WAFWA

WESTERN ASSOCIATION OF FISH & WILDLIFE AGENCIES

GREATER SAGE-GROUSE CONSERVATION REPORT

DECEMBER 2024

Greater Sage-Grouse Conservation Report Executive Summary

In 2015, state and federal agencies made substantial conservation commitments which played a key role in the U.S Fish and Wildlife Service's 2015 "not warranted" listing decision. Although the states' conservation investments to Greater Sage-grouse started long before this time, this was a critical point in history that led to well-defined and documented commitments by state and federal agencies. It is essential the implementation of these actions is recognized and recorded in a range wide Conservation Report. Western Association of Fish and Wildlife Agencies (WAFWA) Greater Sage-grouse range states continue to demonstrate their vast commitment to the species and the sagebrush ecosystem generating regular reports, proposals, and highlighting the best available information through the WAFWA Sagebrush Initiative and Committee

WAFWA received supporting funding from BLM to organize and compile this report using a combination of Federal, NGO, and State insights. The Greater Sage-Grouse Report Team was managed through WAFWA and composed of conservation partners with both scientific, technical, and policy expertise from state and federal agencies. This composition allowed for rangewide collaboration and reporting with significant efforts being made to prove a balanced and empirical assessment of range and species conditions. Engaging these diverse perspectives ensured a robust review of the information on Greater Sage-grouse conservation and produced a fact-based document.

The report review period is focused on 2015 to 2020; however, additional information and updates became available during the development of this report, and therefore, some of this information was included when deemed appropriate for context and being representative of the current available science

This report is not meant to be comprehensive of all research or species needs but to identify data needs, to acknowledge available research and reporting mechanisms, and to guide future work in the sagebrush biome by WAFWA and others. This report does not serve as a species assessment, nor does it intend to make rigid prescription for management. Although the audience for this report may be broad, the intent is to provide a report that consolidates rangewide information as a resource for informed policy makers.

The primary purpose of this report was to review the state and federal agency 2015 conservation commitments and actions which are summarized in Chapter 1. These stated commitments and actions played a critical role in previous policy decisions and this report provides clear evidence that these conservation commitments have been fulfilled rangewide. Unprecedented levels of conservation efforts have been successfully implemented across the range during the reporting time period and continue today. State wildlife management agencies continue to update, develop, and improve state policies and plans. For example, Washington's Shrubsteppe Restoration and Resilience Initiative launched in 2021 and Wyoming's 2019 update of their Core Area Strategy demonstrates their continued commitment to the Greater Sage-grouse. In addition, the states have accomplished untold volumes of work supported by many specific case studies on mitigation, conservation implementation, species monitoring, and policy that is only briefly represented here. Continued documentation of this work is essential to paint the full picture of the states' actions benefiting Greater Sage-grouse

Chapter 2 provides information on the condition of the population. This chapter also reports on habitat conditions, for example, increasing habitat losses from wildfire and anthropogenic development and increases in non-native invasive plant species. A robust assessment of the species status was not intended and therefore is not provided in this chapter. The report discusses Greater Sage-grouse populations and several factors influencing population trends. It portrays the population across the range and specifically notes the uniqueness of Washington's Greater Sage-grouse population. It also identifies the need for identifying causal factors of decline, especially in areas of seemingly intact habitat with minimal human disturbance. In addition, it recognizes the need for analysis on the impacts of diseases on populations. A comprehensive analysis or assessment of habitat conditions for Greater Sage-grouse, including an assessment of intactness, was not completed. However, the report does provide an assessment of habitat conditions. Drought, wildfire and anthropogenic changes continue to affect Greater Sage-grouse populations and the habitats they require to survive. Those ecosystem level changes present challenges today and into the future to keeping habitats intact.

Chapter 3 aggregates the substantial body of scientific literature that has been published since 2015 to improve our understanding of Greater Sage-grouse biology and facilitates conservation delivery. A total of 309 publications were reviewed for this report and are available in Chapter 3. Many new management tools have been developed in the past seven years and a list of those tools addressing key threats to the species is provided. While this is not an exhaustive list, and new tools continue to evolve, those included here provide multiple avenues for developing conservation delivery in the sagebrush biome. Examples include: tools that examine habitat suitability and mapping, impacts of anthropogenic activities and wildfire/invasive annual grasses, and restoration techniques.

Chapter 4 lays out the recommendations provided by the GRSG Conservation Report Team and provides a starting point for additional conservation efforts by WAFWA and others. It provides recommendations that would continue to grow and strengthen state and federal agencies' work. These include additional analysis on mitigation, specifically discussions on documenting the benefits of avoidance. However, it should be noted that the recommendations do not represent a shared direction by all team members and should not be viewed as comprehensive.

This report and other WAFWA products (for example, the Sagebrush Conservation Strategy) catalog the efforts in progress across the range. This report is a review of the conservation actions for the 2015-2020 time period. However, agencies' actions continue today. It should be noted, the report does not include conservation actions completed by our conservation non-governmental organization partners and others which provide additional measurable benefits and support to the Greater Sage-grouse and the sagebrush biome.

Using the lessons learned, the new science available, and established stakeholder relationships, state and federal agencies should continue to work in a strategic fashion on the sagebrush biome for the benefit of Greater Sage-grouse. Working strategically to address identified challenges and threats in an efficient manner will be essential to build off the progress made thus far. This, in concert with continued work to align data, filling in knowledge gaps, and long-term sustainable funding, will be necessary to maintain the momentum and collaborative efforts behind maintaining healthy Greater Sage-grouse populations.

WAFWA plays an essential role in providing a collective voice for Greater Sage-grouse and the conservation of the sagebrush biome ecosystem. WAFWA will continue to engage in these efforts and provide leadership in conservation strategic planning and implementation, initiate data alignment, generate comprehensive reporting, and serve as an instrument of collaboration for the sagebrush biome.

Acknowledgements

This work represents the insights and collaboration of many Federal and State partners working within the sagebrush biome and it would not have been possible without the stewardship and experience represented by the WAFWA Sagebrush Initiative team led by San Stiver and supported by Ken Mayer and Tom Remington. These three individuals invested in this work to further the understanding of the sagebrush and sage grouse conservation needs, but to also contribute to a foundational body of knowledge that might help advance the conversation of the sagebrush biome as we face emerging needs and challenges. We appreciate the effort of the many individuals, Federal, and State partners who contributed to aid in documenting this work.

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Introduction to the Greater Sage-Grouse Conservation Report

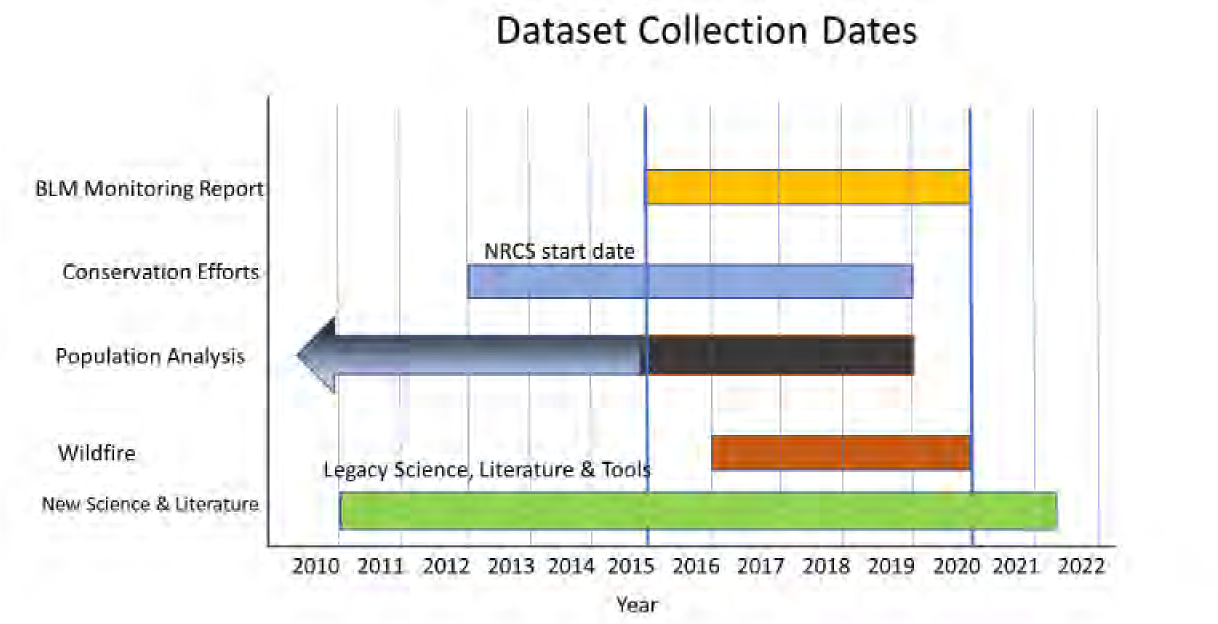
In 2015, state and federal agencies made substantial conservation commitments which played a key role in the U.S. Fish and Wildlife Service's (USFWS) 2015 "not warranted" decision for listing the Greater Sage-grouse (*Centrocercus urophasianus*; GRSG) under the federal Endangered Species Act (ESA). Although the collective states' conservation investments to Greater Sage-grouse started long before this time, this was a critical point in history that led to well-defined commitments by the agencies. The 2015 "not warranted" determination indicated the need for a review of those conservation commitments in 5 years to evaluate whether the data used and assumptions made during this determination were still an effective measure upon which to continue the management efforts of this species and whether any emerging science may influence the species persistence or management:

> *"The completion of this status review is not the end of our commitment to sage-grouse conservation. Our determination today is based on the best scientific and commercial data currently available. That determination, however, cannot guarantee that the sage-grouse (or other sagebrush ecosystem species) will not in the future warrant listing under the Act. New threats may develop, management may change, or the species may not prove as resilient as we concluded based on the currently available science. Thus, although our best judgment today indicates that successful sage-grouse conservation will be achieved by continued implementation of the regulatory mechanisms and conservation efforts we relied on in our finding above, we and our partners must carefully monitor threats to the sage-grouse and its response to those threats. Therefore, we will work with our Federal and State partners to conduct a sage-grouse status review in 5 years. This status review will inform adaptive management and guide future research needs to ensure that conservation efforts continue to benefit sage-grouse into the future. In the meantime, to ensure the long-term successes of this unprecedented conservation effort, we will continue to work with our partners to augment and improve current management within the sagebrush ecosystem. (2015; 80 FR 59858)."*

This Greater Sage-Grouse Conservation Report (GRSG Conservation Report) is not meant to be a species status assessment. Rather, it recognizes and documents initial actions taken by state and federal agencies for the period 2015-2020. This report meets the intent identified in the USFWS's 2015 GRSG ESA finding and compiles information from multiple sources about the status of Greater Sage-grouse and their habitat such as:

- Summary of conservation commitments and actions taken since 2015 (Chapter 1)
- GRSG population status and trend, and habitat conditions (Chapter 2),
- New scientific literature and data management tools (Chapter 3), and
- Recommendations for GRSG conservation, including identifying additional research needs (Chapter 4).

Figure 1: Date ranges for information and publicly available datasets used during the process to develop this report.



Recent information and updates became available during the process to review publicly available information for this GRSG Conservation Report (Figure 1). In some cases, that information is included, such as current information about the status of populations and scientific literature.

This report is not a quantitative review of the conservation efficacy of the projects that have occurred since 2015 as sagebrush habitats respond slowly to habitat improvement and restoration efforts, and Greater Sage-grouse populations are not expected to respond for several years to several decades.

The WAFWA-led team assembled for this effort (GRSG Conservation Report Team) is composed of a diverse mix of conservation partners with scientific and technical expertise, from state and federal agencies which allowed for rangewide collaboration and reporting. Engaging these diverse perspectives ensured a robust review of the information available for Greater Sage-grouse conservation.

Greater Sage-grouse are widely distributed across portions of 11 western states. These states include: California, Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. They are a landscape-scale species requiring large, contiguous areas of sagebrush for long-term persistence, and the loss and fragmentation of sagebrush habitats has resulted in their long-term population decline (Patterson 1952; Connelly and Braun 1997; Braun 1998; Johnson and Braun 1999; Connelly et al. 2000; Miller and Eddleman 2000; Schroeder and Baydack 2001; Aldridge and Brigham 2003; Beck et al. 2003;

Pedersen et al. 2003; Connelly et al. 2004; Schroeder et al. 2004; Leu and Hanser 2011; 75 FR 13910; WAFWA 2015).

The causes of habitat loss and fragmentation vary across the species' range, with primary factors being loss from wildfire exacerbated by highly flammable non-native understory vegetation (primarily invasive annual grasses), conifer encroachment, and infrastructure (roads, powerlines, etc.). Other factors impacting habitat loss include human activities supporting renewable and non-renewable energy development, mining, residential development, historical conversion for agriculture, sagebrush removal to support livestock grazing and other activities, human disturbance, and encroachment of native and invasive species (USFWS 2013b). Functional habitat loss also contributes to habitat fragmentation, as Greater Sage-grouse avoid areas due to human activities, including noise, even where sagebrush remains intact (Blickley et al. 2012).

Greater Sage-grouse are a state and tribal trust resource – meaning management of the species is the responsibility of state wildlife agencies and tribes. However, due to the extent of habitat loss (Schroeder et al. 2004), habitat fragmentation, and long-term declining populations the USFWS received numerous petitions to list Greater Sage-grouse throughout all or part of its range (Table 1). Concern over habitat loss and associated threats, and the lack of sufficient regulatory resources to conserve sagebrush resulted in an ESA warranted but precluded listing determination in 2010. A subsequent listing analysis completed in 2015 reversed that decision, based primarily on the conservation commitments made by numerous partners across the species' range.

Table 1. Summary of petitions to list Greater Sage-grouse.

