BLM

Utah
Greater Sage-Grouse
Approved Resource Management Plan Amendment

Attachment 4

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
Utah 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.

DOI-BLM-UT-9100-2013-0002-EIS

State Director Recommendation for Approval

I hereby recommend for approval the Utah Greater Sage-Grouse Resource Management Plan Amendment.

Jenna Whitlock, Acting Utah State Director

9/15/2015

Date

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ACRONYMS AND ABBREVIATIONS

	Full Phrase
ARMPA	Approved Resource Management Plan Amendment
AUM	animal unit month
BLM	United States Department of the Interior, Bureau of Land Management
BMP	best management practice
BSU	biologically significant unit
CFR	Code of Federal Regulations
cm	centimeter
COT	Conservation Objectives Team
CSU	controlled surface use
EIS	environmental impact statement
ESA	Endangered Species Act of 1973
FLPMA	Federal Land Policy and Management Act of 1976
Forest Service	United States Department of Agriculture, Forest Service
GHMA	general habitat management area(s)
GRSG	Greater Sage-Grouse
HMA	herd management area
LUP	land use plan
LUPA	land use plan amendment
MZ	management zone
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
NSO	no surface occupancy
OHV	off-highway vehicle
PAC	priority area for conservation
PHMA	priority habitat management area(s)
RDF	required design feature
RMP	resource management plan
RMPA	resource management plan amendment
ROD	record of decision
ROW	right-of-way
SFA	sagebrush focal area(s)
SGMA	sage-grouse management area(s)
SITLA	State of Utah School and Institutional Trust Lands Administration
SRP	special recreation permit
TL	timing limitation
USC	United States Code
USFWS	United States Department of the Interior, Fish and Wildlife Service
WAFWA	Western Association of Fish and Wildlife Agencies
WSA	wilderness study area

CHAPTER 1
INTRODUCTION

The Federal Land Policy and Management Act of 1976 (FLPMA) directs the US Department of the Interior, 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 FR 13910, March 23, 2010; USFWS 2010). 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 Endangered Species Act (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 2010). The USFWS identified the principal regulatory mechanisms for the BLM as conservation measures in resource management plans (RMPs).

1.1 DESCRIPTION OF THE UTAH SUB-REGIONAL PLANNING AREA

The ARMPA planning area boundary includes all lands regardless of jurisdiction (see **Figure 1-1**, Utah Planning Area, Surface Management and Sub-surface Estate, and **Figure 1-2**, Utah Planning Area, Greater Sage-Grouse Habitat Management Areas across All Jurisdictions). **Table 1-1**, Land Management in the Utah Subregional Planning Area, outlines the amount of surface acres that are administered by specific federal agencies, states, and 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 GRSG habitat management areas. This ARMPA does not establish any additional management for most of these lands, which will generally continue to be managed according to their existing, underlying land use plans.

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

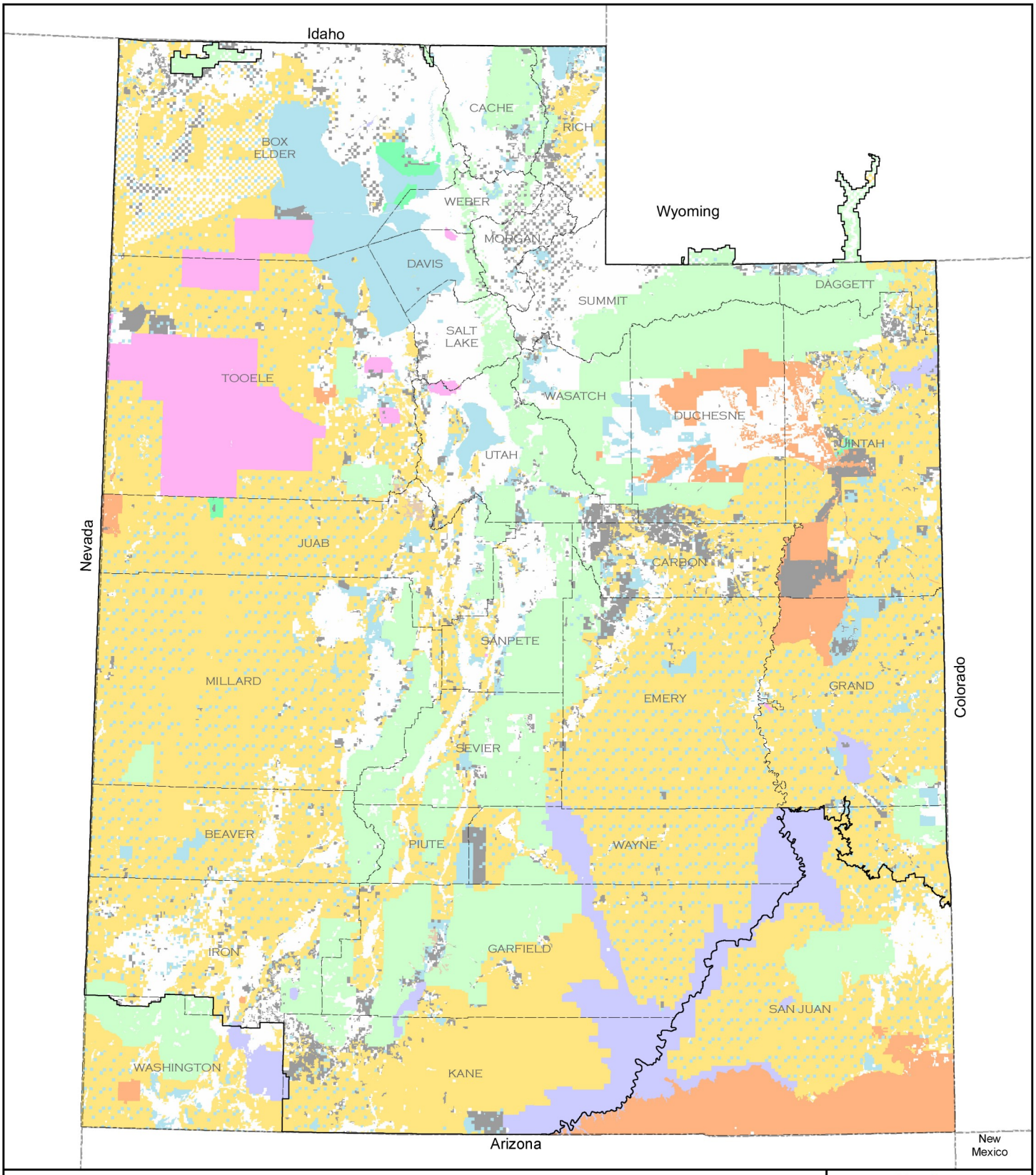

Figure 1-1: Utah Planning Area, Surface Management and Sub-Surface Estate

- Bureau of Land Management
- National Park Service
- US Forest Service
- Indian Reservation
- US Fish & Wildlife
- Department of Defense
- Other Federal
- State/Local
- Private/Other
- Non Federal Surface, Federal Sub-surface
- Planning Area Boundary
- State Boundary
- County Boundary

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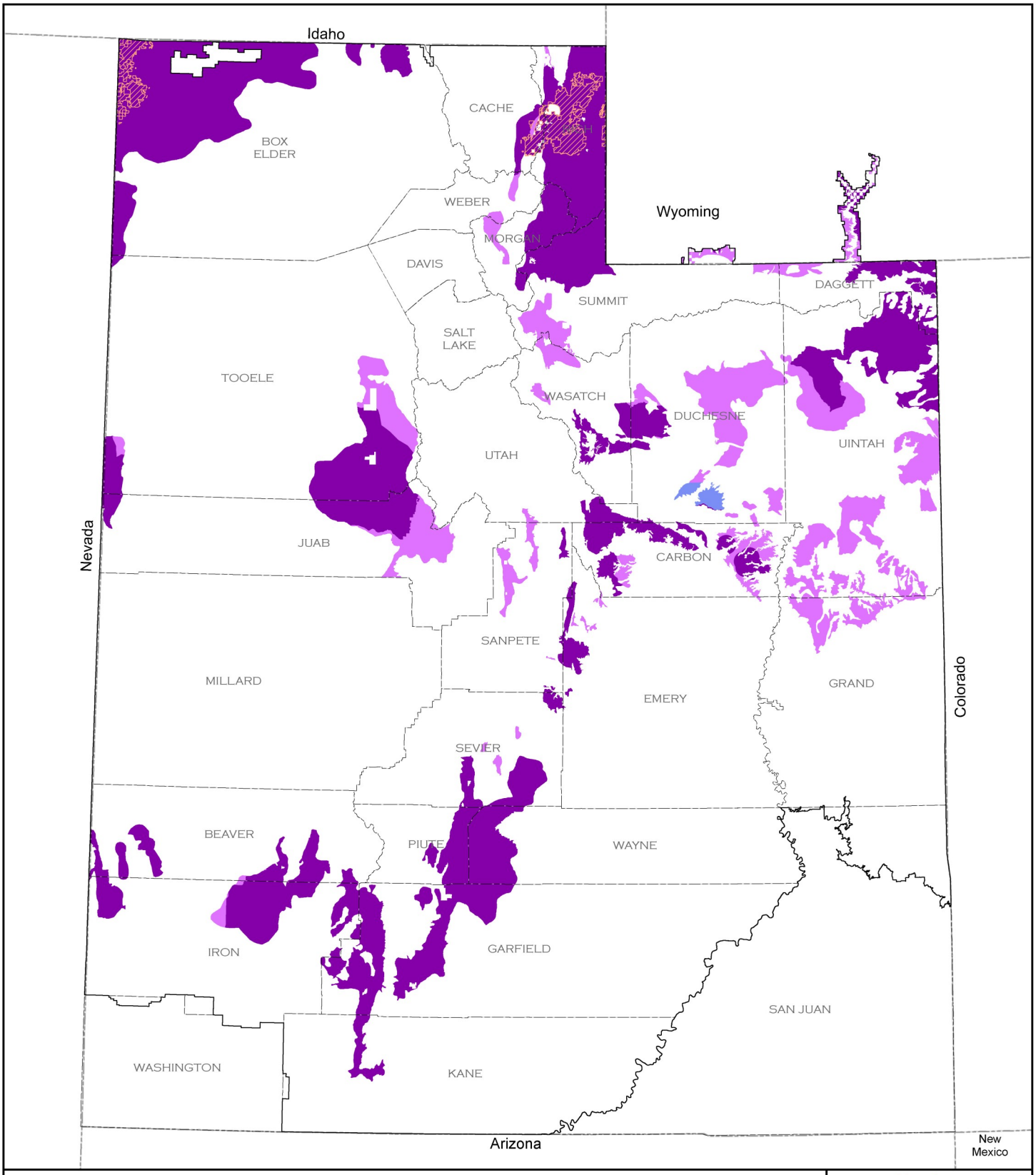

Figure 1-2: Utah Planning Area, Greater Sage-Grouse Habitat Management Areas across All Jurisdictions

- Sagebrush Focal Areas (SFA)
- Priority Habitat Management Areas (PHMA)
- General Habitat Management Areas (GHMA)
- Anthro Mountain (AM)
- Planning Area Boundary
- State Boundary
- County Boundary

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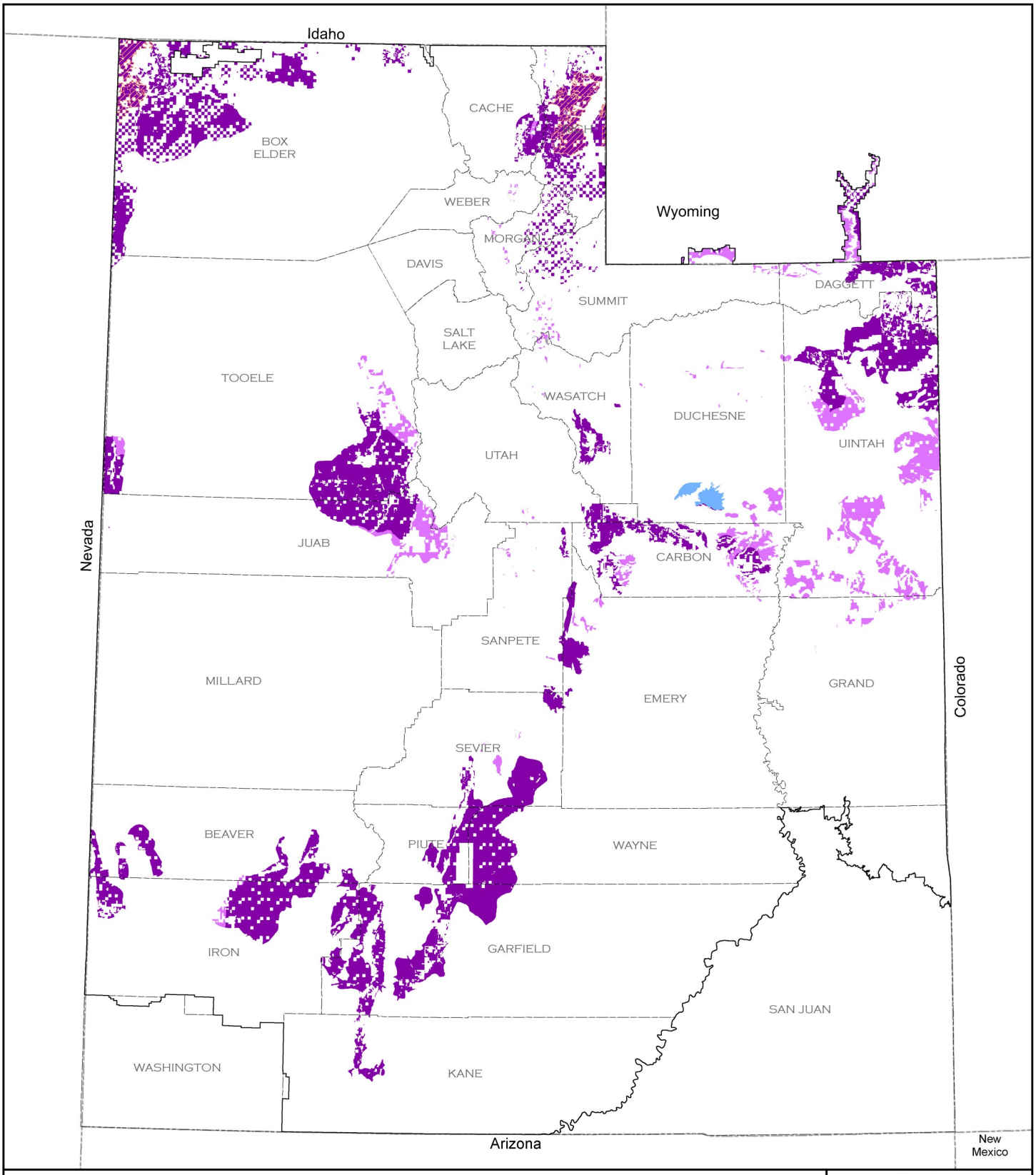

Figure 1-3: Utah Decision Area, Greater Sage-Grouse Habitat Management Areas for BLM Administered Lands

- Sagebrush Focal Areas (SFA)
- Priority Habitat Management Areas (PHMA)
- General Habitat Management Areas (GHMA)
- Anthro Mountain (AM)
- Planning Area Boundary
- State Boundary
- County Boundary

N W E S

0 20 40 Miles

September 2015

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Table 1-1
Land Management in the Utah Subregional Planning Area

Surface Land Management	Total Surface Land Management Acres
BLM	20,387,200
Forest Service	7,396,300
Private	10,818,200
Indian reservation	1,140,000
USFWS	121,900
Other	30,400
State	5,137,200
National Park Service	1,365,600
Other federal	0
Bureau of Reclamation	800
Local government	0
Department of Defense	1,812,300
Total acres	**48,209,900**

Source: BLM GIS 2015

decisions in the 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

	PHMA	GHMA
BLM-administered surface	2,026,400	502,500
BLM-administered mineral estate*	1,297,400	225,000

Source: BLM GIS 2015
*Acreage where the surface and mineral estates are owned or administered by separate entities. These acres show where the surface estate is not BLM administered (e.g., private, state, tribal, and US Department of Agriculture, Forest Service) but that have a federal mineral estate administered by the BLM. There are an additional 41,200 acres of National Forest System lands in the Anthro Mountain portion of the Carbon Population Area that would be managed as neither PHMA nor GHMA. These areas would be identified as "Anthro Mountain." In the BLM's ARMPA, these areas are considered split-estate, where the BLM administers the mineral estate.

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 (PACs) in the USFWS's Conservation Objectives Team

(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**). SFA were 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 24 counties in Utah (see **Table 1-3**, Acres of GRSG Habitat Management Area by County in the Decision Area (BLM-Administered Lands Only)). The habitat management areas also span nine BLM Utah field offices (see **Table 1-4**, Acres of GRSG Habitat Management Area by BLM Field Office in the Decision Area (BLM-Administered Lands Only)).

The Cedar City, Fillmore, Kanab, Price, Richfield, Salt Lake, and Vernal Field Offices and the Grand Staircase-Escalante National Monument administer the 14 pertinent RMPs being amended by this ARMPA.

The following BLM RMPs are hereby amended to incorporate appropriate GRSG conservation measures:

- Vernal Resource Management Plan (2008)
- Price Resource Management Plan (2008)
- Richfield Resource Management Plan (2008)
- Kanab Resource Management Plan (2008)
- Grand Staircase-Escalante National Monument Management Plan (2000)
- Cedar/Beaver/Garfield/Antimony Resource Management Plan (1986)
- Pinyon Management Framework Plan (1978)
- Warm Springs Resource Management Plan (1987)
- House Range Resource Management Plan (1987)
- Pony Express Resource Management Plan (1990)
- Box Elder Resource Management Plan (1986)
- Randolph Management Framework Plan (1980)
- Park City Management Framework Plan (1975)
- Salt Lake District Isolated Tracts Planning Analysis (1985)

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

County Name [1]	ARMPA					
	PHMA		GHMA		TOTAL	
	Surface Estate [2]	Mineral Estate [3]	Surface Estate [2]	Mineral Estate [3]	Surface Estate [2]	Mineral Estate [3]
Beaver	149,800	6,800	1,200	0	151,000	6,800
Box Elder	437,600	111,800	0	0	437,600	111,800
Cache	0	43,700	0	3,500	0	47,200
Carbon	40,300	89,200	52,600	16,400	92,900	105,600
Daggett	57,000	27,300	0	7,800	57,000	35,100
Duchesne [4]	1,100	2,700	28,600	7,200	29,700	9,900
Emery	100	57,400	0	8,800	100	66,200
Garfield	134,200	250,800	0	0	134,200	250,800
Grand	0	0	14,100	4,400	14,100	4,400
Iron	249,800	28,600	7,100	1,200	256,900	29,800
Juab	139,300	5,700	73,600	11,600	212,900	17,300
Kane	22,900	8,600	0	0	22,900	8,600
Morgan	0	29,900	0	3,000	0	32,900
Piute	58,400	17,700	0	0	58,400	17,700
Rich	166,600	78,400	0	400	166,600	78,800
Sanpete	0	16,700	1,600	1,700	1,600	18,400
Sevier	15,500	116,600	0	7,500	15,500	124,100
Summit	300	26,400	50	11,400	350	37,800
Tooele	237,500	105,700	41,500	8,100	279,000	113,800
Uintah	206,200	113,500	280,100	71,500	486,300	185,000
Utah	2,000	25,700	1,800	2,500	3,800	28,200
Wasatch	0	40,900	250	4,300	250	45,200
Wayne	107,800	68,500	0	0	107,800	68,500
Weber	0	0	0	1,700	0	1,700
Sweetwater (WY)	0	23,700	0	31,100	0	54,800
Uinta (WY)	0	1,100	0	20,900	0	22,000
Grand Total	**2,026,400**	**1,297,400**	**502,500**	**225,000**	**2,528,900**	**1,522,400**

Source: BLM GIS 2015

[1]The following counties in the planning area do not contain mapped occupied GRSG habitat: Salt Lake, Davis, and Millard.

[2]Acreage within PHMA/GHMA where the BLM has managerial authority on the surface estate.

[3]Acreage where the surface and mineral estates are owned or administered by separate entities. These acres show where the surface estate is not BLM administered (e.g., private, state, tribal, and Forest Service) but that have a federal mineral estate administered by the BLM.

[4]The 41,200 acres of National Forest System lands in the Anthro Mountain area would be managed as neither PHMA nor GHMA. These areas would be identified as "Anthro Mountain." In the BLM's RMPA, these areas are considered split-estate, where the BLM administers the mineral estate.

Table 1-4
Acres of GRSG Habitat Management Area by BLM Field Office in the Decision Area (BLM-Administered Lands Only)

BLM Office	ARMPA					
	PHMA		GHMA		TOTAL	
	Surface Estate [1]	Mineral Estate [2]	Surface Estate [1]	Mineral Estate [2]	Surface Estate [1]	Mineral Estate [2]
Cedar City	396,100	35,400	8,300	1,200	404,400	36,600
Fillmore	139,300	5,700	73,600	11,600	212,900	17,300
Grand Staircase-Escalante National Monument	5,800	0	0	0	5,800	0
Kanab	122,800	259,200	0	0	122,800	259,200
Moab	0	0	14,100	4,400	14,100	4,400
Price	40,400	146,600	52,700	25,200	93,100	171,800
Richfield	213,700	219,600	1,500	9,200	215,200	228,800
Salt Lake	844,000	462,700	43,600	34,800	887,600	497,500
Vernal [3]	264,300	143,400	308,700	86,600	573,000	230,000
National Forest System lands in Wyoming	0	24,800		52,000	0	76,800
Grand Total	**2,026,400**	**1,297,400**	**502,500**	**225,000**	**2,528,900**	**1,522,400**

Source: BLM GIS 2015
[1]Acreage within PHMA/GHMA where the BLM has managerial authority on the surface estate.
[2]Acreage where the surface and mineral estates are owned or administered by separate entities. These acres show where the surface estate is not BLM administered (e.g., private, state, tribal, and Forest Service) but that have a federal mineral estate administered by the BLM.
[3]The 41,200 acres of National Forest System lands in the Anthro Mountain area would be managed as neither PHMA nor GHMA. These areas would be identified as "Anthro Mountain." In the BLM's RMPA, these areas are considered split-estate, where the BLM administers the mineral estate.

1.2 Purpose and Need

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

The purpose of this 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 on 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 COT Report.

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

- Wildland fire—Loss of large areas of GRSG habitat due to wildfire
- Invasive species—Conversion of GRSG habitat to invasive annual grass-dominated (e.g., cheatgrass) plant communities
- Conifer encroachment—Encroachment of pinyon and juniper into GRSG habitat
- Infrastructure—Fragmentation of GRSG habitat due to human development activities, such as power lines, pipelines, roads, communication sites, railroads, range improvements, and renewable energy development
- Minerals extraction—Fragmentation of GRSG habitat due to mineral exploration and development
- Grazing—Loss of habitat components due to improper livestock, wild horses and burros, and large wildlife use
- Recreation—Loss of habitat tied to cross-country motorized travel

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 UTAH SUBREGIONAL GRSG CONSERVATION SUMMARY

The ARMPA identifies and incorporates measures to conserve, enhance, and restore 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 by the USFWS in the March 2010 listing decision, as well as those threats described in the USFWS's 2013 COT Report. In this 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 GRSG populations in the Utah Subregion. The BLM and Forest Service identified and explained additional threats in the environmental impact statements.

Table 1-6 provides a crosswalk as to how the ARMPA for the Utah Subregion 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 actions, subject to valid existing rights:

- Increasing the quantity and quality of GRSG habitat by providing a framework for prioritizing areas in PHMA and GHMA for conifer reduction, treating areas with invasive annual grasses, and fuel breaks and hazardous fuels treatments
- Requiring specific design features for certain lands and realty uses
- Limiting disturbance through density and disturbance caps in PHMA
- Monitoring GRSG habitat quality and making adjustments in land uses as necessary to meet GRSG habitat objectives, land health standards, and ecological site potential
- Including GRSG habitat objectives in land health standards, as appropriate

Table 1-5
Threats to GRSG in the Utah Subregion as identified by the COT

GRSG Identified Populations from the COT Report Applicable to the Utah Subregion	Unit Number	Isolated Small Size	Sagebrush Elimination	Agriculture Conversion	Fire	Conifers	Weeds/Annual Grasses	Energy	Mining	Infrastructure	Improper Grazing	Free-Roaming Equids	Recreation	Urbanization
Rich-Morgan-Summit	9b				Y	Y	Y	Y		Y			Y	Y
Uintah	9c				Y	Y	Y	L	Y	Y			Y	Y
Strawberry Valley	10a	Y			Y	Y	Y	Y		Y			Y	
Carbon	10b	Y			Y		Y	Y	Y	Y			Y	
Sheeprock Mountains	11	Y			Y	L	L	Y	Y	L		Y	L	
Emery	12	Y			Y	Y	Y	Y	Y	Y			Y	
Greater Parker Mountain	13a				Y	Y	Y			Y			Y	
Panguitch	13b			Y	Y	Y	Y	Y	L	Y			Y	L
Bald Hills	13c	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y
Ibapah	15a	Y			Y	Y	Y	Y	Y	Y		Y	Y	
Hamlin Valley	15b	Y			Y	Y	Y			Y		Y	Y	
Box Elder	26b			Y	Y	Y	Y	L	Y	Y			Y	

Source: USFWS 2013
Threats are characterized as Y = threat is present and widespread, L = threat present but localized, and U = unknown.

Table 1-6
Key Components of the Utah Subregion ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Utah Subregion 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 for actions that result in habitat loss and degradation. • Monitor implementation and effectiveness of conservation measures in GRSG habitats according to the habitat assessment framework.
All development threats, including mining, infrastructure, and energy development	• PHMA—Apply a human disturbance cap of 3 percent within the population areas (PHMA within population areas referred to as biologically significant units [BSUs] when coordinating with other states) and proposed project analysis areas. • PHMA Implement a density cap of an average of 1 energy and mining facility per 640 acres.

Table 1-6
Key Components of the Utah Subregion ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Utah Subregion ARMPA
	• Apply buffers necessary based on project type and location to address impacts on leks when authorizing actions in GRSG habitat. • Apply required design features (RDFs) when authorizing actions in GRSG habitat. • 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	• 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 existing planning decisions, which include closed to fluid minerals leasing, NSO, controlled surface use (CSU), and timing limitation (TL) stipulations and open to leasing, subject to standard stipulations. • 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)
Energy development—solar energy	• PHMA and GHMA—Exclusion area (not available for solar energy development under any conditions)
Infrastructure—major right-of-ways (ROW)	• PHMA—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
Mining—nonenergy leasable minerals	• PHMA—Closed area (not available for nonenergy leasable minerals)
Mining—mineral materials	• 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	• PHMA is essential habitat for maintaining GRSG for the suitability criteria set forth at 43 Code of Federal Regulations (CFR), Part 3461.5(o)(1).
Improper livestock grazing	• Prioritize the review and processing of grazing permits and leases in SFA, followed by PHMA. • Include in the National Environmental Policy Act (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 adjustments to grazing that have already been subjected to NEPA analysis. • Prioritize field checks in SFA followed by PHMA to ensure compliance with the terms and conditions of grazing permits.

Table 1-6
Key Components of the Utah Subregion ARMPA Addressing COT Report Threats

Threats to GRSG and Its Habitat (from COT Report)	Key Component of the Utah Subregion ARMPA
Free-roaming equid (wild horses and burros) management	• Manage herd management areas (HMAs) in GRSG habitat within established appropriate management level ranges to achieve and maintain GRSG habitat objectives. • Prioritize rangeland health assessment, gathers and population growth suppression techniques, monitoring, and review and adjustment of appropriate management levels 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.
Recreation	• PHMA—Do not construct new recreation facilities. • GHMA—Allow special recreation permits (SRPs) only if their effects on GRSG and its habitat are neutral or result in a net conservation gain.
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 GRSG habitat 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 percent) with a minimum of 15 percent 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 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 through monitoring and adaptive management.

The ARMPA adopts some key strategies of the State of Utah's Conservation Plan for Greater Sage-Grouse in Utah. It emphasizes GRSG habitat protections in the areas where GRSG populations are largest and have the greatest potential to maintain and increase populations. Similarly, the ARMPA provides additional flexibility for development in GHMA, while considering and applying conservation measures at the project-implementation stage. Within GHMA, the Utah ARMPA allows for wind energy and high voltage transmission ROW development, as well as oil and gas development. The Utah ARMPA

also integrates the state's strategy of improving GRSG habitat through vegetation treatments by setting treatment objectives established to increase areas available as GRSG habitat and reducing threats from wildfire.

For a full description of the BLM's ARMPA, see **Section 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. Planning criteria are the standards, rules, and factors used as a framework to resolve issues and develop alternatives. Planning criteria 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 Resource Management Plan Amendment (RMPA)/Draft EIS and were further refined for the Proposed RMPA/Final EIS.

Planning criteria carried forward for this ARMPA are as follows:

- This ARMPA is consistent with the objectives and direction in BLM Manual 6840, which includes initiating proactive conservation measures that reduce or eliminate threats to BLM sensitive species and to minimize the likelihood of and need for listing species under the ESA. This includes providing sufficiently detailed land use plans (LUPs) to identify and resolve significant land use conflicts with BLM sensitive species without deferring conflict resolution to implementation-level planning (BLM Manual 6840.2B).
- The BLM used the Western Association of Fish and Wildlife Agencies (WAFWA) Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats (Connelly et al. 2004) and any other appropriate resources to identify GRSG habitat requirements and RDFs.
- This ARMPA is consistent with the BLM's 2004 National Sage-Grouse Habitat Conservation Strategy.
- This ARMPA complies with FLPMA, NEPA, Council on Environmental Quality regulations at 40 CFR, Parts 1500-1508, and Department of the Interior regulations at 43 CFR, Parts 46 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; the 2008 BLM NEPA Handbook (H-1790-1), and all other applicable BLM policies and guidance.
- The implementation of the decisions in the alternatives will be contingent on the availability of needed budget and staffing resources.
- This ARMPA is limited to providing land use planning level direction specific to the conservation of GRSG habitats.
- The BLM considered standards to conserve GRSG habitat as well as objectives and management actions to restore, enhance, and improve GRSG habitat.
- This ARMPA recognizes valid existing rights.

- Lands addressed in this ARMPA are BLM-administered lands in GRSG habitats, including surface and split-estate lands with federal subsurface mineral rights. ARMPA decisions apply only to BLM-administered lands.
- The BLM used a collaborative and multi-jurisdictional approach, where appropriate, to determine the desired future condition of public lands for the conservation of GRSG and their habitats.
- 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 their habitat.
- The BLM considered a range of reasonable alternatives consistent with the conservation objectives and measures in the COT Report (USFWS 2013).
- The BLM addressed socioeconomic impacts of the alternatives. The socioeconomic analysis used IMPLAN, an accepted input-output quantitative model, for analysis.
- The BLM used the best available scientific information, research, technologies, and results of inventory, monitoring, and coordination to inform appropriate local and regional management strategies to enhance or restore GRSG habitats.
- Management of GRSG habitat in the Grand Staircase-Escalante National Monument will comply with Presidential Proclamation 6920 and other legislation applicable to Grand Staircase-Escalante National Monument.
- The ARMPA complies with the Trust Lands Management Act (Utah Code 53C) for lands administered by the State of Utah School and Institutional Trust Lands Administration (SITLA).
- The BLM does not have regulatory authority to directly affect activities conducted on state or private lands. However, when determining whether to permit or authorize an activity on federal lands, the BLM is required by NEPA to analyze the cumulative effects of activities on private and state lands, including activities that would disturb GRSG habitat.
- Management of GRSG habitat that intersects with wilderness study areas (WSAs) on public lands administered by the BLM will be guided by the Manual 6330, Management of Wilderness Study Areas. Land use allocations made for WSAs must be consistent with the Manual 6330 and with other laws, regulations, and policies related to WSA management.
- All activities and uses within GRSG habitats follow existing land health standards. Standards and guidelines for livestock grazing and other programs that have developed standards and guidelines are applicable to this ARMPA.
- The BLM consulted with American Indian tribes to identify sites, areas, and objects important to their cultural and religious heritage within GRSG habitats.
- The BLM coordinated and communicated with state, local, and tribal governments to ensure that it considered provisions of pertinent plans, that it seek to resolve inconsistencies

between state, local, and tribal plans, and that it provide ample opportunities for state, local, and tribal governments to comment on the development of this ARMPA.

- This ARMPA is based on the principles of adaptive management.
- Reasonably foreseeable development scenarios and planning for fluid minerals follows the BLM Handbook H-1624-1, Planning for Fluid Mineral Resources, and current fluid minerals manual guidance for fluid mineral (oil and gas, coal bed methane, and oil shale) and geothermal resources.
- This ARMPA was developed using an interdisciplinary approach to prepare reasonably foreseeable development scenarios, to identify alternatives, and to analyze resource impacts, including cumulative impacts on natural and cultural resources and the socioeconomic environment.
- The most currently approved BLM corporate spatial data was supported by current metadata and will be used to ascertain GRSG habitat extent and quality. Data was consistent with the principles of the Information Quality Act of 2000.
- The BLM used state game and fish agencies' GRSG data and expertise to the fullest extent practicable in making management determinations on federal lands.
- Where more restrictive land use allocations or decisions are in effect for other resources (e.g., WSAs, areas of critical environmental concern, cultural resources, and riparian areas) under existing LUPs, those more restrictive land use allocations or decisions are not amended by this ARMPA.

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CHAPTER 2
APPROVED RESOURCE MANAGEMENT PLAN AMENDMENT

2.1 APPROVED RESOURCE MANAGEMENT PLAN AMENDMENT INSTRUCTIONS

This ARMPA is now the baseline plan for GRSG management in Utah in the Cedar City, Fillmore, Kanab, Moab, Price, Richfield, Salt Lake, and Vernal Field Offices and the Grand Staircase-Escalante National Monument. The ARMPA adopts the management described in the Utah Greater Sage-Grouse Proposed Land Use Plan Amendment and Final Environmental Impact Statement (2015), with modifications and clarifications as described in the *Modifications and Clarifications* section of the record of decision (ROD).

In the event there are inconsistencies or discrepancies with previously approved RMPs, the decisions contained in this ARMPA will be followed, unless there are more restrictive decisions in the existing plans. The more restrictive decisions in the existing plans will be implemented. As appropriate, the BLM will continue to tier to statewide, national, and programmatic EISs and other NEPA and planning documents. It will continue to 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. All existing operations and activities authorized under permits, contracts, cooperative agreements, or other authorizations will be modified, as necessary, to conform to this ARMPA within a reasonable time frame. However, this ARMPA does not repeal valid existing rights on public lands. A valid existing right is a claim or authorization that takes precedence over the decisions developed in this ARMPA. If such authorizations come up for review and can be modified, they will also be brought into conformance with this ARMPA.

While the Final EIS for the Utah Greater Sage-Grouse Proposed Land Use Plan Amendment constitutes compliance with NEPA for the broad-scale decisions made in this ARMPA, the BLM will continue to prepare environmental assessments and EISs where appropriate as part of implementation level planning and decision-making.

2.2 GOALS, OBJECTIVES, AND MANAGEMENT ACTIONS

This section of the ARMPA presents the goals, objectives, land use allocations, and management actions established for protecting and preserving GRSG and its habitat on public lands managed by the BLM in Utah. The BLM will apply these actions where the BLM has discretion to implement them; the actions do not apply in areas where the BLM does not administer the surface or mineral estate. These management decisions are presented by program area. Not all types of decisions were identified for each program. A *Monitoring Framework* is also included (in **Appendix D**, Greater Sage-Grouse Monitoring Framework) to describe how the implemented program decisions will 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 GRSG 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)**
- Fire and Fuels Management **(FIRE)**
- Livestock Grazing **(LG)**
- Wild Horses and Burros **(WHB)**
- Minerals Resources **(MR)**
  - Fluid Minerals
  - Locatable Minerals
  - Saleable Minerals
  - Non-Energy Leasable Minerals
  - Coal
  - Mineral Split Estate
- Renewable Energy (Wind and Solar) **(RE)**
- Lands and Realty **(LR)**
- Recreation **(REC)**
- Travel and Transportation **(TTM)**

Table 2-1, Summary of Allocation Decisions by GRSG Habitat Management Areas, 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*	Exclusion*
Wind	Exclusion	Open**
Major ROWs	Avoidance	Open**
Minor ROWs	Avoidance	Open**
Oil and Gas	Open with Major Stipulations	Open with Standard Stipulations**
Geothermal	Open with Major Stipulations	Open with Standard Stipulations**
Non-energy Leasables	Closed	Open**
Salable Minerals	Closed	Open**
Locatable Minerals	SFA = Recommend Withdrawal Other PHMA = Open**	Open**
Travel Management	Limited	Limited
Livestock Grazing	Open	Open

Notes:
*The BLM's Approved Resource Management Plan Amendments/ROD for Solar Energy Development in Six Southwestern States (October 2012) excluded all GRSG occupied habitat to new utility-scale solar development. Those allocations have not been changed in this land use plan amendment.
**No additional allocations will be added for GRSG as a result of this amendment process. However, allocations present in the existing land use plans will continue (e.g., existing GRSG allocations, fluid mineral closure for WSAs, and allocations to protect a wild and scenic rivers).

2.2.1 Special Status Species (SSS)

Goal SSS-1: Maintain and/or increase GRSG abundance and distribution by conserving, enhancing or restoring the sagebrush ecosystem upon which populations depend in collaboration with other conservation partners.

Objective SSS-1: Designate PHMA that are large enough to stabilize populations in the short-term and enhance populations over the long-term.

Protect PHMA from anthropogenic disturbances that will reduce distribution or abundance of GRSG. Enhance or improve GRSG habitat (e.g., through restoration or rehabilitation activities) within PHMA that has been impaired or altered.

Objective SSS-2: In all GRSG habitat, manage activities that result in habitat loss and degradation to provide a net conservation gain of GRSG habitat. Exceptions to net conservation gain for GRSG shall be made for vegetation treatments to benefit Utah prairie dog.

Objective SSS-3: In all GRSG habitat, where sagebrush is the current or potential dominant vegetation type or is a primary species within the various states of the ecological site description, maintain or restore vegetation to provide habitat for lekking, nesting, brood rearing, and winter habitats.

The Habitat Objectives for Greater Sage-Grouse (see **Table 2-2**, Habitat Objectives for Greater Sage-Grouse) summarize the characteristics that research has found represent the seasonal habitat needs for GRSG. The specific seasonal components identified in **Table 2-2** were adjusted based on local science

Table 2-2
Habitat Objectives for Greater Sage-Grouse

ATTRIBUTE	INDICATORS	DESIRED CONDITION
Breeding and Nesting (February 15-June 15)[1, 2, 3, 4, 5, 6]		
Lek Security	Proximity of trees	Trees absent or uncommon on shrub/grassland ecological sites within 1.8 miles (approx. 3 kilometers) of occupied leks. [6, 7, 8]
	Proximity of sagebrush to leks	Has adjacent sagebrush cover.[6]
Cover	% of seasonal habitat meeting desired conditions	>80% of the mapped nesting habitat meets the recommended vegetation characteristics, where appropriate (relative to ecological site potential, etc.).[8]
	Sagebrush cover	≥15%[6, 8, 9]
	Total shrub cover[6, 8, 9]	15-30%: Box Elder, Parker Mountain, Bald Hills, Hamlin Valley, Panguitch, Uintah south of Hwy 40 15-35%: Rich, Carbon, Emery, Sheeprocks, Ibapah, Uintah north of Highway 40
	Sagebrush height[6, 8, 9]	>12 inches (30 cm): Box Elder, Bald Hills, Hamlin Valley, Sheeprocks, Ibapah >10 inches (25 cm): Rich, Carbon, Emery, Uintah north of Highway 40 >8 inches (20 cm): Parker Mountain, Panguitch, Uintah south of Highway 40
	Predominant sagebrush shape[10]	>50% in spreading (applicable to the specific sagebrush types prone to columnar vs. spreading shape e.g., Wyoming, not black sage)[6]
	Perennial grass cover (such as native bunchgrasses, rhizomatous grasses called for on applicable ecological site descriptions, or other perennial grasses that provide similar functionality)[6, 8, 9]	>10%: Box Elder, Bald Hills, Hamlin Valley, Rich, Carbon, Emery, Sheeprocks, Ibapah, Uintah north of Highway 40 >5%:Parker Mountain, Panguitch, Uintah south of Highway 40
	Perennial grass and forb height (includes residual grasses)[6, 8, 9]	Provide overhead and lateral concealment from predators.[11]
	Perennial forb canopy cover[6, 8, 9]	>5%: Box Elder, Bald Hills, Hamlin Valley, Rich, Carbon, Emery, Sheeprocks, Ibapah, Uintah north of Highway 40 >3%: Parker Mountain, Panguitch, Uintah south of Highway 40
Brood-Rearing/Summer (April 15-August 15)[1]		
Cover	% of Seasonal habitat meeting desired condition	>40% of the mapped brood-rearing/summer habitat meets recommended habitat characteristics where appropriate (relative to ecological site potential, etc.)[8]
	Sagebrush cover[6, 8, 9]	>10%
	Total shrub cover[6, 8, 9]	10-25%: Box Elder, Bald Hills, Hamlin Valley, Panguitch, Rich, Parker Mountain, Uintah 10-30%: Carbon, Emery, Sheeprocks, Ibapah,
	Sagebrush height[6, 8, 9]	>12 inches (30 cm): Box Elder, Bald Hills, Hamlin Valley, Sheeprocks, Ibapah >10 inches (25 cm): Rich, Carbon, Emery, Uintah north of Highway 40 >8 inches (20 cm): Parker Mountain, Panguitch, Uintah south of Highway 40
	Perennial grass cover and forbs[6, 8, 9]	>15% (Grass: >10%; Forb: >5%): Box Elder, Rich, Sheeprocks, Ibapah, Parker Mountain, Panguitch, Uintah, Carbon, Emery >15% (Grass: >8%; Forb: >7%): Bald Hills, Hamlin Valley,

Table 2-2
Habitat Objectives for Greater Sage-Grouse

ATTRIBUTE	INDICATORS	DESIRED CONDITION
	Riparian areas/mesic meadows	Proper Functioning Condition
	Upland and riparian perennial forb availability	Preferred forbs are common with several preferred species present[6, 12]
Winter (November 15-March 15)[1]		
Cover and Food	% of seasonal habitat meeting desired conditions	>80% of the mapped wintering habitat meets winter habitat characteristics where appropriate (relative to ecological site, etc.). [8]
	Sagebrush cover above snow[6, 8,]	>10%
	Sagebrush height above snow[6, 8, 9, 13]	>10 inches (25 cm): Box Elder, Bald Hills, Hamlin Valley, Rich, Carbon, Emery, Sheeprocks, Ibapah, Uintah north of Highway 40 >8 inches (20 cm): Parker Mountain, Panguitch, Uintah south of Highway 40

[1] Specific dates will be based on site-specific conditions and may be modified due to documented local variations (e.g., higher/lower elevations) or annual climactic fluctuations (e.g., early/late spring, and long and/or heavy winter), in coordination with the appropriate State of Utah agency.
[2] Utah Greater Sage-Grouse Working Group 2013
[3] Doherty 2008
[4] Doherty et al. 2010
[5] Holloran and Anderson 2005
[6] Stiver et al. 2015 *In Press*
[7] Baruch-Mordo et al. 2013
[8] Connelly et al. 2000
[9] Unpublished data, Utah Community-Based Conservation Program Greater Sage-grouse Statewide Database, Utah State University, Logan, Utah and Brigham Young University, Provo, Utah. Summarization and analysis of nesting and brood-rearing habitat characteristics from data collected through Utah State University and Brigham Young University research efforts. Researchers located the nest and brood sites using radio-marked telemetry methods. Shortly after the site was used by the marked bird (after hatch or use by a brood), vegetation characteristics on the site were measured using the line intercept method for shrub canopy cover and Daubenmire frames for herbaceous cover. Researchers across the various study areas used methods that followed the guidelines identified in Connelly et al. (2003).
[10] Sagebrush plants that are more tree or columnar-shaped provide less protective cover near the ground than sagebrush plants with a spreading shape (Stiver et al. 2015 *In Press*). Some sagebrush plants are naturally columnar (e.g., Great Basin big sagebrush), and a natural part of the plant community. However, a predominance of columnar shape arising from animal impacts may warrant management investigation or adjustments at site specific scales.
[11] Specific height requirements needed to meet the objective will be set at the time of watershed assessments.
[12] Preferred forbs are listed in Stiver et al. 2015 *In Press*. Overall total forb cover may be greater than that of preferred forb cover since not all forb species are listed as preferred.
[13] The height of sagebrush remaining above the snow depends upon snow depth in a particular year. Intent is to manage for tall, healthy, sagebrush stands.

and monitoring data to define the range of characteristics used in the Utah Sub-region. Thus, the habitat objectives provide the broad vegetative conditions we strive to obtain across the landscape that indicate the seasonal habitats used by GRSG. These habitat indicators are consistent with the rangeland health indicators used by the BLM.

The habitat objectives will be part of the GRSG habitat assessment to be used during land health evaluations (see **Appendix D**). These habitat objectives are not obtainable on every acre within the designated GRSG habitat management areas. Therefore, the determination on whether the objectives have been met will be based on the specific site's ecological ability to meet the desired condition identified in the table. In addition, areas where PHMA and GHMA overlap mapped Utah prairie dog

habitat will be managed for both species; accomplishing this shall include coordination with species-specific experts to develop conservation and recovery objectives that will benefit both species.

All BLM use authorizations will contain terms and conditions regarding the actions needed to meet or progress toward meeting the habitat objectives. If monitoring data show the habitat objectives have not been met nor progress being made towards meeting them, there will be an evaluation and a determination made as to the cause. If it is determined that the authorized use is a cause, the use will be adjusted by the response specified in the instrument that authorized the use.

When using the above indicators and desired conditions to guide management actions or during land health assessments, consider that they 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. Indicators must be collectively reviewed, assessed based on the site potential, and put into spatial and temporal context to correctly determine habitat suitability, which will include more than one scale and multiple indicators.

Objective SSS-4: Within PHMA, increase the amount and functionality of seasonal habitats by:

- Maintaining or increasing sagebrush in perennial grasslands, where needed to meet the Habitat Objectives for Greater Sage-Grouse (**Table 2-2**), unless there is a conflict with Utah prairie dog.
- Reducing conifer (e.g., pinyon/juniper) from areas that are most likely to support GRSG at a rate that is at least equal to the rate of encroachment.
- Reducing the extent of annual grasslands.
- Maintaining or improving corridors for migration or movement between seasonal habitats, as well as for long-term genetic connections between populations.
- Maintaining or improving understory (grass, forb) and/or riparian condition within breeding and late brood-rearing habitats.
- Conducting vegetation treatments based on the following 10-year (decadal) acreage objectives:

Population Areas	Mechanical Treatment[1]	Annual Grass Treatment[1]
Box Elder	9,300	17,800
Ibapah; Hamlin Valley	17,900	2,100
Rich; Uintah	40,700	6,800
Carbon	2,600	200
Bald Hills; Panguitch	43,900	8,900
Parker Mountain	32,800	2,200
Sheeprocks	33,700	10,000
Statewide	*180,900*	*48,000*

[1] These acreage figures, based on Vegetation Dynamics Development Tool modeling, represent an objective for treatment on BLM-administered lands over a 10-year (decadal) time frame to support achievement or progress toward GRSG habitat objectives (see Final EIS Appendix V, Great Basin Vegetation Modeling using Vegetation Dynamics Development Tool). This accounts for variations in yearly funding availability and does not reflect a maximum or minimum acreage for any one treatment type or total treatment acreage, should funding and site specific conditions allow for more or less treatment acreage than described in order to meet habitat objectives.

Outside PHMA (in adjacent opportunity areas) improve and restore historical GRSG habitat to support GRSG populations and to maintain or enhance connectivity. Statewide, complete a decadal average of 170,200 acres of mechanical treatments and 33,000 acres of annual grass treatments. Prioritization is for completion of treatments within PHMA before treating areas outside.

Objective SSS-5: Participate in local GRSG conservation efforts (e.g., the appropriate State of Utah agency, Natural Resources Conservation Service (NRCS), and local working groups) to implement landscape-scale habitat conservation, to implement consistent management to benefit GRSG, and to gather and use local research and monitoring to promote the conservation of GRSG.

Management Actions (MA)

MA-SSS-1: Identify PHMA and GHMA as follows (**Figure 2-1**, Habitat Management Areas [**Appendix A**, Approved RMP Amendment Maps]):

Population Area	Acres					
	PHMA			GHMA		
	Total Surface[1]	BLM Surface[2]	Split Estate Minerals[3]	Total Surface[1]	BLM Surface[2]	Split Estate Minerals[3]
Uintah	566,800	263,200	140,800	991,500	294,200	81,700
Carbon [4]	260,100	43,500	124,200	198,700	82,800	19,200
Emery	85,500	100	84,000	11,400	0	9,700
Parker Mtn.	741,300	214,200	378,300	12,900	0	7,400
Panguitch	343,900	163,200	91,000	0	0	0
Bald Hills	326,400	259,400	5,200	21,200	8,300	1,200
Hamlin Valley	143,700	101,500	6,600	0	0	0
Sheeprocks	534,600	327,100	110,500	296,500	106,800	21,200
Ibapah	88,800	48,000	700	10,800	10,100	0
Box Elder	1,135,700	439,200	112,000	0	0	0
Rich	1,051,000	167,000	178,400	197,900	300	20,600
Lucerne	0	0	0	37,500	0	11,500
Strawberry	161,500	0	40,900	20,600	0	500
WY-Uinta	1,100	0	1,100	20,900	0	20,900
WY-Blacks Fork	23,700	0	23,700	31,100	0	31,100
Statewide	*5,464,100*	*2,026,400*	*1,297,400*	*1,851,000*	*502,500*	*225,000*
% PHMA/ GHMA	*75%*	*80%*	*85%*	*25%*	*20%*	*15%*

[1] Acreage associated with total PHMA/GHMA polygon, regardless of land ownership.
[2] Acreage within PHMA/GHMA where the BLM has managerial authority on the surface estate.
[3] Acreage where the surface and mineral estates are owned or administered by separate entities. These acres show where the surface estate is not BLM (e.g., private, state, tribal, and Forest Service), but that have a federal mineral estate administered by the BLM. Most minerals decisions apply to the combination of the BLM surface and mineral estates.
[4] The 41,200 acres of National Forest System lands in the Anthro Mountain area would be managed as neither PHMA nor GHMA. These areas would be identified as "Anthro Mountain." In the BLM's RMPPA, these areas are considered split-estate, where the BLM administers the mineral estate.

The BLM will apply these the goals, objectives, and management actions where the agency has discretion to implement them; the actions do not apply in areas where the BLM does not administer the surface or mineral estate.

Minor adjustments to PHMA/GHMA external boundaries can be made if BLM biologists, in coordination with the appropriate State of Utah agency, determine site-specific conditions warrant such changes to more accurately depict existing or potential GRSG habitat. The appropriate planning process (i.e., plan maintenance or plan amendment) will be used, as determined on a case-by-case basis considering site-specific issues. See additional information and protocol on adjusting occupied habitat and PHMA/GHMA boundaries in **Appendix K**, Greater Sage-Grouse Habitat Baseline and Habitat Update Protocol.

The PHMA and GHMA objectives and management actions would apply to existing sagebrush areas and areas with ecological sagebrush potential within the respective PHMA and GHMA polygons. In the mapped PHMA and GHMA there may be areas that lack the principle habitat components necessary for GRSG, including but not limited to rock outcrops, alkaline flats, and pinyon-juniper ecological sites. These are areas that do not have existing sagebrush or ecological potential to contain sagebrush. These areas of non-habitat may be identified during site-specific project review by agency biologists, in discussion with the appropriate State of Utah agency.

Because of the importance of PHMA to conserve, enhance and restore GRSG and its habitat, objectives and management actions will apply to all the areas within the respective PHMA polygons. The GHMA objectives and management actions will apply to the areas of identified non-habitat within the GHMA polygons unless **all** the following conditions are met:

- the non-habitat does not provide important connectivity between areas with existing or potential habitat;
- all direct and indirect impacts that impair the function of adjacent seasonal habitats or the life-history or behavioral needs of the GRSG population are eliminated through project design (e.g., minimize sound, preclude tall structures, require perch deterrents), as demonstrated in the project's NEPA document.

Exceptions in non-habitat may be approved by the Authorized Officer, but only with the concurrence of one level of delegated authority above the Authorized Officer.

Any exception granted based on the above criteria would only apply to the specific project-level authorization. Proposed projects in the same area would need to undergo individual analysis to confirm the criteria are met prior to subsequent authorizations. Excepting a site-specific project from compliance with GRSG management in an area of non-habitat would not change the boundaries of PHMA or GHMA.

MA-SSS-2: Designate SFA as shown on **Figure 2-1** (181,100 acres of BLM surface estate; 52,200 acres split-estate federal minerals). SFA will be managed as PHMA, with the following additional management:

- Recommended for withdrawal from the Mining Law of 1872 (as amended), subject to valid existing rights.
- Managed as NSO, without waiver, exception, or modification, for fluid mineral leasing.
- 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).

MA-SSS-3: In PHMA, apply the following management to discretionary disturbances or activities that are not otherwise excluded or closed to minimize and mitigate effects on GRSG and its habitat from the project/activity:

A- Net Conservation Gain

In all GRSG habitat, 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. Exceptions to net conservation gain for GRSG shall be made for vegetation treatments to benefit Utah prairie dog.

Mitigation will be conducted according to the mitigation framework contained in **Appendix F**, Mitigation Strategy: Utah Greater Sage-Grouse RMPA.

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

B- Disturbance Cap

In PHMA, manage discrete anthropogenic disturbances, whether temporary or permanent, so they cover less than 3 percent of 1) PHMA associated with a GRSG population area (**Figure 2-2**, GRSG Biologically Significant Units and Priority Habitat Management Areas [**Appendix A**] – referred to as BSU when coordinating across state lines) and 2) within a proposed project analysis area. See **Appendix E**, Greater Sage-Grouse Disturbance Cap Guidance, for additional information on implementing the disturbance cap, including what is and is not considered disturbance and how to calculate the proposed project analysis area.

If the 3 percent anthropogenic disturbance cap is exceeded on all lands (regardless of land ownership) within GRSG PHMA in any given population area (BSU), then no further discrete anthropogenic disturbances (subject to applicable laws and regulations, such as the Mining Law of 1872 [as amended], valid existing rights, etc.) will be permitted by the BLM within GRSG PHMA in any given population area (BSU) until the disturbance has been reduced to less than the cap.

If the 3 percent disturbance cap is exceeded on all lands (regardless of land ownership) within a proposed project analysis area in PHMA, then no further anthropogenic disturbance will be permitted by the 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 Mining Law of 1872 [as amended], valid existing rights, etc.). Within designated utility corridors, the 3 percent 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.

An area with disturbance is not excluded from the 3 percent until it has been restored to provide GRSG habitat. The objective of successful restoration is to provide for the needs of GRSG, as evidenced by one of the following:

- Vegetative cover is consistent with the GRSG habitat objectives and the ecological site description (Objective SSS-3), or
- Monitoring indicates the area is regularly used by GRSG to sustain one or more seasonal habitat requirements (nesting, brood-rearing, winter).

Final restoration success and approval for abandonment for disturbances will be subject to an interdisciplinary review of available monitoring data and final monitoring reports.

C- Density of Energy/Mining Facilities

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 land ownership) in PHMA 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 collocated into an existing disturbed area (subject to applicable laws and regulations, such as the Mining Law of 1872 [as amended], valid existing rights, etc.). Energy and mining facilities to which this action applies are:

- Oil and gas wells and development facilities,
- Coal mines,
- Wind towers,
- Solar fields,
- Geothermal wells/developments, and
- Active locatable, leasable, and saleable developments.

D- Predation

In PHMA, eliminate or minimize external food sources for corvids, particularly dumps, or waste transfer facilities. Apply best management practices (BMP) to development activities to reduce opportunities for GRSG predators (e.g., limiting food sources, nest/perches deterrents, and road kill).

Apply habitat management practices (e.g. grazing management and vegetation treatments) that decrease the effectiveness of predators.

Collaborate with applicable government entities to implement programs to control predator populations of GRSG (e.g., ravens, red fox, badgers, and raccoons).

E- Noise Restrictions

In PHMA, limit noise from discrete anthropogenic disturbances, whether during construction, operation, or maintenance, to not exceed 10 decibels above ambient sound levels (as available at the signing of the GRSG RMPA ROD or as first measured thereafter) at occupied leks from 2 hours before to 2 hours

after official sunrise and sunset during breeding season (e.g., while males are strutting). Support the establishment of ambient baseline noise levels for PHMA habitat area leks.

Limit project related noise in other PHMA habitats and seasons where it will be expected to reduce functionality of habitats that support associated GRSG populations.

As additional research and information emerges, specific new limitations appropriate to the type of projects being considered will be evaluated and appropriate measures will be implemented where necessary to minimize potential for noise impacts on PHMA GRSG population behavioral cycles.

F- Tall Structure Restrictions

In PHMA, limit the placement of permanent tall structures within GRSG breeding and nesting habitats.

For the purposes of this restriction, a tall structure is any man-made structure that provides for perching/nesting opportunities for predators (e.g., raptors and ravens) that are naturally absent, or that decreases the use of an area by GRSG. A determination as to whether something is considered a tall structure will be made based on local conditions such as existing vegetation or topography.

G- Seasonal Restrictions

In PHMA, in coordination with the appropriate State of Utah agency, apply seasonal restrictions during the period specified below to manage discretionary discrete anthropogenic disturbances and uses on public lands to prevent disturbance to GRSG populations and habitat during seasonal life cycle periods as follows:

- In breeding (leks), nesting and early brood-rearing habitat from Feb 15 – Jun 15
- In brood rearing habitat from Apr 15 – Aug 15
- In winter habitat from Nov 15 – Mar 15

Specific time and distance determinations will be based on site-specific conditions and may be modified due to documented local variations (e.g., higher/lower elevations) or annual climactic fluctuations (e.g., early/late spring and long and/or heavy winter) in order to better protect GRSG, in coordination with the appropriate State of Utah agency.

H- Buffers

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 US Geological Survey Report *Conservation Buffer Distance Estimates for Greater Sage-Grouse – A Review* (Open File Report 2014-1239; Manier et al. 2014) in accordance with **Appendix B**, Applying Lek-Buffer Distances.

I- Required Design Features

In PHMA, apply the RDFs from the applicable sections identified in **Appendix C**, Required Design Features, when authorizing/permitting site-specific activities/projects for wildland fire management actions, travel and transportation, lands and realty, fluid minerals, nonenergy leasable minerals, coal, mineral materials, and locatable minerals (consistent with applicable law).

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 and/or may require slight variations. All variations in RDFs will require that at least one of the following be demonstrated in the NEPA analysis associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/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.

MA-SSS-4: In PHMA and in adjacent opportunity areas, maintain, improve and restore GRSG habitat to support GRSG populations and to maintain or enhance connectivity. Vegetation treatments will be applied to meet GRSG habitat objectives and provide additional GRSG habitat, unless there is a conflict with Utah prairie dog, where the landscape will be managed for both species.

PHMA boundaries may be adjusted to include additional restored GRSG habitat and habitat identified during survey or inventory work. Changes to maps and associated management will occur through the appropriate BLM planning processes (e.g., plan maintenance or plan amendment), as described in **Appendix K**.

MA-SSS-5: In GHMA, apply the following management to meet the objective of a net conservation gain for discretionary actions that can result in habitat loss and degradation:

A- Existing Management

Implement GRSG management actions included in the existing RMPs and project-specific mitigation measures associated with existing decisions.

B- Net Conservation Gain

In all GRSG habitat, 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. Exceptions to net conservation gain for GRSG may be made for vegetation treatments to benefit Utah prairie dog.

Mitigation will be conducted according to the mitigation framework contained in **Appendix F**.

C- Buffers

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 US

Geological Survey Report *Conservation Buffer Distance Estimates for Greater Sage-Grouse – A Review* (Open File Report 2014-1239; Manier et al. 2014) in accordance with **Appendix B**.

D- Required Design Features

In GHMA, apply the fluid mineral RDFs that are associated with GHMA identified in **Appendix C** when authorizing/permitting site-specific fluid mineral development activities/projects.

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 and/or may require slight variations. All variations in RDFs will require that at least one of the following be demonstrated in the NEPA analysis associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/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.

MA-SSS-6:

Sage-Grouse Management outside PHMA/GHMA

Proposed projects within State of Utah Sage-Grouse Management Areas (SGMA) and USFWS priority areas for conservation (PAC), as well as adjacent to PHMA outside these areas, will consider impacts on GRSG and implement measures to mitigate impacts when preparing site-specific planning and environmental compliance documents.

Outside of PHMA, prior to site-specific authorizations, the BLM will evaluate habitat conditions and may require surveys to determine if the project area contains GRSG habitat (FLPMA, 43 United States Code (USC) 1701 Sec. 201 (a); BLM Manual 6840.04 D3; BLM-M-6840.04 E2). Surveys will be required prior to authorizing discrete anthropogenic disturbances within 4 miles of an occupied lek that is located in PHMA, but only in existing sagebrush.

If an area is determined to be GRSG habitat (e.g., nesting, brood-rearing, winter, transition), mitigation will be considered as part of the project level NEPA analysis and will be attached as conditions of approval to new discretionary actions, if deemed necessary to protect the habitat (BLM Manual 6840.04 D 5). Measures that may be considered include those identified in **Appendix C**.

Outside of PHMA, but within SGMAs and PACs, avoid removal of sagebrush and minimize development that creates a physical barrier to GRSG movement; these areas may be used by GRSG to connect to other populations or seasonal habitat areas. Exceptions shall be made for vegetation treatments to benefit Utah prairie dog, where the landscape will be managed for both species.

Outside of PHMA, but within SGMAs and PACs, consider noise and permanent structure stipulations around leks.

Outside PHMA, portions of State of Utah opportunity areas (see Final EIS **Map 2.4**) within 4 miles of a lek that is located in PHMA will be managed with the following allocations:

- Fluid minerals will be open for leasing with CSU stipulations (noise and tall structures).
- Lands ROWs, permits, and leases will be avoided, applying avoidance criteria for noise and tall structures.

Do not site wind energy development in opportunity areas within 5 miles from occupied GRSG leks that are in PHMA.

Outside of PHMA, avoid and minimize effects from discrete anthropogenic disturbances in areas that have been treated with the intent of improving or creating new GRSG habitat. Evaluate conditions in the treated area to determine if it is providing habitat for GRSG and if additional measures are necessary to protect the habitat.

MA-SSS-7:

Adaptive Management

This plan establishes soft and hard triggers for both GRSG populations and habitat. The specific triggers and additional detail on the management responses are identified in **Appendix I**, Adaptive Management. The hard and soft trigger data will be analyzed as soon as it becomes available after the signing of the ROD and then at a minimum, analyzed annually thereafter.

If monitoring indicates the soft-trigger is met, the BLM will determine if there is a specific cause or causes that are contributing to the decline. If it is determined that the decline is related to a natural population variation, no specific management actions will be required. However, if BLM management actions are determined to cause or contribute to the decline, the BLM manager will apply measures within their implementation-level discretion to mitigate the decline of populations and/or habitats to the area where the trigger has been met. These measures will apply more conservative or restrictive implementation conservation conditions, terms, or decisions within the agencies' discretion to mitigate the decline of populations and/or habitats.

If monitoring indicates the hard trigger is met, a set of specific management actions from the BLM Proposed Plan will immediately be replaced with or adjusted by different management actions in the area where the trigger has been met. Table I.1 of **Appendix I** identifies the management actions from the BLM Proposed Plan, and the corresponding new management actions that will be immediately implemented to the specific area in the event a hard trigger is met. In addition to these specific changes, the BLM will review available and pertinent data for the area, in coordination GRSG biologists from multiple agencies including the appropriate State of Utah agency, USFWS, and NRCS, to determine the causal factor(s) and implement a corrective strategy. The final strategy associated with a hard trigger being met will be the changes identified in Table I.1 of **Appendix I**, and may also include the need to further amend or revise the RMP to address the situation and modify management accordingly, for the area where the trigger was met.

2.2.2 Vegetation (VEG)

Objective VEG-1: In SFA and PHMA, the desired condition is to maintain all lands ecologically capable of producing sagebrush (but no less than 70 percent) with a minimum of 15 percent sagebrush cover or as consistent with specific ecological site conditions; exceptions to this objective shall be made where GRSG habitat and Utah prairie dog occur on the same landscape, which will be managed for both species. The attributes necessary to sustain these habitats are described in Interpreting Indicators of Rangeland Health (BLM Tech Ref 1734-6).

Management Actions (MA)

MA-VEG-1: In PHMA, where necessary to meet GRSG habitat objectives, treat areas to maintain and expand healthy GRSG habitat (e.g., conifer encroachment areas and annual grasslands).

In PHMA, prioritize implementation of restoration/treatment projects based on environmental variables that improve chances for project success in areas most likely to benefit GRSG (e.g., proximity to existing GRSG populations, ecological site potential, and resistance and resilience), documented in **Appendix H**, Fire and Invasives Assessment Tool.

In PHMA, prioritize restoration in seasonal habitats that are identified as the limiting factor for GRSG distribution and/or abundance.

Apply seasonal restrictions to avoid treating areas during seasons of use, as needed, when implementing vegetation treatments (see MA-SSS-3G).

In PHMA, avoid sagebrush reduction treatments within GRSG nesting and winter habitat unless the project plan and associated NEPA document demonstrate a biological need for the treatment to maintain or improve habitat for the GRSG population, or unless the treatment is for Utah prairie dog recovery where the needs of both species will be addressed on the landscape. Coordinate with the appropriate State of Utah agency and the USFWS prior to conducting sagebrush treatment projects within nesting and winter habitat.

Use collaborative planning efforts to develop and implement habitat restoration projects. Expertise and ideas from entities such as local landowners, local GRSG working groups, and other federal, state, county, and private organizations shall be solicited and considered in development of restoration projects.

In PHMA, implement project design features that will contribute to the most favorable conditions for success when planning and implementing restoration/vegetation treatment projects. Examples include, but are not limited to the following:

- Review of available plant species and their adaptation to the site when developing seed mixes.
- The need to reduce non-native annual grass densities and competition through herbicide, targeted grazing, tillage, etc.
- Assessment of on-site vegetation to ascertain if enough desirable perennial vegetation exists to consider the use of passive restoration techniques.

- Use of site preparation techniques that retain existing desirable vegetation.
- Use of "mother plant" techniques or planting of satellite populations of desirable plants to serve as seed sources.
- The need for post-treatment control of non-native annual grass and other invasive species.

Upon completion of vegetation treatments, monitor and manage the project area to ensure long-term success, including persistence of seeded species and/or other treatment components, such as implementing maintenance treatments.

MA-VEG-2: Remove conifers encroaching into sagebrush habitats, in a manner that considers tribal cultural values. When conducting conifer treatments:

- Prioritize treatments closest to occupied GRSG habitats and near occupied leks, and where juniper encroachment is phase I or phase II.
- Treat areas in late Phase II or Phase III condition to create movement corridors, connect habitats, or to break up continuous, hazardous fuels and reduce the potential for catastrophic fire.
- Prioritize methods to reduce conifer canopy cover to those that maintain the understory vegetation as the preferred treatment methods (e.g., mechanical, lop and scatter).
- Require that vegetation treatments conducted within 0.6 miles of a lek include an objective of reducing conifer, where technically feasible, to less than 5 percent canopy cover, with preference for complete removal.
- Include stipulations to avoid removing old-growth pinyon/juniper stands (e.g., Tausch et al. 2009; Miller et al. 1999).
- Use of site-specific analysis and tools like the Vegetation Dynamics Development Tool and the fire and invasives assessment tool report (Chambers et al. 2014) will help refine the location for specific areas to be treated.

MA-VEG-3: In PHMA manage wet meadows to maintain a component of perennial forbs with diverse species richness relative to site potential (e.g., reference state) to facilitate brood rearing. Also conserve or enhance these wet meadow complexes to maintain or increase amount of edge and cover within that edge.

MA-VEG-4: In PHMA, include GRSG habitat objectives in restoration/treatment projects. Include short-term and long-term habitat conditions in treatment objectives, including specific objectives for the establishment of sagebrush cover and height, as well as cover and heights for understory perennial grasses and forbs necessary for GRSG seasonal habitats (see Objective SSS-3).

Make meeting the GRSG objectives for the restoration/treatment project one of the primary priorities for the project and subsequent land uses, recognizing that managing for other special status species may result in treatment objectives that may not meet GRSG seasonal habitat objectives (e.g., winter habitat cover requirements versus creation of Utah prairie dog habitat). Where GRSG habitat overlaps with that of federally listed threatened or endangered species (e.g., Utah prairie dogs), coordinate with

species-specific experts to develop conservation and recovery objectives and allow habitat treatments that will benefit both species.

MA-VEG-5: In PHMA, prioritize the use of native seeds for restoration based on availability, adaptation (ecological site potential), and probability of success. Where probability of success or adapted seed availability is low, desirable non-native seeds may be used as long as they support GRSG habitat objectives. Re-establishment of appropriate sagebrush species/subspecies and important understory plants, relative to site potential, should be the principle objective for rehabilitation efforts.

MA-VEG-6: In PHMA, design post restoration management to ensure long term persistence. This could include changes in livestock grazing management, wild horse and burro management and travel management, etc., to achieve and maintain the desired condition of the restoration effort that benefits GRSG, as well as monitoring and maintaining the treated area.

MA-VEG-7: In PHMA, limit commercial seed or live plant collection to levels that ensure long-term maintenance of the GRSG habitat objectives. Locations, species allowed for collection, and limits on the amounts to be collected will be developed on a case-by-case basis following environmental review of annual site-specific conditions. Commercial collection during sensitive seasonal periods (see MA-SSS-3G) will include mitigation, developed to reflect the site-specific conditions on the ground, that could include, but is not necessarily limited to, restrictions on the timing and method of collection activities, limiting the number of individuals collecting, providing portions of collected seeds for use in local restoration projects, etc.

MA-VEG-8: In PHMA, allow for seed collection and use in restoration/reclamation activities. Prioritize use of seed from areas as close as possible to where the seed will be used to capture local adaptations.

MA-VEG-9: In PHMA, diversify the perennial grass and forb components through additional seeding in areas where historical seedings (e.g., crested wheatgrass) have been recolonized by sagebrush.

MA-VEG-10: Follow the applicable and technically feasible RDFs in **Appendix C** for vegetation projects/activities (fuels management) at the site-level unless at least one of the following can be demonstrated in the NEPA analyses associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity;
- 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.

MA-VEG-11: In PHMA, design post Emergency Stabilization and Rehabilitation/Burn Area Emergency Rehabilitation management to ensure long term persistence of seeded or pre-burn native plants. This may require temporary or long-term changes in livestock grazing, wild horse and burro, and travel management, etc., to achieve and maintain the desired condition of Emergency Stabilization and Rehabilitation projects to benefit GRSG (Eiswerth and Shonkwiler 2006).

Monitor and control invasive vegetation post-wildfire for at least 3 years.

MA-VEG-12: In PHMA, integrated Vegetation Management will be used to control, suppress, and eradicate noxious and invasive species per BLM Handbook H-1740-2.

MA-VEG-13: In PHMA, treatments of Mormon cricket outbreaks will be collaborated with partners at the federal, state, and local levels to maintain and enhance GRSG habitats.

MA-VEG-14: Treat areas that contain cheatgrass and other invasive or noxious species to minimize competition and favor establishment of desired species.

2.2.3 Fire and Fuels Management (FIRE)

Management Actions (MA)

MA-FIRE-1: In collaboration with the USFWS and relevant state agencies, complete and maintain GRSG Landscape Wildland Fire and Invasive Species Habitat Assessments to prioritize at risk habitats, and identify fuels management, preparedness, suppression and restoration priorities necessary to maintain sagebrush habitat to support interconnecting GRSG populations. These assessments and subsequent assessment updates will also be a collaborative effort to take into account other GRSG priorities identified in this plan. **Appendix H** describes a minimal framework example and suggested approach for this assessment.

Implementation actions will be tiered to the local GRSG Landscape Wildland Fire and Invasive Species Assessment, using best available science related to the conservation of GRSG.

In collaboration with USFWS and relevant state agencies, BLM planning units will identify annual treatment needs for wildfire and invasive species management as identified in local unit level Landscape Wildfire and Invasive Species Assessments. Annual treatment needs will be coordinated across state/regional scales and across jurisdictional boundaries for long-term conservation of GRSG.

Annually complete a review of landscape assessment implementation efforts with appropriate USFWS and state agency personnel.

Fuels Management

MA-FIRE-2: Follow the applicable and technically feasible RDFs in **Appendix C** for fuels management at the site-level unless at least one of the following can be demonstrated in the NEPA analyses associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity;
- 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.

MA-FIRE-3: In PHMA, fuel treatments will be designed through an interdisciplinary process to expand, enhance, maintain, or protect GRSG habitat.

- In collaboration with USFWS and relevant state agencies, BLM planning units with large blocks of GRSG habitat will develop, using the assessment process described in **Appendix H**, a fuels management strategy which considers an up-to-date fuels profile, land use plan direction, current and potential habitat fragmentation, sagebrush and GRSG ecological factors, and active vegetation management steps to provide critical breaks in fuel continuity, where appropriate. When developing this strategy, planning units will consider the risk of increased habitat fragmentation from a proposed action versus the risk of large scale fragmentation posed by wildfires if the action is not taken.
- Use green strips and/or fuel breaks to protect GRSG habitat from fire events.
- When possible, locate fuel breaks along existing roads, ROWs, and other suitable topographic or natural features (e.g., areas devoid of vegetation, rock outcrops).
- Avoid constructing fuel breaks through large areas of intact GRSG habitat, unless the associated NEPA document demonstrates a biological need for the fuel break to maintain or protect habitat for the GRSG population. Coordinate with the appropriate State of Utah agency and the USFWS prior to constructing fuel breaks within nesting and winter habitat.
- Using an interdisciplinary approach, a full range of fuel reduction techniques will be available. Fuel reduction techniques such as conifer reduction, grazing, prescribed fire, chemical, biological, and mechanical treatments may be acceptable, given site-specific variables.
- Remove encroaching conifer stands as a fuels management tool, where environmental review documents it protects or improves GRSG habitat.
- Prioritize the use of native seeds for fuels management treatment based on availability, adaptation (site potential), and probability of success. Where probability of success for native seed availability is low, desirable non-native seeds may be used to meet GRSG habitat objectives to trend toward restoring the fire regime. When reseeding, use fire resistant native and desirable non-native species, as appropriate, to provide for fire breaks.
- Upon project completion, monitor and manage fuels projects to ensure long-term success, including persistence of seeded species and/or other treatment components, such as implementing maintenance actions. Control invasive vegetation post-treatment.
- Apply seasonal restrictions, as needed, for implementing fuels management treatments according to the type of seasonal habitats present (see MA-SSS-3G).

In PHMA, avoid sagebrush reduction fuels treatments within GRSG nesting and winter habitat unless the project plan and associated NEPA document demonstrate a biological need for the treatment to maintain or improve habitat for the GRSG population, or unless the treatment is for Utah prairie dog recovery where the needs of both species will be addressed on the landscape. Treatments in winter habitat should be designed to maintain sagebrush, especially tall sagebrush (sagebrush capable of standing above heavier than normal snowfall), which will be available to GRSG above snow during a severe winter, considering the needs of Utah prairie dog recovery. Prior to conducting fuels treatments in winter habitat, coordinate with the appropriate State of Utah agency and the USFWS to design the treatment to strategically reduce wildfire risk around or in the winter habitat.

MA-FIRE-4: If prescribed fire is used in GRSG habitat, the NEPA analysis for the Burn Plan will address:

- why alternative techniques were not selected as a viable options;
- how GRSG goals and objectives will be met by its use;
- how the COT Report objectives will be addressed and met;
- a risk assessment to address how potential threats to GRSG habitat will 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 may be used to meet specific fuels objectives that will protect GRSG habitat in PHMA (e.g., creation of fuel breaks that will 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), as well as managing the landscape for GRSG in concert with Utah prairie dog.

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 will need to be designed to strategically reduce wildfire risk around and/or in the winter range and designed to protect winter range habitat quality.

MA-FIRE-5: In PHMA, during fuels management project design, consider the use of targeted livestock grazing to strategically reduce fine fuels and, if used, implement grazing management that will accomplish this objective. If implementing targeted grazing, implement measures to minimize impacts on native perennial grasses.

Pre-Suppression

MA-FIRE-6: Follow the applicable and technically feasible RDFs in **Appendix C** for fire and fuels management at the site-level unless at least one of the following can be demonstrated in the NEPA analyses associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity;
- 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.

Implement a coordinated inter-agency approach to fire restrictions based upon National Fire Danger Rating System thresholds (fuel conditions, drought conditions and predicted weather patterns) for GRSG habitat.

Develop wildfire prevention plans that explain the resource value of GRSG habitat and include fire prevention messages and actions to reduce human-caused ignitions.

Suppression

MA-FIRE-7: Follow the applicable and technically feasible RDFs in **Appendix C** for fire and fuels management at the site-level unless at least one of the following can be demonstrated in the NEPA analyses associated with the project/activity:

- A RDF is documented to not be applicable to the site-specific conditions of the project/activity;
- 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.

MA-FIRE-8: 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. GRSG habitat in PHMA will be prioritized commensurate with property values and other critical habitat to be protected, with the goal to restore, enhance, and maintain areas suitable for GRSG across the range of GRSG habitat consistent with LUP direction.

PHMA will be viewed as more valuable than GHMA when priorities are established. When suppression resources are widely available, maximum efforts will be placed on limiting fire growth in GHMA polygons as well. These priority areas will be further refined following completion of the GRSG Landscape Wildland Fire Invasive Species Habitat Assessments described in **Appendix H**.

In GHMA or areas where treatment/seeding has occurred to improve habitat, prioritize suppression where wildfires threaten adjacent PHMA.

MA-FIRE-9: Within acceptable risk levels use a full range of fire management strategies and tactics, including the management of wildfires to achieve resource objectives, across the range of GRSG habitat consistent with LUP direction.

In PHMA, burnout operations areas should be avoided by constructing direct fire lines, whenever safe and practical to do so.

2.2.4 Livestock Grazing/Range Management (LG)

Management Actions (MA)

MA-LG-1: PHMA and GHMA will be available for livestock grazing (**Figure 2-3**, Livestock Grazing [**Appendix A**]). Active animal unit months (AUMs) for livestock grazing will be 329,521 on BLM lands. Make adjustments to permitted AUMs consistent with regulation and the remaining grazing direction. In addition, on an annual basis livestock numbers and the season of use can be adjusted within the terms and conditions of the permit.

Make adjustments to permitted use and annual adjustments to levels of livestock use consistent with regulation and the direction identified below where livestock grazing is identified as a causal factor to not meeting standards or habitat objectives.

MA-LG-2: 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 SFA first followed by PHMA outside 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 (ex., fire) and legal obligations.

MA-LG-3: In PHMA, consult, cooperate, and collaborate with other land owners and management agencies (e.g., private and SITLA) to develop plans which provide for landscape level approaches to habitat improvement. Manage unfenced private and SITLA lands within a grazing allotment that are under exchange of use agreements or percent public land use as a single unit that will have the same management as the public lands.

MA-LG-4: Evaluate Utah's Rangeland Health Standards and process grazing permits. Focus monitoring and management activities on allotments found not to be achieving Utah's Rangeland Health Standards where livestock grazing is identified as a causal factor and that have the best opportunities for conserving, enhancing or restoring habitat for GRSG.

Use ecological site descriptions and/or other appropriate information to determine the desired plant community within proper functioning ecological processes for conducting land health assessments to evaluate the achievement or non-achievement of rangeland health standards.

MA-LG-5: In PHMA and GHMA, conduct land health assessments that include indicators and measurements of structure, condition, composition, etc., of vegetation specific to achieving GRSG habitat objectives (Objective SSS-3), including within wetlands and riparian areas. Prioritize land health assessments in SFA, followed by PHMA outside of the SFA. Conduct land health assessments at the watershed scale and use the GRSG habitat objectives when assessing the applicable standard in GRSG habitats.

MA-LG-6: In PHMA, 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:

- Season or timing of use;
- Numbers of livestock;
- Distribution of livestock use;
- Duration and/or level of use;
- Kind of livestock (e.g., cattle, sheep, horses, or goats); and
- Grazing schedules (including rest or deferment).

**Not in priority order*

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 **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. Adjustments to meet seasonal GRSG habitat requirements could include those items identified in the list above.

MA-LG-7: In PHMA, during drought periods, prioritize evaluating effects of the drought relative to GRSG needs for food and cover.

Initiate emergency management measures (e.g. delaying turnout, adjusting the amount and/or duration of livestock grazing, implement other terms of the permit) during times of drought to protect GRSG habitat, in accordance with Instruction Memorandum 2013-094 (Resource Management During Drought), or other agency policies.

Implement post-drought management to allow for vegetation recovery that meets GRSG needs.

MA-LG-8: In PHMA, manage riparian areas and wet meadows for proper functioning condition.

MA-LG-9: In PHMA, assess livestock grazing in riparian and meadow complexes and ensure recovery or maintenance of appropriate vegetation and water quality. Where recovery or maintenance is not occurring and the causal factor is livestock grazing, reduce pressure on riparian or wet meadow vegetation used by GRSG in the summer by adjusting grazing management practices (e.g., use fencing/herding techniques, or changes in seasonal use or livestock distribution).

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.

MA-LG-10: In PHMA, limit authorization of new water developments to projects that have a neutral effect or are beneficial to GRSG habitat (such as by shifting livestock use away from critical areas). New developments that divert surface water must be designed to maintain riparian or wet meadow vegetation and hydrology to meet GRSG needs.

MA-LG-11: In PHMA, evaluate existing water developments (springs, seeps, etc., and their associated pipelines) to determine if modifications are necessary to maintain or improve riparian areas and GRSG habitat. Make modifications where necessary, considering impacts on other water uses when such considerations are neutral or beneficial to GRSG.

MA-LG-12: In PHMA, ensure that vegetation treatments conserve, enhance or restore GRSG habitat (this includes treatments that benefit livestock).

MA-LG-13: In PHMA, evaluate the role of existing seedings that are currently composed of primarily introduced perennial grasses to determine if they should be restored to sagebrush or habitat of higher quality for GRSG. If existing seedings provide value in conserving or enhancing GRSG habitats, then no

restoration will be necessary. Assess the compatibility of these seedings for GRSG habitat during the land health assessments.

MA-LG-14: In PHMA, design new structural range improvements to have a neutral effect or conserve, enhance, or restore GRSG habitat through an improved grazing management system relative to GRSG objectives. Structural range improvements, in this context, include but are not limited to: cattle guards, fences, exclosures, corrals or other livestock handling structures; pipelines, troughs, storage tanks (including moveable tanks used in livestock water hauling), windmills, ponds/reservoirs, solar panels and spring developments. Potential for invasive species establishment or increase following construction must be considered in the project planning process and monitored and treated post-construction.

MA-LG-15: In PHMA, evaluate existing structural range improvements to make sure they have a neutral effect or conserve, enhance or restore GRSG habitat.

