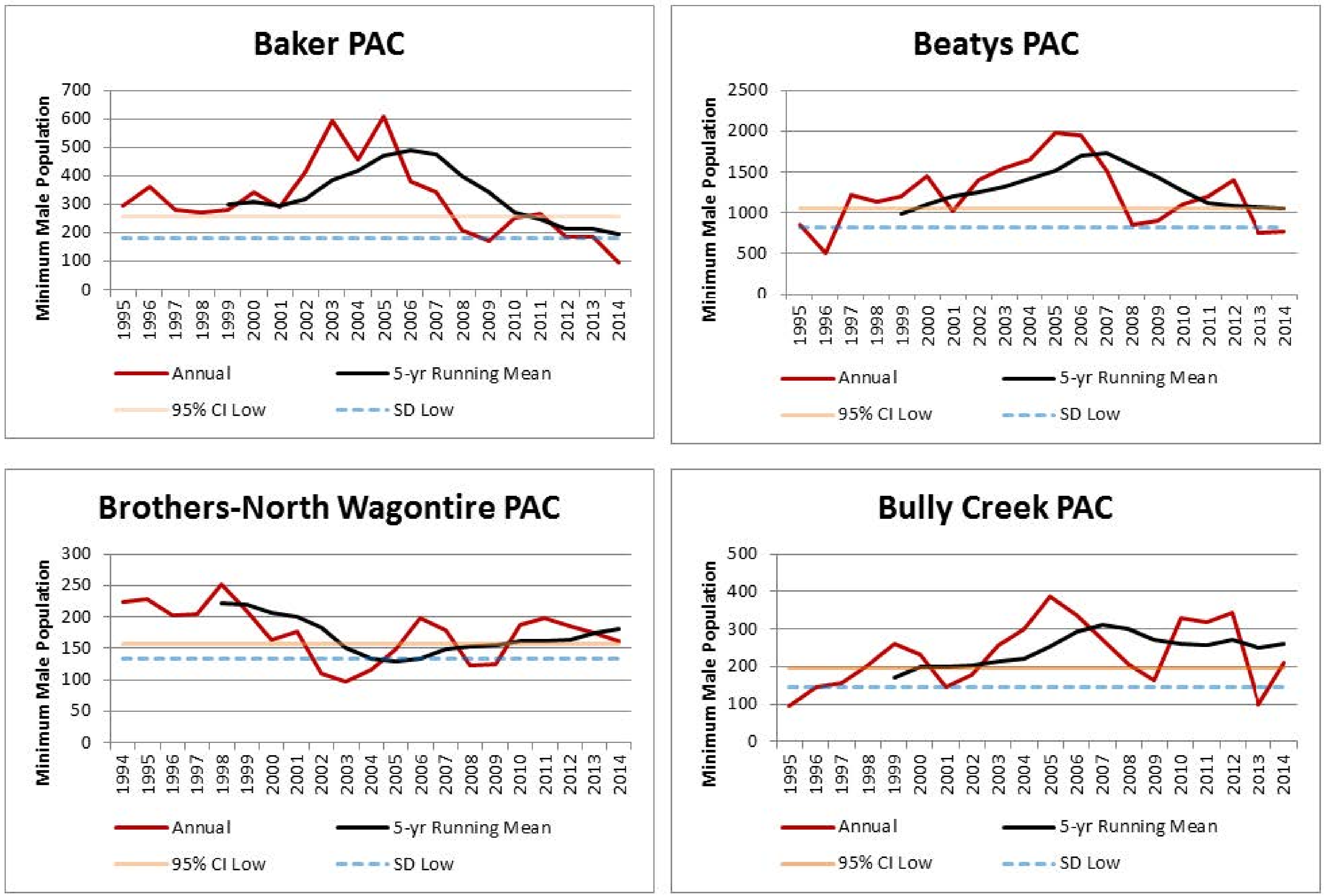


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*