Entity being considered	Date	Responsible Party	Request or action
Greater Sage-grouse in WA (previously referred to as western Greater Sage-grouse or Columbia Basin Distinct Population Segment (DPS))	14 May 1999	Northwest Ecosystem Alliance and Biodiversity Legal Foundation	Petition for federal listing
	24 Aug 2000	USFWS	Positive 90-day decision on petition
	7 May 2001	USFWS	Warranted for federal listing, but precluded by higher listing priorities; established Columbia Basin DPS
	2 Oct 2015	USFWS	Rejection of Columbia Basin DPS and dismissal of previous decision to federally list
Western subspecies of Greater Sage-grouse (not including WA which was already "warranted for listing" at the time)	24 Jan 2002	Institute for Wildlife Protection*	Petition for federal listing
	7 Feb 2003	USFWS	Negative 90-day decision on petition on basis that subspecies designation was not clear and distinct population segment had not been identified
	29 Apr 2008	USFWS	Positive 90-day decision on petition
	23 Mar 2010	USFWS	Negative decision to list because subspecies designation not valid
Bi-State DPS (population of Greater Sage-grouse in Mono Basin area of CA and NV)	28 Dec 2001	Institute for Wildlife Protection	Petition for federal listing
	26 Dec 2002	USFWS	Negative 90-day decision on petition
	10 Nov 2005	Stanford Law School Environmental Law Clinic**	Petition for federal listing
	19 Dec 2006	USFWS	Negative 90-day decision on 28 Dec 2001 and 10 Nov 2005 petitions and rejection of Mono Basin area as a DPS
	29 Apr 2008	USFWS	Positive 90-day decision on 28 Dec 2001 and 10 Nov 2005 petitions following negotiations with petitioners.
	23 Mar 2010	USFWS	Establishment of Bi-State DPS
	28 Oct 2013	USFWS	Proposal to list as threatened
	28 Oct 2013	USFWS	Proposal to designate critical habitat
	23 Apr 2015	USFWS	Withdrawal of proposals to list as threatened and designate critical habitat
Eastern subspecies of Greater Sage-grouse	3 Jul 2002	Institute for Wildlife Protection	Petition for federal listing
	7 Jan 2004	USFWS	Negative 90-day decision on petition on basis that subspecies designation not valid and distinct population segment not identified

Entity being considered	Date	Responsible Party	Request or action
Greater Sage-grouse (rangewide)	8 Jun 2002	Craig C. Dremann	Petition for federal listing
	19 Mar 2003	Institute for Wildlife Protection	Request to combine 24 Jan 2002 and 3 Jul 2002 petitions (referenced above) into a single petition for federal listing (combined petitions referred to as Webb 2001, 2002)
	22 Dec 2003	American Lands Alliance and 20 other organizations	Petition for federal listing
	21 Apr 2004	USFWS	Positive 90-day decision on 8 Jun 2002, 19 Mar 2003 (Webb 2001, 2002), and 22 Dec 2003 petitions
	12 Jan 2005	USFWS	Negative 12-month decision on 8 Jun 2002, 19 Mar 2003 (Webb 2001, 2002), and 22 Dec 2003 petitions (excluding Columbia Basin DPS)
	23 Mar 2010	USFWS	Warranted for federal listing, but precluded by higher listing priorities
	2 Oct 2015	USFWS	Reversal of previous decision; federal listing not warranted

*Petitioner requested inclusion of the Washington (Columbia Basin) DPS even though it was already warranted for listing.

**On behalf of the Sagebrush Sea Campaign, Western Watersheds Project, the Center for Biological Diversity, and Christians Caring for Conservation.

*** Congressional rider established in 2012 that restricts USFWS spending. This has been maintained by Congress ever since.

Chapter 1:
Summary of Commitments & Actions

This chapter summarizes the actions taken by state and federal agencies between 2015 and 2020 to conserve Greater Sage-grouse and review the commitments made in 2015. Additional information that became available during the development of this report is also included in this chapter. For example, updated information is included about conservation commitments, federal mitigation policy and the Western Governors' Association's Compensatory Mitigation Resolution. This chapter does not contain a quantitative review of the conservation efficacy.

Chapter 1 Sections:

A. Conservation Commitments Report
B. Bureau of Land Management (BLM) report on Regulatory and Monitoring Commitments
C. U.S. Forest Service (USFS) Report on Regulatory and Monitoring Commitments
D. Report on Mitigation for Greater Sage-grouse
E. Natural Resources Conservation Service (NRCS) Report on Voluntary Conservation Actions
F. Report on Conservation actions from the Conservation Efforts Database

Section A: Conservation Commitments Report

Through evaluation of federal and state agency's implementation of the conservation commitments from 2015-2020, the GRSG Conservation Report Team developed a spreadsheet (Appendix A. Conservation Commitments.xlsx) summarizing the commitments from the USFWS "not warranted" for listing determination under the Endangered Species Act (2015, 80 FR 59858). Conservation commitments from states not included in the USFWS finding (CO, ID, NV) are also included. A summary and status of implementation of the federal and state-specific commitments identified in 2015, as well as future commitments are listed in Table 2.

Table 2: Summary of the 2015 commitments identified in the USFWS finding (80 FR 59858) for Greater Sage-grouse conservation, their implementation status, and additional and future conservation commitments. Details on specific commitments and status can be found in Appendix A. Additional information is included for actions in states not identified in the USFWS finding.

Agency or State	2015 commitments	2020 Status of 2015 commitments	Future commitments
BLM	Implement decisions identified in 2015 Resource Management Plans (RMPs)	Currently implementing 2015 RMP decisions	2015/2019 Greater Sage-grouse amendments to RMPs are being revisited in close coordination with USFWS, USFS and states.
USFS	Implement decisions identified in 2015 Land Management Plan Amendments (LMPAs)	Currently implementing the decisions in the 2015 LMPAs	Continue to implement the 2015 LMPAs and update plans as needed as LMPs are revised, in close coordination with partners.
Sage Grouse Initiative NRCS	Restoration through conifer removal, grazing management, conservation easements	Financial and acreage commitments summarized in Ch 1, Section E.	"A Framework for Conservation Action in the Sagebrush Biome" (April 2021): continue work with ranchers and partners in voluntarily addressing Greater Sage-grouse threats; exotic annual grass invasion, land use conversion, woodland expansion, and riparian/wet meadow degradation. (*https://wlfw.rangelands.app*)
USFWS	Candidate Conservation Agreement with Assurances (CCAA)	Nine CCAAs in place with greater than 4 million acres available and/or enrolled	Continue to enroll property owners in existing CCAAs. Continue to develop new CCAAs.
State of OR	Implement commitments as per BLM amendments, including disturbance caps, avoidance, minimization, and mitigation requirements, fire management programs.	Currently implementing the OR EO 15-18	Current commitments will continue into the future under Oregon Administrative Law 635-140-0025 and 660-023-0115.
State of MT	Montana's Sage Grouse Conservation Strategy: EOs 12-2015 and 21-2015, and the 2015 Montana Greater Sage Grouse Stewardship Act amended in 2017 and 2019.	Implemented Core area, General area, and connectivity strategy from EOs and with EOs 12-2015 and 21-2015	Continue to work through partnerships to complete conservation easements and long term (30-year) conservation leases to conserve native rangeland habitats from conversion and fragmentation.
State of UT	Utah Executive Order EO/2015/002, Utah Wildlife Action Plan, Utah Conservation Plan for Greater Sage-grouse	Implemented the conservation plan, the EO/2015/02, multiple MOUs and agreements between state agencies and universities, and the Forest Action Plan	Continue to implement the plans and the EO.

EO – Executive Order

MOU – Memorandum of Understanding

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Agency or State	2015 commitments	2020 Status of 2015 commitments	Future commitments
State of WA	Managed as a threatened species with published recovery plan (Stinson et al. 2004). Management of Greater Sage-grouse on the Yakima Training Center controlled by the Western Sage Grouse Management Plan (Livingston 1998) and the Cultural and Natural Resource Management Plan (DoD 2002).	Currently implementing recovery commitments. Greater Sage-grouse up-listed from threatened to endangered in WA in 2021. The 2021 WA State legislature provided funds for restoration and management of sagebrush habitats and associated species, including Greater Sage-grouse through the Washington Shrubsteppe Restoration and Resiliency Initiative (WSRRI).	Continue to implement all previous commitments. Expand shrubsteppe habitat restoration and GRSG population conservation actions by implementing WSRRI 30-year Conservation Strategy.
State of WY	Implement the Core Area Strategy outlined in EO 2015-4	Implement updated EO 2019-3.	Continue to implement EO 2019-3 which includes an Adaptive Management Plan, Coordination and Agency Cooperation, Data Collection and Reporting.
Commitments from Agencies not identified in the Federal Register notice:			
State of CO	CO Executive Orders EO D 2015-004 and D 2018-036, State Land Board Greater Sage-grouse Stewardship Action Plan, COGCC Senate Bill 19-181 Oil and Gas Regulations, Update CPW High Priority Habitats, Habitat Quantification Tool	Currently implementing the CO Executive Orders	Continue to implement commitments from Governor's EO D 2018-036 and the COCGCC Senate Bill 19-181 Oil and Gas Regulations
State of ID	EO 2015-04 (expired), Mitigation Framework, Implementation Task Force, Adaptive Regulatory Triggers	Currently using previous commitments to BLM and USFS under EO 2015-04 and implementing agreements: BLM_MOA_2021, and implementing adaptive regulatory triggers	Continue to implement commitments, update expired EO 2015-04 for Greater Sage-grouse management (Updated EO-2022-03), develop State of Idaho and USFS Mitigation MOU (USFS_MOU) and State of Idaho PF, BLM, IDFG, NRCS, OSC, USFWS and IDL Restoration MOU, and work with Stakeholders and BLM on 2023 Sage-grouse Plan Amendments.

COGCC – Colorado Oil and Gas Conservation Commission

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CPW – Colorado Parks and Wildlife
EO – Executive Order
IDFG – Idaho Department of Fish and Game
IDL – Idaho Department of Lands
MOU – Memorandum of Understanding
OSC – Idaho Governor's Office of Species Conservation
PF – Pheasants Forever

Agency or State	2015 commitments	2020 Status of 2015 commitments	Future commitments
State of NV	NV Executive Orders EO 2012-09, 2012-19, EO 2018-32, Administrative Code 232.400, and Department of Interior – Barrick Gold of North America Bank Enabling Agreement (March 2015)	Currently implementing NV EOs, Admin Code, and Agreement	Continue to implement the commitments, establish a Nevada Habitat Conservation Framework as identified in EO 2021-18, including the development of comprehensive Nevada Sagebrush Habitat Plan.

EO – Executive Order

Section B: BLM Report on Regulatory and Monitoring Commitments

In 2015, the BLM amended and began implementing GRSG land use plans (LUP) to improve management of Greater Sage-grouse habitat on BLM-managed lands across 10 western states, exclusive of the Columbia Basin population in Washington and the Bi-State Distinct Population Segment in California and Nevada. Although the BLM 2015 GRSG LUPs were amended in 2019, the BLM 2015 GRSG LUPs have been reinstated through a preliminary court injunction (October 16, 2019). The BLM has initiated a new land use planning process (2021) aimed at updating science, incorporating climate change, addressing litigation, and focusing on the long-term conservation of Greater Sage-grouse.

BLM has approximately 32,350,000 acres of BLM-managed lands that are considered Priority Habitat Management Areas (PHMA); approximately 26,282,000 acres are General Habitat Management Areas (GHMA); and in Idaho approximately 2,735,000 acres are Important Habitat Management Areas (IHMA). An additional 5 million acres (approximately) are designated in other habitat management area categories in the BLM GRSG 2015 LUPs (Table 3). All Greater Sage-grouse habitat in PHMA, GHMA and IHMA is contained within the Biologically Significant Units (BSUs) established in the BLM 2015 GRSG LUPs.

Table 3. Approximate acreages of Greater Sage-grouse habitat by designated habitat management area category on Bureau of Land Management managed lands only. Habitat Management Area calculations were derived from land use plan data submitted by each individual BLM State Office between 2015 – 2020. Habitat in the state of Washington is not covered by a land use plan habitat management area.

State	PHMA	GHMA	IHMA	Total	Other HMAs	Total
California	1,486,000	668,000	0	2,154,000	278,000	2,432,000
Colorado	748,000	788,000	0	1,536,000	97,000	1,633,000
Idaho	4,224,000	1,971,000	2,735,000	8,930,000	1000	8,931,000
Montana/Dakotas	3,276,000	2,385,000	0	5,660,000	165,000	5,825,000
Nevada	6,746,000	5,104,000	0	11,850,000	4,584,000	16,434,000
Oregon	4,589,000	5,645,000	0	10,234,000	0	10,234,000
Utah	2,080,000	438,000	0	2,518,000	0	2,518,000
Wyoming	8,205,000	9,283,000	0	17,487,000	0	17,487,000
Totals:	*31,354,000*	*26,282,000*	*2,735,000*	*60,369,000*	*5,125,000*	*65,494,000*

PHMA – Priority Habitat Management Areas
IHMA – Important Habitat Management Areas
GHMA – General Habitat Management Areas

BLM Conservation Commitment to Limit Anthropogenic Disturbance:

The BLM 2015 GRSG LUPs capped the footprint and density of disturbance to reduce habitat degradation and fragmentation threats at the BSU and project scale. Most of the LUPs capped anthropogenic disturbance at 3% of total area (both scales). The LUPs in Wyoming and Montana included additional disturbances (agricultural conversion, habitat loss to wildfire, and some treatments) in disturbance caps, with a resulting 5% cap. Most BLM 2015 GRSG LUPs also have a density cap for energy and mining activities of one facility per 640 acres at both scales, with the exception of Nevada.

Implementation results of the major 2015 conservation commitments (e.g., anthropogenic disturbance thresholds) and Greater Sage-grouse habitat conditions were recently published, Herren et. al. 2021, BLM Greater Sage-Grouse Plan Implementation - Rangewide Monitoring Report for 2015–2020, hereafter, BLM Rangewide Monitoring Report). Data collection, analyses, and reporting occurred at several scales (Table 4) primarily within 105 BSUs. For example, Geographic Information Systems (GIS) estimates of anthropogenic disturbance from rangewide spatial datasets were analyzed and reported at the BSU scale and then further summarized for reporting at regional and rangewide scales. Analyses of adaptive management thresholds were reported at the BSU scale and summarized within state boundaries. State-specific methods for monitoring are described in Appendices 7-15 of the BLM Rangewide Monitoring Report. Results of monitoring anthropogenic disturbance at multiple scales are reported below:

BSU Scale: Anthropogenic Disturbance Cap Compliance:

No BSUs exceeded the 3% disturbance cap based on GIS analyses of existing anthropogenic disturbance. Ninety percent (90%) of the total estimated projected anthropogenic disturbance footprint increase occurred on private lands and BLM-managed lands. Due to source data limitations and assumptions used to generate disturbance estimates, BLM may have underestimated existing anthropogenic disturbances in several states (see pages 22-29 of the BLM/USFS Sage-grouse Monitoring Framework Interagency Greater sage-grouse Disturbance and Monitoring Sub-team 2014) and pages 16-17 of the BLM Rangewide Monitoring Report, Herren et al. 2021). In addition, in Wyoming they may have overestimated disturbance estimates due to the limitations of available actual disturbance data verses projected.