MA-LG-16: To reduce outright GRSG strikes and mortality, remove, modify or mark fences in high risk areas (Stevens et al. 2012) based on proximity to lek (e.g., within 1.2 miles of a lek), lek size, and topography, or as latest science indicates. Prioritize actions in SFA first, then PHMA.

Employ NRCS fence collision risk tool (NRCS/CEAP Conservation Insight Publication "Applying the Sage Grouse Fence Collision Risk Tool to Reduce Bird Strikes").

MA-LG-17: In PHMA, monitor for and treat noxious weeds and treat invasive species where needed, associated with existing range improvements.

MA-LG-18: 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 or fire breaks. 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)

Management Actions (MA)

MA-WHB-1: Manage HMAs in GRSG habitat within established appropriate management level ranges to achieve and maintain GRSG habitat objectives (Objective SSS-3).

MA-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 PHMA;
2. HMAs containing only GHMA;
3. HMAs containing sagebrush habitat outside of PHMA and GHMA mapped habitat; and
4. HMAs without GRSG habitat.

MA-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.

MA-WHB-4: In PHMA, assess and adjust appropriate management levels 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 appropriate management levels are not being exceeded.

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

MA-WHB-6: Develop or amend herd management plans to incorporate GRSG habitat objectives and management considerations for all HMAs within GRSG habitat, with an emphasis placed on PHMA.

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

MA-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 effect on GRSG populations and habitat. Implement any water developments or rangeland improvements using the criteria identified for domestic livestock.

MA-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 wild horse and burro program.

2.2.6 Minerals Resources (MR)

Management Actions (MA)

MA-MR-1: Allow exploration for all minerals (e.g., geophysical, trenching, drilling, etc.) within mapped occupied GRSG habitat areas that are not closed to leasing, permitting, etc., to obtain exploratory information. In areas where leasing, permitting, etc. is still available, minerals exploration shall be subject to the pertinent management for discretionary activities in PHMA (MA-SSS-3) and GHMA (MA-SSS-5).

Fluid 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 GRSG, priority will be given to development in non-habitat areas first and then in the least suitable habitat for GRSG. 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 compensate for adverse impacts on 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 for the lease to avoid, minimize, and compensate for 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 Actions (MA)

MA-MR-2: Manage fluid mineral leasing in PHMA as follows (**Figure 2-4**, Fluid Minerals [Oil and Gas] [**Appendix A**]) (**Appendix G**, Stipulations Associated with Fluid Mineral Leasing):

- open to leasing, subject to standard stipulations: 0 acres
- open to leasing, subject to CSU and/or TL stipulations: 23,600 acres
- open to leasing, subject to NSO stipulations: 3,229,600 acres
- closed to leasing: 111,900 acres

Unleased Federal Fluid Mineral Estate

MA-MR-3:

Unleased Areas within PHMA

PHMA will be designated as open to leasing fluid minerals, subject to NSO stipulations.

In SFA, there will be no waivers, exceptions, or modifications. In the remainder of PHMA, 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:

- Would not have direct, indirect, or cumulative effects on GRSG or its habitat; or,
- 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 ARMPA. 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.

In addition, any lease activities will apply the pertinent management for discretionary activities in PHMA identified in MA-SSS-3 (e.g., mitigation, disturbance cap, minerals/energy density, buffers, seasonal restrictions, and RDFs).

Outside PHMA, portions of opportunity areas within 4 miles of a lek that is located in PHMA will be open for leasing with CSU stipulations (avoiding noise and tall structures that could affect adjacent GRSG use of PHMA).

MA-MR-4:

Unleased Areas within GHMA

Manage fluid mineral leasing in GHMA as follows (**Figure 2-4**):

- open to leasing, subject to standard stipulations: 238,700 acres
- open to leasing, subject to CSU and/or TL stipulations: 294,200 acres
- open to leasing, subject to NSO stipulations: 32,700 acres
- closed to leasing: 28,400 acres
- planning decision not mapped: 133,400 acres

In GHMA, new development of fluid mineral leases could be considered if they apply the pertinent management for discretionary activities in GHMA identified in MA-SSS-5.

Leased Federal Fluid Mineral Estate

MA-MR-5: Apply the following conservation measures through implementation decisions (e.g., approval of an application for permit to drill, geothermal drilling permit, Sundry Notice, Master Development Plans, etc.) and upon completion of the environmental record of review (43 CFR, Part 3162.5). In this process, evaluate whether the conservation measures are "reasonable" (43 CFR, Part 3101.1-2) with the valid existing rights.

MA-MR-6: In PHMA, avoid, minimize, and compensate for impacts on GRSG and their habitat (e.g., habitat loss, fragmentation, indirect impacts, etc.) from new oil and gas development on existing leases.

Where possible, place development outside of PHMA. If it is determined that this restriction renders the recovery of fluid minerals infeasible or uneconomic, considering the lease as a whole, or where development of existing leases requires that disturbance density exceeds 1 per 640, and/or 3 percent disturbance cap, apply other measures to site proposed lease activities to meet GRSG habitat objectives and require mitigation as described in **Appendix F**. If the lease is entirely within PHMA, if feasible, apply the lek buffers from MA-SSS-3H. If this is not technically feasible, locate infrastructure in areas that will minimize habitat loss. Require any development to be placed at the most distal part of the lease from the lek or in areas least harmful to GRSG populations and habitat (e.g., areas where local terrain features such as ridges and ravines may reduce habitat importance or shield nearby habitat from disruptive factors).

For geophysical exploration activities, include seasonal TLs and RDFs as permit conditions of approval to eliminate or minimize surface-disturbing and disruptive activities within nesting and brood-rearing habitat and winter concentration areas.

MA-MR-7: To the extent consistent with existing lease-rights, apply the pertinent management for discretionary activities in PHMA identified in MA-SSS-3 (e.g., mitigation, disturbance cap, minerals/energy density, buffers, seasonal restrictions, and RDFs) and in GHMA identified in MA-SSS-5 (i.e., mitigation, buffers, and RDFs).

MA-MR-8: In PHMA, operators must submit a master development plan with site-specific plans of development for roads, wells, pipelines and other infrastructure prior to any development being authorized. The BLM will evaluate the plan through the NEPA process.

MA-MR-9: In PHMA, encourage unitization when deemed necessary for proper development and operation of an area (with strong oversight and monitoring) to minimize adverse impacts on GRSG according to the Federal Lease Form, 3100-11, Sections 4 and 6.

MA-MR-10: In PHMA, identify areas where acquisitions (including federal mineral rights) or conservation easements, will benefit GRSG habitat.

MA-MR-11: In PHMA, require a full reclamation bond specific to the site in accordance with 43 CFR, Parts 3104.2, 3104.3, 3104.5, and 36 CFR, Part 228.109. Insure bonds are sufficient for costs relative to reclamation that will result in full restoration of the lands to the condition it was found prior to disturbance. Base the reclamation costs on the assumption that contractors will perform the work.

Locatable Minerals

MA-MR-12: SFA will be recommended for withdrawal from the Mining Law of 1872 (as amended), subject to valid existing rights (**Figure 2-5**, Locatable Minerals [**Appendix A**]).

Other federal lands or non-federal lands with federal mineral interests within PHMA or GHMA that are not already withdrawn will be available for locatable mineral entry. Areas that are recommended for withdrawal will continue to be managed as they are currently managed.

In PHMA, to the extent consistent with the rights of a mining claimant under existing laws and regulations, limit surface disturbance from locatable mineral development and apply management to minimize and mitigate impacts. To the extent allowable by law, work with claimants to voluntarily apply the pertinent management for discretionary activities in PHMA identified in MA-SSS-3 (e.g., mitigation, disturbance cap, minerals/energy density, buffers, seasonal restrictions, and RDFs) and in GHMA identified in MA-SSS-5 (i.e., mitigation and buffers).

Regardless of whether agreements with the claimant incorporates the 3 percent disturbance cap (MA-SSS-3B), disturbance from locatable mineral development will be included as disturbance when calculating disturbance for other land uses.

Saleable Minerals

MA-MR-13: In PHMA, manage mineral materials as follows (**Figure 2-6**, Salable Minerals [Mineral Materials] [**Appendix A**]):

- open to mineral materials development: 0 acres
- closed to mineral materials development: 2,587,100 acres

MA-MR-14: Close PHMA 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 at all phases of the development (construction and long-term operation of facilities):

- the activity is within the population area (BSU) and project area disturbance cap (MA-SSS-3B);
- the activity is subject to the provisions set forth in the mitigation framework (MA-SSS-3A);
- all applicable RDFs are applied (MA-SSS-3I); and
- the activity applies the other pertinent management for discretionary activities in PHMA in MA-SSS-3.

In GHMA, new mineral material developments can be considered if consistent with the pertinent management for discretionary activities described in MA-SSS-5.

Non-Energy Leasable Minerals

MA-MR-15: In PHMA, manage nonenergy leasable minerals on federal lands and non-federal lands with federal mineral interests as follows (**Figure 2-7**, Non-Energy Leasable Minerals [**Appendix A**]):

- Open to Leasing Consideration – 24,800 acres (National Forest System lands in Wyoming)
- Closed to Leasing – 3,340,200 acres

In PHMA, close federal lands and non-federal lands with federal mineral interests to nonenergy leasable mineral leasing. However, expansion of existing operations could be considered if the new lease is contiguous with an existing operation and the new lease (construction, operation, or maintenance) applies the pertinent management for discretionary activities in PHMA identified in MA-SSS-3 (e.g., mitigation, disturbance cap, minerals/energy density, buffers, seasonal restrictions, and RDFs).

MA-MR-16: In GHMA, manage nonenergy leasable minerals on federal lands and non-federal lands with federal mineral interests as follows (**Figure 2-7**):

- Open to Leasing Consideration – 699,300 acres
- Closed to Leasing – 28,200 acres

New leasing and development in GHMA can be considered if consistent with the pertinent management for discretionary activities described in MA-SSS-5.

MA-MR-17: In PHMA, exploration and prospecting activities associated with nonenergy leasable minerals will be required to comply with the same stipulations identified for leasing and development, above. In addition:

- The exploration/prospecting activity does not occur during sensitive seasonal periods (i.e., breeding and nesting, brood rearing, winter) (MA-SSS-3G).

- Facilities associated with exploration/prospecting activities will be removed before the next breeding season.
- Disturbances will be restored.

Coal

MA-MR-18:

Leases Associated with Surface Mining

At the time an application for a new coal lease or lease modification is submitted to the BLM, the BLM will determine whether the lease application area is "unsuitable" for all or certain coal mining methods pursuant to 43 CFR, Part 3461.5. PHMA is essential habitat for maintaining GRSG for purposes of the suitability criteria set forth at 43 CFR, Part 3461.5(o)(1).

MA-MR-19:

Leases Associated with Underground Mining

Consider leasing PHMA for coal that will be extracted through underground mining. Require the following stipulations as part of any new lease or lease modification:

- In PHMA, appurtenant facilities will not be placed in GRSG habitat, where technically feasible.
- In PHMA, if placement of facilities outside of GRSG habitat is not technically feasible, disturbances associated with the lease (construction, operation, or maintenance) can be allowed if they are consistent with the pertinent management for discretionary activities identified in MA-SSS-3 (e.g., mitigation, disturbance cap, minerals/energy density, buffers, noise restrictions, seasonal restrictions, etc.).

If the above criteria cannot be met, do not grant new leases or modifications.

MA-MR-20: New leasing for underground mining of coal in GHMA can be considered if consistent with the pertinent management for discretionary activities described in MA-SSS-5.

MA-MR-21: In PHMA, exploration activities needed to meet data adequacy standards associated with potential coal leasing will be required to comply with the pertinent management for discretionary activities identified in MA-SSS-3 (e.g., mitigation, disturbance cap, buffers, noise restrictions, seasonal restrictions, etc.).

MA-MR-22: For underground coal mining operations on existing leases: In PHMA, unless required for technical or safety reasons, do not authorize new appurtenant surface facilities for existing underground mining. If new appurtenant surface facilities associated the existing mine leases cannot be located outside of PHMA, collocate them with any existing disturbed areas, if possible. If collocation is not possible, then construct new facilities to minimize disturbed areas while meeting mine safety standards/requirements, as identified by Mine Safety and Health Administration mine-plan approval process, and locate the facilities in an area least harmful to GRSG habitat based on vegetation, topography, or other habitat features.

MA-MR-23: For coal mining operations on existing leases: In GHMA, new disturbances could be considered if consistent with the pertinent management for discretionary activities described in MA-SSS-5.

Mineral Split Estate

MA-MR-24: Where the federal government manages the mineral estate in PHMA and GHMA, and the surface is in non-federal ownership, apply the same stipulations, conditions of approval, and/or conservation measures and RDFs 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.

Where the federal government manages the surface and the mineral estate is in non-federal ownership in PHMA and GHMA, apply appropriate surface use conditions of approval, 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 Actions (MA)

Wind Energy Development

MA-RE-1: PHMA will be designated as exclusion areas for wind energy development (2,026,400 acres) (**Figure 2-8**, Wind [**Appendix A**]).

Do not site wind energy development in opportunity areas within 5 miles from occupied GRSG leks that are in PHMA.

Manage wind energy development in GHMA as follows:

- Open – 484,900 acres
- Avoided – 0 acres
- Excluded – 17,600 acres

New wind ROW authorizations can be allowed in GHMA if they apply the pertinent management for discretionary activities identified in MA-SSS-5.

Solar Energy Development

The BLM's Approved Resource Management Plan Amendments/ROD for Solar Energy Development in Six Southwestern States (October 2012) excluded all GRSG occupied habitat to new utility-scale solar development. Because the existing land use plans already exclude solar development in GRSG habitat; this plan amendment process does not need to make additional decisions related to solar development (**Figure 2-9**, Solar [**Appendix A**]).

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 Actions (MA)

MA-LR-1: In PHMA, manage lands ROWs, permits, and leases as follows (**Figure 2-11**, Rights-of-Way [**Appendix A**]):

- Open: 18,900 acres (associated with designated above-ground ROW corridors)
- Avoided: 1,997,000 acres
- Excluded: 10,500 acres

MA-LR-2:

Linear and Site-Type ROWs, Permits, and Leases (excluding wind and solar)

PHMA will be avoidance areas for new linear and site type ROWs, permits, and leases except for within ROW corridors designated for aboveground use. Placement of new ROWs, permits, and leases in PHMA shall be avoided if at all possible. Where avoidance is not possible in PHMA, placement of a new ROW/permit/lease can be allowed if it applies the management for discretionary activities in PHMA identified in MA-SSS-3 (e.g., mitigation, disturbance cap, buffers, tall structure restrictions, seasonal restrictions, and applicable RDFs).

In PHMA, lands ROWs, permits and leases that cannot be avoided shall be located in areas that minimize the effect on the GRSG population (e.g., non-habitat areas, least suitable habitat, collocated with existing disturbances).

In PHMA, new proposals for power lines, access roads, pump storage, and other hydroelectric facilities licensed by Federal Energy Regulatory Commission will be subject to all GRSG ROW avoidance allocations and pertinent management for discretionary activities in MA-SSS-3.

Outside PHMA, portions of opportunity areas within 4-miles of a lek that is located in PHMA will be avoidance areas for new ROWs, permits and leases, applying stipulations for noise and tall structures.

In addition to the above requirements, the subsequent conditions will apply to specific types of ROW authorizations:

Transmission Lines

PHMA are designated as avoidance areas for high voltage transmission line ROWs, except for the transmission projects specifically identified below. All authorizations in these areas, other than the following identified projects, must comply with the conservation measures outlined in this plan, including the RDFs and avoidance criteria presented in MA-SSS-03. The BLM is currently processing an application for TransWest Express (including those portions of Energy Gateway South that are collocated) 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.

In PHMA, high voltage transmission lines (100 kilovolt or greater) will be avoided if possible. If avoidance is not possible, they will be placed in designated corridors where technically feasible. Where not technically feasible, lines should be located adjacent to existing infrastructure, unless using a different alignment better minimizes impacts on GRSG. New ROWs constructed adjacent to existing infrastructure will be constructed as close as technically feasible to existing infrastructure to limit disturbance to the smallest footprint.

In PHMA outside of designated corridors, new transmission lines must be buried where technically feasible. Where burying transmission lines is not technically feasible:

- new transmission lines must be located adjacent to existing infrastructure, unless using a different alignment better minimizes impacts on GRSG; and
- they will be subject to GRSG ROW avoidance criteria described above.

In PHMA, if an existing transmission line is being upgraded to a higher voltage transmission line outside an existing corridor:

- the existing transmission line must be removed within a reasonable amount of time after the new line is installed and energized; and
- the new line must be constructed in the same alignment as the existing line unless an alternate route will benefit GRSG or GRSG habitat.

In PHMA, where existing guy wires are determined to have a negative impact on GRSG or its habitat, they shall be removed or appropriately marked with bird flight diverters to make them more visible to GRSG in flight.

Pipelines

In PHMA, major pipelines (greater than 24 inches) that cannot avoid PHMA will be placed in designated corridors where technically feasible. Where not technically feasible, pipelines shall be located adjacent to existing infrastructure, unless using a different alignment better minimizes impacts on GRSG.

Communication Sites

In PHMA, new communication towers that cannot avoid PHMA must be located, where technically feasible, within an existing communication site. New sites will be considered where necessary for public safety.

MA-LR-3:

Road ROWs

In PHMA, new road ROWs will be authorized 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, then avoid, minimize, and compensate for the impacts.

In PHMA, limit route construction to realignments of existing ROWs if the realignment maintains or enhances GRSG habitat, eliminates the need to authorize a new ROW to construct a new road, or is necessary for public safety or public need.

In PHMA, subject to valid existing rights, new road ROWs/easements will be authorized only when necessary for public safety or administrative access or, if it creates no new or de minimis new surface disturbance.

In PHMA, collocate new ROWs as close as technically possible to existing ROWs or where it best minimizes GRSG 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 build any new road constructed to the absolute minimum standard necessary.

In PHMA, existing Federal Highway Act Appropriation ROWs will be managed as valid existing rights, and new Federal Highway Act ROWs will continue to be considered and subject to all GRSG ROW plan restrictions.

MA-LR-4: In PHMA, designate ROW corridors as identified on **Figure 2-10**, Designated Utility Corridors [**Appendix A**]:

- Retain 17,600 acres of existing designated ROW corridor
- Retain 44,300 acres of existing designated ROW corridor, but stipulate new developments be limited to underground use only
- Undesignate 18,200 acres of existing designated ROW corridor

In PHMA, placement of new ROWs in corridors should be avoided if at all possible. Where avoidance is not possible:

- Allow new linear ROWs in designated corridors.
- New ROWs constructed in designated corridors will be constructed as close as technically feasible to existing linear ROW infrastructure to limit disturbance to the smallest footprint, unless using a different alignment better minimizes impacts on GRSG.
- Apply the pertinent management for discretionary activities in PHMA identified in MA-SSS-3.

MA-LR-5: In PHMA, when a ROW grant expires, is relinquished, or terminated, required rehabilitation as a term and condition of the FLPMA ROW grant, in compliance with 43 CFR, Part 2805.12(i).

- the lease holder will be required to restore the site by removing overhead lines and other infrastructure, and;
- eliminate existing raven nesting opportunities created by anthropogenic development on public lands (e.g., remove power line and communication facilities no longer in service).

In PHMA, during renewal, amendment or reauthorization of existing permits, work with existing ROW holders to mitigate impacts of existing ROW infrastructure. Where technically feasible, require ROW holders to bury or relocate existing power lines to minimize long-term impacts on GRSG habitat.

Where the potential long-term impacts of relocating or burying the line will be greater than the existing impacts, do not pursue the mitigation. If relocation or burying is not feasible or will result in severe short-term or greater long-term impacts on GRSG habitat, incorporate additional terms and conditions in the ROW authorization for protection of GRSG habitat.

Work with ROW holders to retrofit existing towers with perch deterrents or other anti-perching devices, where appropriate, to limit GRSG predation.

MA-LR-6: In PHMA, where existing leases or ROWs have had some level of development (road, fence, well, etc.) and are no longer in use, remove the features and restore the habitat.

MA-LR-7: In GHMA, manage ROWs, permits, and leases as follows (**Figure 2-11**):

- Open: 484,900 acres
- Avoided: 0 acres
- Excluded: 17,600 acres

New ROWs (including permits and leases) authorizations will be allowed if they apply the pertinent management for discretionary activities in GHMA identified in MA-SSS-5.

MA-LR-8: In GHMA, retain 74,700 acres of designated ROW corridors as identified on **Figure 2-10**.

Land Tenure

MA-LR-9: Lands classified as PHMA and GHMA for GRSG will be retained in federal management (**Figure 2-12**, Land Tenure [**Appendix A**]) unless: (1) the agency can demonstrate that disposal of the lands, including land exchanges, will provide a net conservation gain to the GRSG or (2) the agency can demonstrate that the disposal of the lands, including land exchanges, will have no direct or indirect adverse impact on conservation of the GRSG.

MA-LR-10: In PHMA, where suitable conservation actions cannot be achieved, seek to acquire state and private lands with intact federal mineral estate by donation, purchase or exchange in order to best conserve, enhance or restore GRSG habitat.

Recommended Withdrawals

MA-LR-11: SFA will be recommended for withdrawal from the Mining Law of 1872 (as amended), subject to valid existing rights. Other federal lands or non-federal lands with federal mineral interests within PHMA or GHMA that are not already withdrawn or recommended for withdrawal will be available for locatable mineral entry (**Figure 2-5**).

2.2.9 Recreation (REC)

Management Actions (MA)

MA-REC-1: In PHMA, only allow BLM SRPs that have neutral or beneficial effect on GRSG and their habitat. Evaluate existing SRPs for adverse effect on GRSG and their habitat. Modify or cancel the permit, as appropriate and where possible to avoid or mitigate effects of habitat alterations or other physical disturbances to GRSG (e.g., breeding, brood-rearing, migration patterns, or winter survival).

Identify permit stipulations that require the permittee to implement any necessary habitat restoration activities after SRP events. Restoration activities must be consistent with GRSG habitat objectives.

MA-REC-2: In PHMA, do not construct new recreation facilities (e.g., campgrounds, trailheads, staging areas) unless the development will have a net conservation gain to GRSG habitat (such as concentrating recreation, diverting use away from critical areas, etc.), or unless the development is required for visitor health and safety or resource protection.

2.2.10 Travel and Transportation Management (TTM)

Management Actions (MA)

MA-TTM-1: Manage off-highway vehicle (OHV) use in GRSG habitat as follows (**Figure 2-13**, Trails and Travel Management [**Appendix A**]):

- Open to cross-country use: 525 acres (one area each in Parker Mountain and Uintah Population Areas)
- Limited to existing routes: 1,274,700 acres
- Limited to designated routes: 1,220,500 acres
- Closed: 33,200 acres

MA-TTM-2: PHMA and GHMA that do not have designated routes in a Travel Management Plan will be managed as limited to existing routes until a Travel Management Plan designates routes (unless they are already designated as limited to designated routes or closed to OHV use).

OHV Areas designated as "closed" will be managed as areas closed to motorized vehicles. OHV Areas designated as "limited existing" within PHMA will be managed as "limited to existing roads, primitive roads, and trails" until the completion of an implementation level travel plan. 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 automatically transition to "limited to designated roads, primitive roads and trails."

MA-TTM-3: Implementation level travel planning efforts will be guided by the goals, objectives and guidelines outlined in the GRSG section, relevant national and Utah specific guidance as well as the following:

- A timeline to complete travel planning efforts 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 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."
- 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 will 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 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 (e.g., no use between 6:00 pm and 9:00 am) to reduce impacts on GRSG during breeding periods.

MA-TTM-4: In PHMA, 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 Utah's top priority areas to designate comprehensive travel plans:

- Sheeprocks
- Bald Hills
- Box Elder
- Rich
- Ibapah
- Hamlin Valley

MA-TTM-5: In PHMA, 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.

MA-TTM-6: In PHMA, when considering upgrade of existing routes that will change route category (BLM route categories: road, primitive road, or trail) or capacity, consider the larger transportation network while providing for protection of GRSG habitat.

MA-TTM-7: In PHMA, use existing roads, or realignments as described above to access valid existing rights that are not yet developed. If valid existing rights cannot be accessed via existing roads, then build any new road constructed to the absolute minimum standard necessary, and add the surface disturbance to the total disturbance. Apply additional effective mitigation necessary to offset the resulting loss of GRSG habitat. Plan for new routes in consideration of the larger transportation network objectives and needs while providing for protection of GRSG habitat.

MA-TTM-8: In PHMA, when reseeding roads, primitive roads and trails, use appropriate seed mixes and consider the use of transplanted sagebrush.

MA-TTM-9: Develop an educational process to advise OHV users of the potential for conflict with GRSG.

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

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 OHVs 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 should be considered only after other management strategies and alternatives have been explored. The duration of temporary closure or restriction orders should 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.

CHAPTER 3
CONSULTATION, COORDINATION, AND PUBLIC INVOLVEMENT

The BLM land use planning activities are conducted in accordance with NEPA requirements, Council on Environmental Quality regulations, and Department of the Interior and BLM policies and procedures implementing NEPA. 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 Utah Subregion GRSG website (http://www.blm.gov/ut/st/en/prog/planning/SG_RMP_rev.html).

3.1 CONSULTATION AND COORDINATION

The BLM collaborated with numerous agencies, municipalities, and tribes throughout the preparation of this ARMPA. Its outreach and collaboration with cooperating agencies are described in Chapter 6 of the Proposed Resource Management Plan Amendment (RMPA)/Final EIS. Twenty-eight agencies signed memoranda of understanding to participate in the BLM planning process as cooperating agencies. The BLM invited the cooperating agencies 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 ESA, as amended, the BLM requested a species list from USFWS of any federally listed, federally proposed, or current federal candidate species that may be present in the planning area. It initiated formal consultation with the USFWS under Section 7 of the ESA on November 19, 2013, and requested concurrence on which species would be analyzed in the biological assessment. In May 2015, the biological assessment was formally submitted to the USFWS for review. In July 2015, following additional consultation efforts, the BLM formally submitted a revised biological assessment to the USFWS for review.

The determination for most species is "no effect." Two species received a determination of "not likely to jeopardize the continued existence of the species" and 11 species received a determination of "may affect, but is not likely to adversely affect." The Utah prairie dog received a determination of "may affect, likely to adversely affect." This means that the Utah prairie dog or its habitat are likely to be exposed to the action or its environmental consequences and would respond in a negative manner to the exposure. Formal Section 7 consultation was completed on August 3, 2015, when the USFWS provided a biological opinion, concurring with the findings of the biological assessment (see **Appendix J**, Biological Opinion).

3.1.2 NHPA Section 106 Consultation

The BLM completed consultation with the Utah State Historic Preservation Officer, in accordance with 36 CFR, Part 800. In July 2015, it submitted a formal letter, concluding that the land use plan amendments would not adversely affect cultural properties and seeking input and concurrence on those findings. The BLM received a concurrence letter from the Utah State Historic Preservation Officer on July 30, 2015. The BLM will satisfy the requirements of National Historic Preservation Act (NHPA) Section 106 for future implementation-level decisions, such as project proposals. This will include adequate consultation with State Historic Preservation Officers, tribal historic preservation officers, Native American tribes, and other interested parties, consistent with the alternative procedures set forth in the NHPA and relevant state protocol, programmatic agreements, or where applicable the Section 106 regulations.

3.1.3 American Indian Tribal Consultation

In accordance with the NHPA and other legal authorities (see BLM Manual 8120), the BLM consulted with tribal representatives for the RMP planning process. Coordination with American Indian tribes occurred throughout the planning process. All tribes and organizations with interests in the planning area were contacted by mail and encouraged to be cooperating agencies. Tribes have been participating in the RMP process through meetings and other contacts. A request for a consultation meeting and copies of the RMP were sent to the following tribes and reservations in December 2011, October 2013, and May 2015:

- Confederated Tribes of the Goshute Indian Reservation
- Eastern Shoshone Tribe
- Hopi Tribal
- Kaibab Band of Paiute Indians
- Navajo Nation
- Navajo Utah Commission
- Northwest Band of Shoshone Nation
- Paiute Indian Tribe of Utah
- Shoshone-Bannock Tribes
- Skull Valley Band of Goshute Indians
- Southern Ute Indian Tribe
- Te-Moak Tribe of Western Shoshone Indians of Nevada

- Ute Indian Tribe-Uintah and Ouray Reservation
- Ute Mountain Ute Tribe
- White Mesa Ute Tribe

The Confederated Tribes of the Goshute Indian Reservation responded to the initial letter, accepting the invitation to be a cooperating agency. The BLM presented additional information related to the project at a Tribal Council Meeting on February 10, 2012. The Confederated Tribes of the Goshute Indian Reservation formalized their cooperating agency status through a Memorandum of Understanding on June 1, 2012. They have participated in a variety of meetings, briefings, and reviews throughout preparation of the EIS. The BLM met with the tribal council and discussed the Proposed RMPA/Final EIS in June 2015.

The Shoshone-Bannock Tribes responded to the letter and follow-up phone conversations, requesting additional information before making a decision on cooperating agency status. Through coordination with the BLM's Utah and Idaho State Offices and the Shoshone-Bannock Tribe, the tribe decided not to become a cooperating agency, but it did request ongoing consultation in relation to the GRSG planning in Idaho and the adjacent states. The determination was made that the BLM's Idaho Falls District would take the lead in face-to-face consultation efforts but that any additional information from other planning efforts would be provided as needed and requested. The BLM met with resource specialists from the Shoshone-Bannock Tribes and discussed the Proposed RMPA/Final EIS in June 2015.

The Paiute Indian Tribe of Utah also requested information on the project. The BLM consulted with the tribe on November 1, 2013, at a tribal council meeting. The agencies presented information related to the planning process in general and the Draft RMPA/EIS in particular. At the end of the briefing, the participants discussed several questions, and the BLM offered to consult further on GRSG planning. Additional consultation was conducted during development of the Proposed RMPA/Final EIS, when the BLM met with the tribal council in June 2015.

The Ute Indian Tribe-Uintah and Ouray Reservation submitted comments on the Draft RMPA/EIS to the BLM on January 14, 2014. The tribe raised several concerns about the range of alternatives, including restrictions in Alternatives B, C, and D. Additional attempts to contact or meet with the tribe were unsuccessful.

Other tribes declined or did not respond to the BLM's requests for consultation on the RMPA.

Regardless of consultation efforts, nothing in the ARMPA affects tribal treaty or off-reservation rights. Management of public lands recognizes and will be consistent with the treaty rights retained by the various tribes. Many of the treaty rights and subsequent laws, executive orders, regulations, and agency policies protect the sovereign nature of the reservations, as well as use of traditional homelands and use areas, including portions of the planning area.

3.2 PUBLIC INVOLVEMENT

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

A notice of availability for the Draft RMPA/EIS was published in the *Federal Register* on November 1, 2013, initiating a 90-day public comment period. The BLM held eight public comment open houses for the Draft RMPA/EIS from November 19 to December 12, 2013, in Richfield, Cedar City, Panguitch, Vernal, Price, Salt Lake City, Randolph, and Snowville. The comments received on the Draft RMPA/EIS and the BLM's responses were summarized in Appendix X of the Proposed RMPA/Final EIS.

The notice of availability for the Proposed RMPA/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, by which point the BLM had received 43 protest letters.

CHAPTER 4
PLAN IMPLEMENTATION

4.1 IMPLEMENTING THE PLAN

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

Immediate decisions—These are the land use planning decisions that go into effect when the ROD is signed. They include goals, objectives, allowable uses, and management direction, such as the allocation of lands as open or closed for salable mineral sales, lands open with stipulations for oil and gas leasing, and areas designated 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 LUP decisions to determine if the proposal conforms with the LUP.

One-time future decisions—These types of decisions are those 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 by partner and external public cooperation. 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, best management practices, and scientific principles. Where monitoring shows LUP actions or best management practices are not effective, plan maintenance or amendment may begin, as appropriate.

Plan maintenance will be documented in supporting records; it does not require formal public involvement, interagency coordination, or NEPA analysis for making new LUP decisions.

4.3 CHANGING THE PLAN

The ARMPA may be changed, should conditions warrant, through a plan amendment or plan revision. 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.

As new information becomes available about GRSG habitat, including seasonal habitats, in coordination with the state wildlife agency and USFWS and based on best available scientific information, the BLM may revise the GRSG habitat management area maps and associated management decisions through plan maintenance or plan amendment/revision, as appropriate.

Minor adjustments to PHMA and GHMA external boundaries can be made. This would come about if BLM biologists determine, in coordination with the appropriate State of Utah agency and based on best scientific information, that site-specific conditions warrant such changes to more accurately depict existing or potential GRSG habitat. The appropriate planning process (i.e., plan maintenance or plan amendment/revision) will be used, as determined on a case-by-case basis, considering site-specific issues.

4.4 PLAN EVALUATION, MONITORING, AND ADAPTIVE MANAGEMENT

Evaluation is a process in which the plan and monitoring data are reviewed to see if management goals and objectives are being met and if management direction is sound. RMP 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 changed through amendment or revision. 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 RMP evaluations to determine if the decisions in the RMP Amendment, 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 is tripped during the life of the plans, the BLM's response is 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 would be made to preclude tripping a hard trigger, which would signal 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 hard trigger response 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 revisions, if necessary. More information regarding the ARMPA's adaptive management strategy can be found in **Appendix I** and is outlined in the adaptive management direction in **Section 2.2** of this ARMPA.

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CHAPTER 5
GLOSSARY

Acquisition. Acquisition of lands can be pursued 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*); an activity plan 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.

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.

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

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

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 and to renewable resources, such as watersheds, vegetation, and wildlife. 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 (human) disturbances. 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.

Authorized/authorized use. This is an activity (i.e., resource use) occurring on the public lands that is either 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 or other appropriate authority (e.g., Congress for RS 2477 rights-of-way or FERC for major interstate rights-of-way) has issued a formal authorization document, such as a livestock grazing lease or permit, a right-of-way grant, a coal lease, or an oil and gas permit to drill. Formally authorized uses can involve commercial and noncommercial activity, facility placement, or event. These formally authorized uses are often limited by area or time. Unless constrained or bound by statute, regulation, or an approved land use plan decision, legal activities involving public enjoyment and use of the public lands for such activities as hiking, camping, and hunting require no formal BLM.

Avoidance/avoidance area. These terms usually address mitigation of some resource use. Paraphrasing the Council on Environmental Quality 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 relocating or totally redesigning an action to eliminate any potential impacts resulting from it. Also see *"right-of-way avoidance area"* definition.

Baseline. The existing condition of a defined area or resource that can be quantified by an appropriate measure. During environmental reviews, the baseline is considered the affected environment at the time the review begins 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 aid 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.

Biologically significant unit (BSU). A geographical/spatial area within GRSG habitat that contains the relevant habitats that GRSG use. In Utah, BSUs are synonymous with PHMA within a geographic area identified as the population area. BSU is used as a common point of reference for coordinating across state lines on regional conservation monitoring and management. A BSU or subset is used only in calculating the human disturbance threshold and the adaptive management habitat trigger.

BLM Sensitive Species. Those species that are not federally listed as endangered, threatened, or proposed under the ESA 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, which are managed so they will not need to be listed as proposed, threatened, or endangered under the ESA.

Candidate species. Taxa for which the USFWS has sufficient information on their status and threats to propose the species for listing as endangered or threatened under the Endangered Species Act, but for which issuing a proposed rule is currently 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).

Chemical vegetation treatment. Application of herbicides to control invasive species, noxious weeds, and 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.

Closed area. Where one or more uses are prohibited, either temporarily or over the long term. Areas may be closed to such uses such as off-road vehicles, mineral leasing, mineral or vegetation collection, or target shooting. In areas closed to off-road vehicle use, motorized and mechanized off-road vehicle use is prohibited. Use of motorized and mechanized off-road vehicles in closed areas may be allowed for certain reasons; however, such use would be made only with the approval of the BLM Authorized Officer (43 CFR, Part 8340.0-5).

Collocation (communication sites). The installation of new equipment or facilities on, in, or next to existing authorized equipment or facilities or within a communication site boundary, as designated in the communication site plan.

Collocation (electrical lines). Installation of new rights-of-way next to current ROW boundaries, not necessarily placed on the same power poles.

Collocation (designated corridors). The installation of new rights-of-way in or next to the existing corridor.

Collocation (other rights-of-way). The installation of new rights-of-way in the existing footprint of an approved ROW boundary or next to an approved ROW boundary.

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.

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 of a certain action or parts of an action by replacing or providing substitute resources or environments. (40 CFR, Part 1508.20)

Compensatory mitigation projects. 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 (e.g., chemical vegetation treatments, land acquisitions, and conservation easements).

Condition class (fire regimes). Fire regime condition classes describe the degree of departure from historical fire regimes, possibly altering 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, or introduced insects or disease.

Condition of approval. A condition of approval is a requirements under which a permit is approved after a lease is issued. Conditions of approval are based on site-specific analysis and are designed to minimize, mitigate, or prevent impacts on resource values or other uses of public lands.

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

Conservation measures. Measures to conserve, enhance, or restore Greater Sage-Grouse habitat by reducing, eliminating, or minimizing threats.

Conservation strategy. Outlines 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 threats. 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 Endangered Species Act.

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. 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. It 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.

Council on Environmental Quality. An advisory council to the President, established by the National Environmental Policy Act of 1969. It reviews federal programs to analyze and interpret environmental trends and information.

Cultural resources. Locations of human activity, occupation, or use. Cultural resources include archaeological, historic, 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.

Decision area. Includes lands within the planning area for which the BLM has authority to make management decisions. The BLM has jurisdiction over all BLM-administered lands. In addition, it has jurisdiction over federal minerals in some areas where the surface is owned by a non-federal entity. The decision area for this project includes all GRSG-occupied habitat administered by the BLM, including non-federal lands where there are federal mineral interests.

Deferred/deferred use. To set aside or postpone a particular resource use or activity on the public lands to a later time. Generally when this term is used the period of the deferral is specified. Deferments sometimes follow the sequence time frame of associated serial actions (e.g., Action B will be deferred until Action A is completed).

Designated roads and trails. Specific roads and trails identified by the BLM (or other agency) where some type of motorized or nonmotorized use is appropriate and allowed, either seasonally or yearlong (H-1601-1, BLM Land Use Planning Handbook). The action of designating specific routes for specific uses is done during implementation-level planning. The action of designating areas where travel will be limited to designated routes is a land use plan-level decision.

Desired condition. A description of specific social, economic, or ecological characteristics of the plan area, or a portion of the plan area, where management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined but not include completion dates.

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.

Directional drilling. A technique whereby a well is deliberately deviated from vertical in order to reach a particular part of the oil- or gas-bearing reservoir. Directional drilling technology enables the driller to steer the drill stem and bit to a desired bottom hole location. Directional wells initially are drilled straight down to a predetermined depth and then gradually curved at one or more different points to penetrate one or more given target reservoirs. This specialized drilling usually is accomplished with the use of a fluid-driven downhole motor, which turns the drill bit. Directional drilling also allows multiple production and injection wells to be drilled from a single surface location, such as a gravel pad, thus minimizing cost and the surface impact of oil and gas drilling, production, and transportation facilities. It can be used to reach a target located beneath an environmentally sensitive area (Alaska Department of Natural Resources, Division of Oil and Gas 2009).

Disposal lands. Transfer of public land out of federal ownership to another party through sale, exchange, Recreation and Public Purposes Act of 1926, Desert Land Entry, or other land law 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 time. In this context, a disruptive activity refers to those actions that alter behavior or displace

individuals of a species such that reproductive success is negatively affected, or an their 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 (e.g., 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 (e.g., breeding, nesting, and birthing), although it could apply to any resource value on the public lands. The use of this land use restriction is not intended to prohibit all activity or authorized uses.

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.

Emergency stabilization. Planned actions to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a fire, or to repair, replace, or 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 (BLM Manual 6840, Special Status Species Manual). Under the Endangered Species Act, "endangered" is the more protected of two categories (the other being "threatened"). Designation as endangered or threatened is determined by the USFWS as directed by the Endangered Species Act.

Endangered Species Act of 1973 (as amended; ESA). Designed to protect critically imperiled species from extinction because 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. The purpose of the ESA is to protect species and the ecosystems they depend on (16 US Code, Sections 1531-1544).

Enhance. The improvement of habitat by increasing missing or modifying unsatisfactory components or attributes of the plant community to meet GRSG objectives.

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.

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 National Environmental Policy Act of 1969 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 public 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, such as rights-of-way, but is not unique to lands and realty program activities. This restriction is functionally analogous to no surface occupancy, which is used by the oil and gas program, and is applied as an absolute condition to those affected activities. The less restrictive analogous term is avoidance area. Also see *right-of-way exclusion area.*

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

Exploration. Active drilling, geophysical operations, surface sampling and trenching, or small-scale mining or similar activities, to determine the presence of the mineral resource or the extent of the reservoir or mineral deposit.

Facility, Energy and Mining. 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 (FLPMA). 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, tribal lands, privately owned lands, and state-owned lands.

Federal mineral interest. See *Federal mineral estate.*

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

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

Fuelbreak. A natural or man-made change in fuel characteristics that affects fire behavior so that fires burning into them can be more readily controlled.

General Habitat Management Area. BLM-administered lands where some special management will apply to sustain GRSG populations; areas of occupied seasonal or year-round habitat outside of PHMA.

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. An activity to locate or better define mineral or oil and gas deposits, using such geophysical methods as seismic refraction, electrical resistivity, induced magnetism, or other methods.

Geothermal energy. Natural heat from within the Earth captured to produce electricity, space heating, or industrial steam.

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

Grazing preference. Grazing preference means a superior or priority position against others for receiving a grazing permit or lease. This priority is attached to base property owned or controlled by the permittee or lessee (43 CFR, Part 4100.0-5).

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 consent or approval by BLM. The BLM's receipt of a relinquishment is not a decision to close areas to livestock grazing.

Grazing system. Scheduled grazing use and non-use of an allotment to reach identified goals or objectives by improving the quality and quantity of vegetation. It includes pasture development, utilization levels, grazing rotations, timing and duration of use periods, and necessary range improvements.

Guidelines. Actions or management practices that may be used to achieve desired outcomes, sometimes expressed as BMPs. 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. For the BLM, 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.

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

Implementation decisions. Decisions that take action to implement land use planning; generally appealable to Interior Board of Land Appeals under 43 CFR, Part 4.410.

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

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

Indirect impacts. Result from implementing an action or alternative but usually occur later in time or are removed in distance and are reasonably certain to occur.

Land health condition. A classification for land health that includes these categories: meeting land health standard(s) and not meeting land health standard(s).

Meeting land health standard(s)—Lands for which health indicators are currently in acceptable condition such that basic levels of ecological processes and functions are in place. This rating includes the following subcategories:

- Fully meeting standard(s)—Lands for which there are no substantive concerns with health indicators
- Exceeding standard(s)—Lands for which health indicators are in substantially better conditions than acceptable levels
- Meeting standard(s) with problems—Lands that have one or more concerns with health indicators to the degree that they are categorized as meeting the land health standards but have some issues that make them at risk of becoming "not meeting"

Not meeting land health standard(s)—Lands for which one or more health indicators are in unacceptable conditions such that basic levels of ecological processes and functions are no longer in place.

Land health trend is used to describe these classes further. It includes these categories: upward, static, and downward.

- Upward trend—Lands that have shown improving indicator conditions over time
- Static trend—Lands that have shown no clear improvement or decline in indicator conditions over time
- Downward trend—Lands that have shown declining indicator conditions over time

Land tenure adjustments. Landownership or jurisdictional changes. To improve the manageability of 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 treatment. All methods of artificial range improvement arid soil stabilization, such as reseeding, brush control (chemical and mechanical), pitting, furrowing, and water spreading.

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. A set of decisions that establish management direction for land within an administrative area.

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 Interior Board of Land Appeals.

Late brood-rearing area. Habitat includes mesic sagebrush and mixed shrub communities, wet meadows, and riparian habitats, as well as some agricultural lands (e.g., 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 Federal Land Policy and Management Act of 1976 provides the BLM with the authority to issue leases for the use, occupancy, and development of public 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 mineral lease form established at the time of the lease sale.

Lessee. A person or entity authorized to use and occupy National Forest System land under a specific instrument identified as a lease. Forest special use leases are limited to authorize certain wireless communication uses. Leases are also used for certain mineral leasable activities.

Lek. A traditional courtship display area attended by male GRSG in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male GRSG engaged in courtship displays. Subdominant males may display on itinerant strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where fewer than five males are observed strutting should be confirmed active for two years before meeting the definition of a lek (Connelly et al. 2000, 2003, 2004).

Each state may have a slightly different definition of lek, active lek, inactive lek, occupied lek, and unoccupied leks. Regional planning will use the appropriate definition provided by the state of interest. Leks may be different shapes, may move, and may change size year to year. When specific information is available for lek edges, that information would be used for determining management buffers; when no specific information is available for lek edges and only lek point data are available, that information would be used for determining management buffers.

Active lek. Any lek that has been attended by male GRSG during the strutting season.

Inactive lek. Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. (Absence of strutting GRSG during a single visit is insufficient documentation to establish that a lek is inactive.) This designation requires documentation of an absence of GRSG on the lek during at least two ground surveys separated by at least seven days. These surveys must be conducted under ideal conditions (April 1 to May 7, or other appropriate date based on local conditions), no precipitation, light or no wind, half-hour before sunrise to one hour after sunrise). Alternatively, a ground check of the exact known lek site late in the strutting season (after April 15) that fails to find any sign (tracks, droppings, or feathers) of strutting activity. Data collected by aerial surveys should not be used to designate inactive status as the aerial survey may actually disrupt activities.

Occupied lek. A lek that has been active during at least one strutting season within the last 10 years.

Unoccupied lek. A lek that has either been destroyed or abandoned.

Destroyed lek. A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for GRSG breeding.

Abandoned lek. A lek in otherwise suitable habitat that has not been active for 10 consecutive years. To be designated abandoned, a lek must be inactive (see above criteria) in at least four nonconsecutive strutting seasons spanning 10 years. The site of an abandoned lek should be surveyed at least once every 10 years to determine whether it has been reoccupied by GRSG.

Limited area. Motorized vehicle travel within specified areas or on designated routes, roads, vehicle ways, or trails is subject to restrictions. The limited designation is used where OHV use must be restricted to meet specific resource management objectives. Examples of limitations include the number or type of vehicles, time or season of use, permitted or licensed use only, use limited to designated roads and trails, or other limitations if restrictions are necessary to meet resource management objectives, including certain competitive or intensive use areas that have special limitations (see 43 CFR, Part 8340.0-5; BLM Manual 1626, Travel and Transportation Manual).

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.

Master development plan. 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 (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 public 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. 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 of 1872 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, as amended. Provides for claiming and gaining title to locatable minerals on public lands. Also referred to as the Mining Law.

Mitigation. Includes specific means, measures, or practices that could be used to 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, rehabilitation, restoring the affected environment, reducing or eliminating the impact over time by 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 their effectiveness.

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 public lands and their various resource values so that they are used in the combination that will best meet the present and future needs of the American people; 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; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given 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; BLM Manual 6840, Special Status Species Manual).

National Environmental Policy Act of 1969 (NEPA). Public Law 91-190. Establishes environmental policy for the nation. 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 include 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 D.2 in the Greater Sage-Grouse Monitoring Framework (**Appendix D**). Exceptions to net conservation gain for GRSG may be made for vegetation treatments to benefit the Utah prairie dog.

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

Nonhabitat. Lands within management areas that do not contribute to the annual life-cycle of GRSG.

No surface occupancy (NSO). A major constraint where use or occupancy of the land surface for fluid mineral exploration or development and all activities associated with fluid mineral leasing (e.g., truck-mounted drilling and geophysical exploration equipment off designated routes, construction of wells or pads) are prohibited to protect identified resource values. Areas identified as NSO are open to fluid mineral leasing, but surface occupancy or surface-disturbing activities associated with fluid mineral leasing cannot be conducted on the surface of the land. Access to fluid mineral deposits would require horizontal drilling from outside the boundaries of the NSO area.

Noxious weeds. A plant species designated by federal or state law as generally possessing one or more of the following characteristics: aggressive and difficult to manage, parasitic, a carrier or host of serious insects or disease, or nonnative, new, or not common to the United States.

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

Off-highway vehicle (OHV). Any motorized vehicle capable of or designated for travel on or immediately over land, water or other natural terrain. The definition excludes any non-amphibious 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, and any combat or combat support vehicle when used for national defense emergencies (43 CFR, Part 8340.0-5).

Open. Generally 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.

Opportunity areas or habitat. Those portions of a GRSG management area that currently do not contribute to its life cycle but are where restoration or rehabilitation can provide additional habitat

when linked to existing GRSG populations. This definition is applicable to Alternative E1 (based on the State of Utah's *Conservation Plan for Greater Sage-grouse in Utah*) and the Proposed Plans.

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; from H-4180-1, BLM Rangeland Health Standards Manual).

Permittee. A person or company permitted to graze livestock on public land.

Plan of operations. 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 areas of critical environmental concern, 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 geographical area for which land use plans are developed and maintained. The Utah Subregion planning area includes all lands in Utah, minus Washington, San Juan, Davis, and Salt Lake Counties. These counties were not included in the planning area because they do not include GRSG habitat. In addition to lands in Utah, the Utah Subregion planning area also includes portions of the Ashley National Forest that extend into Wyoming.

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.

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. Policies are established interpretations of legislation, executive orders, regulations, or other presidential, secretarial, or management directives.

Population area. Within the planning area, there are numerous areas with GRSG habitat. These areas are noncontiguous, meaning they are often separated by natural geographic features or barriers or human development. Because of the disconnected nature of the habitat, for the purpose of this planning process, the BLM placed all occupied GRSG habitat into one of 15 GRSG population areas (13 in Utah, 2 in Wyoming). The population area boundaries were drawn to include all occupied GRSG habitat in Utah plus areas within five miles of all occupied leks. The boundaries are also large enough to include areas that are not considered GRSG habitat but have been identified as lands that could provide important connectivity or facilitate the movement of GRSG between habitats. Although the boundaries of population areas were drawn using some biological considerations it is important to note that they are not intended to reflect distinct populations.

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 ignition.

Primitive road. A linear route managed for use by four-wheel drive or high-clearance vehicles. These routes do not customarily meet any BLM road design standards. Unless specifically prohibited, primitive roads can also include other uses, such as hiking, biking, and horseback riding (BLM Manual 1626, Travel and Transportation Manual).

Priority habitat management area (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, and winter concentration areas and migration or connectivity corridors.

Proper functioning condition. A term describing stream health that is based on the presence of adequate vegetation, landform, and debris to dissipate energy, reduce erosion, and improve water quality.

Public 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 land held for the benefit of Indians, Aleuts, and Eskimos (H-1601-1, BLM Land Use Planning Handbook).

Range Improvement. Any activity, structure, or program on or relating to rangelands that is designed to improve production of forage, to change vegetative composition, to control patterns of use, to provide water, to stabilize soil and water conditions, and to provide habitat for livestock and wildlife. The term includes structures, treatment projects, and use of mechanical means to accomplish the desired results.

Raptor. Bird of prey with sharp talons and strongly curved beaks, such as hawks, owls, falcons, and eagles.

Reclamation. The suite of actions taken in an area affected by human disturbance, the outcome of which is intended to change the condition of the disturbed area to meet predetermined objectives or to make it acceptable for certain defined resources (e.g., wildlife habitat, grazing, and ecosystem function).

Reference state. The state where the functional capacities represented by soil and site stability, hydrologic function, and biotic integrity are performing at an optimum level under the natural disturbance regime. This state usually includes what is often referred to as the potential natural plant community.

Renewable energy. Energy resources that constantly renew themselves or that are regarded as practically inexhaustible, such as 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). RDFs are required for certain activities in all GRSG habitat. They 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/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 designated in the land use plan as available for livestock grazing; however, it is reserved as available 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. The reserve common allotment would provide needed flexibility that would help the agency apply temporary rest from grazing where vegetation treatments or management would be most effective.

Resource management plan. A BLM land use plan, as prescribed by the Federal Land Policy and Management Act that, for a given area of land, establishes land use allocations, coordination guidelines for multiple-use, objectives, and actions to be achieved.

Restore/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 goal 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/restricted use. A limitation or constraint on public 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.

Right-of-way (ROW). Public lands authorized to be used or occupied, for specific purposes according to a right-of-way grant, that are in the public interest and that require ROWs over, on, under, or through them.

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

Right-of-way 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.

Rotation. Grazing rotation between pastures in the allotment for the permitted time.

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

Sagebrush focal areas (SFA). Areas identified by the USFWS that represent recognized strongholds for GRSG that 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.

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

Seeding. Seeding is a vegetation treatment that includes the application of grass, forb, or shrub seed, either aerially or from the ground. In areas of gentle terrain, seed is often applied with a rangeland drill. Seeding allows the establishment of native species or placeholder species and the 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.

Special recreation permit (SRP). Authorization that allows for recreational uses of public 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 public lands.

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

Split-estate. This is the circumstance where the surface of a particular parcel of land is owned by a different party than the minerals underlying the surface. 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.

Stabilize. The process of stopping further damage from occurring.

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).

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 individual lease requirements at the time the lease is issued. Once a mineral lease is issued, the applied stipulations cannot generally be changed or altered. Exceptions, modifications, or waivers may be granted under certain conditions outlined in the land use plan. Typical lease stipulations include no surface occupancy (NSO), timing limitations (TL), and controlled surface use (CSU). Lease stipulations are developed through the land use planning (RMP) process.

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

- Long-term removal occurs when habitat is 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, soil removal, and soil exposure to erosion.
- Short–term removal occurs when vegetation is removed in small areas but is restored to suitable habitat within fewer than five years of disturbance, such as a successfully reclaimed pipeline, or successfully reclaimed drill hole or pit.
- Suitable habitat rendered unusable due to numerous human disturbances.
- Human surface disturbance are surface disturbances meeting the above definitions that result from human activities.

Surface-disturbing activities. An action that alters the vegetation, surface/near surface soil resources, or surface geologic features, beyond natural site conditions and on a scale that affects other public land values. Examples of surface-disturbing activities may include operation of heavy equipment to construct well pads, roads, pits and reservoirs; installation of pipelines and power lines; and the conduct of several types of vegetation treatments (e.g., prescribed fire). Surface-disturbing activities may be either authorized or prohibited.

Surface use. This is all the various activities that may be present on the surface or near-surface, such as pipelines, of public lands. It does not refer to those subterranean activities, such as mining, occurring on the public 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 public lands consistent with multiple uses.

Tall structure. As used in this document, any man-made structure that could disrupt lekking or nesting birds by creating new perching or nesting opportunities or decrease the use of an area. A determination

as to whether something is considered a tall structure would be made based on local conditions, such as vegetation or topography.

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 will consider 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 Council on Environmental Quality's 40 Most Asked Questions and BLM NEPA Handbook, Section 6.6.3.)

Temporary/temporary use. A relative term that must be considered in the context of the resource values affected and the nature of the resource use or 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 Endangered Species Act, threatened is the lesser-protected of two categories (the other being "endangered"). Designation as threatened (or endangered) is determined by USFWS as directed by the Endangered Species Act.

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, and construction of wells and pads), and other surface-disturbing activities (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.

Trail. A linear route managed for human-power (e.g., hiking or bicycling), stock (e.g., equestrian), or off-highway vehicle 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 purposes 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 to apply.

Transmission. The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to

consumers or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Transmission line. An electrical utility line with a capacity greater than or equal to 100 kilovolts or a natural gas, hydrogen or a water pipeline greater than or equal to 24 inches in diameter.

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. A grouping of multiple adjacent mineral leases, in order to operate those leases as a single unit, under a single operator.

Utility corridor. Tract of land varying in width forming passageway through which various commodities such as oil, gas, and electricity are transported.

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, rights-of-way, 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.

Watershed. Topographical region or area delineated by water draining to a particular watercourse or body of water.

West Nile virus. A virus that is found in temperate and tropical regions of the world and most commonly transmitted by mosquitoes. 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 (MZs). Seven GRSG management zones established based on populations across the entire range of the GRSG. GRSG habitat in the Utah Subregion overlaps four WAFWA MZs: MZ II (Wyoming Basins), MZ III (Southern Great Basin), MZ IV (Snake River Plain), and MZ VII (Colorado Plateau). WAFWA MZs are used in the cumulative effects analysis. WAFWA MZs 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.

Wilderness study area (WSA). An area inventoried, found to have wilderness characteristics, and managed to preserve those characteristics under authority of public lands required by Section 603 of FLPMA or the land use planning direction found in Section 202 of FLPMA.

Wildfire. Unplanned ignition or prescribed fire that is declared a wildfire. 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.

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

Winter concentration areas. GRSG winter habitats that are occupied annually by GRSG and 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, who typically show 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

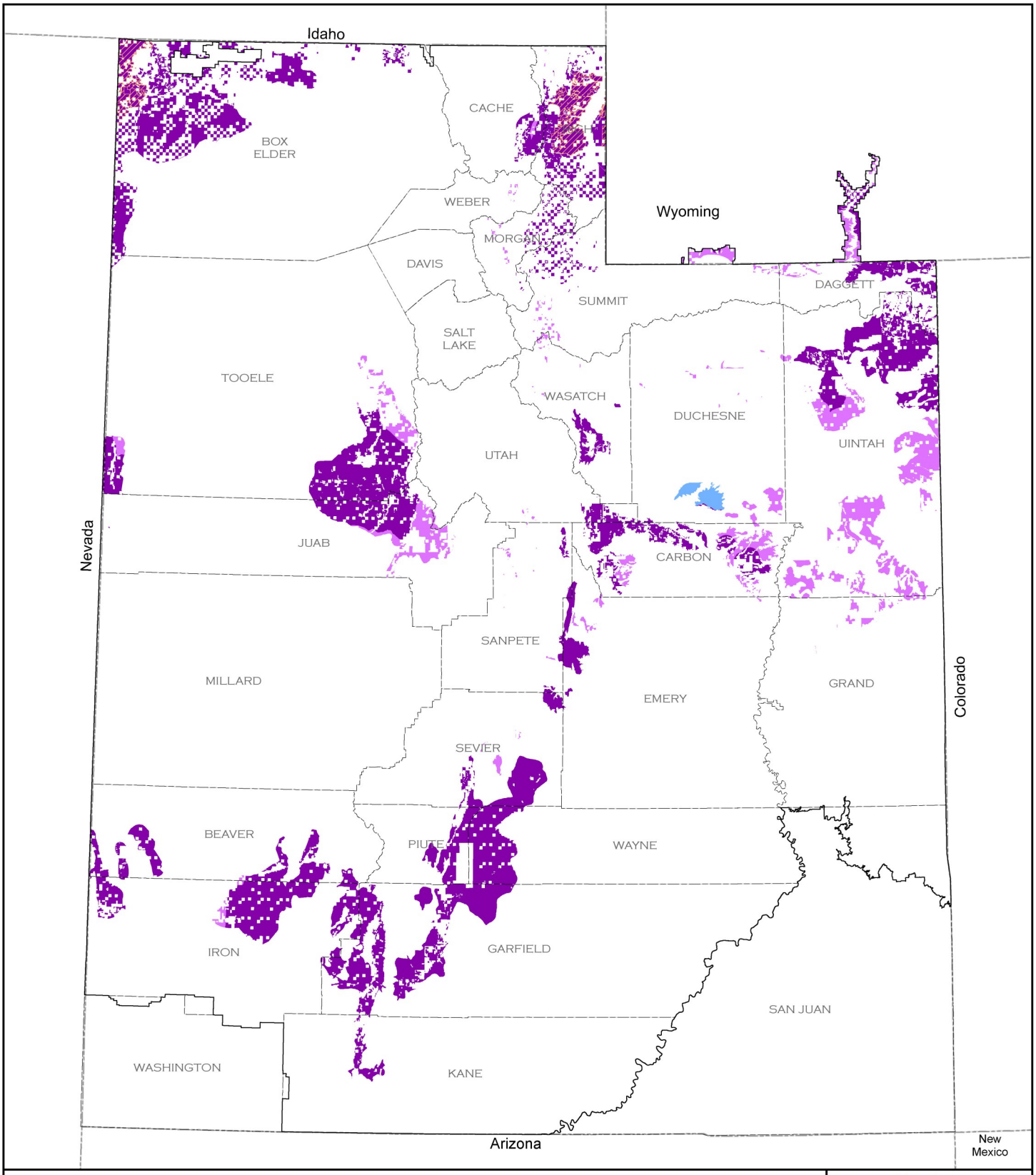

Figure 2-1: Utah Habitat Management Areas

- Sagebrush Focal Areas (SFA)
- Priority Habitat Management Areas (PHMA)
- General Habitat Management Areas (GHMA)
- Anthro Mountain (AM)
- Planning Area Boundary
- State Boundary
- County Boundary

N W E S

Miles
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September 2015

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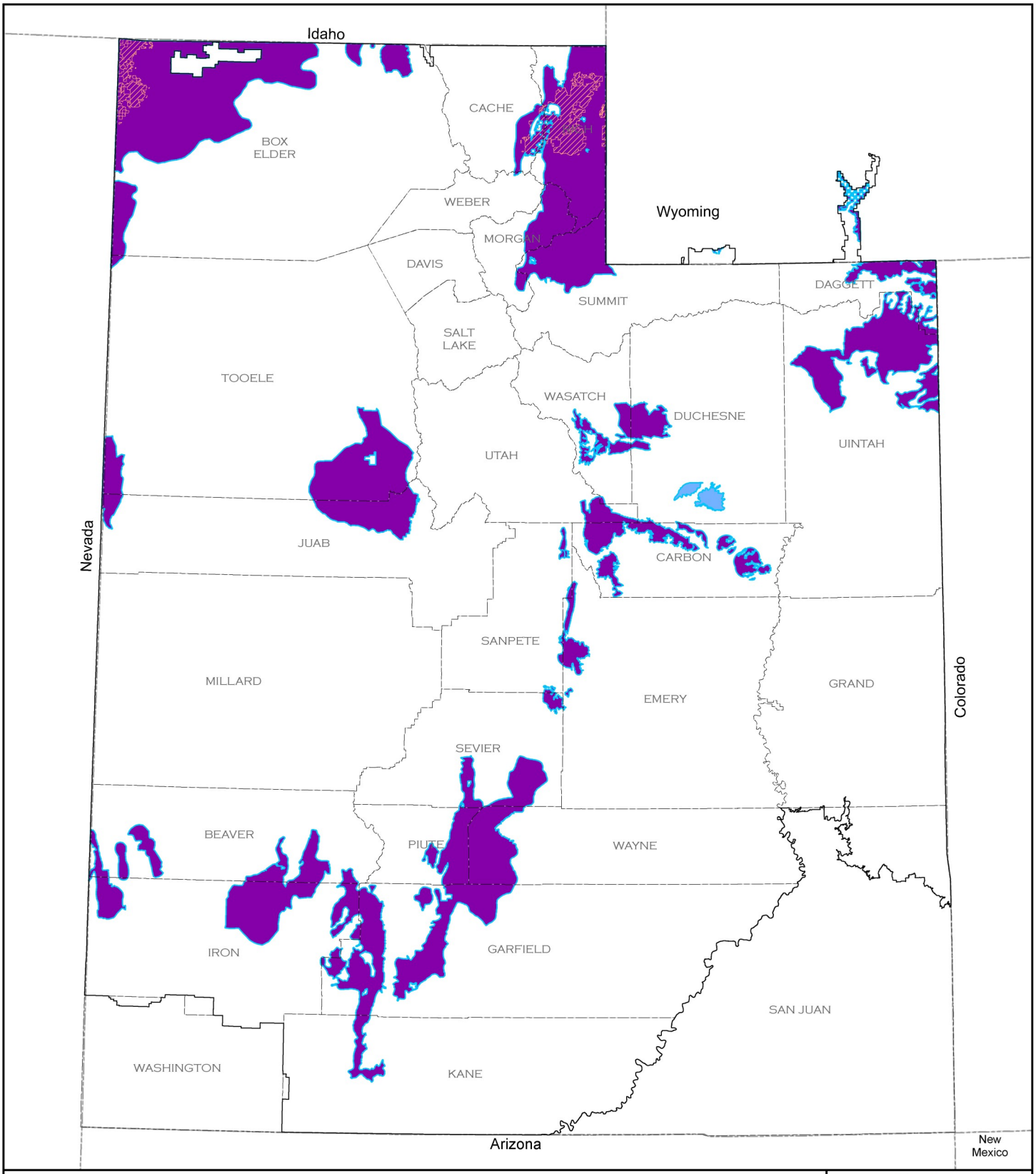

Figure 2-2: Utah GRSG Biologically Significant Units and Priority Habitat Management Areas

- Biologically Significant Units
- Sagebrush Focal
- Priority Habitat Management
- Anthro Mountain (AM)
- Planning Area
- State Boundary
- County Boundary

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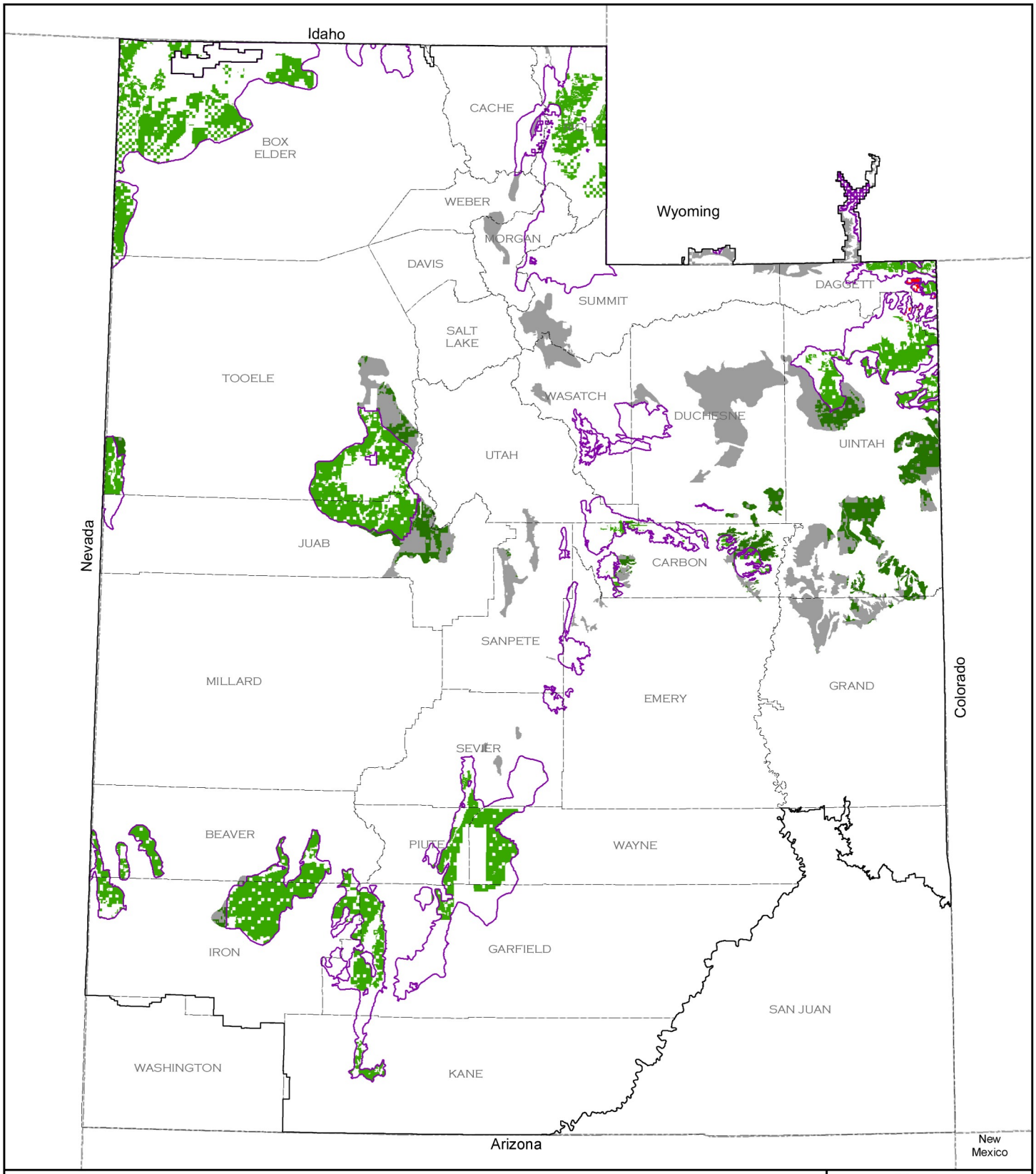

Figure 2-3: Utah Livestock Grazing

PHMA	GHMA	
		Outside of BLM Decision Area
		Areas Unavailable for Livestock Grazing
		Areas Available for Livestock Grazing

Planning Area Boundary
State Boundary
County Boundary

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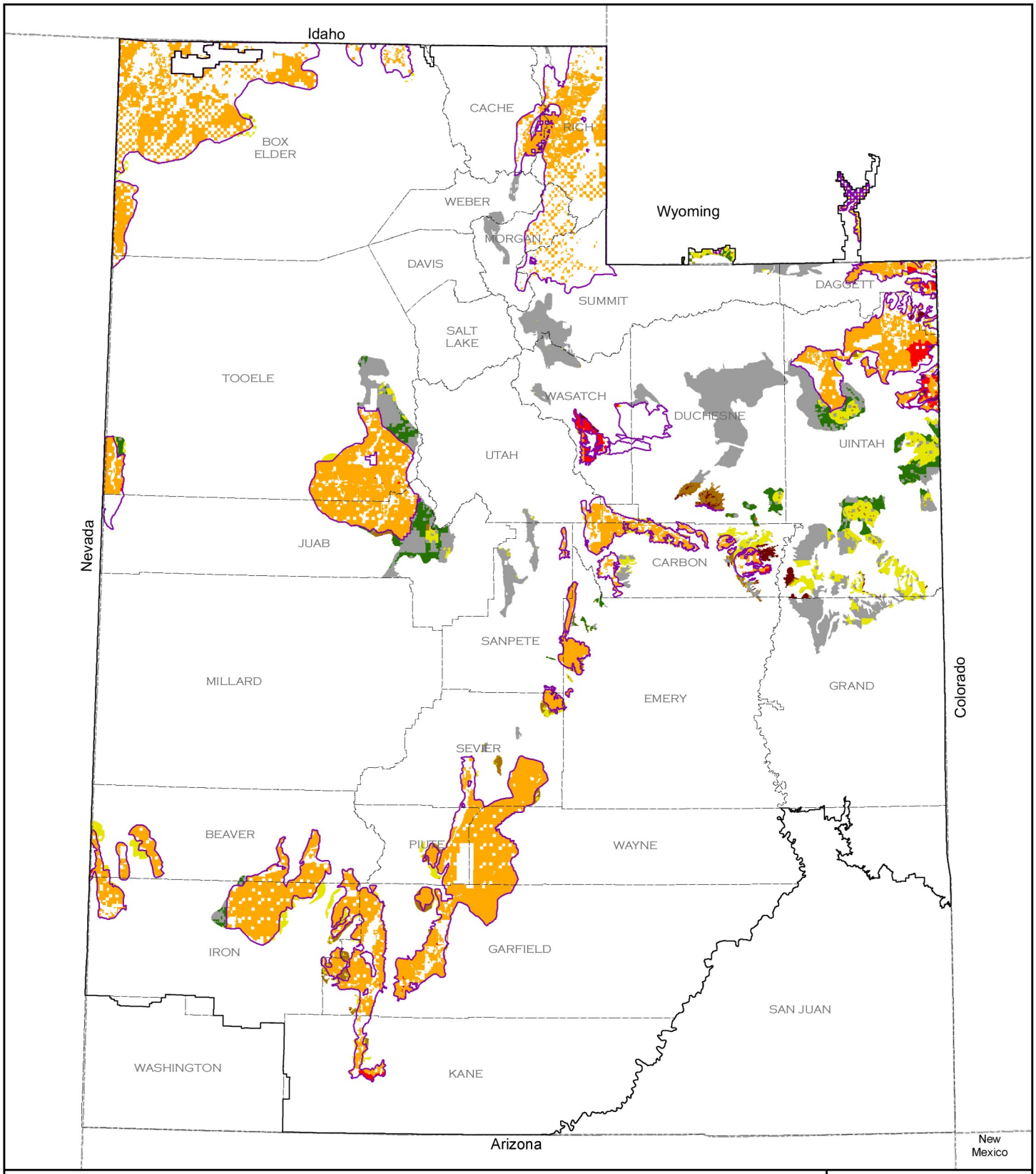

Figure 2-4: Utah Fluid Minerals (Oil and Gas)

PHMA	GHMA	
		Outside of BLM Decision Area
		Closed
		Open w/ Major Stipulations (NSO)
		Open w/ Moderate Stipulations (CSU and/or TL)
		Open w/ Standard Stipulations

Planning Area Boundary
State Boundary
County Boundary

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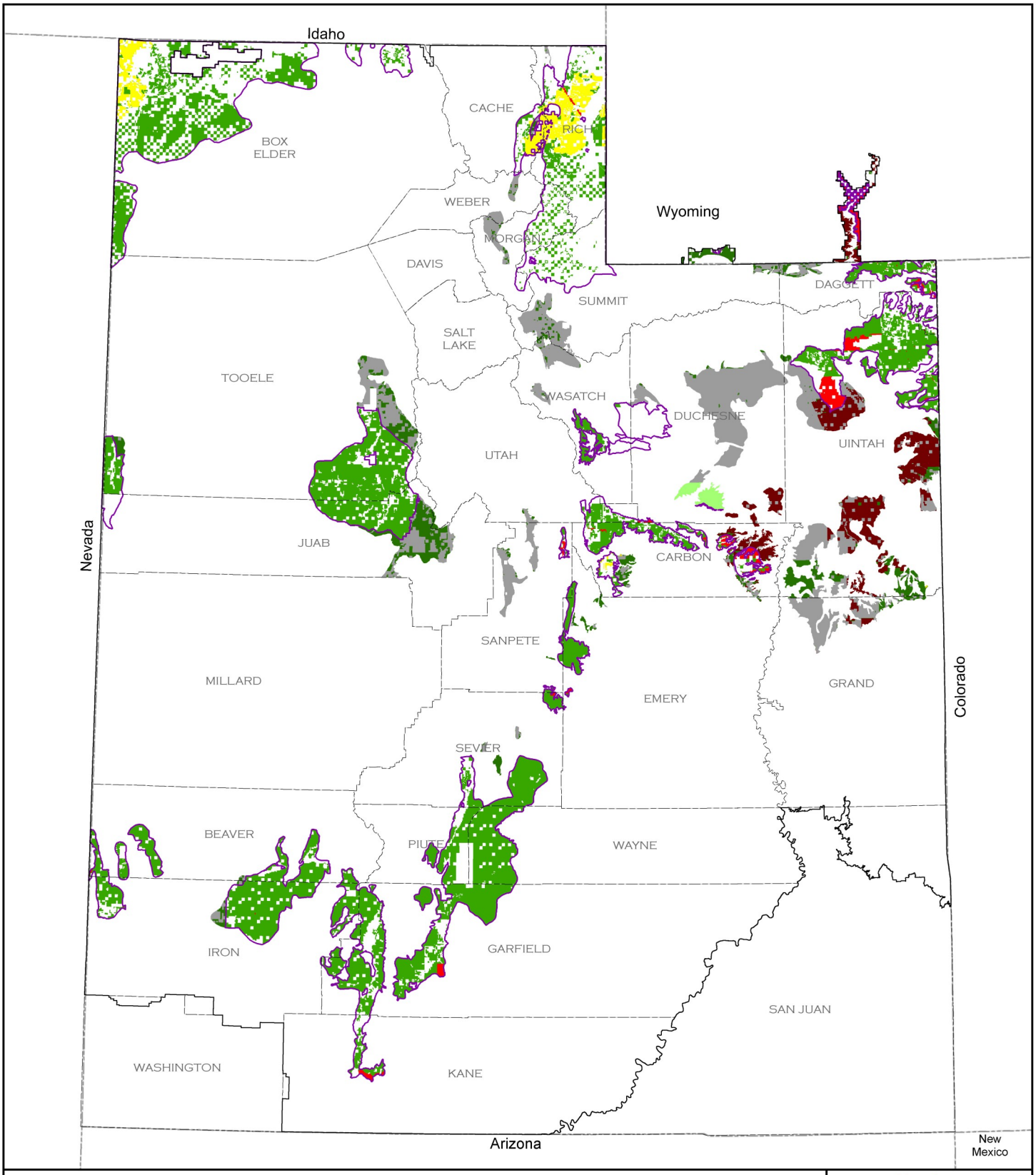

Figure 2-5: Utah Locatable Minerals

PHMA	AM*	GHMA	
			Outside of BLM Decision Area
			Existing Withdrawals
			Recommended Withdrawals
			Locatabel Minerals Open

Planning Area Boundary
State Boundary
County Boundary

* AM - Anthro Mountain

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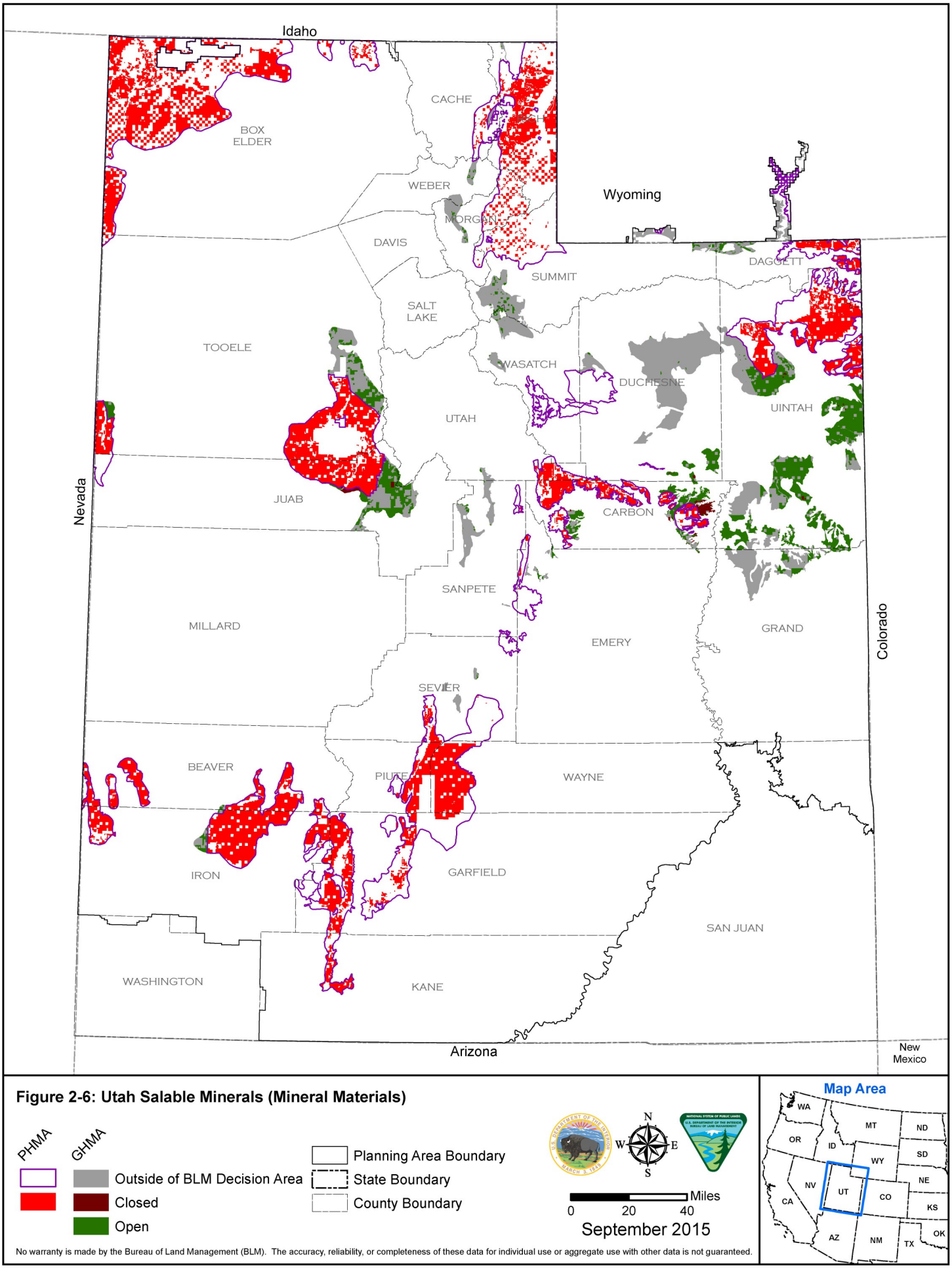

Figure 2-6: Utah Salable Minerals (Mineral Materials)

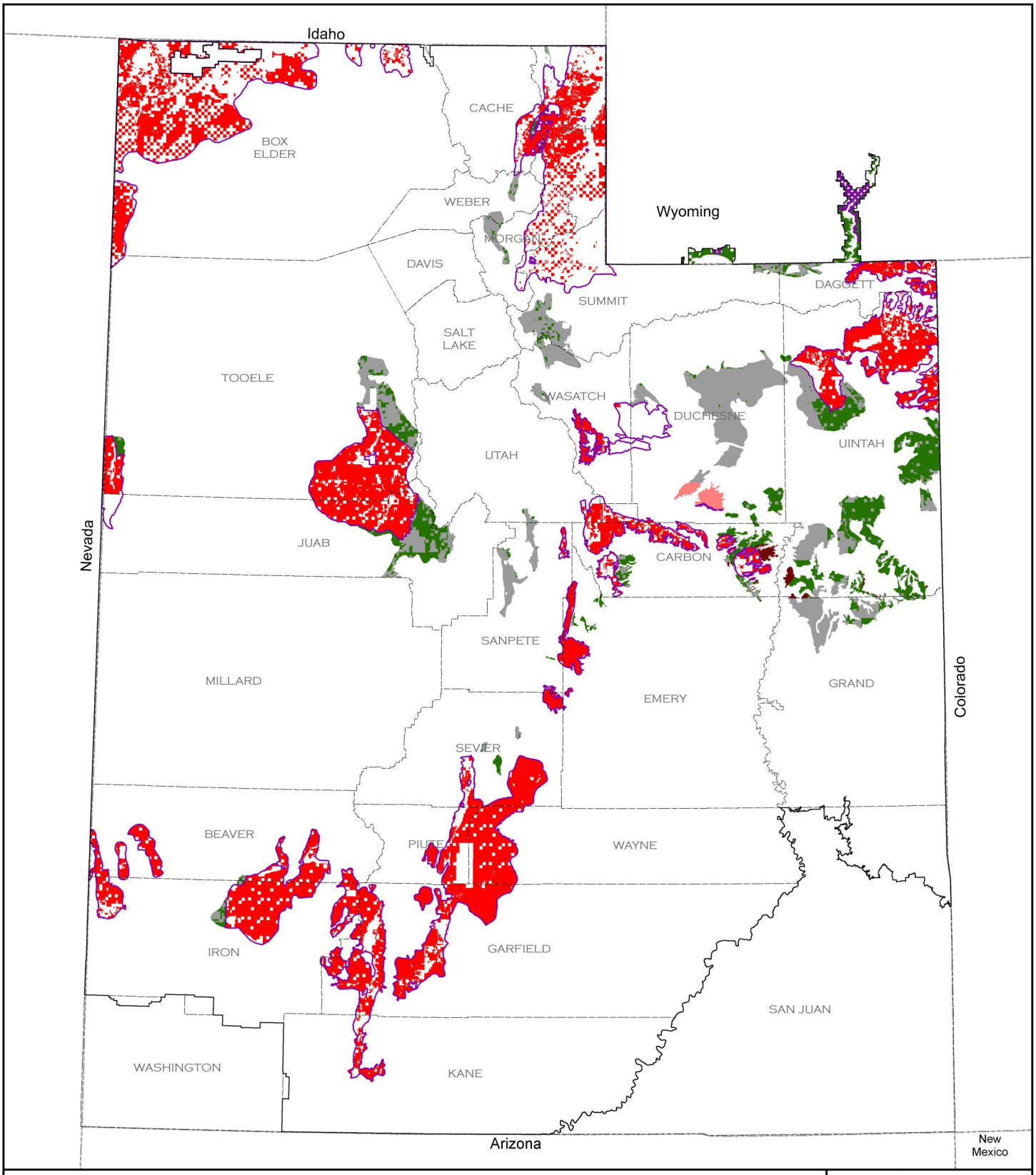

Figure 2-7: Utah Non-Energy Leasable Minerals

PHMA | AM* | GHMA

Outside of BLM Decision Area
Closed
Open

Planning Area Boundary
State Boundary
County Boundary

* AM - Anthro Mountain

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Miles
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September 2015