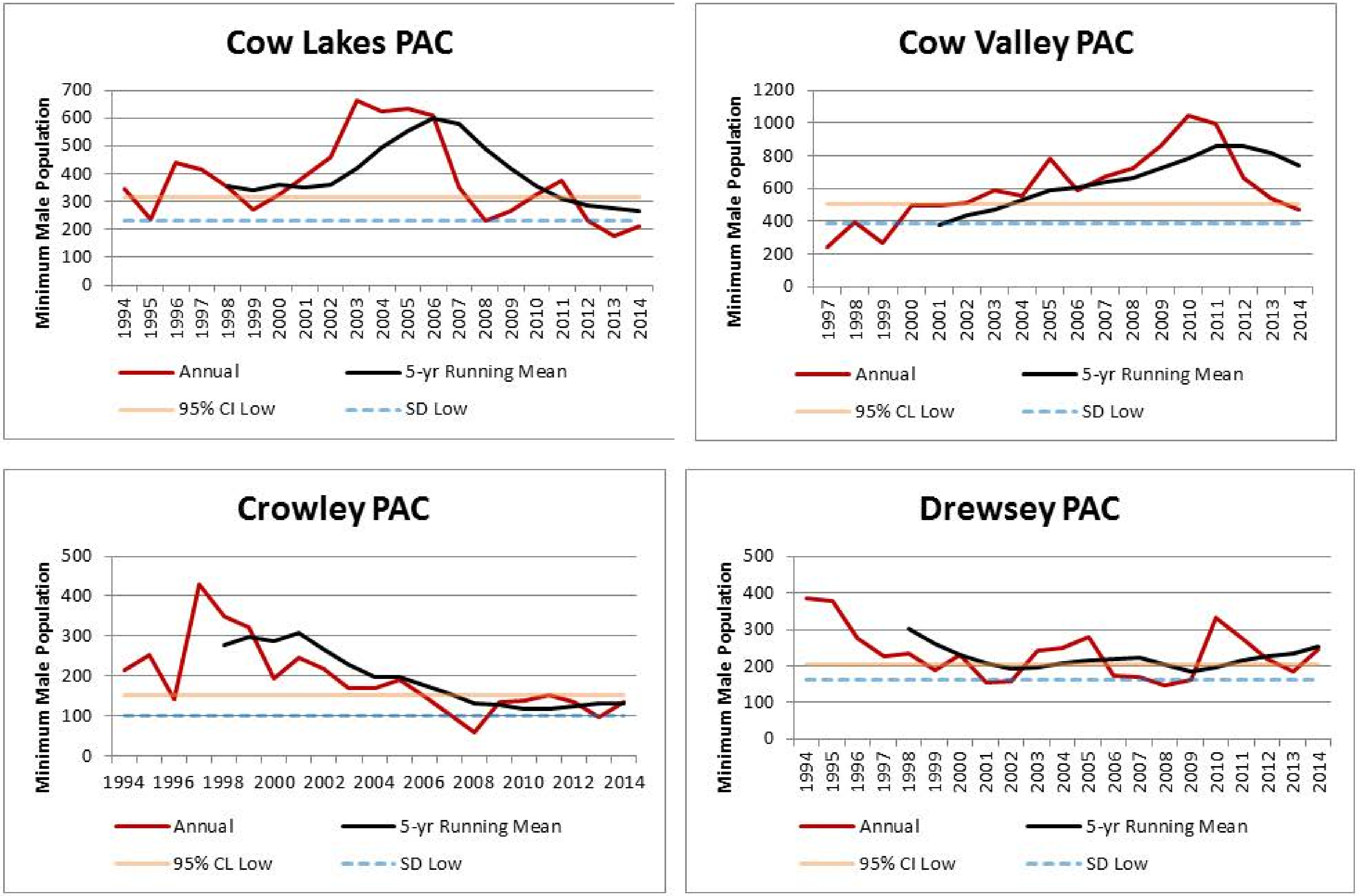


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*

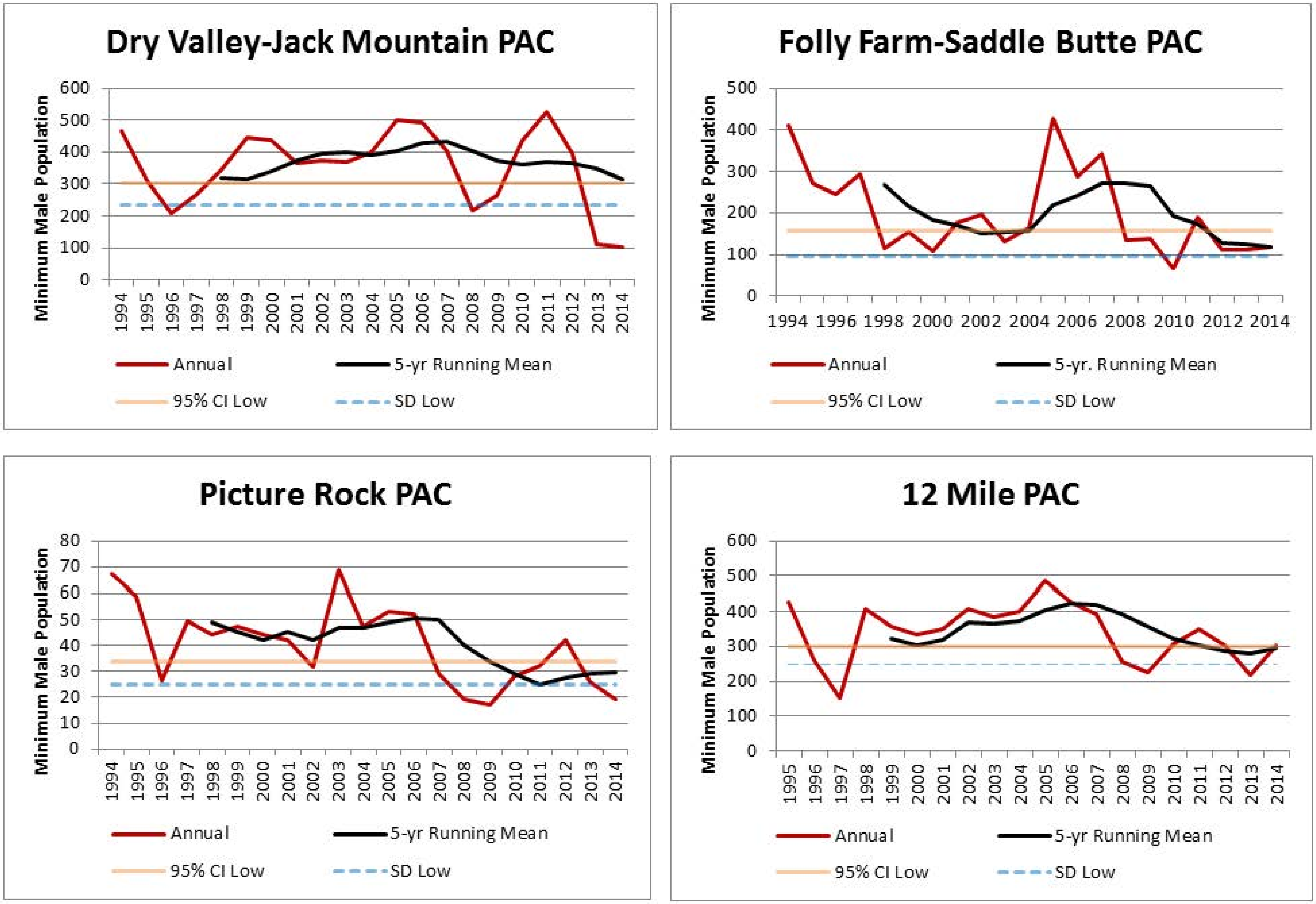