BSU Scale: Density Cap for Energy and Mining Compliance:

Anthropogenic disturbances were estimated using 9 sources of 20 proprietary datasets, the Surface Disturbance and Reclamation Tracking Tool, and the Wyoming Density Disturbance Calculation Tool (DDCT) (see pages 16-17 in the BLM Rangewide Monitoring Report). Results of anthropogenic density disturbance analysis indicated 2 (1 in CO and 1 in WY) of the 105 BSUs exceeded the density cap. Wyoming BLM analyzed on-the-ground data which provided a more accurate calculation that showed disturbance density which had not

Land Use Authorizations Note:

A total of 604 BLM land use authorizations (authorization types are listed in Appendices 7-15 in the BLM Rangewide Monitoring Report) occurred in PHMA and IHMA (in Idaho) between 2015 and 2020. The total acreage of those authorizations was approximately 73,000 acres, the majority of which were in BLM CO (34,000 acres), BLM NV (22,000 acres), and BLM WY (approximately 13,000 acres). These authorized anthropogenic disturbances may not yet be developed or developed at the scale authorized which partially explains the discrepancy between the acreages presented in the text and in Table 3 (previous page), the project scale authorized disturbance total, and the rangewide disturbance estimate (next page).

been exceeded at the BSU scale. The final conclusion was that 1 of the 105 BSUs exceeded the density cap of one facility per 640 acres.

Project Scale: Disturbance and Density Cap Compliance:

The BLM tracked surface disturbance at the project scale in PHMA and in IHMA in Idaho. Existing and proposed disturbances within the analysis area were evaluated when a proposed surface-disturbing authorization was received against the disturbance cap as defined in the BLM 2015 LUP. The vast majority of projects were found to be compliant, but disturbance and density cap compliance on a project level does not always tell the whole story. For example, one project analysis area in Montana exceeded the disturbance cap. However, that project resulted in a net conservation benefit to Greater Sage-grouse by co-locating disturbance into an existing disturbed area rather than fragmenting intact habitat (see pages A10-39 and 40 of the BLM MT appendices to the BLM Rangewide Monitoring Report).

Table 4. Summary of land use plan commitments, scale of analysis and reporting units identified in the BLM Rangewide Monitoring Report.

Commitment	Scale of Analysis	Reporting Unit
Disturbance level estimate (all lands in PHMA and IHMA)	· By BSU · Aggregated to BSUs in RMR and GBR · Aggregated to rangewide	Disturbance limitation per BSU
Disturbance cap (all lands in PHMA and IHMA)	· Per authorization/project analysis area (except BLM CO in Colorado SG MZs and federal nexus lands) · Summarized by state	Disturbance limitation per project analysis area
Density level estimate (all lands in PHMA and IHMA)	· By BSU · Aggregated to BSUs in RMR and GBR · Aggregated to rangewide	Limitation per BSU, except BLM NV which has no density cap
Density cap	· Per authorization/ project analysis area (except BLM CO in CO SG MZs and federal nexus)	Limitation per project analysis area, except BLM NV which has no density cap
Adaptive Management - population	· By BSU · Summarized by state	Hard and soft triggers
Adaptive Management - habitat	· By BSU · Summarized by state	Hard and soft triggers

LUP – Land use plan
PHMA – Priority Habitat Management Area
IHMA - Important Habitat Management Areas in Idaho
BSU – Biologically Significant Unit
RMR – Rocky Mountain Region
GBR – Great Basin Region
BLM CO – Bureau of Land Management Colorado
CO SG MZ – Colorado Sage-Grouse Management Zones
BLM NV – Bureau of Land Management Nevada

Regional and Rangewide: Greater Sage-Grouse Habitat Conditions for Anthropogenic Disturbance:

Rangewide dataset analysis (as described in the 2015 BLM/USFS Greater Sage-Grouse Monitoring Framework) estimated anthropogenic disturbance within PHMA and IHMA increased by approximately 0.03% (approximately 17,000 total acres of increase: 5,000 acres in the Great Basin region; 12,000 acres in the Rocky Mountain region) between 2015 and 2020. The BLM estimated a slight decrease in density of energy and mining activities, (count per 640 acres)" in PHMA and IHMA rangewide and within each region (change of <0.01 facilities per 640 acres, respectively), based on rangewide datasets used for the analysis. The analyses do not include authorized actions (73,000 acres mentioned above) that may not have been implemented or developed at the time the BLM conducted these analyses or developed at the authorized scale.

BLM Land Use Plan Adaptive Management: Population and Habitat Triggers:

With the exception of BLM ND (whose LUP does not contain adaptive management triggers), each BLM 2015 GRSG LUP contains two types of adaptive management triggers for 105 BSUs across the planning areas: population triggers and habitat triggers. Approaches to evaluate the adaptive management triggers are described in each BLM 2015 GRSG LUP. Both population and habitat adaptive management triggers have two levels – soft triggers and hard triggers. For details, see each BLM 2015 GRSG LUP.

Figure 2 presents an overview of the total BLM 2015 GRSG LUP adaptive management triggers tripped between 2016 and 2019. The BLM offices in California and Nevada use methods other than those in their BLM 2015 GRSG LUPs. This is due to a collaboration with the State of Nevada and multiple partners to implement a monitoring methodology in population management units (PMUs) based on science and methods established for the BLM 2019 GRSG LUP. Therefore, for California and Nevada, the map in Figure 2 depicts BSUs where underlying Population Management Units (PMUs) have reached habitat and/or population triggers tripped based on the statewide partners' analysis.

Each BLM 2015 GRSG LUP contains a suite of BLM authorized actions to be taken if applicable to address the cause(s) of tripped triggers. Actions range from project level changes (e.g., Best Management Practices application) to LUP decision changes (e.g., managing General Habitat Management Areas [GHMA] as PHMA).

BLM Commitment Relative to Livestock Grazing Management in Greater Sage-Grouse Habitat:

The BLM 2015 LUPs included a decision to use the LUP sage-grouse habitat objectives when determining achievement of the wildlife standard during rangeland health evaluations in livestock grazing allotments that overlap with any amount or any type of the Greater Sage-grouse habitat management areas (approximately 67.4 million acres). From 2015 through 2019, BLM evaluated Land Health Standards on 3,455,073 acres in livestock grazing allotments that contain Greater Sage-grouse habitats (5% of the total number of acres of allotments in Greater Sage-grouse habitat) in CA, CO, ID, MT, OR, NV, UT, and WY. Of those livestock grazing allotments containing Greater Sage-Grouse habitat where the BLM conducted land health evaluations between 2015 and 2019, approximately 3 million acres have achieved, or are making progress towards achieving, BLM land health standards. The BLM changed livestock grazing management on approximately 620,000 additional acres to help to achieve these standards. See Appendices 7-15 of the BLM Rangewide Monitoring Report for details.

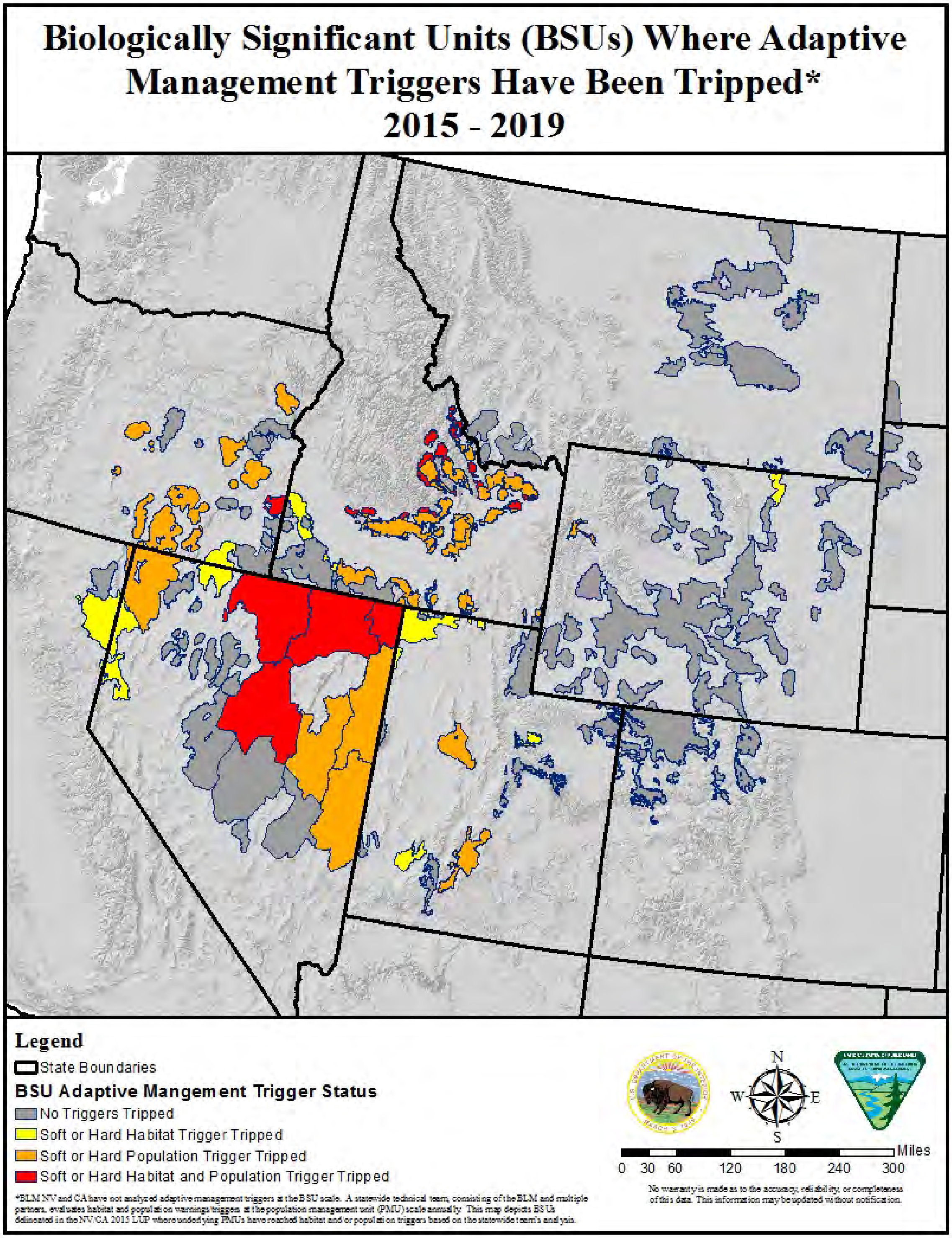


Figure 2. The status of adaptive management triggers in BLM Biologically Significant Units from 2016-2019 (BLM 5-Year Monitoring Report). Biologically Significant Units are defined in the 2015 BLM land use plans for Greater Sage-grouse which did not include the state of Washington.

Section C: USFS Report on Regulatory and Monitoring Commitments

In 2015, USFS finalized and began implementing Greater Sage-grouse land management plan amendments (LMPAs) to improve management of Greater Sage-grouse habitat on national Forest Service lands across 20 National Forests in 6 western states. Between 2016 and 2019, USFS conducted habitat improvement projects for Greater Sage-grouse on nearly 480,000 acres. Similar to BLM, data collection, analyses and reporting on disturbance caps and population and habitat triggers occurs at several scales (see Table 4 in section B above) primarily within the 73 BSUs within the states where plan areas guided by the 2015 LMPAs occur.

USFS Conservation Commitment to Limit Anthropogenic Disturbance:

The USFS 2015 GRSG LMPAs contained caps on the footprint of disturbance and the density of disturbance to reduce the threats of habitat degradation and fragmentation at two scales: the BSU and the project. These caps are described in section B above (BLM report on regulatory and monitoring commitments).

- Estimates of the footprint of existing anthropogenic disturbance within each BSU indicate that no BSUs exceed the 3% anthropogenic disturbance cap.
- In the years 2016-2019, the USFS made 165 project decisions of National Forest Service Lands covered by the 2015 Greater Sage-grouse amendments, of which 100% were reported to be fully compliant with plans, and the project level caps therein. Only 25% of those project decisions occurred within greater sage grouse habitat management areas.
- The LMPAs emphasize avoidance of surface development in Greater Sage-grouse habitat and no exceptions were allowed for fluid minerals development in Greater Sage-grouse management areas during the monitoring period.

USFS Land Management Plan Amendment Adaptive Management: Population and Habitat Triggers:

The 2015 GRSG LMPAs contains two types of adaptive management triggers that apply within a total of 73 BSUs across the states where USFS 2015 GRSG LMPA planning areas occur (Figure 2): population triggers and habitat triggers. Within the two types of adaptive management triggers are two levels of triggers – soft triggers and hard triggers. For details, see Section B above (BLM report on regulatory and monitoring commitments) and 2015 LMPAs.

Section D: Report on Mitigation for Greater Sage-Grouse

The USFWS finding of "not warranted for listing" under the ESA for Greater Sage-grouse relied in part upon implementation of the mitigation hierarchy and the regulatory mechanisms that were explicitly incorporated into three state Greater Sage-grouse conservation strategies (WY, MT, and OR) and the 2015 BLM and USFS land use plans (2015, 80 FR 59857). Information on non-regulatory programs was summarized in the USFWS finding, including Executive Orders or state rulings related to Greater Sage-grouse conservation effort (80 FR 59858). The addition of voluntary incentives to conserve habitat on private or public lands created the foundation for delivering rangewide conservation benefits for Greater Sage-grouse to offset habitat impacts attributed to development. This is the case even though state and federal mitigation programs and impact quantification methods vary given the presence of compensatory mitigation in most states, as well as the federal land use plan mitigation hierarchy requirements.

Mitigation Approaches by States

All states except CA, SD, ND, and WA, have developed compensatory mitigation frameworks that include or are specific to Greater Sage-grouse since 2015. Some compensatory mitigation frameworks are required for developers (i.e., regulatory) such as the conservation strategies put forth by WY, MT, NV, and OR. Utah and CO have codified voluntary compensatory mitigation frameworks, and Idaho developed compensatory mitigation guidelines through a Governor's Executive Order. The mitigation policy developed in WA does not mandate mitigation but has discouraged development in sagebrush-dominated habitats (WDFW 2009). A summary of states' progress to develop and implement compensatory mitigation is provided in Appendix B.

Federal Mitigation Policy and Implementation

From March 2017 until March 2019, new federal compensatory mitigation policy was issued, and the 2015 BLM land use plan mitigation decisions were amended through:

- Executive Order (EO 13783, 3/28/2017),
- Department of Interior Secretarial Orders (3349, 3/29/2017 and 3360, 12/27/2017)
- BLM mitigation policy (IM 2018-093, July 2018), and
- BLM Greater Sage-grouse 2019 land use plan decisions (March 2019).

The BLM policy (BLM IM 2018-093) stated that BLM could not require compensatory mitigation unless it was voluntary or required by the states. As a result, several states took a stronger role in developing their compensatory mitigation plans, both regulatory and non-regulatory (described above). The 2019 Greater Sage-grouse land use plan decisions followed the 2018 policy and no longer required compensatory mitigation.