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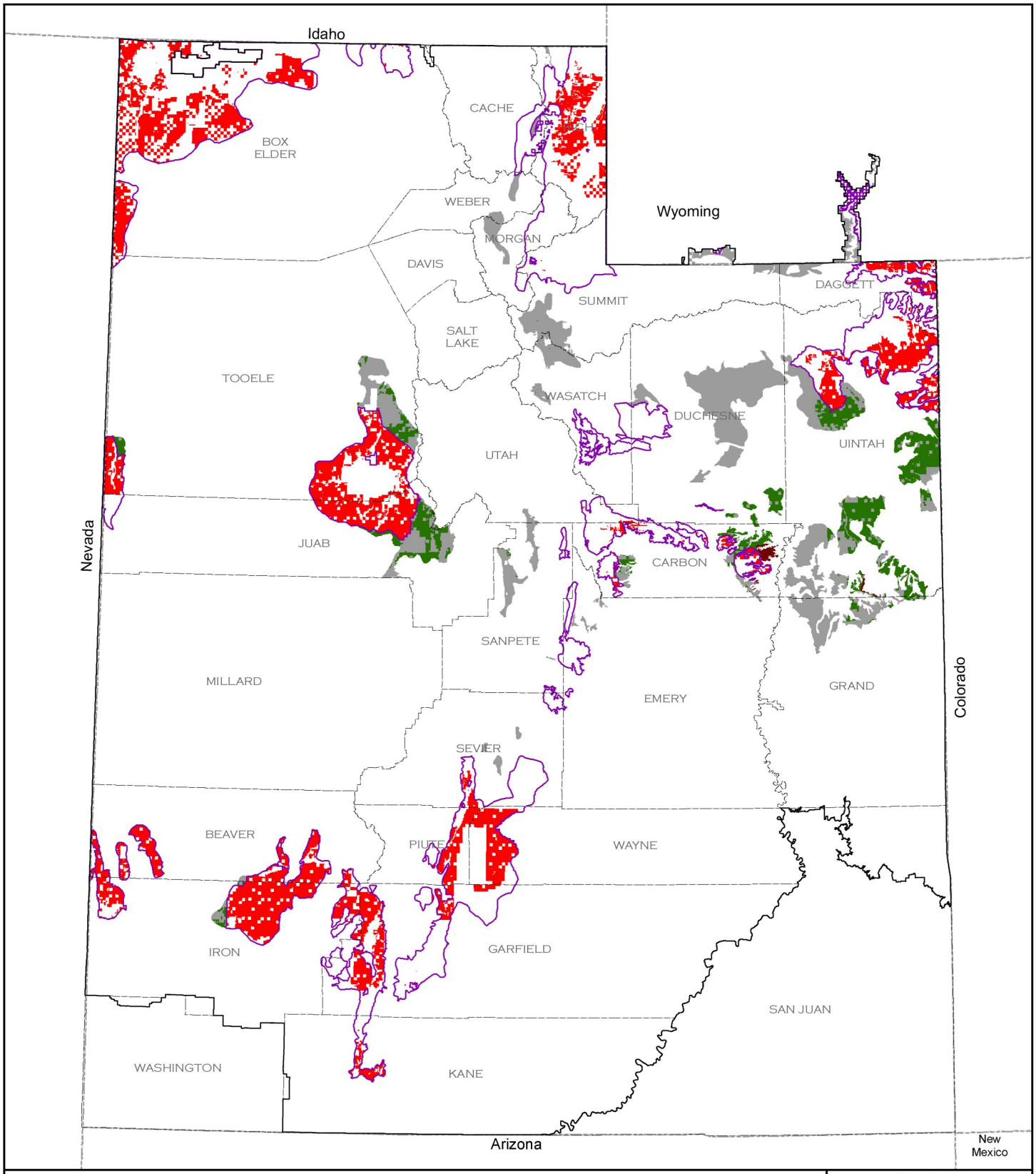

Figure 2-8: Utah Wind

PHMA GHMA

- Outside of BLM Decision Area
- Exclusion
- Open
- Planning Area Boundary
- State Boundary
- County Boundary

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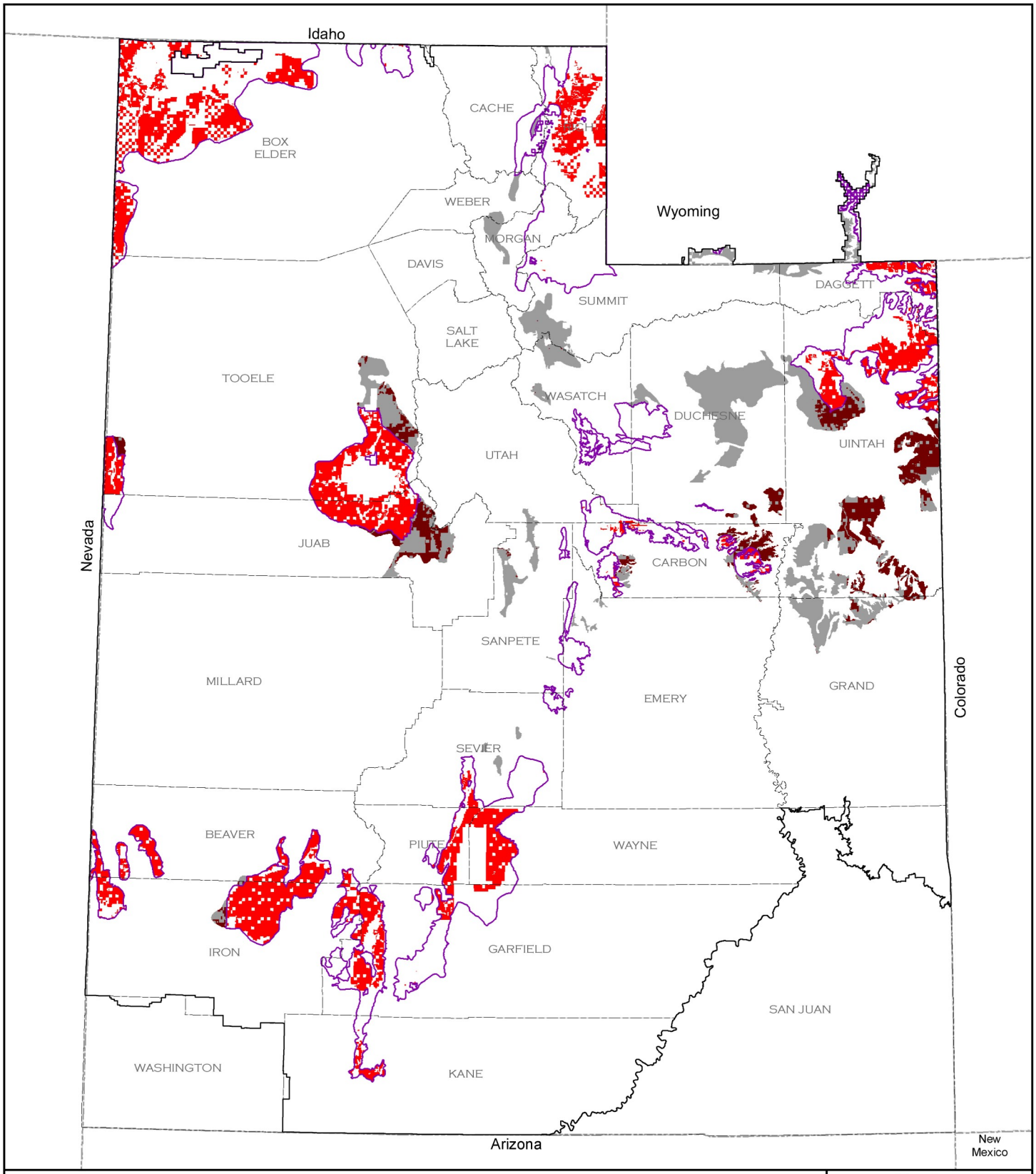

Figure 2-9: Utah Solar

PHMA
GHMA

Outside of BLM Decisioin Area
Exclusion
Open

Planning Area Boundary
State Boundary
County Boundary

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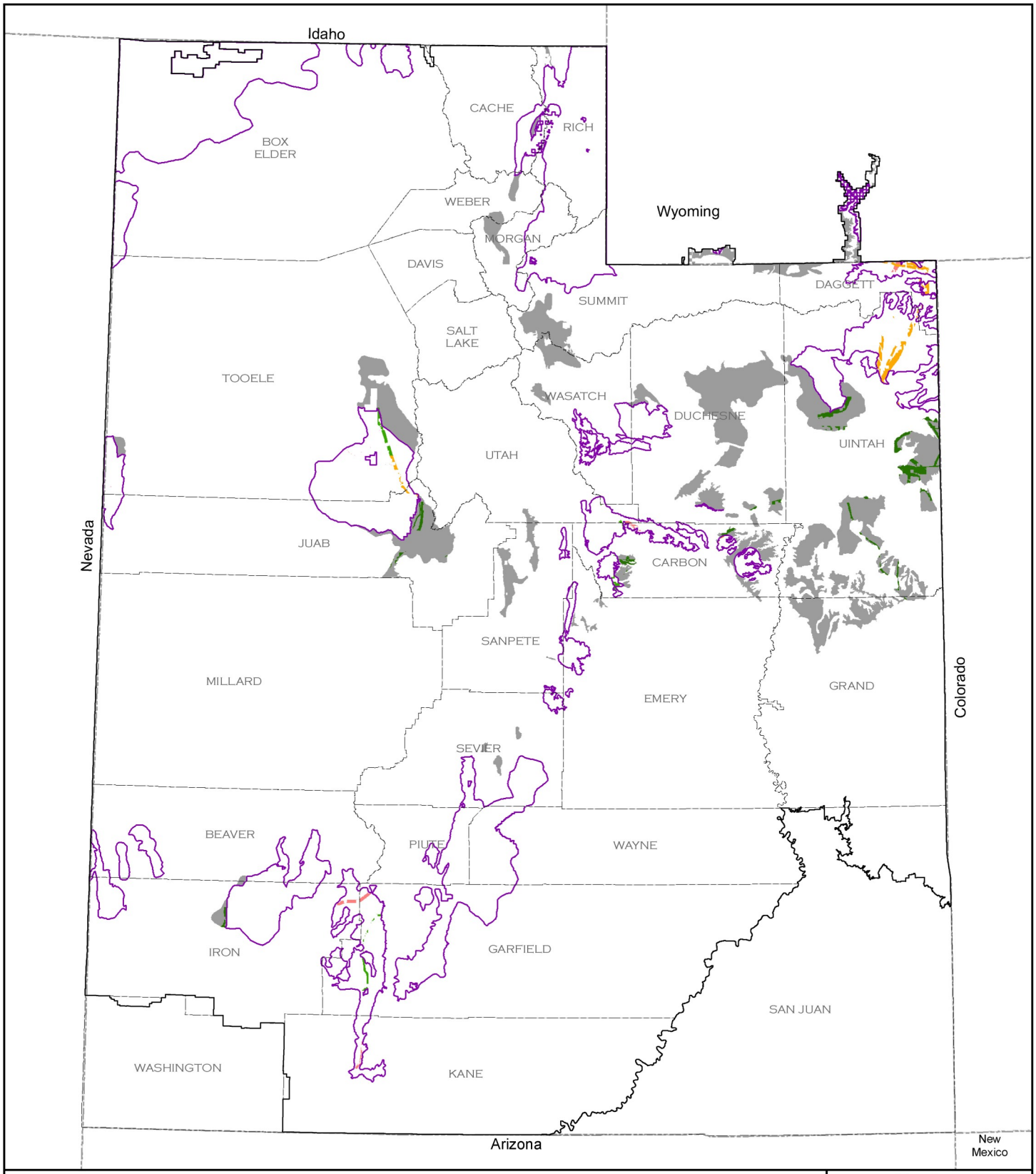

Figure 2-10: Utah Designated Utility Corridors

PHMA	GHMA	
		Outside of BLM Decision Area
		Designated Surface Utility Corridors
		Designated Subsurface Utility corridors
		Undesignated Utility corridors

Planning Area Boundary
State Boundary
County Boundary

N W E S

Miles
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September 2015

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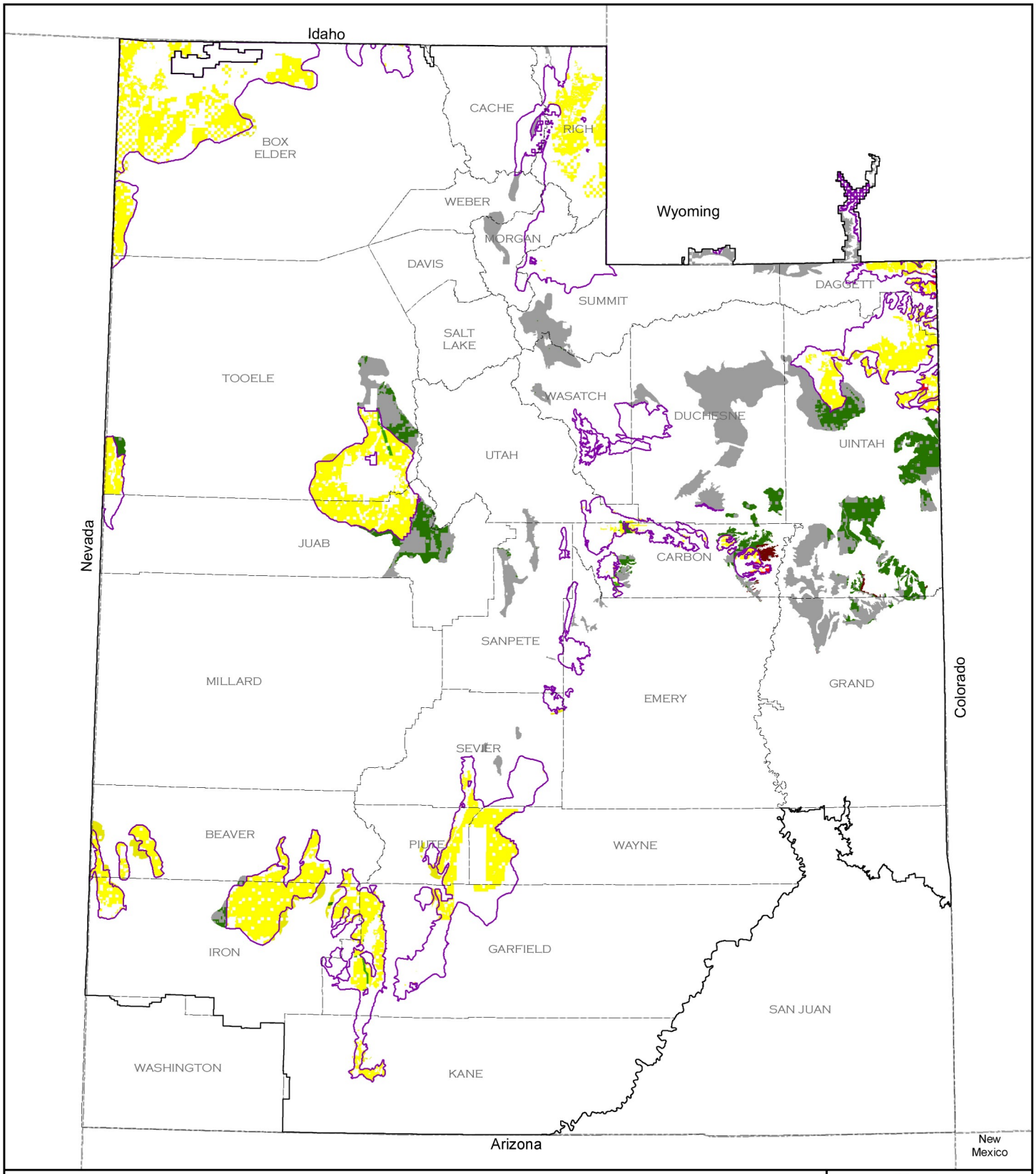

Figure 2-11: Utah Rights-of-Way

PHMA	GHMA	
		Outside of BLM Decision Area
		Exclusion
		Avoidance
		Open

Planning Area Boundary
State Boundary
County Boundary

N W E S

Miles
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September 2015

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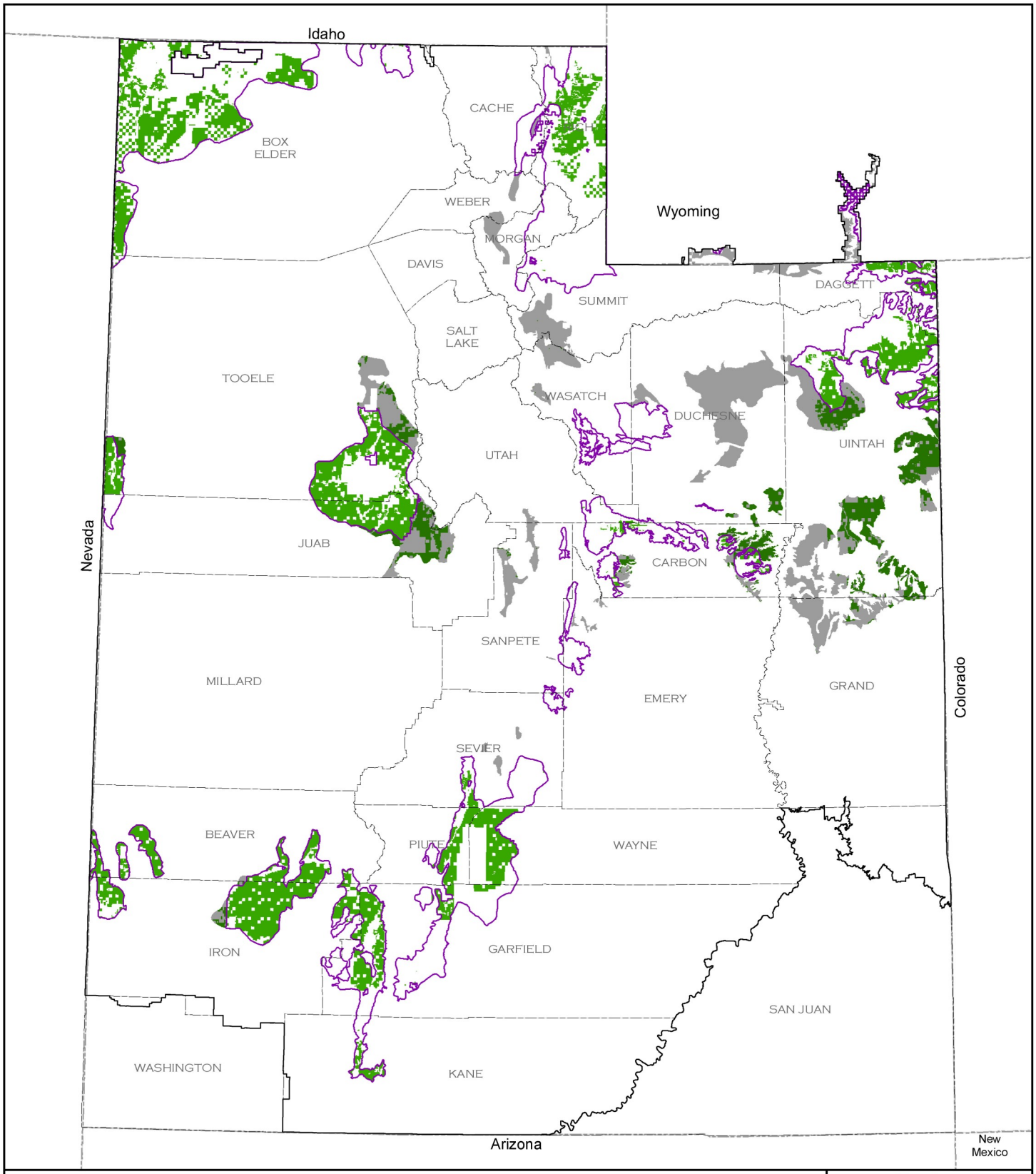

Figure 2-12: Utah Land Tenure

PHMA GHMA

Outside of BLM Decision Area

Retention

Planning Area Boundary

State Boundary

County Boundary

Miles

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September 2015

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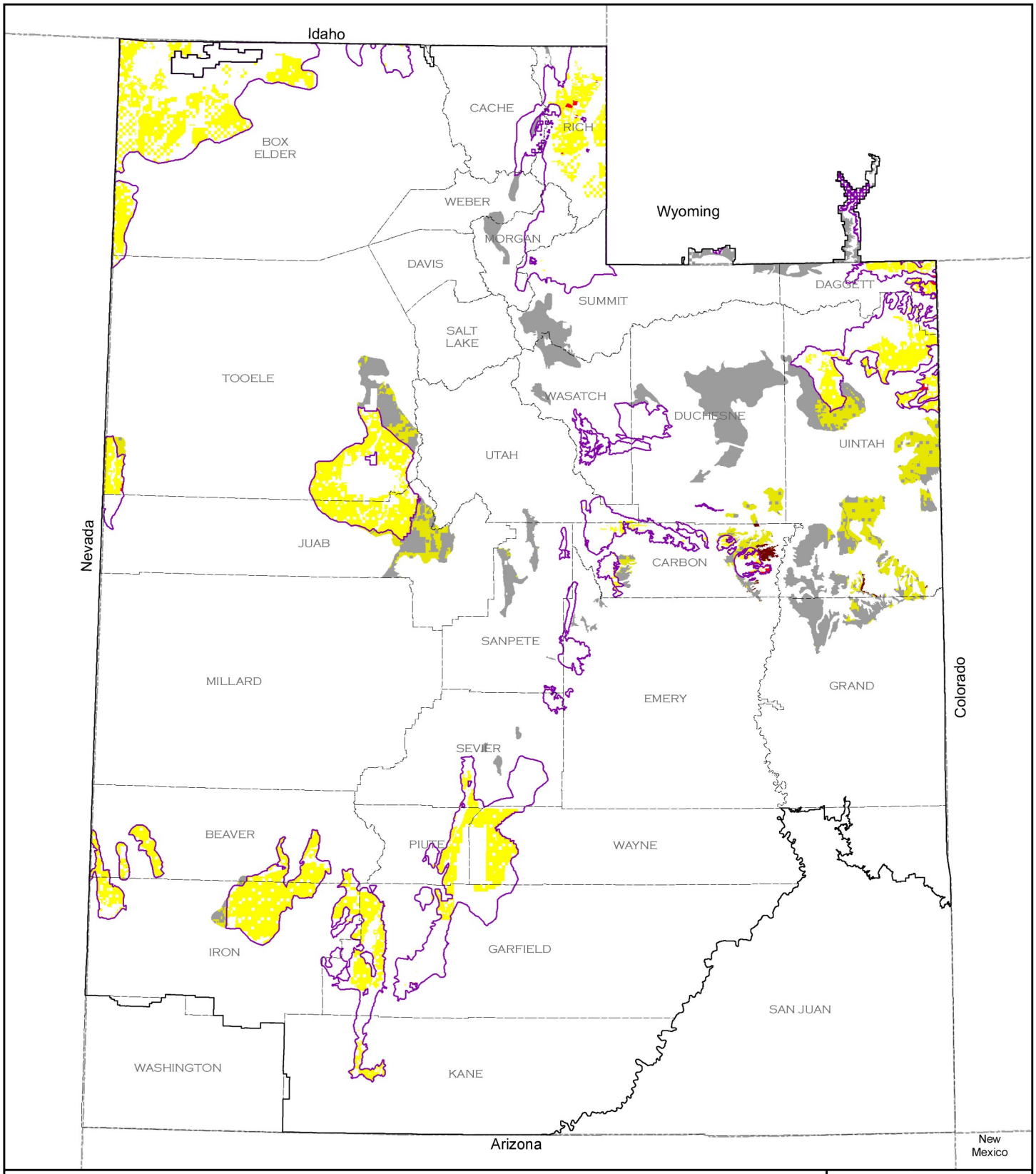

Figure 2-13: Utah Trails and Travel Management

PHMA GHMA

- Outside of BLM Decision Area
- Closed
- Limited
- Open

- Planning Area Boundary
- State Boundary
- County Boundary

N W E S

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.

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Appendix B

Applying Lek Buffer Distances

APPENDIX B
APPLYING LEK BUFFER DISTANCES

BUFFER-DISTANCES AND EVALUATION OF IMPACTS TO LEKS

Evaluate impacts to leks during the National Environmental Policy Act (NEPA) analysis process. 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 US Geological Survey (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) within 1.2 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.

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.

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

- 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 the project 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 F**, Mitigation Strategy: Utah Greater-Sage-Grouse RMPA).

ACTIONS IN PHMA

The BLM will apply the lek buffer-distances identified above as mandatory 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

APPENDIX C
REQUIRED DESIGN FEATURES

The following conservation measures have typically been referred to as best management practices (BMPs) or recommended management practices. These conservation measures are treated in the land use plan amendment as required design features (RDFs) to ensure regulatory certainty and the conservation of Greater Sage-Grouse (GRSG).

Required design features are required for certain activities in all GRSG habitat. Required design features 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) and/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/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/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, a 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.

The RDFs are required for the activities associated with each heading below. In addition, all project proponents are encouraged to include any appropriate conservation measure in their proposals. The US Department of the Interior, Bureau of Land Management (BLM) will require application of all appropriate conservation measures, warranted by site-specific analysis, in order to avoid, minimize, or compensate for impacts. Conservation measures not included in project proposals and determined appropriate from the site-specific analysis will be required as conditions of approval, stipulations, terms and conditions, etcetera. Additional conditions of approval developed through consultation with other federal, state, and local regulatory and resource agencies may be applied when supported by site-specific analysis.

REQUIRED DESIGN FEATURES FOR FIRE AND FUELS

Fire Operations

- Compile District level information into state-wide GRSG tool boxes. Tool boxes will contain maps, listing of resource advisors, contact information, local guidance, and other relevant information for each District/Forest, which will be aggregated into a state-wide document.
- Provide localized maps to dispatch offices and extended attack incident commanders for use in prioritizing wildfire suppression resources and designing suppression tactics.
- Assign a resource advisor who has GRSG expertise or 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 state wildlife agency expertise in fire operations through:
  - instructing resource advisors during preseason trainings
  - qualification as resource advisors
  - coordination with resource advisors during fire incidents
  - contributing to incident planning with information such as habitat features or other key data useful in fire decision making
- On critical fire weather days, pre-position additional fire suppression resources to optimize a quick and efficient response in GRSG habitat areas.
- During periods of multiple fires, ensure line officers are involved in setting priorities.
- To the extent possible, locate wildfire suppression facilities (e.g., base camps, spike camps, drop points, staging areas, and heli-bases) in areas where physical disturbance to GRSG habitat can be minimized. These include disturbed areas, grasslands, near roads/trails, or other areas where there is existing disturbance or minimal sagebrush cover.
- Power-wash all firefighting vehicles, to the extent possible, including engines, water tenders, personnel vehicles, and all-terrain vehicles prior to deploying in or near GRSG habitat areas to minimize noxious weed spread.
- Minimize unnecessary cross-country vehicle travel during fire operations in GRSG habitat.
- Utilize retardant, mechanized equipment, and other available resources to minimize burned acreage during initial attack.
- As safety allows, conduct mop-up where the black adjoins unburned islands, dog legs, or other habitat features to minimize sagebrush loss.
- Adequately document fire operation activities in GRSG habitat for potential follow-up coordination activities.

Fuels Management

- Where applicable, design fuels treatment objectives to protect existing sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patterns that most benefit GRSG habitat.
- Provide training to fuels treatment personnel on GRSG biology, habitat requirements, and identification of areas utilized locally.
- Use burning prescriptions which minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable perennial plant species and reduce risk of annual grass invasion).
- Where appropriate, ensure that treatments are configured in a manner that promotes use by GRSG.
- Power-wash all vehicles and equipment involved in fuels management activities, prior to entering the area, to minimize the introduction of undesirable and/or invasive plant species.
- Design vegetation treatments in areas of high fire frequency that facilitate firefighter safety, reduce the potential acres burned, and reduce the fire risk to GRSG habitat. Additionally, develop maps for GRSG habitat which spatially display existing fuels treatments that can be used to assist suppression activities.
- As funding and logistics permit, restore annual grasslands to a species composition characterized by perennial grasses, forbs, and shrubs or one of that referenced in land use planning documentation.
- Protect wildland areas from wildfire originating on private lands, infrastructure corridors, and recreational areas.
- Reduce the risk of vehicle- or human-caused wildfires and the spread of invasive species by installing fuel breaks and/or planting perennial vegetation (e.g., greenstrips) paralleling road rights-of-way.
- Strategically place and maintain pre-treated strips/areas (e.g., mowing and herbicide application) to aid in controlling wildfire should wildfire occur near PPMA or important restoration areas (such as where investments in restoration have already been made).

REQUIRED DESIGN FEATURES FOR SOLID MINERALS (INCLUDING LOCATABLE MINERALS)

The following measures would be applied as RDFs for all solid minerals. They would also apply to locatable minerals consistent with applicable law.

Roads

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purposes.
- Locate roads to avoid important areas and habitats (important habitats include seasonal habitats within PHMA).
- Coordinate road construction and use among right-of-way or special use authorization holders.
- Construct road crossing at right angles to ephemeral drainages and stream crossings.

- Establish speed limits on BLM system roads or design roads to be driven at slower speeds to reduce vehicle/wildlife collisions.
- Do not issue rights-of-way or special use authorizations to counties on mining development roads, unless for a temporary use consistent with all other terms and conditions including this document.
- Restrict vehicle traffic to only authorized users on newly constructed routes (e. g., use signing and gates).
- Use dust abatement practices on roads and pads.
- Close and reclaim duplicate roads by restoring original landform and establishing desired vegetation.

Operations

- Cluster disturbances associated with operations and facilities as closely as possible.
- Place infrastructure in already disturbed locations where the habitat has not been restored.
- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Site and/or minimize linear rights-of-way or special use authorizations to reduce disturbance to sagebrush habitats.
- Bury power lines.
- Cover (e.g., fine mesh netting or use other effective techniques) all pits and tanks regardless of size to reduce sage-grouse mortality.
- Equip tanks and other above ground facilities with structures or devices that discourage nesting of raptors and corvids.
- Control the spread and effects of non-native plant species (Gelbard and Belnap 2003; Bergquist et al. 2007).
- Restrict pit and impoundment construction to reduce or eliminate threats from West Nile virus (Doherty 2007). See Required Design Features for Preventing West Nile Virus.
- Remove or re-inject 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:
  - Overbuild size of ponds for muddy and non-vegetated shorelines.
  - Build steep shorelines to decrease vegetation and increase wave actions.
  - Avoid flooding terrestrial vegetation in flat terrain or low lying areas.
  - Construct dams or impoundments that restrict down slope seepage or overflow.
  - Line the channel where discharge water flows into the pond with crushed rock.
  - Construct spillway with steep sides and line it with crushed rock.

  - Treat waters with larvicides to reduce mosquito production where water occurs on the surface.
- Require sage-grouse-safe fences around sumps.
- Clean up refuse (Bui et al. 2010).
- Locate worker camps outside of PHMA.

Reclamation

- Include restoration objectives to meet sage-grouse habitat needs in reclamation practices/sites.
- Address post reclamation management in reclamation plans such that goals and objectives are to protect and improve sage-grouse habitat needs.
- Maximize the area of interim reclamation on long-term access roads and well pads including reshaping, topsoiling and revegetating cut and fill slopes.
- Restore disturbed areas at final reclamation to pre-disturbance landform and desired plant community
- Irrigate interim reclamation as necessary during dry periods. Utilize mulching techniques to expedite reclamation.

REQUIRED DESIGN FEATURES FOR FLUID MINERALS

Roads

PHMA

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Do not issue rights-of-way or special use authorizations to counties on newly constructed energy development roads, unless for a temporary use consistent with all other terms and conditions included in this document.
- Establish speed limits on BLM system roads to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.
- Coordinate road construction and use among right-of-way or special use authorization holders.
- Construct road crossings at right angles to ephemeral drainages and stream crossings.
- Use dust abatement practices on roads and pads.
- Close and rehabilitate duplicate roads.
- Locate roads to avoid important areas and habitats (important habitats include seasonal habitats (i.e., winter, nesting, breeding, and brooding habitats) within PHMA).
- Restrict vehicle traffic to only authorized users on newly constructed routes using signage, gates, etc.

GHMA

- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Do not issue rights-of-way or special use authorizations to counties on newly constructed energy development roads, unless for a temporary use consistent with all other terms and conditions included in this document.
- Establish speed limits on BLM system roads to reduce vehicle/wildlife collisions or design roads to be driven at slower speeds.
- Coordinate road construction and use among right-of-way or special use authorization holders.
- Construct road crossings at right angles to ephemeral drainages and stream crossings.
- Use dust abatement practices on roads and pads.
- Close and rehabilitate duplicate roads.

Operations

PHMA

- Cluster disturbances, operations (e.g., fracture stimulation and liquids gathering), and facilities.
- Use directional and horizontal drilling to reduce surface disturbance.
- Develop a plan to reduce vehicular traffic frequency of vehicle use through establishing trip restrictions (Lyon and Anderson 2003) or minimization through use of telemetry and remote well control (e.g., Supervisory Control and Data Acquisition), unless required for safety purposes.
- Clean up refuse.
- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Cover (with fine mesh netting or other effective techniques) all drilling and production pits and tanks regardless of size to reduce GRSG mortality.
- Equip tanks and other above-ground facilities with structures or devices that discourage nesting of raptors and corvids.
- Control the spread and effects of non-native plant species by washing vehicles and equipment (Evangelista et al. 2011).
- Restrict pit and impoundment construction to reduce or eliminate augmenting threats from West Nile virus (Doherty 2007).
- Place infrastructure in already disturbed locations where the habitat has not been fully restored.

- Consider using oak (or other material) mats for drilling activities to reduce vegetation disturbance and for roads between closely spaced wells to reduce soil compaction and maintain soil structure to increase likelihood of vegetation reestablishment following drilling.
- Apply a phased development approach with concurrent reclamation.
- Place liquid gathering facilities outside of PHMA. Have no tanks at well locations within PHMA to minimize truck traffic and perching and nesting sites for ravens and raptors. Pipelines must be under or immediately adjacent to the road (Bui et al. 2010).
- Site and/or minimize linear rights-of-way or special use authorizations to reduce disturbance to sagebrush habitats.
- Bury distribution power lines.
- Collocate powerlines, flow lines, and small pipelines under or immediately adjacent to existing roads (Bui et al. 2010).
- Design or site permanent structures which create movement (e.g. pump jack) to minimize impacts on Greater Sage-Grouse.
- Use only closed-loop systems for drilling operations and no reserve pits.
- Remove or re-inject 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:
  - Overbuild size of ponds for muddy and non-vegetated shorelines.
  - Build steep shorelines to decrease vegetation and increase wave actions.
  - Avoid flooding terrestrial vegetation in flat terrain or low lying areas.
  - Construct dams or impoundments that restrict down slope seepage or overflow.
  - Line the channel where discharge water flows into the pond with crushed rock.
  - Construct spillway with steep sides and line it with crushed rock.
  - Treat waters with larvicides to reduce mosquito production where water occurs on the surface.
- Require noise shields when drilling during the lek, nesting, brood-rearing, or wintering season.
- Fit transmission towers with anti-perch devices (Lammers and Collopy 2007).
- Locate new compressor stations outside PHMA and design them to reduce noise that may be directed towards PHMA.
- Locate worker camps outside of PHMA.

GHMA

- Cluster disturbances, operations (e.g., fracturing stimulation and liquids gathering), and facilities.
- Use directional and horizontal drilling to reduce surface disturbance.

- Develop a plan to reduce vehicular traffic frequency of vehicle use through establishing trip restrictions (Lyon and Anderson 2003) or minimization through use of telemetry and remote well control (e.g., Supervisory Control and Data Acquisition), unless required for safety purposes.
- Clean up refuse.
- Restrict the construction of tall facilities and fences to the minimum number and amount needed.
- Cover (with fine mesh netting or other effective techniques) all drilling and production pits and tanks regardless of size to reduce GRSG mortality.
- Equip tanks and other above-ground facilities with structures or devices that discourage nesting by raptors or corvids.
- Control the spread and effects of non-native plant species by washing vehicles and equipment (Evangelista et al. 2011).
- Restrict pit and impoundment construction to reduce or eliminate augmenting threats from West Nile virus (Dougherty 2007).

Reclamation

PHMA

- Include objectives for ensuring habitat restoration meets GRSG habitat needs in reclamation practices/sites (Pyke 2011). Address post reclamation management in reclamation plan such that goals and objectives are to improve or restore GRSG habitat needs.
- Maximize the area of interim reclamation on long-term access roads and well pads including reshaping, topsoiling and revegetating cut and fill slopes.
- Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community.
- Irrigate interim reclamation if necessary for establishing seedlings more quickly.
- Utilize mulching techniques to expedite reclamation and to protect soils.

GHMA

- Include objectives for ensuring habitat restoration meets GRSG habitat needs in reclamation practices/sites (Pyke 2011). Address post reclamation management in reclamation plan such that goals and objectives are to improve or restore GRSG habitat needs.

REQUIRED DESIGN FEATURES FOR PREVENTING WEST NILE VIRUS

- Increase the size of fresh-water ponds to accommodate a greater volume of water than is discharged. This will result in un-vegetated and muddy shorelines that breeding Cx. tarsalis avoid (De Szalay and Resh 2000). This modification may reduce Cx. tarsalis habitat but could create larval habitat for Culicoides sonorensis, a vector of blue tongue disease, and should be used sparingly (Schmidtmann et al. 2000). Steep shorelines should be used in combination with this technique whenever possible (Knight et al. 2003).

- Build steep shorelines to reduce shallow water (more than 60 centimeters) and aquatic vegetation around the perimeter of impoundments (Knight et al. 2003). Construction of steep shorelines also will create more permanent ponds that are a deterrent to colonizing mosquito species like Cx. tarsalis, which prefer newly flooded sites with high primary productivity (Knight et al. 2003).
- Maintain the water level below that of rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Avoid flooding terrestrial vegetation in flat terrain or low lying areas. Aquatic habitats with a vegetated inflow and outflow separated by open water produce 5- to 10-fold fewer Culex mosquitoes than completely vegetated wetlands (Walton and Workman 1998). Wetlands with open water also had significantly fewer stage III and IV instars which may be attributed to increased predator abundances in open water habitats (Walton and Workman 1998).
- Construct dams or impoundments that restrict down slope seepage or overflow by digging ponds in flat areas rather than damming natural draws for effluent water storage, or lining constructed ponds in areas where seepage is anticipated (Knight et al. 2003).
- Line the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
- Line the overflow spillway with crushed rock, and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation.
- 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.

REQUIRED DESIGN FEATURES FOR LANDS AND REALTY

- Where technically and financially feasible, bury distribution powerlines and communication lines within existing disturbance.
- Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
- Place infrastructure in already disturbed locations where the habitat has not been fully restored.
- Cluster disturbances, operations, and facilities.
- Micro-site linear facilities to reduce impacts to GRSG habitats.
- Locate staging areas outside GRSG habitat to the extent possible.
- Coordinate road construction and use among ROW holders.
- Restrict vehicle traffic to only authorized users on newly constructed routes using signage, gates, etc.
- Construct road crossings at right angles to ephemeral drainages and stream crossings.

- Consider placing pipelines under or immediately adjacent to a road or adjacent to other pipelines first, before considering co-locating with other ROW.
- Control the spread and effects of non-native plant species.
- New ROW structures will be constructed with perch deterrents or other anti-perching devices, where needed.

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Appendix D

Greater Sage-Grouse Monitoring Framework

APPENDIX D
GREATER SAGE-GROUSE MONITORING FRAMEWORK

D.1 INTRODUCTION

The purpose of this US Bureau of Land Management (BLM) and US Forest Service (Forest Service) 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 planning strategy (BLM Instruction Memorandum 2012-044) and the Forest Service Land Use Plans to conserve the species and its habitat. The regulations for the BLM (43 CFR 1610.4-9) 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. The BLM and Forest Service will use the methods described herein to collect monitoring data to evaluate implementation and effectiveness of the Greater Sage-grouse (hereafter, GRSG) planning strategy and the conservation measures contained in land use plans. The type of monitoring data to be collected at the land use plan scale will be described in the monitoring plan which will be developed after the signing of the Record of Decision. 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 the BLM and Forest Service have the ability to make consistent assessments about GRSG habitats across the range of the species, this framework lays out the methodology for monitoring the implementation and evaluating the effectiveness of BLM and Forest Service actions to conserve the species and its habitat through monitoring that informs effectiveness at multiple scales. Monitoring efforts will include data for measurable quantitative indicators of sagebrush availability, anthropogenic disturbance levels, and sagebrush conditions. Implementation monitoring results will provide information to allow the BLM and Forest Service to evaluate the extent that decisions from the BLM resource management plans (RMP) and Forest Service land and resource management plans (LRMPs) to conserve GRSG and its habitat have been implemented. Population monitoring information will be collected by state fish and wildlife agencies and will be incorporated into effectiveness monitoring as it is made available.

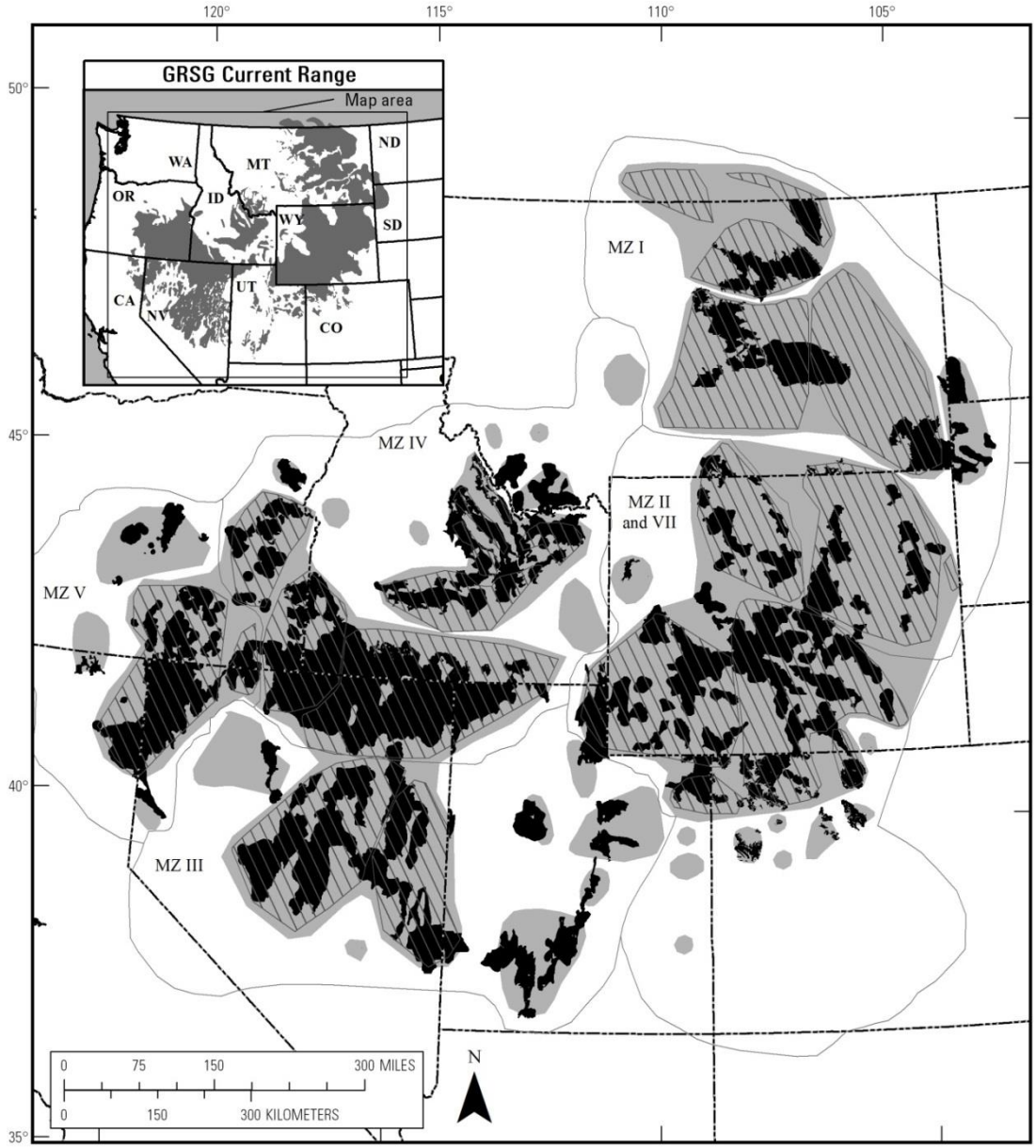
This multi-scale monitoring approach is necessary as GRSG are a landscape species and conservation is scale-dependent whereby conservation actions are implemented within seasonal habitats to benefit

populations. The four orders of habitat selection (Johnson 1980) used in this monitoring framework are described by Connelly et al. (2003) and Stiver et al. (2015 *In Press*) as first order (broad scale), second order (mid-scale), third order (fine scale), and fourth order (site scale) to apply them to GRSG habitat selection. Habitat selection and habitat use by GRSG occurs at multiple scales and is driven by multiple environmental and behavioral factors. Managing and monitoring GRSG habitats are complicated by the differences in habitat selection across the range and habitat utilization by individual birds within a given season. Therefore, the tendency to look at a single indicator of habitat suitability or only one scale limits the ability for managers to identify the threats to GRSG and to respond at the appropriate scale. For descriptions of these habitat suitability indicators for each scale, see the Sage-grouse Habitat Assessment Framework (HAF; Stiver et al. 2015 *In Press*).

Monitoring methods and indicators in this monitoring framework are derived from the current peer-reviewed science. Range wide best-available datasets for broad and mid-scale monitoring will be acquired. If these exiting datasets are not readily available or are inadequate, but are necessary to effectively inform the three measurable quantitative indicators (sagebrush availability, anthropogenic disturbance levels, and sagebrush conditions), the BLM 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 GRSG 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; **Figure D.1**, Map of Greater Sage-grouse Range, Populations, Subpopulations and Priority Areas for Conservation (PACs) as of 2013). This broad and mid-scale monitoring data and analysis will provide context for RMP/LRMP areas; states; GRSG priority habitat management areas (PHMA) and general habitat management areas (GHMA); and Priority Areas for Conservation (PACs) as defined in the Greater Sage-grouse Conservation Objectives: Final Report (COT report; US Fish and Wildlife Service 2013). Throughout the remainder of the document, all of these areas will be referred to as "GRSG areas".

This monitoring framework is divided into two sections. The broad and mid-scale methods, described in **Section D.2**, 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 BLM and Forest Service planning strategy and management decisions (see **Table D.1**, Indicators for Monitoring Implementation of the Strategy, Decisions, Sage-grouse Habitat, and Sage-grouse Populations at the Broad and Mid-scales). For the GRSG habitat fine and site scales (**Section D.3**), this framework describes a consistent approach (e.g., indicators and methods) for monitoring GRSG 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 the BLM and Forest Service multi-scale monitoring commitments see **Attachment A**.

Figure D.1
Map of Greater Sage-grouse Range, Populations, Subpopulations and Priority Areas for Conservation (PAC) as of 2013



GRSG PACs, Subpopulations and Populations

LEGEND

- Subpopulations
- COT PACs
- Populations

Sources:
Current Range: Schroeder et al., 2004
Populations: Connelly et al., 2004
Subpopulations: Connelly et al., 2004
PACs: USFWS COT Report, 2013

Table D.1
Indicators for Monitoring Implementation of the Strategy, Decisions, Sage-grouse Habitat, and Sage-grouse Populations at the Broad and Mid-scales

Geographic Scales	Implementation	Habitat		Population (State Wildlife Agencies)
		Availability	Degradation	Demographics
Broad Scale: From the range of GRSG to WAFWA MZs	BLM/Forest Service Planning Strategy goal and objectives	Distribution and amount of sagebrush within the range	Distribution and amount of energy, mining and infrastructure facilities	WAFWA MZ population trend
Mid-scale: From WAFWA MZ to populations. PACs	RMP/LRMP decisions	Mid-scale habitat indicators (HAF 2014; **Table D.2** e.g., percent of sagebrush per unit area)	Distribution and amount of energy, mining and infrastructure facilities (**Table D.2**)	Individual population trend

D.2 Broad and Mid-Scales

First order habitat selection at the broad scale describes the physical or geographical range of a species. The first order habitat, the range of the species, is defined by populations of GRSG associated with sagebrush landscapes based on Schroeder et al. 2004, Connelly et al. 2004 and population surveys and local adjustments based on population or habitat surveys since 2004. There is an intermediate scale between the broad and mid-scales that was delineated by WAFWA from floristic provinces within which similar environmental factors influence vegetation communities. This scale is referred to as the WAFWA GRSG 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 GRSG 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 square miles. PACs range from 20 to 20,400 square miles and are nested within population areas, and populations are nested within MZs.

Other mid-scale landscape indicators such as patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (Stiver et al. 2015 *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).

D.2.1 Implementation (Decision) Monitoring

Implementation monitoring is the process of tracking and documenting the implementation (or the progress toward implementation) of land use plan decisions. The BLM and the Forest Service will monitor implementation of project level and/or site specific actions within PHMA and GHMA for the Utah Greater Sage-Grouse LUPA/EIS. These actions and authorizations as well as progress toward completing and implementing activity-level plans will be monitored consistently across all planning units and reported to BLM and Forest Service headquarters annually, with a summary report every five years.

A national-level Land Use Plan Implementation Monitoring and Reporting Structure (IMARS) that describes how the BLM and Forest Service will monitor and report implementation level activity plans and implementation actions for all amended plans will be developed by the Implementation Monitoring Team and included in the Record of Decision/Approved Plan. A centralized tracking tool (IMARS) for collection, roll-up and reporting of tabular and spatially explicit data will be utilized. The BLM and Forest Service will provide data that can be integrated with other conservation efforts conducted by state and federal partners.

D.2.2 Habitat Monitoring

In the USFWS's 2010 listing decision for GRSG, the USFWS identified 18 threats contributing to the destruction, modification, or curtailment of the GRSG's habitat or range (75 *Federal Register* 13910 2010). The BLM and Forest Service will therefore monitor the relative extent of these threats that remove sagebrush (see **Table D.2**, Relationship between the 18 Threats and the Three Habitat Disturbance Measures for Monitoring), both spatially and temporally, on all lands within PHMA and GHMA and report on amount, pattern and condition of habitat. 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. 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: Density of Energy and Mining (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 to account for actual removal of sagebrush upon which GRSG depend (Connelly et al. 2000) and for habitat degradation as a surrogate for human activity. Measure 1 examines where disturbances have removed plant communities that support sagebrush (or have broadly removed sagebrush from the landscape), and therefore monitors the change in sagebrush availability, or specifically where and how much of the sagebrush community is available within the range of GRSG. The sagebrush community is defined as the ecological systems that have the capability to support sagebrush vegetation and seasonal GRSG habitats within the range of GRSG (see **Section D.2.2.1** below). Measures 2 and 3 (see **Section D.2.2.2** below) focus on where habitat degradation is occurring 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 unit of interest and in areas that have the capability to support sagebrush and seasonal GRSG use. Measure 2 is not only a quantification of footprint/area of direct disturbance but also a surrogate for those threats most likely to have ongoing activity. In addition, energy development and mining activities are typically the most intensive activities in sagebrush habitat. Therefore, Measure 3, the density of active energy development, production, and mining sites will be monitored to help identify areas of particular concern for factors such as noise, dust, traffic, etc., that degrade GRSG habitat.

Table D.2
Relationship between the 18 Threats and the Three Habitat Disturbance Measures for Monitoring

USFWS Listing Decision Threat	Sagebrush Availability	Habitat Degradation	Density of Energy and Mining
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 salable 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 ways		X	

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

The methods to monitor disturbance found herein differ slightly from methods used in the Sage-Grouse Baseline Environmental Report (BER; Manier et al. 2013) that provided a baseline of datasets of disturbance across jurisdictions. One difference is that, for some threats, the data in the BER were for federal lands only. In addition, threats were assessed individually in that report, 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 utilize the best available data across the range of the GRSG 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 the three measures.

D.2.2.1 Sagebrush Availability (Measure 1)

GRSG 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. This measure has been divided into two sub-measures to describe sagebrush availability on the landscape:

- Measure 1a) the current amount of sagebrush on the landscape of interest and

- Measure 1b) the amount of sagebrush on the landscape of interest compared to 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 unit of interest]. The appropriate geographic units of interest for sagebrush availability include the species' range, WAFWA MZs, populations, and PACs. In some cases these GRSG 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 area of interest) will be calculated using this formula: [the existing updated sagebrush layer (EVT)] divided by [pre Euro-American geographic extent of lands that could have supported sagebrush (BpS)]. This will provide information during evaluations of monitoring data to set the context for a given geographic unit of interest. That information could also be used for management options for restoration or mitigation.

The sagebrush base layer for the sagebrush availability measure will be based on geospatial vegetation data adjusted for the threats listed in **Table D.2**. The following sub-sections of this monitoring framework describe the methodology to determine 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.

Establishing the Sagebrush Base Layer

The current geographic extent of sagebrush vegetation within the range wide distribution of GRSG populations will be ascertained using the most recent version of the Existing Vegetation Type (EVT) layer in LANDFIRE (2010). 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 range wide 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 to support sagebrush vegetation pre Euro-American settlement [LANDFIRE Biophysical Setting (BpS)]. This fifth reason provides a reference point for understanding how much sagebrush currently remains in a defined geographic area compared with how much sagebrush existed historically (Measure 1b). Therefore, BLM and Forest Service 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. Along with aggregating the sagebrush types into the sagebrush base layer, BLM and Forest Service will aggregate the accuracy assessment reports from LANDFIRE to document the cumulative accuracy for the sagebrush base layer. For the long-term, BLM through its Assessment, Inventory, and Monitoring (AIM) program and specifically the BLM'S Landscape Monitoring Framework (Taylor et al. *in press*) will provide field data to the LANDFIRE program to support continuous quality improvements in their products specifically for rangeland systems to improve the LANDFIRE EVT layer.

Within the Forest Service and BLM, forest-wide and field office-wide existing vegetation classification mapping and inventories are available that provide a much finer level of data than provided through LANDFIRE. Where available, these finer scale products are useful for additional and complimentary mid-

scale indicators and local scale analyses (see **Section D.3**, Fine and Site Scale). 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.

The sagebrush layer based on LANDFIRE EVT will allow for the mid-scale estimation of existing percent 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 be used to determine the trend in other landscape indicators, e.g. patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (Stiver et al. 2015 *In Press*). In the future, changes in sagebrush availability, generated bi-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 D.2.4**).

Data Sources to Establish and Monitor Sagebrush Availability

In much the same manner as how the LANDFIRE data was selected as the data source, described above, the criteria for selecting the datasets (**Table D.3**, Datasets for Establishing and Monitoring Changes in Sagebrush Availability) for establishing and monitoring the change in sagebrush availability, Measure 1, were threefold:

- Nationally consistent dataset available across the range
- Known level of confidence or accuracy in the dataset
- Dataset is continually maintained with a known update interval

Table D.3
Datasets for Establishing and Monitoring Changes in Sagebrush Availability

Dataset	Source	Update Interval	Most Recent Version Year	Use
BioPhysical Setting (BpS) v1.1	LANDFIRE	Static	2008	Denominator for Sagebrush Availability (1.b.)
Existing Vegetation Type (EVT) v1.2	LANDFIRE	Static	2010	Numerator for Sagebrush Availability
Cropland Data Layer (CDL)	National Agricultural Statistics Service (NASS)	Annual	2012	Agricultural Updates; removes existing sagebrush from numerator of sagebrush availability
National Land Cover Dataset (NLCD) Percent Imperviousness	Multi-Resolution Land Characteristics Consortium (MRLC)	5 Year	2011 available in March 2014	Urban Area Updates; removes existing sagebrush from numerator of sagebrush availability
Fire Perimeters	GeoMac	Annual	2013	< 1,000 acres Fire updates; removes existing sagebrush from numerator of sagebrush availability

Table D.3
Datasets for Establishing and Monitoring Changes in Sagebrush Availability

Dataset	Source	Update Interval	Most Recent Version Year	Use
Burn Severity	Monitoring Trends in Burn Severity (MTBS)	Annual	2012 available in April 2014	> 1,000 acres Fire Updates; removes existing sagebrush from numerator of sagebrush availability except for unburned sagebrush islands

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 up to 2008 and version 1.2 reflects changes on the landscape up to 2010. Version 1.2 will be used as the starting point to develop the sagebrush base layer.

Ecological systems from the LANDFIRE EVT to be used in the sagebrush base layer were determined by GRSG subject matter experts through the identification of the ecological systems that have the capability of supporting sagebrush vegetation and could provide suitable seasonal habitat for the GRSG (**Table D.4**, Ecological Systems in BpS and EVT Capable of Supporting Sagebrush Vegetation and Could Provide Suitable Seasonal Habitat for Greater Sage-grouse). Two additional vegetation types that are not ecological systems were added to the EVT and are *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.

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 D.4** will be merged into one value that represents the sagebrush base layer. By aggregating all ecological systems, the combined accuracy of the sagebrush base layer (EVT) is much greater than if all categories were treated separately.

LANDFIRE performed the original accuracy assessment of their EVT product on a map zone basis. There are 20 LANDFIRE map zones that cover the historic range of GRSG as defined by Schroeder (2004). **Attachment C**, User and Producer Accuracies for Aggregated Ecological Systems within LANDFIRE Map Zones, lists the user and producer accuracies for the aggregated ecological systems that make up the sagebrush base layer and also defines user and producer accuracies. The aggregated sagebrush base layer for monitoring had producer accuracies ranging from 56.7 percent to 100 percent and user accuracies ranging from 57.1 percent to 85.7 percent.

Table D.4
Ecological Systems in BpS and EVT Capable of Supporting Sagebrush Vegetation and Could Provide Suitable Seasonal Habitat for Greater Sage-grouse

Ecological System	Sagebrush Vegetation that the Ecological System has the Capability to Produce
Colorado Plateau Mixed Low Sagebrush Shrubland	*Artemisia arbuscula* ssp. *longiloba* *Artemisia bigelovii* *Artemisia nova* *Artemisia frigida* *Artemisia tridentata* ssp. *wyomingensis*
Columbia Plateau Scabland Shrubland	*Artemisia rigida*
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 Mixed Salt Desert Scrub	*Artemisia tridentata* ssp. *wyomingensis* *Artemisia spinescens*
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	*Artemisia arbuscula* ssp. *longiloba* *Artemisia nova* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia tripartita* ssp. *rupicola*
Columbia Plateau Low Sagebrush Steppe	*Artemisia arbuscula* *Artemisia arbuscula* ssp. *longiloba* *Artemisia nova*
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 Montane Sagebrush Steppe	*Artemisia tridentata* ssp. *vaseyana* *Artemisia tridentata* ssp. *wyomingensis* *Artemisia nova* *Artemisia arbuscula* *Artemisia tridentata* ssp. *spiciformis*
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*
Western Great Plains Sand Prairie	*Artemisia cana* ssp. *cana*
Western Great Plains Floodplain Systems	*Artemisia cana* ssp. *cana*
Columbia Plateau Steppe and Grassland	*Artemisia* spp.

Table D.4
Ecological Systems in BpS and EVT Capable of Supporting Sagebrush Vegetation and Could Provide Suitable Seasonal Habitat for Greater Sage-grouse

Ecological System	Sagebrush Vegetation that the Ecological System has the Capability to Produce
Inter-Mountain Basins Semi-Desert Shrub-Steppe	*Artemisia tridentata* *Artemisia bigelovii* *Artemisia tridentata* ssp. *wyomingensis*
Rocky Mountain Lower Montane-Foothill Shrubland	*Artemisia nova* *Artemisia tridentata* *Artemisia frigida*
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	*Artemisia tridentata*
Inter-Mountain Basins Curl-Leaf Mountain Mahogany Woodland and Shrubland	*Artemisia tridentata* ssp. *vaseyana* *Artemisia arbuscula* *Artemisia tridentata*
Artemisia tridentata ssp. *vaseyana* Shrubland Alliance (EVT only)	*Artemisia tridentata* ssp. *vaseyana*
Quercus gambelii Shrubland Alliance (EVT only)	*Artemisia tridentata*

LANDFIRE EVT data are not designed to be used at a local level. In reporting 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 pixel level (30 square meters resolution of raster data) for any reporting. The smallest geographic extent use of the data for this purpose is at the PAC level and 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).[1] CDL data are generated on an annual basis with "estimated producer accuracies for large row crops from the mid-80 to mid-90 percent" depending on the State.[2] Readers are referred to the NASS metadata website for specific information on accuracy.[3] 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.

[1] http://www.nass.usda.gov/research/Cropland/Release/index.htm
[2] http://www.nass.usda.gov/research/Cropland/sarsfaqs2.htm#Section3_18.0
[3] http://www.nass.usda.gov/research/Cropland/metadata/meta.htm

The CDL data contain both agricultural classes as well as non-agricultural classes. For this effort, as was also done in the BER (Manier et al. 2013), non-agricultural classes were removed from the original dataset. The excluded classes are as follows:

- 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 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 CDL classifies that pixel as one of the non-ag classes listed above. The assumption is that even though individual pixels may get classified as a non-agricultural class in any given year the pixel has not necessarily been restored to a natural sagebrush community that would be included in **Table D.4**. It is further assumed that once an area has moved into agricultural use, it is unlikely that it would be restored to sagebrush. Should that occur, the method and criteria for adding pixels back into the sagebrush base layer would follow those found in the Restoration Updates section of this framework.

Urban Adjustments for the Sagebrush Base Layer

The National Land Cover Dataset (NLCD) Percent Imperviousness was selected as the best available dataset to be used for urban updates. These data are generated on a five-year cycle and 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 will be removed from the sagebrush base layer during the update process. Although the impervious surface layer includes a number of impervious pixels outside of urban areas, there are two reasons why this is acceptable for this process. 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 because unincorporated urban areas were not being included, thus leaving large chunks of urban pixels unaccounted for in this rule set. Secondly, 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, it was determined to include all impervious pixels.

Fire Adjustments for the Sagebrush Base Layer

Two datasets were selected for performing fire updates: GeoMac fire perimeters and Monitoring Trends in Burn Severity (MTBS). An existing data standard in the BLM requires all fires with sizes greater than 10 acres to be reported to GeoMac, therefore there will be many small fires less than 10 acres in size

that will not be accounted for in the fire updates. In the update process using fire perimeters from GeoMac, all sagebrush pixels falling within the perimeter of fires less than 1,000 acres in size will be used to update the sagebrush layer.

MTBS was selected for use as a means to account for unburned sagebrush islands during the update process of the sagebrush base layer. The MTBS program[4] is an on-going multi-year project to consistently map fire severity and fire perimeters across the US. For lands in the western US, MTBS only maps burn severity for fires greater than 1,000 acres in size. 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 that will be retained in 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. However, not all wildfires have the same impact 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 the warmer, dryer sagebrush habitat. These 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 GRSG habitat (Davies et al. 2011; Baruch-Mordo et al. 2013). Conifer species that show propensity for encroaching into sagebrush vegetation which results in GRSG 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 determine the existing 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 have the capability of supporting the conifer species (listed above) and sagebrush vegetation. Those ecological systems (**Table D.5**, Ecological Systems with Conifers Most Likely to Encroach into Sagebrush Vegetation) were deemed to be the plant communities with conifers most likely to encroach into sagebrush vegetation. Sagebrush vegetation was defined as including sagebrush species (**Attachment B**, List of All Sagebrush Species and Subspecies Included in the Selection Criteria for Building the EVT and BpS Layers) that provide habitat for the GRSG and are included in the Sage-Grouse HAF. An adjacency analysis was conducted to identify all sagebrush pixels that were directly adjacent to these conifer ecological systems. Those immediately adjacent sagebrush pixels were removed from the sagebrush base layer.

[4] http://www.mtbs.gov

Table D.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 to Produce
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*

Table D.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 to Produce
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 present (beyond the LANDFIRE data) that meet our 3 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 the **Monitoring Sagebrush Availability** section below.

Sagebrush Restoration Adjustments for the Sagebrush Base Layer

There are no datasets from 2010 to 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) due to restoration activities since 2010. Successful restoration treatments prior to 2010 are assumed to have been captured in the LANDFIRE refresh.

Monitoring Sagebrush Availability

Updating the Sagebrush Availability Sagebrush Base Layer

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 < 1,000 acres] minus [2009/10 MTBS Fires excluding unburned sagebrush islands] minus [Conifer Encroachment Layer]
>
> ***2012 Existing Sagebrush Update*** = [Base 2010 Existing Sagebrush Layer] minus [2011 Imperviousness Layer] minus [2011 and 2012 CDL] minus [2011/12 GeoMac Fires < 1,000 acres] minus [2011/12 MTBS Fires > 1,000 acres, excluding unburned sagebrush islands within the perimeter]

2013 and beyond Existing Sagebrush Updates = [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 MTBS Fires > 1,000 acres, excluding unburned sagebrush islands within the perimeter] plus [restoration/monitoring data provided by the field]

Sagebrush Restoration Updates

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. When restoration has been determined to be successful through range wide, 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 the change in the amount of sagebrush in a landscape 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 Euro-American settlement (biophysical setting (BpS) v1.2 of LANDFIRE). This measure (1b) will provide information during evaluations of monitoring data to set the context for a given geographic area of interest. The information could also be used to inform management options for restoration, mitigation and inform effectiveness monitoring.

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 Euro-American settlement) disturbance regime and how the historical disturbance regime operated on the current biophysical environment. BpS is composed of map units which are based on NatureServe's (2011) terrestrial ecological systems classification.

The ecological systems within BpS used for this monitoring framework are those ecological systems that have the capability of supporting sagebrush vegetation and could provide seasonal habitat for the GRSG. These ecological systems are listed in **Table D.4** with the exception of the *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance and the *Quercus gambelii* Shrubland Alliance. Ecological systems selected included sagebrush species or subspecies that are included in the Sage-Grouse HAF and are found in **Attachment B**.

Attributable to the lack of any reference data, the BpS layer does not have an associated accuracy assessment. Visual inspection, however, of the BpS data reveals inconsistencies in the labeling of pixels among LANDFIRE map zones. The reason for these inconsistencies between map zones are the decision rules used to map a given ecological system will vary between map zones based on different physical, biological, disturbance and atmospheric regimes of the region. This can result in artificial edges in the map that are an artifact of the mapping process. However, metrics will be calculated 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 is minor compared with the size of the reporting units. Therefore, since BpS will be used to identify broad landscape patterns of dominant vegetation, these inconsistencies will only have a minor impact on the percent sagebrush availability calculation.

LANDFIRE BpS data are not designed to be used at a local level. In reporting the percent sagebrush statistic for the various reporting units, 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 pixel level (30 square meters) for any reporting. The smallest geographic extent use of the data for this purpose is at the PAC level and for the smallest PACs the initial percent sagebrush remaining estimate will have greater uncertainties compared with the much larger PACs.

Tracking

BLM and Forest Service will analyze and monitor sagebrush availability (Measure 1) on a bi-annual basis and it 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. An updated estimate for 2012 will be reported in 2014 after all datasets become available. The 2012 estimate will capture changes attributable to fire, agriculture, and urban development. Subsequent updates will always include new fire and agricultural data and new urban data when available. Restoration data that meets criteria of adding sagebrush areas back into the sagebrush base layer will be factored in as data allows. There will be a two year lag (approximately) between estimate generation and data use/availability (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 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 share to help users understand the limitation of the sagebrush estimates and will be summarized spatially by map zone and included in the Portal.

LANDFIRE plans to begin a remapping effort in 2015. This remapping has the potential to greatly improve overall quality of the data products primarily through the use of higher quality remote sensing datasets. Additionally, 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 in partnership with the MRLC. The Grass/Shrub mapping effort applies the Wyoming multi-scale sagebrush habitat methodology (Homer et al. 2009) to spatially depict fractional percent cover estimates for five components range 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. One of the benefits of the design of these fractional cover maps is that they facilitate monitoring "with-in" class variation (e.g., examination of declining trend in sagebrush cover for individual pixels). This "with-in" class variation can serve as one indicator of sagebrush quality that cannot be derived from LANDFIRE's EVT information. The Grass/Shrub 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. The earliest possible date for this evaluation will not occur until 2018 or 2019 depending on data availability.

D.2.2.2 Habitat Degradation Monitoring (Measure 2)

The measure of habitat degradation will be calculated by combining the footprints of threats identified in **Table D.2**. The footprint is defined as the direct area of influence of "active" energy and infrastructure

and is used as a surrogate for human activity. Thus, the footprint of habitat degradation per GRSG area will be calculated. Although these analyses will try to summarize results at the aforementioned meaningful landscape units, some may be too small to appropriately report the metrics and may be combined (smaller populations, PACs within a population, etc.). Data sources for each threat are found in **Table D.6**, Geospatial Data Sources for Habitat Degradation (Measure 2). 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 available to the USFWS.

Table D.6
Geospatial Data Sources for Habitat Degradation (Measure 2)

USFWS Listing Decision Threat	Data Source	Direct Area of Influence
Agriculture	National Agriculture Statistics Service	Polygon Area
Urbanization	USGS Percent Imperviousness	Polygon Area
Wildfire	Geospatial Multi-Agency Coordination Group; Monitoring Trends in Burn Severity	Polygon Area
Conifer encroachment	LANDFIRE	Polygon Area
Energy (oil and gas wells and development facilities)	IHS; BLM (AFMSS)	5 ac (2.0 ha)
Energy (reclaimed site degradation)	IHS; BLM (AFMSS)	3 ac (1.2 ha)
Energy (coal mines)	BLM & FS data; Office of Surface Mining Reclamation and Enforcement	Polygon Area
Energy (wind towers)	Federal Aviation Administration	3 ac (1.2 ha)
Energy (solar fields)	Argonne National Laboratory	Polygon Area
Energy (geothermal)	Argonne National Laboratory	Polygon Area or 5 ac (2.0 ha)
Mining (active locatable, leasable, and salable developments)	InfoMine	Polygon Area or 5 ac (2.0 ha)
Infrastructure (roads)	ESRI StreetMap Premium	40.7-240.2 ft. (12.4-73.2 m)
Infrastructure (railroads)	Federal Railroad Administration	30.8 ft. (9.4 m)
Infrastructure (power lines)	Platts Transmission Lines	100-250 ft. (30.5-76.2 m)
Infrastructure (communication towers)	Federal Communications Commission	2.5 ac (1.0 ha)
Infrastructure (other vertical structures)	Federal Aviation Administration	2.5 ac (1.0 ha)

Habitat Degradation Datasets and Assumptions:

<u>Energy (oil and gas wells and development facilities)</u>
This dataset will be a compilation of two oil and gas well databases: the proprietary IHS Enerdeq® database and the BLM Automated Fluid Minerals Support System (AFMSS) database (AFMSS data will be

used to supplement the IHS data). Point data from wells active within the last ten years from IHS and producing wells from AFMSS will be considered as a 5 acre (2.0 ha) footprint (BLM WO 2014) centered on the well point. Plugged and abandoned wells will be removed, though only if the date of well abandonment was prior to the first day of the reporting year (i.e., for the 2010 reporting year a well must be plugged and abandoned by December 31, 2009 to be removed).

Additional Measure: Reclaimed Energy-related Degradation

This dataset will include those wells that have been plugged and abandoned in an effort to measure energy-related degradation that has been reclaimed but not necessary fully restored to GRSG habitat. This measure will establish a baseline by using wells that have been plugged and abandoned within the last ten years from the IHS and AFMSS datasets. Time lags for lek attendance in response to infrastructure have been documented to be delayed by 2-10 years from energy development activities (Harju et al. 2010), while reclamation actions may require two or more years from the Final Abandonment Notice. Sagebrush seedling establishment may take six or more years from the point of seeding, depending on variables such as annual precipitation, annual temperature, and soil type and depth (Pyke 2011). This ten-year period is conservative, assuming some level of habitat improvement ten years after plugging. However, research by Hemstrom et al. (2002) proposes an even longer period of greater than 100 years for recovery of sagebrush habitats even with active restoration approaches. Direct area of influence will be considered 3 acres (1.2 ha) (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 and 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 fire and agriculture conversion (see **Sagebrush Restoration Updates** section). This dataset will be updated annually with new plugged and abandoned well 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, US Energy Information Administration mine occurrence points, US Office of Surface Mining Reclamation and Enforcement (OSMRE) coal mining permit polygons (as available), and USGS Mineral Resources Data System (MRDS) mine occurrence points. These data will inform where active coal mining may be occurring. Aerial imagery will then be used to manually digitize active coal 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 utilized to locate (generally at 1:50,000 and below) and digitize (generally at 1:10,000 and below) active coal mine footprints. Coal mine location data source and imagery date will be documented for each digitized coal footprint polygon at the time of creation. Sub-surface facility locations (polygon or point location as available) will also be collected, if available, and included in density calculations, and added to the active surface activity layer as appropriate (if actual footprint can be located).

Energy (wind energy facilities)
This dataset will be a subset of the Federal Aviation Administration Digital Obstacles point file to include points where "Type_" = "WINDMILL". Direct area of influence of these point features will be measured by converting to a polygon dataset of three acres (1.2 ha) centered on each tower point (BLM Wind Energy Programmatic Environmental Impact Statement, 2005). Additionally, we will use Platts Power Plants and Generating Units database for transformer stations associated with wind energy sites.

Energy (solar energy facilities)
This dataset will include solar plants in existence or under construction as compiled with the proprietary Platts in the Power Plants and Generating Units database. The point data will be buffered to represent a three acre (1.2 ha) direct area of influence.

Energy (geothermal energy facilities)
This dataset will include geothermal plants in existence or under construction as compiled with the proprietary I.H.S and Platts (Power Plants and Generating Units) databases. The point data will be buffered to represent a three acre (1.2 ha) direct area of influence.

Mining (active developments; locatable, leasable, saleable)
This dataset will include active mining locations as compiled with the proprietary InfoMine® database. Other data sources will be evaluated as they are identified or become available. The point data will be buffered to represent a five acre (2.0 ha) 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: Interstates, 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 our broad and mid-scale monitoring, may support a volume of traffic that can have deleterious effects to GRSG 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/project scale analysis will require more site-specific data than is identified in this monitoring framework. The direct influence area for roads will be represented by 240.2 feet, 84.0 feet, and 40.7 feet (73.2 meters, 25.6 meters, and 12.4 meters) total widths centered on the line feature for Interstates, 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 as was used in the Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (Manier et al., 2013). Individual BLM and Forest Service planning units may utilize different roads layers for fine and site scale monitoring.*

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

Infrastructure (power lines)
This line dataset will be a compilation from EV Energy Map, Platts/Global Energy of transmission lines, substations, electric power generation plants, and energy distribution control facilities. Linear features in

the dataset attributed as "buried" will be removed from the disturbance calculation. Only "In Service" lines will be used, not "Proposed" lines. Direct area of influence will be determined by the kilovolt designation: 1-199 kilovolts (100 feet; 30.5 meters), 200-399 kilovolts (150 feet; 45.7 meters), 500-699 kilovolts (200 feet; 61.0 meters), and 700-or greater kilovolts (250 feet; 76.2 meters) based on average right-of-way and structure widths.

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 2.47 acres (1.0 ha) centered on each communication tower point (Knick et al. 2011).

Infrastructure (other vertical structures)
This point dataset will be compiled from the Federal Aviation Administration (FAA) 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 2.47 acres (1.0 ha) centered on each vertical structure point (Knick et al. 2011).

Other developed rights-of-ways
Currently no additional data sources for other rights-of-ways have been identified; roads, power lines, railroads, pipelines, and other known linear features are represented in categories above. Our newly purchased IHS data does contain pipeline information, but further investigation is needed to determine if the dataset is comprehensive. If additional features representing human activities are identified, they will be added to monitoring reports using similar assumptions to the threats above.

Habitat Degradation Threat Combination and Calculation
The threats targeted for measuring human activity from **Table D.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 GRSG. However, individual datasets will be preserved to ascertain which types of threats may be contributing to overall habitat degradation. Percentages will be calculated as follows: This measure has been divided into three sub-measures to describe habitat degradation on the landscape:

> Measure 2a) Footprint by landscape unit: Divide area of the active/direct footprint within a GRSG area by the total area of the GRSG area. (percent disturbance in landscape unit)
>
> Measure 2b) Active/direct footprint by historic sagebrush potential: Divide area of the active footprint that coincides with areas with historic sagebrush potential (BpS calculation from habitat availability) within a given landscape unit by the total area with sagebrush potential within the landscape unit. (percent disturbance on potential historic sagebrush in landscape unit)
>
> 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 landscape unit by the total area that is current sagebrush within the landscape unit. (percent disturbance on current sagebrush in landscape unit)

D.2.2.3 Density of Energy and Mining (Measure 3)

The measure of density of energy and mining will be calculated by combining the locations of threats identified in **Table D.2**. This will provide an estimate of intensity of human activity or intensity of habitat degradation. The number of energy facilities and mining locations will be summed and divided by the area of meaningful landscape units to calculate density of these activities. Data sources for each threat are found in **Table D.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.

Density of Energy and Mining Datasets and Assumptions:

<u>Energy (oil and gas wells and development facilities)</u>
[See **Section D.2.2.2**]

<u>Energy (coal mines)</u>
[See **Section D.2.2.2**]

<u>Energy (wind towers)</u>
[See **Section D.2.2.2**]

<u>Energy (solar energy facilities)</u>
[See **Section D.2.2.2**]

<u>Energy (geothermal energy facilities)</u>
[See **Section D.2.2.2**]

<u>Mining (active developments; locatable, leasable, saleable)</u>
[See **Section D.2.2.2**]

Density of Energy and Mining 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 landscape units 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, nor 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 counts will be converted to densities by dividing 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 with display and conveying information about areas within meaningful landscape units that have high energy and/or mining activity.
7. Additional statistics for each defined unit may also include adjusting the area to only include area with the historic potential for sagebrush (BpS) or areas currently sagebrush (EVT).

Key habitat degradation individual datasets and threat combination datasets will be available through BLM's EGIS Web Portal and Geospatial Gateway. Legacy datasets will be preserved, so that trends may be calculated.

D.2.3 Population (Demographics) Monitoring

State wildlife management agencies are responsible for monitoring GRSG populations within their respective states. WAFWA will coordinate this collection of annual population data by state agencies. These data will be made available to BLM and Forest Service through the Sage-grouse Implementation Memorandum of Understanding (2013) signed by WAFWA, BLM, Forest Service, NRCS, USGS, Farm Service Agency, and USFWS. An amendment to the MOU (2014) will outline a process, timeline, and responsibilities for regular data sharing of GRSG population and/or habitat information. The Landscape Conservation Management and Analysis Portal (LC MAP) will be used as the instrument for state wildlife agencies to annually submit population data and analyses that will be accessed by the BLM through a data sharing agreement. Population areas were refined from the COT report 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 inform the adaptive management responses.

D.2.4 Effectiveness Monitoring

Effectiveness monitoring will provide the information to evaluate BLM and Forest Service actions to reach the objective of the planning strategy (BLM Instruction Memorandum 2012-044), to conserve GRSG populations and its habitat, and the objectives in this Utah Greater Sage-Grouse LUPA/EIS. 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 information used for these larger scale evaluations includes 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 a LUP or PACs within a LUP (described in **Section D.3**). The information will also include the trend of disturbance within these areas of interest which informs the need to initiate adaptive management responses as described in this Utah Greater Sage-Grouse LUPA/EIS.

Effectiveness monitoring reported for these larger areas provides the context to then conduct effectiveness monitoring at finer scales and helps focus scarce resources to areas experiencing habitat

loss, degradation, or population declines. These large area evaluations would not exclude the need for concurrent finer scale evaluations where habitat or population anomalies have been identified through some other means.

To determine the effectiveness of the GRSG planning strategy, the BLM and Forest Service 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 Euro-American historical distribution of sagebrush (BpS)?
    c. What is the trend and condition of the indicators describing sagebrush characteristics important to GRSG?
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 GRSG and the change in the population estimation?
4. How are the BLM and Forest Service contributing to changes in the amount of sagebrush?
5. How are the BLM and Forest Service 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, which may be accelerated to respond to critical emerging issues (in consultation with USFWS and state wildlife agencies). In addition, effectiveness monitoring results will be used to identify emerging issues and research needs and will be consistent with and inform the BLM and the Forest Service adaptive management strategy (see "Adaptive Management" section of the EIS).

To determine the effectiveness of the GRSG objectives of this Utah Greater Sage-Grouse LUPA/EIS, the BLM and Forest Service will evaluate the answers to the following questions and prepare a plan effectiveness report:

1. Is this plan meeting the GRSG habitat objectives?
2. Are GRSG areas within the land use plan meeting, or making progress towards meeting, land health standards, including the Special Status Species/ wildlife habitat standard?
3. Is the plan meeting the disturbance objective(s) within GRSG areas?
4. Are the GRSG populations within this plan boundary and within the GRSG 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 identify 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- biological scales (PACs and above) the BLM and the Forest Service will summarize the vegetation, disturbance, and population data (when available). Although the analysis will try to summarize results for PACs within each GRSG population, some populations may be too small to appropriately report the metrics and may need to be combined to provide an estimate with an acceptable level of accuracy or they will be flagged for more intensive monitoring by the appropriate landowner or agency. The BLM and Forest Service will then analyze monitoring data to detect the trend in the amount of sagebrush; the condition of the vegetation in the GRSG areas (MacKinnon et al. 2011); the trend in the amount of disturbance; the change in disturbed areas due to successful restoration; and the amount of new disturbance the BLM or Forest Service has permitted. This information could be supplemented with population data to understand the correlation between habitat and PACs within a population when population data are available. This overall effectiveness evaluation must consider the lag effect response of populations to habitat changes (Garton et al. 2011).