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*

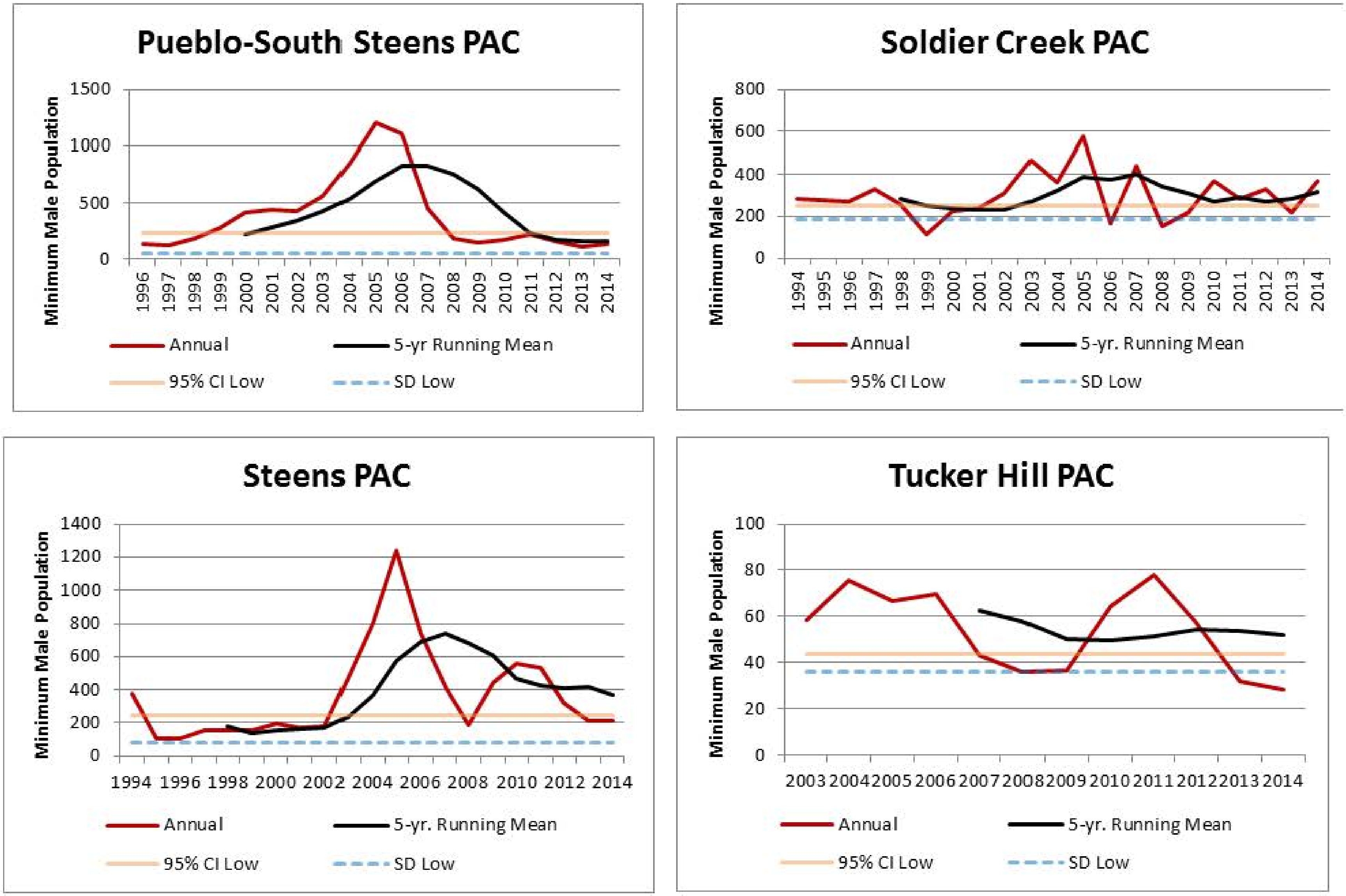