In October 2019, implementation of compensatory mitigation resulted when a Preliminary Injunction (October 16, 2019) blocked implementation of the BLM 2019 Greater Sage-grouse plan amendments, including compensatory mitigation, leaving the BLM to return to implementation of the 2015 plans. More detailed federal policy information is provided in Appendix C.

- BLM Mitigation Implementation: BLM offices began implementing the steps in the mitigation hierarchy for authorized actions in Greater Sage-grouse PHMA and other habitat management areas in 2015 based on the BLM 2015 Sage-Grouse Records of Decision. Out of the total 604 land use authorizations, there were 36 compensatory mitigation projects in seven states (CO, ID, MT, NV, UT, WA, and WY) authorized by a BLM land use decision between 2016 and 2020 that included compensatory mitigation actions specifically for Greater Sage-grouse (Appendix D). The information in Appendix D contains BLM authorizations for compensatory mitigation only; information on the progress of implementing compensatory mitigation for these projects has not been summarized, nor does it contain information about whether compensatory mitigation associated with these projects was effective.

- USFS Mitigation Implementation: From 2015 – 2019 there were 165 proposed projects, including conservation actions, in Greater Sage-grouse habitats (PHMA and GHMA) in the 13 National Forests with Greater Sage-grouse plans.
    - Of the 83 projects authorized within PHMA, 45 projects (54%) included avoidance and minimization measures to avoid impacts to Greater Sage-grouse. Other avoidance and minimization approaches were applied to avoid Greater Sage-grouse habitat degradation and the need for compensatory mitigation for the other 38 projects in PHMA.
    - Of the 82 projects authorized within GHMA, 41 projects (50%) included avoidance and minimization measures to avoid impacts to Greater Sage-grouse. Other avoidance and minimization approaches were applied to avoid Greater Sage-grouse habitat degradation and the need for compensatory mitigation for the other 41 projects in GHMA.
    - No compensatory mitigation has been required because all projects successfully implemented avoidance and minimization measures and prevented residual impacts to Greater Sage-grouse habitat that would have required compensatory mitigation.

Western Governors' Association 2022 Compensatory Mitigation Resolution

During the process to review the publicly available information and develop this report, some updated information became available. In 2021, the Western Governors' Association (WGA) adopted Policy Resolution 2022-06 on Compensatory Mitigation (originally published in 2019). The Resolution affirms that states have the primary responsibility for fish and wildlife management and that the responsibility extends to the development of compensatory mitigation standards and implementation for state and tribal trust species. The WGA urged consistency between state and federal approaches to mitigation, including compensatory mitigation.

Six specific objectives from WGA Resolution 2022-06 were identified, which largely mirror universal principles common to all effective mitigation programs. The WGA resolutions are:

- WGA Objective 1: Provide measurable and documentable habitat and conservation values, services and functions that are at least equal to any quantifiable lost or degraded values, services and functions caused by the impact, recognizing that compensatory mitigation may not be appropriate and/or necessary for all projects and locations when considering the net overall impact.
- WGA Objective 2: Incorporate adaptive management measures to account for the risk that a particular compensatory mitigation action may fail or not achieve its stated objectives. Adaptive management alternatives should be sufficient to address the uncertainty about the level and duration of estimated impacts.
- WGA Objective 3: Compensatory mitigation projects should be sited and designed strategically to support the most effective conservation or restoration projects; the

effectiveness of mitigation actions should be based on the best available science and geographic location of highest benefit.

- WGA Objective 4: Provide benefits to fully compensate for any realized adverse impacts, both short and long term. Where effects are permanent, perpetual mitigation is ideal.
- WGA Objective 5: Encourage the application of compensatory mitigation prior to the impact occurring to ensure no lag time occurs between impacts and offsets where such mitigation or conservation banking exists. If completing the mitigation prior to impact is infeasible, the mitigation shall be secured with a funding assurance such as a surety bond or irrevocable letter of credit prior to the initiation of impacts.
- WGA Objective 6: Apply regulatory processes that offer transparency and certainty to developers, regulators, and the public to the extent feasible. This necessitates early and substantive consultation with states and consistency with state-designed compensatory mitigation standards where they exist.

Section E: NRCS Report on Voluntary Conservation Actions

The NRCS launched the Sage Grouse Initiative (SGI) across 11 western states in 2010 to voluntarily reduce threats facing Greater Sage-grouse on private lands. Farm Bill programs provide NRCS the funding mechanism for accelerating on-the- ground conservation across private lands that represent 40 percent of the Greater Sage-grouse species' range. In SGI's first 5 years (2010 –14), 1,129 participating ranchers implemented conservation actions on 4.4 million acres. The results of NRCS's $267.1 million Farm Bill conservation investment with ranchers and partners were highlighted along with new science in the 2015 SGI Outcomes in Conservation Progress Report (NRCS Working Lands For Wildlife SGI 2015).

In 2015, NRCS released the SGI 2.0 Business Plan that continued the NRCS commitment to funding Farm Bill Greater Sage-grouse conservation in the sagebrush biome beyond 2015. The SGI 2.0 Business Plan is a spatially explicit and state-based plan that guided the (2015-2018) $198 million Farm Bill investment of additional resources on 3.6 million privately-owned acres of Greater Sage-grouse habitat. By 2020, adaptive SGI 2.0 implementation and additional funding resulted in a Farm Bill investment of $269.1 million on 4.18 million acres with ranchers and partners to address identified threats impacting Greater Sage-grouse on privately-owned land. This surpasses NRCS's SGI 2.0 Sage-grouse conservation commitment goals made in 2015.

NRCS has invested $536.2 million Farm Bill dollars into SGI (*from 2010–2020*) with 2,366 participating SGI landowners in the sagebrush biome, resulting in voluntary and science-based Greater Sage-grouse conservation implementation on 8.58 million acres of private working lands. Research on the efficacy of SGI conservation efforts in addressing threats impacting Greater Sage-grouse is covered in the publication titled "*A Decade of Science Support in the Sagebrush Biome.*"

Conservation Implementation

NRCS provided information to the Conservation Efforts Database (CED) regarding SGI 2.0 conservation efforts implemented on private lands from 2015 through 2019. Implemented SGI conservation actions were reported in the CED using the Sagebrush Reporting Units (SRUs) that obscure private landowner location (Chapter 1, Section B. Data Collection in the CED). Types of actions implemented include conifer removal, conservation easements, riparian restoration, invasive species control, and grazing management infrastructure.

Conservation Implemented Under SGI 2.0 and Reported in the CED:

- Conifer Removal: Using the NRCS Working Lands for Wildlife (WLFW) Program's proactive "Protect the Core, Grow the Core" strategy, SGI conifer cuts implemented inside of state-identified Greater Sage-grouse priority habitat areas and near their encroached edges functions to increase the amount of available habitat. The targeted removal of encroached Phase I (Low conifer canopy cover with a predominance of sagebrush and perennial grass species) and II (Conifer has become codominant with sagebrush and perennial grass understory) conifer reclaims otherwise suitable habitat.
- Conservation Easements: Conservation easements are an effective, yet expensive, mechanism for removing habitat conversion and development threats by keeping working ranches with key wildlife habitat and migratory corridors intact. For example, NRCS and partners provided easements to producers who voluntarily agreed to: keep working lands undeveloped; maintain intact native sagebrush plant communities; avoid further loss of riparian edges, wet meadows, seasonal wetlands, and irrigated pastures; and maintain important wildlife corridors.
- Riparian Restoration: SGI WLFW implemented on-the-ground projects to restore and enhance degraded mesic (*riparian and wet meadows*) areas in Greater Sage-grouse breeding and nesting habitats to ensure a reliable source of forage for growing chicks as uplands dry out in the summer.
- Invasive species control: NRCS and SGI partners have worked with ranchers in implementing practices to address invasive annual grasses and plants that are negatively impacting Greater Sage-grouse habitat. Invasive species control is more effective and cost-efficient when done early, before infestations become widespread, and when management is informed by the surrounding landscape. Core areas with minimal annual grass invasion serve as anchors for conservation where efforts are most likely to be successful and cost effective.
- Grazing Management Infrastructure: NRCS has continued to work to transform the type and placement of infrastructure to facilitate private lands grazing management and reduce the mortality risk from improperly placed range management infrastructure such as fences.

Implemented SGI 2.0 Conservation Not Captured Spatially in the CED

- Grazing management: NRCS SGI grazing management was not entered in the CED data collection categories, due to the complexity in evaluating effectiveness with this scale of data. The SGI objective of implementing NRCS Prescribed Grazing (NRCS 2017 Practice Code 528) coupled with Upland Wildlife Habitat practice (NRCS 2010 Practice Code 645) is to ensure that rangelands are managed sustainably to provide continued ecological function of the sagebrush-steppe. Through 2019, NRCS SGI has worked with ranchers to enhance rangeland health on 3.39 million acres by implementing SGI grazing systems that balance forage availability with livestock demand and maintains ecosystem function by adjusting the timing, frequency, and duration of grazing. A primary focus of Prescribed Grazing is maintenance of key plant species, such as deep-rooted perennial grasses that are essential for ecological resistance to invasive grasses. Ecological Site Description and comprehensive rangeland inventories, coupled with Prescribed Grazing, provide the biological basis for sustainable SGI grazing plans.

- Training and publication: SGI WLFW conducted a series of low-tech mesic restoration field and virtual workshops with partners, along with webinars, to reach nearly 2,000 practitioners; and sponsored the publication of technical restoration design manuals and pocket guides detailing how to implement low-tech restoration.
- Support for invasive species initiative: This strategy is being employed in ID by NRCS working closely with ranchers and partners to launch the Cheatgrass Challenge, a proactive strategy for tackling exotic annual grasses. Other neighboring states are working with NRCS in initiating similar efforts. Also, following Idaho's lead, the Western Governors' Association–appointed Western Invasive Species Council convened the Cheatgrass Committee. The committee created an integrated annual herbaceous cover map (Maestas et al. 2020) and developed a new toolkit for invasive annual grass management across the West that incorporated WLFW's spatial targeting strategy and Rangeland Analysis Platform data.

Future Commitment

NRCS will continue to work with ranchers and partners by implementing the Sagebrush Biome Framework for Conservation Action (designed to work with the Rangeland Analysis Platform) is based on the *Decade of Science Support in the Sagebrush Biome Report*). This new sagebrush framework is the agency's continued contribution to voluntary conservation benefitting both Greater Sage-grouse and sagebrush rangeland to address threats impacting Greater Sage-grouse habitat while maintaining vibrant rural economies and the multi-generational legacy of stewardship and ranching culture on which sagebrush-reliant wildlife depend. It also serves as a partnership commitment to implementing the WAFWA Sagebrush Conservation Strategy with the people who live and work in the sagebrush biome.

Section F: Report on Conservation Actions from the Conservation Efforts Database

The GRSG Conservation Report Team used data from the Conservation Efforts Database (CED), a secure, cloud-based, web-tool used to monitor the implementation of conservation actions across large, multi-jurisdictional landscapes. Conservation partners voluntarily uploaded tabular data, documents, and spatial data, recorded conservation actions, and linked conservation actions to one or more of the threats driving sagebrush loss, fragmentation, and degradation. Source data were self-reported from a variety of conservation partners. Each partner reported activities according to their specific reporting timeframe requirements, therefore, some projects completed in late 2019 and in 2020 are not included in the analysis.

- Actions reported in the CED: The GRSG Conservation Report Team summarized efforts primarily captured under the *Habitat Protection* and *Habitat Restoration* Activity types, although the CED captures other types of actions (Figure 3). 'Habitat Restoration' treatments comprise approximately 70% of the records in the CED for on-the-ground management and conservation delivery to address the threat of habitat loss. A detailed structure of the Activities, Subactivities, and the tools available for analyses can be found at https://conservationefforts.org.
- Caveats about CED data that the GRSG Conservation Report Team considered when using and reviewing summarized data from the CED:
  - Given that data provision is voluntary, it is unlikely that all conservation efforts between 2015 and the end of 2019 were reported in the CED. The cutoff date for some partners that provided bulk data was September 2019, however some partners may not have fully provided information through that time. Nonetheless, the CED contains a large volume of records from agencies responsible for public and private lands management (i.e., BLM, USFS, NRCS, and state wildlife agencies), therefore, omissions are likely relatively low.

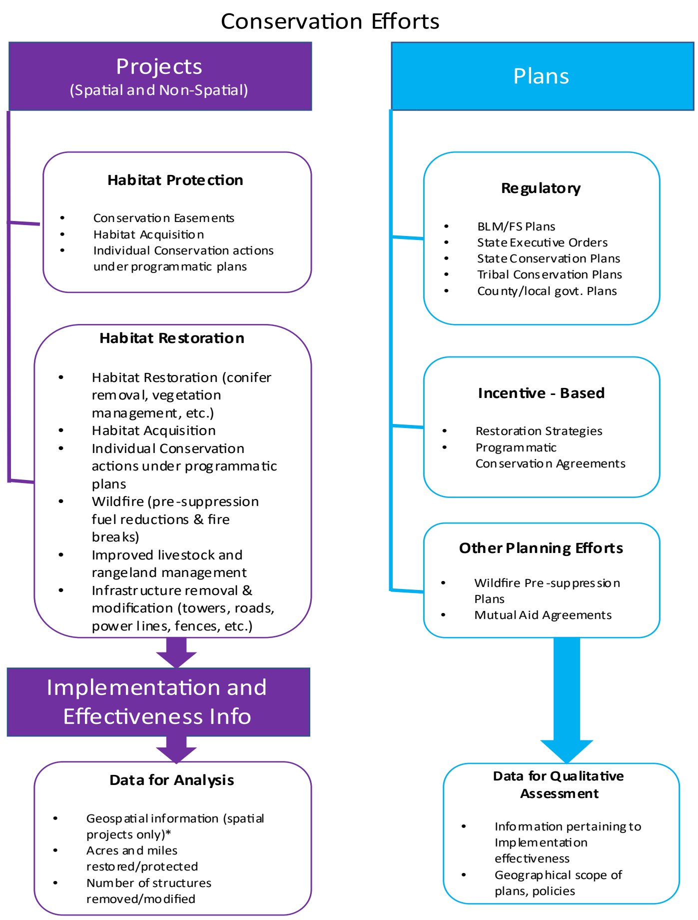


Figure 3. Simplified portrayal of the Conservation Efforts Database structure and information flow.