Calculating Question 1, Planning Strategy Effectiveness: The amount of sagebrush available in the large area of interest will utilize the information from Measure 1a (Section B1, 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 (**Section D.2.2.1,** Sagebrush Availability) will be utilized. To calculate the trend in the condition of sagebrush at the mid-scale, three sources of data will be utilized: the BLM Grass/ Shrub mapping effort (**Section D.2.2.1**, Future Plans); the results from the calculation of the landscape indicators such as patch size (described below); and the BLM Landscape Monitoring Framework (LMF) and GRSG intensification effort (also described below). The LMF and GRSG intensification effort data is collected in a statistical sampling framework that allows calculation of indicator values at multiple scales.

Beyond the importance of sagebrush availability to GRSG, the mix of sagebrush patches on the landscape at the broad and mid-scale provides the life requisite of space for GRSG 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 utilized using the same data layers derived for sagebrush availability.

The BLM initiated the LMF in 2011 in cooperation with NRCS. The objective of the LMF effort is to provide non-biased estimates of vegetation and soil condition and trend using a statistically balanced sample design across BLM lands. Recognizing that GRSG populations are more resilient where the sagebrush plant community has certain characteristics unique to a particular life stage of GRSG (Knick and Connelly 2011; Stiver et al. 2015 *In Press*), a group of GRSG habitat and sagebrush plant community subject matter experts identified those vegetation indicators collected at LMF sampling points that

inform GRSG habitat needs. The experts represented BLM, USFWS, WAFWA, NRCS, ARS, state wildlife agencies, and academia. The common indicators that were 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 GRSG, additional plot locations in occupied GRSG habitat (Sage-grouse Intensification) were added in 2013. The common indicators are also collected on sampling locations in the NRCS Rangeland Monitoring Survey.

The Sage-grouse Intensification baseline data will be collected over a five year period and an annual Sage-grouse Intensification report will be prepared describing the status of the indicators. Beginning in year six, the annual status report will be accompanied with a trend report which will be available on an annual basis thereafter contingent upon 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 Planning Strategy Effectiveness Report.

Calculating Question 2, Planning Strategy Effectiveness: The amount of habitat degradation and the intensity of the activities in the area of interest will utilize the information from Measures 2 and 3 (**Section D.2.2.2**, Habitat Degradation). The amount of reclaimed energy-related degradation will be collected by the FO on plugged and abandoned and oil/gas well sites. The data will demonstrate that the reclaimed sites have yet to meet the habitat restoration objectives for GRSG habitat. This information, in combination with the amount of habitat degradation, will be used to answer Question 2 of the Planning Strategy Effectiveness Report.

Calculating Question 3, Planning Strategy Effectiveness: The change in GRSG estimated populations will be calculated from data provided by the state wildlife agencies, when available. This population data (**Section D.2.3**, Population (Demographics) Monitoring) will be used to answer Question 3 of the Planning Strategy Effectiveness Report.

Calculating Question 4, Planning Strategy Effectiveness: The estimated contribution by the BLM or the Forest Service to the change in the amount of sagebrush in the area of interest will utilize the information from Measure 1a (**Section D.2.2.1**, Sagebrush Availability).This measure is derived from the national data sets that remove sagebrush (**Table D.2**). To determine the relative contribution of the BLM and Forest Service 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 area of interest. This information will be used to answer Question 4 of the Planning Strategy Effectiveness Report.

Calculating Question 5, Planning Strategy Effectiveness: The estimated contribution by the BLM or the Forest Service to the change in the amount of disturbance in the area of interest will utilize the information from Measure 2a (**Section D.2.2.2**, Habitat Degradation, Percent) and Measure 3 **Section D.2.2.2**, Habitat Degradation, Intensity). These measures are all derived from the national disturbance data sets that degrade habitat (**Table D.2**). To determine the relative contribution of the BLM and Forest Service 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 area of interests. This information will be used to answer Question 5 of the Planning Strategy Effectiveness Report.

Answering the five questions that determine the effectiveness of the BLM and Forest Service 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 the objectives of the Planning Strategy to maintain populations and their habitats have been met. Conversely, where information indicates sagebrush is decreasing and vegetation conditions are degrading, disturbance in GRSG areas is increasing, and populations are declining relative to the baseline, there is evidence the objectives of the Planning Strategy are not being achieved. This would likely result in a more detailed analysis and could be the basis for implementing more restrictive adaptive management measures.

At the Land Use Plan area, the BLM and the Forest Service 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 and Forest Service surface management areas and will help inform where finer scale evaluations are needed such as seasonal habitats, corridors, or linkage areas. The information should also include the trend of disturbance within the GRSG areas which informs the need to initiate adaptive management responses as described in this Utah Greater Sage-Grouse LUPA/EIS.

Calculating Question 1, Land Use Plan Effectiveness: The condition of vegetation and the allotments meeting Land Health Standards in GRSG areas will both be used as part of the determination of the effectiveness of the LUP in meeting the vegetation objectives in GRSG habitat set forth in this LUP. The collection of this data will be the responsibility of the Field Office/Ranger District. In order for this data to be consistent and comparable, common indicators, consistent methods, and a nonbiased sampling framework should be implemented following the principles in the AIM Strategy (Toevs et al. 2011; BLM TN 440 BLM Core Indicators and Methods), in the BLM Technical Reference Interpreting Indicators of Rangeland Health (Pellant et al. 2005), and the HAF (Stiver et al. 2015 *In Press*) or other approved WAFWA MZ consistent guidance to measure and monitor GRSG habitats. The analysis of this information will be used to answer Question 1 of the Land Use Plan Effectiveness Report.

Calculating Question 2, Land Use Plan Effectiveness: The amount of habitat disturbance in GRSG areas identified in this LUP will be used as part of the determination of the effectiveness of the LUP in meeting the disturbance objectives set forth in this LUP. National data sets 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 2 of the Land Use Plan Effectiveness Report.

Calculating Question 3, Land Use Plan Effectiveness: The change in estimated GRSG populations will be calculated from data provided by the state wildlife agencies, when available and will part of the determination of effectiveness. This population data (**Section D.2.3**) will be used to answer Question 3 of the Land Use Plan Effectiveness Report.

Results of the effectiveness monitoring process for the land use plan will be used to inform the need for finer scales investigations, initiate Adaptive Management actions as described in **Appendix I**, 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 from which the effectiveness of the adaptive management strategy will be evaluated.

D.3 FINE AND SITE SCALES

Fine scale (third order) habitat selected by GRSG is described as the physical and geographic area within home ranges including breeding, summer, and winter periods. At this level, habitat suitability monitoring should address factors that affect GRSG use of, and movements between, seasonal use areas. The habitat monitoring at fine and site scale (fourth order) should focus on indicators to describe seasonal home ranges for GRSG associated with a lek, or lek group within a population or subpopulation area. Fine and site scale monitoring should inform LUP effectiveness monitoring (see **Section D.2.4**) and the hard and soft triggers identified in the Adaptive Management section of the land use plan.

Site-scale habitat selected by GRSG 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 as well as vegetation associated with riparian areas, wet meadows, and other mesic habitats adjacent to sagebrush that may support GRSG habitat needs during different stages in their annual cycle.

As described in the Conclusion (**Section D.4**), details and application of monitoring at the fine and site scales will be described in the implementation-level monitoring plan of the Utah Greater Sage-Grouse LUPA/EIS. 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 evaluating the success of projects targeting GRSG 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 AIM Strategy (Toevs et al. 2011) and AIM-Monitoring: A Component of the Assessment, Inventory, and Monitoring Strategy (Taylor et al. *in press*). Approved monitoring methods are:

- BLM Core Terrestrial Indicators and Methods, (MacKinnon et al. 2011)
- BLM Technical Reference Interpreting Indicators of Rangeland Health (Pellant et al. 2005); and
- Sage-Grouse HAF.

Other state-specific disturbance tracking models include: the BLM Wyoming Density and Disturbance Calculation Tool[5]; and the BLM White River Data Management System (WRDMS) 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 GRSG habitat suitability indicators for seasonal habitats are identified in the HAF. The HAF has incorporated the Connelly et al. (2000) GRSG guidelines as well as many of the core indicators in the assessment, inventory and monitoring (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 and any such adjustments should be ecologically defensible. However, to foster consistency, adjustments to site suitability values at the local scale should be avoided unless there is strong, scientific justification for

[5] http://ddct.wygisc.org/

doing so and 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 GRSG studies found in the relevant area and peer reviewed by the appropriate wildlife management agency(s) and researchers.

When conducting land heath assessments, at a minimum, the BLM should follow Interpreting Indicators of Rangeland Health (Pellant et al. 2005) and the BLM Core Terrestrial Indicators and Methods, (MacKinnon et al. 2011). If the assessment is being conducted in GRSG 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 roll-up analysis among management units; will be useful to provide consistent data to inform the classification and interpretation of imagery; and will provide condition and trend of the indicators describing sagebrush characteristics important to GRSG habitat (see **Section D.2.4**).

D.4 CONCLUSION

This Greater Sage-grouse Monitoring Framework was developed for all of the Final Environmental Impact Statements involved in the GRSG planning effort. As such, it describes the monitoring activities at the broad and mid-scales and sets the stage for BLM and Forest Service to collaborate with partners/other agencies to develop the Utah Greater Sage-Grouse LUPA/EIS Monitoring Plan using this Greater Sage-grouse Monitoring Framework as a guide.

D.5 THE GREATER SAGE-GROUSE DISTURBANCE AND MONITORING SUB-TEAM MEMBERSHIP

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ATTACHMENT A: AN OVERVIEW OF MONITORING COMMITMENTS

	Broad and Mid-scales					Fine & Site Scales
	Implementation	**Sagebrush Availability**	**Habitat Degradation**	**Population**	**Effectiveness**	
How will the data be used?	Tracking and documenting implementation of land use plan decisions and inform adaptive management	Tracking changes in land cover (sagebrush) and inform adaptive management	Tracking changes in disturbance (threats) to GRSG habitat and inform adaptive management	Tracking trends in GRSG populations (and/or leks; as determined by state wildlife agencies) and inform adaptive management	Characterizing the relationship among disturbance, implementation actions, and sagebrush metrics and inform adaptive management	Measuring seasonal habitat, connectivity at the fine scale, and habitat conditions at the site scale, calculating disturbance and inform adaptive management
Who is collecting the data?	BLM FO and Forest Service Forest	NOC and NIFC	National data sets (NOC), BLM FOs and Forest Service 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, Forest Service Forests and RO (with partners) including disturbance
How often are the data collected, reported and made available to USFWS?	Collected and reported annually; summary every 5 years	Updated and changes reported annually; summary reports every 5 years	Collected and changes reported annually; summary reports every 5 years	State data reported annually per WAFWA MOU; summary reports 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 mgmt cost are TBD	At a minimum, current skills and capacity must be maintained; data mgmt and data layer purchase cost are TBD	No additional personnel or budget impacts for BLM or Forest Service	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 responsibilities for reporting?	BLM FO & SO; Forest Service Forest & RO BLM & Forest Service Planning	NOC WO	NOC BLM SO, Forest Service RO & appropriate programs	WAFWA & state wildlife agencies BLM SO, Forest Service RO, NOC	Broad and mid-scale at the NOC, LUP at BLM SO, Forest Service RO	BLM FO & Forest Service Forests BLM SO & Forest Service RO
What new processes/ tools are needed?	National implementation data sets and analysis tools	Updates to national land cover data	Data standards and roll-up methods for these data	Standards in population monitoring (WAFWA)	Reporting methodologies	Data standards data storage; and reporting

ATTACHMENT B: LIST OF ALL 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*

ATTACHMENT C: USER AND PRODUCER ACCURACIES FOR AGGREGATED ECOLOGICAL SYSTEMS WITHIN LANDFIRE MAP ZONES

LANDFIRE Map Zone Name	User Accuracy	Producer Accuracy	% of Map Zone within Historic 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 percent user and producer accuracies attributable to no available reference data for the ecological systems of interest.

Producer's 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 - producers accuracy).

User's 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).

Appendix E

Greater Sage-Grouse Disturbance Cap Guidance

APPENDIX E
GREATER SAGE-GROUSE DISTURBANCE CAP GUIDANCE

INTRODUCTION

In the US Fish and Wildlife Service's (USFWS) 2010 listing decision for Greater Sage-Grouse (GRSG), the USFWS identified 18 threats contributing to the destruction, modification, or curtailment of the GRSG's habitat or range (75 *Federal Register* 13910 2010). The 18 threats have been aggregated into three measures. The three measures are:

- 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 National Environmental Policy Act of 1969 (NEPA) process for projects authorized or undertaken by the Bureau of Land Management (BLM).

DISTURBANCE CAP

This land use plan has incorporated a 3 percent disturbance cap, applicable only within GRSG priority habitat management areas (PHMA). The disturbance cap applies to PHMA within 1) PHMA associated with a GRSG population area (referred to as biologically significant units {BSU} when coordinating across state lines), and 2) the project authorization scale.

For the Utah Sub-region, a "BSU" is the total PHMA acreage associated with a GRSG population area. At this scale, the total PHMA acreage in a population area is the denominator portion of the percentage calculation.

At the project scale, the denominator is determined by identifying PHMA that is nearby or affected by the proposed project that is also located in PHMA. Additional detail on identifying the project level boundaries is identified below.

The denominator in the disturbance calculation formula consists of all acres of lands classified as PHMA within the analysis area (BSU or project scale). Areas that are not GRSG 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 GRSG seasonal habitats, sagebrush availability, and areas with the potential to support GRSG populations will be considered along with other local conditions that may affect GRSG during the analysis of the proposed project area.

The numerator portion of the percentage calculation is limited to specific activities associated with specific GRSG threats. At both the BSU and project scale, this includes the 12 items identified in the "Habitat Degradation" column of **Table E.1**, Relationship between the 18 Threats and the Three Habitat Disturbance Measures for Monitoring and Disturbance Calculations. At the project scale, seven additional site scale features are included in the cap, identified and defined in **Table E.2**, Seven Site Scale Features Considered Threats to GRSG Included in the Disturbance Calculation for Project Authorizations. No other activities, actions, or threats are included in the numerator when calculating the cap.

At both the BSU and project scale, the best available information should be used to map existing disturbance. At the BSU scale, the west-wide habitat degradation (disturbance) data layers and associated areas of direct influence identified in **Table E.3**, Anthropogenic Disturbance Types for Disturbance Calculations, 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 are being implemented. Locally collected disturbance data will be used to determine if the disturbance cap has been exceeded for project authorizations, and, as available, may also be used to calculate the amount of disturbance in the BSUs. Locally collected disturbance data should identify the actual areas of disturbance to the extent possible, and are not required to relay on the "Direct Area of Influence" estimates in **Table E.3**.

Although locatable mine sites are included in the degradation calculation, mining activities under the Mining Law of 1872, as amended, may not be subject to the 3 percent disturbance cap. Details about locatable mining activities will be fully disclosed and analyzed in the NEPA process to assess impacts to GRSG and their habitat as well as to goals and objectives, and other agency programs and activities.

DISTURBANCE FORMULAS

Formulas for calculations of the amount of disturbance in PHMA in a Population Area (BSU) and in a proposed project area are as follows:

- For PHMA within a Population Area (BSUs):

  % Degradation Disturbance = (combined acres of the 12 degradation threats[1]) ÷ (acres of all lands within PHMA in a Population Area {BSU}) x 100.

- For the Project Analysis Area:

  % Degradation Disturbance = (combined acres of the 12 degradation threats[2] plus the 7 site scale threats and acres of habitat loss[3]) ÷ (acres of all lands within PHMA in the project analysis area) x 100.

[1] See **Table E.1**.

PROJECT ANALYSIS AREA METHOD FOR PERMITTING SURFACE DISTURBANCE ACTIVITIES

1. Identify the portions of the proposed area of physical disturbance within PHMA. In other words, in GIS, "clip" the proposed project to PHMA.
2. Determine potentially affected occupied leks by placing a 4 mile boundary around the proposed area of physical disturbance related to the project. All occupied leks located within the 4 mile project boundary and within PHMA will be considered affected by the project.
3. Next, place a 4 mile boundary around each of the affected occupied leks.
4. PHMA within the 4 mile project boundary as well as the 4 mile lek boundary creates the project analysis area for each individual project. If there are no occupied leks within the 4 mile project boundary, the project analysis area will be that portion of the 4 mile project boundary within PHMA.
5. Map disturbances or use locally available data. Use of NAIP imagery is recommended.
6. Calculate percent existing disturbance using the formula above. If existing disturbance is less than 3 percent, proceed to next step. If existing disturbance is greater than 3 percent, defer the project.
7. Add proposed project disturbance footprint area and recalculate the percent disturbance. If disturbance is less than 3 percent, proceed to next step. If disturbance is greater than 3 percent, defer project.
8. For disturbance from proposed energy or mining facilities, calculate the disturbance density (listed below under *Density Cap*). If the disturbance density is less than 1 facility per 640 acres, averaged across the 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 energy or mining project or co-locate it into existing disturbed area.
9. If a project that would exceed the degradation cap or density cap (for energy or mining facilities) 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.

TRAVEL AND TRANSPORTATION FEATURES IN THE DISTURBANCE CAP

When locally collecting disturbance inventories, travel and transportation features would be included or not included as disturbance based on the characteristics of the feature.

The following would count as disturbance (see **Attachment I** for definitions):

- Linear transportation features identified as roads that have a maintenance intensity of 3 or 5

[2] See **Table E.1**.
[3] See **Table E.2**.

- Linear transportation features identified as primitive roads, temporary routes, or administrative routes that have a functional classification and a maintenance intensity of level 3 or 5

The following items would not count as disturbance:

- Linear transportation features identified as trails.
- Linear transportation features identified as primitive roads, temporary routes, or administrative routes that have a maintenance intensity of either level 0 or 1.
- Linear transportation features identified as primitive routes.
- Linear disturbances.

DENSITY CAP

This land use plan has also incorporated a cap on the density of energy and mining facilities at an average of 1 facility per 640 acres in PHMA in a project authorization area. If the disturbance density from energy or mining facilities in 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 from energy or mining facilities 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 it into existing disturbed area (subject to applicable laws and regulations, such as the Mining Law of 1872, as amended, valid existing rights, etc.). Facilities affected by the density calculation (**Table E.3**) 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)

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	

Table E.2
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, hangers, 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.

Table E.3
Anthropogenic Disturbance Types for Disturbance Calculations
Data Sources are Described for the West-Wide Habitat Degradation Estimates

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

Note: Data sources are described for the west-wide habitat degradation estimates.

ATTACHMENT 1: TRAVEL AND TRANSPORTATION MANAGEMENT DEFINITIONS FOR USE IN ANTHROPOGENIC DISTURBANCE CALCULATION

Roads are linear routes managed for use by low clearance vehicles having four or more wheels, and are maintained for regular and continuous use.

Primitive Roads are linear routes managed for use by four-wheel drive or high-clearance vehicles. They do not normally meet any design standards.

Trails are linear routes managed for human-powered, stock, or off-highway vehicle forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Linear Disturbances are human-made linear features that are not part of the designated transportation network are identified as "Transportation Linear Disturbances." These may include engineered (planned) as well as unplanned single and two-track linear features that are not part of the BLM's transportation system.

Primitive Routes are any transportation linear feature located within a wilderness study area or lands with wilderness characteristics identified for protection by a land use plan and not meeting the wilderness inventory road definition.

Temporary Routes are short-term overland roads, primitive roads or trails which are authorized or acquired for the development, construction or staging of a project or event that has a finite lifespan. Temporary routes are not intended to be part of the permanent or designated transportation network and must be reclaimed when their intended purpose(s) has been fulfilled. Temporary routes should be constructed to minimum standards necessary to accommodate the intended use; the intent is that the project proponent (or their representative) will reclaim the route once the original project purpose or need has been completed. Temporary routes are considered emergency, single use or permitted activity access. Unless they are specifically intended to accommodate public use, they should not be made available for that use. A temporary route will be authorized or acquired for the specific time period and duration specified in the written authorization (e.g., permit, ROW, lease, or contract) and will be scheduled and budgeted for reclamation to prevent further vehicle use and soil erosion from occurring by providing adequate drainage and re-vegetation.

Administrative Routes are those that are limited to authorized users (typically motorized access). These are existing routes that lead to developments that have an administrative purpose, where the agency or permitted user must have access for regular maintenance or operation. These authorized developments could include such items as power lines, cabins, weather stations, communication sites, spring.

Maintenance Intensities

Level 0

Maintenance Description

Existing routes that will no longer be maintained and no longer be declared a route. Routes identified as Level 0 are identified for removal from the Transportation System entirely.

Maintenance Objectives

- No planned annual maintenance.
- Meet identified environmental needs.
- No preventative maintenance or planned annual maintenance activities.

Level 1

Maintenance Description

Routes where minimum (low intensity) maintenance is required to protect adjacent lands and resource values. These roads may be impassable for extended periods of time.

Maintenance Objectives

- Low (Minimal) maintenance intensity.
- Emphasis is given to maintaining drainage and runoff patterns as needed to protect adjacent lands. Grading, brushing, or slide removal is not performed unless route bed drainage is being adversely affected, causing erosion.
- Meet identified resource management objectives.
- Perform maintenance as necessary to protect adjacent lands and resource values.
- No preventative maintenance.
- Planned maintenance activities limited to environmental and resource protection.
- Route surface and other physical features are not maintained for regular traffic.

Level 3

Maintenance Description

Routes requiring moderate maintenance due to low volume use (for example, seasonally or year-round for commercial, recreational, or administrative access). Maintenance Intensities may not provide year-round access but are intended to generally provide resources appropriate to keep the route in use for the majority of the year.

Maintenance Objectives

- Medium (Moderate) maintenance intensity.
- Drainage structures will be maintained as needed. Surface maintenance will be conducted to provide a reasonable level of riding comfort at prudent speeds for the route conditions and intended use. Brushing is conducted as needed to improve sight distance when appropriate for management uses. Landslides adversely affecting drainage receive high priority for removal; otherwise, they will be removed on a scheduled basis.
- Meet identified environmental needs.
- Generally maintained for year-round traffic.
- Perform annual maintenance necessary to protect adjacent lands and resource values.

- Perform preventative maintenance as required to generally keep the route in acceptable condition.
- Planned maintenance activities should include environmental and resource protection efforts, annual route surface.
- Route surface and other physical features are maintained for regular traffic.

Level 5

Maintenance Description
Route for high (maximum) maintenance due to year-round needs, high volume of traffic, or significant use. Also may include route identified through management objectives as requiring high intensities of maintenance or to be maintained open on a year-round basis.

Maintenance Objectives

- High (Maximum) maintenance intensity.
- The entire route will be maintained at least annually. Problems will be repaired as discovered. These routes may be closed or have limited access due to weather conditions but are generally intended for year-round use.
- Meet identified environmental needs.
- Generally maintained for year-round traffic.
- Perform annual maintenance necessary to protect adjacent lands and resource values.
- Perform preventative maintenance as required to generally keep the route in acceptable condition.
- Planned maintenance activities should include environmental and resource protection efforts, annual route surface.
- Route surface and other physical features are maintained for regular traffic.

Appendix F

Mitigation Strategy:
Utah Greater Sage-Grouse RMPA

APPENDIX F
MITIGATION STRATEGY: UTAH GREATER SAGE-GROUSE RMPA

INTRODUCTION

In undertaking US Department of the Interior, Bureau of Land Management (BLM) and US Department of Agriculture, Forest Service (Forest Service) 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. Actions which result in habitat loss and degradation include those identified as threats which contribute to GRSG disturbance as identified by the USFWS in its 2010 listing decision (75 *Federal Register* 13910) and shown in Table D.2 in the Greater Sage-Grouse Monitoring Framework (Appendix D of the Utah Greater Sage-Grouse Approved Resource Management Plan Amendment [ARMPA]). Exceptions to net conservation gain for GRSG may be made for vegetation treatments to benefit Utah prairie dog.

Mitigation will follow the regulations from the White House Council on Environmental Quality (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 Terms).

The BLM, via the Western Association of Fish and Wildlife Agencies (WAFWA) Management Zone Greater Sage-Grouse Conservation Team, will develop a WAFWA Management Zone Regional Mitigation Strategy that will inform the National Environmental Policy Act (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 (GRSG) habitat conservation by reducing, eliminating, or minimizing threats and compensating for residual impacts to GRSG 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 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 GRSG 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 of the Utah Greater Sage-Grouse Proposed LUPA/Final EIS, the BLM will establish a WAFWA Management Zone Greater Sage-Grouse Conservation Team to help guide the conservation of GRSG, within 90 days of the issuance of the record of decision (ROD). The Strategy will be developed within one year of the issuance of the ROD.

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. BLM resource management plans, forest plans, and state plans); and
- Include any potential, additional avoidance actions (e.g. additional avoidance best management practices) with regard to GRSG conservation.

Minimization

- Include minimization actions (e.g. required design features and 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 GRSG 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 Terms), timeliness (see Glossary Terms), 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 GRSG (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 GRSG, regardless of land ownership.
- Sites should be durable (see Glossary Terms).
- 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 GRSG and are durable.

– Compensatory Mitigation Project Types and Costs

- Project types should be identified that help reduce threats to GRSG (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 GRSG 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 SUBSEQUENT 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 need 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, a Field Office, or a Forest), 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 and Forest Service 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 ROD. The selection of the third-party compensatory mitigation administrator will conform to all relevant laws, regulations, and policies. The BLM and Forest Service will remain responsible for making decisions that affect federal lands.

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))

Net conservation gain. The actual benefit or gain above baseline conditions.

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

Stipulations Associated with Fluid Mineral Leasing

APPENDIX G
STIPULATIONS ASSOCIATED WITH FLUID MINERAL LEASING

This appendix lists stipulations for new fluid minerals leases referred to throughout this Greater Sage-Grouse (GRSG) Approved Resource Management Plan Amendment (ARMPA).

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, but are not limited to, the 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 use; placement of surface facilities such as utilities, pipelines, structures, and oil and gas wells; new road construction; and 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 ARMPA, including exceptions, modifications, and waivers by alternative. Three types of surface stipulations could be applied to fluid mineral leases: (1) no surface occupancy (NSO), (2) timing limitations (TL), and (3) controlled surface use (CSU). All stipulations for other resources, besides Greater Sage-Grouse (GRSG), included in the existing land use plans would still be applicable.

Areas identified as NSO would be closed to surface disturbing activities associated with fluid mineral development.

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.

RELIEF FROM STIPULATIONS

With regard to fluid minerals, surface stipulations could be excepted, modified, or waived by the Authorized Officer, but only as specifically identified below. An exception exempts the holder of the land use authorization document from the stipulation on a one-time (or case-by-case) basis. A modification changes the language or provisions of a surface stipulation, either temporarily or permanently. A waiver permanently removes the stipulation from the lease. The environmental analysis document prepared for site-specific proposals such as fluid minerals development (i.e., master development plans applications for permit to drill or sundry notices) also would need to address proposals to exempt, modify, or waive a surface stipulation.

On BLM-administered lands, to exempt, modify, or waive a stipulation, the environmental analysis document would have to show that (1) the circumstances or relative resource values in the area had changed following issuance of the lease, (2) less restrictive requirements could be developed to protect the resource of concern, and (3) operations could be conducted without causing unacceptable impacts.

With respect to granting relief to stipulations on other types of authorizations, such as solid mineral leases, land use authorizations, etc. any changes to the contractual nature of these instruments would require environmental review and coordination with the Lessee, permit or authorization holder when specific surface disturbing activities are proposed via an operation plan, permitting action or similar instrument.

Table G.1
BLM Approve Plan Amendment
Fluid Minerals Stipulations and Exception, Modification, and Waiver Criteria

Stipulation	Stipulation Description
No surface occupancy within sagebrush focal areas (SFA).	**Purpose:** To protect GRSG habitat from activity in SFA. **Exception:** None **Modification:** None **Waiver:** None
No surface occupancy within PHMA.	**Purpose:** To protect GRSG habitat from activity in PHMA. **Exception:** The Authorized Officer with concurrence with the State Director, may grant an exception 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. The conservation gain must 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. 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. **Modification:** None **Waiver:** None
Manage discrete anthropogenic disturbances, whether temporary or permanent, so they cover less than 3 percent of 1) PHMA associated with a GRSG population area (referred to as biologically significant units {BSU} when coordinating across state lines) and 2) within the proposed project analysis area.	**Purpose:** To protect PHMA and the life-history needs of GRSG from habitat loss and GRSG populations from disturbance and limit fragmentation in PHMA. This would be implemented as a lease notice associated with new leases, in addition to the NSO stipulation. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** None

Table G.1
BLM Approve Plan Amendment
Fluid Minerals Stipulations and Exception, Modification, and Waiver Criteria

Stipulation	Stipulation Description
	Waiver: None
In PHMA, limit the density of energy and mining facilities during project authorization to an average of one energy/mineral facility per 640 acres.	**Purpose:** To protect PHMA and the life-history needs of GRSG from habitat loss and GRSG populations from disturbance and limit fragmentation in PHMA. This would be implemented as a lease notice associated with new leases, in addition to the NSO stipulations. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** None **Waiver:** None
Surface occupancy or use within the PHMA is subject to the following operating constraints: • Limit noise from discretionary activities (during construction, operation, or maintenance) will not exceed 10 decibels above ambient sound levels at occupied leks from 2 hours before to 2 hours after official sunrise and sunset during breeding season (e.g., while males are strutting); support the establishment of ambient baseline noise levels for PHMA habitat area leks. • Limit project related noise in other PHMA habitats and seasons where it would be expected to reduce functionality of habitats that support associated GRSG populations.	**Purpose:** Protecting GRSG from auditory disturbance associated with fluid mineral developments. **Exception:** None **Modification:** As additional research and information emerges, specific new limitations appropriate to the type of projects being considered would be evaluated and appropriate measures would be implemented where necessary to minimize potential for noise impacts on PHMA GRSG population behavioral cycles. **Waiver:** None
Surface occupancy or use within the PHMA is subject to the following operating constraints: • Limit the placement of permanent tall structures within PHMA breeding and nesting habitats. • For the purposes of this restriction, a tall structure is any man-made structure that provides for perching/nesting opportunities for predators (e.g., raptors, ravens) that may naturally be absent, or that	**Purpose:** To minimize placement of structures that introduce new perching and/or nesting opportunities for avian predators. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** None **Waiver:** None

Table G.1
BLM Approve Plan Amendment
Fluid Minerals Stipulations and Exception, Modification, and Waiver Criteria

Stipulation	Stipulation Description
decreases the use of an area by PHMA. A determination as to whether something is considered a tall structure would be made based on local conditions such as existing vegetation or topography.	
No surface disturbance allowed between Feb 15 – June 15, in PHMA GRSG breeding, nesting, and early brood-rearing habitat.	**Purpose:** To seasonally protect GRSG within PHMA from disruptive activity during breeding, nesting and early brood-rearing. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** Specific time and distance determinations would be based on site-specific conditions and 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 order to better protect GRSG, in coordination with UDWR biologists. **Waiver:** None
No surface disturbance allowed between April 15 – August 15, in PHMA GRSG brood-rearing habitat.	**Purpose:** To seasonally protect GRSG within PHMA from disruptive activity during brood-rearing. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** Specific time and distance determinations would be based on site-specific conditions and 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 order to better protect GRSG, in coordination with UDWR biologists. **Waiver:** None
No surface disturbance allowed between Nov 15 – March 15, in PHMA GRSG winter habitat.	**Purpose:** To seasonally protect GRSG within PHMA from disruptive activity during the winter season. This would only be applicable to new fluid minerals leases if the exception criteria identified for the NSO stipulation above were granted. **Exception:** None **Modification:** Specific time and distance determinations would be based on site-specific conditions and may be modified due to documented local variations (e.g., higher/lower elevations) or annual climactic fluctuations (e.g.,

Table G.1
BLM Approve Plan Amendment
Fluid Minerals Stipulations and Exception, Modification, and Waiver Criteria

Stipulation	Stipulation Description
	early/late spring, long and/or heavy winter) in order to better protect GRSG, in coordination with UDWR biologists. **Waiver:** None
Areas outside of PHMA but within 4 miles of a lek that is located within PHMA will be subject to the following operating constraints: • Limit noise from discretionary activities (during construction, operation, or maintenance) so it will not exceed 10 decibels above ambient sound levels at occupied leks from 2 hours before to 2 hours after official sunrise and sunset during breeding season (e.g., while males are strutting); support the establishment of ambient baseline noise levels for PHMA habitat area leks. • Limit project related noise in other PHMA habitats and seasons where it would be expected to reduce functionality of habitats that support associated GRSG populations.	**Purpose:** Protecting GRSG from indirect disturbance near leks within PHMA. **Exception:** None **Modification:** As additional research and information emerges, specific new limitations appropriate to the type of projects being considered would be evaluated and appropriate measures would be implemented where necessary to minimize potential for noise impacts on PHMA GRSG population behavioral cycles. **Waiver:** None
Areas outside of PHMA but within 4 miles of a lek that is located within PHMA will be subject to the following operating constraints: • Limit the placement of permanent tall structures within PHMA breeding and nesting habitats. • For the purposes of this restriction, a tall structure is any man-made structure that provides for perching/nesting opportunities for predators (e.g., raptors, ravens) that may naturally be absent, or that decreases the use of an area by PHMA. A determination as to whether something is considered a tall structure would be made based on local conditions such as existing vegetation or topography.	**Purpose:** To minimize placement of structures that introduce new perching and/or nesting opportunities for avian predators. **Exception:** None **Modification:** None **Waiver:** None

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 (2013) 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) 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. 2014; see **Attachment 1**), FIAT provides the BLM and other agencies with a mechanism to 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, such as wildfire. Low resistance and resilient 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 rehabilitation/emergency stabilization and rehabilitation

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:

- Operational decision-making during fires
- Implementation of NEPA projects for invasive annual grass and conifer reduction, fuel breaks, and emergency stabilization and rehabilitation efforts in GRSG habitat

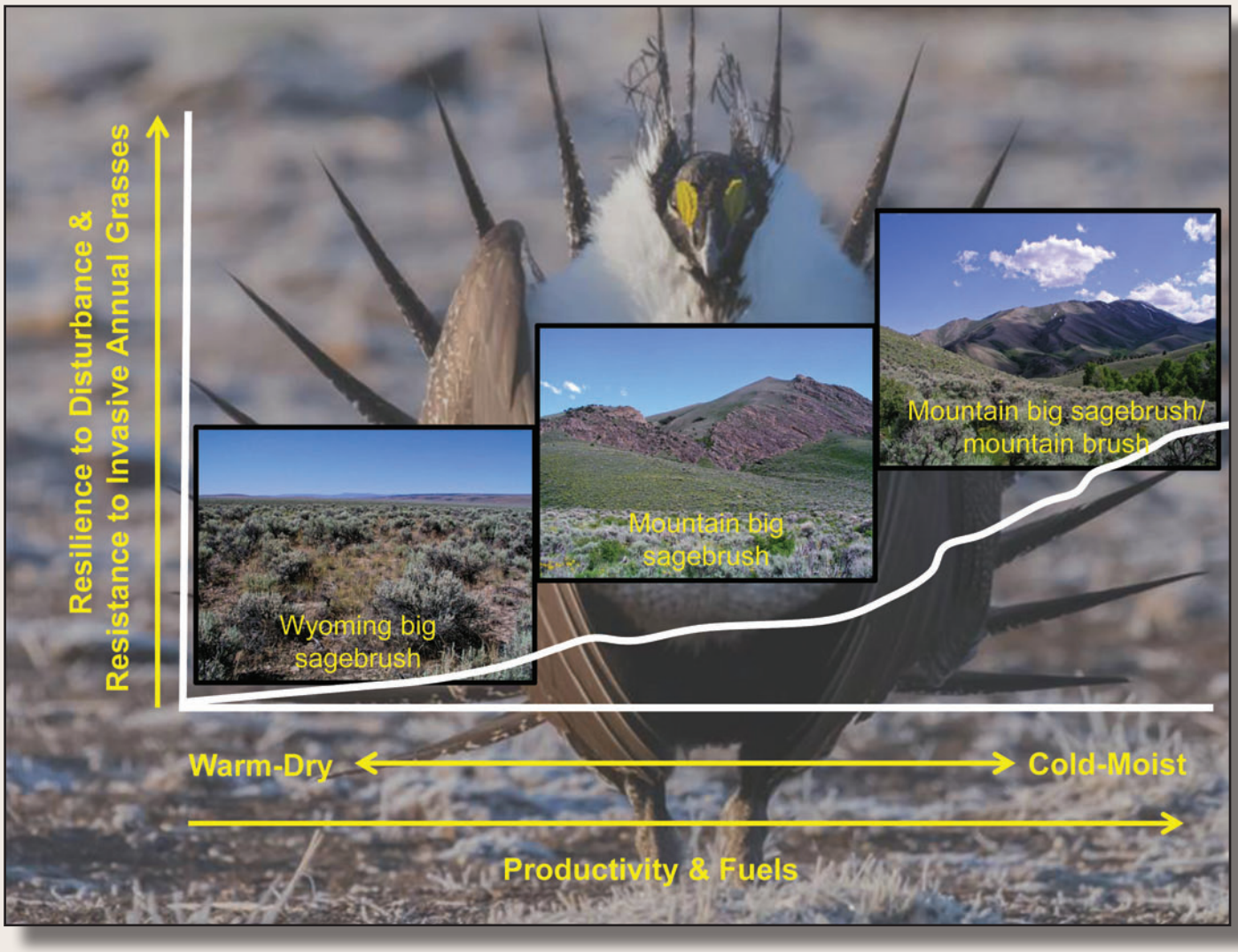
Attachment 1—Chambers et al. 2014 report

Attachment 2—Greater Sage-Grouse Wildfire, Invasive Annual Grasses, and Conifer Expansion Assessment

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



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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).

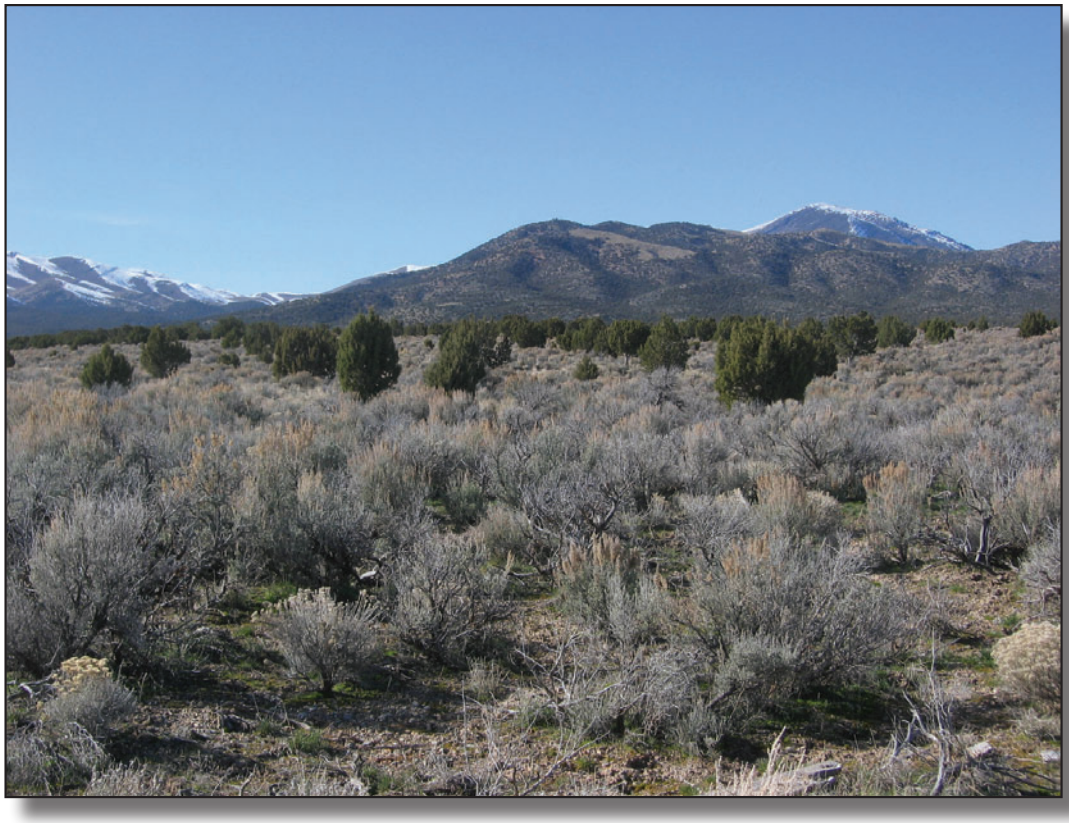

Figure 4. Expansion of Utah juniper trees into a mountain big sagebrush ecosystem in east central Utah (top) that is resulting in progressive infilling of the trees and exclusion of native understory species (bottom) (photos by Bruce A. Roundy).

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;

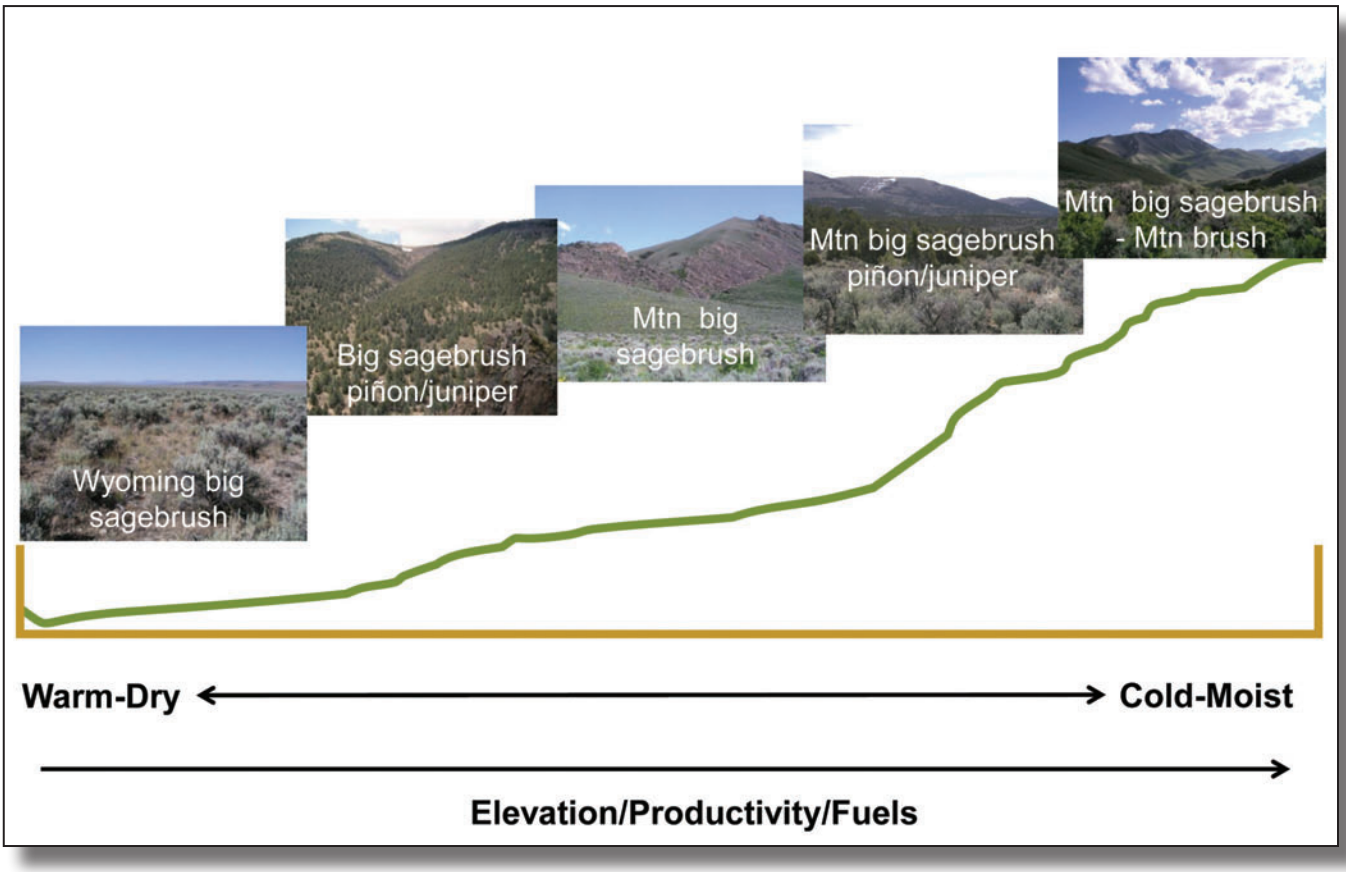

Figure 6. The dominant sagebrush ecological types that occur along environmental gradients in the western United States. As elevation increases, soil temperature and moisture regimes transition from warm and dry to cold and moist and vegetation productivity and fuels become higher.

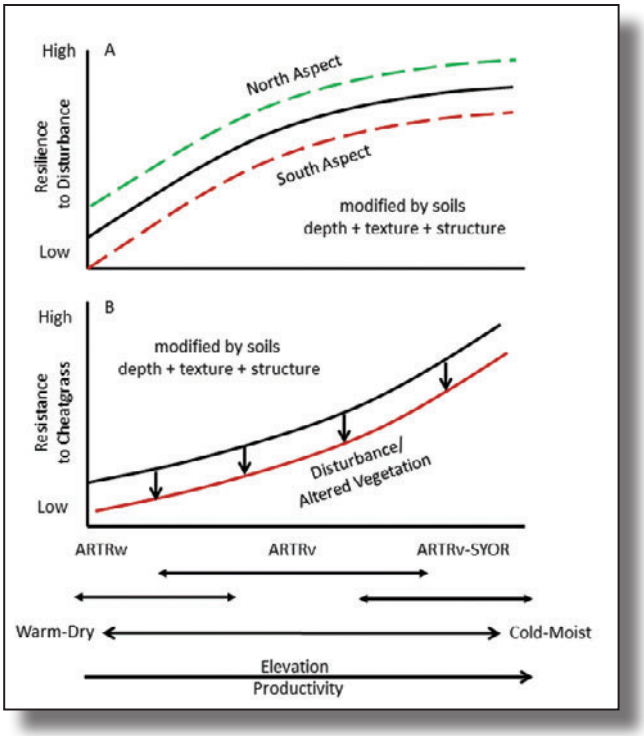

Figure 7. (**A**) Resilience to disturbance and (**B**) resistance to cheatgrass over a typical temperature/precipitation gradient in the cold desert. Dominant ecological sites occur along a continuum that includes Wyoming big sagebrush on warm and dry sites, to mountain big sagebrush on cool and moist 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

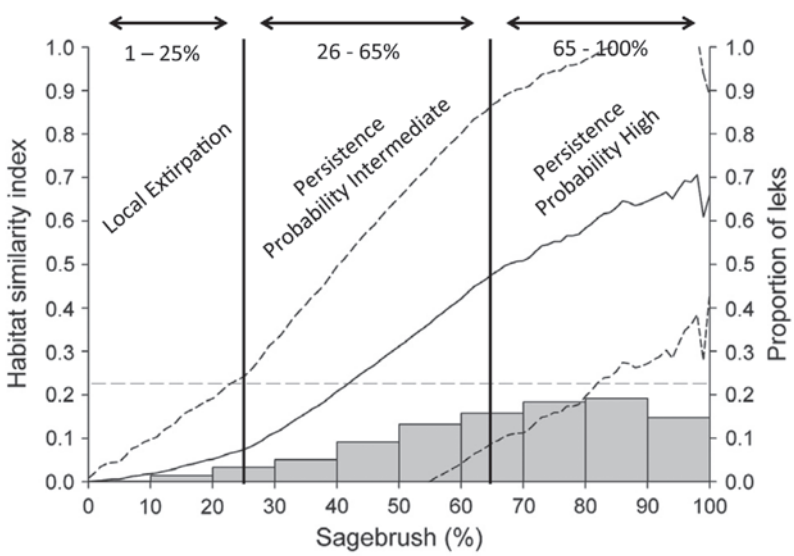

Figure 8. The proportion of sage-grouse leks and habitat similarity index (HSI) as related to the percent landscape cover of sagebrush. The HSI indicates the relationship of environmental variables at map locations across the western portion of the range to minimum requirements for sage-grouse defined 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).

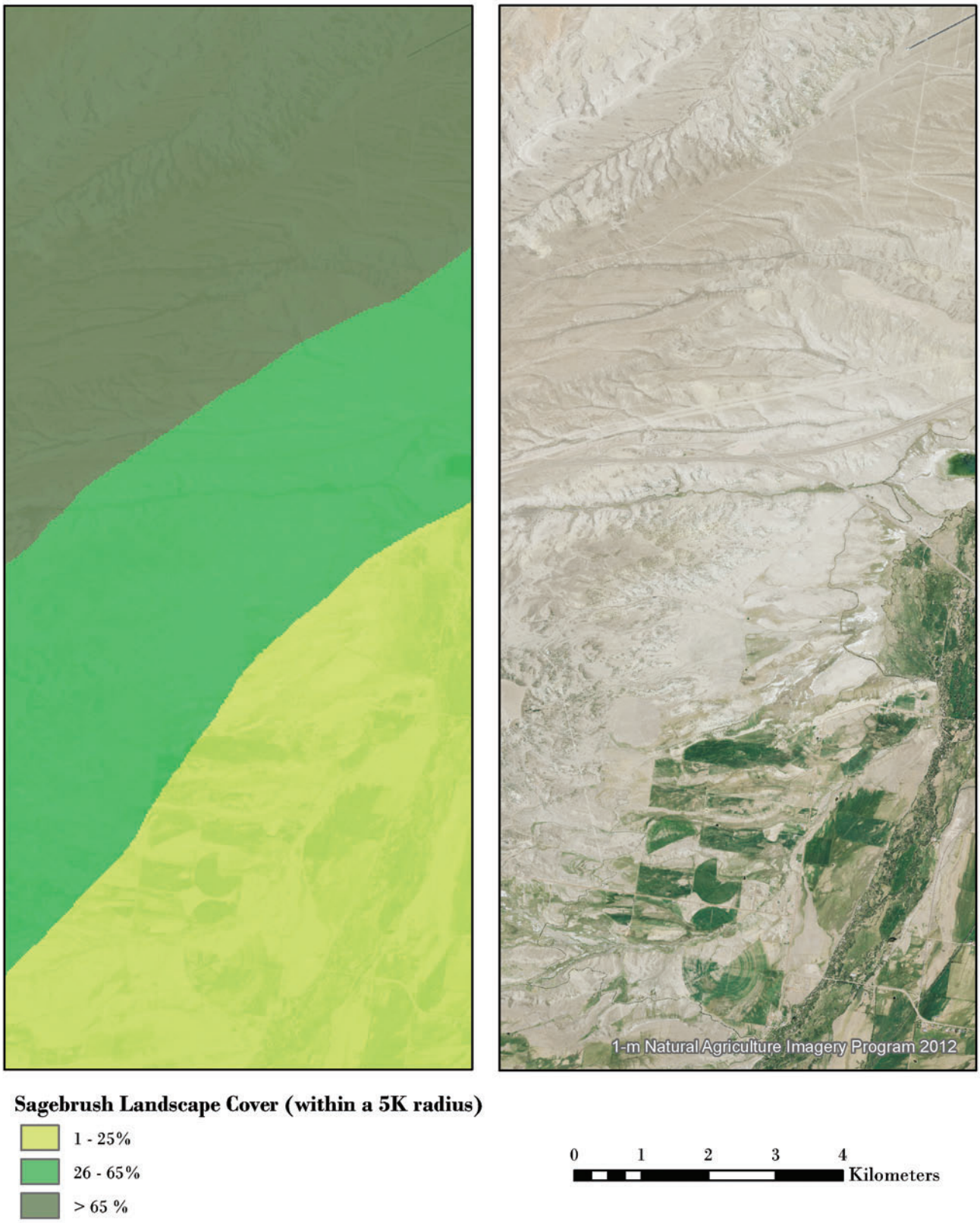

Figure 9. Landscape cover of sagebrush from 1-m National Agricultural Imagery (right) and the corresponding sagebrush landscape cover for the 1-25%, 26-65%, and >65% categories (left). See Appendix 2 for an explanation of how the categories are determined.

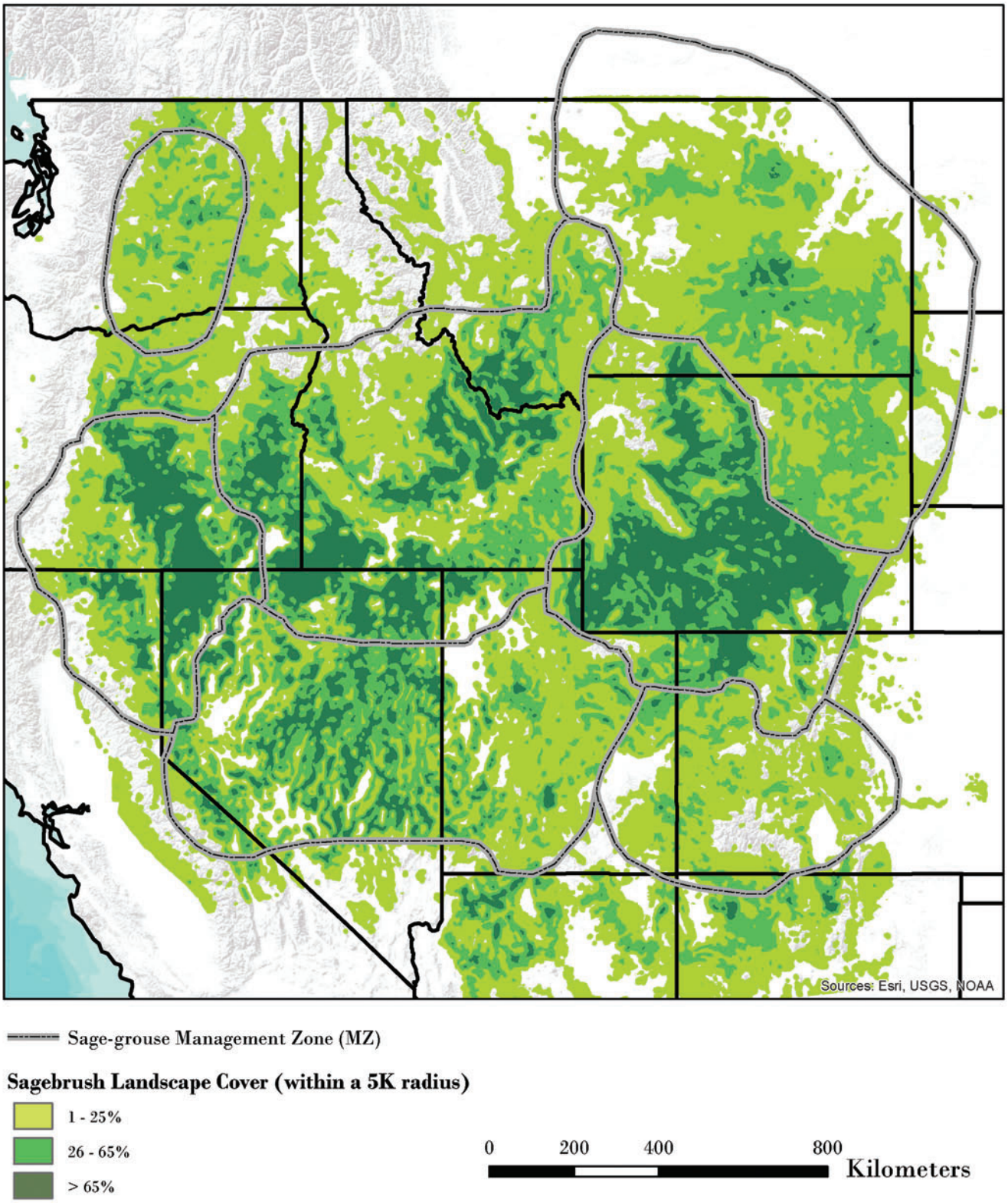

Figure 10. The landscape cover of sagebrush within each of three selected categories (1-25%, 26-65%, >65%) for the range of sage-grouse (Management Zones I – VII; Stiver et al. 2006). The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land cover types for locations with sagebrush cover.

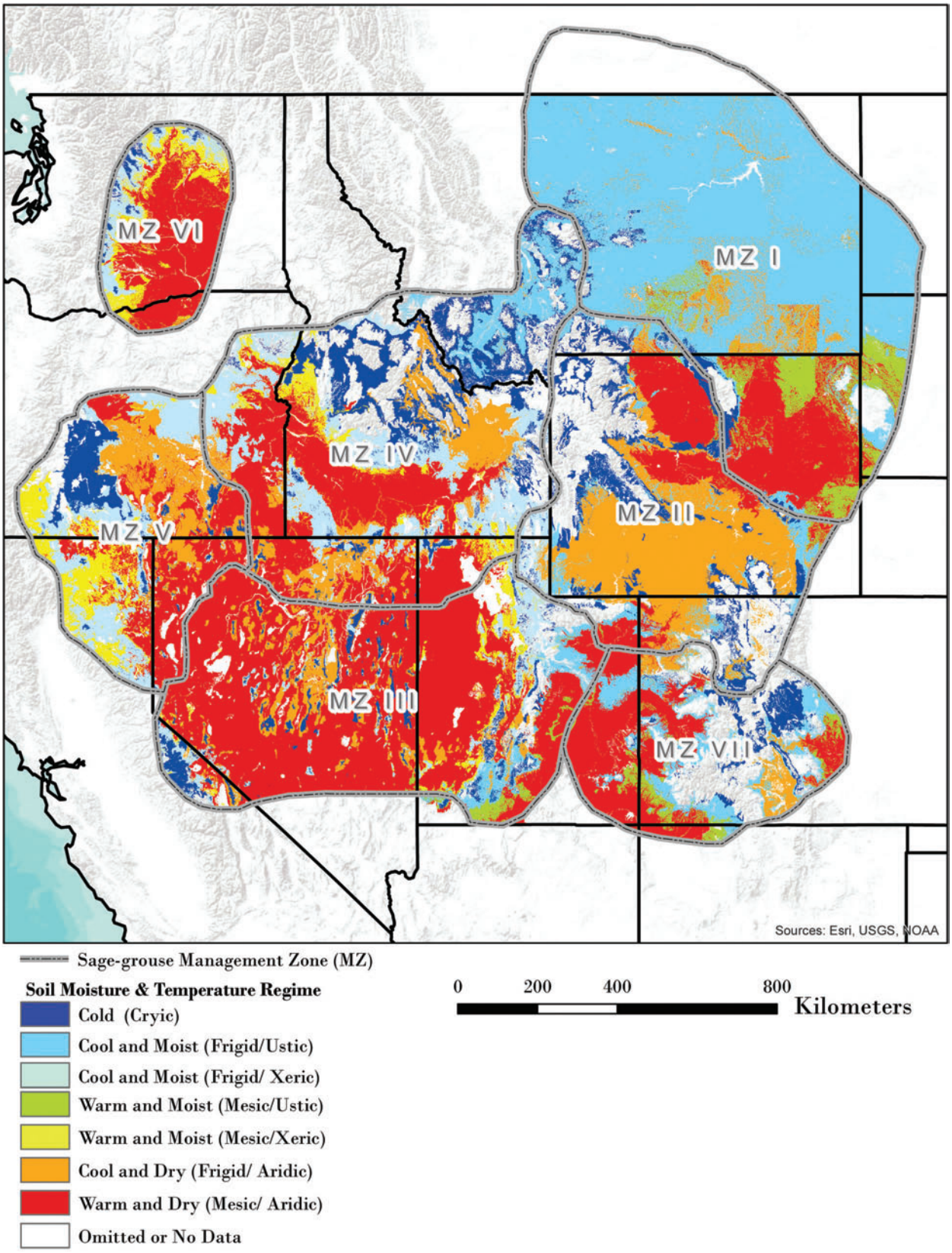

Figure 11. The soil temperature and moisture regimes for the range of sage-grouse (Management Zones I – VII; Stiver et al. 2006). Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). 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.

Ecosystem Resilience to Disturbance and Resistance to Invasive Annual Grasses	Proportion of Landscape Dominated by Sagebrush		
	Low 1-25% Too little sagebrush on the landscape significantly threatens likelihood of sage-grouse persistence.	**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.	**High >65%** Sufficient sagebrush exists on the landscape and sage-grouse are highly likely to persist.
High	**1A** Natural sagebrush recovery is likely to occur, but if large, contiguous areas lack sagebrush, the time required for recovery may be too great.	**1B** Natural sagebrush recovery is likely to occur, but certain areas may lack connectivity.	**1C** Natural sagebrush recovery is likely to occur.
	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.		
Moderate	**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.	**2B** Natural sagebrush recovery is likely on cooler and moister sites, but certain areas may lack connectivity.	**2C** Natural sagebrush recovery is likely on cooler and moister sites.
	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.		
Low	**3A** Natural sagebrush recovery is not likely.	**3B** Natural sagebrush recovery may occur, but the time required will likely be too great and certain areas may lack connectivity.	**3C** Natural sagebrush recovery may occur, but the time required will likely be too great.
	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.		

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.

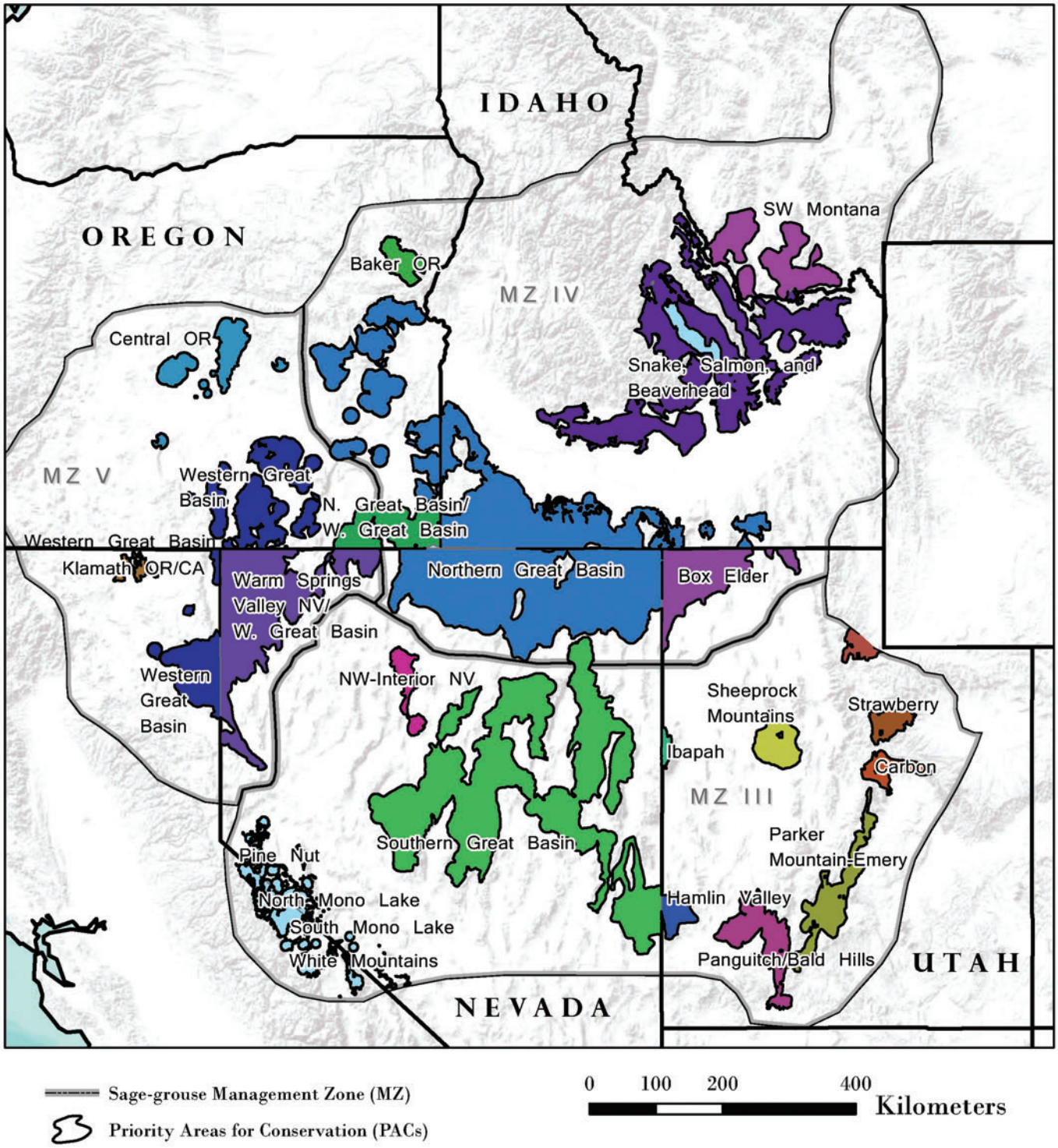

Figure 14. Priority Areas for Conservation (PACs) within the range of sage-grouse (USFWS 2013). Colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

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).

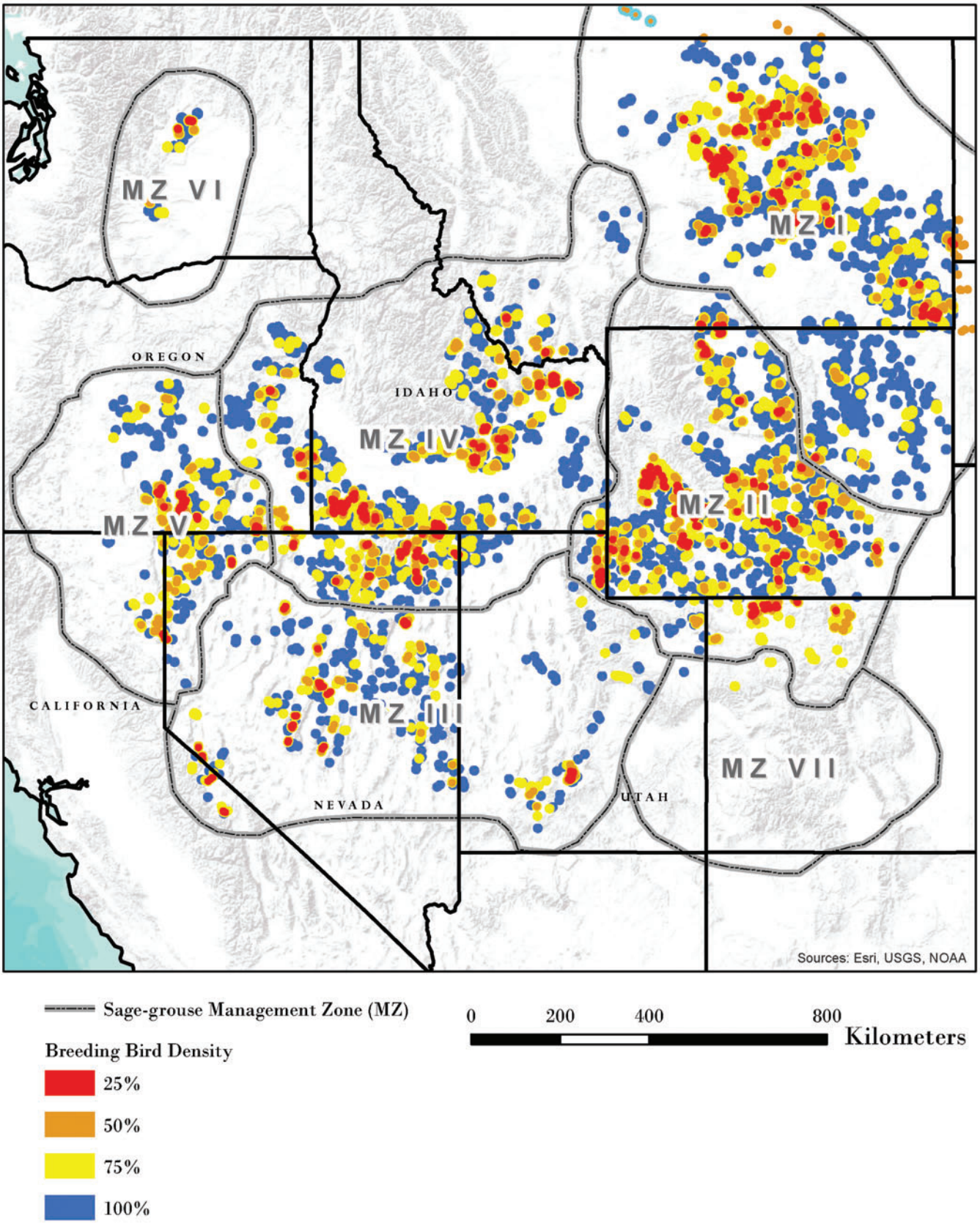

Figure 15. Range-wide sage-grouse breeding bird densities from Doherty et al. 2010. Points illustrate breeding bird density areas that contain 25, 50, 75, and 100% of the known breeding population and are based on maximum counts of males on leks (n = 4,885). Leks were mapped according to abundance values and buffered by 6.4 to 8.5 km (4.0 to 5.2 mi) to delineate nesting areas.

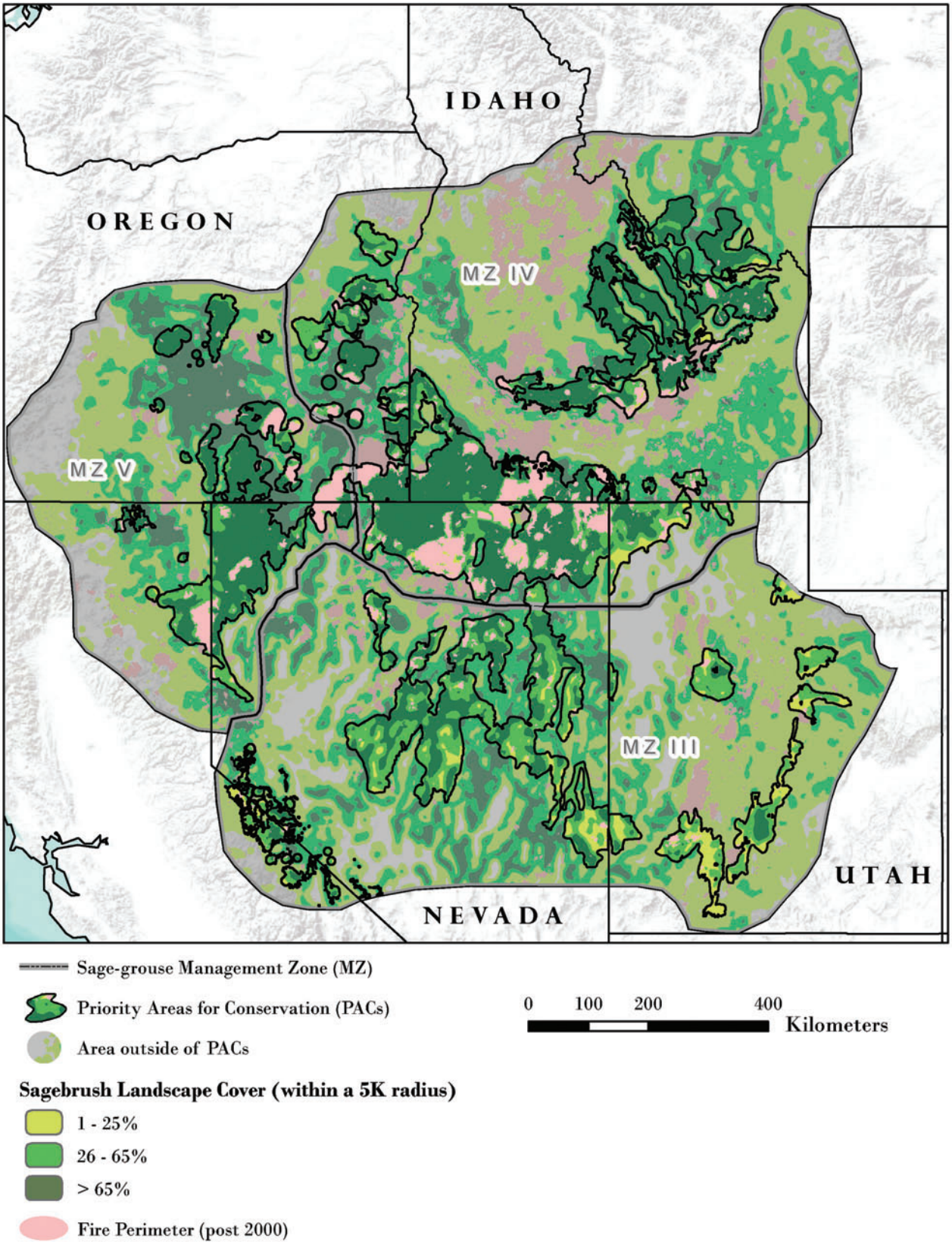

Figure 16. The landscape cover of sagebrush within each of three selected categories (1-25%, 26-65%, >65%) for Management Zones III, IV, and V (Stiver et al. 2006). The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land cover types for locations with sagebrush cover. Darker colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

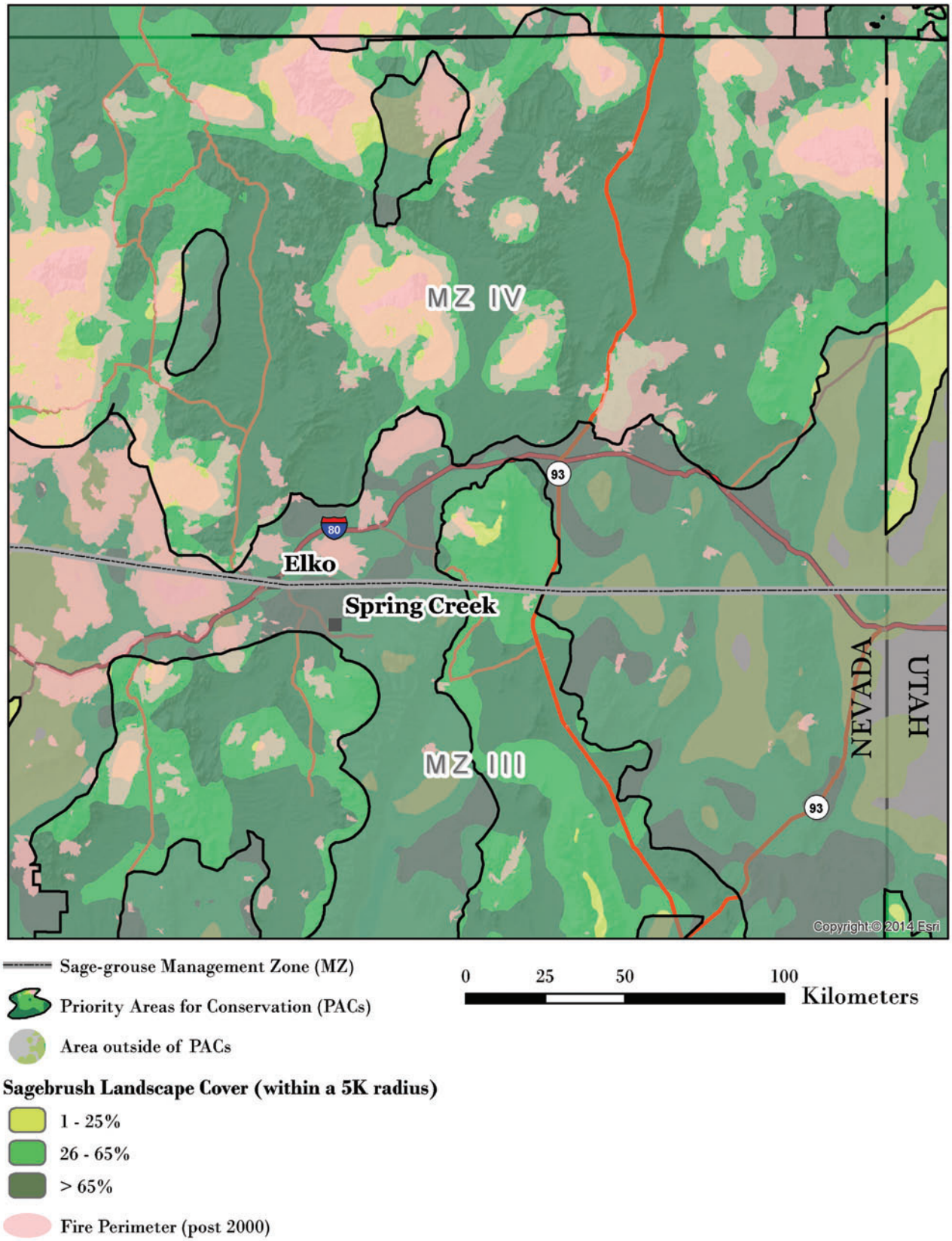

Figure 17. The landscape cover of sagebrush within each of the selected categories (1-25%, 26-65%, >65%) for the northeastern portion of Nevada. The proportion of sagebrush (USGS 2013) within each of the categories in a 5-km (3.1-mi) radius surrounding each pixel was calculated relative to other land 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).

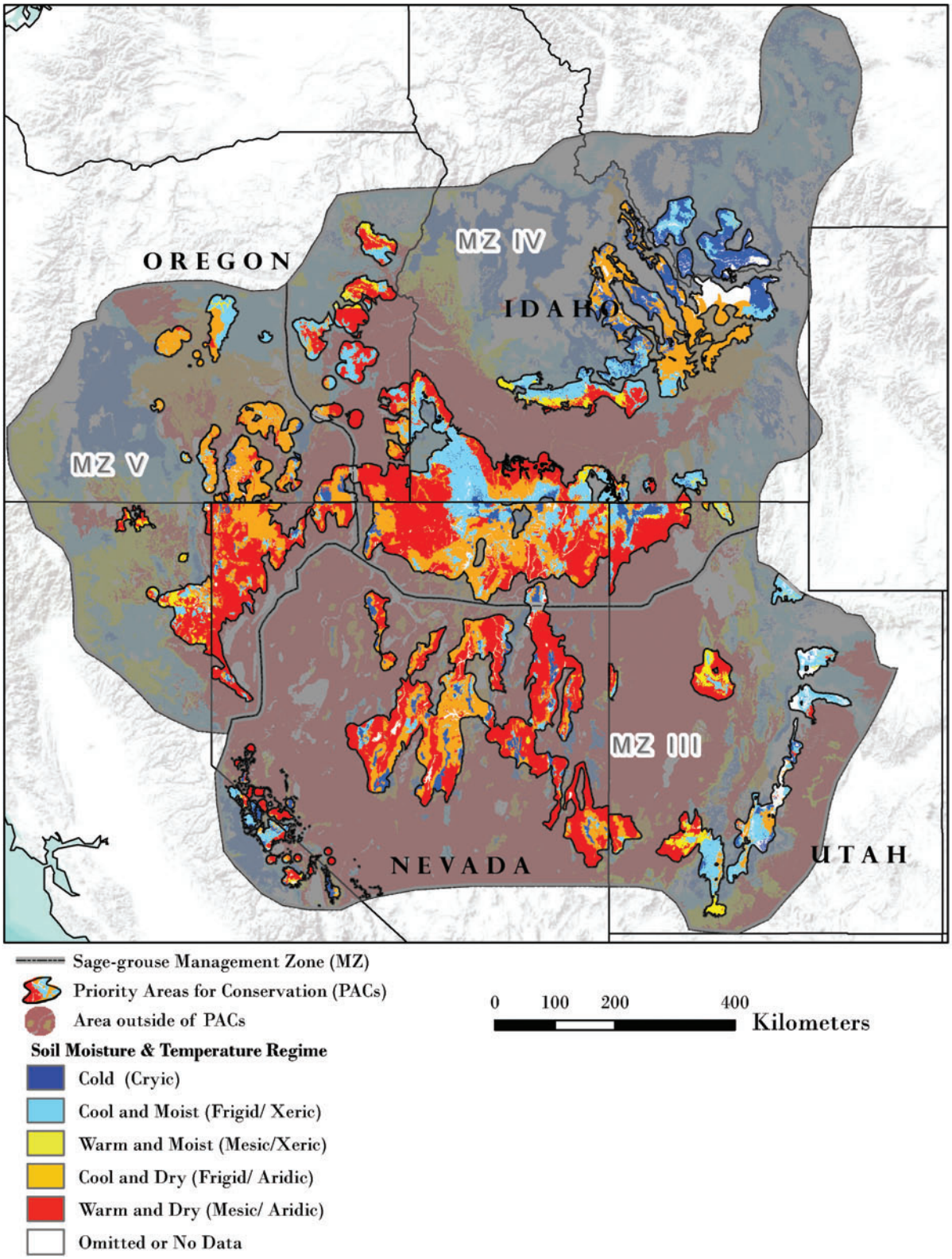

Figure 18. The soil temperature and moisture regimes within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). Gaps 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).

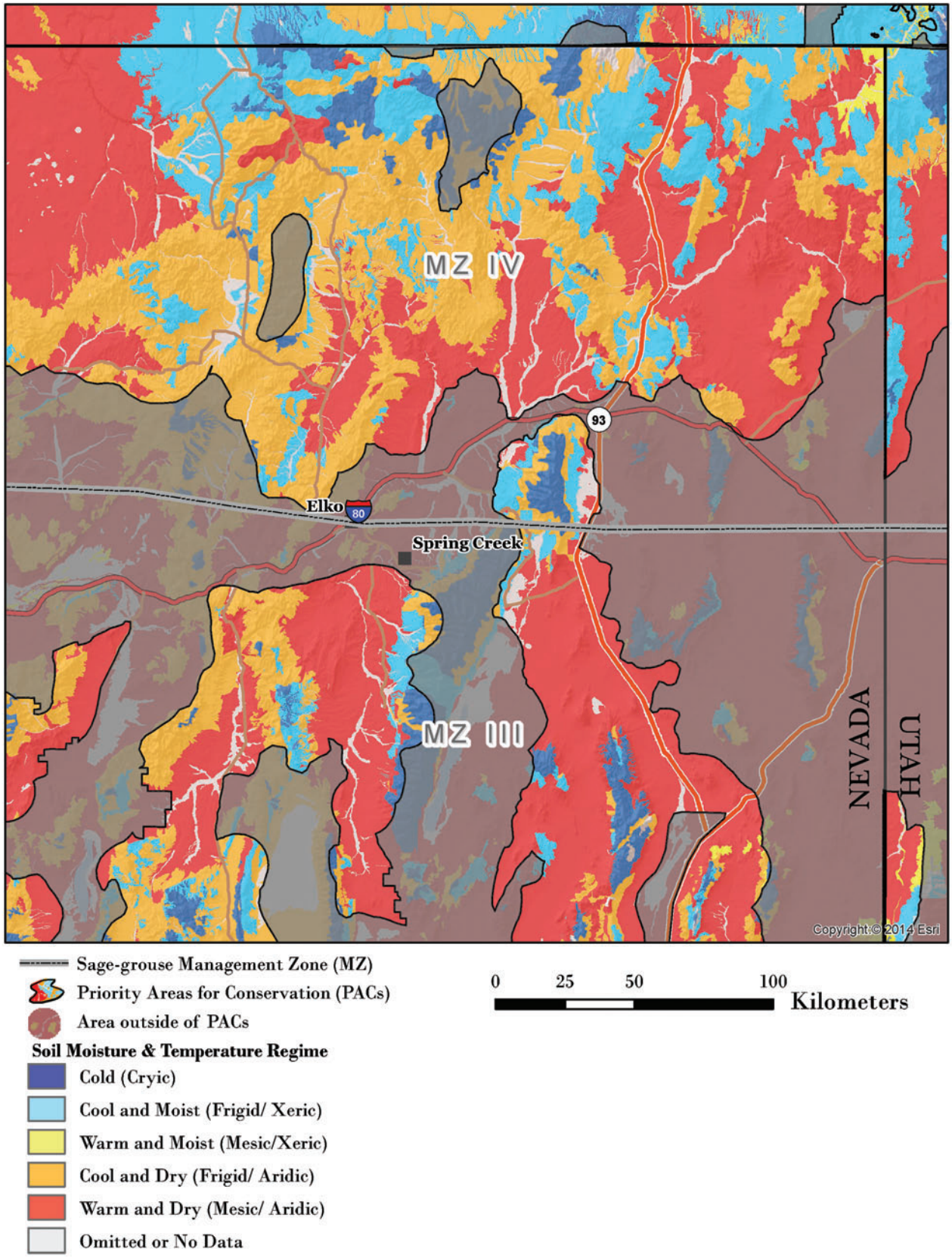

Figure 19. The soil temperature and moisture regimes for the northeast corner of Nevada. Soil temperature and moisture classes were derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (Soil Survey Staff 2014a). Gaps in that dataset were filled in with the NRCS State Soil Geographic Database (STATSGO) (Soil Survey Staff 2014b). Darker colored polygons delineate Priority Areas for Conservation (USFWS 2013).