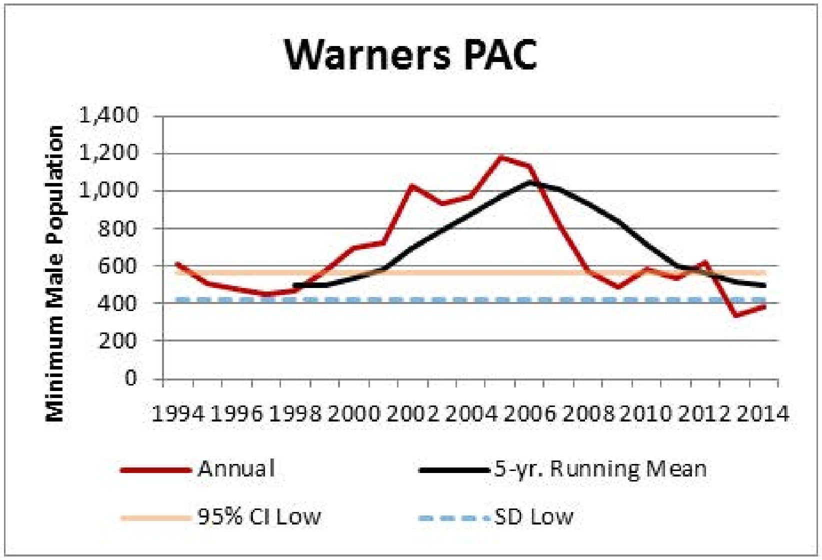
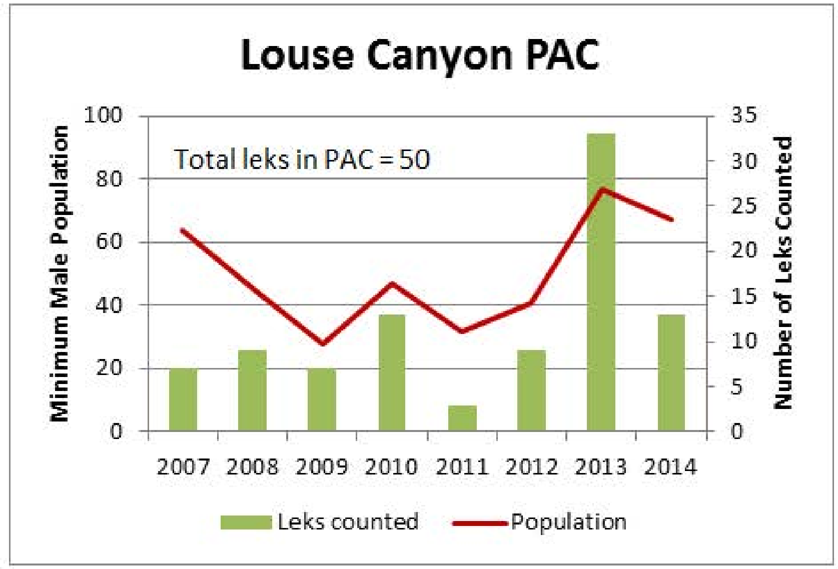
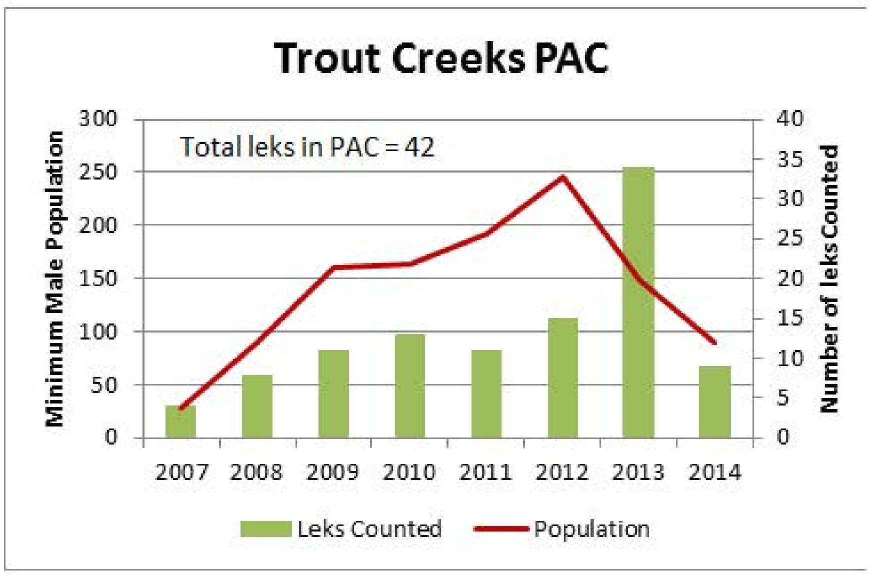