- The GRSG Conservation Report Team only included efforts deemed to be ‘already effective’ or ‘likely to be effective given adequate time’ by the data provider with the understanding that the level of effectiveness monitoring varies by implementing agency and/or the action type and the time it takes for sagebrush habitats to respond to those actions also varies widely due to a host of environmental factors and differences in habitat treatment application. See Appendices E and F for the scientific support of many of the conservation actions.
- The CED does not capture spatial information for some conservation actions, such as improved grazing practices or regulatory-driven avoidance of high-quality habitat. While those types of actions provide benefits to Greater Sage-grouse, the scale of the data creates challenges in assessing effectiveness and requires evaluation outside of the CED (see the NRCS report below).
- Many of the conservation efforts reported in the CED, and used in this report, are the result of broad-based collaborations. Data are typically entered by one partner, although many partners may have provided support.

CED Data Collection

Partners and Data Providers: A host of conservation partners implementing conservation and restoration actions across the sagebrush biome and in Greater Sage-grouse habitats voluntarily entered data in the CED. Data providers for this GRSG Conservation Report include state and federal government agencies (Table 5), NGOs, industry, and private landowners.

Table 5. State and federal agencies provided data to the Conservation Efforts Database and used it for this report.

Agencies who provided data	
Bureau of Land Management	Nevada Department of Forestry
California Department of Fish and Wildlife	North Dakota Department of Game and Fish
Colorado Parks and Wildlife	Oregon Department of Fish and Wildlife
Department of Defense	Oregon Department of State Lands
Idaho Department of Fish and Game, Idaho Governor’s Office of Species Conservation	Oregon Watershed Enhancement Board
Idaho Department of State Lands	South Dakota Game, Fish, and Parks
Montana Department of Natural Resources	U.S. Fish and Wildlife Service
Montana Fish, Wildlife, and Parks	U.S. Forest Service
Natural Resources Conservation Service	Utah Department of Natural Resources, Utah Watershed Restoration Initiative
Nevada Sagebrush Ecosystem Technical Team	Wyoming Game and Fish Department
Nevada Department of Wildlife	

- Public and Private Lands Data: This GRSG Conservation Report uses Sagebrush Reporting Units (SRUs, Figure 4) from the CED to summarize and report on actions implemented on private lands (obscured locations to protect private landowner information) and actions implemented on public lands (spatially explicit locations in the CED). The SRUs were developed for the CED in 2020 by leveraging spatial data from two monitoring efforts: the BLM's Habitat Assessment mid-scale polygons (HAF; Stiver et al. 2015) and Level 2-6 population 'clusters' from the U.S. Geological Survey (USGS) Greater Sage-Grouse Hierarchical Population Monitoring Framework (Coates et al. 2021a). Polygons and clusters used to develop the SRUs were modified along state lines and merged where needed to ensure private landowner locations would be obscured.
    - It is important to note that the CED captures efforts across the sagebrush biome which includes portions of sagebrush habitat outside of Greater Sage-grouse range. In some cases, conservation easements that span beyond Greater Sage-grouse range were rectified in the results to only include that portion within the range of Greater Sage-grouse.
- Data Collection: The original version of the CED Sagebrush Module summarized conservation efforts data for actions implemented from 2009 to 2014 in support of the 2015 USFWS Greater Sage-Grouse Status Assessment (80 FR 59858). In 2019, data providers submitted information into the CED on efforts implemented between 2015 and late 2019 in support of this Conservation Report. The CED's new SRU Tool for collecting and obscuring private lands efforts allowed the NRCS to enter data about efforts going back to 2012. The USFWS Partners for Fish and Wildlife Program also utilized the SRU tool to capture efforts implemented on private lands. The CED obtained conservation easement data from the National Conservation Easement Database (https://www.conservationeasement.us/). Data provision is voluntary; therefore, the information is not complete. However, partners contributing to this GRSG Conservation Report reviewed the database information and supplemented it with additional easement data as needed.

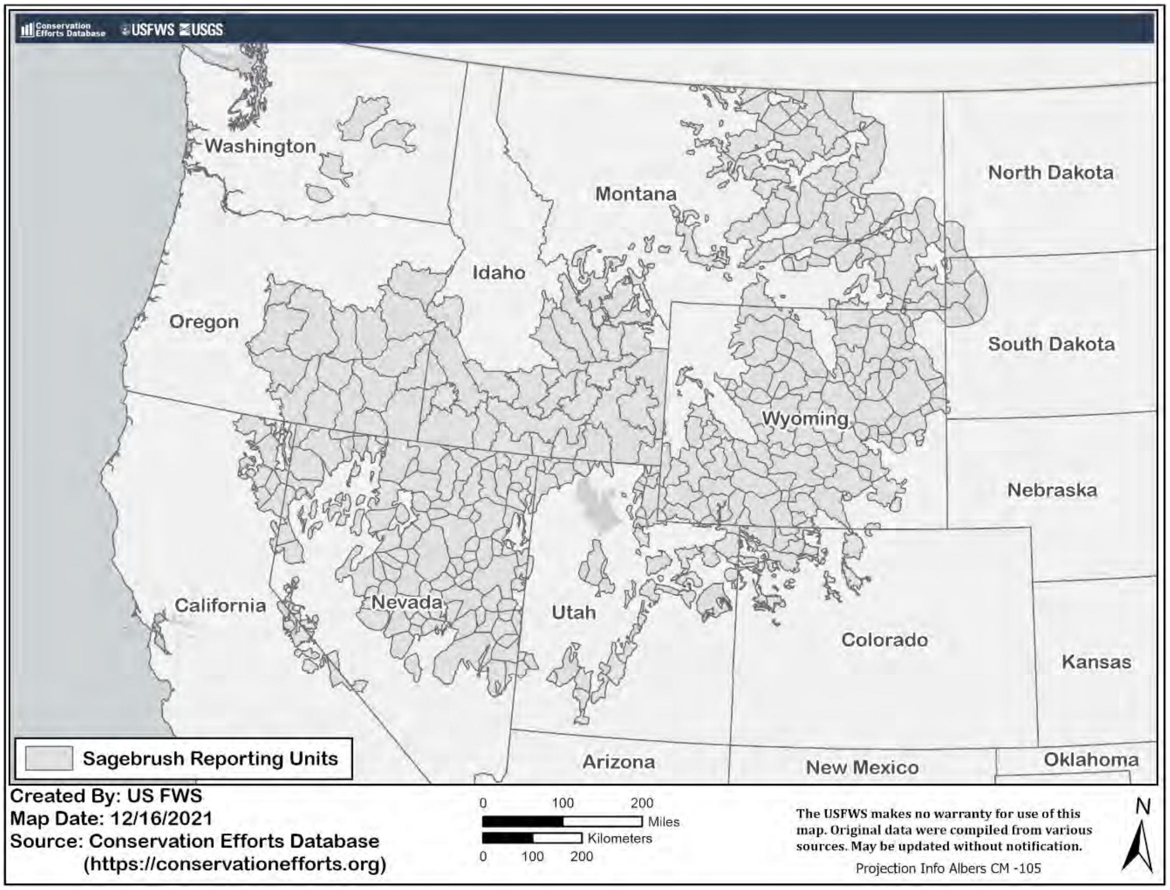


Figure 4. Sagebrush Reporting Units from the Conservation Efforts Database are used in this Conservation Assessment for summarizing and displaying conservation efforts.

Reporting

Using the CED tools to perform queries, generate tabular summaries, and produce maps of CED data, the GRSG Conservation Report Team summarized the majority of on-the-ground Greater Sage-grouse conservation efforts rangewide by:

- Activity Types: Sagebrush Protection, Conifer Removal, and Habitat Restoration from 2009–2019 in tabular format (Table 6).
- Activity Types: Sagebrush Protection, Conifer Removal, and Habitat Restoration from 2015 –2019 efforts by SRUs (Figure 6).
- Activity Types: Sagebrush Protection, Restoration, and Conifer data from Figure 5 were aggregated for reporting by two regions (Figure 6).

The two regions represent the Rocky Mountain and Great Basin portions of the species' range and were developed using Climate Clusters (Coates et al. 2021a) to allow for congruency with other findings (e.g., population trends) in this report. Climate Clusters C [Jackson Hole], D [Eastern portion of the range], and F [western WY area] represent the Rocky Mountain portion of the range, and Climate Clusters B [WA area] and E [Great Basin area] represent the Great Basin portion of the range. Climate Cluster A represents the Bi-State Distinct Population Segment and was not included in the CED summaries.

Results

- Results by Activity Type:
    - *Sagebrush Protection:* From 2015 – 2019, over 500 actions, including conservation easements were finalized in sagebrush habitats, covering over 1,000,000 acres (Table 6). Of those actions, about 400 occurred in Greater Sage-grouse range and covered over 849,000 acres (Figure 5). This equates to an annual average of approximately 169,800 acres enrolled in easements.
    - *Conifer Removal:* 1,143 Conifer Removal efforts were implemented totaling over 1,167,000 acres (Figure 5). This equates to an average of approximately 233,400 acres per year from 2015 – 2019.
    - *Habitat Restoration:* Restoration activities include, but are not limited to fuels management, post-fire restoration, and invasive annual grass treatments. A total of 3,496 efforts were implemented from 2015 – 2019 and over 4.3 million acres were treated (Figure 5), an average of approximately 860,000 acres implemented annually.
- Results by Region (Figure 6): More actions were reported via the CED in the Great Basin portion of the range (3,455 efforts on over 4.6 million acres) than on the Rocky Mountain side (1,378 efforts on 1.5 million acres). The difference in the number of implemented actions between regions is likely to be attributed to the higher number of acres burned by wildfire and the associated presence of invasive annual grasses in the Great Basin region relative to the Rocky Mountain region and the actions conducted for post-fire restoration and subsequent management of invasive annual grasses.
- Tabular Results by Activity - The total amount of Protection, Restoration and Conifer Removal activities in the CED increased from 3,957,187 acres reported for 2009 –2014 to 7,402,105 acres reported for 2015 –2019 (Table 6).

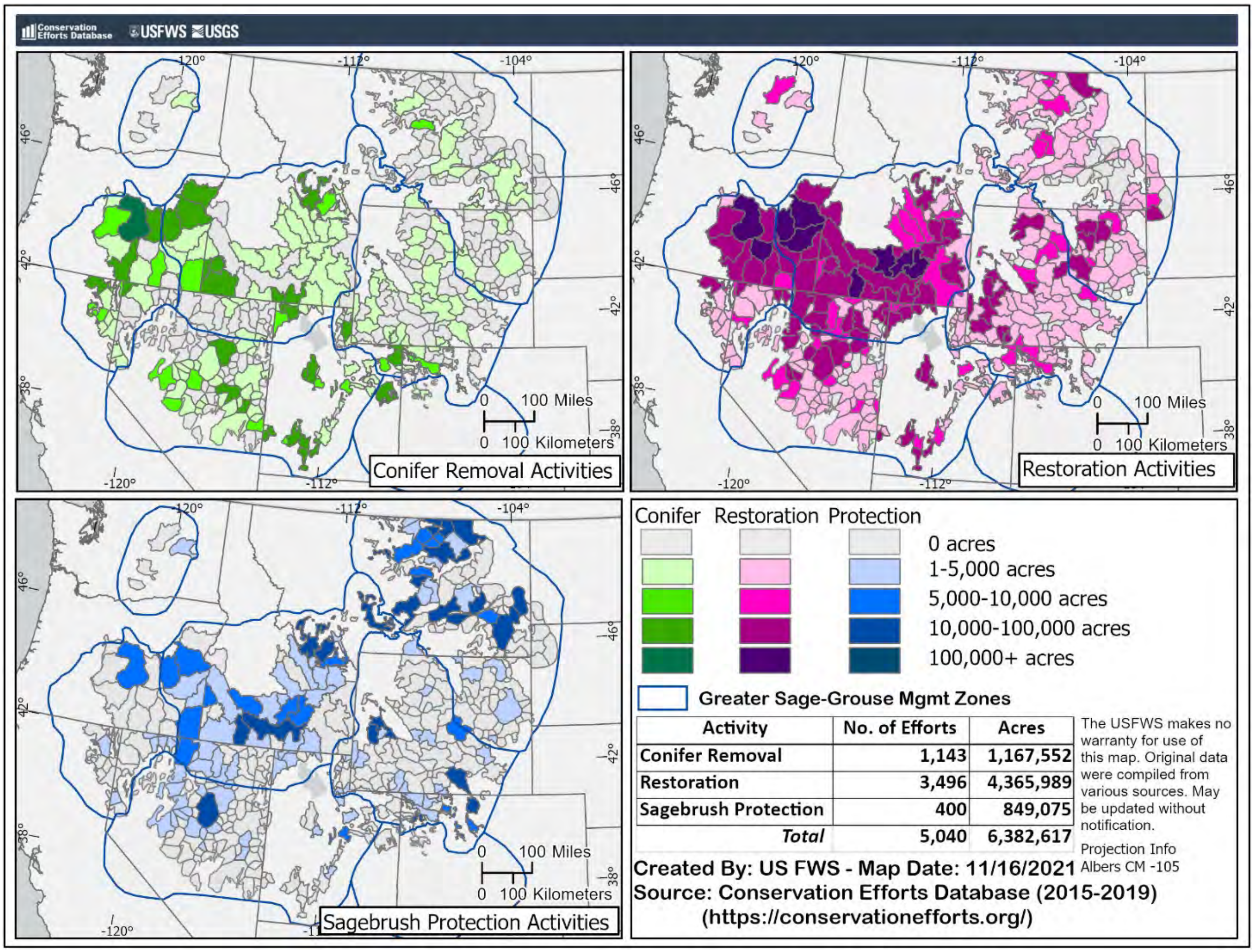
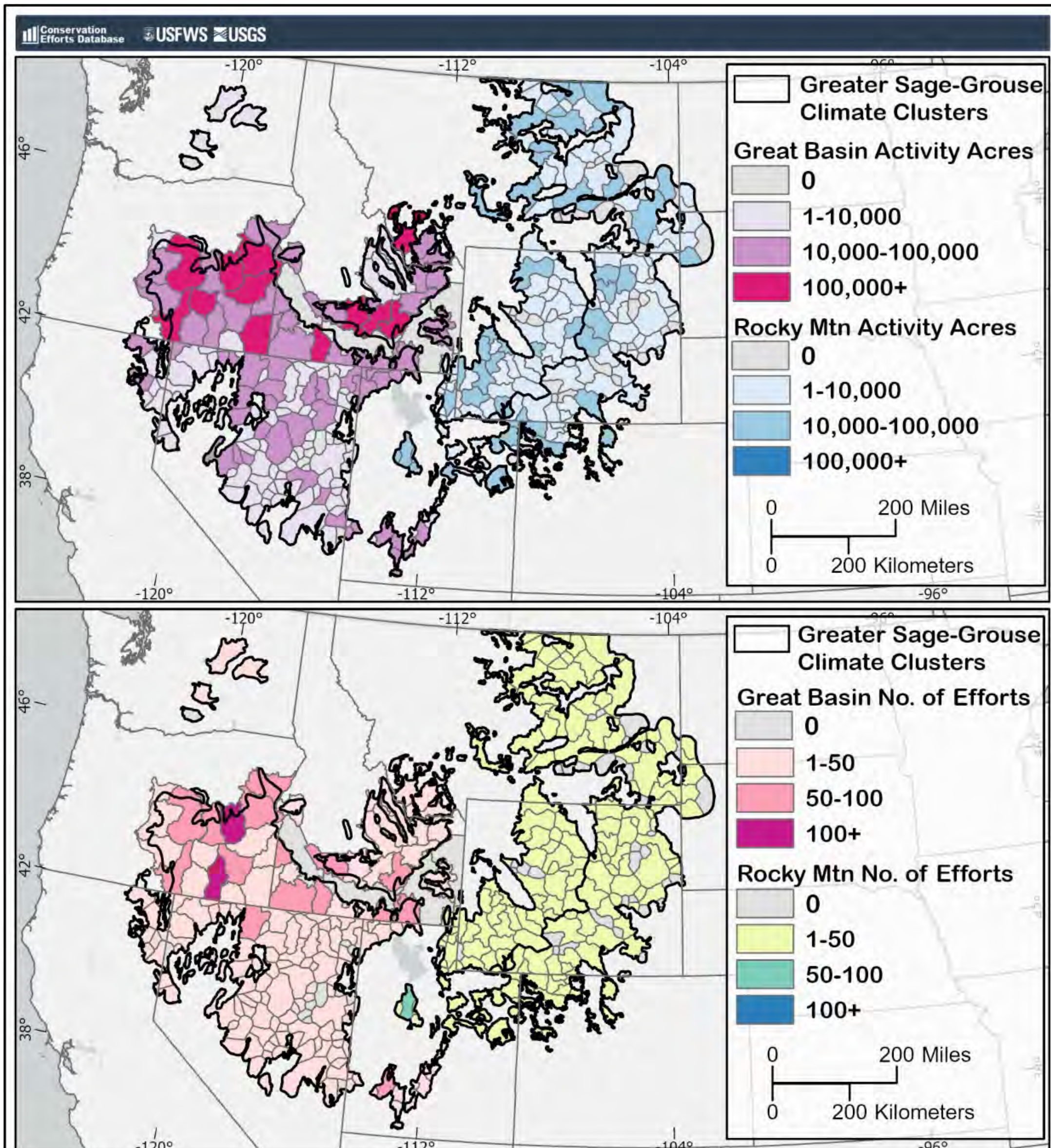