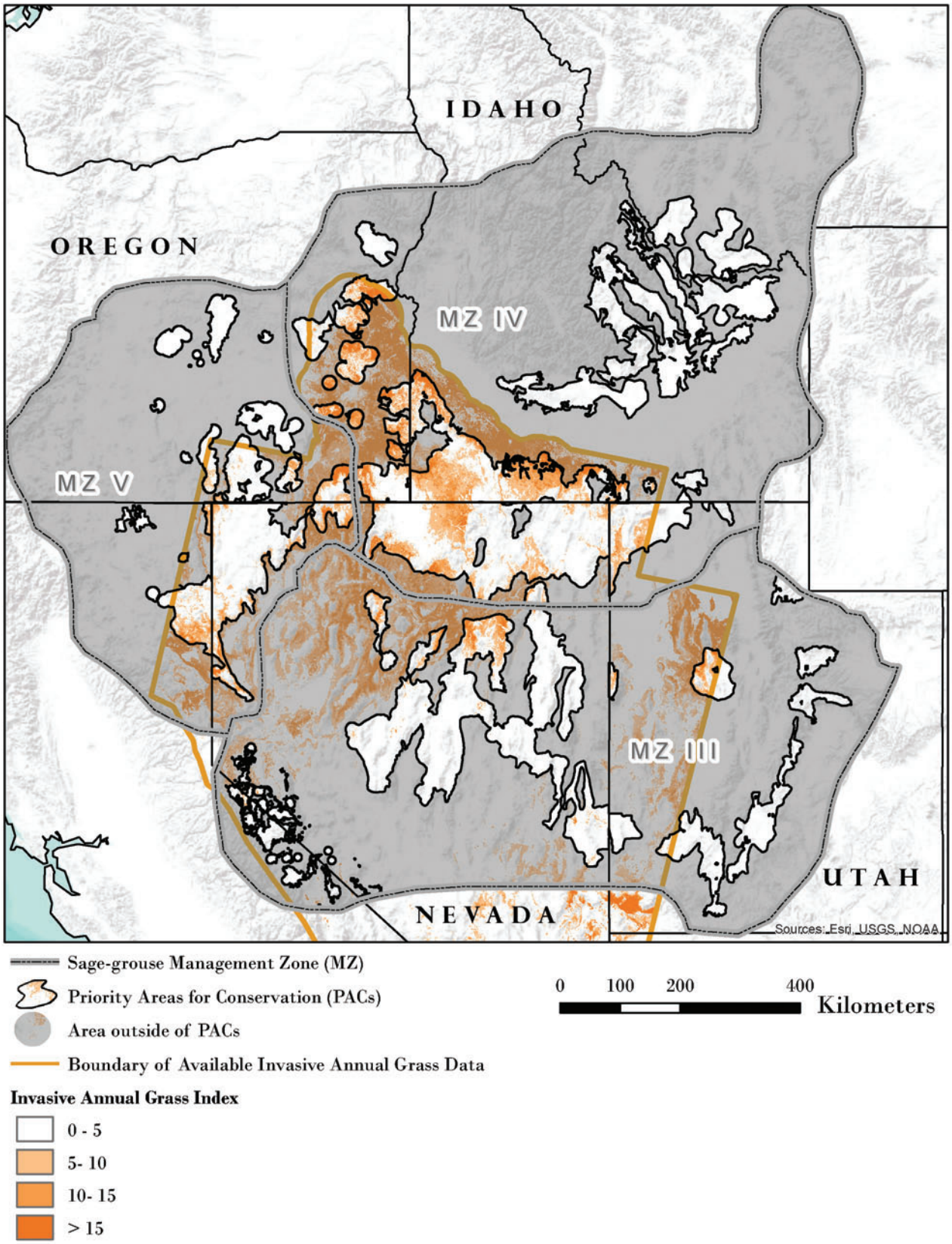

Figure 20. Invasive annual grass index for Nevada (Peterson 2006) and the Owhyee uplands (Peterson 2007) displayed for sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

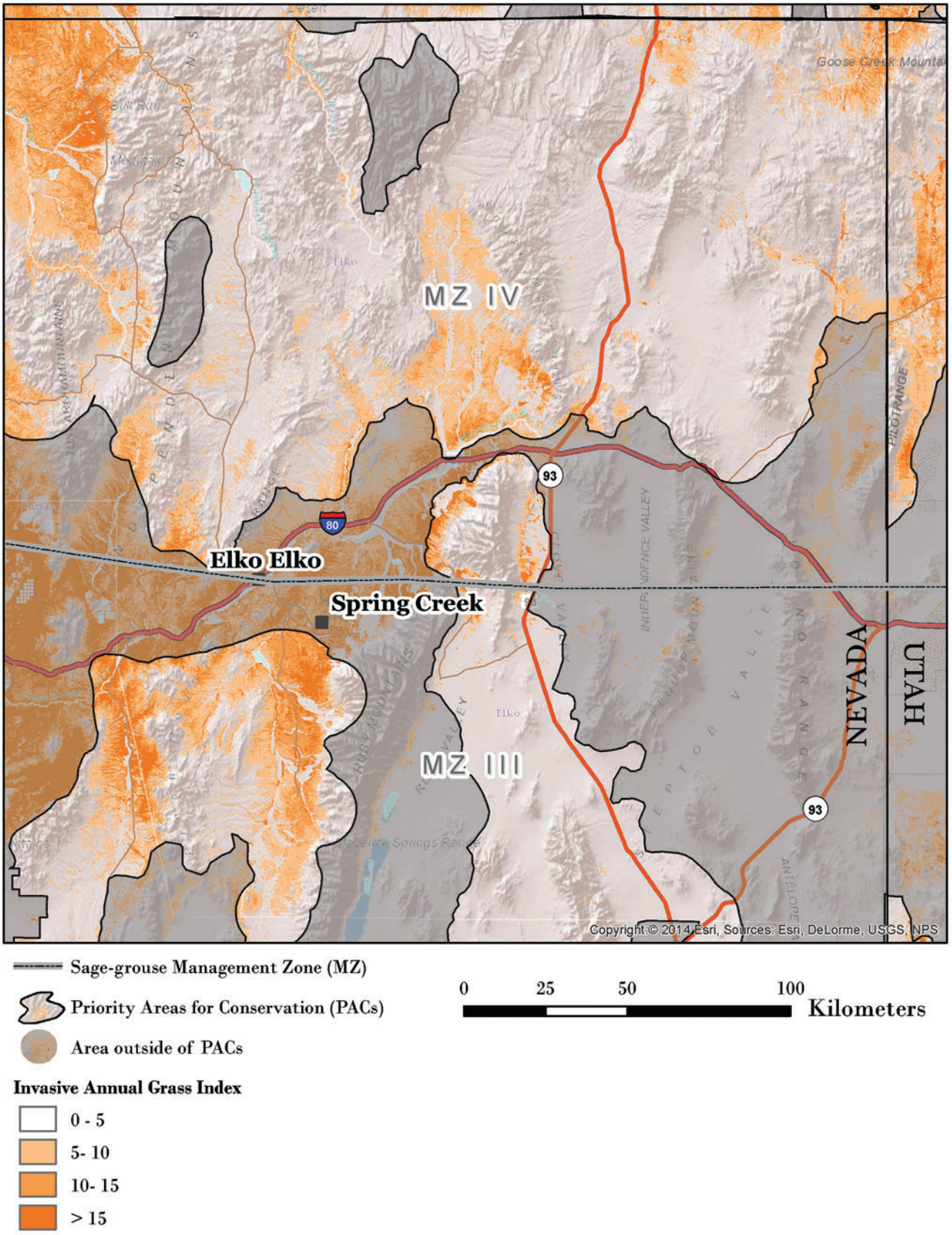

Figure 21. Invasive annual grass index for Nevada (Peterson 2006) and the Owhyee uplands (Peterson 2007) displayed for the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

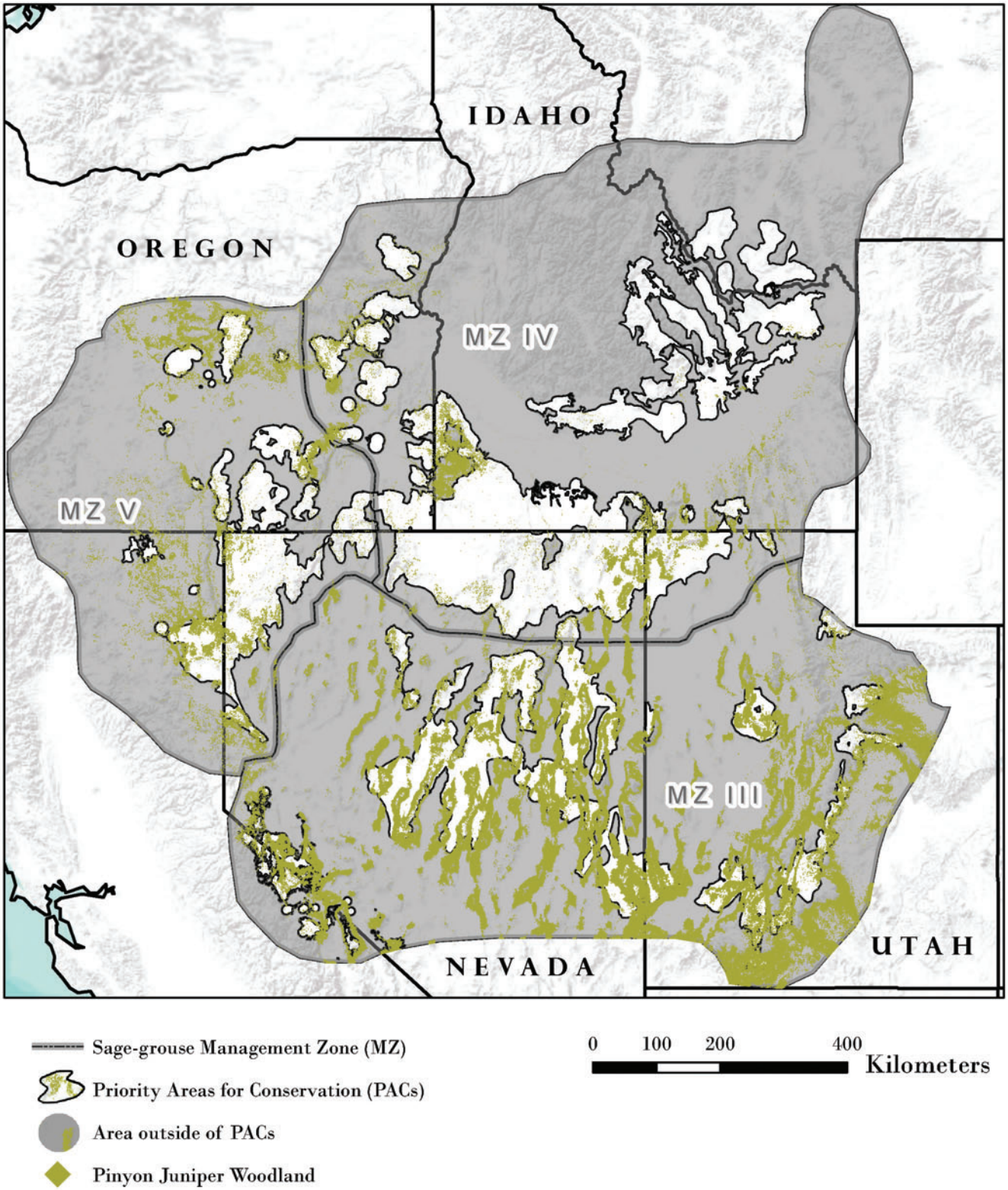

Figure 22. Piñon and/or juniper woodlands (USGS 2004; USGS 2013) within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Lighter colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

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).

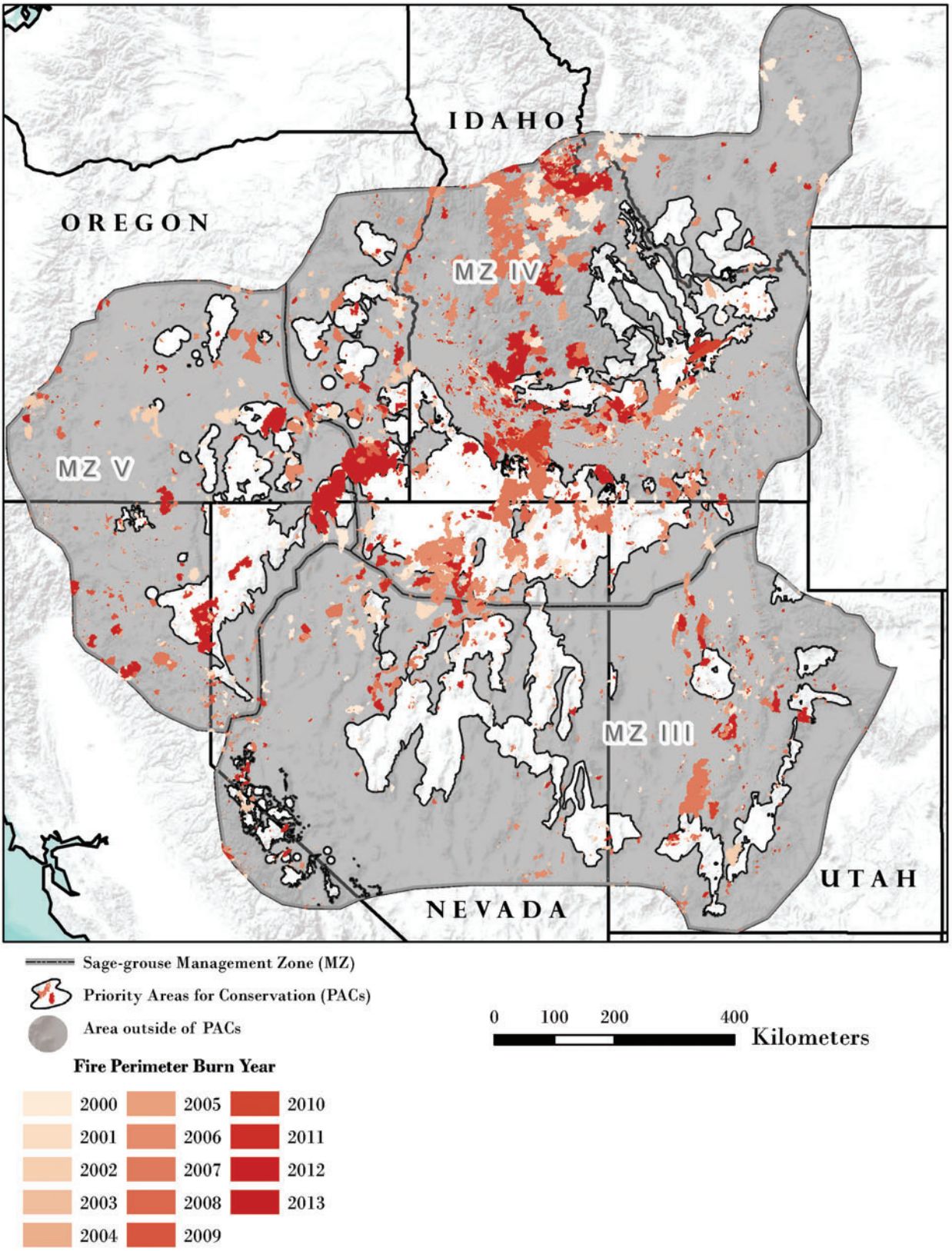

Figure 24. Fire perimeters (Walters et al. 2011; Butler and Bailey 2013) within sage-grouse Management Zones III, IV, and V (Stiver et al. 2006). Ligher colored polygons within Management Zones delineate Priority Areas for Conservation (USFWS 2013).

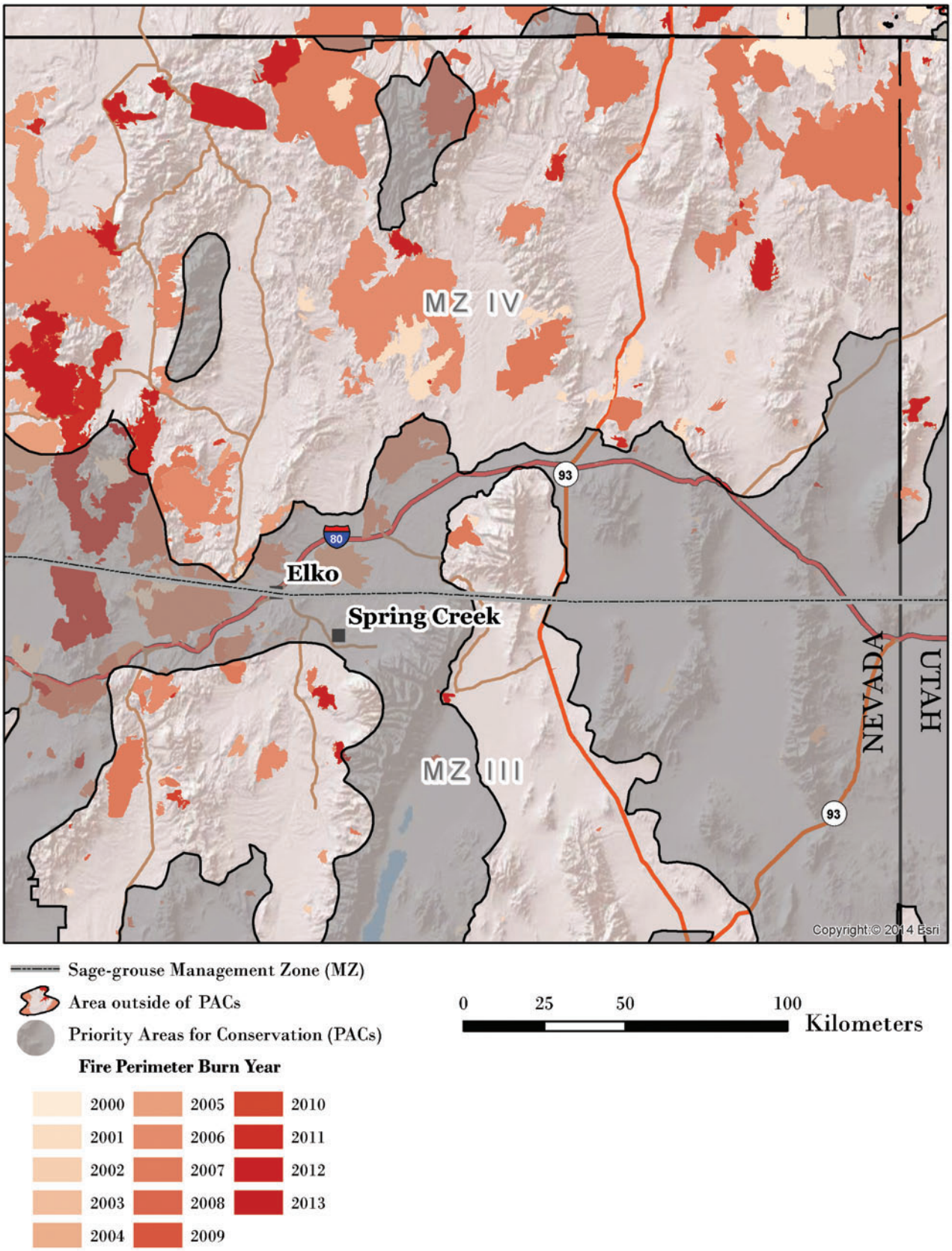

Figure 25. Fire perimeters (Walters et al. 2011; Butler and Bailey 2013) within the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

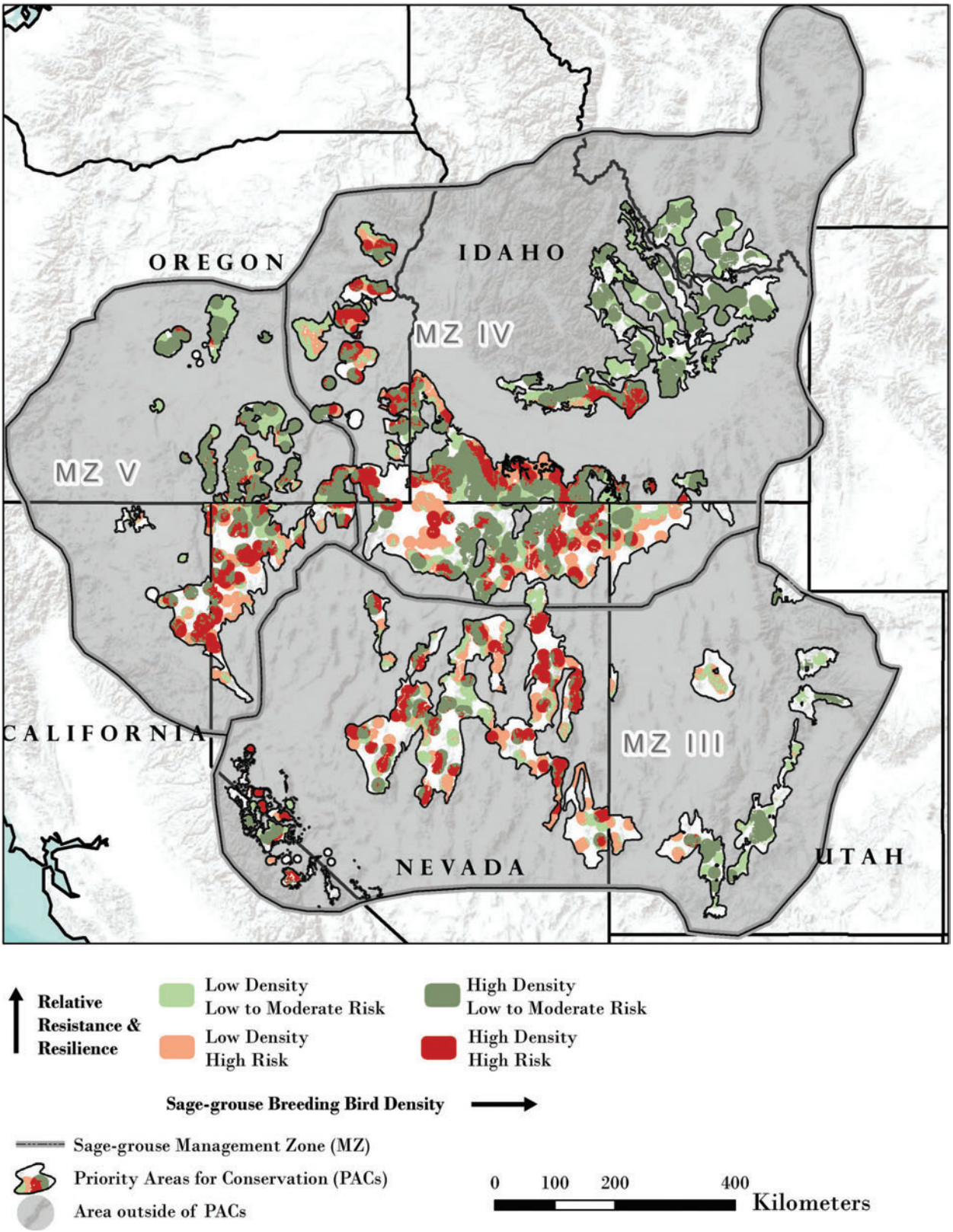

Figure 26. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to resilience and resistance within sage-grouse 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).

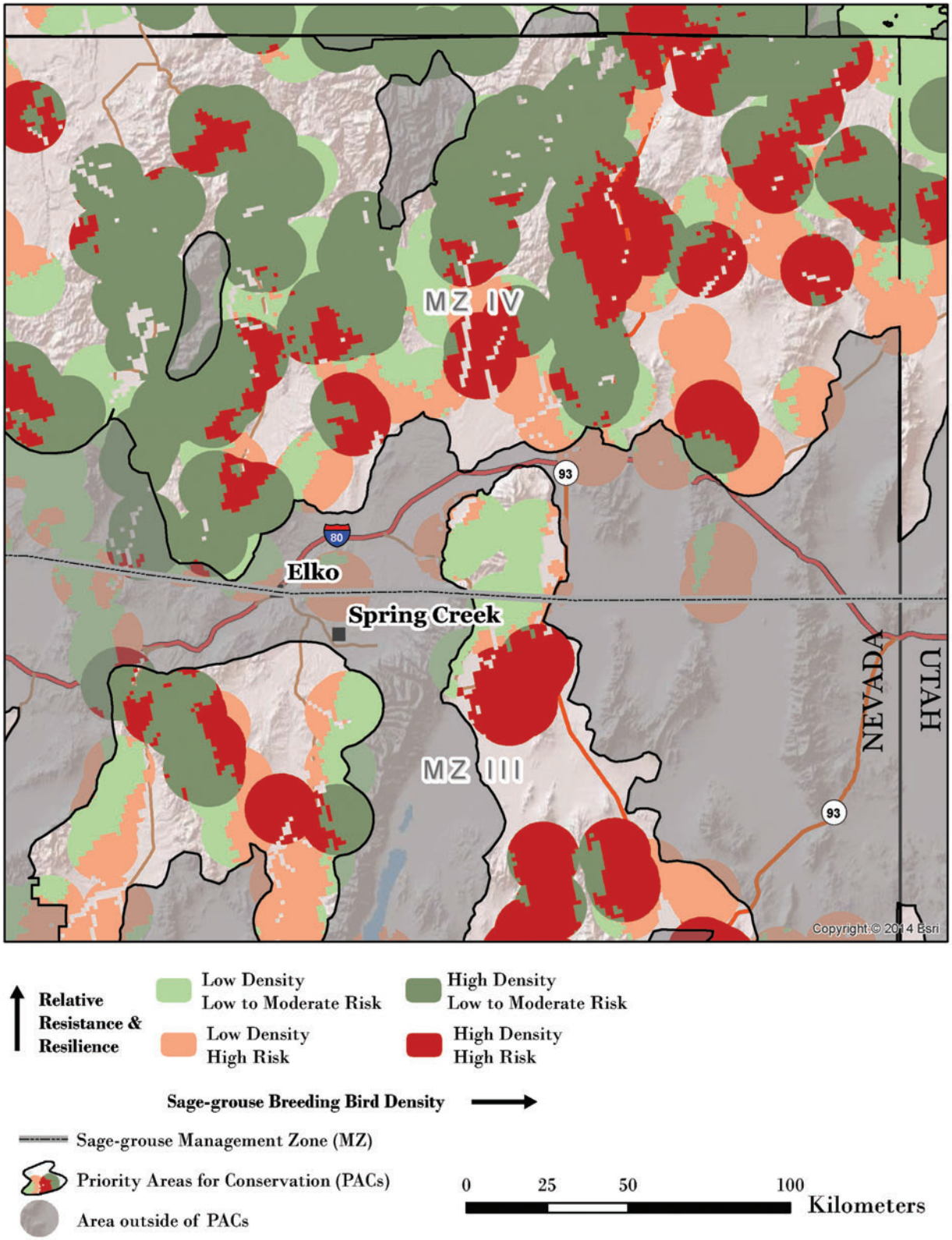

Figure 27. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to resilience and resistance in the northeast 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).

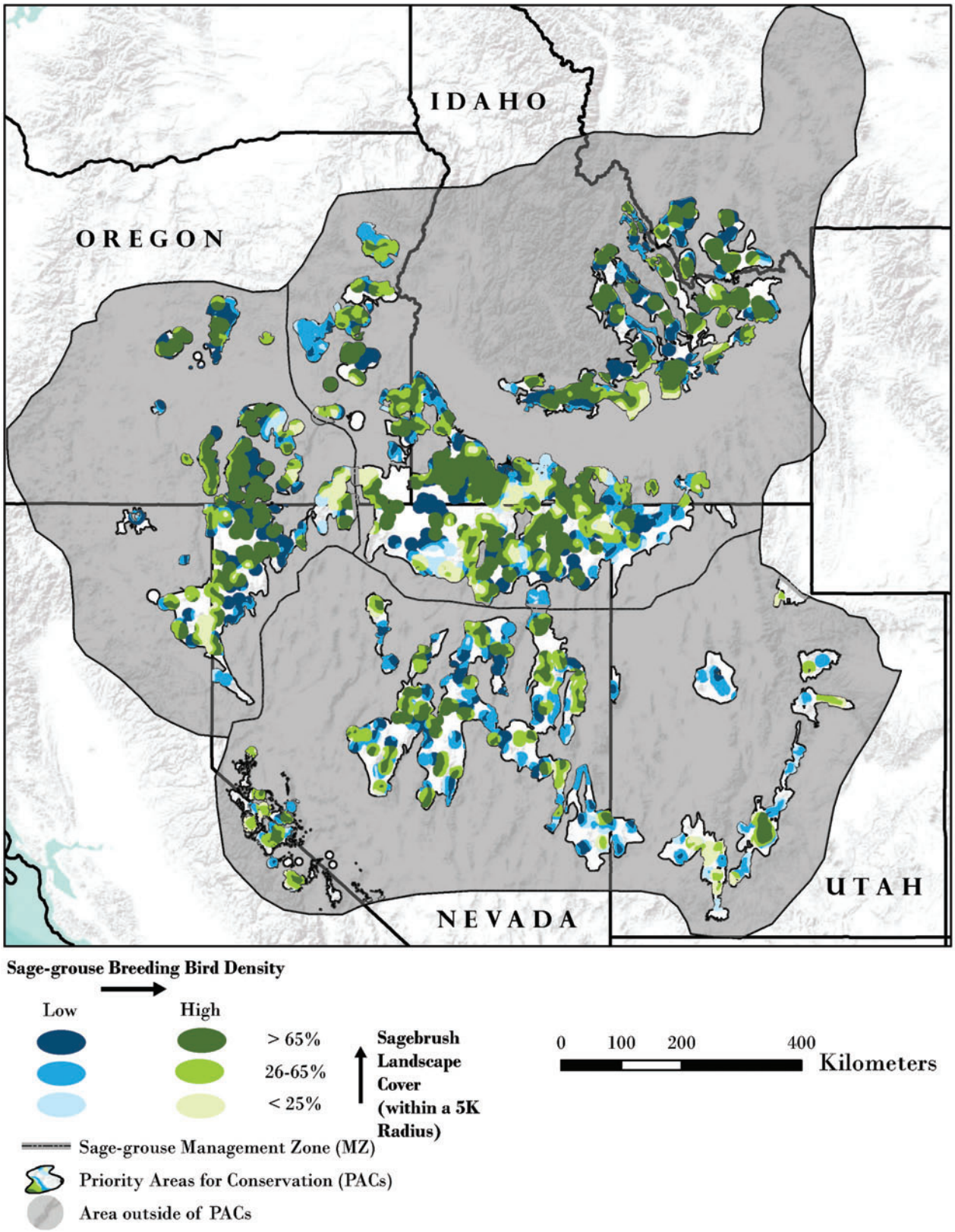

Figure 28. Sage-grouse breeding bird densities (Doherty et al. 2010) for high breeding bird densities (areas that contain 75% of known breeding bird populations) and low breeding bird densities (areas that contain all remaining breeding bird populations) relative to sagebrush cover. Lighter colored polygons 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.

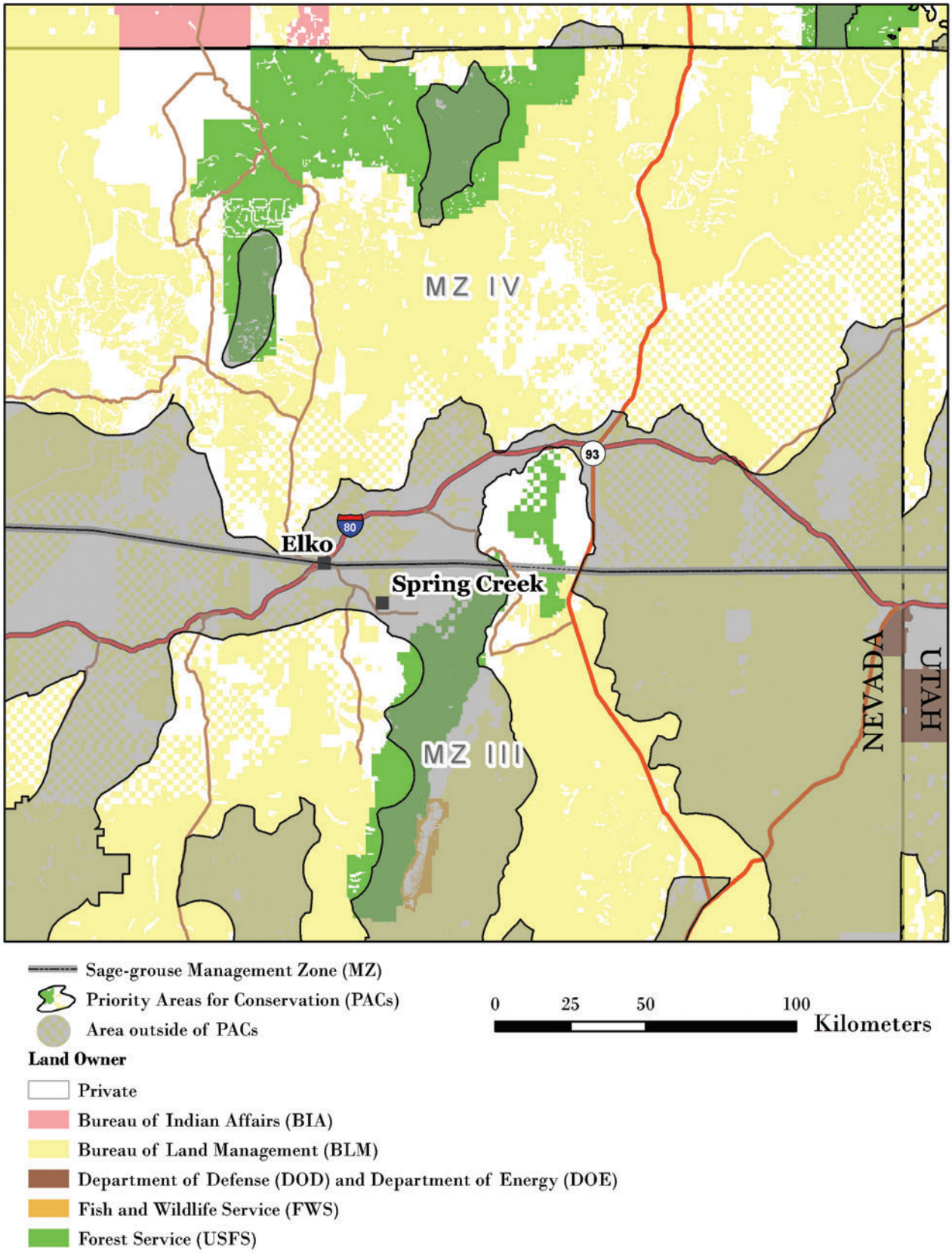

Figure 29. Land ownership for the northeast corner of Nevada. Lighter colored polygons delineate Priority Areas for Conservation (USFWS 2013).

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.

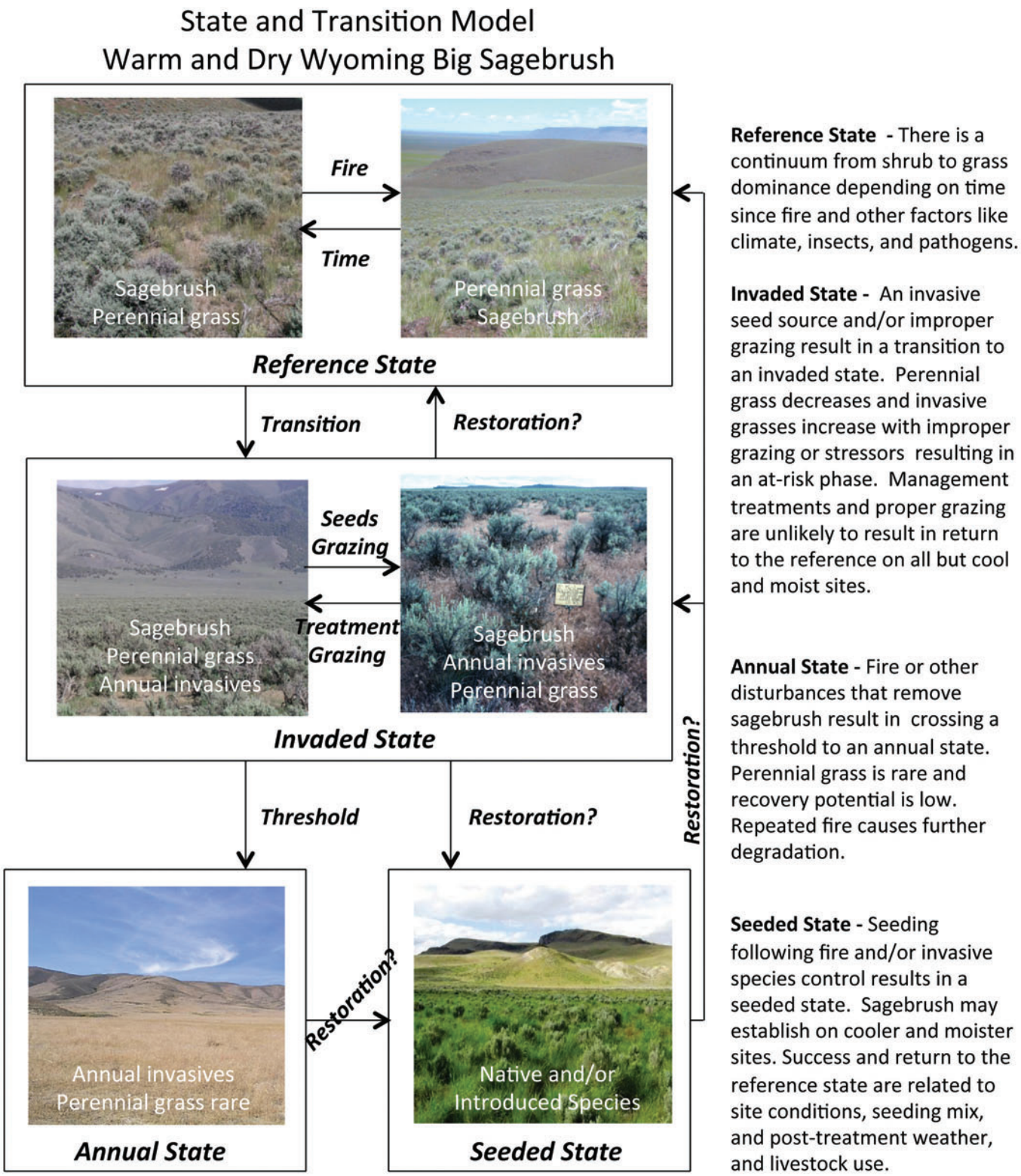

Figure 32. A state and transition model that illustrates vegetation dynamics and restoration pathways for the warm and dry, Wyoming big sagebrush ecological type. This ecological type occurs at relatively low elevations in the western part of the range and has low to moderate resilience to disturbance 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.

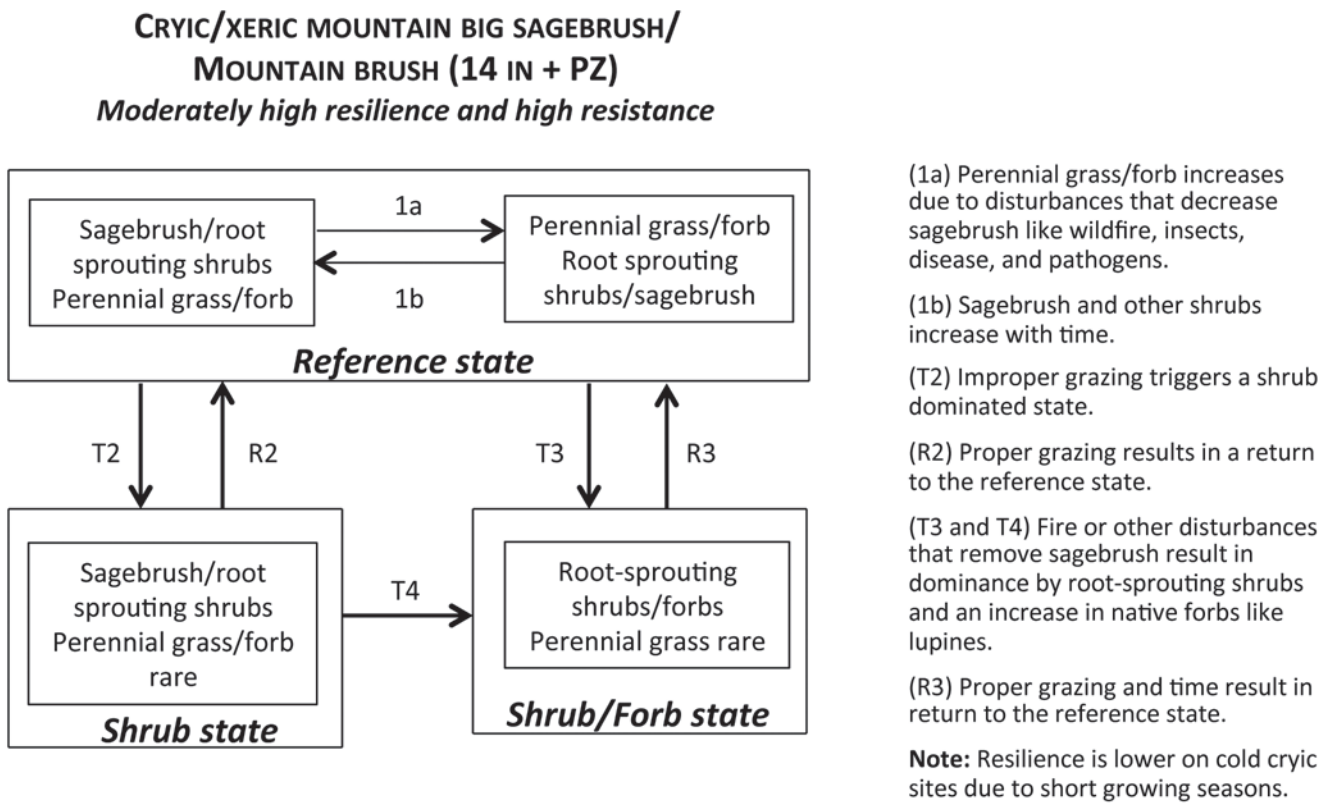
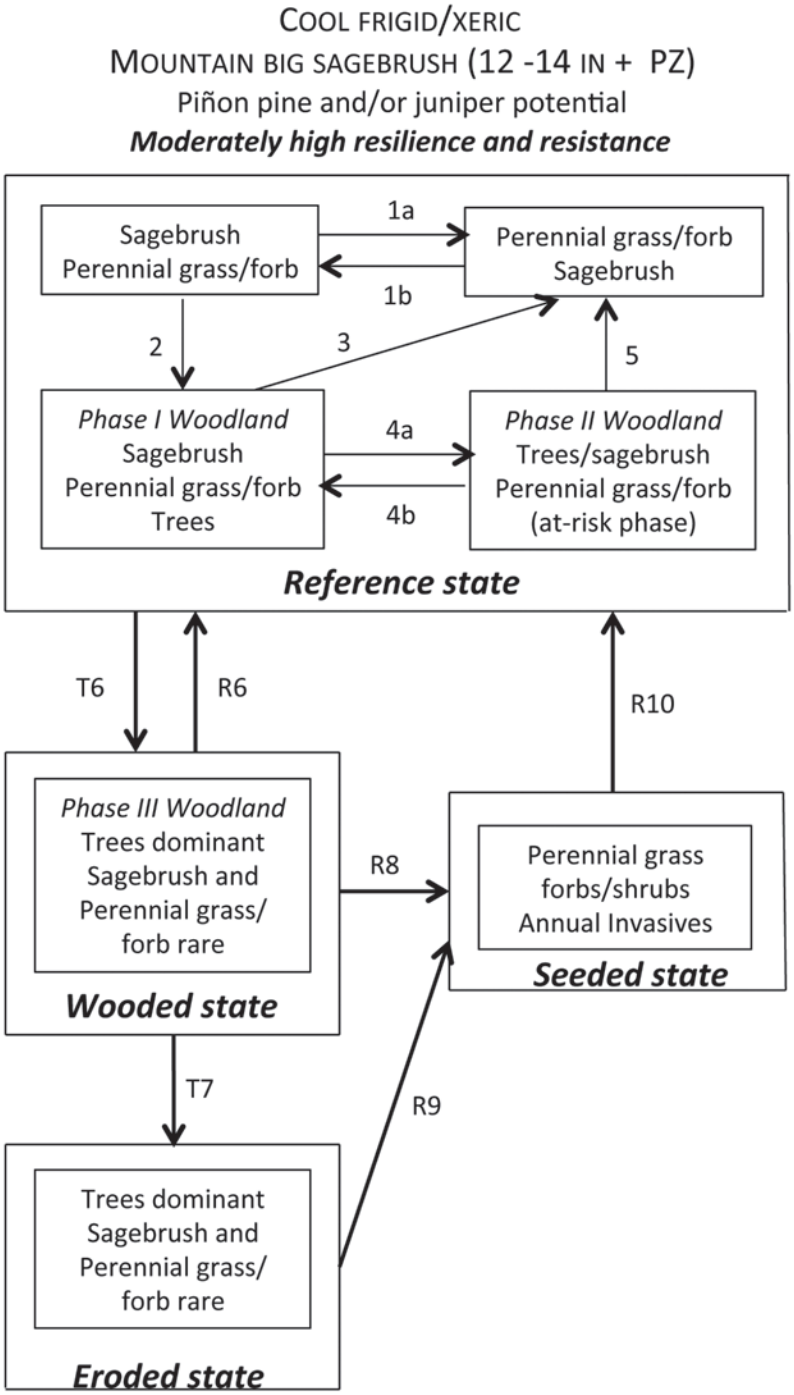


Figure A.5A. STM for a cryic/xeric mountain big sagebrush/mountain brush ecological type characterized by moderately high resilience and high resistance.



(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.

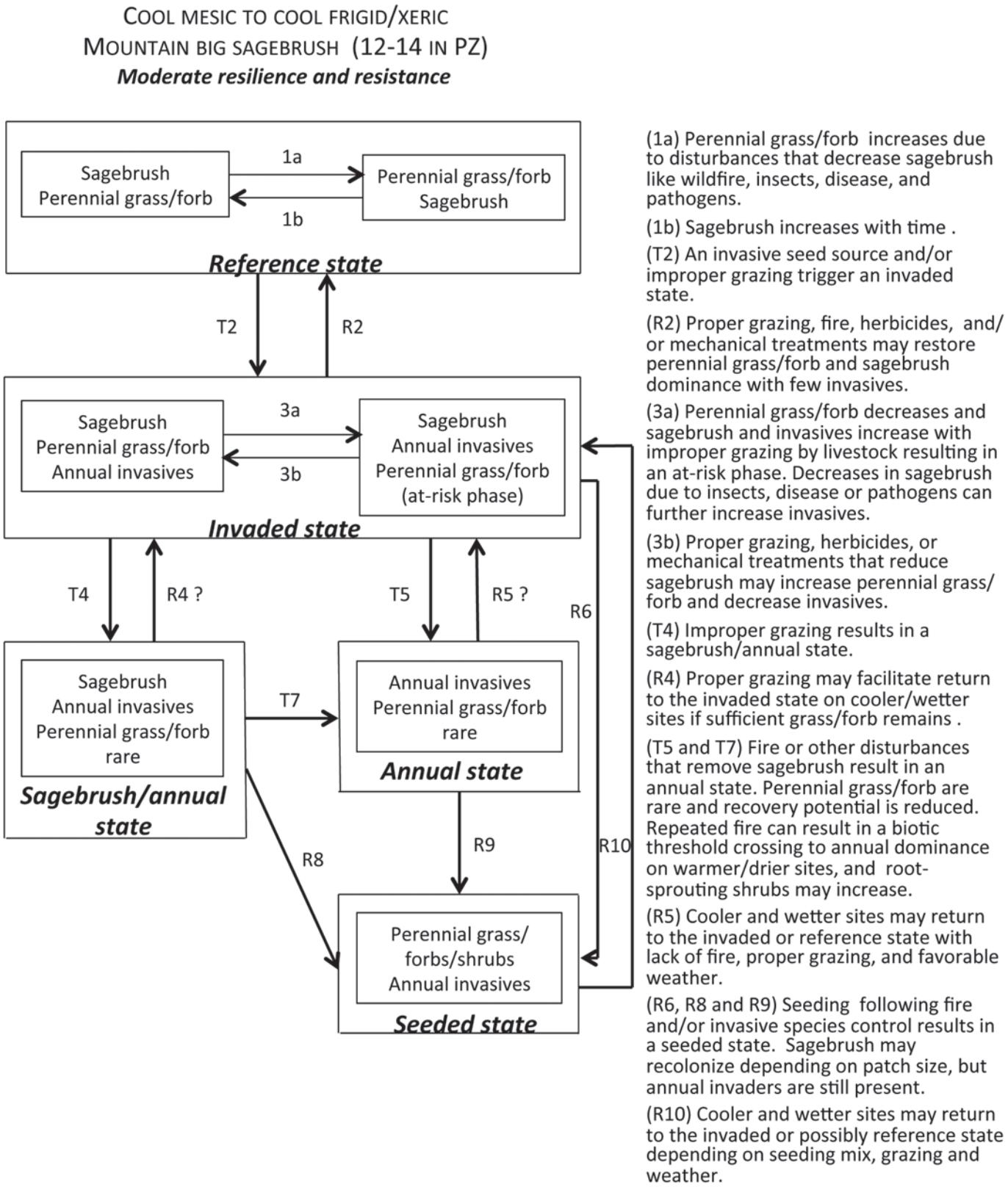


Figure A.5C. STM for a cool mesic to cool frigid/xeric mountain big sagebrush ecological type that is characterized by moderate resilience and resistance.

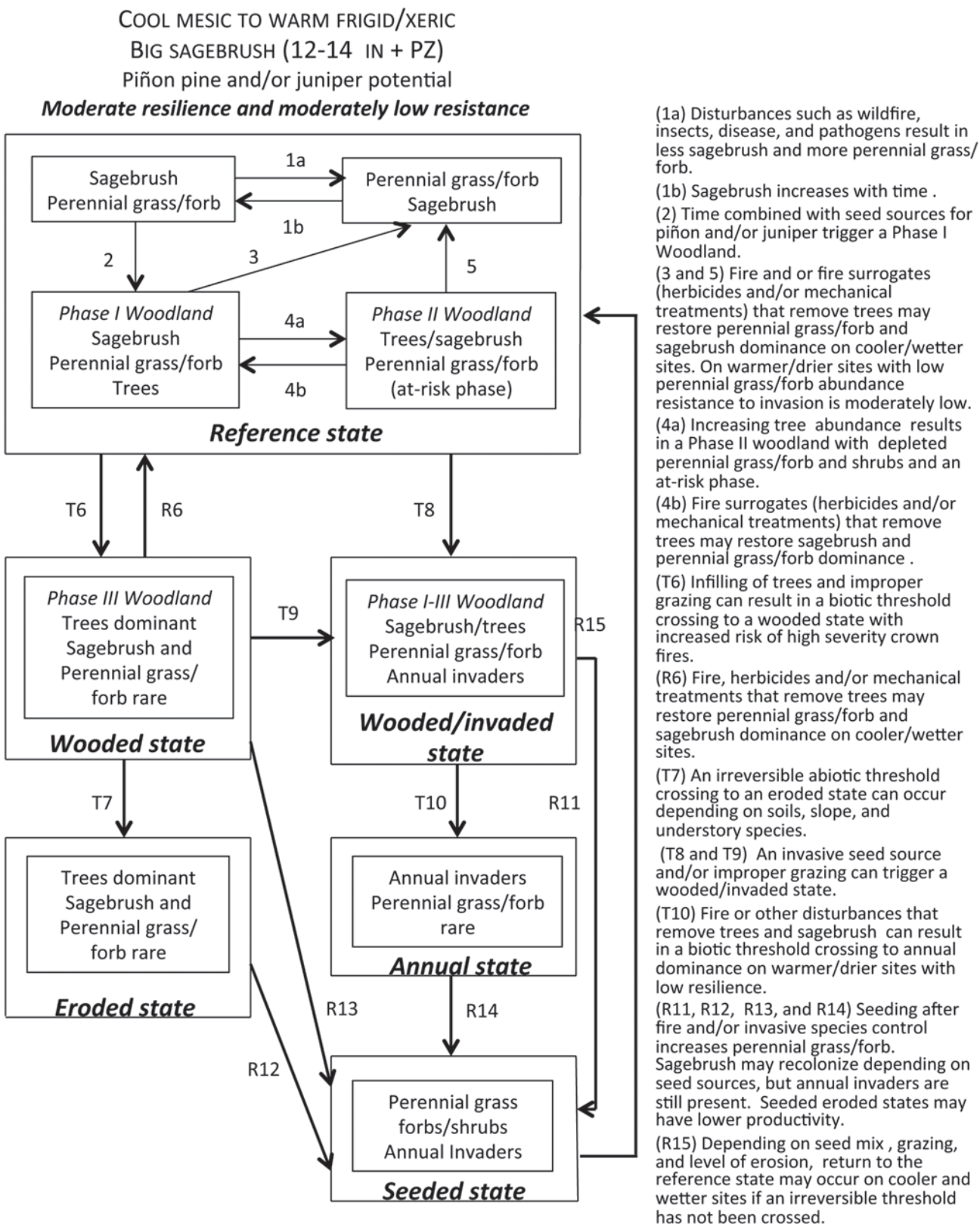
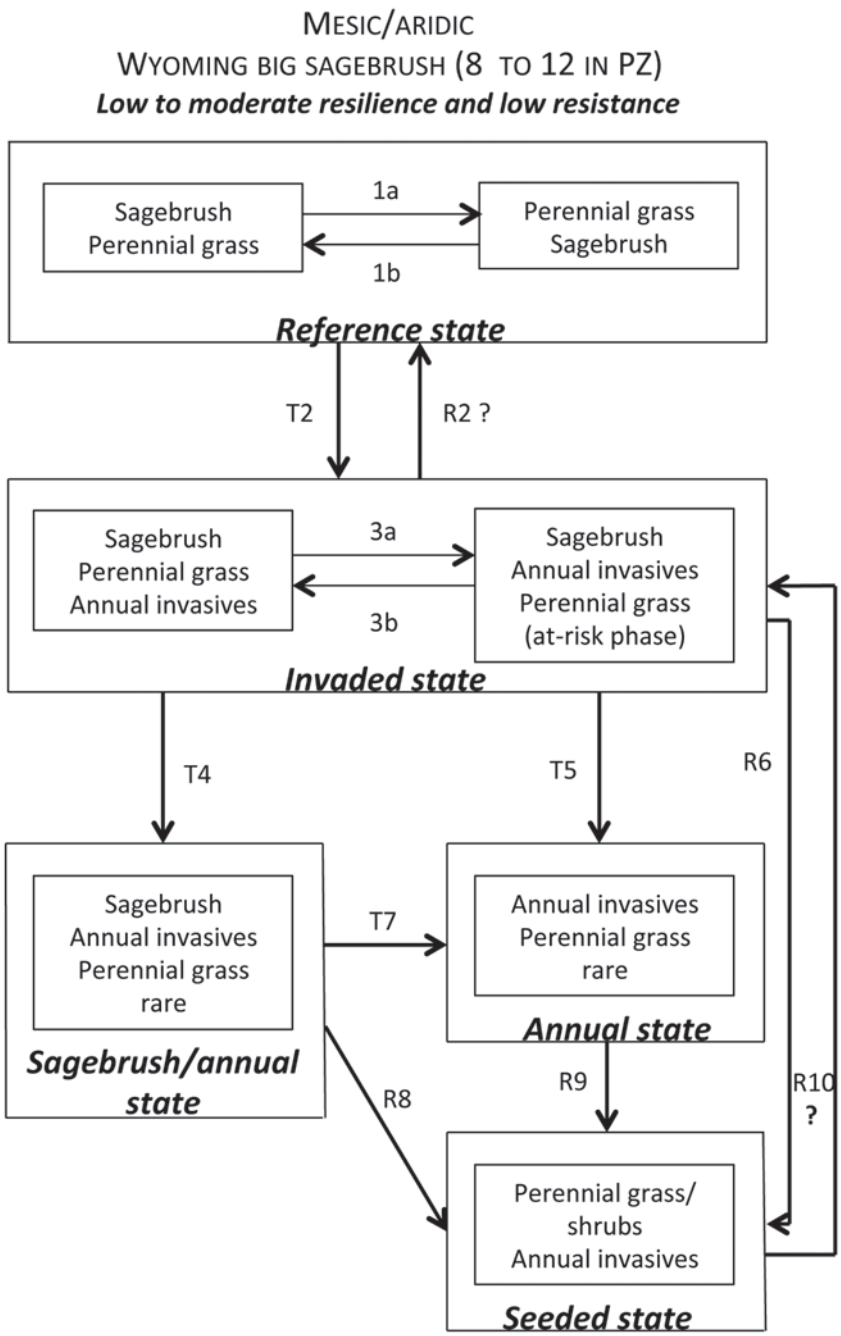


Figure A.5D. STM for a cool mesic to warm frigid/xeric mountain big sagebrush ecological type type that has piñon pine and/or juniper potential and is characterized by moderate resilience and moderately low resistance.



(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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Greater Sage-Grouse Wildfire, Invasive Annual Grasses & Conifer Expansion Assessment

June 2014

Suggested Citation:

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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-

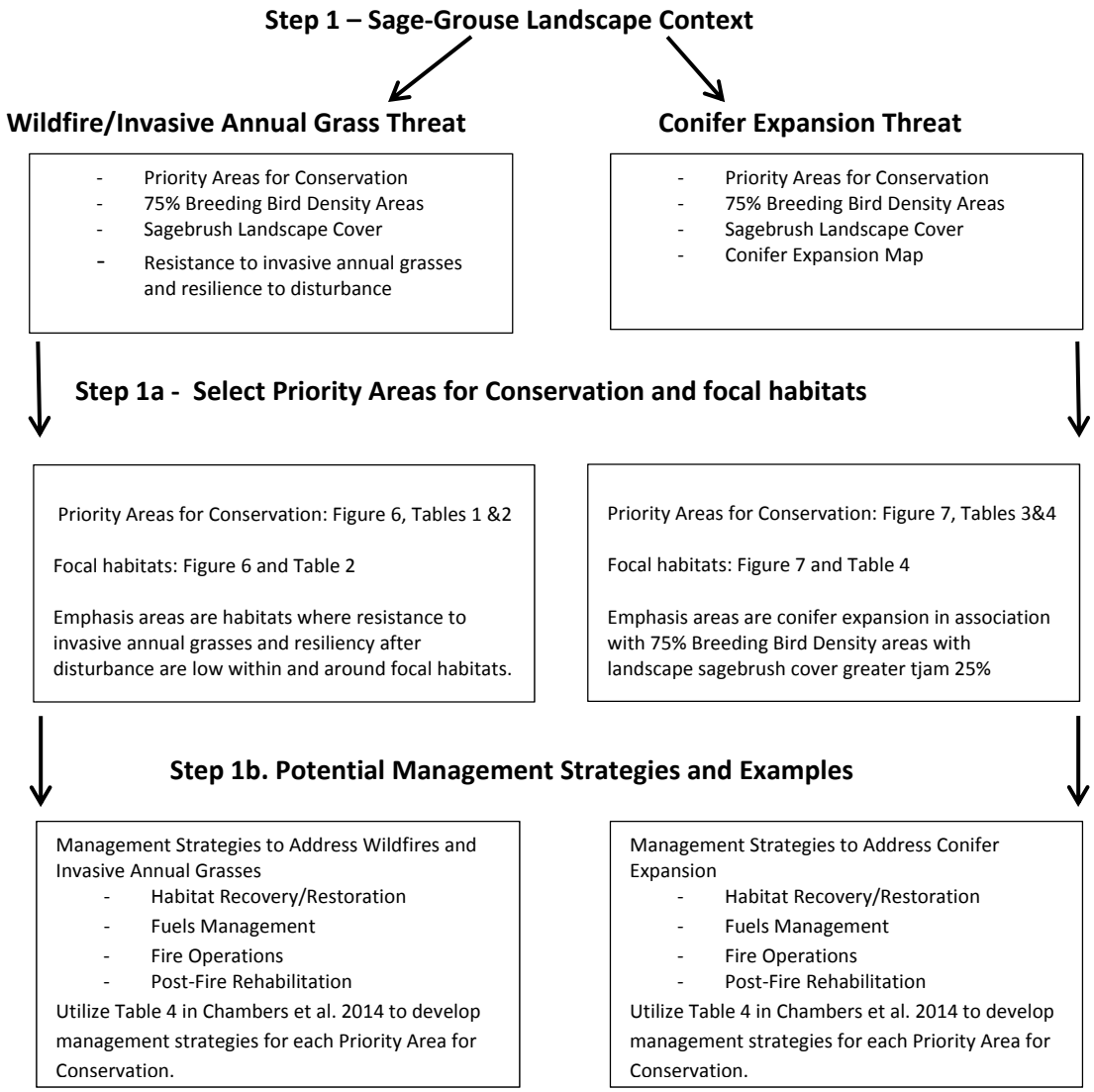
3. **Fire Operations** includes preparedness, prevention, and suppression activities. When discussing specific components of fire operations, the terms fire preparedness, fire prevention and fire suppression are used.

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 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:

Priority Areas for Conservation (PACs)

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.

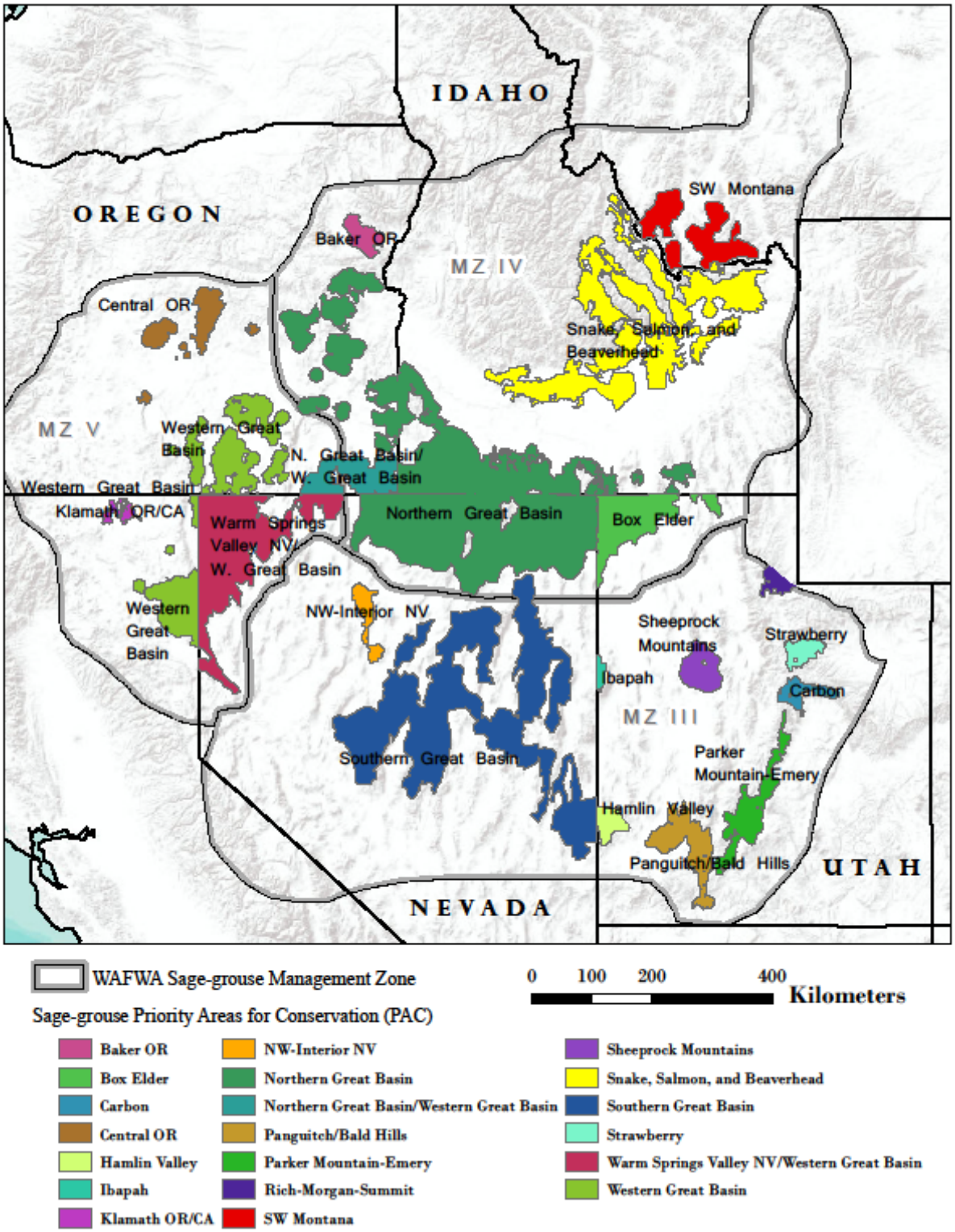


Figure 2, Current PACs for WAFWA Management Zones III, IV, and V. Bi-State sage-grouse populations were not included for this analysis and are being addressed in separate planning efforts.

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.

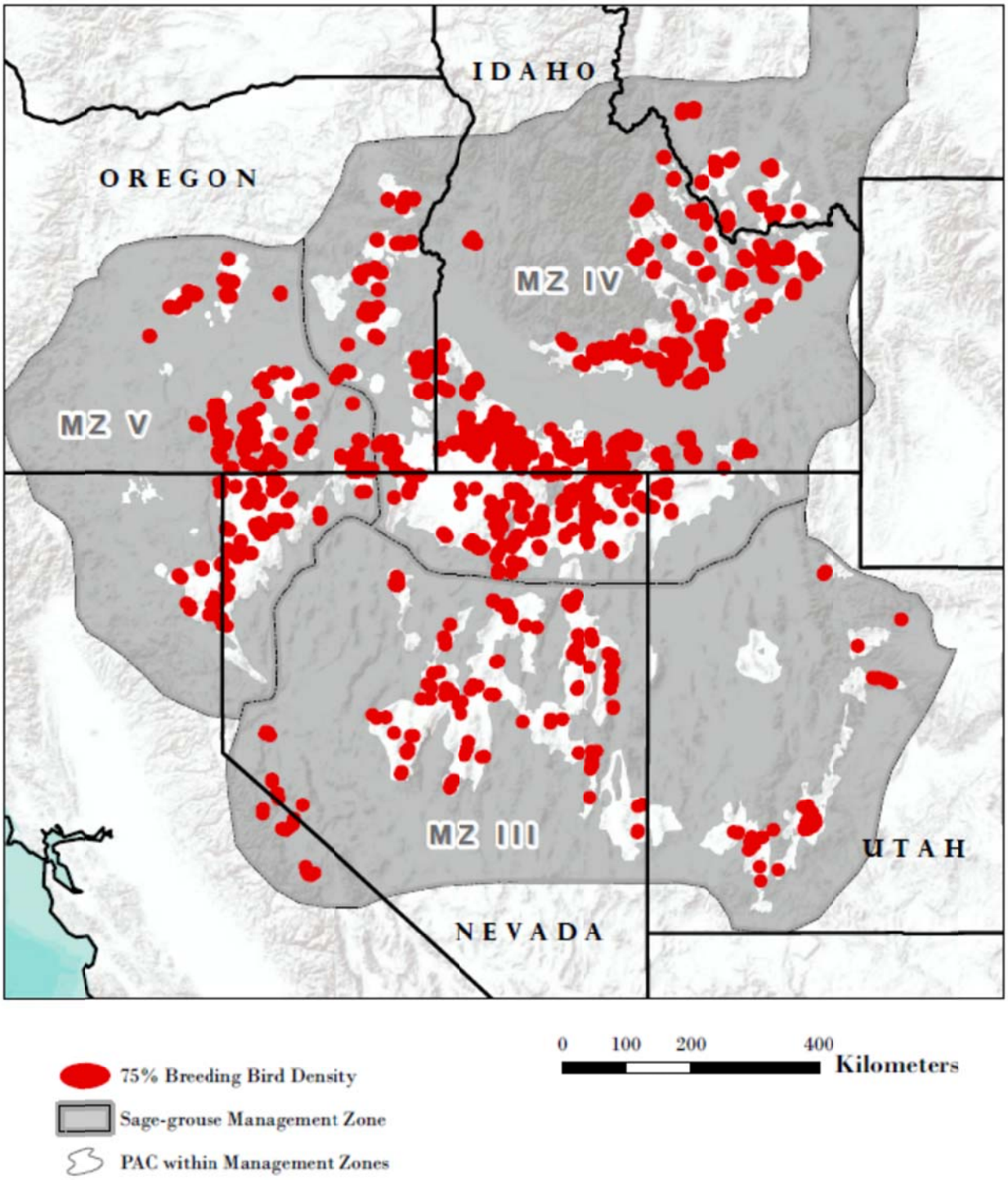


Figure 3, Sage-Grouse Breeding Bird Density Thresholds for 75% of the breeding birds, Management Zones, and PACs. Breeding bird density of 75 to 100% is shown in Appendix 1 to provide context for local management units when making decisions concerning connectivity between populations and PACs.

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).

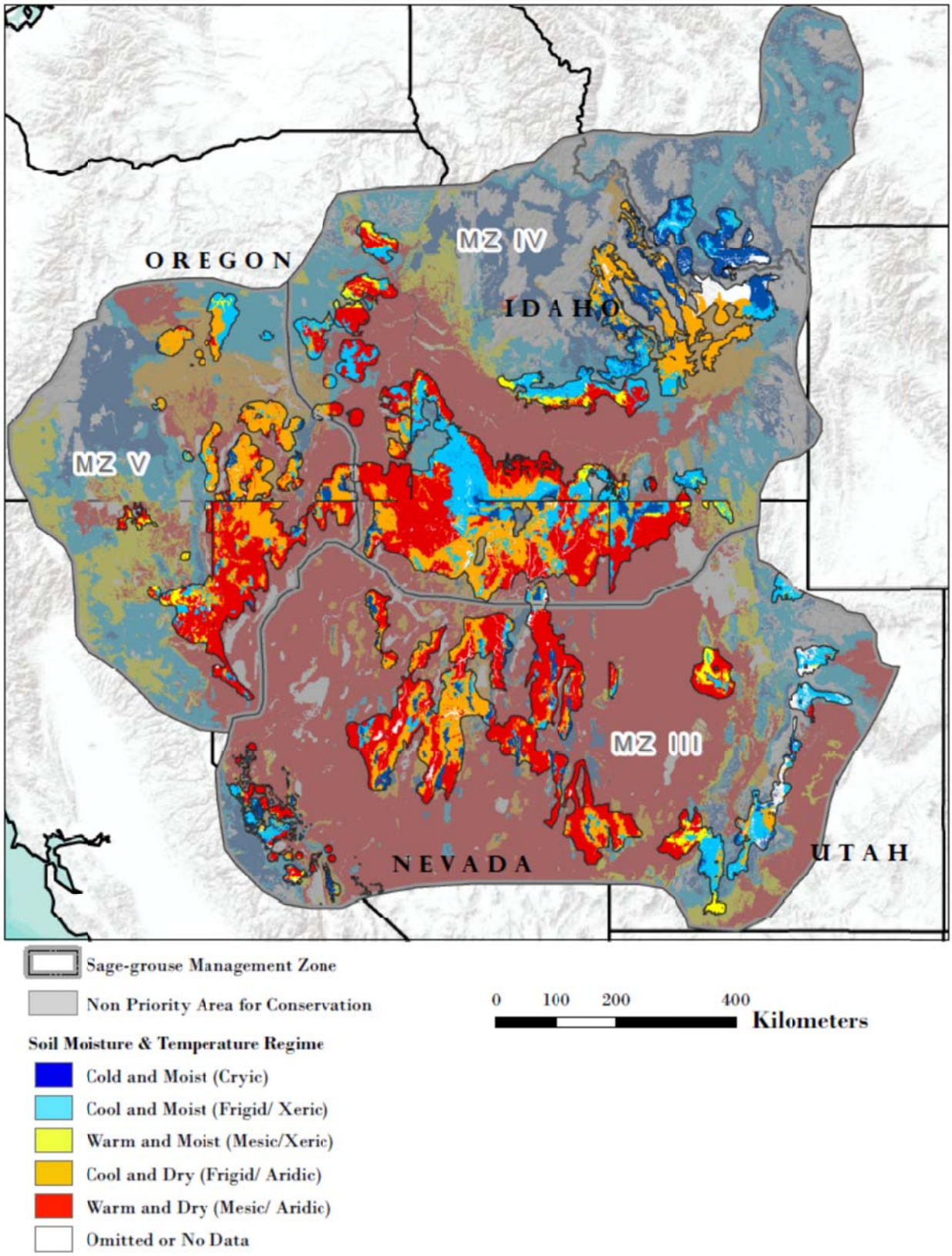


Figure 4, Soil Moisture and Temperature Regimes for Management Zones III, IV, and V

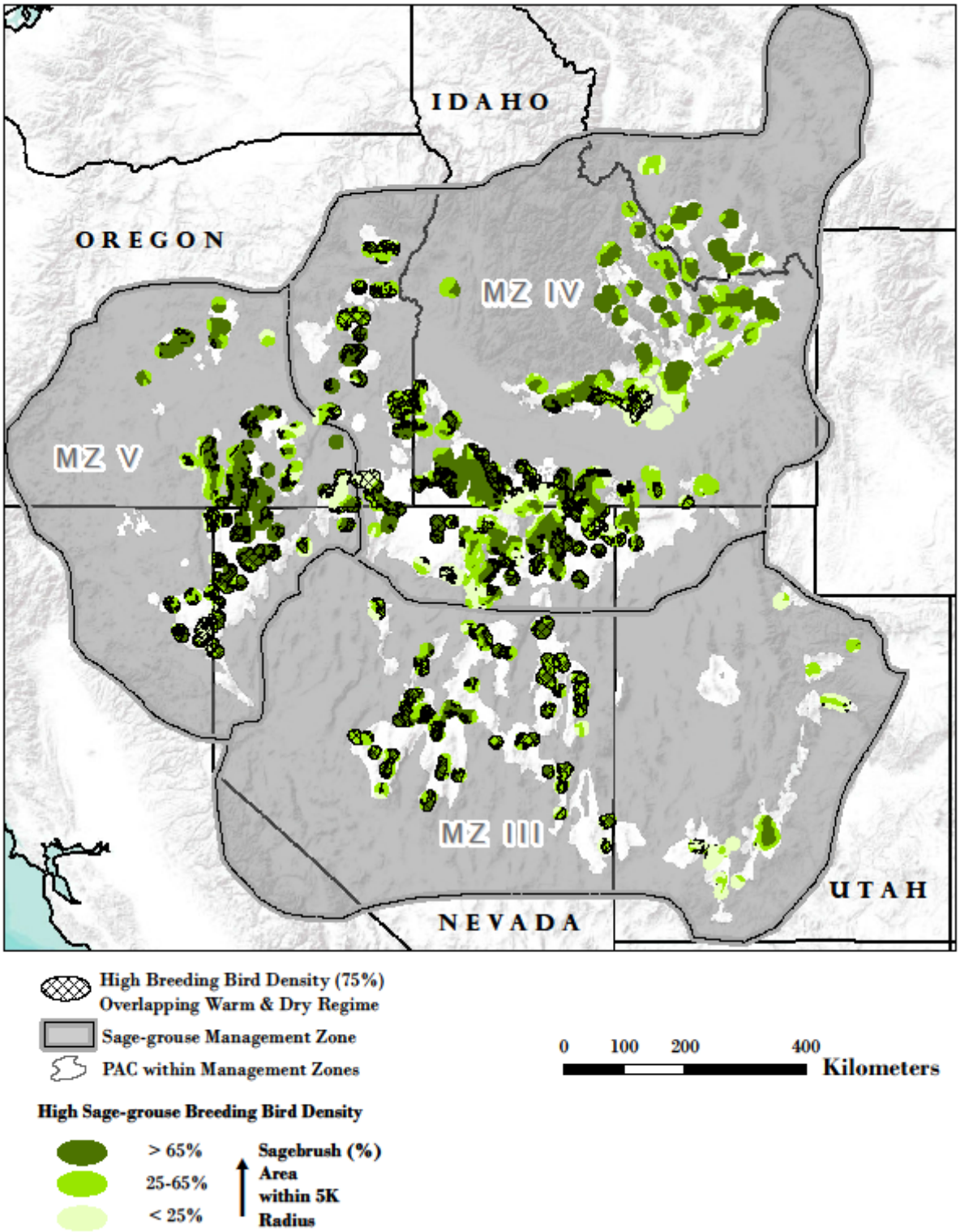


Figure 5, Intersection of High Density (75% BBD) Populations. The warm and dry sites and the proportion of these habitats in the three sagebrush landscape cover classes by management zone, and PACs within the Great Basin.

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.

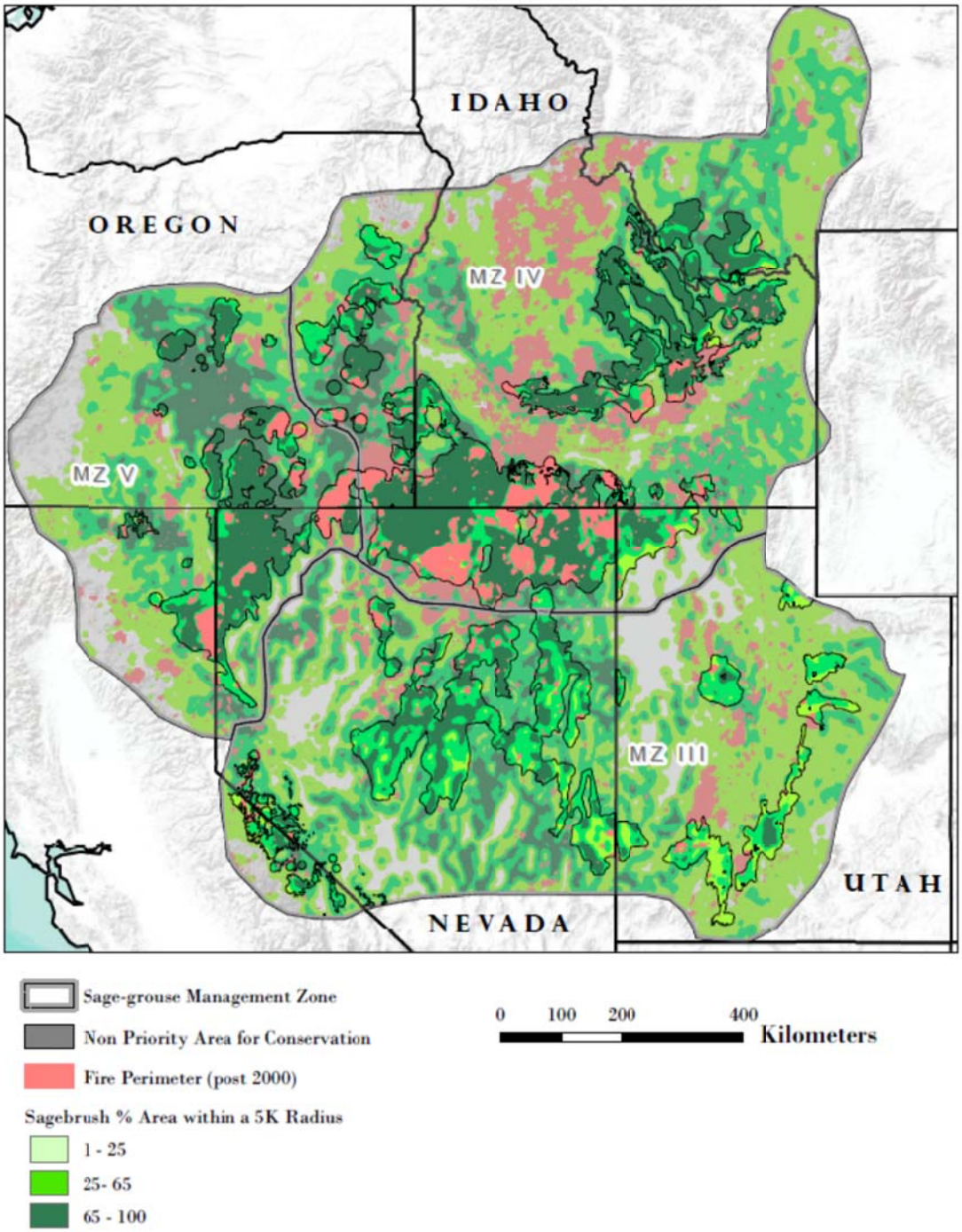


Figure 6, Sagebrush Landscape Cover and Fire Perimeters (post-2000) for the Analysis Area

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.