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*







Habitat Trigger Development Process

Understanding that there are natural minor fluctuations in sagebrush cover, its percent cover in the landscape serves as an indicator for GRSG habitat quality (Karl and Sadowski 2005; Hagen 2011). Short-term losses of sagebrush due to such factors as fire or insect defoliation are to be expected, recognizing that recovery rates vary considerably between the type and scale of disturbance and the specific ecological sites involved. However, sagebrush landscape cover of less than or equal to 25 percent has a low probability of maintaining GRSG leks, while greater than 65 percent sagebrush landscape cover has a high probability of sustaining GRSG populations (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013; Chambers et al. 2014b).

The BLM developed habitat objectives for the plan based on the scientific information cited above (see **Tables 2-2** and **2-3**). The soft trigger indicates the level of landscape sagebrush cover that still provides some use by GRSG but does not meet the level of cover indicated by scientific studies and recommended by the NTT report to sustain GRSG populations. The hard trigger indicates the level of landscape sagebrush cover that does not provide sufficient habitat to sustain GRSG populations over the long term.

Population Trigger Development Process

In order to set adaptive management soft and hard triggers for GRSG populations, the BLM analyzed male GRSG population data provided by the ODFW in spreadsheets. The state uses counts of males at leks to estimate populations of both males and females (see Hagen 2011, Section III, for details on state methods for estimating population based on lek counts). The data provided assigned leks and lek complexes to individual PACs as well as the statewide data.

The initial data consisted of survey results conducted as far back as 1980. However, because the survey effort was much less, involving far fewer leks, and survey effort increased beginning in the mid-1990s, the BLM discarded data prior to the mid-1990s. This resulted in approximately 20 years of data for most PACs and on a statewide basis.

The State of Oregon does not survey every lek every year due to limited resources and accessibility problems. The lack of roads in the largest PACs along Oregon's southern border with Nevada as well as the sheer distance limits the State's ability to survey these areas in particular. Years with high snowpack or wet conditions during the mating period often limit the State's ability to reach more remote leks; as a consequence, data are sparse, particularly for smaller and more remote PACs. Before analyzing population trends, the BLM used a similar process to what the State uses to fill in missing data, projecting forward and backward from actual counts.