Figure 5. Three-panel figure illustrating conservation efforts implemented from 2015 – 2019 and summarized by the Conservation Efforts Database (CED) Sagebrush Reporting Units. Each panel displays a different CED Activity Type. Included is a summary table containing the number of efforts and associated acreages. This does not include Bi-State State Distinct Population Segment, along the California-Nevada state line or Canadian populations.



The USFWS makes no warranty for use of this map. Original data were compiled from various sources. May be updated without notification.

Projection Info Albers CM -105

Spatial Activity	Great Basin No. of Efforts	Great Basin Acres	Rocky Mtn No. of Efforts	Rocky Mtn Acres
Conifer Removal	728	863,110	331	224,974
Restoration	2,551	3,524,400	850	716,606
Sagebrush Protection	176	228,792	197	597,294
Total	3,455	4,616,302	1,378	1,538,874

Created By: US FWS
Map Date: 11/16/2021
Source: Conservation Efforts Database (2015-2019) (https://conservationefforts.org/)

Figure 6. Conservation efforts implemented [and reported] from 2015 –2019 summarized by region using climate clusters. Climate Clusters B [WA area] and E [Great Basin area] were used to represent the Great Basin and Climate Clusters C [Jackson Hole], D [Eastern area], and F [western WY area] (Coates et al. 2021a) were used to represent the Rocky Mountain portion of the range. The top panel (A) is displaying acres of implemented actions and the lower panel (B) is displaying the number of actions implemented. This does not include Bi-State or Canadian populations.

Table 6. The acres (ac) and miles (mi) of specific Subactivity types of conservation actions within the three Activity types (Protection, Restoration and Conifer Removal). Dashes represent "no data collected" in the CED for that year. The "n/a" represents the years that data input into the CED was not available for data providers. Data include actions conducted on both public and private lands.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Subactivity Totals
PROTECTION ACTIVITY												
Conservation Easements	22,607	32,244	45,543	129,931	48,257	27,765	140,142	125,476	220,025	282,938	121,354	1,196,282
Land Acquisition	1,001	968	-	38,715	6,028	-	-	-	-	-	-	46,712
Fuel Breaks (ac)	1,977	6,968	6,873	14,895	6,585	11,353	724	32,525	63,881	61,943	90,694	298,418
Fuel Breaks (mi)	261	491	350	470	869	352	-	-	-	-	-	2,793
Annual Total acres (not miles)	25,585	40,180	52,416	183,541	60,870	39,118	140,866	158,002	283,906	344,881	212,048	
Total Acres 2009-2019	**401,709**						**1,139,703**					
RESTORATION and CONIFER REMOVAL ACTIVITIES												
Conifer Removal	**52,093**	**61,793**	**77,380**	**80,484**	**102,931**	**179,728**	**269,765**	**330,605**	**353,031**	**188,306**	**52,173**	1,748,289
Noxious Weed Treatment	13,981	10,448	9,362	32,411	45,737	207,935	622,053	301,303	340,909	309,263	3,242	1,896,644
Annual Grass Treatment	80,395	89,137	124,424	73,652	112,615	25,665	191,473	353,046	411,182	225,074	58,401	1,745,064
Fuels Management	1,700	10,208	7,536	6,856	12,902	66,397	105,782	92,086	45,959	60,350	11,062	420,838
Vegetation Mgmt/ Habitat Enhancement	84,295	171,500	242,994	312,317	772,836	389,548	499,870	310,804	393,501	424,469	233,407	3,835,541
Riparian, Wet Meadow or Spring Restoration	1,027	19,133	1,385	30,563	27,409	16,701	17,638	28,245	17,899	9,959	-	169,959
Energy Development Reclamation	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	1,103	-	442	-	-	1,545
Annual Total Acres	233,491	362,219	463,080	536,283	1,074,430	885,974	1,707,684	1,416,089	1,562,923	1,217,421	358,285	
Total Acres 2009-2019	**3,555,478**						**6,262,402**					

Chapter 1 Conclusions:
Assessment of Implementation of Commitments and Actions

Conservation commitments made on behalf of Greater Sage-grouse from 2015 and beyond exceeded the conservation actions before 2015 which were touted by Secretary of the Interior Sally Jewel as the largest conservation effort on record. The information presented here demonstrates the variety of ways that Greater Sage-grouse conservation partners implemented state and federal regulatory conservation commitments, mitigation actions, voluntary conservation actions, and public and private lands conservation actions.

The information provided in Chapter 1 was gathered from conservation partners, agency reports and databases. After review of this information, the GRSG Conservation Report Team concluded that the commitments identified in the Federal Registry Notice, as well as subsequent voluntary and regulatory conservation actions, are being implemented and will continue to be implemented into the future. We conclude that:

- Regulatory disturbance measures:
  - Regulatory-driven avoidance is occurring throughout the range. However, this avoidance is difficult to monitor. Therefore, avoidance is not reported in this assessment.
  - The amount of disturbance authorized by BLM in PHMA and IHMA (in ID) from 2015-2019 increased by 73,000 acres west wide. That amount of authorized disturbance remains below the BLM thresholds (disturbance caps) as prescribed in the BLM 2015 GRSG LUPs.
  - The majority of project areas met the disturbance and density caps.
  - Direct disturbance, the actual footprint of the disturbance, is monitored by the BLM. The vast majority of BSUs (99%) were found within the established density cap. Indirect effects, such as noise or vehicle traffic, are not continually monitored but are evaluated in the project-specific approval process for any proposed disturbance. Indirect effects can be as, or more deleterious than the actual direct disturbance of a facility or feature on the landscape due to noise, vehicular traffic and predator supplementation.
  - Specific details about the anthropogenic disturbance caps (e.g., the state, disturbance type, acres disturbed, Habitat Management Areas, affected leks, mitigation actions) are not provided in this report. Most of the information (the state, disturbance type and acres disturbed in PHMA (and IHMA in ID) is available in Appendices 7-15 of the BLM Rangewide Monitoring Report.
- BLM and USFS adaptive management triggers and responses: Forty-two population or habitat triggers were tripped between 2015 and 2019. Second occurrences are not counted again unless the level of the trigger changes (i.e., from a soft trigger to a hard trigger) in subsequent years. Because population or habitat triggers can be tripped within the same BSU, fewer than 42 BSUs were affected.

    - This report does not provide information regarding the factors that caused the triggers to be tripped nor does it provide information about existing or potential time lag effects related to the causes for declines that tripped the triggers.
- Mitigation:
    - A total of 604 projects were authorized by BLM in PHMA of which 36 projects required compensatory mitigation (Appendix D). It was not possible for the GRSG Conservation Report Team to assess the effectiveness of these mitigation projects because of the complexity of indirect effects of the several types of developments, whether mitigation has actually been implemented, and the amount of time since development. Often, it takes 7-10 years to understand the ramification of development and whether mitigation efforts were successful.
    - The report does not include information about where mitigation was sited in relation to the impact or provide criteria that was used to site mitigation. The GRSG Conservation Report Team did not assess the level of implementation for those states with mitigation programs nor did the GRSG Conservation Report Team assess or report on the level of disturbance that has been avoided or offset under state regulatory programs.
- Livestock grazing:
    - Only 5% (3.5 million acres of the approximately 67.4 million acres) of livestock grazing allotments containing Greater Sage-grouse habitat were evaluated by BLM for land health standards between 2015 and 2019.
- Conservation efforts from the CED:
    - The CED includes the majority of efforts reported, although it does not capture all types of efforts spatially and may not include efforts by some NGO conservation partners or industry, or the entirety of voluntary conservation efforts by private landowners and industry. Similarly, it may not capture efforts that benefit Greater Sage-grouse but were not specifically implemented for them (e.g., USFWS's efforts to make the sagebrush biome a priority ecosystem).
    - Figure 5 and 6 display the distribution and magnitude of three categories of conservation efforts implemented; conifer removal, restoration, and sagebrush protection.

Chapter 2: Summary of Greater Sage-Grouse Populations & Habitat Conditions

Section A. Summary of Greater Sage-Grouse (GRSG) Populations

This section of the GRSG Conservation Report provides background and an update on population monitoring, population trends, lek monitoring protocols, population management techniques, and the use of population data-based thresholds (e.g., Bureau of Land Management (BLM) land use plan population triggers, Coates et al. 2021a Hierarchical Monitoring Framework and Targeted Annual Warning System concepts) for implementing adaptive management strategies.

During the process to review the 2015-2020 publicly available information to develop this section of the GRSG Conservation Report, some updated information became available. In some cases, updated information is included. For example, more current information is included about: state wildlife agency lek data, population nadirs, BLM adaptive management population triggers, translocations and augmentations, and the status of the population in the state of Washington.

Population Information

Background

Greater Sage-grouse are a state and tribal trust species, meaning that the management of the species is the responsibility of states and tribes. Data collected by most states includes an array of demographic data including but not limited to counts of birds on breeding grounds (leks), ratios of males to females, ratios of juveniles to adults by sex, ratios of yearlings to adults by sex, distribution of birds on the landscape by season of use, numbers of birds harvested by location, hunter number, and hunter days among other data. Some states began recording lek counts in the 1940s with ten of the 11 Greater Sage-grouse states recording data by 1960. A range-wide lek count database includes data from the mid-1960s to the present day and forms the foundational data for modeling Greater Sage-grouse populations (see the Population (Lek) Counting section below) (Table 7, Figure 7).

Distinct populations

In the late 1990s and early 2000s, genetic analyses were conducted to evaluate variation in size, appearance, and behavior of Greater Sage-grouse across the range. This research established the difference between greater (*Centrocercus urophasianus*) and Gunnison (*C. minimus*) Sage-grouse (Oyler-McCance et al. 1999) and the lack of substantial difference between western (*C. urophasianus phaios*) and eastern (*C. u. urophasianus*) Greater Sage-grouse (Benedict et al. 2003). At the same time, the 2003 research provided a foundation for subsequent designation (USFWS 2013a) of the Distinct Population Segment in the Bi-State area of the States of California (CA) and Nevada (NV; Carson City, Esmeralda, Douglas, Lyon and Mineral counties in NV and Alpine, Inyo and Mono counties in CA) which were different from Greater Sage-grouse populations north and east of that area. Subsequent research has shown that Greater Sage-grouse in the State of Washington (WA) are genetically more distinct than the Bi-state population suggesting that they have been isolated in the Columbia Basin for many thousands of years (Oh et al. 2019). This genetic information has impacted both status and management throughout the range including the 2015 U.S. Fish and Wildlife Service's decision to reverse the 2001 recommendation to list the western Greater Sage-grouse as threatened, and listing of Greater Sage-grouse in WA as State Endangered (M. A. Schroeder, WA Department of Fish and Wildlife, personal communication)), and has intensified cooperative management in the Bi-State population.

Table 7. Results and level of monitoring effort of Greater Sage-grouse leks by state from 2014 through 2021. Displayed is the peak number of males counted, the total number of leks monitored, the number of active leks monitored, and the average number of males per active lek each year in each of the 11 states in the range of Greater Sage-grouse. The 2021 lek data information that became available while developing this GRSG Conservation Report is included. The timeframe exception was made because COVID restrictions in 2020 hindered survey efforts in many states (e.g., NV). Figures for the maximum average number of males per active lek (in bold, blue italics) and the minimum average number of males per active lek (in bold, red italics) are noted for the analysis period.