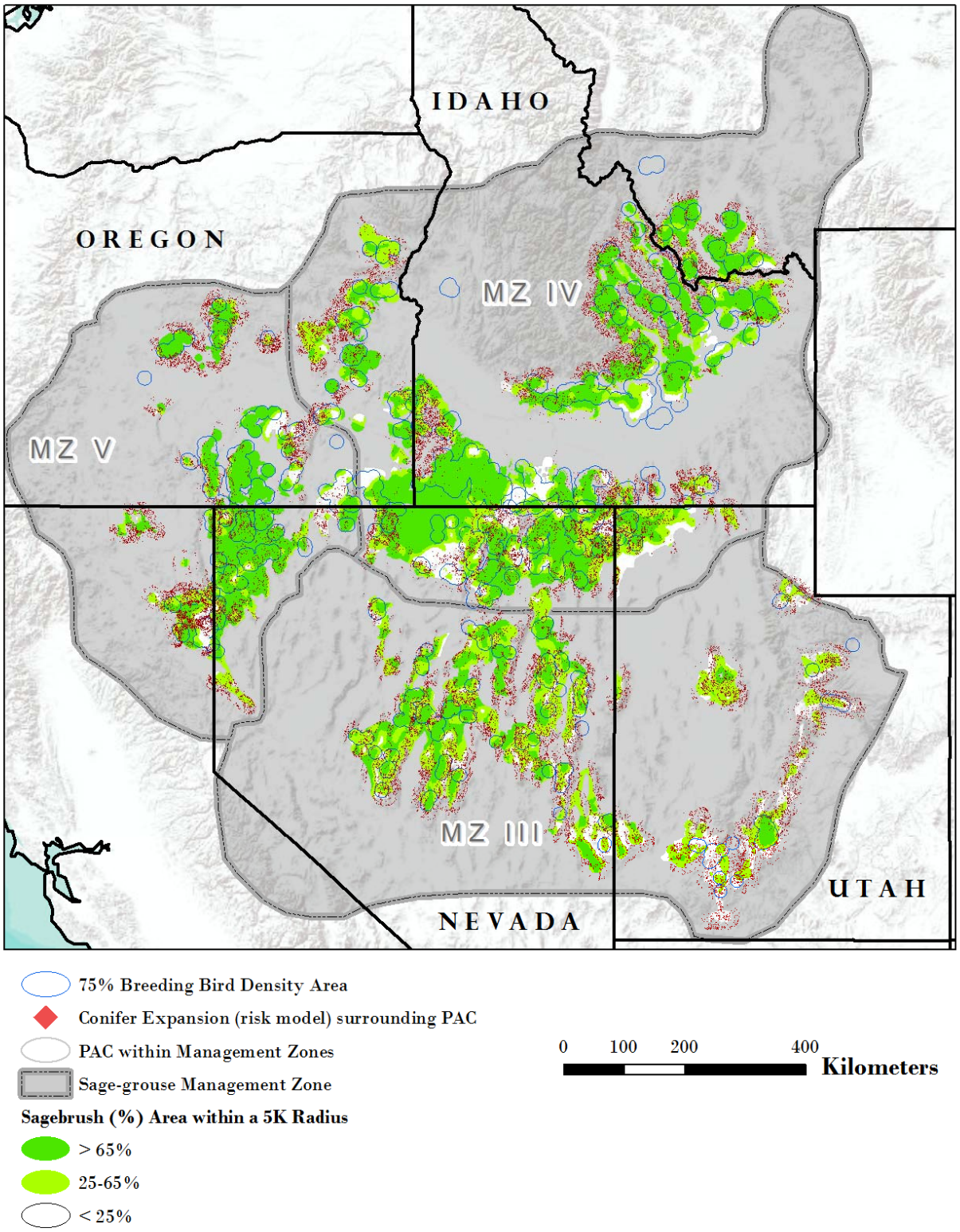


Figure 7, Modeled Conifer Expansion for PACs with Greater Than 25% Sagebrush Landscape Cover In and Around 75% BBD

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.

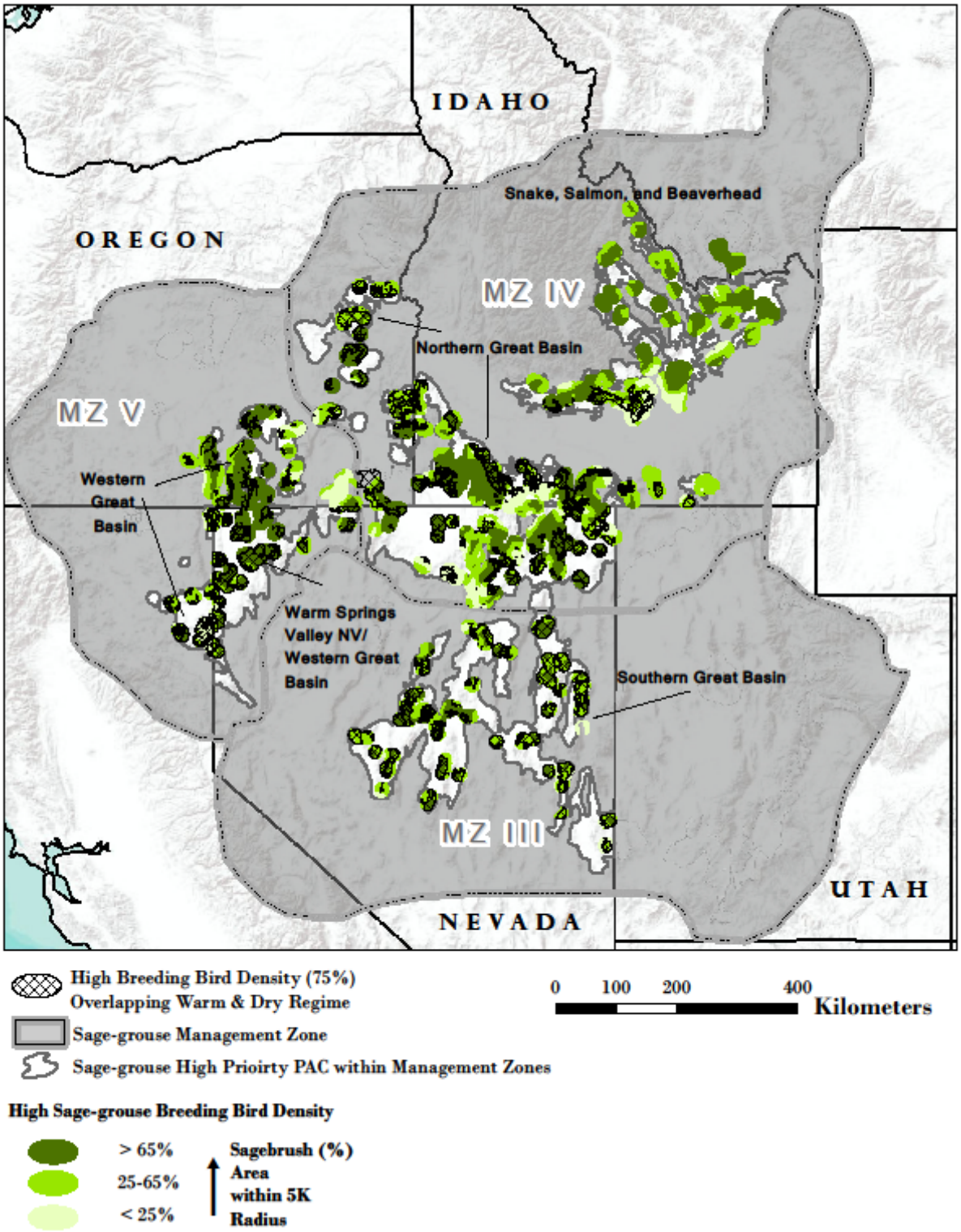


Figure 8, High Priority PACs with High Density Sage-Grouse Populations (75% BBD) sagebrush landscape cover classes, and areas with low resistance and resilience relative to wildfires and invasive annual species.

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.

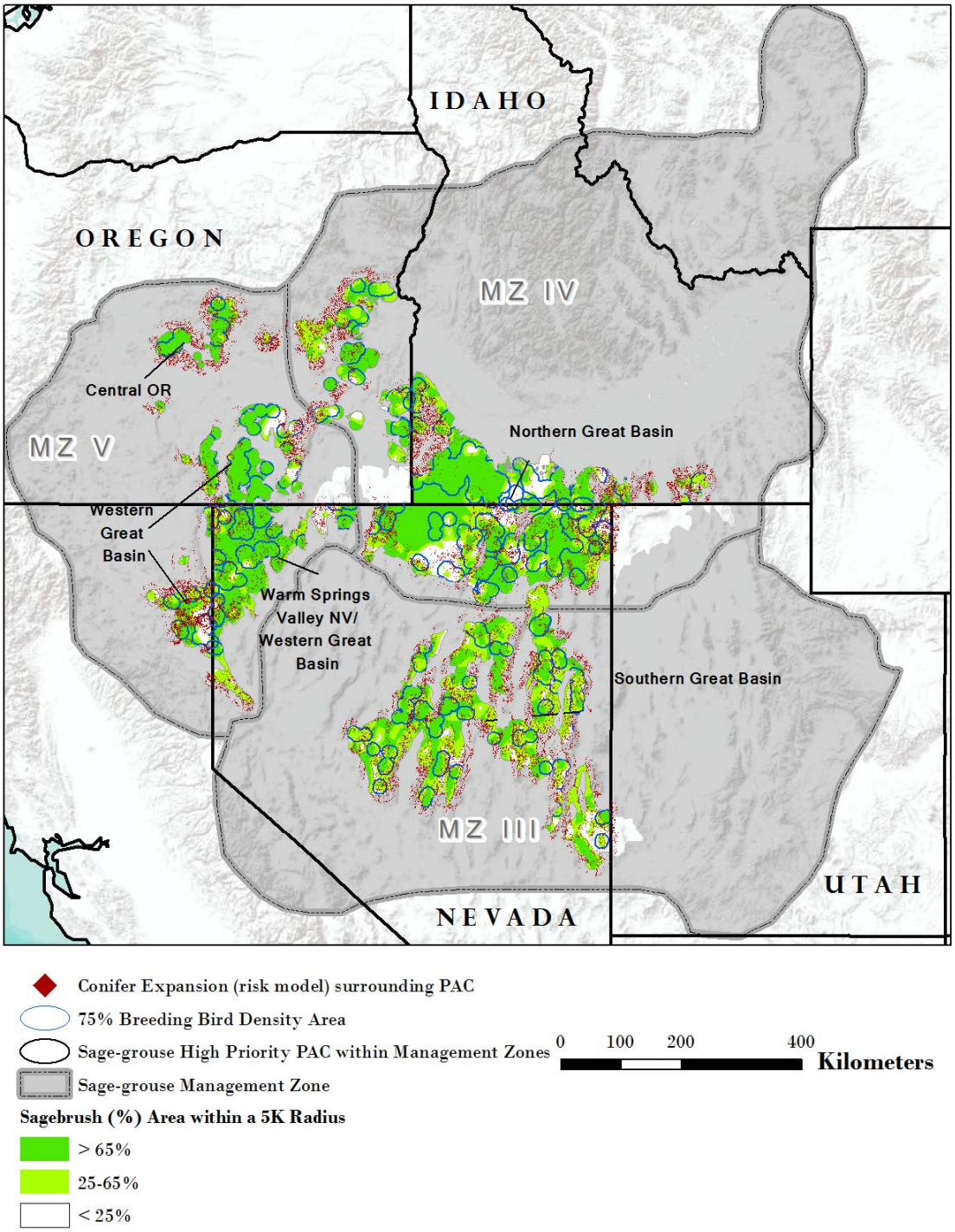


Figure 9, Five PACs Significantly Impacted by Conifer Expansion that contribute substantially to the 75% BBD and that have sagebrush landscape cover greater than 25%.

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%*

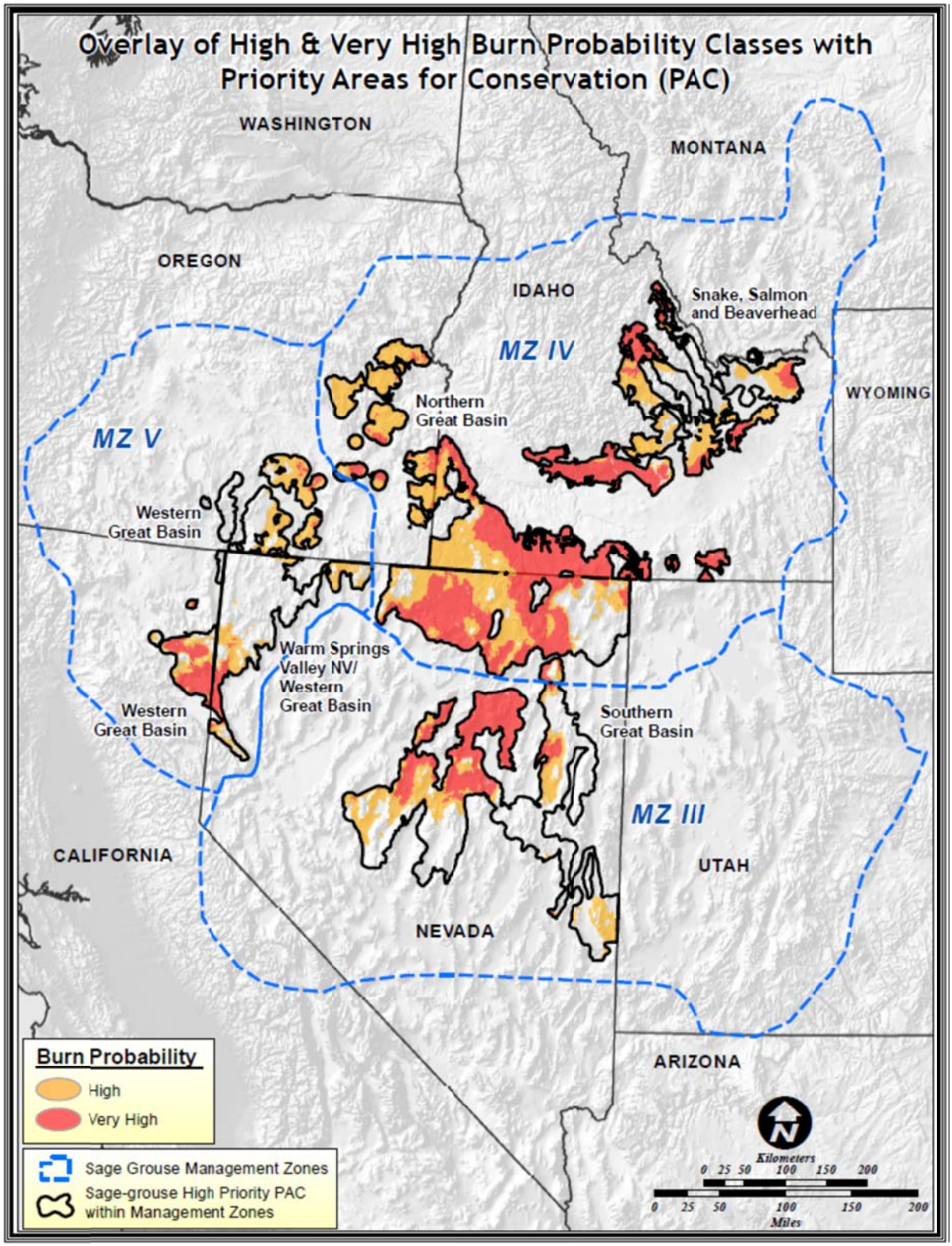


Figure 10, Burn Probability (high and very high) in priority invasive annual grass and wildfire PACs. .

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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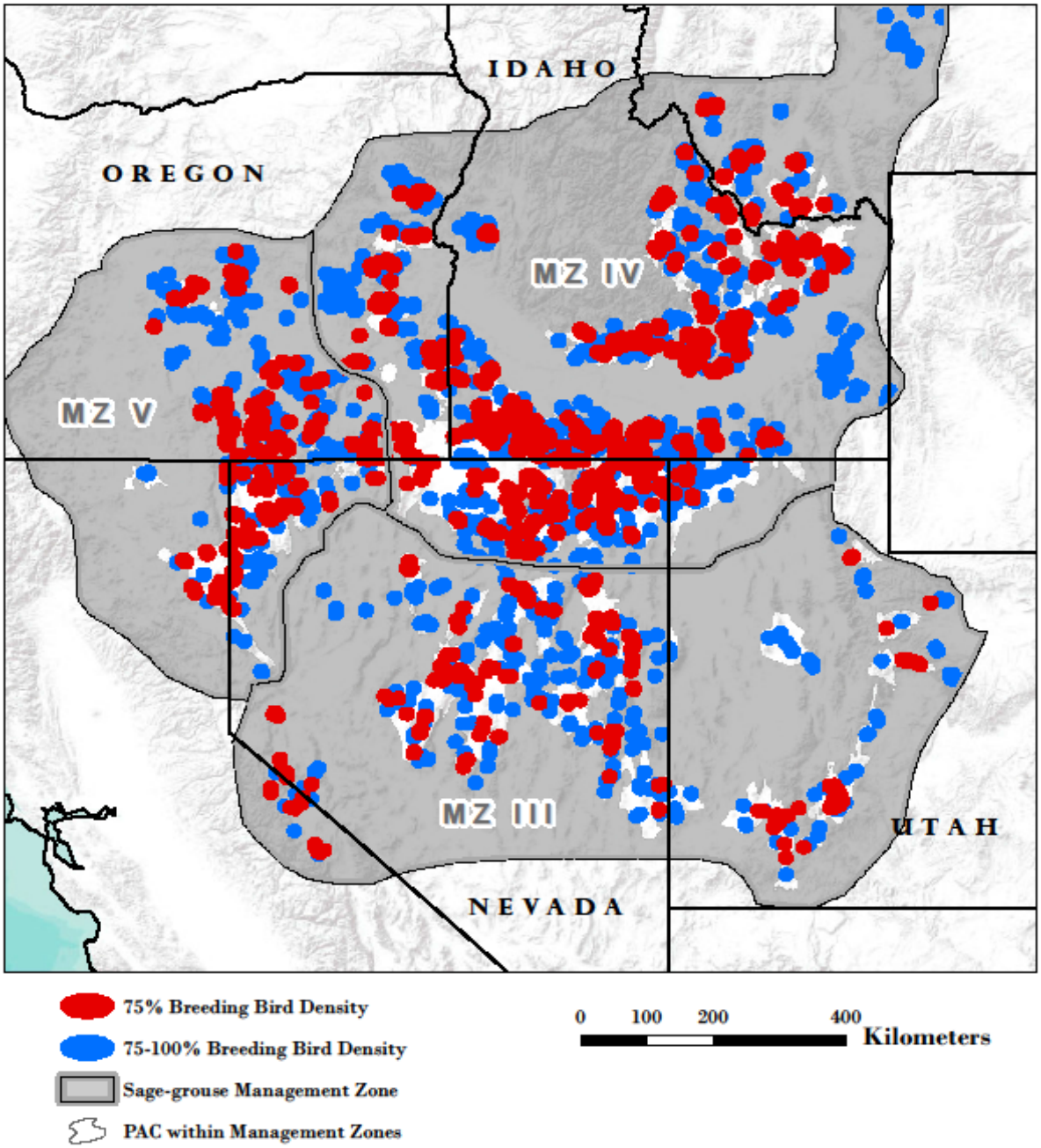
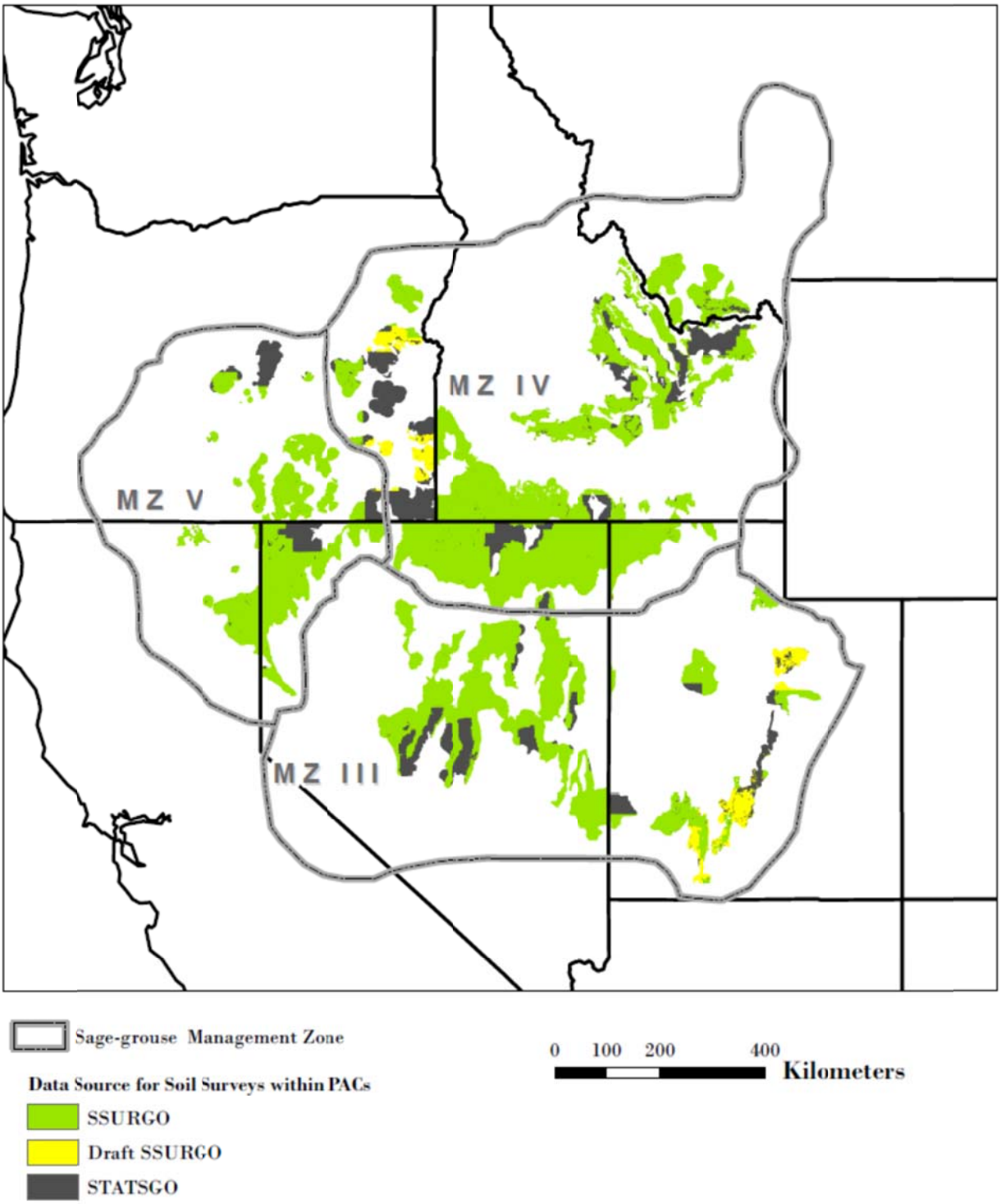
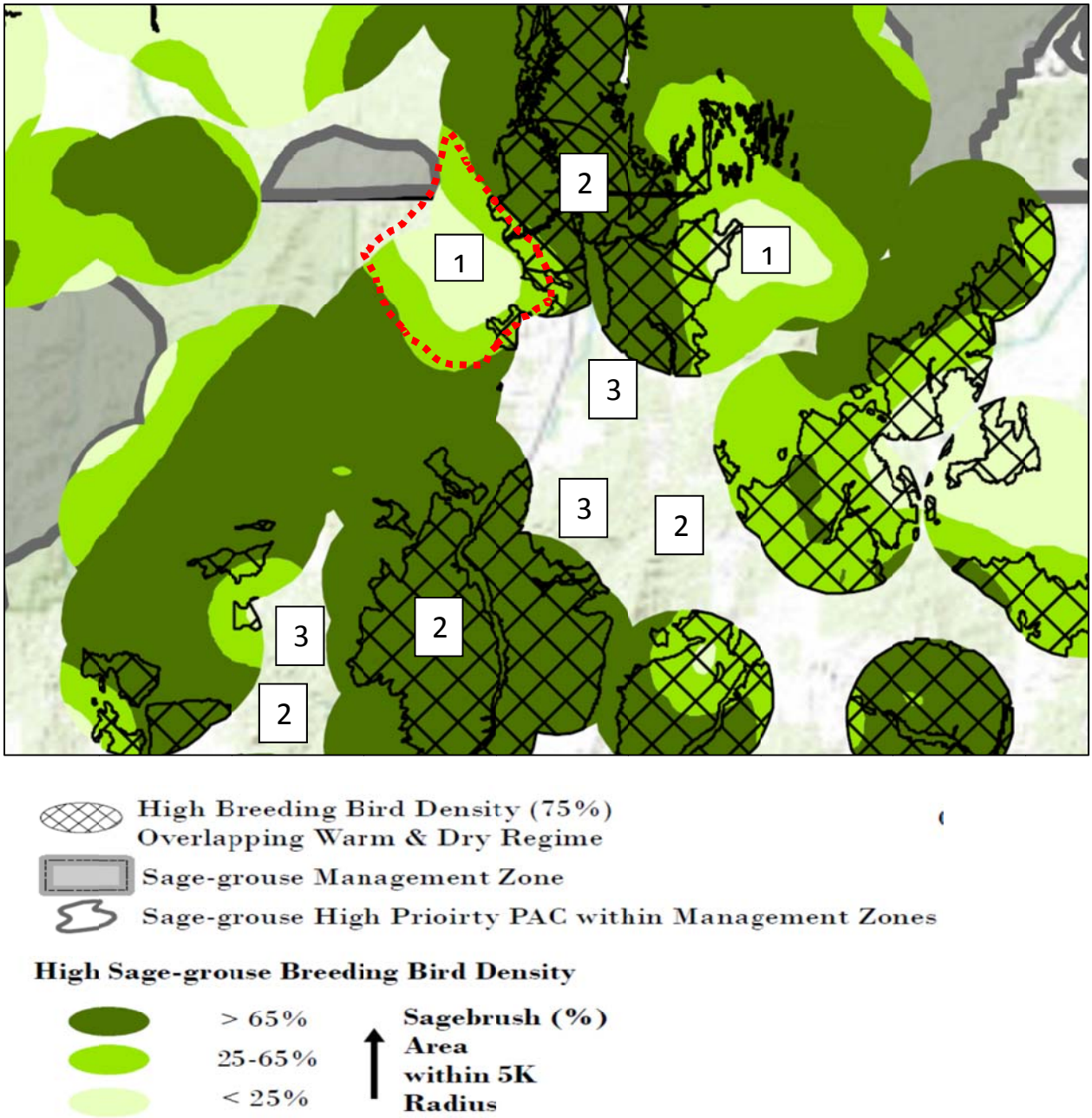
Appendix 1. Sage-grouse breeding bird density thresholds for 75% and 100% of the breeding birds, Management Zones, and PACs. Breeding bird density of 75 to 100% is included in this figure to provide context for local management units when making decisions concerning connectivity between populations and 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.

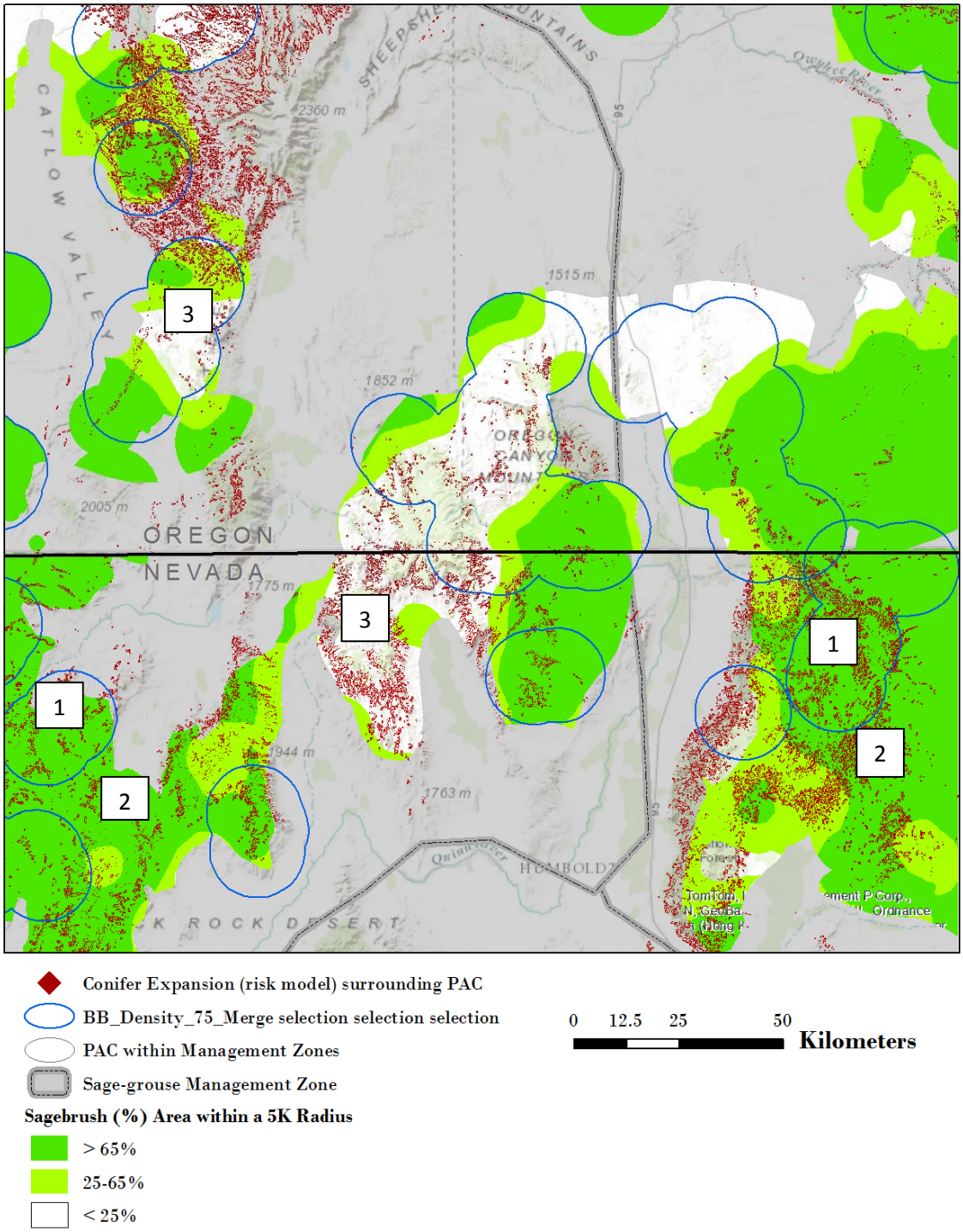


1 High priority for habitat restoration and post-fire rehabilitation to restore connectivity.

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 I

Adaptive Management

APPENDIX I
ADAPTIVE MANAGEMENT

Adaptive management is a decision 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 as part of an iterative management process. 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. Adaptive management does not represent 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). The adaptive management strategy presented within this Approved Resource Management Plan Amendment complies with this policy and direction.

In relation to the Bureau of Land Management (BLM) and US Forest Service (Forest Service) National Greater Sage-Grouse Planning Strategy, adaptive management provides additional certainty for effectiveness of conservation when implemented in concert with the Greater Sage-Grouse (GRSG) conservation measures presented in the plan amendments. This adaptive management strategy is incorporated along with the conservation measures in the plan to ameliorate threats GRSG, thereby increasing the likelihood that the combined conservation measures are effective in reducing threats to that species. The following provides the BLM's adaptive management strategy for the Utah Greater Sage-Grouse Approve Resource Management Plan Amendment (ARMPA).

UTAH SUBREGIONAL ADAPTIVE MANAGEMENT STRATEGY

The Utah Subregional adaptive management strategy includes the identification of soft and hard triggers and a management approach for responding to those triggers. In the spring of 2014, a multi-agency Utah group coordinated to developed adaptive management triggers for GRSG populations in Utah. This group includes State of Utah Division of Wildlife Resources (UDWR), Utah Governor's Public Lands Policy Coordination Office, US Fish and Wildlife Service (USFWS), Forest Service, and BLM. A biologist focus group, a subset of the Utah adaptive management group, was tasked with reviewing GRSG monitoring data and determining what population and habitat triggers are appropriate given the natural cyclic variability observed in all GRSG populations.

BACKGROUND INFORMATION

Greater Sage-Grouse Population Change

As is discussed in the Utah Greater Sage- Grouse Proposed Land Use Plan Amendment (LUPA)/Final Environmental Impact Statement (FEIS), **Section 3.3**, GRSG populations across the range fluctuate cyclically. In Utah the cycle seems, generally, to follow a 10-year pattern. The exact reason for the cycle is currently unknown. However, various aspects (i.e., vital rates) of the GRSG's life cycle have been linked by past research to changes in environmental and habitat

Utah's GRSG populations will likely continue to fluctuate over the short-term and on their historic 10-year cycle. The general direction of the cycles, whether populations are trending up or down, is the critical conservation concern for GRSG. Connelly et al. (2004) showed that rangewide the trend was decreasing from the 1960s to the mid-1980s, hitting a low in the mid-1990s, but then stabilizing to the present. Certainly, if habitat loss and degradation occur within a population's habitat base the population would likely decline in succeeding years without habitat restoration and/or other management intervention. However, if the habitat base remains intact it is likely that the population will continue to fluctuate, but remain relatively stable in the long-term. GRSG require large landscapes of contiguous sagebrush habitat to carry out their life-cycle. Securing these large landscapes from further degradation and adding more habitat through restoration is the primary conservation action for GRSG.

Lek Count Data

When considering monitoring data there is always uncertainty, error, and statistical noise. GRSG lek (breeding ground) counts are not comprehensive in nature, but rather represent a sample of and index to the population. This uncertainty carries over into using lek counts to make decisions for implementing management actions. Any metric of population change (e.g., percent annual change, percent above or below 10-year average, etc.) includes the uncertainty that comes from sampling populations. Therefore, creating precise decision triggers based on lek data is inherently problematic, and should include a relatively large range of specific metrics and management options. However, much more certainty exists concerning the effect of habitat loss or degradation, and precise decision triggers would be much more reliable for habitat conservation purposes.

For GRSG, while some production data has been collected in various populations, the only data that has been consistently collected across the range of the species and within Utah for this species has been males attending leks. While male lek attendance has been the primary source of data collected and is used as an index of GRSG populations, it is critical that the strengths and weaknesses of lek counts be understood to appropriately evaluate how confidence in the data may vary. For instance, the number of males counted on leks can vary depending upon how many times the lek was counted in a spring (at least three times is recommended to increase the chances that the peak male lek attendance was observed), time of day (three counts conducted between 30 minutes before sunrise to 1 hour after sunrise), and the weather conditions (calm). Standardized lek counts have become more common practice recently. The lek count protocol is based on lek attendance research (Jenni and Hartzler 1978; Emmons and Braun 1984; Connelly et al. 2003). In general, lek count protocol has become a priority in the last 15 years and adherence to the protocol increases the confidence in and comparability of the resulting data.

Early in the history of collecting lek count data in Utah, the likelihood that leks were known depended on two things: 1) the proximity of the lek to areas frequented by people during dawn (near roads or corrals); and 2) the size of the lek; the larger the lek, the more likely it was noticed. Therefore, the leks counted earliest in the history of GRSG monitoring in Utah were either large leks and/or easily accessible leks (e.g. near roads). In the last 20 years in Utah and throughout the west, efforts to count and find leks have increased substantially (though there is variation in the number of leks counted, up and down, each year). With these concerted efforts to find new leks, new and generally smaller leks were added to the list of known leks. Consequently, by adding primarily small leks to the overall state "average males per lek", the state average males per lek decreases even though more birds and more leks are being counted. In addition, where graduate students have studied GRSG populations, new leks have been found as a result of the amount of time on the landscape and radio-telemetry information. From these increased efforts, the number of leks counted has increased from 14 leks in 1959, 99 leks in 1980, up to 362 leks in 2012 (2,485 percent increase) (UDWR 2009). Similarly, the total number of birds counted in a spring has increased, based on State of Utah data, from 451 males in 1959 to 3,231 males counted in 2012 (616 percent increase).

ADAPTIVE MANAGEMENT TRIGGERS

This overarching adaptive management strategy includes the identification of a two-tiered system of triggers (soft and hard) for both GRSG populations and habitat. These triggers are not specific to any particular project, but identify population and habitat thresholds which, if exceeded/tripped, would result in a change in how the BLM addresses management of GRSG in that area. Triggers have been based on the two key metrics that are regularly monitored: population declines and habitat loss.

Soft triggers represent an intermediate threshold indicating that management changes are needed to address habitat or population losses before they become severe. They represent a "caution" signal that changes outside the normal range of variation may be occurring. If a soft-trigger is tripped, monitoring data would be evaluated and management would be implemented to stop further 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 BLM plan. The intent of a soft-trigger is to identify changes in management at a point where further losses could be avoided. There should be no expectation of hitting a hard trigger; if unforeseen circumstances occur that trip either a population or habitat hard trigger, more restrictive management will be required.

The changes in management required after a trigger is tripped are included below in the "Management Response" section. The following sections present the adaptive management triggers, organized first by the metric being addressed (population or habitat) and then by the associated soft and hard triggers.

Population Triggers

When evaluating population-based adaptive management triggers, this adaptive management strategy includes consideration of two aspects of population data to ensure that one set of data, if in error for any reason, would not unnecessarily trigger management changes. Population declines will be evaluated using the following two metrics:

- Population trends based on "trend leks," and

- Population growth as indicated by Lambda (λ) (as described below) from one year to the next for monitoring associated with all leks within a priority habitat management area (PHMA).

Trend leks are either leks that have been surveyed consistently in the last 20 years or leks that provide spatial representation within PHMA. Twenty years was chosen as the appropriate time period to identify trend leks with consideration of the cyclic nature of GRSG populations, and to capture monitoring results during the period of time when lek counts were conducted more consistently, and when lek count protocol was more standardized. The Utah GRSG lek counts appear to have been in a low oscillation in the mid-1990s and again in the last few years (2011). During this same time period, standard lek count protocol use was increasing. Criteria for the trend leks are below:

- Starting with 1996, a lek that had > 1 male counted within one of 5 years between 1994-1998,
- Lek counts have occurred on 80 percent of the years since 1994 (16 years), **AND**
- Lek counts on 50 percent of the years are > 1 (8 of 16), **OR**,
- A lek provides spatial representation (in the case of small populations, all leks may be included).

Lambda (λ) is the population change from a given Year 1 to the following Year 2 by dividing the total PHMA males counted in Year 2 by the total males counted in Year 1. If the result equals one (1), there was no change in the population level. A lambda that exceeds one (> 1) means the population is growing. A lambda that is less than one (< 1) indicates a declining population. To generate a consistent and comparable number, lambda can only be calculated on leks that are counted in consecutive years. This is to ensure that the increase in number of leks does not skew population data. This way, lambda can only be calculated for a lek if it is counted in two consecutive years. Some examples of calculating lambda are as follows:

- Males in Year 2/males counted in Year 1 = Lambda (λ)

  Example A – No Change in Population: Assuming in 2000, the total males counted on leks in PHMA is 350 and in 2001, on the same leks counted in 2000, the total males counted are 350.

- 350/350 = 1; since lambda is 1, the population is unchanged.

  Example B: Increasing Population: Assuming in 2000, the total males counted on leks in PHMA is 350 males and in 2001, on the same leks counted in 2000, the total males counted are 430.

- 430/350 = 1.23; since lambda is > 1, the population is increasing.

  Example C: Decreasing Population: Assuming in 2000, the total males counted on leks in PHMA is 350 males and in 2001, on the same leks counted in 2000, the total males counted are 280.

- 280/350 = 0.8; since lambda is < 1, the population is decreasing.

Multiple population triggers were established to account for different potential population trends for which management and monitoring should respond. This includes triggers to address rapid short-term declines in a population, as well as persistent long-term decreases of both trend leks or all monitored leks (using lambda - λ).

Population Soft Triggers

A population soft trigger would be met in PHMA if any one of 1a, 1b, 1c, or 1d are met, AND number 2 is also met:

1a) 4 consecutive years of 10 percent or greater annual decline in average males per lek in each year, based on "trend leks"; **OR**

1b) 6 consecutive years of declining average males per lek in each year, based on "trend leks"; **OR**

1c) 40 percent or greater decline in average males per lek in any single year, based on "trend leks"; **OR**

1d) 50 percent or greater decline in average males per lek in a 4 consecutive year period, based on "trend leks"; **AND**

2) Lambda of less than 1 in 4 consecutive years, based on all leks in the PHMA. Using criteria 1c, the 40 percent decline in a single year may occur at any point of the four year lambda monitoring window (year one, two, three or four).

For PHMA in the Ibapah and Hamlin Valley population areas, if a GRSG population adaptive management trigger (hard or soft) from a Nevada LUP is met on GRSG habitat in Nevada that is adjacent to the Ibapah or Hamlin Valley PHMA, a soft trigger would be met for the Utah areas, regardless of whether the above criteria have been met or not.

The management to be applied if the soft trigger criteria are met is identified below under the Management Response header. The intent of the population soft trigger is to identify changes to population trends and adjust management before a hard trigger is met.

Population Hard Triggers

A population hard trigger would be met in PHMA if any one of the following criteria (a-d) is identified through monitoring:

Short term Decline

a) 4 consecutive years of 20 percent or greater annual decline in average males per lek in each year, based on "trend leks"; **OR**

b) average males per lek, based on trend leks, drops 75 percent below the 10-year rolling average males per lek in any single year (not a 75 percent decrease, but a decline under 75 percent of the 10-year rolling average); **OR**

Long term Decline

c) Lambda of less than 1 in 6 consecutive years, based on all leks within the PHMA; **OR**

d) Lambda of less than 1 in 8 years of a 10 year window, based on all leks within the PHMA.

The management to be applied if the hard trigger criteria are met is identified below under the Management Response header. Any change in management would only apply to the PHMA where the trigger is tripped.

Habitat Triggers

The adaptive management approach also includes triggers based on GRSG habitat. Habitat quality is addressed by adherence to the objectives contained in the plan amendment. The adaptive management triggers for habitat is based on the availability of habitat within PHMA, measured using a percent of habitat loss from a baseline of available GRSG habitat at the signing of the final plan amendments.

Available habitat will be mapped within each PHMA using available information such as vegetation data from satellite imagery (e.g., reGAP, LANDFIRE), local monitoring, soils data, etc. As additional information is made available in the future it can be used to refine the baseline habitat areas that existed at the point the plan amendments are finalized (e.g., removing areas of high juniper density, cliffs, salt-desert scrublands). However, any such changes should reflect habitat as it occurred at the signing of the plan amendments and not reflect changes to habitat from that time. Changes from the baseline acreage could occur through either the addition of habitat (e.g., juniper reduction projects) or reduction of habitat (e.g., wildfire). In either case, the percentages identified in the triggers are generated by comparing the availability of habitat at a point in time to the acres of habitat available at the signing of the plan amendments.

For both soft and hard triggers, nesting areas will be delineated using lek buffers based on published peer-reviewed data, unless local nesting areas have been specifically mapped by BLM and Forest Service and UDWR biologists using telemetry or other methods with appropriate sampling across the population. Wintering areas will be identified using UDWR mapping, in coordination with BLM and Forest Service biologists.

Habitat Soft Triggers

A habitat soft trigger would be met in PHMA if one of the following criteria is identified through monitoring:

a) 10 percent loss of total GRSG habitat in PHMA; **OR**

b) 10 percent loss of habitat within nesting areas in PHMA; **OR**

c) 5 percent loss of habitat within UDWR mapped wintering areas in PHMA; **OR**

d) any one fire that burns 5 percent of total GRSG habitat in PHMA.

For PHMA in the Ibapah and Hamlin Valley population areas, if a GRSG habitat adaptive management trigger (hard or soft) from a Nevada LUP is met on GRSG habitat in Nevada that is adjacent to the Ibapah or Hamlin Valley PHMA, a soft trigger would be met for the Utah areas, regardless of whether the above criteria have been met or not.

The management to be applied if the soft trigger criteria are met is identified below under the Management Response header. The intent of the population soft trigger is to identify decreases in the availability of GRSG habitat and adjust management before a hard trigger is met.

Habitat Hard Triggers

a) 20 percent loss of total GRSG habitat in PHMA; **OR**

b) 20 percent loss of habitat within nesting areas in PHMA; **OR**

c) 20 percent loss of habitat within UDWR mapped wintering areas in PHMA.

The management to be applied if the hard trigger criteria are met is identified below under the Management Response header. Any change in management would only apply to the PHMA where the trigger is tripped.

MANAGEMENT RESPONSE

To be successful, an adaptive management strategy couples a change in management direction to an identified change in resource condition (e.g., meeting an identified trigger). The type of management response would vary whether a soft trigger is met versus a hard trigger. The larger deviation from natural variation associated with a hard trigger would necessarily correspond with a greater change in management.

Ideally, the adaptive change in management is targeted to respond/resolve the cause of the observed change in resource condition. A causal factor may be associated with one of the threats the USFWS identified in its 2010 listing determination, though additional monitoring information and research may also identify other causes that could result in reaching population or habitat triggers. It is also important to note that while one or more factors may be associated with a habitat or population decline, directly attributing a change to a specific cause or causes may not be possible. The complexity of some interactions may make it difficult to establish a direct cause-and-effect relationship for a specific cause or causes. Many factors have been suggested as affecting GRSG populations and habitats throughout the species' range. These factors can interact in numerous potential complex relationships, making the identification of "the" specific cause or causes difficult. It can be difficult to separate proximate factors from ultimate factors leading to population declines. Further, GRSG populations that use habitat owned or administered by multiple jurisdictions (e.g., private, state, tribal, or other federal) could result in causes of population or habitat declines that are not able to be ameliorated by the BLM.

If direct cause or causes cannot be identified, the change in management may need to address multiple threats that were identified in the area where the trigger was been met in order to alter a negative trend. Absence of a clear cause is not justification to not take some action to reverse a trend.

Management Response to Meeting Soft Triggers

Upon an annual review of monitoring data, if it is apparent that soft trigger criteria have been met for an area (see Spatial Scale discussion below) the BLM will determine if there is a specific cause or causes that are contributing to the decline. In completing this evaluation, the BLM will coordinate with GRSG biologists from multiple agencies including the Forest Service, USFWS, NRCS, and UDWR. Through this coordination, the BLM will review available national, state-wide, and local data to determine if there is additional information that could identify the cause/causes of the declines. The BLM will also coordinate with field office/district and state agency specialists and local GRSG working groups to identify additional information that could assist in identifying the cause/causes.

If it is determined that the decline is related to a natural population variation, no specific management actions would be required. However, if BLM management actions are determined to cause or contribute

to the decline, the BLM manager would apply measures within their implementation-level discretion to mitigate the decline of populations and/or habitats to the area where the trigger has been met. These measures would apply more conservative or restrictive implementation conservation conditions, terms, or decisions within the agencies' discretion to mitigate the decline of populations and/or habitats. If identified, the management measures should address the specific causal factor(s) that resulted in the decline, with consideration of local knowledge and conditions.

Responses to soft triggers may require the adjustment of future project level/plan implementation activities in the short- or long-term, as consistent with the individual site-specific NEPA analyses. Soft trigger responses can come in the form of terms, conditions, design features, BMPs, or site specific mitigation measures. Examples of soft trigger responses could include, but are not limited to:

- Extending seasonal restrictions for seasonal surface disturbing activities (provided as stipulations to a right-of-way grant or a condition of approval to an oil and gas lease),
- Reprioritizing wild horse and burro gathers;
- Applying sequential development after reclamation;
- Temporary area closures related to travel management; (2-year maximum);
- Modifying seasons of use for livestock grazing through annual permit authorizations; and/or
- Applying additional restrictions on discretionary activities, or reject the authorization if mitigation criteria cannot be met.

It is expected that monitoring and management in response to soft-triggers should preclude tripping a "hard" trigger, which signals more severe habitat loss or population declines.

Management Response to Meeting Hard Triggers

Hard triggers represent a threshold indicating that immediate action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the BLM plan. As such, the ARMPA includes a "hard-wired" plan-level response; that is, it provides that, upon reaching the trigger, a more restrictive alternative, or an appropriate component of a more restrictive alternative analyzed in the EIS will be implemented without further action by the BLM in the area where the trigger has been met. Specific "hard-wired" changes in management are identified in **Table I.1**, Specific Management Responses. This table also identifies which decision from the BLM ARMPA would be changed.

In addition to the specific changes identified in **Table I.1**, the BLM will review available and pertinent data, in coordination GRSG biologists from multiple agencies including Forest Service, UDWR, USFWS, and NRCS, to determine the causal factor(s) and implement a corrective strategy in the area where the trigger has been met. The corrective strategy would include the changes identified in **Table I.1**, and could also include the need to amend or revise the RMP/LRMP to address the situation and modify management accordingly.

Table I.1
Specific Management Responses

Program	Adaptive Management Response[1]	Affected Decision Number
Sage-Grouse Management	If a hard-trigger is tripped in the Sheeprocks Population Area, adopt the PHMA boundary from Alternative B and apply management as described in the Proposed Plan, except as modified below.	Modify MA-SSS-1 specific to Sheeprocks
	PHMA within a Population Area (also referred to as a biologically significant unit {BSU}) where a soft trigger has been reached would be the top priority for habitat improvement and restoration projects and for fuels reduction treatments. Areas within and adjacent to PHMA within a Population Area (BSU) where a hard trigger has been reached would be the top priority for regional mitigation habitat restoration and fuels reduction treatments.	Adjust: MA-VEG-1, MA-FIRE-1, and MA-SSS-3A to address specific area
	Collaborate with applicable government entities to implement intensive programs to reduce populations of GRSG predators (e.g., ravens, red fox, badgers, raccoons, skunks, raptors), focusing on area-specific predators to provide GRSG populations the best opportunity to recover while improving habitat conditions.	Adjust MA-SSS-3D to focus on area-specific predators
Vegetation Management	PHMA within a Population Area (BSU), would be the top priority for regional mitigation, habitat restoration and fuels reduction treatments.	Adjust: MA-VEG-1, MA-FIRE-1, and MA-SSS-3A to address specific area
Wild Horse and Burro Management	Initiate emergency gathers to reduce wild horse and burro populations within affected area to low end of AML, subject to funding and holding space availability. If the population is within AML and the area does not meet GRSG habitat objectives, reduce AML for the HMA within the affected area up to 25 percent to facilitate meeting habitat objectives.	Adjust: MA-WHB-7, MA-WHB-3, and MA-WHB-4 to address specific area
Wildland Fire Management	Reassess GRSG habitat needs to determine if priorities for at risk habitats, fuels management areas, preparedness, suppression and restoration have changed.	Adjust MA-FIRE-1 to address specific area
Livestock Grazing	In areas where a soft trigger was met, prioritize the completion of rangeland health assessments to determine if the area is meeting Utah's Rangeland Health Standards and is achieving the GRSG habitat objectives (Objective SSS-3). Focus monitoring and management activities on allotments found not to be achieving Utah's Rangeland Health Standards and that have the best opportunities for conserving, enhancing or restoring habitat for GRSG. For areas not achieving the GRSG habitat objectives (Objective SSS-3), apply one or more of the adjustments to livestock grazing from MA-LG-6.	Adjust: MA-LG-4 and MA-LG-5 to address specific area

Table I.1
Specific Management Responses

Program	Adaptive Management Response[1]	Affected Decision Number
Rights of Way – Existing Corridors	Retain the corridors as mapped, but limit the size of new lines within the corridors to same as existing structures, or not larger than 138kV.	Augment MA-LR-2 and MA-LR-4 with additional criteria
Rights of Way – Outside of Corridors	Management of the affected PHMA Population Area (BSU) would change to exclude high voltage transmission lines (greater than or equal to 100kv) and major pipelines (greater than or equal to 24 inch). No change in management would be made to transmission lines under 100kv or pipelines less than 24 inches.	Augment MA-LR-2 with additional criteria
Wind Energy Development	No change from Proposed Plan.	Not applicable
Industrial Solar	No change from Proposed Plan.	Not applicable
Comprehensive Travel and Transportation Management	If travel management planning has not been completed within GRSG habitat, PHMA areas where the hard trigger was met would be the highest priority for future travel management planning efforts. If travel management has been completed within GRSG habitat in the PHMA where the hard trigger was met, re-evaluate designated routes to determine their effects on GRSG. If routes are found to be causing population-level impacts, revise their designation status to reduce the effect.	Adjust: MA-TTM-4, MA-TTM-2, MA-TTM-5, and MA-TTM-3 to address specific area.
Fluid Minerals	No change from Proposed Plan.	Not applicable
Locatable Minerals	No change from Proposed Plan.	Not applicable
Salable Minerals	No change from Proposed Plan.	Not applicable
Nonenergy Leasable Minerals	No change from Proposed Plan.	Not applicable

[1]Any change in management would only apply to the PHMA where the trigger is tripped.
Unless otherwise noted as a soft trigger response, all Adaptive Management Responses would be implemented where a hard trigger is reached.

In addition to implementing the hard wired plan-level response, in the event that new scientific information becomes available demonstrating that the hard wired response would be insufficient to stop a severe deviation from GRSG conservation objectives set forth in the BLM plan, the BLM will immediately implement a formal directive akin to BLM Instruction Memorandum 2012-043 to protect GRSG and its habitat and to ensure that conservation options are not foreclosed in the area where the trigger has been met. To the extent that it is supported scientifically, this formal directive will be drawn from the range of alternatives analyzed in the development of the RMPA.

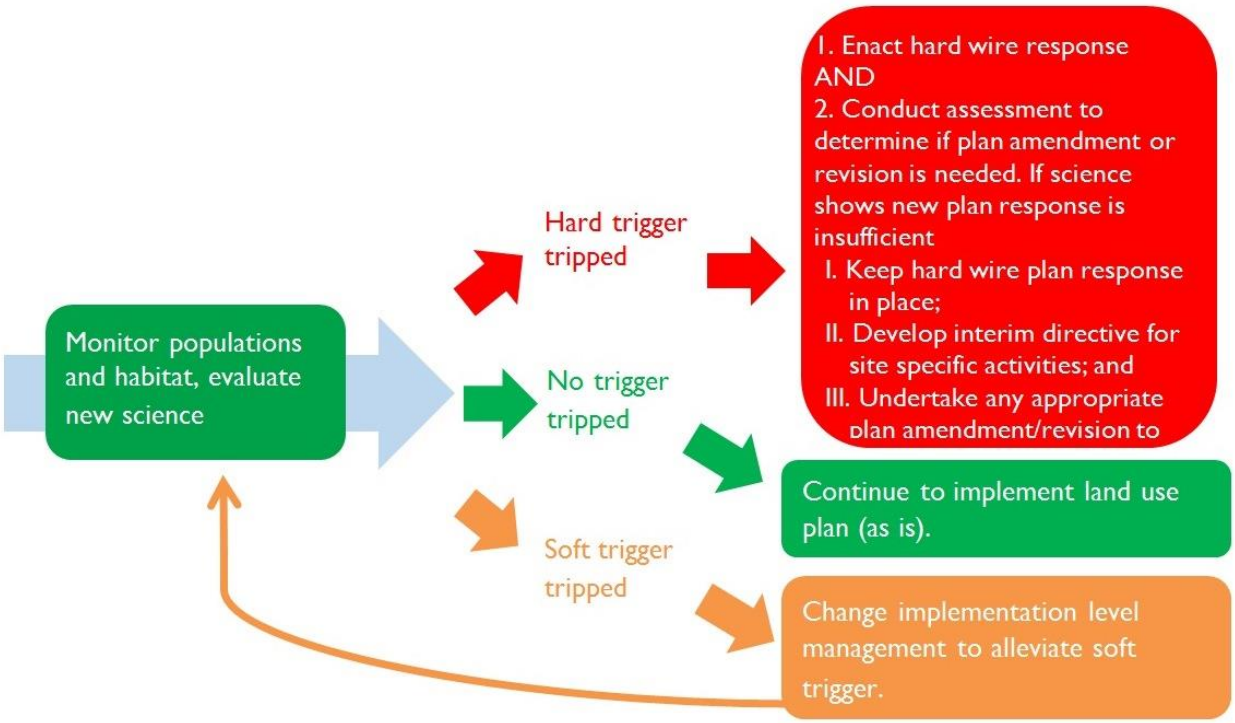
For those Population Areas (BSUs) that are directly connected to identified BSUs in adjacent states (Box Elder, Hamlin Valley, Uintah, and Rich), if a hard trigger is reached on one of the connected BSUs

outside of the Utah sub-region, the applicable WAFWA Management Zone Greater Sage-Grouse Conservation Team will convene to determine the causal factor and propose project level responses, as appropriate, and discuss further appropriate actions that could be applied. The team will also investigate the status of the hard triggers in other BSUs within the PAC (in adjacent states) and will recommend the appropriate plan response. Adoption of any further actions at the plan level may require initiating a plan amendment process.

MONITORING

Monitoring is a critical part of implementing adaptive management. Through monitoring, the agencies determine when a trigger has been met, as well as whether management actions taken, including adaptive responses, are effective in increasing GRSG habitat and populations. The following image shows how monitoring information will be integrated into implementation of the adaptive management plan.

This ARMPA contains a Monitoring Framework Plan (**Appendix D**) that monitoring of several aspects of GRSG biological criteria and aspects of monitoring RMP effectiveness. The information collected through the Monitoring Framework Plan will be used by the BLM to determine when adaptive management hard and soft triggers are met.



The BLM will organize an adaptive management working group, inviting participation from the Forest Service, USFWS, local governments, and UDWR. This group will annually review monitoring information related to GRSG populations and habitat availability to determine if an adaptive management trigger has been met.

The working group will evaluate GRSG population data collected by the UDWR's lek counts, as well as habitat information available from the BLM's National Operation Center. Habitat information available from the BLM National Operation Center is based on remotely sensed sagebrush vegetation collected as part of the LANDFIRE Existing Vegetation Type layer. Habitat information may be adjusted based on locally available vegetation data, if agreed upon by all adaptive management working group members. However, the baseline for determining the percent loss for the purposes of the adaptive management triggers must remain associated with a consistent vintage, namely the finalization of the RMP-decisions. It is also important that the vegetation data remain at a scale consistent with implementation of the adaptive management plan (BSUs), and remain at such a consistent scale over time.

SPATIAL SCALE

GRSG biologists, assigned to the multi-agency adaptive management working group, will assess population and habitat adaptive management triggers for PHMA within each Population Area (also referred to as BSUs when coordinating with other states). A BSU is a geographical/spatial area that contains the relevant habitats which are used by GRSG. In Utah, the BLM is applying adaptive management monitoring and management to the total PHMA area associated with a GRSG population area. When coordinating with adjacent states in regional monitoring and management, these areas will be referred to as BSUs. These areas generally align with habitat areas within the State of Utah's Sage-Grouse Management Areas (SGMAs) with two adjustments. One adjustment includes some PHMA in the Carbon area that was not identified as an SGMA. Portions of the Anthro Mountain and West Tavaputs areas are combined with Emma Park area for adaptive management purposes. The other adjustment is the Emery population (Wildcat Knoll and Horn Mountain) that is combined with the Parker Mountain SGMA but will be considered separately because the population is small in size and effects to this population would be masked by what is going on in the much larger Parker SGMA. As a result, PHMA in the following areas will be monitored and evaluated for population and habitat adaptive management triggers: Box Elder, Rich, Uinta, Strawberry, Carbon, Emery, Parker, Panguitch, Bald Hills, Hamlin, Sheeprocks, and Ibapah. These areas generally represent population use areas within the sub-region.

As described in the Monitoring Framework Plan, habitat data can be collected at these "BSU" scales, and can be both aggregated up to the state-wide population, WAFWA Management Zone, or other reporting units. Similarly, more specific habitat delineation may be gathered identifying specific seasonal use patterns and even daily movements and preferences. However, in monitoring landscape changes in habitat and effects on GRSG populations, the interagency team of GRSG biologists identified the Population Area/SGMA/BSU scale as best capturing the needed metrics at a meaningful and consistent scale. The boundaries of these and other reporting units may be adjusted over time based on the understanding of local population interactions and climate variation.

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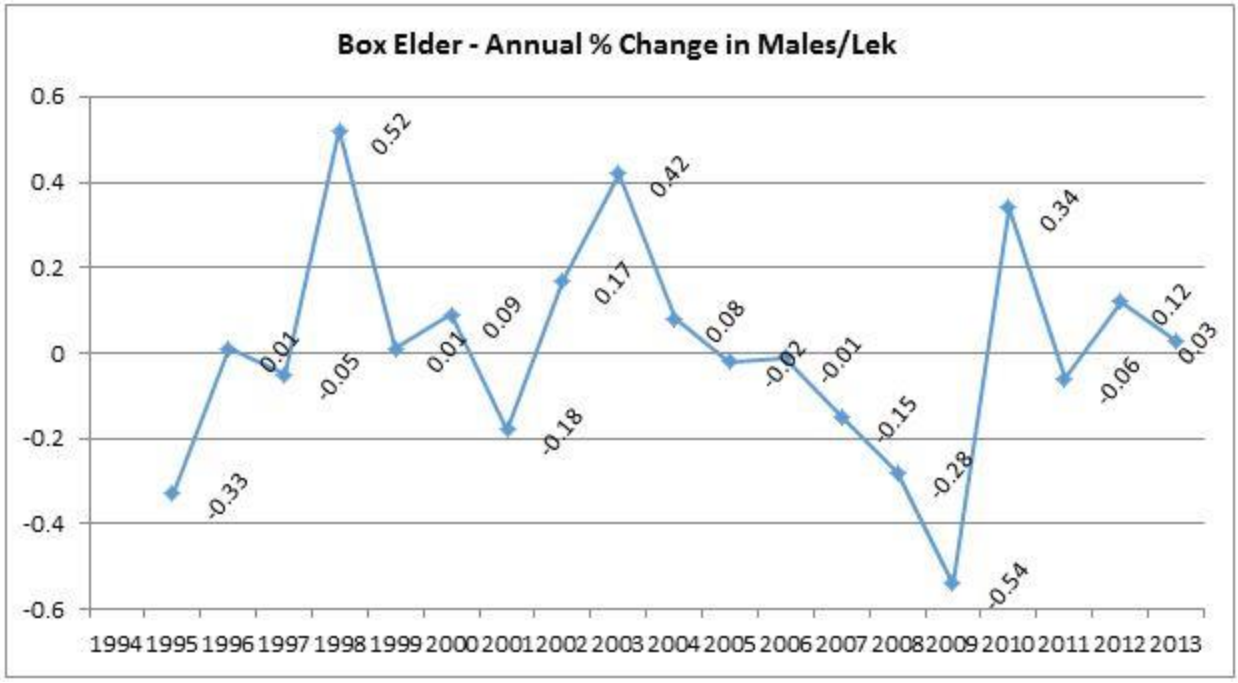
ATTACHMENT A - POPULATION TREND GRAPHS

Explanation of Graphs

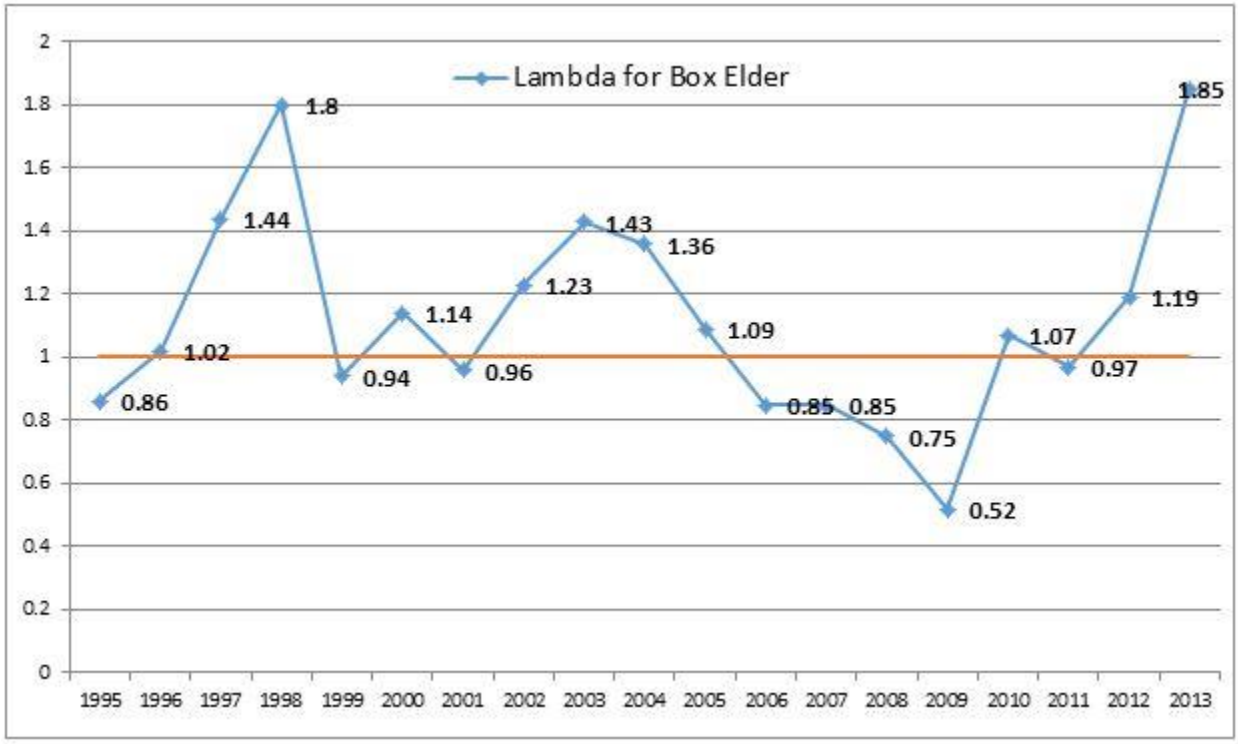
The following information is provided for the purposes of adaptive management, and identifies each GRSG population unit being considered specifically for adaptive management triggers. For each population, we list the leks that will be closely monitored for the population adaptive management triggers. The first graph represents the average males per trend lek (blue line) and the 10-year running average of males per lek for the trend leks (red line). The second graph is the change from year to year on the trend leks. If the number is < 0, average males on trend leks have declined since the previous year. If it is > 0, the average males on trend leks have increased since the previous year. The third graph is the Lambda for all the leks in the population, as a means of ensuring that the trend leks are representative of what is going on with the entire population. If Lambda is < 1, the entire population declined from the previous year. If Lambda is >1, the entire population increased from the previous year.

Box Elder

In this PHMA, 21 of 79 leks were identified as trend leks (Badger Flat, Cotton Thomas, Dove Creek Sign, Dove Creek Upper West, Dry Basin, Dry Canyon Mountain North, Goose Creek South, Hardister, Highway Cut, Keg Spring Turnoff, Lynn Reservoir North, Meadow Creek pass, Park Valley M53, Red Bank Spring, Sickle Spring, Warm Springs Road, Dakes Pass, with Cliff Reservoir, Middle Canyon, Ray Kimber Ranch, and Wildcat Knoll for spatial representation). In addition, some leks were clumped because they were previously reported as one number of strutting males but were split to reflect the exact location of the multiple strutting spots (Hardister leks, Red Bank Spring leks, and the Cotton Thomas/First leks).

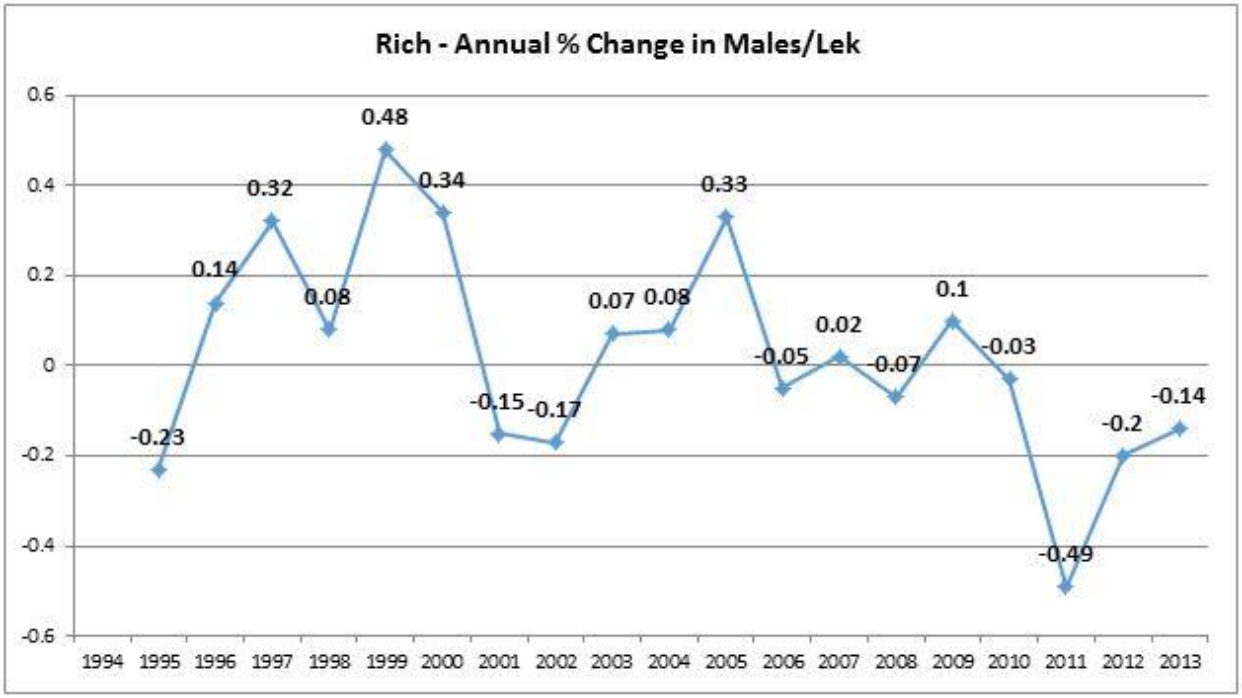


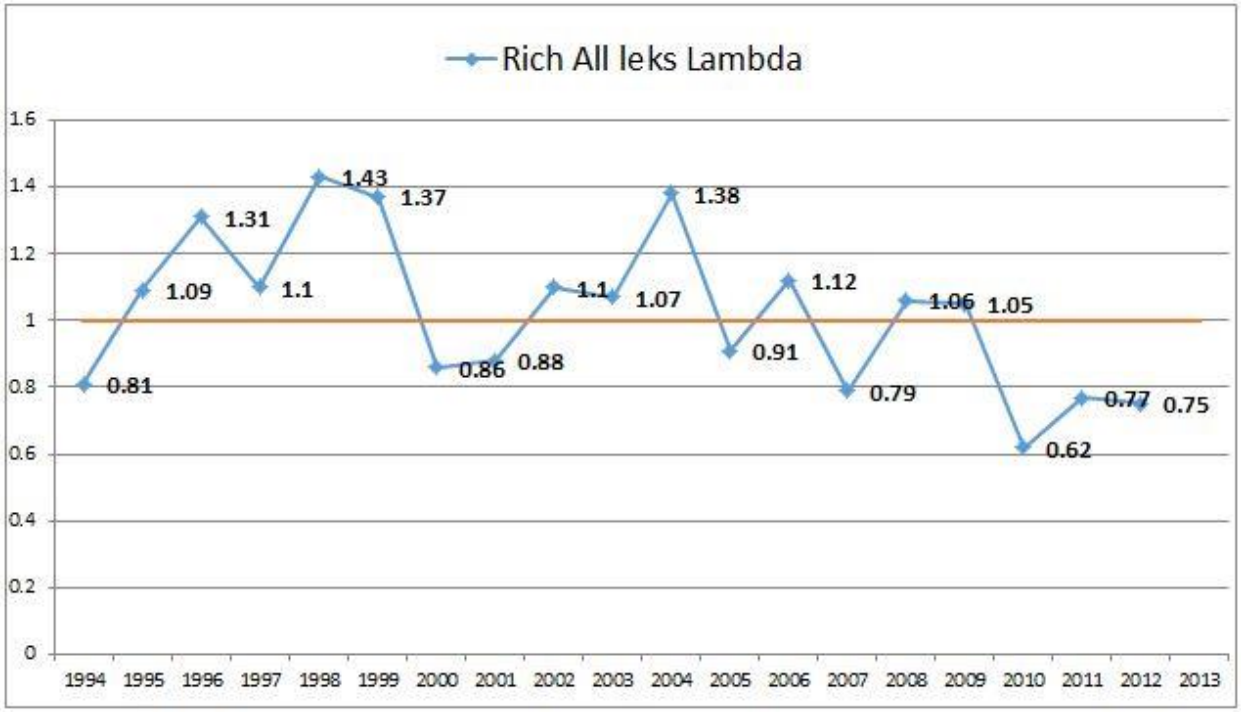
Note: Any time the annual change goes below 0, there is a decline in the population between years. Similarly, any time the annual change is above 0, that represents an increase between years.



Rich

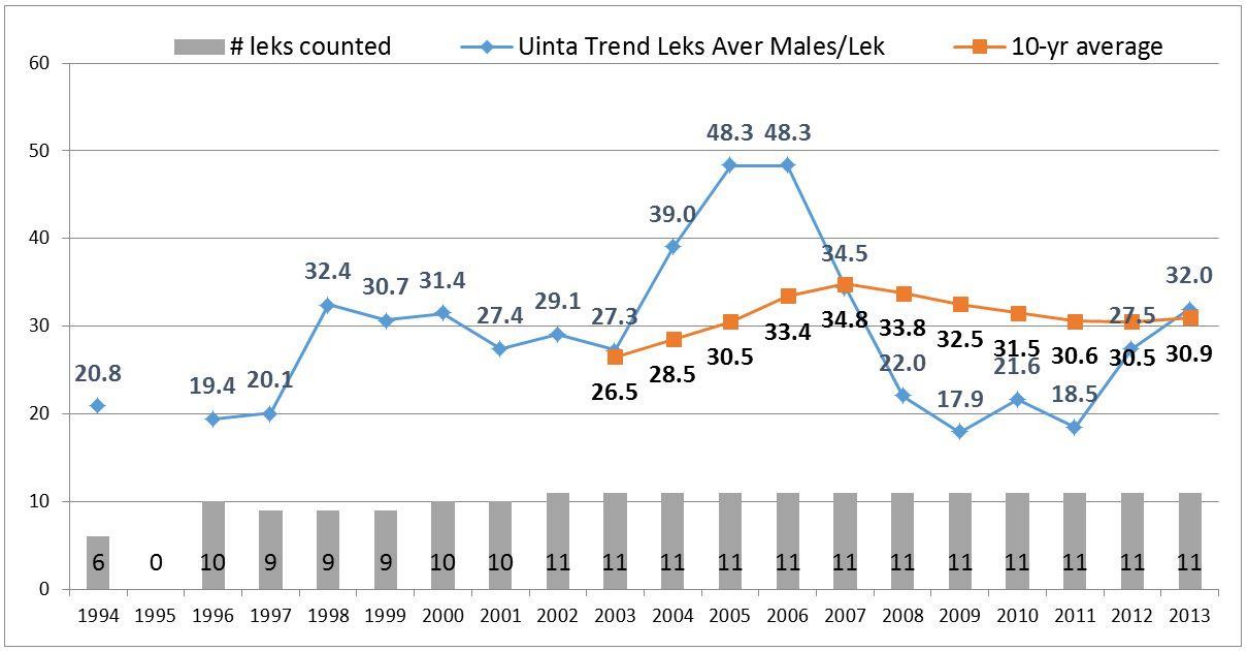
In this PHMA, 18 of 54 leks were identified as trend leks (Alkali Hollow, Black Tank, Cabin Hollow, Chicken Treatment, Dixon Hole, Dry Hollow North, Dry Hollow South, Hardware Plateau, Henefer Divide, Lake Ridge, McKay Hollow, Neponset, North Eden, Otter Creek, Six Mile, South Lake North, Spring Canyon North, Stacey Hollow and for spatial representation, Little Creek and Woodruff leks).

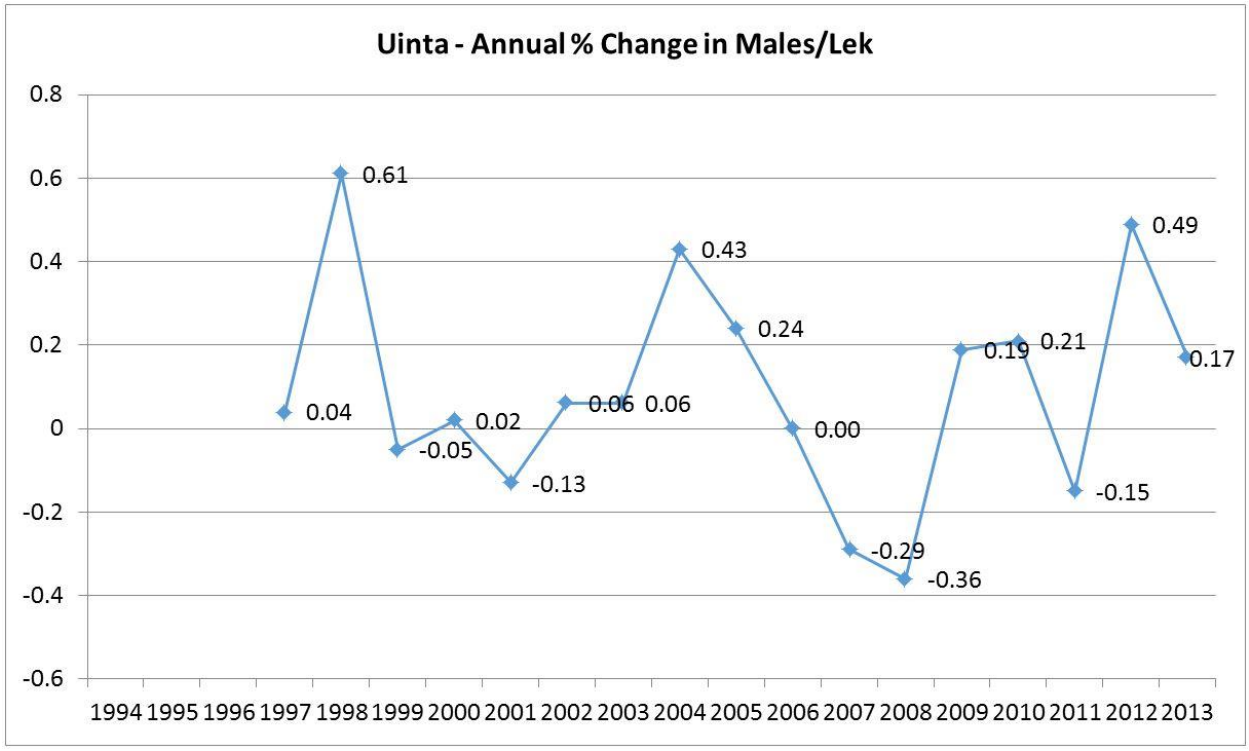


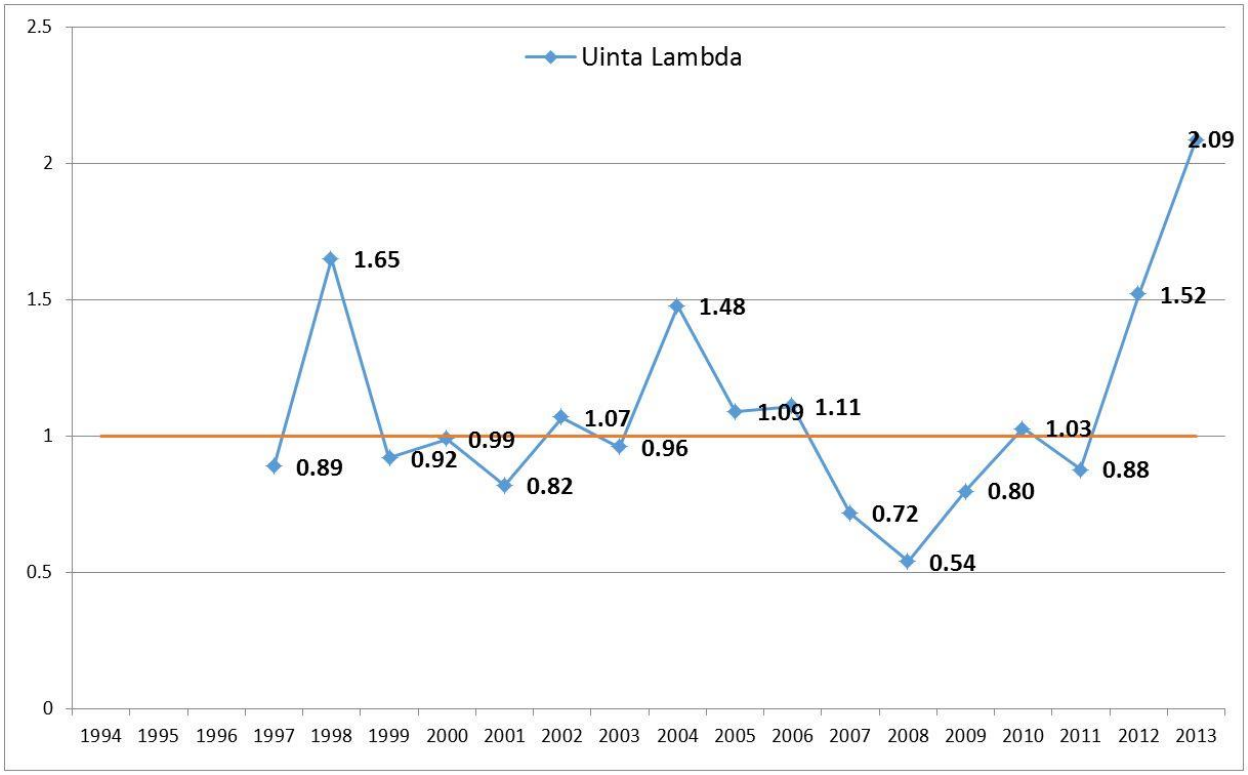


Uinta Basin

In this PHMA, 11 of 53 leks were identified as trend leks (Seedskadee, Blue Mountain, Goslin Mountain, Benchmark, Borens Salt Shed, Diamond Mountain Burn, Diamond Springs, Taylor Mountain Face, West McKeaknie, Red Narrows West, and Little Mountain South). These leks represent 2 of 6 leks in Three Corners/Browns Park area, 2 of 8 leks in Blue Mountain, 5 of 24 leks on Diamond Mountain, and 2 of 7 leks on Halfway Hollow.