For this analysis, the BLM defined a trend lek as one with no more than one year of missing data over the analysis period and identified trend leks for each PAC. This definition differs from the definition used by the ODFW for a trend lek (Hagen 2011, p. 14).

The: Burns, Louse Canyon, and Trout Creeks PACs did not have any leks that met the BLM definition. The BLM did not conduct a population analysis or establish PAC-specific soft and hard population triggers for these PACs. Ten PACs had usable population data back to 1994 (21 years), four had usable data back to 1995 (20 years), the Pueblos-South Steens PAC had usable data back to 1996 (19 years), the Cow Valley PAC had population data back to 1997 (18 years), and the Tucker Hill PAC had usable data back to 2003 (12 years).

To fill in missing data and allow population levels to fluctuate over time, the BLM summed the observations for all trend leks in each PAC and calculated the interannual rate of change (lambda) for each PAC by dividing the total for the current year by the total for the previous year. The BLM assumed that population change for the PAC as a whole followed the same pattern as in the trend leks. Rates of change varied between 0 and 3 using this method. A lambda of less than one indicated a population decline, while a lambda greater than one indicated a population increase.

When there were one or more observations, the BLM projected backward by dividing the observation in the source cell by the lambda associated with the source cell year and projected forward by multiplying the observation in the source cell by the lambda associated with the destination cell year. For example, to project backward in 2000 from an observation in 2001, the BLM divided the observation in 2001 by the lambda for 2001; to project forward to 2002, the BLM multiplied the observation in 2001 by the lambda for 2002.

Where two numbers (excluding zero) bracketed a period of no surveys, the BLM projected half the years backward and half the years forward.

Where a positive number and zero bracketed a period of no surveys, the BLM projected backward or forward from the positive number to the year with a zero. the BLM could not make projections when the observation was zero males because multiplying by zero yields zero and dividing by zero is mathematically undefined. Thus, population estimates over time remain incomplete both statewide and in all PACs analyzed.

To deal with this remaining data gap, the BLM followed a procedure used by the ODFW for estimating total male GRSG population. The BLM calculated the average male population over the most recent eight years and grouped leks and lek complexes based on estimated annual lek population size. Using ODFW definitions, the BLM created between two and five strata per PAC, as follows:

- Inactive—average male population = 0
- Small—average male population = 0.01-10
- Medium—average male population = 11-25
- Large—average male population = 26-50
- Extra large—average male population = 51+

The BLM estimated the annual population for each stratum by averaging the population estimate in each year and multiplying that average by the number of leks and lek complexes in that stratum. The BLM often did not estimate stratum population for inactive leks because all values were either "not surveyed" or zero. However, it did include the inactive stratum for PACs where the population earlier than the most recent eight years was largely positive. Most PACs had some leks or lek complexes where no surveys had occurred over the analysis period; these were not included in the estimate.

The BLM then summed the strata population estimate for each year. Both the BLM and ODFW consider the resulting estimate to be a minimum male population estimate.

To set the soft and hard triggers for population, the BLM estimated the average population over the analysis period for each PAC and calculated the standard deviation, the 95 percent confidence interval of the average, and five-year running mean. The five-year running mean equals the average of the current year plus the previous four years.

The BLM used large drops in the annual population estimate as soft trigger criteria and the five-year running mean population estimates in relation to the lower 95 percent confidence interval and the lower standard deviation values for both soft and hard trigger criteria.

The BLM established all triggers in consultation with the ODFW and USFWS. The State GRSG management strategy (Hagen 2011, p. 35) was to use a greater than 7 percent decline for three consecutive years in the state-wide five-year running mean. The BLM used 10 percent since greater fluctuation in estimated populations should be expected at the smaller scale. At the state-wide scale, decreases in some PACs are often partially offset by increases in other PACs.