		2014	2015	2016	2017	2018	2019	2020	2021
California	Peak Males	1450	1261	1431	1081	1037	713	643	655
	Total Leks Monitored	141	87	90	88	74	82	56	153
	Active Leks	63	86	60	52	57	47	33	41
	Avg/Active Lek:	23.0	14.7	***23.9***	20.8	18.2	***15.2***	19.5	16.0
Colorado	Peak Males	4260	6400	7329	5322	3596	2245	2533	2850
	Total Leks Monitored	492	524	510	588	559	536	598	557
	Active Leks	262	274	279	281	279	271	266	265
	Avg/Active Lek:	16.3	23.4	***26.3***	18.9	12.9	***8.3***	9.5	10.8
Idaho	Peak Males	11859	12999	15997	13065	11614	8658	8283	8560
	Total Leks Monitored	1269	1148	1207	1209	1367	1408	1367	1303
	Active Leks	673	642	713	658	710	662	628	605
	Avg/Active Lek:	17.6	20.2	***22.4***	19.9	16.4	***13.1***	13.2	14.1
Montana	Peak Males	4914	8523	11908	12770	7535	7021	9987	a10446
	Total Leks Monitored	983	973	1038	939	770	895	887	811
	Active Leks	763	755	780	784	638	752	715	698
	Avg/Active Lek:	***6.4***	11.3	15.3	***16.3***	11.8	9.3	14.0	15.0
Nevada	Peak Males	9063	12551	13366	11027	9184	7098	2306	4892
	Total Leks Monitored	934	1003	1048	954	971	849	394	982
	Active Leks	512	606	586	552	551	460	182	436
	Avg/Active Lek:	17.7	20.7	***22.8***	20.0	16.7	15.4	12.7	***11.2***
North Dakota	Peak Males	37	30	22	5	27	29	27	22
	One private sector party has bred Greater Sage-grouse in captivity	56	56	56	24	46	56	30	31
	Active Leks	7	6	6	4	6	8	7	5
	Avg/Active Lek:	***5.3***	5.0	3.7	***1.3***	4.5	3.6	3.9	4.4

		2014	2015	2016	2017	2018	2019	2020	2021
Oregon	Peak Males	3065	4501	5214	4789	4499	3270	3571	4008
	Total Leks Monitored	349	660	508	435	526	490	507	544
	Active Leks	203	259	267	263	268	244	241	275
	Avg/Active Lek:	15.1	17.4	***19.5***	18.2	16.8	***13.4***	14.8	14.6
South Dakota	Peak Males	109	158	288	218	168	139	158	173
	Total Leks Monitored	47	67	48	58	53	58	59	56
	Active Leks	21	17	24	25	22	17	17	18
	Avg/Active Lek:	***5.2***	9.3	***12.0***	8.7	7.6	8.2	9.3	9.6
Utah	Peak Males	4892	5801	5681	4434	3883	2268	2333	2233
	Total Leks Monitored	353	375	375	362	367	335	389	387
	Active Leks	249	279	267	257	254	205	217	197
	Avg/Active Lek:	19.7	20.8	***21.3***	17.3	15.3	11.1	***10.8***	11.3
Washington	Peak Males	372	396	287	201	281	268	303	269
	Total Leks Monitored	44	39	41	36	37	41	40	41
	Active Leks	30	28	28	26	27	23	22	21
	Avg/Active Lek:	12.4	***14.1***	10.3	***7.7***	10.4	11.7	13.8	12.8
Wyoming	Peak Males	20216	36534	43298	36594	29663	21666	19353	16479
	Total Leks Monitored	1794	1824	1828	1817	1794	1765	1765	1749
	Active Leks	1105	1215	1258	1204	1179	1134	1009	999
	Avg/Active Lek:	18.6	30.9	***35.6***	31.4	25.6	20.1	19.4	***16.8***
Rangewide	Peak Males	60237	89154	104820	89506	71487	53375	49497	50584
	Total Leks Monitored	6424	6755	6748	6509	6563	6515	6092	6614
	Active Leks	3888	4166	4267	4106	3991	3823	3337	3560
	Avg/Active Lek:	14.3	17.1	***19.4***	16.4	14.2	***11.8***	12.8	12.4

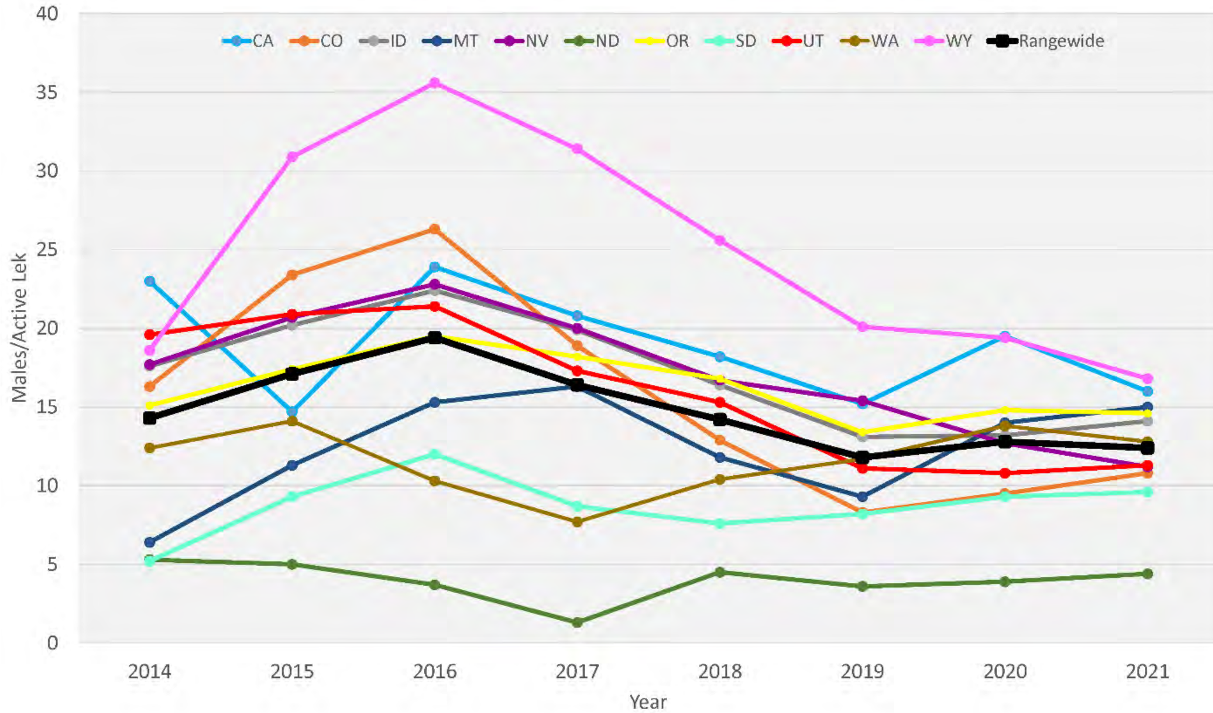


Figure 7. Number of males per active lek counted per year for 11 states within the current range of Greater Sage-grouse from 2014 through 2021.

During the analysis period, range-wide averages for male attendance at active leks indicates a peak in 2016 at 19.4. This was followed by a steady decline to 2019 when male attendance averaged 11.8 males/lek, representing a decline of 39 percent. This could be considered a population nadir that matches the one described in Coates et al. 2021; however, there is variability among different states (also described in Coates et al. 2021). It is noteworthy to point out that male attendance on active leks in 2021 were also very low for the analysis period at 12.4 males/lek and that States such as Nevada and Wyoming experienced their lowest male attendance in 2021 at 11.2 and 16.8 respectively.

Population (Lek) Monitoring/Counting Greater Sage-Grouse

Counts of males on traditional lek sites during the breeding season is the standard method for monitoring Greater Sage-grouse populations. Guidelines for conducting and analyzing these 'lek counts' have evolved with both field protocols (Autenrieth et al. 1982, Connelly et al. 2003, Connelly and Schroeder 2007) and statistical analysis (Johnson et al. 2007, Coates et al. 2014, McCaffery and Lukacs 2016, McCaffery et al. 2016). Many of these guidelines have been updated to address potential sources of bias including annual, seasonal, daily, and temporal variation in visitation rates of males to leks, observer variation, unknown and/or variable sex ratios, impacts of weather and/or disturbance on attendance, and variation in lek detectability, type, and location. The Sage and Columbian Sharp-tailed Grouse Technical Team (a multi-agency rangewide team) developed updated guidelines for monitoring leks (Greater Sage-grouse Rangewide Population Monitoring Guidelines Part A; Cook et al. 2022) and assessing data collected from leks (Part B; In development). The Technical Team is developing the Greater Sage-grouse Rangewide Population Monitoring Guidelines Part B. Protocols have been developed to conduct ground-based lek counts (including replicate counts), aerial visual lek counts, aerial infrared lek counts, and differentiation between actual counts of males and presence-absence data.

Population Monitoring for BLM Adaptive Management

In the BLM Rangewide Monitoring Report (Herren et al. 2021), the BLM reported that from 2016 to 2019, the cumulative total count of adaptive management population triggers tripped was 42 in six of the nine states however, more recent information shows that additional BLM adaptive management population triggers have been tripped since 2019. The BLM reports that in CA, ID, NV, OR, UT and WY, greater sage-grouse population declines in a BSU exceeded a soft or hard trigger in at least one year since 2016. The total count of 42 triggers tripped is cumulative and does not mean that 42 BSUs had population triggers tripped. For example, if a trigger is tripped in a BSU in one year and remains tripped the next year, the second occurrence is not counted again unless the level of the trigger changes (i.e., from a soft trigger to a hard trigger) in subsequent years.

The types of actions that can be taken by the BLM in response to tripping adaptive management triggers are identified in the 2015 GRSG Land Use Plans (LUPs). Responses taken during this time period are contained in each state-specific appendix to the BLM Rangewide Monitoring Report (Herren et al. 2021). Three examples are provided for this GRSG Conservation Report. In UT, the Sheeprocks BSU met a hard trigger in 2016, resulting in portions of it changing from General Habitat Management Area (GHMA) to Priority Habitat Management Area (PHMA), as well as the population becoming a high priority for UT BLM and partners for translocations and habitat rehabilitation. Also in UT, the Parker Mountain BSU hit a soft trigger in 2019, resulting in habitat improvement projects to increase available habitat. In ID, state-led causal factor analyses were developed for BSUs that tripped hard triggers and BLM changed management status of these Important Habitat Management Areas (IHMA) to PHMA.

Population Monitoring for USFS Adaptive Management

The USFS used information supplied by state wildlife agencies and/or BLM State Offices to complete annual adaptive management evaluations by state. From 2015-2019, no population triggers were tripped in CO or MT. Five hard and two soft population triggers were tripped in Idaho, and one soft and one hard population trigger were tripped in UT. One soft population trigger was tripped in WY. Triggers in NV are still being evaluated. Adaptive management actions in response to triggers being tripped are considered and determined at the local unit scale, in collaboration with partners.

Population Trends

Multiple rangewide population assessments for Greater Sage-grouse have been conducted with increasingly quantitative refinements over time. The first qualitative assessment was conducted by Hornaday (1916) while more recent quantitative assessments have been based on improved data collection methods (typically number of males attending leks) and analyses, including Connelly and Braun (1997), Braun (1998), Connelly et al. (2004), Garton et al. (2011 and 2015), Nielson et al. (2015), and Coates et al. (2021a). All previous and current trend analyses documented continued long-term declines in Greater Sage-grouse populations. Recent improvements in how lek data are collected and analyzed have increased the precision of trend estimates.

Greater Sage-grouse populations oscillate or 'cycle' on average every 9.4 years (Coates et al. 2021a). Population trend analyses are sensitive to the start and stop years of the analysis itself, depending on where those years fall within population cycles. Therefore, Coates et al. (2021a) evaluated spatiotemporal trends in populations across nadirs (the lowest points in Greater Sage-grouse male lek attendance rates) over time as the population cycles. Nadirs were selected for use in analysis for two reasons. The first was that population low points presented a less variable population trend when compared to estimated apexes in populations, leading to more precise and conservative realized trend estimations through time. The second was that use of nadirs provides awareness of population vulnerabilities by tracking lows in population estimates (Coates et al 2021a). They used a state-space model to estimate trends at four different spatial scales (leks, neighborhood clusters, climate clusters, and rangewide) and different temporal periods representing complete multi-year oscillations (nadirs at 1966, 1975, 1986, 1996, 2002, and 2013 (Table 8). Data from Table 7 and Figure 7 indicates that the rangewide population was lower in 2021 (12.4 males/active lek) than it was in 2020 (12.8 males/active lek) and just a slight improvement from 2019 (11.8.3 males/active lek). This was especially apparent in the core states of Nevada and Wyoming.

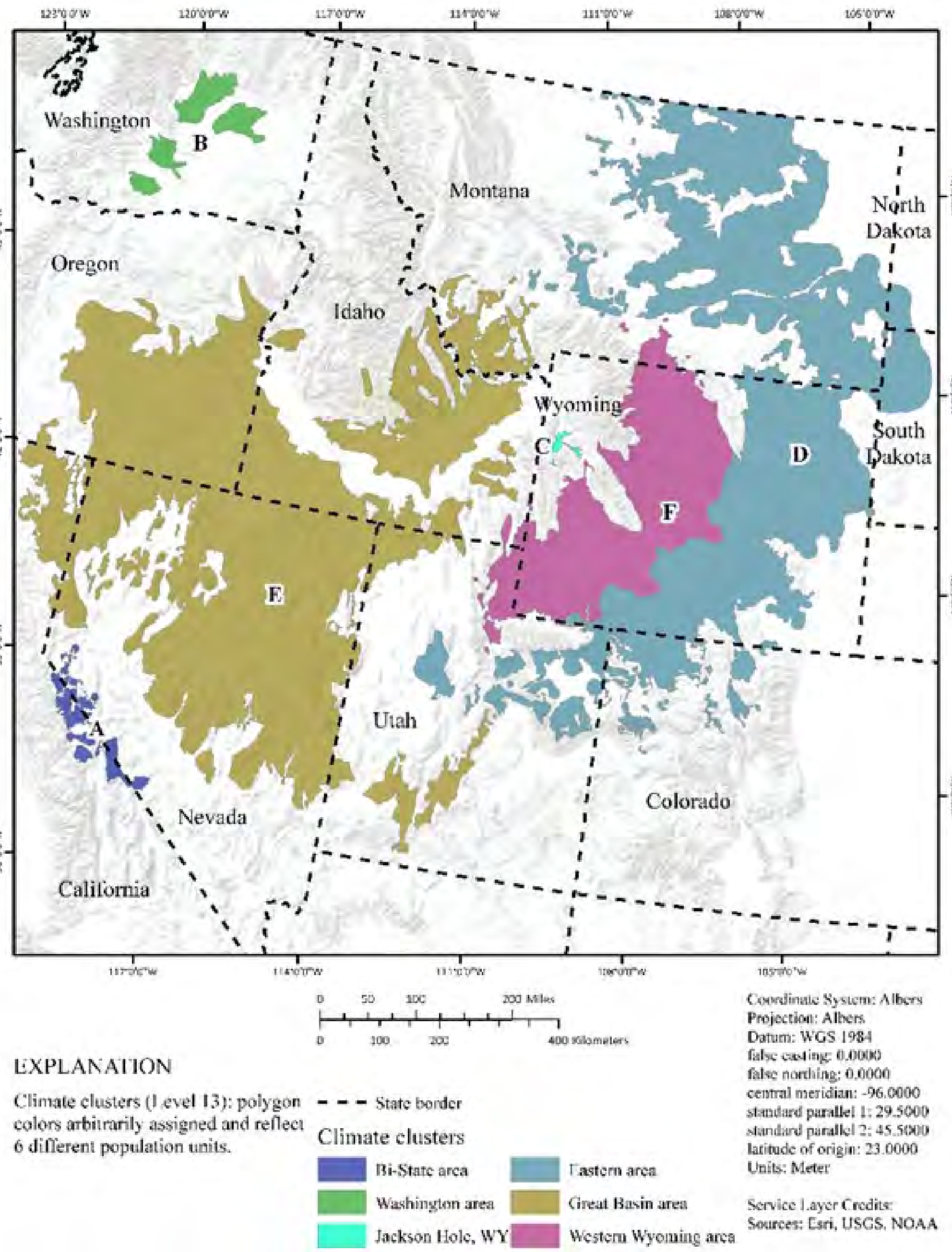


Figure 8. Greater Sage-grouse hierarchical population monitoring framework for climate clusters (level 13) in the western United States. A = Bi-State, B = Washington area, C = Jackson Hole, Wyoming area, D = eastern area, E = Great Basin area, F = western Wyoming area. Map image is the intellectual property of Esri and is used herein under license. Copyright c) 2020 Esri and its licensors. All rights reserved.