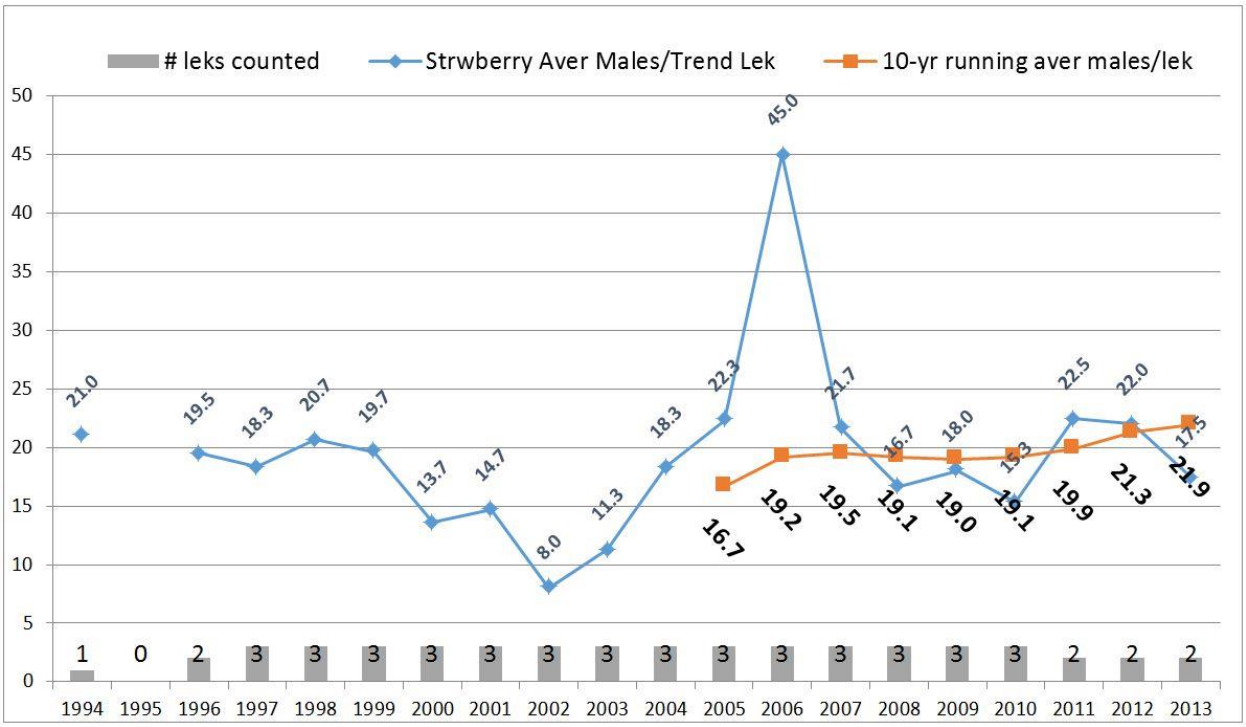


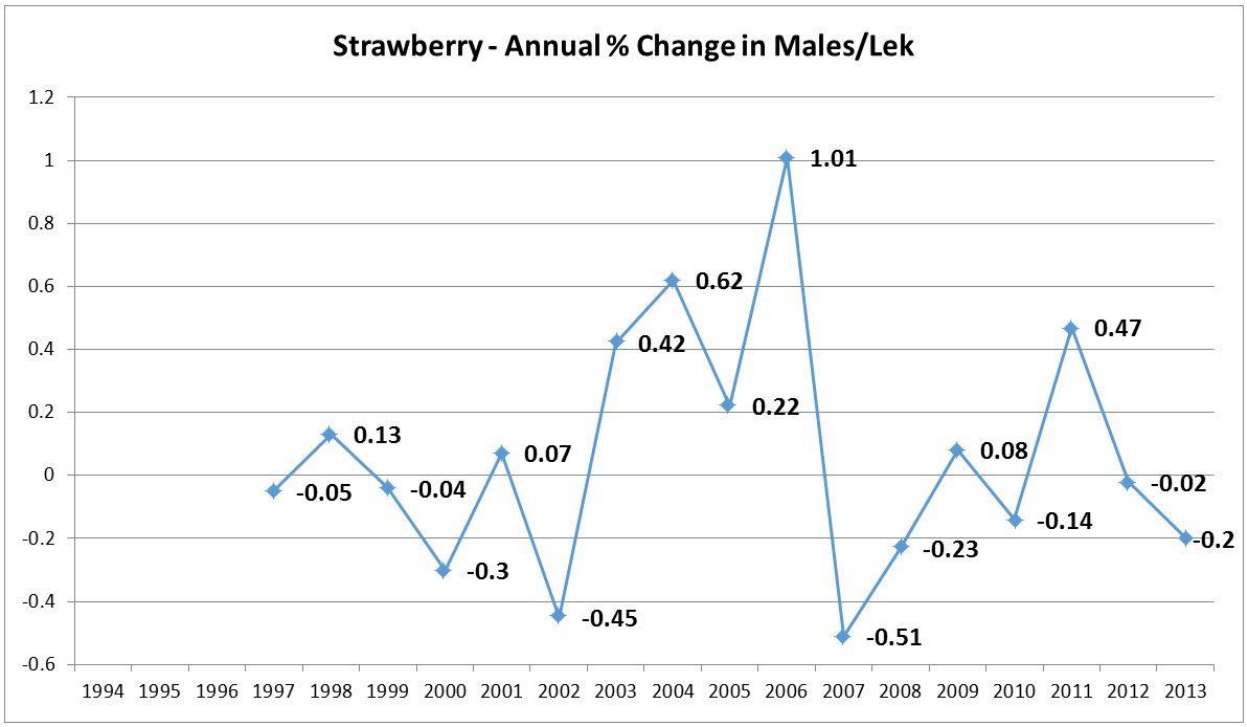

Uinta - Annual % Change in Males/Lek
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0.04
0.61
-0.05
0.02
-0.13
0.06
0.06
0.43
0.24
0.00
-0.29
-0.36
0.19
0.21
-0.15
0.49
0.17
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

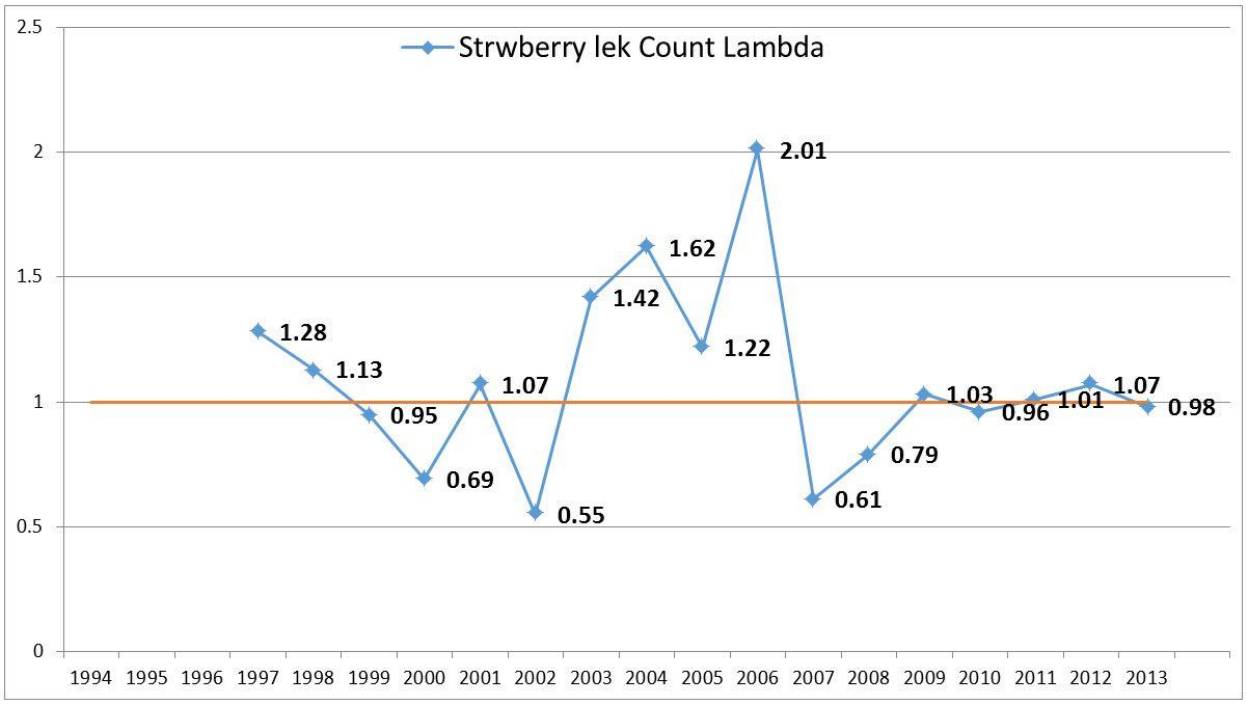

Uinta Lambda
2.5
2
1.5
1
0.5
0
0.89
1.65
0.92
0.99
0.82
1.07
0.96
1.48
1.09
1.11
0.72
0.54
0.80
1.03
0.88
1.52
2.09
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Strawberry-Fruitland

In this PHMA, 3 of 8 leks were identified as trend leks (Lower Red Creek, Road Hollow, and Saleratus Upper).

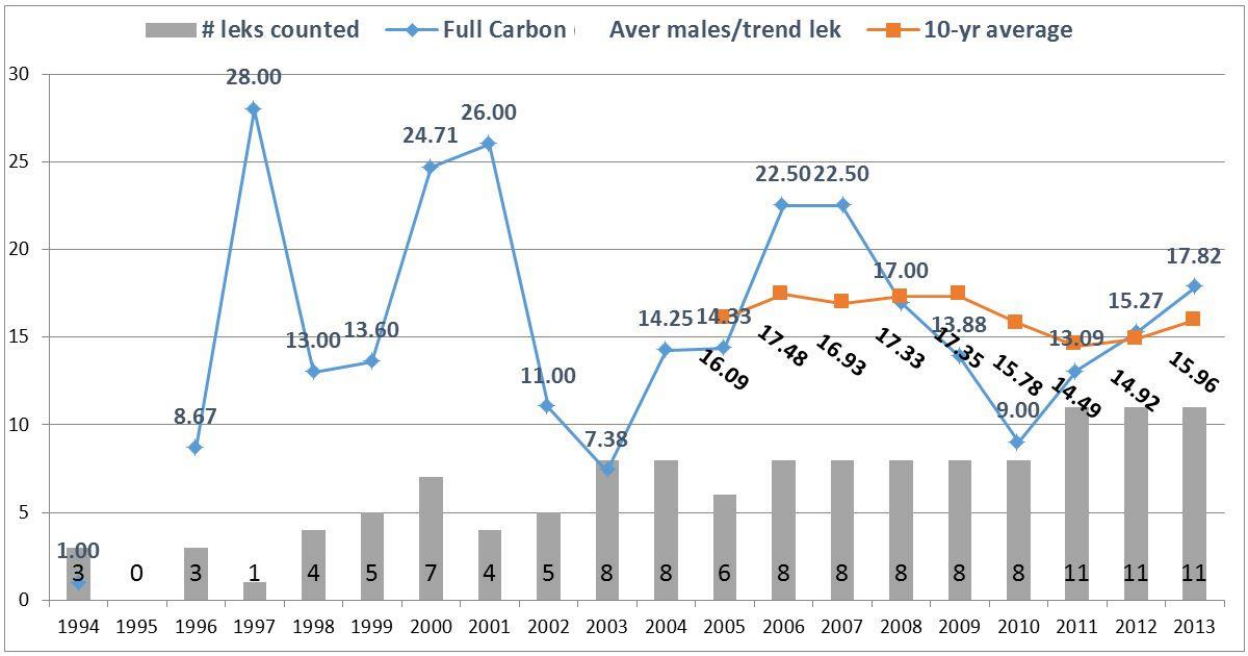


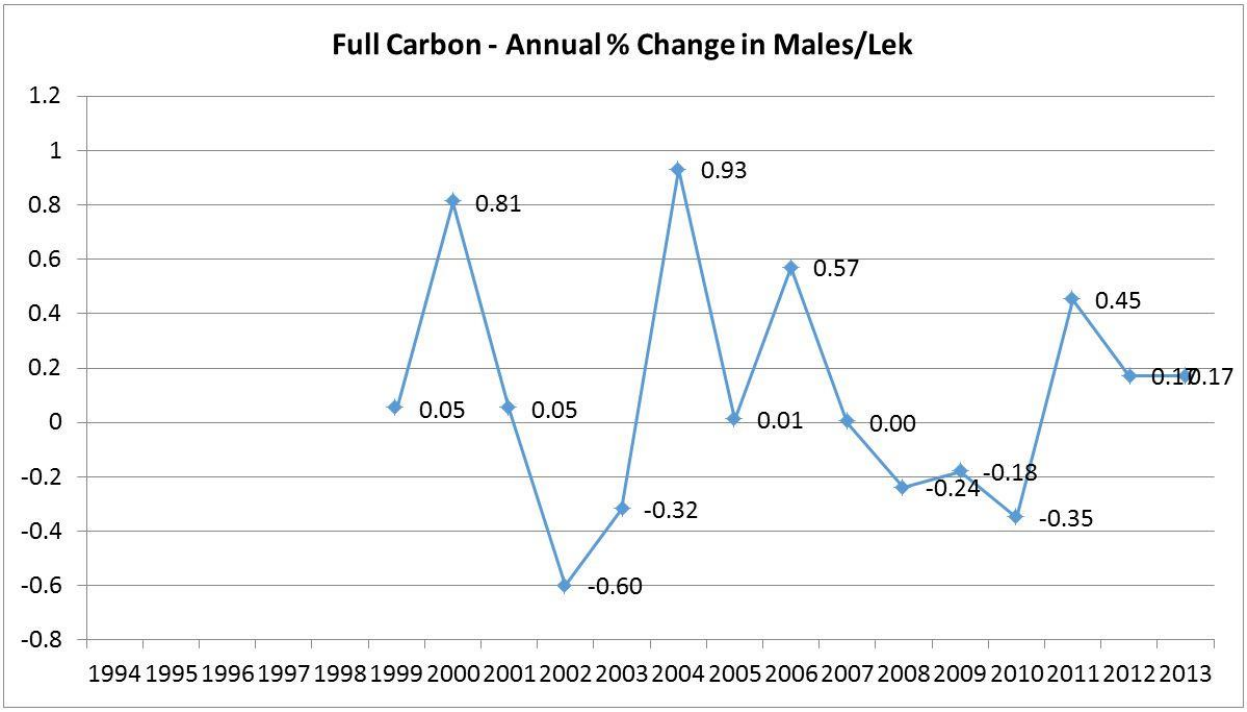


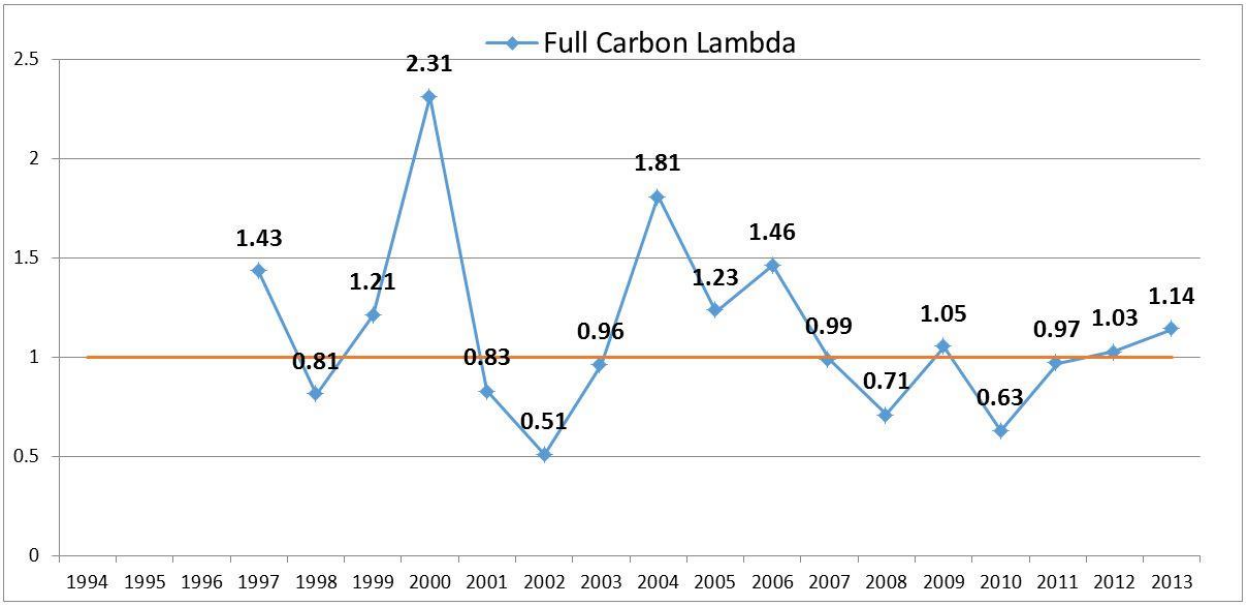


All Carbon (Emma Park, Anthro Mountain, and West Tavaputs)

BLM decided to group Emma Park, West Tavaputs, and Anthro Mountain into "All Carbon", similar to the Uinta Basin grouping but more justifiable because of documented movements. In these populations, 11 of 24 leks were used as trend leks (Antone Creek, Brook Meadow, Moynier Meadows, Houston, Lost Creek, Matt's Summit, Jeep Trail, Nutters Ridge, Bishop Ridge Corral, Steer Ridge Pond, and Steer Ridge Snag). These trend leks represent Anthro Moutain (2 leks), West Tavaputs (3 leks), and Emma Park (6 leks).

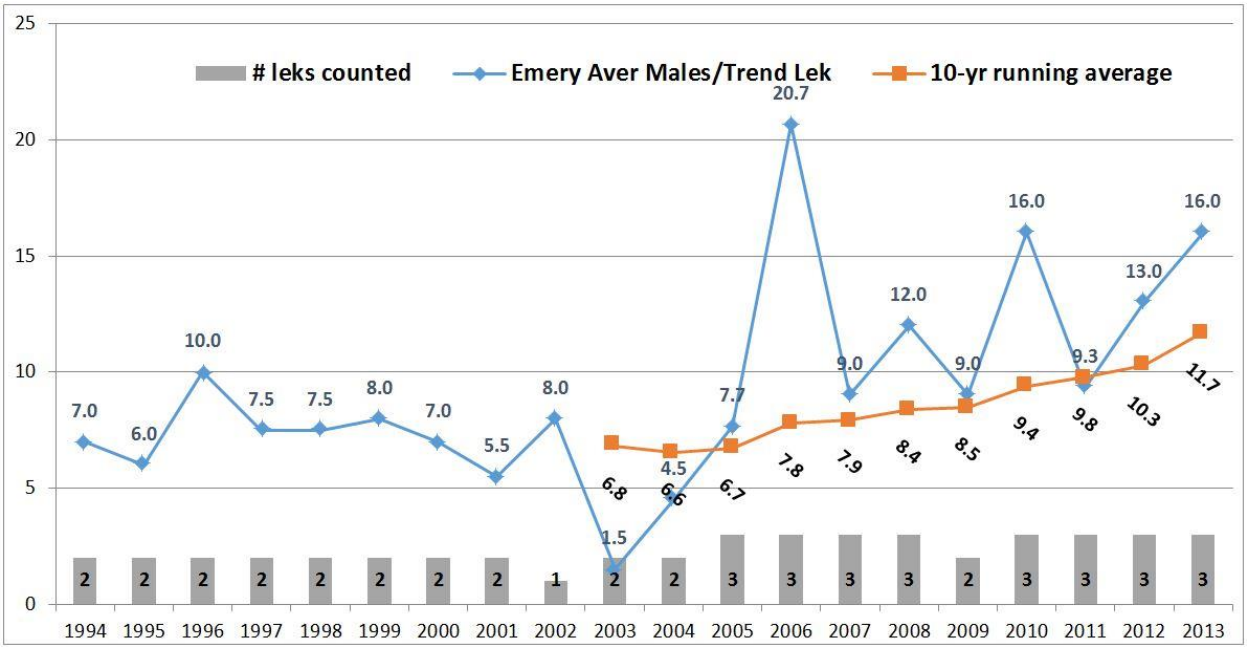


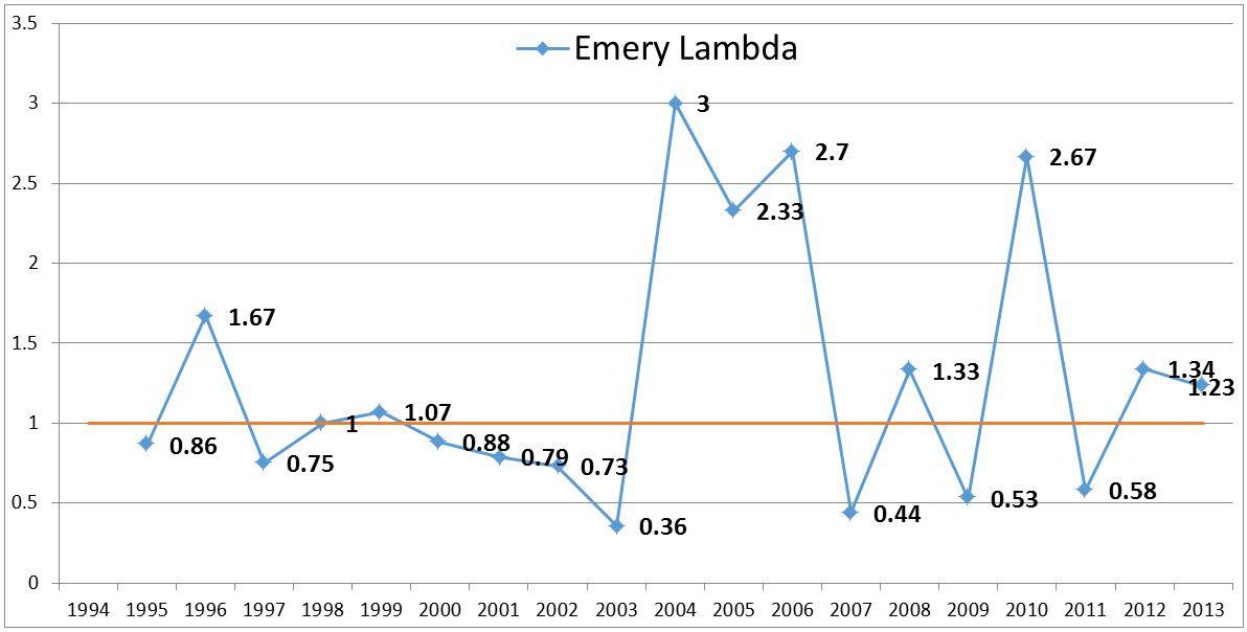

Full Carbon - Annual % Change in Males/Lek
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0.05
0.81
0.05
-0.60
-0.32
0.93
0.01
0.57
0.00
-0.24
-0.18
-0.35
0.45
0.17
0.17
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013


Full Carbon Lambda
2.5
2
1.5
1
0.5
0
1.43
0.81
1.21
2.31
0.83
0.51
0.96
1.81
1.23
1.46
0.99
0.71
1.05
0.63
0.97
1.03
1.14
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Emery

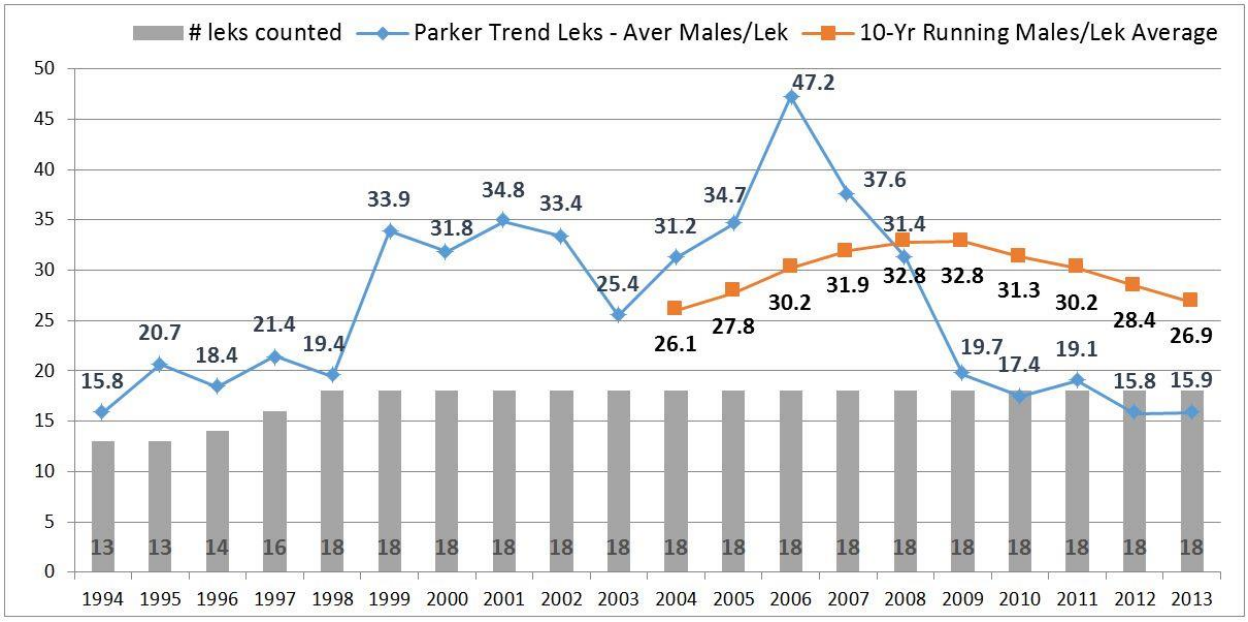
This PHMA is Wildcat Knoll and Horn Mountain and was specifically considered separately from the larger Parker Mountain PHMA because there is no documented bird movement between the two areas. This was also done to provide that substantial declines in the smaller Emery area would be detected and appropriate management actions made. There are only 3 occupied leks in Emery and all 3 leks will be used as trend leks for the adaptive management assessment. For this population, all the leks are being monitored for changes in average males per lek. Therefore, it is not necessary to calculate annual changes from year to year separately, because Lambda already captures this.

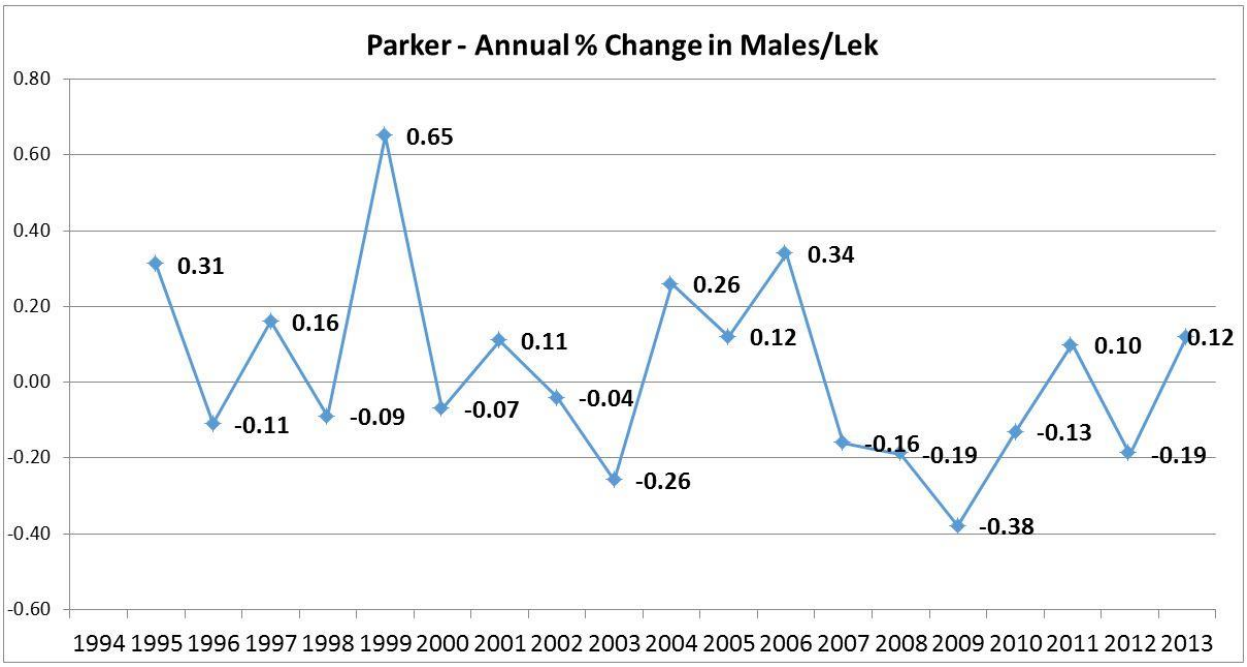


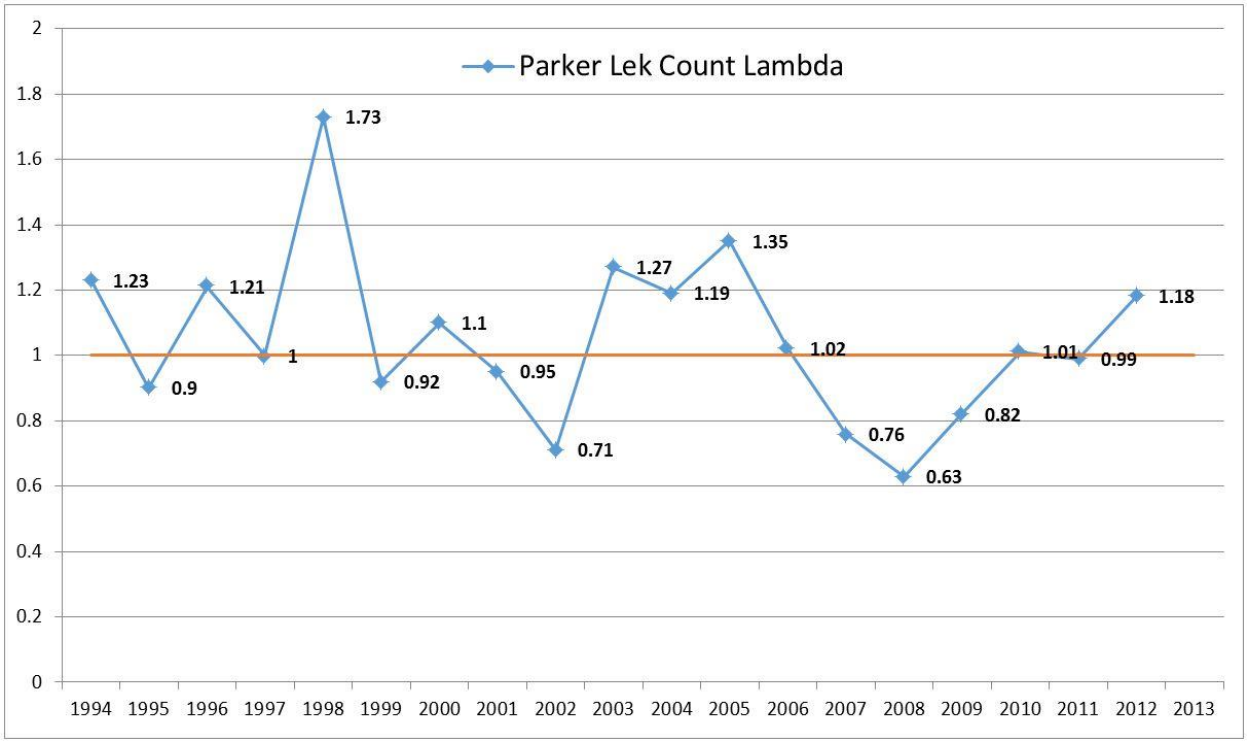


Parker Mountain

In this PHMA, 18 of 50 leks are trend leks (Angle, Bald Knoll Reservoir, Balsam Hollow Reservoir, Black Point, Bull Roost, Cedar Peak, Dog Flat, Dry Lake, Hare Lake, Hunts Reservoir, John L. Swale, John's Valley Cottonwood, Mud Lake Reservoir, Sage Reservoir, Tom Best Spring, Vance Corral, Vance Reservoir, and Widstoe).

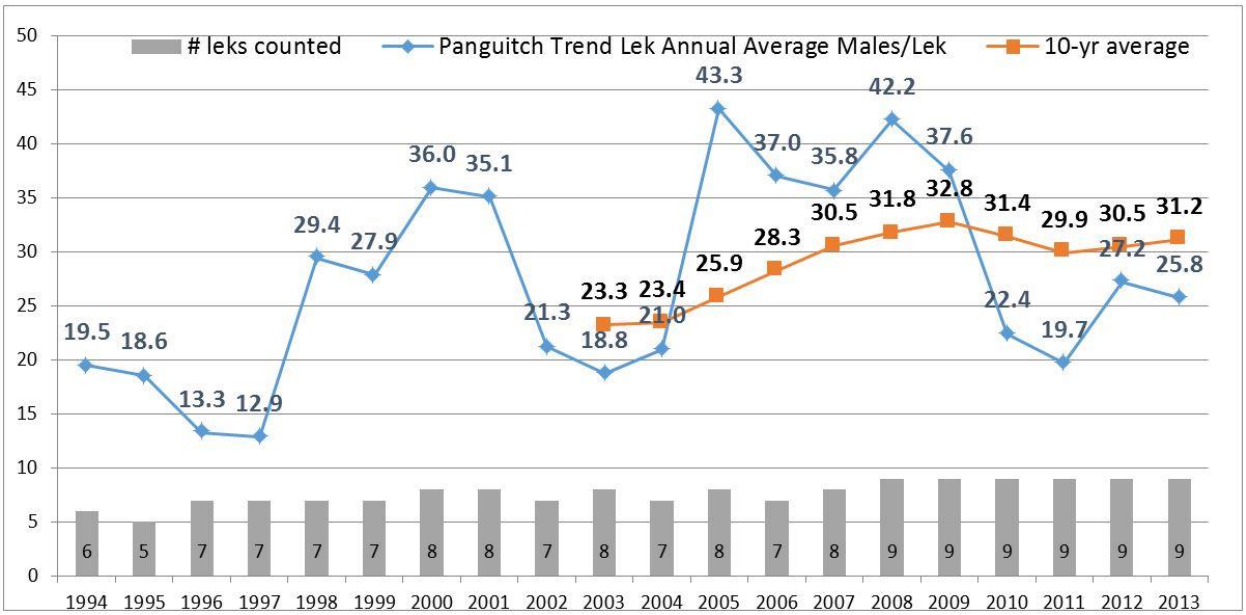


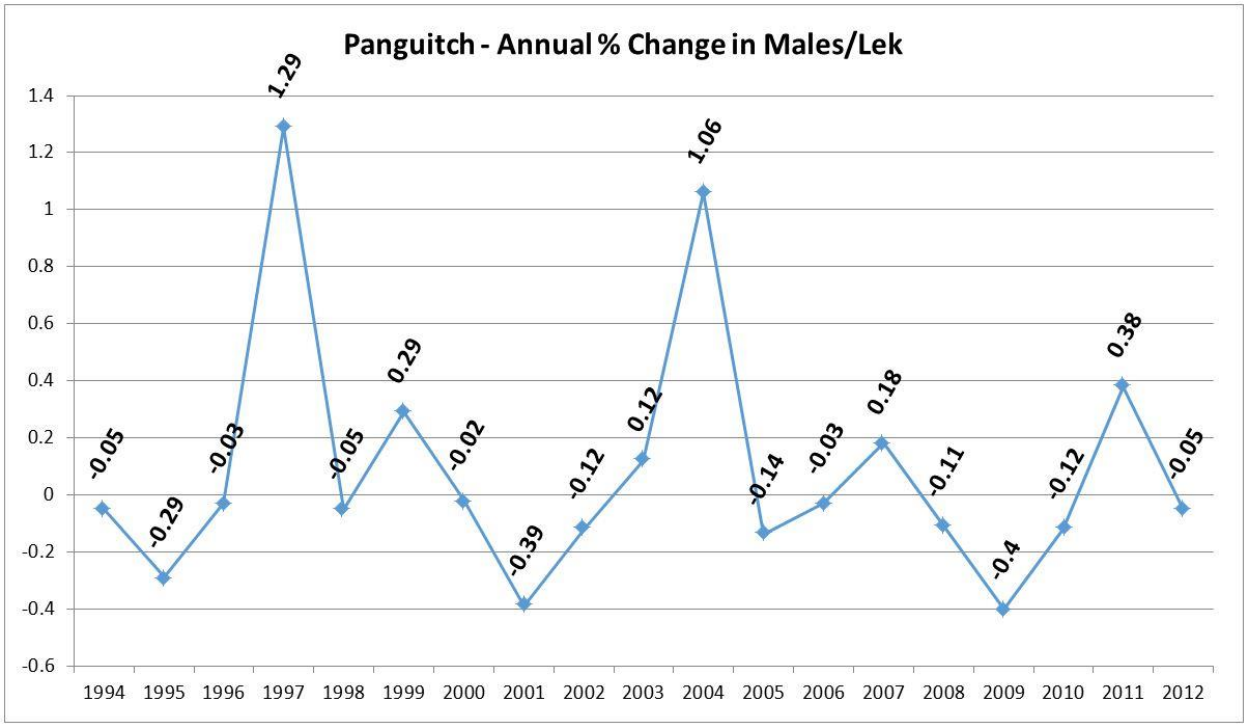


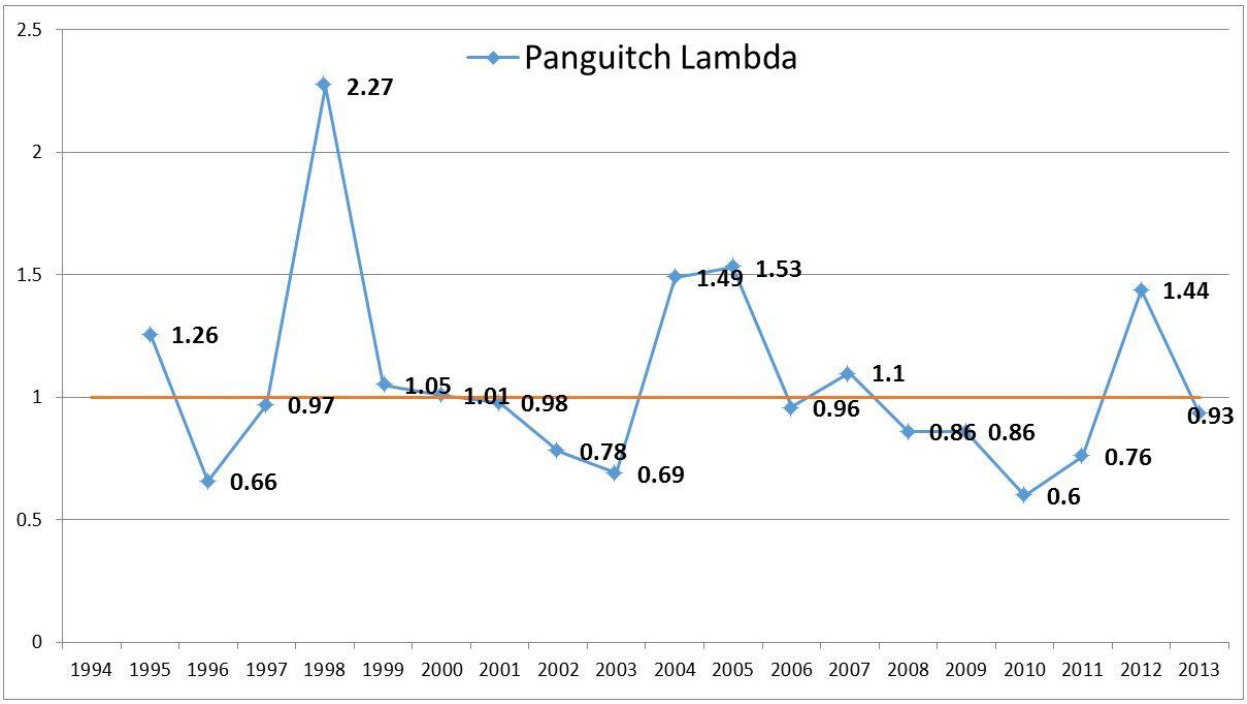


Panguitch

In this PHMA, 9 of 17 occupied leks are trend leks (Sage Hen Hollow, Panguitch Valley East Bench, Pole Hollow Ridge, Butler Creek, Hoyt's Ranch, Sink Hollow and for spatial representation, Buckskin Valley, Dog Valley, and Upper Bear Valley North leks were added).

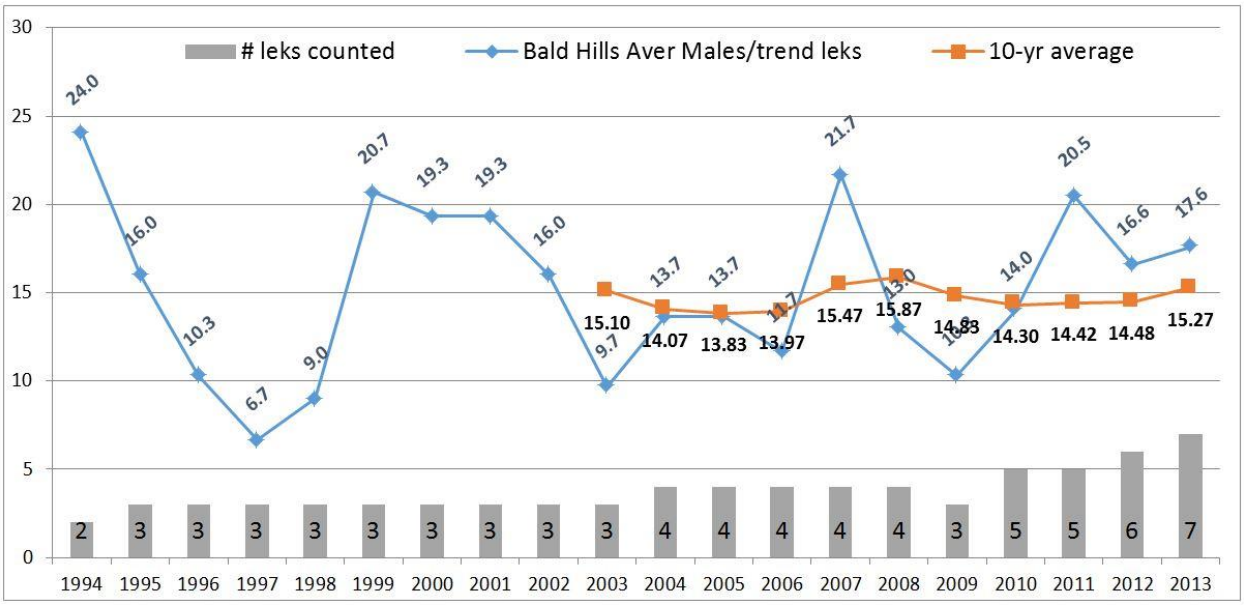


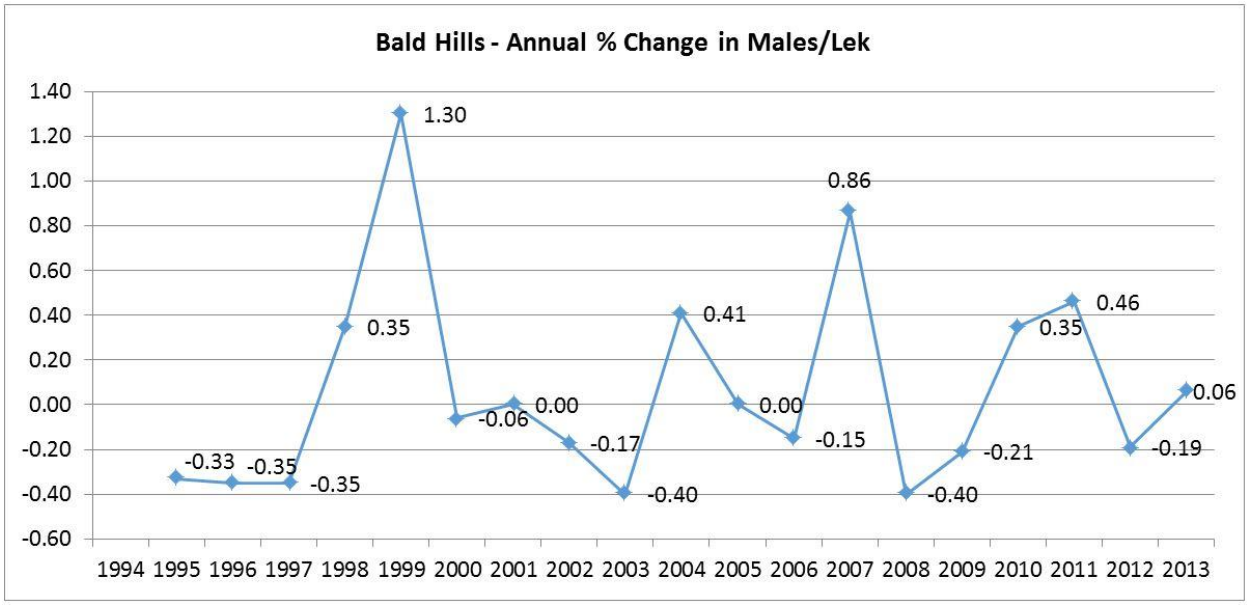

Panguitch - Annual % Change in Males/Lek
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.05
-0.29
-0.03
1.29
-0.05
0.29
-0.02
-0.39
-0.12
0.12
1.06
-0.14
-0.03
0.18
-0.11
-0.4
-0.12
0.38
-0.05
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

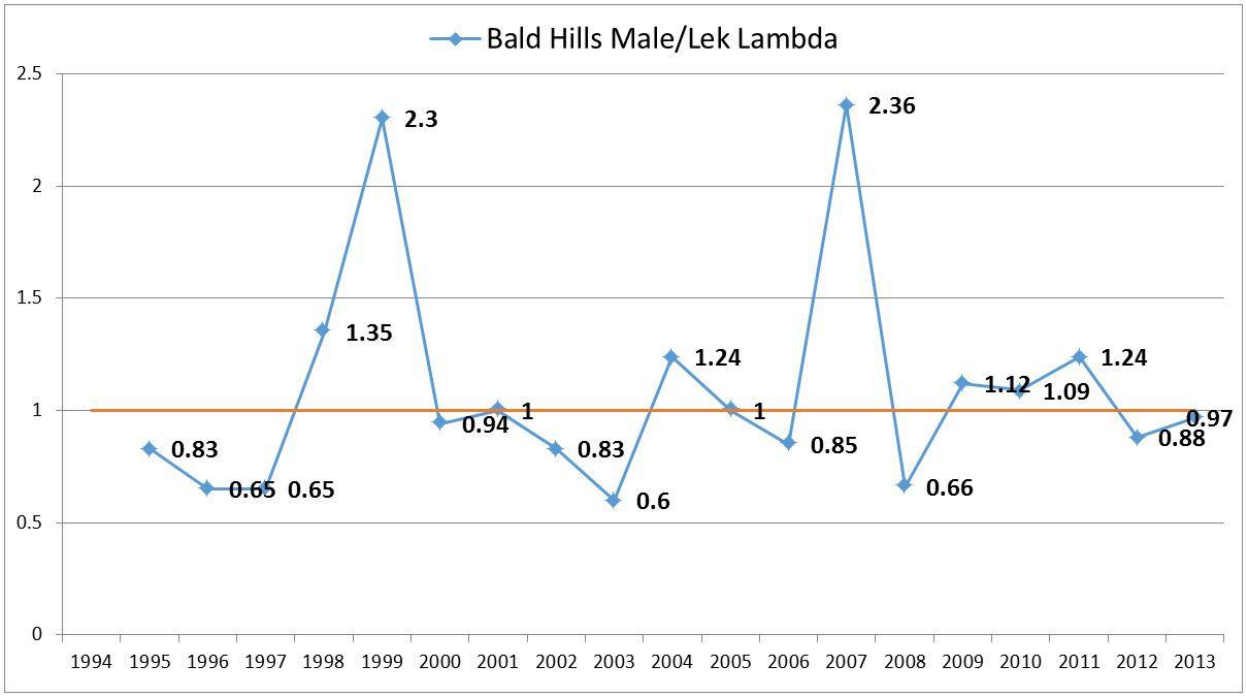

Panguitch Lambda
2.5
2
1.5
1
0.5
0
1.26
0.66
0.97
2.27
1.05
1.01
0.98
0.78
0.69
1.49
1.53
0.96
1.1
0.86
0.86
0.6
0.76
1.44
0.93
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Bald Hills

In this PHMA, 7 of 12 leks are trend leks but four leks have been combined into two leks since the newer lek is anticipated to be the result of fire to the old lek (Minersville and Poorman Ridge). As a result, for the purposes of adaptive management, the Minersville lek is combined with the Marshall lek and the Poorman Ridge lek is combined with the Poorman Jeff lek.

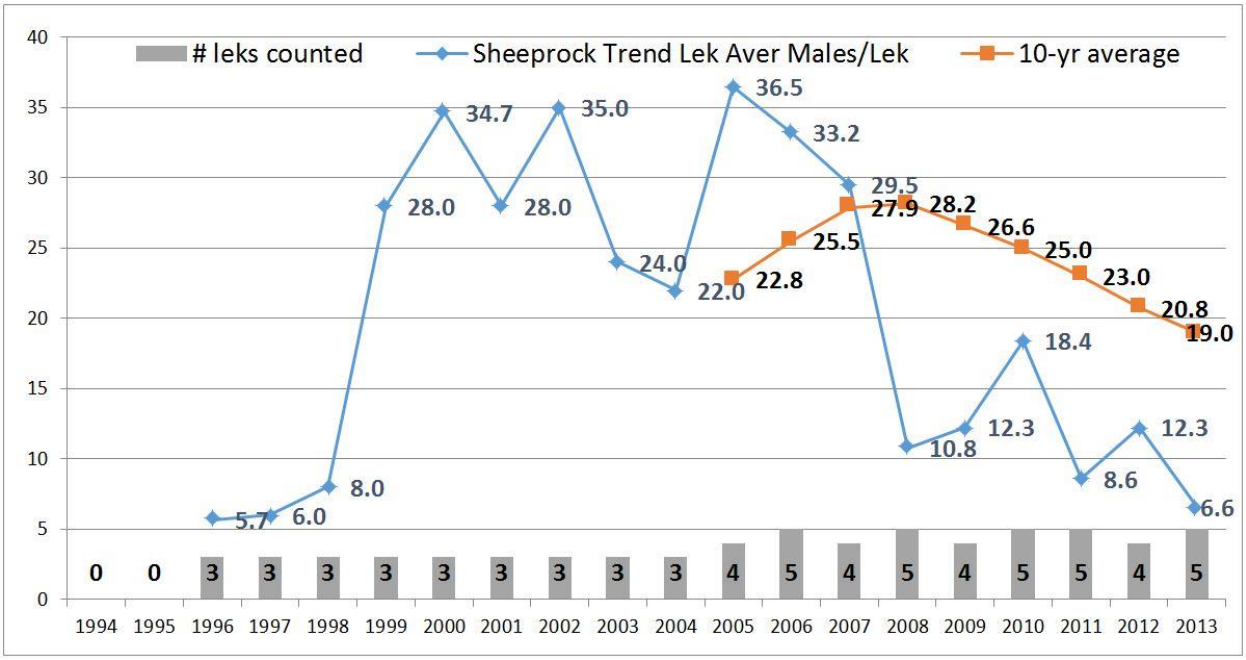


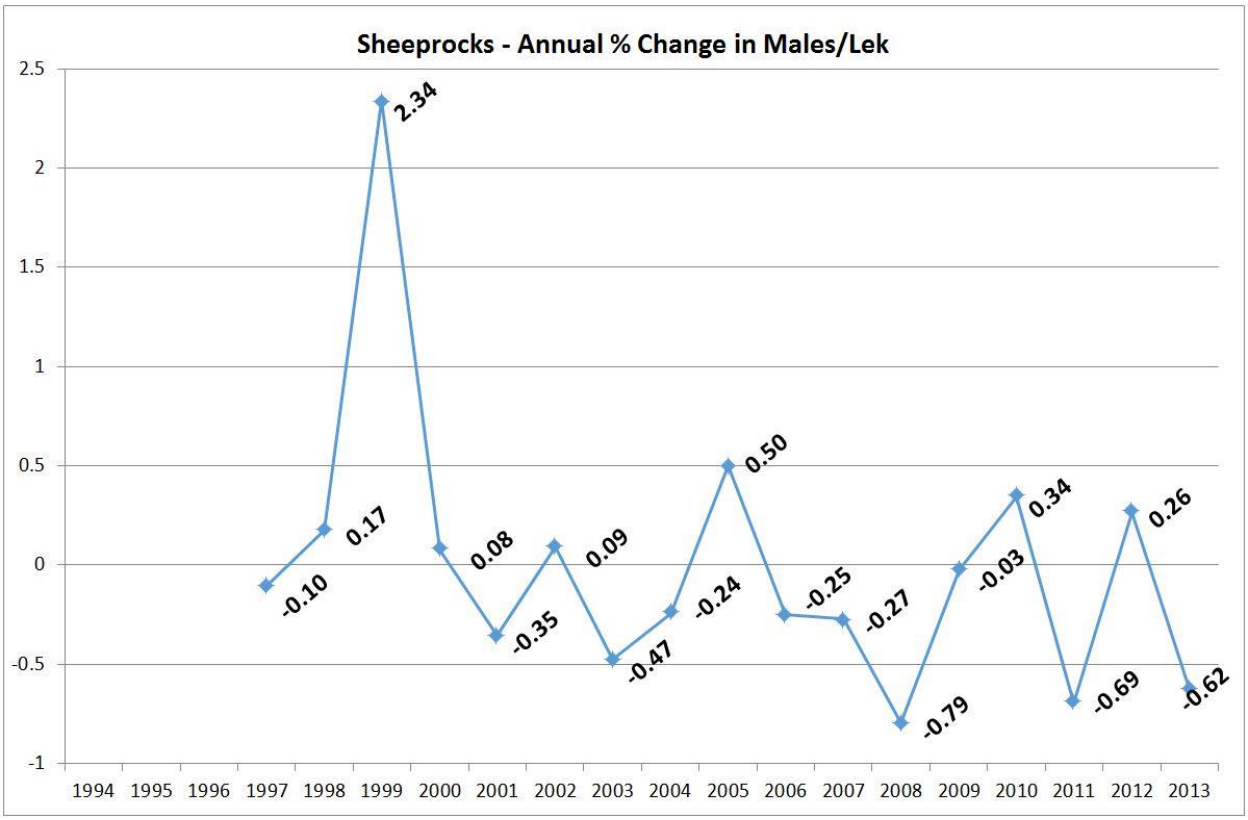


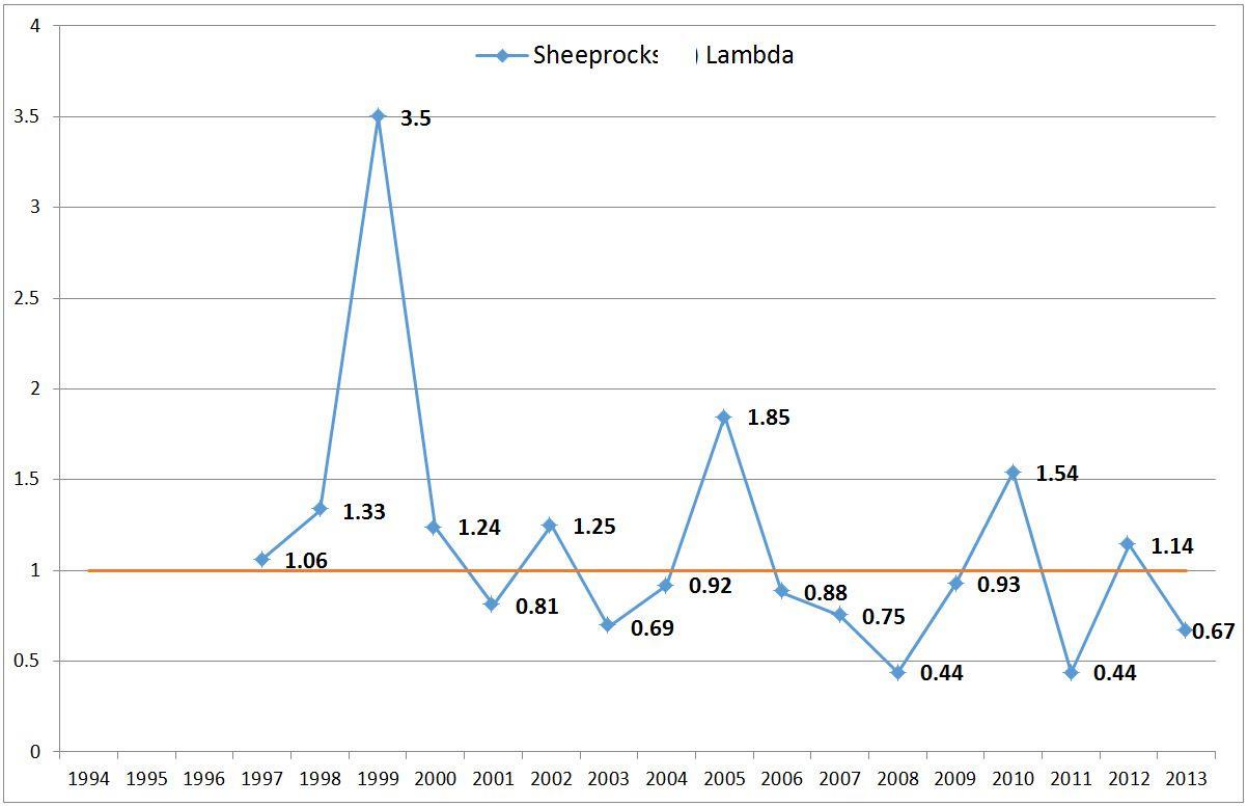


Sheeprocks

In this PHMA, 5 of 7 leks are trend leks (McIntyre Meadow, McIntyre Ridge, Vernon Little Valley, and for spatial representation Benmore Pastures and Government Creek leks were added).

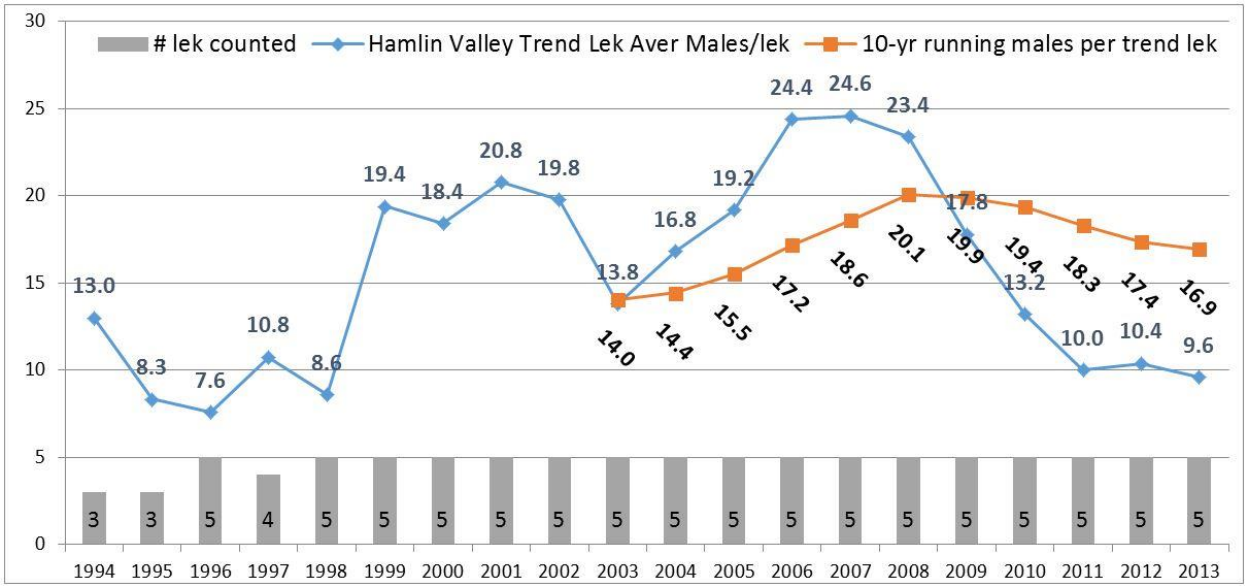


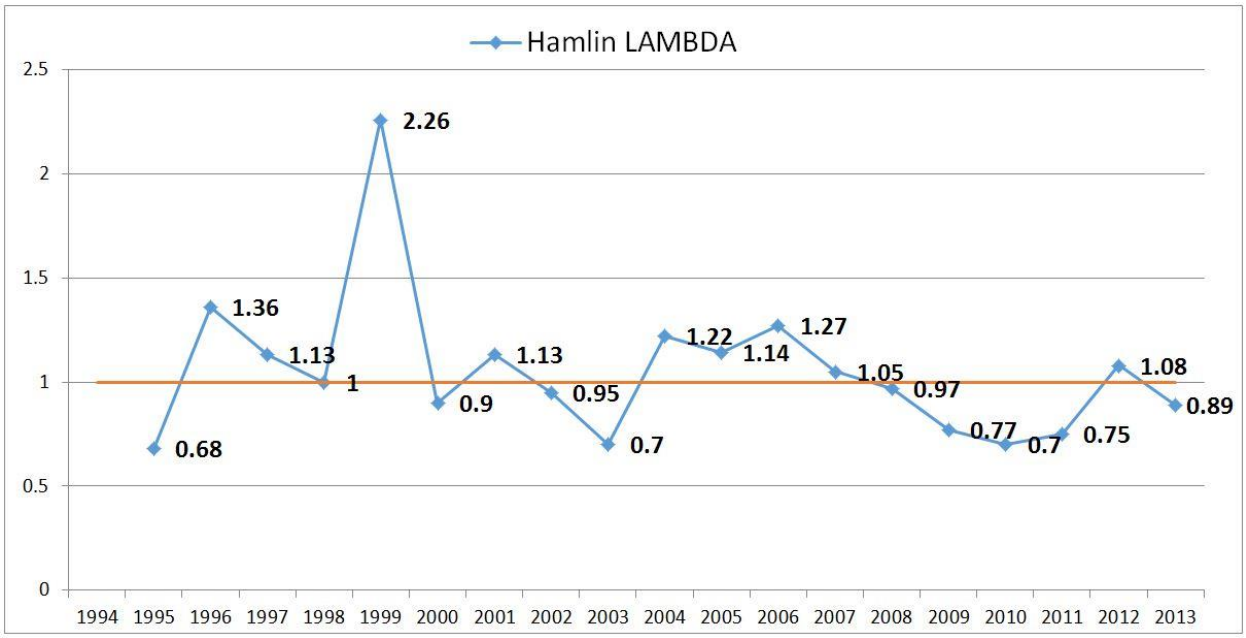

Sheeprocks - Annual % Change in Males/Lek
2.5
2
1.5
1
0.5
0
-0.5
-1
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
-0.10
0.17
2.34
0.08
-0.35
0.09
-0.47
-0.24
0.50
-0.25
-0.27
-0.79
-0.03
0.34
-0.69
0.26
-0.62


Sheeprocks
Lambda
4
3.5
3
2.5
2
1.5
1
0.5
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
1.06
1.33
3.5
1.24
0.81
1.25
0.69
0.92
1.85
0.88
0.75
0.44
0.93
1.54
0.44
1.14
0.67

Hamlin Valley

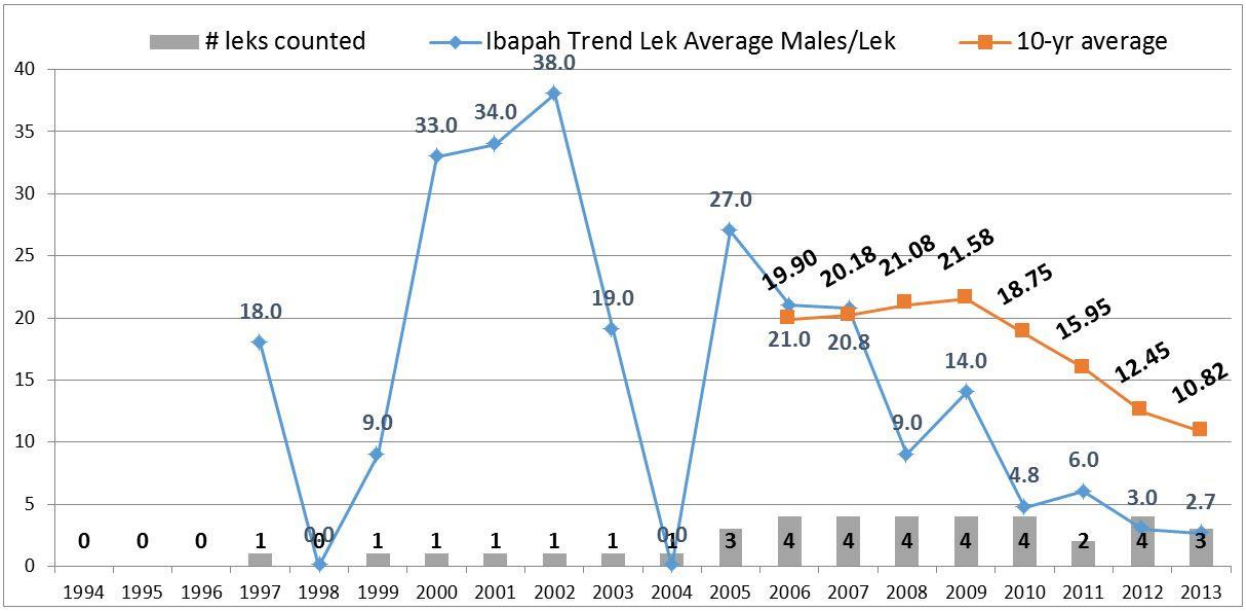
In this PHMA, 5 of 6 are trend leks. For this population, all the leks are being monitored for changes in average males per lek. Therefore, it is not necessary to calculate annual changes from year to year separately, because Lambda already captures this.

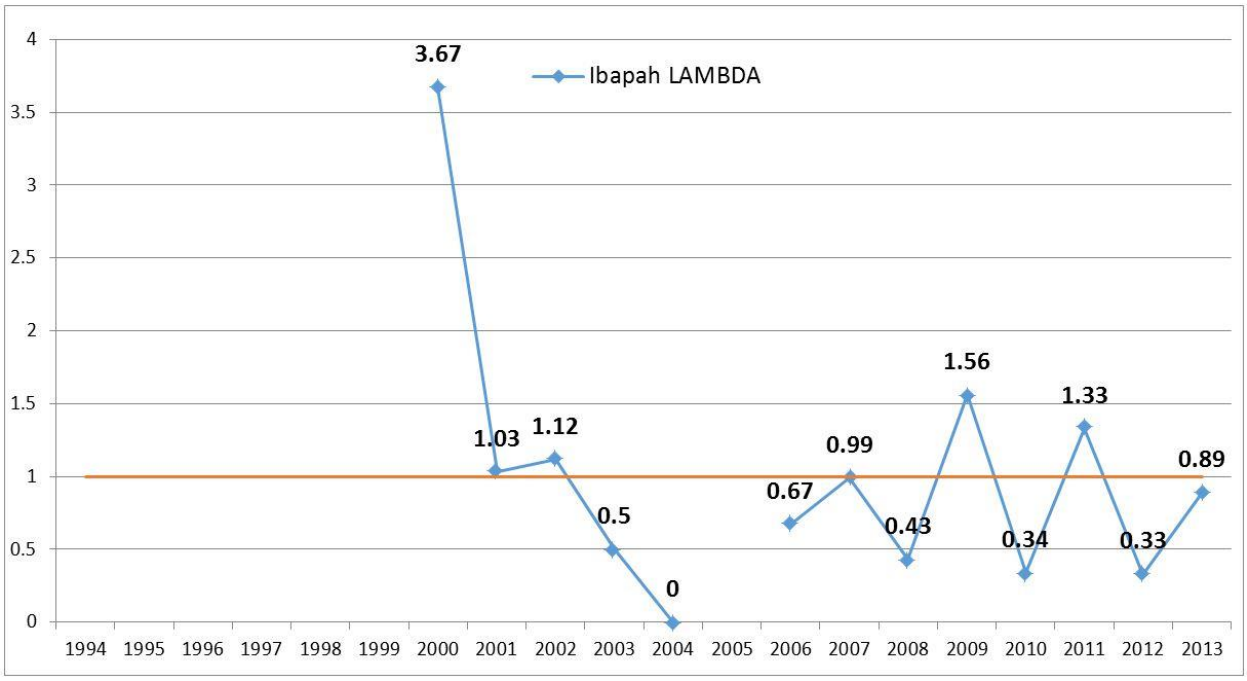




Ibapah

In this PHMA, only one of 4 leks met the trend lek criteria but all leks will be used as trend leks. For this population, all the leks are being monitored for changes in average males per lek. Therefore, it is not necessary to calculate annual changes from year to year separately, because Lambda already captures this.





Appendix J

Biological Opinion

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

August 3, 2015

In Reply Refer To:
FWS/R6
ES/UT
06E23000-2014-F-0265

Memorandum

To: State Director, Bureau of Land Management, Salt Lake City, Utah

From: Utah Field Supervisor, Ecological Services, U.S. Fish and Wildlife Service, West Valley City, Utah

Re: Final Biological Opinion for the Utah Greater Sage Grouse Land Use Plan Amendment and Final Environmental Impact Statement

In accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this transmits our final biological opinion (BO) for impacts to the Utah prairie dog (*Cynomys parvidens*) from the Utah Greater Sage-Grouse Land Use Plan Amendment and Final Environmental Impact Statement ("Land Use Plan" or "Project").

The Utah prairie dog is federally listed as a threatened species and occurs within the proposed Project area. This biological opinion is based on information provided in your July 16, 2015 BA, and email and phone communications between our offices. A complete consultation record is on file at this office.

We concur with your "not likely to adversely affect" determination for the following species; Canada lynx (*Lynx Canadensis*), California condor (*Gymnogyps californianus*), Mexican spotted owl (*Strix occidentalis lucida*), autumn buttercup (*Ranunculus aestivalis*), clay phacelia (*Phacelia argillacea*), and clay reed-mustard (*Schoenocrambe argillacea*). We also concur with your "not likely to adversely modify" critical habitat determination for the Mexican Spotted Owl (*Strix occidentalis lucida*). Our concurrence is based on a small overlap of habitat between the greater sage grouse and the above listed species and insignificant or beneficial effects due to the conservation objectives of the Land Use Plan amendment, as described in your BA.

CONSULTATION HISTORY

- November- December 2014- Emails and phone calls were exchanged between our office and members of the U.S. Forest Service (USFS), the USFS Enterprise Team, and Bureau of Land Management (BLM), discussing background Utah prairie dog information.

- March-April 2015 - Emails and phone calls were exchanged between our office and members of the USFS, the USFS Enterprise Team, and BLM in an effort to develop the biological assessment and appropriate conservation measure for Utah prairie dogs.

- March- April 2015- We received and reviewed your draft BA. We provided comments on your draft BA to the BLM State Office.

- May 18, 2015- We received an email with your formal request for consultation and a biological assessment.

- May- June 2015- Emails and phone calls were exchanged between our office and the BLM State Office, providing edits and suggestions to your original BA.

- June 25, 2015- We received your revised biological assessment, with draft edits to Attachments B and C (Land Use Plan Amendments).

- July 8, 2015 2015- We sent an email to the BLM State Office approving the draft edits to the biological assessment.

- July 15, 2015- There was a conference call between our office and the BLM State Office reviewing final edits to the biological assessment.

- July 16, 2015- We received your final biological assessment via email.

A complete administrative record of this consultation is on file at our office.

BIOLOGICAL OPINION

1 DESCRIPTION OF THE PROPOSED ACTION

1.1 ACTION AREA

The planning area for the proposed action includes almost 48 million acres in Utah and a small part of Wyoming. Approximately 12.7 million acres are administered by the BLM and 13.9 million acres are administered by the Forest Service. The action area for this consultation is a subset of the Project area; it includes all greater sage-grouse mapped habitat, occupied habitat, Priority Habitat Management Areas (PHMA), and General Habitat Management Areas (GHMA)

where these habitats overlap mapped Utah prairie dog habitat[1] within the three Utah prairie dog recovery units West Desert, Paunsaugunt, and Awapa recovery units (see Appendix A).

The action area includes all areas on federal land where there is an overlap of greater sage-grouse habitat and Utah prairie dog habitat. The action area also includes private and state lands where they border federal lands because there may be indirect effects to Utah prairie dogs on non-federal lands from greater sage-grouse management actions on adjacent federal lands.

There are two large areas of private lands that we excluded from the action area because they are not adjacent to sage-grouse habitats within the project planning area—Cedar and Parowan Valleys in the West Desert recovery unit (see Appendix B). These areas contain large numbers of Utah prairie dogs [i.e., approximately 80 percent of Utah prairie dogs in the West Desert Recovery Unit occur on private and other non-federal lands (USFWS 2012)], but the proposed action will not affect these populations.

1.2 Proposed Action

The proposed action includes implementation of land use plan amendments designed to enhance and prioritize greater sage-grouse conservation on BLM and USFS administered lands. The plan amendments provide guidance and framework for greater sage-grouse conservation to the field offices and ranger districts when planning and implementing management actions. The USFS's proposed actions that will affect Utah prairie dogs fall within two management action categories; Habitat Management, and Fire and Fuels Management. The BLM's proposed actions that will affect Utah prairie dogs fall within three management action categories: Habitat Management; Wildland Fire Management (General, Fuels, Suppression); and Lands and Realty (e.g., transmission corridors). For a complete description of the proposed action see Attachments B and C of the BA.

1.3 Applicant Committed Conservation Measures

1) In the BA, the BLM and USFS committed to implementing the following conservation measure when planning and implementing management actions in areas where greater sage-grouse and Utah prairie dog habitat overlaps:

> Under the authority of BLM and Forest Service laws, regulations, and policies, where Utah prairie dog habitat overlaps with greater sage-grouse habitats, it is the intent of these land use plan amendments to co-manage for the benefit of both species. For example, when applying various management actions and objectives that are applicable specifically to greater sage-grouse but could affect Utah prairie dog habitat, landscapes would be managed for both species. Examples of some of these BLM management actions and objectives are included in over-arching management in GRSG habitat (e.g., Objective GRSG-3, MA-GRSG-4),

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1 Mapped habitat is any and all areas within the species' range that were mapped since 1972 as currently or historically occupied by Utah prairie dogs. Official maps of Utah prairie dog habitat are maintained by the Utah Division of Wildlife Resources and are updated annually.

vegetation management (e.g., Objective VEG-1, MA-VEG-1), and fire management (e.g., MA-FIRE-3, MA-FIRE-4).

2) In the BA, the USFS developed and committed to apply the following "Standard" in their Forest Plan that will help guide co-management of Utah prairie dogs and greater sage-grouse;

The Forest Service has developed a Standard that specifically addresses instances where Utah prairie dog and greater sage-grouse habitat overlap. This Standard provides direction that involves site specific consultation with the U.S. Fish and Wildlife Service to ensure that management actions are developed using the most current version of conservation measures developed by the U.S. Fish and Wildlife Service. These conservation measures will provide direction to manage towards Utah prairie dog recovery while striving to manage for greater sage-grouse habitat benefit.

• The following standard, GRSG-GRSGH-ST-029, will be included in the Forest Service's Record of Decision;

On the Dixie and Fishlake National Forests, where GRSG priority habitat management areas overlap with identified Utah prairie dog habitat, the most current version of conservation measures developed by the U.S. Fish and Wildlife Service will be used during implementation of recovery actions.

3) In the BA, the BLM commits to include co-management language that will help guide planning and implementing management actions in areas where greater sage-grouse and Utah prairie dog habitat overlaps. This co-management language is included in the following Management Actions and Objectives in the final BA;

- Objective GRSG-2
- Objective GRSG-4
- MA-GRSG-3
- MA-GRSG-5
- MA-VEG-4

Co-management language will be included in the following Management Actions and Objectives in the BLM's Record of Decision;

- Objective GRSG-3
- MA-GRSG-4
- MA-GRSG-6
- Objective VEG-1
- MA-VEG-1
- MA-FIRE-3
- MA-FIRE-4

4) There is a suite of project-level conservation measures that will minimize impacts to Utah prairie dogs that are already in place in existing biological assessments, plans, policies, and regulations (see Attachment E *in* the BA). The following conservation measure from the BA for this proposed action describes this as follows:

> The original biological assessment impacts analysis included conservation measures from various existing land use plans and conservation measures from existing, site-specific projects, as well as their associated section 7 consultations for Utah prairie dog. The conservation measures from the existing land use plans and land use plan section 7 consultations have been more clearly identified in Attachment E of the BA. The conservation measures from the existing site-specific projects were illustrative of the types of site-specific conservation measures that may be used during implementation of Utah prairie dog recovery actions.

2 STATUS OF THE SPECIES/ CRITICAL HABITAT

The range wide status of the Utah prairie dog is provided in Appendix C of this biological opinion and includes information on the species' listing history, life history, population dynamics, status and distribution, and recovery efforts. There is no designated critical habitat for the Utah prairie dog.

3 ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in an action area, the anticipated impacts of all proposed federal projects in an action area that have already undergone formal or early section 7 consultation, and both the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR §402.02).

3.1 STATUS OF THE SPECIES WITHIN THE ACTION AREA

For section 7 consultations for the Utah prairie dog, we base our assessment of status of the species in the action area by reviewing the 5-year average spring count data and corresponding population estimates. The Utah Division Wildlife Resources (UDWR) initiated annual counts of Utah prairie dogs in 1976. These annual spring counts are conducted in April and May when the adults have emerged from hibernation, but before the young are born (hereafter referred to as "spring counts").

To estimate the number of Utah prairie dogs that may be located within the action area (see Proposed Action, above), we use the UDWR 2010-2014 spring count data (total adults counted in the spring) (UDWR 2015). In 2010-2014, there was an average of 2,721 adults counted in occupied habitat within the action area (across all land ownership types-see description of Action Area above) where impacts to Utah prairie dog habitat may occur.

Adult population estimates are made based on the number of individual adult Utah prairie dogs observed during survey efforts. The adult population estimate is derived by multiplying the count by two, as only 40 to 60 percent of individual prairie dogs are above ground at any one time (Crocker-Bedford 1976).

Adult Population Estimate = 2 x (5-Year Average Adult Spring Count):

2 x 2,721 = 5,442 adult Utah prairie dogs

In the summer, pup production can increase this number to approximately 19,589 Utah prairie dogs, based on the below equation (USFWS 2012).

Population Estimate (with productivity) =
[(2 x Adult Spring Count) x 0.67 (proportion of adult females) x 0.97 (proportion of breeding females) x 4 (average number of young per breeding female)] + (2 x Adult Spring Count):

[(2 x 2,721) x 0.67 x 0.97 x 4] + (2 x 2,721) = 19,589 Utah prairie dogs

Using the same equations, the Utah prairie dog 2010-2014 range-wide adult spring count average is 7,792 which yields a population estimate of 56,099 individuals. Therefore, the Utah prairie dog population estimate (19,589) within the action area is 35% of the total population estimate (19,589/56,099) of prairie dogs on all lands across all three recovery units. Overall, rangewide Utah prairie dog populations have been generally stable to increasing since 1976 (USFWS 2012).

3.2 Factors Affecting the Species Environment Within the Action Area

Plague

Plague occurs across the entire range of the Utah prairie dog, and is considered to be a primary threat to the species' survival and conservation. Plague is caused by a bacterium (*Yersinia pestis*) not native to North America. Plague likely arrived in North America about 100 years ago via flea-infested rats on ships coming from Asia and Europe (Biggins and Kosoy 2001a, Hoogland et al. 2004).

Fleas are the most common vector for plague (Biggins and Kosoy 2001a). Infected fleas can be brought into the vicinity of a prairie dog colony by a suite of mammals (Biggins and Kosoy 2001a), and fleas may survive for over a year after their hosts have died (Gage and Kosoy 2005). Much of the plague research available is for white-tailed prairie dogs; however, due to the similarity in life history and habitat use of white-tailed prairie dogs and Utah prairie dogs, we consider the research to be relevant to the Utah prairie dog. We use this information as well as any information specifically pertinent to Utah prairie dogs in the below discussion. Plague occurs in prairie dog colonies as enzootic and epizootic events. Enzootic plague is an infection that is persistent in the population over time and causes a low rate of mortality. Epizootic plague occurs when the disease spreads from enzootic hosts to more susceptible animals, resulting in a rapidly spreading die-off cycle (Barnes 1993, Biggins and Kosoy 2001b, Cully and Williams

2001, Gage and Kosoy 2005). During epizootic plague events, large numbers of animals can die within a few days (Lechleitner et al. 1962; Cully 1993).

The factors that cause a change from an enzootic to epizootic cycle are still being researched, but may include host density, flea density, and climatic conditions (Cully 1989; Parmenter et al. 1999; Cully and Williams 2001; Enscore et al. 2002; Lomolino et al. 2003; Stapp et al. 2004; Gage and Kosoy 2005; Ray and Collinge 2005; Stenseth et al. 2006; Adjemian et al. 2007; Snäll et al. 2008; Biggins et al. 2010). More specifically, enzootic plague may be influenced by factors including genetics, prairie dog immunity and physiologic state, and interactions with other bacteria (Gage and Kosoy 2005). Occurrence of epizootic plague outbreaks may be dependent on the density of the host population and/or flea vector abundance (Barnes 1993), or flea density (Biggins 2010), which may be affected by climatic factors (Gage and Kosoy 2005). Epizootic plague outbreaks may occur when Utah prairie dog populations increase to high densities causing increased stress among individuals and easier transmission of disease between individuals (Gage and Kosoy 2005). However, plague also could occur when Utah prairie dogs are at lower densities but flea density is high (Biggins et al. 2010).

Epizootic and enzootic plague can have wide-reaching impacts to prairie dog populations. Although the impacts of enzootic plague may be less dramatic and obvious than epizootic outbreaks of plague, enzootics may be a constant threat to prairie dog persistence over moderate time spans (Biggins et al. 2010).

Plague likely persists in prairie dog colonies at enzootic levels even after an epizootic outbreak subsides. In the absence of epizootic events, plague antibodies and plague positive fleas and prairie dogs occur in colonies (Biggins et al. 2010). Other evidence of enzootic plague includes the increased survival of prairie dogs and black-footed ferrets exposed to flea control and experimental vaccines despite the lack of epizootic plague outbreaks (Matchett et al. 2010).

Increased survival with these treatments indicates that enzootic plague is frequently present and suppressing prairie dog population levels in the absence of plague prevention measures. Possible reasons for persistence of plague as an enzootic in the environment include survival of the bacterium in the soil, persistence of the bacterium in fleas, and the continued slow transmission of the bacterium within the prairie dog community (Biggins et al. 2010). Infected fleas can exist in burrows for up to 13 months following a plague event (Fitzgerald 1993).

Long-term enzootic plague infection may cause local extirpation of colonies, extreme fluctuations in population densities and occupied habitat area, and inbreeding (Seglund et al. 2006). Enzootic plague also may alter population dynamics and dispersal (Biggins et al. 2010). For example, if plague results in higher mortality of adults than juveniles, the remaining juveniles would be less likely to disperse away from their native colonies, instead replacing the adults and resulting in a younger population (Biggins et al. 2010).

Recovery of colonies after plague outbreaks within localized white-tailed prairie dog populations can occur within as little as 1 to 2 years (Menkens and Anderson 1991; Anderson and Williams 1997) or as long as 10 years (Cully and Williams 2001). Some of reasons for the variability in recovery rates may be due to the continued existence of chronic enzootic plague within colonies,

or lack of immigration (due to large distances between colonies) of prairie dogs to reestablish affected colonies (Barnes 1993). Many times, when a colony begins to regain its former population size, it again becomes susceptible to plague epizootics—high population densities provide greater opportunities for the exchange of fleas and thus affect the speed at which plague can move through the population (Barnes 1993).

The long-term consequence of repeated or continued exposure to plague in white-tailed prairie dogs may lead to selection of individuals that are genetically more resistant to the disease and are able to maintain plague in an enzootic form in the environment. However, populations of white tailed prairie dogs thus far have remained highly susceptible to plague even after being subjected to repeated exposure (Biggins and Kosoy 2001b). Evaluation of plague over longer time periods may provide better insight into the ability of prairie dog populations to cope with this introduced pathogen. Environmental stochastic events and anthropogenic disturbances in combination with plague could ultimately decrease the ability of a population to recover to historical densities and reduce the long-term persistence of prairie dog populations. In addition, a loss of genetic diversity due to periodic population bottlenecks caused by epizootics may occur (Trudeau et al. 2004). Utah prairie dogs exhibit very low genetic variation (Chesser 1984) and little gene flow between colonies (Ritchie and Brown 2005; Brown 2009), possibly due to plague and habitat fragmentation.