PAC Name	Number of Leks/Lek Complexes	Number of Trend Leks	Effective Period of Record	Average Minimum Male Population	Lower 95th Percentile Confidence Interval Value	Lower Standard Deviation Value
Baker	36	3	1995-2014	313	256	182
Beatys	74	2	1995-2014	1221	1048	825
Brothers/North Wagontire	19	9	1994-2014	174	156	132
Bully Creek	30	2	1995-2014	232	195	147
Burns	2	0	N/A	N/A	N/A	N/A
Cow Lakes	40	2	1994-2014	377	314	230
Cow Valley	38	2	1997-2014	606	506	388
Crowley	33	3	1994-2014	190	152	101
Drewsey	22	2	1994-2014	234	204	164
Dry Valley/Jack Mountain	20	6	1994-2014	354	302	233
Folly Farm/ Saddle Butte	17	1	1994-2014	200	156	97
Louse Canyon	50	0	2007-2014	N/A	N/A	N/A
12 Mile	36	1	1995-2014	337	300	252
Picture Rock	5	2	1994-2014	40	34	25
Pueblos/South Steens	20	2	1996-2014	386	237	54
Solider Creek	30	4	1994-2014	298	251	188
Steens	10	3	1994-2014	368	246	82
Trout Creeks	42	0	2007-2014	N/A	N/A	N/A
Tucker Hill	5	1	2003-2014	54	44	36
Warners	46	4	1994-2014	672	566	424

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Appendix K

Biological Assessment Summary

APPENDIX K
BIOLOGICAL ASSESSMENT SUMMARY

BACKGROUND

The Bureau of Land Management (BLM) has prepared an amendment to its Resource Management Plans (RMP), resulting in a Proposed RMP Amendment (RMPA) and Final Environmental Impact Statement (FEIS). Its purpose is to provide direction for the conservation of greater sage-grouse (Centrocercus urophasianus, GRSG) in the following plans in Oregon:

- Andrews RMP (Andrews Resource Area)
- Baker RMP (Baker Resource Area)
- Brothers/La Pine RMP (Central Oregon Resource Area)
- Lakeview RMP (Lakeview Resource Area)
- Southeastern Oregon RMP (Jordan and Malheur Resource Areas)
- Steens Mountain Cooperative Management and Protection Area RMP (Andrews Resource Area)
- Three Rivers RMP (Three Rivers Resource Area)
- Upper Deschutes RMP (Deschutes Resource Area)

Section 7(a)(2) of the US Endangered Species Act (ESA) of 1973, as amended (16 US Code, Section 1531 et seq.), requires each federal agency to consult with the US Fish and Wildlife Service (USFWS) on any action authorized, funded, or carried out by such agency that it has reason to believe will likely affect any endangered, threatened, or proposed species or designated or proposed critical habitat. Section 7(c) requires each federal agency to conduct a Biological Assessment (BA) for the purpose of identifying any listed or proposed species or designated or proposed critical habitat that is likely to be affected by such action.

The BLM in cooperation with USFWS and National Marine Fisheries Service (NMFS) conducted a BA for the Proposed Plan in the RMPA/FEIS. Because the RMPA is a planning document, the BA focuses on the effect of management actions to be implemented as a part of this planning. This appendix summarizes the findings from the BA (BLM 2015). For purposes of brevity, only the findings from the BA are presented in this appendix.

Summary

The effects determinations from the BA are summarized in **Table K-1**. The BLM has determined the Proposed Plan will have no effect to any of these species or critical habitat. The BLM coordinated the determination with USFWS and NMFS. No consultation, formal or informal, was required.

Table K-1
Summary of the Species Analyzed in This RMPA/EIS and Their Determinations

Species	Status[1]	Determination[2]	Rationale
Gray wolf *Canis lupus*	E	No effect	There is no known overlap between the area occupied by the wolves where federally listed in Oregon and priority habitat management areas (PHMA) or general habitat management areas (GHMA). In the event that the gray wolf occupies the decision area, any effects would be addressed under project-specific National Environmental Policy Act (NEPA) analysis.
Canada lynx *Lynx canadensis*	T	No effect	There is currently no known occurrence of Canada lynx in the decision area. In addition, there is no overlap of habitat described as suitable for Canada lynx and GRSG PHMA and/or GHMA.
Western yellow-billed cuckoo *Coccyzus americanus*	T	No effect	The decision area may overlap with riparian habitat. However, the type or intensity of the activity in the Proposed Plan is expected to have no effect on this species or its habitat.
Western yellow-billed cuckoo Proposed critical Habitat	T	No effect	No critical habitat proposed for the yellow-billed cuckoo occurs in the decision area.
Oregon spotted frog *Rana pretiosa*	T	No effect	Potential habitat for the species does not occur in the decision area.
Oregon spotted frog Proposed critical habitat	T	No effect	Proposed critical habitat for the species does not occur in the decision area.
Borax Lake chub *Gila boraxobius*	E	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or cause water depletions in lakes, rivers, or streams occupied by this species.
Borax Lake chub Critical habitat	E	No effect	There are no actions within this RMPA decision that would impact aquatic habitat or cause water depletions in Borax Lake or aquatic environments associated with its outflow.

[1]E = Endangered; T = Threatened; P-T = Proposed threatened
[2]NE = No effect (will not affect the species)

Species	Status[1]	Determination[2]	Rationale
Bull trout *Salvelinus confluentus*	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by bull trout.
Bull trout Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for bull trout.
Lahontan cutthroat trout *Oncorhynchus clarkii henshawi*	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by Lahontan cutthroat trout.
Chinook salmon *O. tshawytscha*	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in chinook salmon habitat.
Chinook salmon Critical habitat	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact primary constituent elements described for this evolutionarily significant unit (ESU).
Foskett speckled dace *Rhinichthys osculus*	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Hutton tui chub *Gila bicolor* ssp.	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Steelhead trout *Oncorhynchus mykiss*	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical habitat	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Steelhead trout *O. mykiss*	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical Habitat	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Warner sucker *Catostomus warnerensis*	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Warner sucker Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Howell's spectacular thelypody *Thelypodium howellii* ssp. *spectabilis*	T	No effect	Howell's spectacular thelypody does not occur in PHMA or GHMA. Because the Proposed Plan would apply only to BLM-administered lands, and all known occurrences are on private lands, the proposed RMPA would not affect this species.

Species	Status[1]	Determination[2]	Rationale
MacFarlane's four-o'clock *Mirabilis macfarlanei*	T	No effect	MacFarlane's four-o'clock habitat does not overlap with PHMA or GHMA, and no occurrences are known to exist on BLM-administered lands; therefore, the proposed RMPA would not affect this species.
Malheur wire-lettuce *Stephanomeria malheurensis*	E	No effect	Although GRSG habitats are nearby, Malheur wire-lettuce does not occur in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows Area of Critical Environmental Concern (ACEC) already excludes livestock grazing and off-road vehicle use, the proposed RMPA would not affect this species.
Malheur wire-lettuce Critical habitat	E	No effect	Malheur wire-lettuce critical habitat does not exist in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows ACEC already excludes livestock grazing, off-road vehicle use, and mining, the proposed RMPA would not affect the designated critical habitat for this species.
Spalding's catchfly *Silene spaldingii*	T	No effect	Spalding's catchfly occurrences and suitable habitat are found only to the north of PHMA and GHMA; therefore, the proposed RMPA would not affect this species.

Appendix L
Greater Sage-Grouse Noise Protocol

APPENDIX L
GREATER SAGE-GROUSE NOISE PROTOCOL

The following protocol provides direction for collecting noise measurements in areas of existing and proposed development in GRSG habitat. The intent is to provide guidelines to **experienced personnel** so that measurements are made in a consistent and accurate manner and to highlight areas where specialized training and equipment is required. The goal is to develop a protocol that is efficient, effective, and produces consistent results. The protocol was written to facilitate the gathering of noise measurements relevant to stipulations for GRSG protection. Use of a standard protocol for noise monitoring will ensure that future measurements are comparable across locations, times, and surveyors. This protocol should be updated, as data needs and availability change (Blickley and Patricelli 2013).

SUMMARY OF NOISE-MONITORING RECOMMENDATIONS

- Measurements should be made by qualified personnel experienced in acoustical monitoring.
- Measurements should be made with a high quality, calibrated Type I (noise floor < 25 dB) sound level meter (SLM) with a microphone windscreen and (where applicable) environmental housing.
- Measurements should be collected during times when noise exposure is most likely to affect GRSG—nights and mornings (i.e., 6 pm – 9 am) and should be taken for ≥1 hour at each site, ideally over multiple days with suitable climactic conditions. To capture typical variability in noise levels at the site of interest, deployment of SLM units for multiple days is preferred.
- Environmental conditions should be measured throughout noise measurement periods so that measurements made during unsuitable conditions can be excluded.
- Measurements should be made at multiple (3-4) locations between each noise source and the edge of the protected area (NSO or PHMA boundary, or lek perimeter). On-lek measurements should exclude time periods when birds are lekking.
- Accurate location data should be collected for each measurement location. Surveyors also should catalog the type and location of all nearby sources of anthropogenic noise.
- Critical metrics should be collected: L50, L90, L10, Leq, and Lmax. All measurements should be collected in A-weighted decibels (dBA) and, if possible, also collected in unweighted

(dBF) and C-weighted (dBC) decibels. If possible, SLM should log 1/3-octave band levels throughout the measurement period. Additional metrics may be collected, depending on the goals of the study.