Plague will likely continue to be a threat throughout the range of western prairie dog species for the foreseeable future. Some tools are available to control plague. Deltamethrin and pyraperm are two insecticides used to successfully control fleas in colonies of many prairie dog species (Seery et al. 2003; Hoogland et al. 2004). Use of these insecticides has increased the number of juvenile Utah prairie dogs weaned (Hoogland et al. 2004) and resulted in higher survival rates for black-tailed (C. ludovicianus), white-tailed, and Utah prairie dogs (Biggins et al. 2010).

Experimental vaccine-laden baits are in development to immunize prairie dogs against plague. Black-tailed prairie dogs exposed to plague in a lab setting and fed vaccine baits experienced a high level of survival (Mencher et al. 2004; Rocke et al. 2008). A systemic flea control bait also was developed and tested in the field, and was not found to be consistently effective in reducing flea loads (Poché et al. 2008; Jachowski et al. 2012). The flea control bait reduces flea loads on animals, the primary vector in spreading plague in prairie dogs (Jachowski 2009).

Other threats may compound the impacts of plague, at least in the short-term, and should be addressed where possible to lessen the impacts or duration of plague. The effects of plague may be exacerbated and recovery rates slowed when additional stresses such as shooting, poisoning, and habitat loss co-occur. These pressures acting together may increase the isolation of prairie dog populations, and if plague infiltrates isolated areas and localized populations are eradicated, may reduce the number of source animals present to recolonize the area.

Management measures to control plague (i.e., vaccines, insecticides) are being developed and their success may influence long-term prairie dog conservation. Initial lab and field testing shows promise in the ability of these measures to manage plague. Additional testing is needed at the landscape level to determine the ability of these methods to effectively manage plague and

contribute to the recovery of the species. If the methods prove successful in the wild, we will need substantial funds to employ these techniques at a scale able to benefit recovery.

Poaching

Poaching is any unauthorized killing of Utah prairie dogs, including shooting, poisoning, trapping, and other lethal methods. There are no data to quantify these impacts. We have observed shell casings in Utah prairie dog colonies, and it is possible that prairie dogs are the target animals in some of these locations. Since the fall of 2007, three poisoning incidents and one shooting incident occurred in the West Desert recovery unit. One poaching incident that led to a citation occurred in the Paunsaugunt Recovery Unit in 2013. These unauthorized killings resulted in impacts to a few colonies, but these impacts did not extend to the population level.

Off-Highway Vehicle/Recreational Uses

Off-highway vehicle (OHV) recreation is an increasingly common use of public lands. Off-highway vehicle registrations in Utah increased 233% from 1998-2006 (Burr et al. 2008), and new retail sales of OHVs increased 163% between 1995 and 2001, with most of these vehicles being used on public lands (Fischer et al. 2002).

Though not specific to Utah prairie dogs, OHV use affects soils, vegetation, and wildlife species (Ouren et al. 2007). Based on the available information, it is likely that OHV use results in habitat fragmentation and reduced connectivity across the species' range, increasing the likelihood of local extirpations. Direct mortality may occur as a result of collision or burrow collapse. Repeated OHV disturbances may reduce the foraging time of Utah prairie dogs and negatively affect weight gain, resulting in decreased overwinter survival. Loud OHV noises may cause hearing loss in prairie dogs, leading to a higher risk of predation. Physiological effects from disturbance can lead to declines in local population size, survivorship, and productivity of wildlife species in general (Ouren et al. 2007). OHV activities can crush vegetation, decreasing forage quality and availability for prairie dogs. OHV use also allows more human access to prairie dog colonies, which may increase the risk of illegal shooting (USDA 2009a).

On federal lands, increased planning efforts direct OHV use to designated trails or play areas, and consequently away from Utah prairie dog habitats. The range of the Utah prairie dog overlaps the Dixie and Fishlake National Forests, and the Cedar City, Richfield, and Kanab BLM Field Office areas. The Dixie and Fishlake National Forests prohibit cross-country vehicle travel Forest wide; motorized travel is restricted to designated open routes or areas (USDA 2006, 2009b). In addition, the Dixie Motorized Travel Plan includes conservation measures specific to Utah prairie dog, including surveys, avoidance (i.e., spatial and seasonal), and revegetation prescriptions for the species along roads proposed for closure (USDA 2009c).

Almost all public lands administered by the Richfield BLM Field Office are either closed to OHV use or limited to designated routes, and includes conservation measures (i.e., seasonal and spatial buffers) specific to Utah prairie dog (BLM 2008a). The Kanab BLM Resource Management Plan (RMP) includes a conservation measure to preclude cross-country motorized use in occupied or inactive Utah prairie dog colonies (BLM 2008b). The Cedar Beaver Garfield Antimony RMP (BLM 1986) provides management direction for the Cedar BLM Field Office

area, and limits vehicle use to existing roads and trails near prairie dog colonies. This restriction is in effect at one Utah prairie dog complex (Three Peaks) and portions of four additional complexes totaling approximately 7% of Utah prairie dog mapped habitat in the West Desert recovery unit (Bonebrake pers. comm. 2010). The BLM Cedar City Field Office has initiated a RMP revision process. In the revised RMP, they will designate all areas under the jurisdiction of the Field Office as either open to cross-country travel, limited to existing routes, or closed to all motorized travel. However, it is too early to determine how the revisions to this RMP will affect Utah prairie dogs.

While OHV use is not restricted on non-federal lands, OHV activity in these areas is more likely to be utilitarian in nature (i.e., related to getting around private property) and of lower intensity and impact when compared to recreational use more common on federal lands.

Energy Resource Exploration and Development

Energy resource exploration and development activities within the range of the Utah prairie dog primarily include wind and oil and gas development. Wind development projects include construction of wind towers, roads, and transmission lines. These facilities can result in the loss and fragmentation of Utah prairie dog habitat and increased predation due to added perching locations for raptors. The most likely areas for wind power development in Utah are the Raft River Mountains in western Utah and the Milford area in southwest Utah (USDOE 2010). The Raft River Mountains do not overlap the historical or current range of the Utah prairie dog. Suitable habitat for Utah prairie dogs occurs in the Milford area (in the species' current range) (BLM 2009), but we are not aware of any occupied habitats within 25 mi (40 km) of the wind development area. Therefore, we do not consider wind power to be a threat to the Utah prairie dog.

Oil and gas development includes seismic activities, exploratory wells, and production facilities. Development also includes the construction of roads, wells and pads, and energy corridors (i.e., long distance pipelines or transmission lines). Resulting impacts to prairie dogs from oil and gas development may include direct mortality from vehicles; direct mortality associated with increased access by recreational shooters who use the new roads (Gordon et al. 2003); increased disturbance responses from increased human activity; direct loss and fragmentation of habitat and forage resources during exploration, drilling, and production; and indirect loss of forage resources from invasive nonnative plant species (Seglund and Schnurr 2009). Potential impacts from seismic testing on Utah prairie dogs are negligible (Young and Sawyer 1981).

The Cedar City BLM Field Office is the primary Federal land management entity in the West Desert recovery unit. Oil and gas exploration on public lands administered by the Cedar City Field Office is expected to continue at a low pace, unless there is a new discovery or unless nationwide demand for onshore oil and gas dramatically increases (BLM 1986). In the past nine years, only four applications for Permit to Drill (APD) have been received by the Cedar City Field Office; there are no active oil or gas wells operating in the area (Burghard 2015, pers. comm.). The Cedar Beaver Garfield Antimony RMP (BLM 1986) and the Pinyon Management Framework Plan (BLM 1983), which cover the Cedar City Field Office area, both identified specific lands that were known at that time to be occupied by Utah prairie dog. These lands were identified as Category 3 lands (open to leasing subject to No Surface Occupancy stipulations).

However, the majority of mapped Utah prairie dog habitat in the West Desert recovery unit is non-federal, and no conservation measures are in place to minimize the effects of energy development to Utah prairie dogs on these lands, should such development occur in the future.

We do not anticipate extensive oil and gas development on areas that overlap Utah prairie dog habitat in the Paunsaugunt recovery unit based on historic and current low levels of development (BLM 2008c, 2008d). However, where energy development may occur, we note that the majority of the Paunsaugunt recovery unit is comprised of non-federal lands, where no Utah prairie dog conservation measures are in place to minimize energy development impacts to the Utah prairie dog. The Dixie National Forest is the primary federal land management entity in the Paunsaugunt recovery unit; the Kanab BLM Field Office also manages a small portion of the Paunsaugunt recovery unit. The potential for energy resource development on the Dixie National Forest over the next 15 years appears low due in large part to discouraging results of previous tests, the remoteness of the area, and the questionable quality of the geologic strata for producing oil and gas (USDA 2007). Both the Dixie and Fishlake National Forests have 0.5 mile No Surface Occupancy stipulations for oil and gas development within 0.5 miles of active Utah prairie dog colonies (USDA 2010, 2012). The Kanab BLM RMP includes a conservation measure that precludes surface disturbance activities within 0.5 mi (0.8 km) of Utah prairie dog active colonies, suitable habitat, and potential reintroduction sites (BLM 2008b).

The majority of the BLM and U.S. Forest Service (USFS) planning areas on the Awapa Plateau recovery unit have low energy resource potential in the areas occupied by Utah prairie dogs (USDA 2007, BLM 2008e). The Fishlake and Dixie National Forests and the Richfield BLM Field Office comprise the primary Federal land management entities in the Awapa Plateau recovery unit, and the majority of the Awapa Plateau recovery unit is in federal ownership. Both the Dixie and Fishlake National Forests have 0.5 mile No Surface Occupancy stipulations for oil and gas development within 0.5 miles of active Utah prairie dog colonies (USDA 2010, 2012) As described above, The Richfield BLM RMP provides specific conservation measures to minimize the effects of energy development to Utah prairie dogs (BLM 2008a).

In 2008-2011, we completed programmatic consultations with the BLM and USFS regarding oil and gas development on lands they manage. Through the consultation process, we worked with both agencies to develop a set of avoidance and minimization measures for Federal oil and gas leases within the range of the Utah prairie dog (BLM 2008a, 2008b; USFWS 2011). These measures are attached to all BLM and USFS leases with the range of the Utah prairie dog, and include no surface disturbance within 0.8 km (0.5 mi)) of active Utah prairie dog colonies, and no permanent disturbance within 0.8 km (0.5 mi) of potentially suitable, unoccupied Utah prairie dog habitat. Instruction Memorandum (IM) 2002-174 directs all BLM State Offices to "include the lease stipulation on oil and gas leases where threatened, endangered, or other special status species or critical habitat is known or strongly suspected."

The Department of Energy (DOE) and the BLM prepared Programmatic Environmental Impact Statement (PEIS; DOE 2012) to address utility-scale solar energy development in six southwestern States, including Utah. There are three solar energy zones proposed in Iron and Beaver Counties. Impacts to the species are small—the PEIS estimates 0.1% of suitable Utah prairie dog habitat occurs within the solar energy zones across the species range (DOE 2012).

Although energy development may occur in some locations across the species' range, there has been a low level of exploration and development to date, and projections remain low for the majority of the species' range for the foreseeable future. Some land use planning documents include conservation measures to avoid and minimize impacts to Utah prairie dog habitats.

Fire Management

Fires within the planning area are both naturally occuring and used as a management tool. Naturally occuring fires are widely distributed in terms of frequency and severity. Wildfires are suppressed when they threaten values and resources, such as: wildland urban interface areas, developed recreation sites, areas that are unlikely to recover following fire (i.e., areas of noxious weeds or invasive species), sensitive soils, critical threatened and endangered species habitat, or fires with potential to spread to private, state, or other federal lands. Fire suppression methods vary with the intensity of the wildfire and are conducted on an emergency basis. Firelines may be constructed by hand or by heavy equipment to contain the wildfire. Water may be withdrawn from nearby sources to suppress fires. Chemical fire suppression agents and retardants may be used, if necessary. The use of aerial fire retardant is restricted near water resources.

After a fire is extinguished, emergency stabilization techniques may be used to stabilize soils in the burned area. These techniques may include seeding or mechanical soil stabilization methods. Burned area rehabilitation may also include seeding, but is intended to move the area toward the condition that it was prior to the fire. Burned area rehabilitation is used on lands that are unlikely to recover naturally. These suppression and post-suppression activities often employ the use of off-road vehicles, hand tools, and heavy equipment such as bulldozers.

The wildland fire program implements fire, as a tool, in areas that would benefit from the reintroduction of fire. Some suppression techniques, as described above, may be used to keep the fire within pre-determined boundaries, but no emergency stabilization and rehabilitation actions are taken following wildland fire use.

Prescribed fire and non-fire fuels treatment objectives are to restore natural fire regimes, reduce hazardous fuel loading, reduce fire fighter risk, and enhance resources, such as wildlife habitat. Prescribed fires follow a pre-determined prescription and include activities such as broadcast burning or pile burning following manual or mechanical fuel treatments. Non-fire fuel treatment actions include: tree thinning or clear-cutting (i.e., juniper) by hand or using mechanized equipment, chemical application of herbicides to reduce shrub cover, disking to remove vegetation and prepare the soil for seeding, and seeding of native and/or non-native species to prevent increase of invasive species.

Livestock Management

Grazing occurs in almost all mapped and occupied Utah prairie dog habitat including private, state, and federal lands. The threatened status of the Utah prairie dog results in site-specific and programmatic section 7 consultations for grazing actions on federal lands, and an ability to develop and implement conservation measures to avoid and minimize the effects of potential

over-grazing on a site-specific basis (USFWS 2008a, b, c). Examples of conservation measures used in Utah prairie dog habitat include: restricting surface disturbing activities and facilities within 0.5 miles of occupied habitat, conducting restoration activities using native seed, and implementing monitoring and corrective actions via adaptive management (USFWS 2008a, b, c).

We do not have information on the amount of Utah prairie dog habitat, if any, that is over grazed, so we do not fully understand the extent of this threat on the landscape. Our best available information suggests that Utah prairie dogs can coexist with properly managed grazing systems. Livestock grazing may even benefit prairie dogs where grazing enhances primary production and reduces shrub invasion (Coppock et al. 1983, Holland et al. 1992). Higher vegetation quality and a higher proportion of nutrient-rich young shoots occur in properly managed grazed habitats as compared to ungrazed habitats (Cheng and Ritchie 2006). Prescribed rotational grazing may help to maintain suitable vegetation height for Utah prairie dogs, especially in highly productive sites like irrigated pastures or where shrub invasion has occurred (Ritchie and Cheng 2001).

In general, if grazing has been managed poorly, there can be decreased habitat quality resulting from increases in invasive plants and decreased vegetation diversity (Collier and Spillett 1973). Historically, over-grazing in swale formation habitat led to erosion and reduced the amount of moisture available for grasses and forbs (Crocker-Bedford 1975). Over-grazing can decrease forage availability, with the potential to increase Utah prairie dog foraging time, and consequently decrease vigilance and survivorship (Ritchie 1998, Cheng and Ritchie 2006). These effects may be more likely during times of drought or in areas with low plant diversity (Elmore and Messmer 2006a, 2006b).

Many agricultural producers believe that Utah prairie dogs impact their operations through loss of forage for their cattle, equipment damage from driving across burrows, and livestock injury if animals step in burrows (Hoogland 2003; Elmore and Messmer 2006a, 2006b). Although some of these impacts may be site-specific or uncommon (Hoogland 2003), the perceived impacts result in negative human perceptions of prairie dogs (Hoogland 2003; Elmore and Messmer 2006a).

Because of these concerns, and similar to the previous discussion on Cultivated Agriculture, the conflicts between agricultural producers and Utah prairie dogs historically led to wide-scale eradication programs. Without ESA protection, no other mechanisms provide regulatory control of Utah prairie dog poisoning or shooting on agricultural lands (e.g., 4d rule, see Cultivated Agriculture above). Safe Harbor or other private landowner conservation efforts will continue to be part of our recovery efforts to promote public education and foster proactive grazing practices that will simultaneously benefit Utah prairie dog habitats.

Habitat conversion impacts Utah prairie dogs in the action area. In the biological assessment from the BLM's Cedar City Field Office for the "Minersville # 3, Mortenson-Holyoak, and Long Hollow (Sheep) grazing allotments in Iron and Beaver Counties, Utah," (received June 4, 2007) the BLM describes the process of Utah prairie dog habitat conversion on public rangelands:

- "Suitable habitat may be the most important factor limiting prairie dog recovery (McDonald 1993; McDonald and Bonebrake 1994). Lack of suitable habitat for Utah prairie dogs on public lands is widespread (McDonald 1993; 1994). Most areas within the species' range that were shrub-grassland mosaics in pre-settlement times have been converted to shrublands through long term, continuous seasonal grazing and fire suppression. Additionally, much of the historic, high quality Utah prairie dog habitats are within the valleys, where urban expansion and intensive farming occurs. Thus, much of the historical habitat of the Utah prairie dog has been lost."

The action area overlaps with the area described above; thus overgrazing and subsequent habitat conversion has affected the Utah prairie dog populations in the action area. The conversion to shrublands has benefited greater sage grouse populations but in some areas this same conversion can have negative effects to Utah prairie dog conservation.

Climate Change

The term "climate change" refers to a change in the state of the climate (whether due to natural variability, human activity, or both) that can be identified by changes in the mean or variability of its properties and that persists for an extended period, typically decades or longer (IPCC 2007 a, b). Changes in climate are occurring. The southwest is projected to experience significant reductions in precipitation. Over the last 50 years, the southwest experienced a 9% increase in very heavy precipitation events (defined as the heaviest 1% of all daily events) (U.S. Global Change Research Program 2009). A 10-30% decrease in precipitation is projected in mid-latitude western North America by mid-century (Milly et al. 2005). The Utah Prairie Dog Revised Recovery Plan (USFWS 2012) provides additional climate change analyses on a regional basis.

With regard to the area of analysis for the Utah prairie dog, climate change projections are available to the scale of the southwestern United States, as described above. We can make certain species-specific projections and recommendations based on our available knowledge of the species' distribution and life history. The climate in southern Utah has become progressively drier over the last several thousand years, which has led to the gradual transition of grass-dominated ecosystems to those dominated by shrubs. Continued vegetation shifts may result in reduced prairie dog habitat quantity and quality over time. Thus, climate change has emerged as a significant concern for the Utah prairie dog, particularly in regard to the potential for increasingly prolonged drought cycles. The projected warmer atmosphere and intensified water cycle in the southwest is likely to increase the likelihood of drought, heavy precipitation events, and flooding (U.S. Global Change Research Program 2009).

Impacts from drought include loss of succulent vegetation that is necessary for Utah prairie dog abundance (Crocker-Bedford and Spillett 1981). Increased drought may thus result in range constrictions for Utah prairie dogs, or they may shift their range northward and upward to cooler and moister climates (IPCC 2007 a, b). Drought was implicated in the historical loss and drastic decline of some Utah prairie dog colonies, particularly at lower elevations with consequently drier vegetation conditions (Collier and Spillett 1975). Increased drought can reduce habitat suitability for prairie dogs directly and indirectly.

Indirectly, drought and climate change may increase the expansion of invasive plants (BLM 2011), particularly cheatgrass (see Invasive Species, below), and this could become a factor affecting Utah prairie dog recovery. Climate change is expected to result in large-scale range shifts in invasive plant species distributions with some species expected to experience range expansions (e.g., yellow starthistle, tamarisk) and others expected to experience range contractions (e.g., cheatgrass, spotted knapweed, leafy spurge). Cheatgrass is anticipated to shift northward, with reduced invasion risk in Utah. However, these same areas may remain at risk from other invasive species that can tolerate the changed climate conditions (Bradley 2009).

Heavy precipitation events may result in temporary increases in soil moisture. Projected changes in soil moisture content could impact epizootic plague outbreaks. Moist soil conditions enhance the conditions for flea reproduction and survivorship, thereby increasing the number of available fleas. This outcome would lead to a greater frequency of plague in wild animal populations if the fraction of plague-infectious animals remains constant or increases (Thomas 1996 *in* Parmenter et al. 1999). Alternatively, prolonged drought conditions may reduce the frequency of plague.

Although we have described some potential impacts to the Utah prairie dog under future climate change models, there is uncertainty in the scope and severity of this potential threat. There also is uncertainty in how the species will respond.

Conservation Measures

Efforts to conserve the Utah prairie dog and its habitat have occurred since the time of listing. The aim of recovery is for conservation to outpace threats until the ability of the Utah prairie dog to persist within its natural ecosystems is assured. The Utah Prairie Dog Revised Recovery Plan (see section 1.9, Conservation Measures and Assessment *in* USFWS 2012) described conservation measures that are in place to assist with recovery efforts for this species. These measures include annual spring counts (see section 3.1, Status of the Species within the Action Area, above), translocations, plague prevention and response, safe harbor agreements, conservation easements and acquisitions to protect habitats (to date, our partners have secured 2,548 acres of non-federal land as conservation areas that are protected in perpetuity for Utah prairie dogs), section 7 consultations, research, and public outreach and education. Since 2010, the Utah Prairie Dog Recovery Implementation Program (UPDRIP; recently "rebranded" as the Utah Prairie Dog Oversight Group) and Utah Prairie Dog Recovery Implementation Team have worked together in a public-private partnership to facilitate recovery efforts for this species. These groups have developed and implemented guiding documents for recovery of the Utah prairie dog including the Utah Prairie Dog 5-Year Management Unit Plans-The Path to Recovery (2014-2018) (UPDRIP 2014; see Effects of the Action, Habitat Management, below) and Population Structure for Utah Prairie Dog Recovery (UPDRIP 2013).

State Plan

In November 2014, the U.S. District Court for the District of Utah held that the 2012 4(d) Rule for the Utah prairie dog is unconstitutional to the extent it regulates Utah prairie dog take on non-

federal lands. That decision is currently on appeal. After the decision, the UDWR assumed management authority for Utah prairie dogs on non-federal lands. The UDWR generated a new Utah Prairie Dog Management Plan for Non-federal Lands (State Plan) , effective May 8 2015, which allows for increased levels of lethal take (minimum 6,000 which is upwards of 20-30% of estimated total population) on non-federal lands than previously authorized under the 4(d) rule (10% of estimated total population). Additionally under the State Plan, lethal take is authorized on all unmapped Utah prairie dog habitat and there is no mitigation for the loss of occupied habitat due to development activities. Long-term, the State Plan would remove all take restrictions when a Recovery Unit reaches 2,000 adult animals on protected lands whereas our Recovery Plan takes a broader view of what is needed before delisting is considered, including assurances that the Utah prairie dog population is spatially distributed to provide sufficient connectivity and gene flow. It is too early in the implementation of the State Plan to assess any positive or negative effects of that plan. However, the relative recovery contribution of each Utah prairie dog on Federal land may change depending on how the State Plan (above) is implemented. As data from the implementation of the new State Plan is reported (we generally receive annual reports of prairie dog actions from the Utah Division of Wildlife Resources), our evaluations of the Status of the Species and future Environmental Baselines will be updated accordingly in new biological opinions, and re-initiation of section 7 consultations would occur as needed.

4 EFFECTS OF THE PROPOSED ACTION

As described above (see section 1.2, Proposed Action), effects of the action to Utah prairie dogs are most likely to occur from habitat management, wildfire suppression, fuel treatment effects, and power line placement. Overall, disturbance (harassment) of Utah prairie dogs may occur from these types of projects due to increased noise levels, ground vibration, and increased human and vehicle activity. Though small, there is the potential for habitat management projects and fire suppression activities to result in the accidental mortality or injury of individual Utah prairie dogs due to direct mortality from heavy equipment, smoke inhalation, and the deployment of chemical retardants. These disturbances may affect Utah prairie dog foraging activity, social interactions, and other behaviors which could be significant if these effects are long term. However, most of these effects will be short in duration only taking days or weeks to complete individual habitat management or fire projects. These impacts would be minimized to the maximum extent practicable during project level section 7 consultation.

The land use plans may result in increased conversion of "shrub-grassland mosaics" to "shrublands," due to the desire to maintain high densities of sagebrush to support greater sage-grouse across large landscapes. The proposed land use plan amendments do not specifically include sagebrush removal, restraint of fire suppression activities in Utah prairie dog habitats, and other proactive Utah prairie dog management activities. However, the BLM and USFS have included language in their land use plan amendments and BA that highlight the importance of using adaptive co-management strategies where Utah prairie dog and greater sage-grouse habitat overlap, which should allow for flexibility at the project level, as further discussed below.

Habitat Management

An estimated 19,589 (see section 3.1 above) prairie dogs (summer population, including adults and pups) occur within the action area, this is roughly 35% of the estimated 5-year average range-wide summer population. There is an 81% overlap between mapped greater sage-grouse habitat and Utah prairie dog Management Units (MU; UPDRIP 2013) (comprising 267,853 acres) in the action area. The Utah Prairie Dog Recovery Implementation Team delineated 40 MUs where Utah prairie dog management and recovery actions should be emphasized. The 40 MUs were also developed to ensure Utah prairie dog habitat and population connectivity, and metapopulation dynamics across the range of the Utah prairie dog. We distributed the 40 MUs across the entire range of the species to ensure that we can take advantage of conservation opportunities as they arise (e.g., land acquisitions, easements) and that we retain management options in the event of catastrophic changes to some of the MUs (e.g., fire, plague). Overall, there is a high degree of overlap between the priority areas of Utah prairie dog conservation (i.e., MUs) and the priority areas for greater sage-grouse conservation (i.e., PHMAs).

This overlap in priority habitat areas for greater sage-grouse and Utah prairie dogs is important when considering the BLM and USFS commitment to co-manage for these species. Co-management should allow for continued implementation of habitat projects for Utah prairie dogs, such as those projects identified in the Utah Prairie Dog 5-Year Management Unit Plans (MU Plans; UPDRIP 2014). Habitat management projects for Utah prairie dogs frequently include removing shrubs (e.g., sagebrush) to provide suitable habitat for prairie dog colonies (see Appendix D, extract from Translocation Guidelines). The MU Plans include prescriptions over the next five years for 5,500 acres of habitat treatment within the West Desert recovery unit, 3,600 acres of habitat treatments within the Paunsaugunt recovery unit, and 3,800 acres of habitat treatment within the Awapa Plateau recovery unit. Of these habitat treatments, approximately 74% of the acres are sagebrush removal or thinning projects and 26% are pinyon-juniper removal projects. Co-management commitments should allow for the implementation of the MU Plans for the Utah prairie dog.

Wildfire Suppression

During wildfire suppression activities the visual or auditory disturbance or displacement (harassment) of individuals from low-flying aircraft, vehicles, heavy equipment, and humans during operations or treatments may affect foraging behavior of Utah prairie dogs in the short term. The removal of key habitat components for burrowing, foraging, or cover may occur due to equipment or operational tactics, such as tree and shrub removal and soil disturbance during fire line construction; vegetation removal and soil disturbance during helipad or base camp construction; and vegetation removal and soil disturbance during temporary or permanent road construction for project access. Though small, there is a risk of direct injury, mortality and displacement of adults or young from smoke inhalation, vehicles, heavy equipment, inadvertent strikes during aerial drops (including fire retardant), and inadvertent chemical contamination during the aerial application of fire retardant.

Wildfire suppression activities may be prioritized in greater sage-grouse habitat and will often overlap with mapped or occupied Utah prairie dog habitat within and outside the Utah prairie dog MUs. In many cases, allowing the fire to burn through these areas of habitat overlap would

benefit Utah prairie dogs. Fire converts "shrublands" to "shrub-grassland" mosaics, increasing habitat suitability for Utah prairie dogs by reducing sage brush canopy cover. Increased focus on fire suppression in greater sage-grouse habitat inadvertently may facilitate the conversion of "shrub-grassland mosaics" to "shrublands" at the landscape scale over time. However, the BLM and USFS co-management commitments should allow for review of site-specific scenarios and wildfire suppression decisions based on the habitat needs of both species.

Fuels Treatments Effects

Fuels treatments using prescribed fire or other means in grassland and sagebrush habitats could negatively affect Utah prairie dog from smoke, fire, noise, or other human-caused disturbance, resulting in harassment, displacement, injury, or possibly mortality; or immediate post-project alteration of key habitat components (e.g., forage or vegetative cover). Most effects would be short term and of low intensity due to the implementation of resource protection measures, including pre-project surveys and avoiding critical periods for the Utah prairie dog (e.g., hibernation and when pups are in the burrows) (see Attachment E in the BA for specific commitments).

There may be soil or ground disturbance from vehicles or heavy equipment during treatments, resulting in disturbance or destruction of vegetation and subsurface dens or burrows. This disturbance may result in burrow abandonment or mortality of young Utah prairie dogs, resulting in the loss of one year's recruitment.

There may be long term effects to Utah prairie dogs due to changes in quality or quantity of habitat following fuels treatments. However the level and extent of effects will be site-specific and weather-dependent. For example, sometimes the initial loss of forage and cover after a prescribed fire would be followed by vigorous regrowth of forb species in the growing seasons that follow given favorable weather conditions. In other situations, especially during drought conditions, there may be long term effects due to changes in quality or quantity of habitat when key habitat components are slow to recover. Slow recovery of suitable habitat conditions may affect the ability of Utah prairie dogs to continue occupying a site.

As described above (see Wildfire Suppression), fire can be beneficial to Utah prairie dogs when it converts "shrubland" to "shrub-grassland mosaics." Where prescribed fire occurs in Utah prairie dog habitat, the reduction of sagebrush canopy cover (shrub removal) could have long term beneficial effects to Utah prairie dogs. Prescribed fire could be used to accomplish some of the habitat treatments recommended in the Utah prairie dog MU Plans. The commitment of BLM and the USFS to co-manage for prairie dogs and greater sage-grouse should allow the continued implementation of the MU Plans whether habitat treatments are accomplished through the use of chemical, mechanical, or fire tools.

Lands and Realty (Transmission Lines)

The proposed action includes the relocation of one section of a designated transmission line right-of-way corridor to avoid greater sage-grouse nesting habitat and existing leks. The general location of the proposed relocation would result in a section of the existing designated

transmission line right-of-way corridor being moved closer to an existing Utah prairie dog colony within the BLM's Kanab field office area. The existing section of designated transmission line right-of-way corridor does not have any transmission lines but the adjusted alignment coincides with an existing transmission line. However, the existing Kanab RMP management decisions that pertain to Utah prairie dog (and are not being amended in this process) state that no surface disturbance or surface occupancy can occur within 0.5 miles of active Utah prairie dog habitats. Thus, if a transmission line is proposed in this corridor in the future, the direct and indirect impacts of a project in this adjusted right-of-way corridor will be minimized by the existing conservation measures in the Kanab RMP (BLM 2008).

5 CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Cumulative effects to the Utah prairie dog and its habitat under the Proposed Action would include, but not be limited to, the following broad types of impacts:

- Changes in land use patterns or practices that adversely affect a species' suitable or potential habitat.
- Encroachment of human development into suitable habitat.
- Habitat and fire management actions by some, or all, of the following groups, on lands adjoining BLM-administered lands:
    - State of Utah
    - County Governments in Utah
    - Local Governments in Utah
    - Private landholders in Utah

The locations of Utah prairie dog colonies and mapped habitat are set amidst a checkerboard pattern of land ownership including Federal, State, and private landowners. Utah prairie dogs are therefore susceptible to activities on State and private lands. Many of these activities, such as human population expansion and associated infrastructure (increased roads); oil and gas exploration and development; unregulated recreation activities (e.g. off-highway vehicles); and control of prairie dogs as pests on state and private lands within the action area may contribute to negative cumulative effects to the Utah prairie dog through human-caused injury or mortality, elimination of or disturbance to colonies, tunnels, and den sites, destruction or degradation of native grassland or sagebrush habitats, and spreading disease, such as distemper. Contributing as cumulative effects to the proposed action, these activities may affect Utah prairie dog population persistence by contributing to loss and fragmentation of small, isolated colonies.

As described above (see section 3.2, Factors Affecting the Species within the Action Area, Conservation Measures, above), conservation measures are ongoing on some of the private and state lands through the completion of land acquisitions and easements. In addition, the State or local governments (e.g. counties), continue to assist or implement plague management strategies and translocations to support Utah prairie dog recovery within the action area. These efforts should have a positive impact on Utah prairie dog populations within the action area; prairie dog populations are generally stable to increasing range wide (USFWS 2012).

As previously described (see section 3.2, Factors Affecting the Species within the Action Area, State Plan, above), the UDWR recently developed a new Utah Prairie Dog Management Plan for Non-federal Lands (State Plan). It is too early in the implementation of the State Plan to assess any positive or negative effects of that plan, but we will continue to monitor its implementation and work with our partners to implement recovery actions for this species.

6 CONCLUSION

After reviewing the current status of the Utah prairie dog, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Utah prairie dog. We have reached this conclusion based on the following reasons:

1) The Plan amendments do not authorize individual management actions that may affect Utah prairie dogs; there will be project-level section 7 consultation that will minimize any adverse impacts to Utah prairie dogs to the maximum extent practicable.

2) The conservation measure in the BA makes clear the co-management commitment by the BLM and USFS for Utah prairie dogs and greater sage-grouse. Utah prairie dogs and greater sage grouse are sympatric species, and good management of the shrub-grassland mosaic will benefit both species.

7 INCIDENTAL TAKE STATEMENT

The proposed actions described in the biological assessment are programmatic level planning document (Land Use/Forest Plan) amendments and do not specifically authorize individual management actions/projects. As such, the actions evaluated in the preceding biological opinion meets the regulatory definition of a framework programmatic action: "a Federal action that approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further section 7 consultation (50 CFR §402.02)". An incidental take statement is not required for a framework programmatic action (50 CFR §402.14(i)(6)).

Therefore, we are not anticipating any incidental take under this biological opinion. Future actions that are guided by the framework identified in the BLM Land Use and USFS Forest Plan amendments would undergo project level consultation and will include incidental take statements, reasonable and prudent measures; and terms and conditions, when appropriate.

8 REPORTING REQUIRMENTS

Upon locating a dead or injured Utah prairie dog, initial notification must be made within one business day to our Division of Law Enforcement in St. George, Utah, at telephone (435) 673-3420, our Ecological Services Offices at telephone (801) 975-3330 and (435)-865-3763, and the Cedar City UDWR office at telephone (435) 865-6120. This reporting requirement will allow our Division of Law Enforcement or the UDWR to collect and process dead prairie dogs, if necessary, to determine cause of death. Instructions for proper handling and disposition of such specimens will be issued by our Division of Law Enforcement consistent with the provisions of the Incidental Take Statement. Care must be taken in handling sick or injured animals to ensure effective treatment and care in handling dead specimens to preserve biological material in the best possible state.

9 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- The BLM and USFS should continue to participate in Utah prairie dog recovery implementation teams and continue to assist with strategies to co-manage for the greater sage-grouse and Utah prairie dog. For the Utah prairie dog, the BLM and USFS should use available recovery documents such as the 2012 Revised Utah Prairie Dog Recovery Plan; Utah Prairie Dog 5-Year Management Unit Plans-The Path to Recovery (2014-2018) (UPDRIP 2014; see Effects of the Action, Habitat Management, below); Population Structure for Utah Prairie Dog Recovery (UPDRIP 2013), and any subsequent updates and guidance from the U.S. Fish and Wildlife Service.

10 REINITIATION NOTICE – CLOSING STATEMENT

This concludes formal consultation on the Utah Greater Sage-Grouse Land Use Plan Amendment and Final Environmental Impact Statement. As provided in 50 CFR §402.16, reinitiation of formal consultation is required for projects where discretionary Federal Agency involvement or control over the action has been retained (or is authorized by law) and under the following conditions:

1. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion.
2. The action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion.
3. A new species is listed or critical habitat designated that may be affected by the action.

4. If co-management language is not added to the Finalized Plan Amendments or Record of Decision as described in the Applicant Committed Conservation Measure Section of this biological opinion.

To re-initiate section 7 consultation, the BLM or USFS should immediately notify our office by phone or email.

Thank you for your interest in conserving sensitive, threatened, and endangered species. If we can be of further assistance, please contact Nathan Brown at (435) 865-3763 or Laura Romin at (801) 975-3330, ext. 142.

Attachments

cc: Ron Rodriguez, Wildlife and Fish Program Manager, U.S. Forest Service, Dixie and Fishlake National Forests, 1789 North Wedgewood Lane, Cedar City, UT 84721

Keith Day, Utah Division of Wildlife Resources, Southern Regional Office, 1470 North Airport Road, Cedar City, Utah 84720

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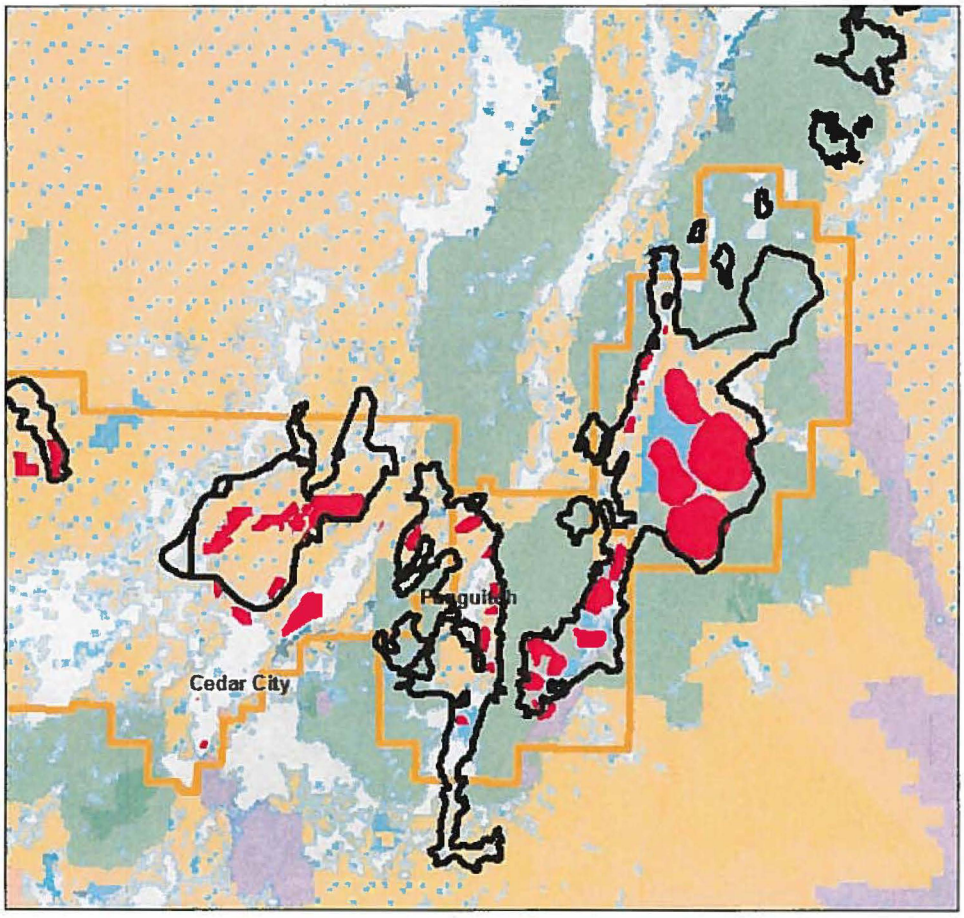
Appendix A

UPD Management Units and GRSG Overlap (GRSG PHMA's - BLM +FS)



Legend

- UPD Management Units
- GRSG PHMA's
- UPD Recovery Units

Land Status Basic

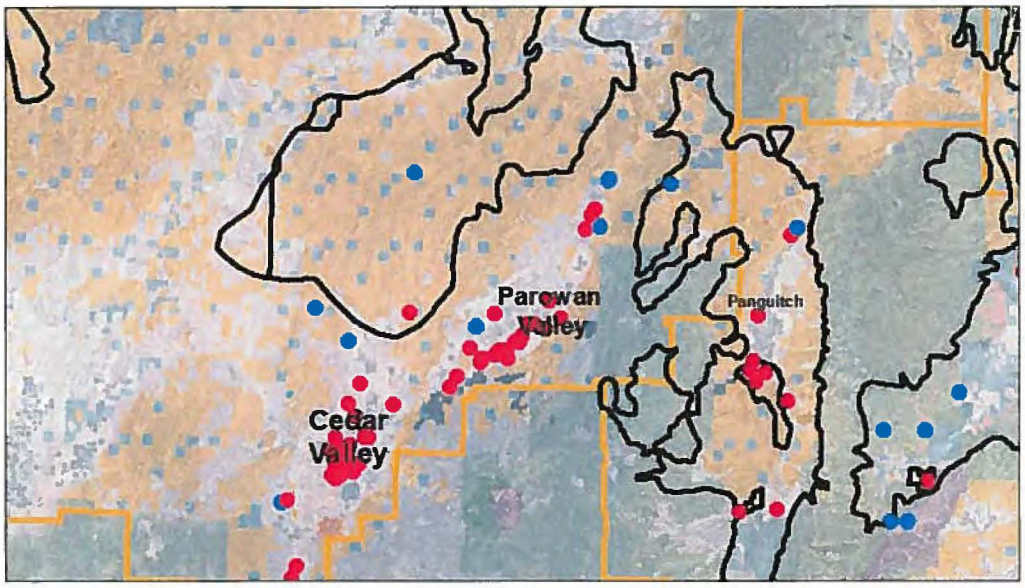
ADMIN

- BLM
- NPS
- Private
- SITLA
- USFS

N

Appendix B

UPD Large Colonies
in Cedar and Parowan Valleys Outside
(GRSG PHMA's - BLM +FS)



Legend

UPD Large Colonies

- Not Protected
- Protected
- GRSG PHMA's
- UPD Recovery Units

N

0 5 10 20 Miles

Appendix C

Status of the Utah Prairie Dog

Utah Prairie Dog

(*Cynomys parvidens*)

Status of the Species: June 2015

U.S. Fish and Wildlife Service

Utah Field Office

2369 West Orton Circle, Suite 50

West Valley City, Utah 84119

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Executive Summary

The purpose of this report is to summarize the status of the Utah prairie dog, a federally threatened species. For more information regarding the species, please contact the Utah Field Office by mail at 2369 West Orton Circle, Suite 50, West Valley City, Utah 84119, or by telephone at (801) 975-3330.

Literature Citations

Literature Citations should read:

U.S. Fish and Wildlife Service. 2015. Utah Prairie Dog (*Cynomys parvidens*) Status of the Species: June 2015. U.S. Fish and Wildlife Service, West Valley City, Utah. 15 pp.

Status of the Species / Critical Habitat

Species/Critical Habitat Description

The Utah prairie dog (*Cynomys parvidens*) is the smallest species of prairie dog. Individuals are typically 12 to 14 inches (in) long (Hollister 1916) and weigh 1.4 to 3.1 pounds (Wright-Smith 1978). Utah prairie dogs range in color from cinnamon to clay. The Utah prairie dog is distinguished from other prairie dog species by a relatively short (1.2 to 2.8 in) white- or gray-tipped tail and a black "eyebrow" above each eye (Pizzimenti and Collier 1975; Hoogland 2003).

The Utah prairie dog was listed as an endangered species on June 4, 1973 (38 FR 14678), pursuant to the Endangered Species Conservation Act of 1969. At the time of listing, the species was threatened with extinction due to habitat destruction, modification or severe curtailment of habitat, over exploitation, disease, and predation. The species was reclassified as threatened on May 29, 1984 (49 FR 22330), with a special rule to allow take of prairie dogs on agricultural lands. The rule was amended in 1991 to increase the amount of regulated take and it was revised again in 2012. The revised 4(d) rule August 2, 2012, expanded the rule to include lethal take where prairie dogs "create serious human safety hazards or disturb the sanctity of significant human cultural or human burial sites". The revised 4(d) rule August 2, 2012 expanded the rule to allow lethal "take on agricultural lands and properties within .5 mi of conservation lands", and it set the annual take limit under the revised rule to 10 % of the annual range-wide population estimate instead of a "fixed" annual limit.

In November 2014, the U.S. District Court for the District of Utah held that the 2012 4(d) Rule for the Utah prairie dog is unconstitutional to the extent it regulates Utah prairie dog take on non-federal lands. That decision is currently on appeal. After the decision, the UDWR assumed management authority for Utah prairie dogs on non-federal lands. The UDWR generated a new State management plan, effective May 8 2015, which allows for increased levels of lethal take (minimum 6,000 which is upwards of 20-30% of estimated total population) on non-federal lands than previously authorized under the 4(d) rule (10% of estimated total population). Additionally under the State Plan, lethal take is authorized on all unmapped Utah prairie dog habitat and there is no mitigation for the loss of occupied habitat due to development activities. Long-term, the State Plan would remove all take restrictions when a Recovery Unit reaches 2,000 adult animals on protected lands whereas our Recovery Plan takes a broader view of what is needed before delisting is considered, including assurances that the Utah prairie dog population is spatially distributed to provide sufficient connectivity and gene flow. It is too early in the implementation of the State Plan to assess any positive or negative effects of that plan. However, the relative recovery contribution of each individual Utah prairie dog on Federal land may change depending on how the State Plan (above) is implemented. As data from the implementation of the new State Plan is reported (we generally receive annual reports of prairie dog actions from the Utah Division of Wildlife Resources), our evaluations of the Status of the Species and future Environmental Baselines will be updated accordingly in new biological opinions, and reinitiations of section 7 consultations would occur as needed.

Life History and Population Dynamics

Utah prairie dogs spend four to six months underground each year during harsh winter months (Hoogland 2001). Some observations suggest that Utah prairie dogs hibernate. However, other evidence suggests that at lower elevations Utah prairie dogs may enter torpor more intermittently at the beginning and end of the hibernation season and may be seen above ground in mild weather (Collier and Spillet 1975; Hoogland 1995, 2001; Lehmer and Biggins 2005). Torpor patterns of Utah prairie dogs might be influenced by environmental conditions, and may differ across the species' range (Lehmer and Biggins 2005).

Adult males usually cease surface activity during August and September, followed by adult females several weeks later (lactating females enter hibernation later than non-lactating females) (Hoogland 2003). Juvenile prairie dogs remain active as late as November. Temperature is thought to trigger emergence from hibernation beginning in mid-March to mid-April. Mating occurs soon after emergence.

One half to two thirds of Utah prairie dog's adult population is female (Mackley *et al.* 1988). Approximately 67 percent of females wean a litter each year (Hoogland 2001). Each female produces an average of 3.88 pups which are born in April after a 30 day gestation period (Pizzimenti and Collier 1975; Wright-Smith 1978; Mackley *et al.* 1988; Hoogland 2001). Young appear above ground at five to seven weeks of age, are full grown by October of their first year, and reach sexual maturity at one year. Less than 50 percent of both males and females survive the first year (Hoogland 2001). Only about 20 percent of females and less than 10 percent of males survive to age 4 (Hoogland 2001). Due to their limited reproductive rates, short life span and high mortality rates, numbers of individuals counted within a colony can fluctuate greatly throughout the year with low points in the spring and peaks in the late summer when adults and pups are above ground.

Traditionally, it was thought that natal dispersal (movement of first year animals away from their area of birth) and breeding dispersal (emigration of sexually mature individuals from the area where they copulated) were male-biased, leading to higher mortality rates to young males from predation (Hoogland 2003). However, recent genetic work in a range wide study showed that of the Utah prairie dogs that dispersed, 25 percent were adult females (Brown 2009).

Young male Utah prairie dogs disperse in the late summer with average dispersal events of 0.35 mile (mi), long-distance dispersal events of up to 0.75 mi, and unusually long-distance dispersals of 4 mi (Mackley *et al.* 1988; Brown *et al.* 2011). In the summer of 2014 the Utah Division of Wildlife Resources documented a recently translocated individual traveling upwards of 10 miles, though unusual this drastically changes our understanding of their dispersal potential.

Utah prairie dogs are organized in social groups, or clans, consisting of an adult male, several females, and their young (Wright-Smith 1978). Clans are loosely organized with no observable dominance hierarchy. Geographic boundaries of clans remain fairly constant within a colony, and young prairie dogs are the only ones to regularly cross boundaries. Utah prairie dogs will use common feeding grounds, but still maintain elements of territoriality in those areas

(Wright-Smith 1978). The typical home range of the Utah prairie dog is 750 feet (ft) (Crocker-Bedford 1975; Wright-Smith 1978) and the distance at which disturbance affects a prairie dog's normal behavior is estimated to be 350 ft (Ashdown 1995). Social behaviors', especially socially facilitated vigilance and warning vocalizations, are important to survival of individuals in colonies and to the overall well-being of the colony. The adult females play the major role in caring for young, they are also the primary ones that provide warning of danger (Wright-Smith 1978).

Utah prairie dogs forage primarily on grasses and forbs, and tend to select those with higher moisture content (Crocker-Bedford 1976). They often select colony sites in swales where the vegetation can remain moist even in drought conditions (Collier 1975; Crocker-Bedford and Spillet 1981). Vegetation must be of short stature to allow the prairie dogs to see approaching predators as well as have visual contact with other prairie dogs in the colony (Collier 1975; Crocker-Bedford and Spillet 1981). Prairie dogs will avoid areas where brushy species dominate, and will eventually decline or disappear in areas invaded by brush (Collier 1975; Player and Urness 1983). Well-drained soils are a habitat requirement for Utah prairie dogs to excavate burrow sites. Burrows must be deep enough to protect the prairie dogs from predators and environmental and temperature extremes.

Predators of Utah prairie dogs include: badgers (*Taxidea taxus*), coyotes (*Canis latrans*), raptors, fox, and weasels. In an established prairie dog colony, predators do not have a significant impact; conversely, they have a huge impact on translocation sites where an established social system or burrow system is not present.

Utah prairie dog populations are susceptible to sylvatic plague (*Yersinia pestis*), a bacterium introduced to the North American continent in the late 1800's (Cully *et al.* 1993). There is a limited understanding of the variables that determine when sylvatic plague will impact prairie dog populations. Fleas are the vectors that spread the disease and can be brought into the vicinity of a prairie dog colony by a suite of mammals. Plague outbreaks generally occur when populations increase to high densities causing increased stress among individuals and easier transmission of disease between individuals.

Status and Distribution

There are five species of prairie dogs native to North America (Hoogland 2003). Taxonomically, prairie dogs (*Cynomys spp.*) are divided into two subgenera: the white-tail and black-tail. The Utah prairie dog (*C. parvidens*) is a member of the white-tail group, subgenus *Leucocrossuromys*. Other members of this group, which also occur in Utah, are the white-tailed prairie dog (*C. leucurus*) and the Gunnison prairie dog (*C. gunnisoni*).
The Utah prairie dog is recognized as a distinct species (Zeveloff 1988; Hoogland 1995), but is most closely related to the white-tailed prairie dog. These two species may have once belonged to a single interbreeding species (Pizzmenti 1975). They are now separated by ecological and physiographic barriers and exhibit genetic differences. The type locality for the Utah prairie dog is Buckskin Valley in Iron County, Utah (Pizzimenti and Colllier 1975).

The Utah prairie dog is the westernmost member of the genus *Cynomys*. Historically, Utah prairie dog colonies were found as far west as Pine and Buckskin Valleys in Beaver and Iron Counties, and may have occurred as far north as Nephi, southeast to Bryce Canyon National Park, east to the foothills of the Aquarius Plateau, and south to the northern borders of Kane and Washington Counties (Figure 1) (Pizzimenti and Collier 1975). Factors that resulted in the historical decline of Utah prairie dogs were poisoning; drought; ecosystem conversion (agriculture, overgrazing, urbanization); shooting; and disease (Collier and Spillet 1972).

The Utah prairie dog currently occurs in three areas within southwestern Utah, which are designated as recovery units (RU; figure 2):

1) the Awapa Plateau;
2) the Paunsaugunt region, along the east fork and main stem of the Sevier River; and,
3) the West Desert region of Iron County, with a few isolated colonies existing in mountain and desert valleys in Iron and Beaver Counties (Pizzimenti and Collier 1975).

Utah prairie dogs are found in elevations from 5,400 ft on valley floors up to 9,500 ft in mountain habitats. For more information on these recovery units, refer to our revised recovery plan for the species (USFWS 2012).

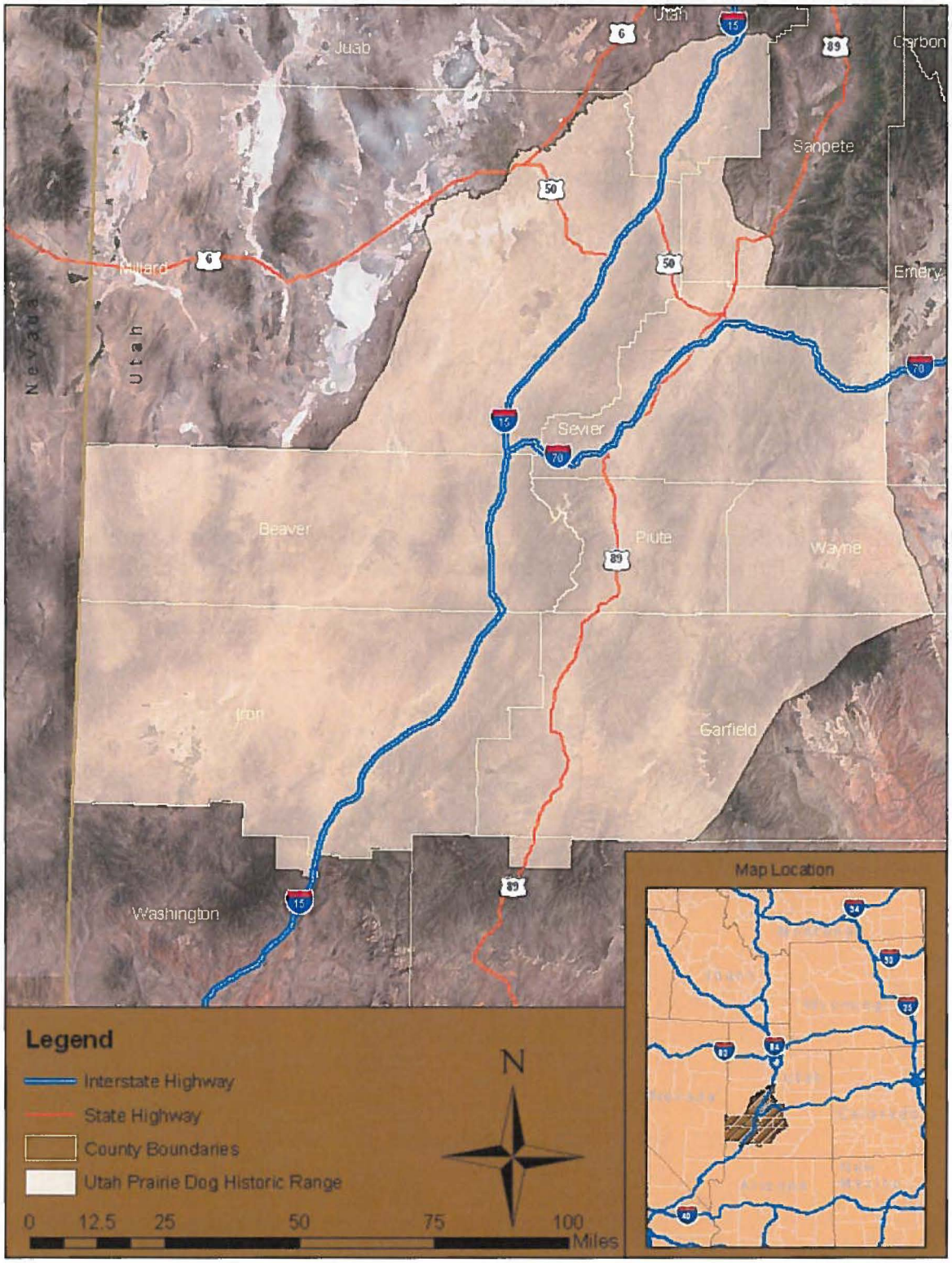

Figure 1. Utah prairie dog historic range.

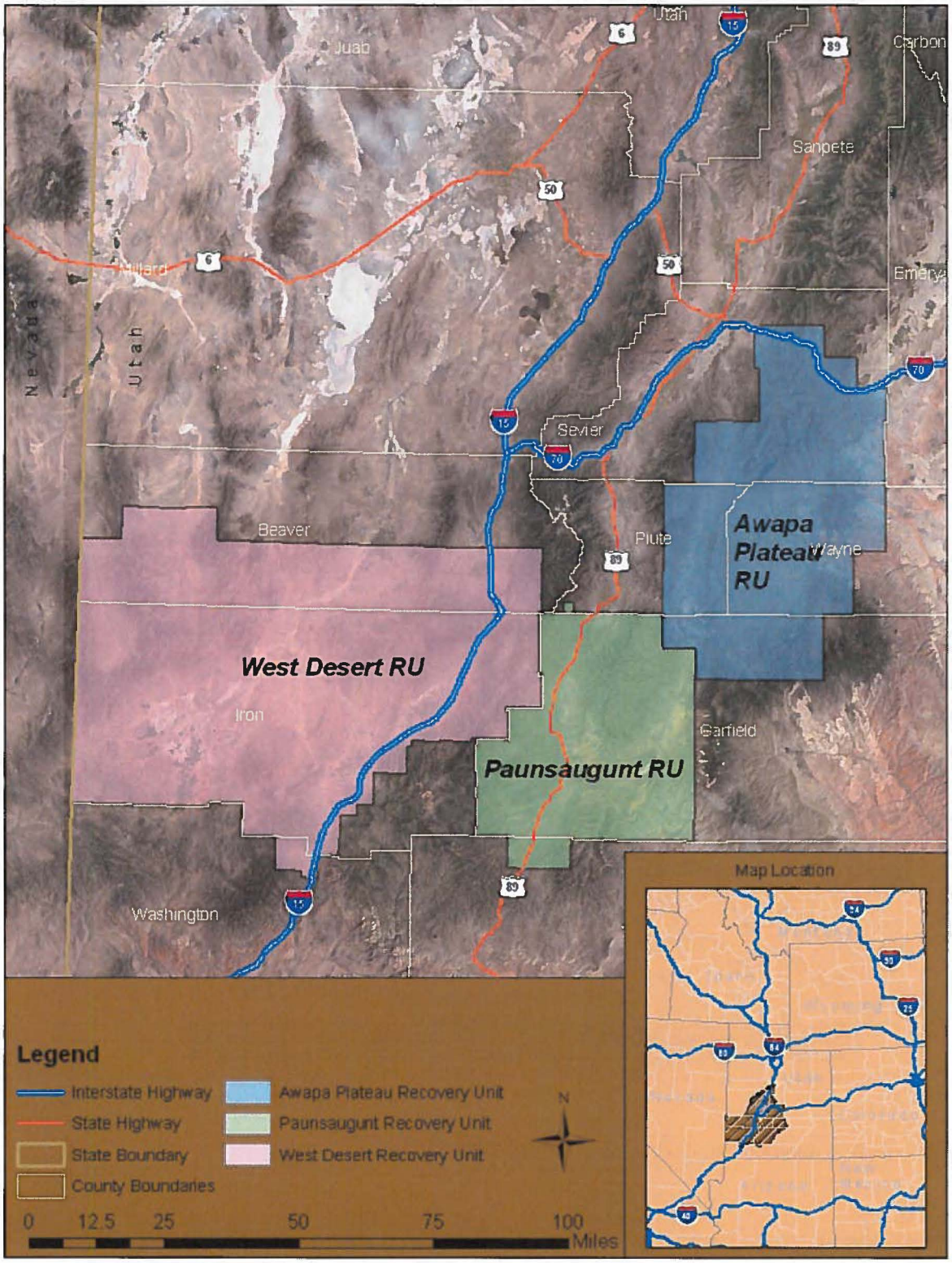

Figure 2. Utah prairie dog recovery unit boundaries.

Rangewide adult counts were as high as 11,431 in the 2014 spring census count (Utah Division of Wildlife Resources (UDWR 2010a, UDWR 2015) with a low count of 1,866 in 1976 (Figure 3). We use established survey protocols for counting Utah prairie dogs and determining population trends. Counts are made in the spring before juveniles emerge and we estimate that only 50 percent of all adults within the colony are seen at any one time (Crocker-Bedford 1975). Counts of adult Utah prairie dogs from 2010 to 2014 are 5,642; 6,640; 7,979; 7,270; and 11,431 respectively (5 year average= 7,792) (Figure 3) (UDWR 2010a, UDWR 2012, UDWR 2014, UDWR 2015). Total population estimates are calculated using a formula that accounts for the adult population estimate derived from spring counts and the estimated reproduction:

> Population estimate = [(2 x Spring Adult Count) x 0.67 (proportion of adult females) x 0.97 (proportion of breeding females) x 4 (average number of young per breeding female)] + (2 x Spring Adult Count)

Overall, spring counts from the past 30 years show considerable annual fluctuations, but stable to increasing long-term trends in adult Utah prairie dog numbers.

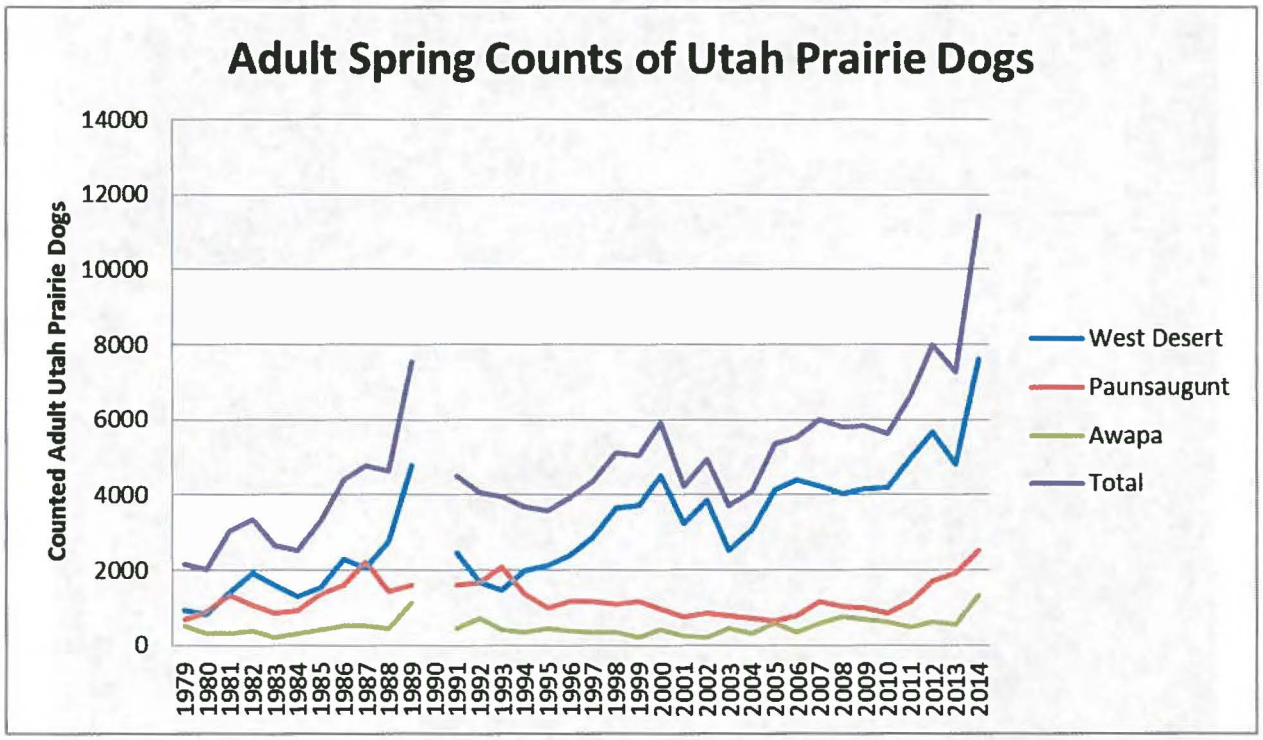

Figure 3. Graph of Adult Utah Prairie Dog Counts (1976-20014)[2].

2 The 1990 count has been removed because none of the private lands colonies were counted due to staffing and budget limitations.

In 1972, the UDWR began mapping occupied Utah prairie dog habitat throughout their range (USFWS 2012). The UDWR has mapped 59,656 acres as Utah prairie dog habitat (UDWR 2010b). Mapped Utah prairie dog habitat includes any and all areas within the species' range that were mapped since 1972 as currently or historically occupied by Utah prairie dogs. Official maps of mapped Utah prairie dog habitat are maintained by the UDWR and updated annually. Occupied habitats are areas of known Utah prairie dog habitat that, at the time in question, support Utah prairie dogs. There are 16,841 acres of mapped habitat in the West Desert Recovery Area; 15,620 acres of mapped habitat in the Paunsaugunt Recovery Area; and 27,195 acres of mapped habitat in the Awapa Recovery Area (Table 1) (UDWR 2010b).

Table 1. Mapped Utah Prairie Dog Habitat by Land Ownership (acres).

LAND OWNERSHIP[3]	RECOVERY UNITS		
	West Desert	Paunsaugunt	Awapa
U.S. Forest Service	140	3,776	8,591
Bureau Land Management	6,372	602	9,367
National Park Service	0	301	60
Protected Habitat	266	0	566
Utah School and Institutional Trust Lands Administration Lands	428	4,778	6,850
Private	9,969	6,163	1,761
Total	**17,175**	**15,620**	**27,195**
Habitat Removed (Developed)	400 (est)	0	0
Total Habitat Remaining	**16,775**	**15,620**	**27,195**

3 The definitions used in these tables for public, protected, and State Institutional Trust Lands Administration lands are found in the glossary.

Recovery Efforts

The 2012 Utah Prairie Dog Revised Recovery Plan (USFWS 2012) calls for the three recovery units (RU) to each contain 2,000 adult animals for 5 consecutive years (based on annual spring counts), and to maintain these population goals by protecting populations from habitat loss (i.e., development) and managing the threat of plague. Our recovery strategy for the Utah prairie dog focuses on the need to address colony loss and disease through a program that encompasses threats abatement, population management, research, and monitoring. We emphasize: conserving existing colonies; establishing additional colonies on federal and protected non-federal lands via habitat improvement or translocations; controlling the transmission of plague; and monitoring habitat conditions. Recent successes include the protection of over 1,200 acres of non-federal lands through habitat acquisitions and conservation easements with willing landowners; increased translocation successes on United States Forest Service (USFS) lands near Bryce Canyon National Park, due in part to increased plague management efforts; and the encouraging field trials and early success an oral plague vaccine.

A rangewide public-private partnership called the Utah Prairie Dog Recovery Implementation Program (UPDRIP) was initiated in 2010 (http://www.suu.edu/ad/regional/updrip/). There is currently limited funding available to pursue landscape-level conservation efforts for recovery of the species. However, the Program has already become a valuable tool for increasing coordination efforts and is preparing action plans for Utah prairie dog conservation. In addition, the support of UPDRIP partners has already proven important in obtaining some funding from various grant programs. In 2015 UDRIP changed its name to the Utah Prairie Dog Oversight Group (UPDOG).

All Recovery Team and Recovery Program members are involved in efforts to conserve and recover the Utah prairie dog using the best available information and adaptive management practices. We believe that the Utah prairie dog is a very recoverable species, particularly if we can successfully garner resources, cooperation, and dedication from all involved.

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Appendix D

Vegetation

The vegetation objectives represent best current knowledge of ideal parameters. Individual locations may vary from these parameters; however, each deviation from the vegetation objectives should be noted and explained. For example, *shrub ground cover at site xyz equals 10%. Of this 10%, 8% are subshrubs (generally <6" in height), and only 2% is big sagebrush. Other vegetation objectives are met at site xyz. Since the amount of subshrubs is not expected to interfere with Utah prairie dog visibility or compete with the herbaceous understory, site xyz is recommended as a translocation site.*

Refer to Appendix 1 for definitions and examples of the vegetation parameters. Habitat manipulation may be required at sites not meeting the vegetation objectives.

Warm season grasses: 1 - 20% ground cover

Cool season grasses: 12 - 40% ground cover

Forbs: 1 – 10% ground cover (perennial, non noxious)

Shrubs: 0 – 8% ground cover and <10% canopy cover

Minimum number of plant species: 10

Vegetation definitions

Vegetative Type	Definition	Examples
Warm season grasses	Grasses which "green up" and do most of their growing during the warm summer months.	Sand dropseed, curlygrass, mountain muhly, and grama grass.
Cool season grasses	Grasses which "green up" and do most of their growing during the cool spring months.	Indian ricegrass, squirreltail, western wheatgrass, crested wheatgrass, needle and thread grass, cheatgrass, bluegrass, and wildrye.
Forbs	Included are any herbaceous plant other than those in the grass family (*Poacae*). Must be palatable and provide nutritional value to prairie dogs.	Astragalus, alfalfa, aster, *Cymopterus* spp., buckwheat, fleabane, *Penstemon* spp., cinquefoil, phlox, globemallow, vetch, *Cryptantha* spp., lupine, crazyweed, clover, and goosefoot or pigweed.
Shrub	A plant with persistent, woody stems and a relatively low growth form, compared to trees, and that generally produces several basal shoots.	Sagebrush, big rabbitbrush, greasewood, four-wing saltbush, and broom snakeweed. Desirable subshrubs include forage kochia, winterfat, Gardiner saltbush, and little rabbitbrush.

Appendix K

Greater Sage-Grouse Habitat Baseline and Habitat Update Protocol

APPENDIX K
GREATER SAGE-GROUSE HABITAT BASELINE AND HABITAT UPDATE PROTOCOL

BACKGROUND

Habitat for Greater Sage-Grouse (GRSG) is the most critical element in any efforts to manage and conserve the species in its range across the Western United States. Consequently, considerable time and expense has been dedicated to identifying current, historical, and potential expansion of GRSG habitat and how it functions to provide the life sustaining elements for the species. Conservation of habitat is the foundation for this resource management plan amendment (RMPA). Any GRSG conservation effort in Utah, as stated in the Conservation Plan for Greater Sage-Grouse in Utah (State Conservation Plan) (UDWR 2013), must be "designed to protect high-quality habitat, enhance impaired habitat and restore converted habitat to support, in Utah, a portion of the range-wide population of GRSG necessary to eliminate threats to the species."

According to Manier et al. (2013), GRSG are currently estimated to occupy 165 million acres (668,000 square kilometers) across the western United States and Canada (Knick and Connelly, 2011), and this range encompasses tremendous variability in habitat conditions, anthropogenic activities, and GRSG populations. Development of comprehensive monitoring approaches lead to formal recognition that habitat selection assessments are needed to utilize approaches that address multiple spatial scales to represent selection processes of the animals (Connelly et al. 2003; Stiver et al. 2010). The first-order (1) is the geographic range and defines the GRSG population of interest, and within this geographic range (2) characterization of the second-order hinges on large, relatively intact regions of habitat identified using subpopulation distributions (for example, geographic connections among leks or regional population connectivity using genetics) to link habitats to GRSG use. The third-order (3) requires refinement from broad delineations of the species range in a given area to the seasonal habitats (for example, nesting and winter habitats), patch selection, and migration habitats. Finally, assessment can be made of fourth-order selection (for example, daily site selection and behavioral observations) by (4) quantifying food and cover attributes and foraging behavior at particular sites. In practice, selection of food items is nested within selection of feeding site because selection of a particular site determines the array of food items available to be selected; importantly, habitat value and use will best be determined using a combination of these characteristics (not one alone). To accurately characterize GRSG

habitat/range selection for a given population at the first- and second-orders, or landscape spatial scales, the migratory nature (seasonal movements) of the population must be well understood (see Connelly et al. 2000), and this may include very large areas on an annual basis. It has been suggested that migratory populations may range across hundreds of square miles (Connelly et al. 2003).

HABITAT IDENTIFICATION PROCESS

The UDWR is the primary entity responsible for management of GRSG populations in Utah and is also the lead entity in identifying and mapping GRSG distribution. Information on the distribution identification process followed in Utah was summarized and is included in the Utah Greater Sage-Grouse Management Plan (State Management Plan) (UDWR 2009). Although this plan has been superseded by the State Conservation Plan, the now dated Management Plan provides relevant information on the habitat identification process.

Following Doherty's work in Wyoming, Montana, and Colorado (Doherty 2008), core Utah GRSG breeding habitats were mapped. The mapping was accomplished utilizing occupied lek densities and associated male GRSG maximum lek attendance data for the period 1999 – 2008 (10 years), referred to as the breeding bird density mapping. The breeding bird density mapping identified four density levels or parameters. The first parameter identified areas where 25 percent of the state's total 10-year average spring breeding GRSG males (indicator for populations) are located. These areas symbolize the highest statewide density of breeding males on leks and can also be viewed as high priority leks or those leks and associated habitats that individually contribute the most to the state's GRSG total population. The second parameter identified areas where 50 percent of the state's total breeding GRSG males are found. This was repeated for the 75 percent and 100 percent of spring breeding GRSG males until all occupied leks were classified. Viewed from the converse, the total known spring GRSG statewide population was indicated by the combined area of all parameters.

The breeding bird density mapped habitat was further refined over time as additional population and habitat area inventory, studies and other information were available. This included information provided by other field specialists, other agencies, local and special interest groups, private landowners, and academia. Adjustments to habitat boundaries have been made based on verified information. The mapped occupied habitat boundaries in each population area include areas currently occupied by a population or populations of GRSG and are based upon the location of occupied leks, the identification of nesting and brood rearing habitat, and associated winter and other habitat.

For decades prior to the current review, the UDWR has been supporting research and community-based conservation efforts to learn more about the ecology of the species. Appendix 8 of the State's 2013 Conservation Plan contains a listing of research studies and reports on GRSG conducted in Utah. To facilitate this effort, the UDWR established ten Local Area Working Groups under the general direction of Utah State University, with the first established as far back as 1996. These Local Area Working Groups were composed of private interests and governmental entities, and were tasked to assess the local nature and scope of the threats to the species, and to recommend a course of action to address those threats. Because of this early and ongoing assessment, the State of Utah is fortunate to have a high level of knowledge about many of the populations including seasonal range, migration routes, and other factors known to be essential to maintenance of the species, all in the context of Utah's unique conditions.

GRSG distribution in Utah is highly influenced by the geography of Utah, which is characterized by mountainous terrain, separated by broad valleys in the Great Basin, and by deeply incised canyons in the Colorado Plateau. GRSG habitat may be found in intact blocks in the Great Basin, or in disconnected "islands" of habitat in the Colorado Plateau.

The UDWR's broadly depicted occupied GRSG habitat maps are intended to encompass the range used throughout the year by known GRSG populations. Broad based maps that identify the GRSG range are necessary to include a variety of important seasonal habitats and movement corridors that are spread across Utah's geographically diverse and naturally fragmented landscape. GRSG, frequently described as "landscape-scale species", may use multiple areas to meet seasonal habitat needs throughout the year and the resulting patchwork of habitats (e.g. winter, breeding, nesting, early brood-rearing, late brood-rearing, transitional, and movement corridor habitats) can encompass large areas, sometimes ranging between 180,000 and 1.2 million acres. Broad range maps increase the likelihood that all seasonal habitats (including transition and movement corridors) are included, especially where there are information gaps on GRSG populations' habitats. Inevitably these GRSG range maps include a patchwork of GRSG habitats and non-habitats. Non-habitats, in and of themselves, may not provide direct habitat value for GRSG (e.g. deep canyons or water bodies), but may be crossed by GRSG when moving between seasonal habitats.

To assist in refining GRSG occupied habitat in Utah, telemetry and GPS data has been collected for a portion of the GRSG populations in the state. Telemetry and GPS data provides UDWR with site-specific data on how GRSG use the landscape. Telemetry information provides a snapshot of how GRSG used the landscape in specific years but does not necessarily represent how those same birds use the landscape every year. To ensure all potential areas used by GRSG are identified and adequately managed to maintain and enhance GRSG populations, non-sagebrush habitat types (i.e. alfalfa fields) adjacent to telemetry locations are likely included in UDWR occupied GRSG range maps. Similarly, for populations where there is no telemetry data, the UDWR occupied GRSG range maps are intentionally broad in an attempt to include all possible areas, adjacent or nearby, that may be used by GRSG as habitat or movement corridors. In general, maps are refined as additional information on habitat conditions, GRSG habitat use patterns, population susceptibility to stochastic events, and impacts of vegetation treatment are available.

In summary, broad maps are more likely to include all seasonal habitat areas important for each population and can be refined as management agencies gain more information. Occupied habitat maps used as a baseline for this RMPA currently include known use areas, areas of potential habitat, as well as areas of non-habitat.

PLANNING REQUIREMENTS

Though the BLM manages the habitat for wildlife species, the UDWR is the agency primarily responsible for managing GRSG in Utah. In the past, the UDWR has been the primary repository for information regarding GRSG habitat in Utah. The range maps represent a broad combination of information sources, including intact sagebrush areas, field observations, radio-telemetry data, historic habitats, professional judgment, and sagebrush areas adjacent to the previously mentioned areas. Since telemetry data has not been collected for every GRSG population in the state, to refine the broader identified ranges, the aforementioned other sources of information are used in conjunction with telemetry and GPS data to create the GRSG range maps. For BLM's purposes of maintaining and enhancing GRSG persistence on

the landscape, all GRSG occupied range identified and mapped by UDWR is included as the baseline for planning to ensure that all habitats that are or may be necessary for long-term GRSG persistence are including for assessment and evaluation in the planning process.

In general, the planning schedule and analysis process required a cutoff point for any further consideration of additional habitat information. For this reason the March 2012 version of the UDWR GRSG range map was used as the baseline for the planning amendment. Without the establishment of the a clear cut-off point, the BLM would constantly be in a process of revising baseline information, which would prohibit the agencies from ever being able to complete this RMPA process and begin implementing measures that are needed to reduce or eliminate identified threats to GRSG and prevent listing as threatened or endangered species. However, there is general recognition that the identification and mapping of GRSG habitat is an ongoing effort.

The mapped occupied range map used as a baseline for this planning process is not intended to represent a survey-grade boundary of GRSG habitat and is not expected to be exclusively used at the project-level. In this sub-regional RMPA the BLM are making broad-scale land use planning decisions that are connected with similarly broad-scale RMPAs being simultaneously completed across the range of GRSG (see **Section 1.1** of the Proposed Plan/Final EIS). Based on the scale of planning (landscape level), baseline habitat represented in this RMPA primarily represents first and second order habitat selections discussed in the Background section above.

Not only is the scale of mapping appropriate given the scale of planning, but it is also appropriate given the stated goals and objectives of this RMPA. Through this planning process the BLM aims to not only stop the decline of GRSG populations, but to increase populations, which may require protection and restoration of historic use areas, or stated another way, protection of potential habitat near existing GRSG populations that does not currently support GRSG populations but is ecologically capable of doing so with proper management.

HABITAT UPDATES

As expressed in the 2013 State Conservation Plan, the implementation of any plan should be accompanied by efforts to refine mapping of habitats, which includes this RMPA. These efforts should be coordinated among federal, state and local agencies, private landowners, GRSG working groups and academia that may choose to participate. On-the-ground projects should also contribute to this refined habitat mapping effort, at a level commensurate with the decisions to be made.

Habitat map updates will be made when agencies with special expertise and legal jurisdiction for GRSG and their habitat gain more information on the presence/absence of GRSG; obtain new or additional baseline population data, including information on the distribution and connectivity of GRSG populations with other populations; identify GRSG seasonal habitats and movements; and identify and quantify sagebrush habitats, the condition of those habitats, and connectivity within populations.

While refinements to habitat maps are necessary and appropriate, the Proposed Plan includes management that gives the agency's discretion to authorize actions in non-habitat areas under identified conditions. This eliminates the need to make constant site-specific adjustments to GRSG habitat management area boundaries through the land use planning processes, which is neither consistent with the landscape nature of management actions in BLM RMPs, nor consistent with application of conservation measures at a scale and timing needed to protect GRSG.

Prior to considering proposed actions within Priority Habitat Management Areas (PHMA) or General Habitat Management Areas (GHMA), an evaluation should be conducted by a qualified biologist in collaboration with federal and state biologists, including a field investigation if needed. To this end, additional site-specific information associated with local surveys could result in a more precise delineation of habitat boundaries. If during implementation of the Proposed Plan or evaluation of a proposed action there are discrepancies between the LUP maps and the on-the-ground conditions, the on-the-ground information should be used to determine where the management included within this RMPA would apply. A similar site-specific review process has been effectively employed while GRSG occupied habits have been under interim management, allowing proposed projects in areas identified as non-habitat to proceed.

When considering new or local information for application of management actions, the goal is to provide a transparent and consistent scientific-based process for adjusting GRSG habitat that will promote conservation of GRSG in Utah. To that end, the following would be considered when updating the GRSG habitat delineations:

Occupied Habitat

- Determination of adjustments in the delineation of mapped occupied GRSG habitat would be coordinated among federal, state and local agencies, academia and technical specialists through a GRSG Working Group.
- Adjustments in mapped occupied GRSG habitat will be based on the best available information, including field observations and inventories, radio-telemetry data, habitat assessments, site visits, supporting research and science, restoration treatments, disturbance, technical expertise, and accepted modeling (including ground-truthing).
- Review of GRSG mapped occupied habitat and proposed adjustments could occur anytime there is a need to adjust the habitat baseline. At a minimum, the BLM would evaluate the mapped occupied habitat boundaries approximately every 5 years in conjunction with land use plan evaluations.
- In general, boundaries would not be adjusted to exclude non-habitat areas if those areas are wholly contained in the mapped occupied habitat boundaries, considering the level of habitat identification needed commensurate with the level of decision-making.
- Habitat altered by fire would not be removed as occupied habitat. If the BLM, in consultation with other agencies, determine that rehabilitation or restoration of mapped GRSG habitat is not feasible and that the area no longer contributes to any part of the GRSG lifecycle, adjustments may be made to exclude the area.
- Determinations on adjustments to mapped occupied GRSG habitat would be by consensus of the GRSG Working Group. If consensus cannot be reached, the BLM Utah State Director would determine whether habitat boundary adjustments should be made.

Priority and General Management Areas

- Because PHMA and GHMA boundaries are a land use plan action, adjustments are a BLM responsibility and will comply with the applicable BLM planning regulations and policies.
- Adjustments in delineation of PHMA and GHMA would be coordinated among federal, state and local agencies and interested parties.

- Adjustments in delineation of PHMA and GHMA would be based on the best available information, including field observations and inventories, radio-telemetry and GPS data, habitat assessments, site visits, supporting research and science, restoration treatments, disturbance, technical expertise, and accepted modeling (including ground-truthing).
- Review of PHMA and GHMA boundaries would generally be done approximately every 5 years (for the BLM, this would be in conjunction with land use plan evaluations), unless more frequent adjustments are needed.
- Consistent with landscape-level decision making, PHMA and GHMA would be identified at a first- and second-order level (Manier et. al. 2013), and as such, boundaries would generally not be adjusted to exclude non-habitat areas if those areas are wholly contained within the LUP-identified boundaries.
- Areas within PHMA and GHMA that are not currently used by GRSG, but are capable ecologically capable of supporting GRSG would not be removed from PHMA/GHMA boundaries.
- The GRSG Working Group would make adjustment recommendations to PHMA and GHMA to the BLM Utah State Director, who will make the final determination on whether the boundary adjustment is appropriate.
- New areas of mapped GRSG occupied habitat could be identified as either PHMA or GHMA following the appropriate BLM planning rules and procedures. The administrative process through which boundary adjustments will be made would be determined on a case-by-case basis.

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