Table 8. Identified years of population abundance nadirs used to define temporal scales (recent to long-term) of population trend estimates across different climate clusters (A–F) and range-wide for Greater Sage-grouse (*Centrocercus urophasianus*) in the western United States. Range-wide estimated abundance nadirs were 1966, 1975, 1986, 1996, 2002, and 2013 that reflect Long, Medium/Long, Medium, Short/Medium, Short, and Recent, respective, temporal scales for inferencing trends.

CC	Long	Medium/Long	Medium	Short/Medium	Short	Recent
A (Bi-State)	1969	1977	1983	1995	2002	2008
B (Washington)	1964	1976	1987	1996	2001	2008
C (Jackson Hole)	1963	1973	1984	1999	2003	2011
D (Eastern Range)	1966	1977	1986	1997	2004	2014
E (Great Basin)	1967	1975	1985	1996	2002	2013
F (Wyoming Basin)	1966	1973	1987	1996	2002	2013
Range	1966	1975	1986	1996	2002	2013

CC, climate cluster

The results showed an 80.7 percent rangewide population decline from 1966 to 2019, a 65.2 percent decline from 1986 to 2019, and a 37.0 percent decline from 2002 to 2019. At the neighborhood cluster level, population declines were observed in 94.3 percent of the clusters from 1966 to 2019, 88.4 percent of the clusters from 1986 to 2019, and 81.3 percent of the clusters from 2002 to 2019 (Figure 9). When the analysis was restricted to climate clusters, the population declines were largest in WA while the western Wyoming (WY) climate cluster (which does not include the Jackson Hole climate cluster) showed modest population increases and stabilization in several neighborhood clusters between 1996 and 2019 (Coates et al. 2021a). However, data from 2020 and 2021 that were not available for the Coates et al. 2021a analysis in Wyoming showed that the average number of males/active lek declined 16 percent from 2019 to 2021. As stated earlier, more recent lek count data from 2020 and 2021 suggests that a population nadir may not have been realized until 2020 or 2021; therefore, these increases have likely subsided.

Over the long term, the annual decline of Greater Sage-grouse populations was calculated at 3.1 percent per year at the rangewide level (Coates et al. 2021a). Populations in all climate clusters declined (no population rates of change > 1.0) over the long-term with the Wyoming Basin (F) population performing the best (0.980) and the Washington (B) population declining at the highest rate (0.956). Recent (one-cycle, or oscillation) trends suggest that the Jackson Hole, Wyoming, and Great Basin populations are performing worse now when compared to longer term trends. Although data (Coates et al. 2021a) indicates that the eastern portion of the range (D) and the Wyoming Basin (F) are performing better since their respective nadirs occurring in 2014 and 2013, there are indications that populations have not recovered significantly since 2019 and new nadirs may have been realized in important states such as Nevada and Wyoming in 2021.

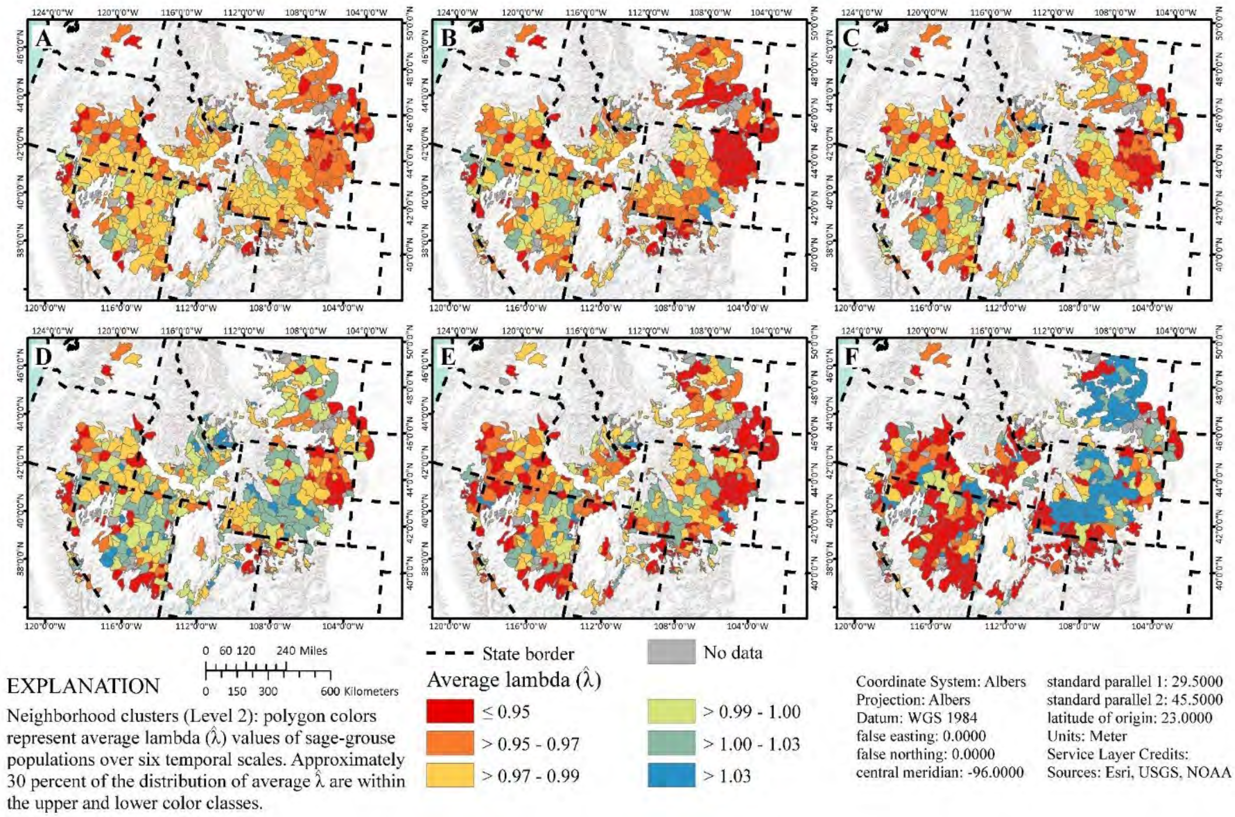


Figure 9. Rangewide spatial estimates of average annual rate of change ($\hat{\lambda}$) in abundance of Greater Sage-grouse across six temporal scales based on periods of oscillation between nadirs: A, Long (six periods, 1966-2019); B, Medium/Long (five periods, 1975-2019); C, Medium (four periods, 1986-2019); D, Short/Medium (three periods, 1996-2019); E, Short (two periods, 2002-2019); and F, Recent (one period, 2013-2019) within neighborhood clusters (figure from Coates et al. 2021a).

Table 9. Greater Sage-grouse average annual rate of population change (λ) across six different temporal scales which corresponded to differing periods of oscillation (Recent [one period], Short [two periods], Short/Medium [three periods], Medium [four periods], Medium/Long [five periods], Long [six periods]) for each climate cluster within western United States.

	Temporal scales[1]							
CC	**Long**	**Medium/ Long**	**Medium**	**Short/ Medium**	**Short**	**Recent**	**Number of leks[2]**	**Average count/lek[3]**
A	0.978	0.978	0.990	0.995	0.973	0.981	84	21.3
	(0.965-0.988)	(0.962-0.986)	(0.974-1.000)	(0.979-1.005)	(0.964-0.981)	(0.969-0.993)	(55)	(19.9-22.8)
B	0.956	0.949	0.946	0.956	0.966	0.957	108	14.0
	(0.944-0.973)	(0.928-0.968)	(0.907-0.966)	(0.909-0.981)	(0.936-0.998)	(0.932-1.000)	(70)	(13.2-14.9)
C	0.966	0.963	0.972	0.970	0.962	0.935	17	14.1
	(0.951-0.982)	(0.941-0.980)	(0.942-0.997)	(0.948-0.989)	(0.942-0.981)	(0.905-0.966)	(14)	(12.3-15.9)
D	0.963	0.956	0.967	0.983	0.963	0.980	2,944	16.7
	(0.960-0.968)	(0.946-0.960)	(0.960-0.972)	(0.975-0.989)	(0.959-0.967)	(0.972-0.989)	(1,831)	(16.5-16.9)
E	0.971	0.973	0.974	0.986	0.968	0.949	4,015	17.3
	(0.967-0.976)	(0.967-0.978)	(0.963-0.979)	(0.981-0.990)	(0.964-0.971)	(0.944-0.955)	(2,187)	(17.1-17.5)
F	0.980	0.976	0.976	1.003	0.991	1.016	1,253	23.7
	(0.975-0.987)	(0.969-0.984)	(0.966-0.980)	(0.997-1.008)	(0.988-0.995)	(1.011-1.023)	(974)	(23.3-24.2)
Range	0.969	0.965	0.969	0.989	0.973	0.977	8,421	18.4
	(0.967-0.974)	(0.960-0.970)	(0.963-0.973)	(0.983-0.992)	(0.971-0.975)	(0.973-0.981)	(5,131)	(18.3-18.6)

CC, climate cluster; A, Bi-State; B, Washington area, C, Jackson Hole, Wyoming; D, eastern area; E, Great Basin area; F, Wyoming Basin

[1]Lengths of temporal scales were defined by population abundance nadirs that varied for each climate cluster (see Table 8). Estimates for each period represent median λ with 95-percent credible intervals in parentheses.

[2]Number of leks in database and number that were used in the analysis in parentheses.

[3]Average number of males counted on leks used in analysis and 95-percent confidence intervals in parentheses.

The Greater Sage-grouse populations in Washington state, although small, are unique among populations in the range of the species. Population trends in Washington track with other clusters in the range of the species and are impacted by similar stressors and have shown a steep decline. A recent genetic analysis comparing Gunnison Sage-grouse to Greater Sage-grouse, showed that after the difference between the two species was considered, that within the remaining Greater Sage-grouse samples, Washington's population is significantly genetically divergent from other greater sage grouse populations throughout the range (Oh et al. 2019). Further, Greater Sage-grouse in Washington are found primarily on private land and rely on habitat programs such as the Conservation Reserve Program (CRP) which face additional threats as CRP contracts expire combined with a county cap that limits enrolling additional acreage, despite the interest from landowners (Appendix E).

Harvest Management

Contemporary Greater Sage-grouse hunting seasons have occurred across their range since the 1940's. Early harvest structure included relatively liberal bag limits and long seasons. Today, conservative seasons of Greater Sage-grouse hunting is permitted in 6 states (Table 10).

Table 10. General harvest regulations for Greater Sage-grouse by state in 2021. The dates and limits shown are for the portions of each state with the most liberal regulations.

State	2021 season dates	Daily limit	Possession limit	Season limit	Season Type
California	Closed	0	0	0	N/A
Colorado	11–17 Sep	2	4	-	General Hunt
Idaho	18 Sep – 31 Oct	-	-	2 (tags)	OTC[1] – limited # tags
Montana	1–30 Sep	2	4	-	General Hunt
Nevada	25 Sep – 3 Oct	2	4	-	General Hunt
North Dakota	Closed	0	0	0	N/A
Oregon	11–19 Sep	-	-	2 (permit)	Controlled Hunt – limited # tags
South Dakota	Closed	0	0	0	N/A
Utah	25 Sep – 17 Oct	-	-	2 (tags)	Controlled Hunt – limited # tags
Washington	Closed	0	0	0	N/A
Wyoming	18–30 Sep	2	4	-	General Hunt

[1]Over-the-Counter – limited # of tags are available first-come, first-served in 12 Management Zones

Translocations and Augmentations

Translocations of wild Greater Sage-grouse have been used to introduce new populations outside the original distribution, reintroduce populations within formerly occupied range, and augment existing populations within occupied range. None of the introductions or reintroductions has produced populations which could quantifiably be called viable (Schroeder et al. 2021). The vast majority of translocations have been augmentations, and the success rate of these efforts has also been poor. Data suggest that quality, quantity, and configuration of habitat at the target location matters more than other factors including time in captivity, type of release (soft or hard), number of birds released, and distance between source and target location (Schroeder et al. 2021). In addition, recent research has shown that new translocation methods including translocating hens with entire broods may substantially increase effectiveness relative to previous methods (Meyerpeter et al. 2021). Translocations are no replacement for conserving intact habitats for Greater Sage-grouse and should be conducted only under certain circumstances such as improving genetic diversity or enhancing small and declining populations (e.g., isolated populations in North Dakota, Washington and Utah).

Use of captive-reared Greater Sage-grouse for translocations has been considered because of high costs of wild bird translocations, lack of genetically similar source birds, disease concerns, and logistical difficulties (Thompson et al. 2015). However, captive-reared grouse have the same challenges and are more vulnerable to predators. These challenges have generally limited captive breeding to species with no potential source populations and have not demonstrated widespread success in re-establishing wild populations, such as the endangered Attwater's prairie-chicken (*Tympanuchus cupido attwateri*). Despite this issue, techniques for captive rearing and release of Greater Sage-grouse (Thompson et al. 2015, WAFWA 2017) and the congeneric Gunnison Sage-grouse (*Centrocercus minimus*; Apa and Wiechman 2015, 2016) have been developed. The Calgary Zoo has been successful at maintaining a flock of Greater Sage-grouse in captivity for several years, producing small numbers of surplus birds for release each year. However, survival of captive birds released from the Calgary Zoo remains extremely low (Joel Nicholson, Alberta Environment and Parks, personal communication). It is unknown if these efforts will succeed where others have failed (Heinrichs et al. 2019).

Section B. Assessment of Greater Sage-Grouse Habitat Conditions

During the process to review the 2015-2020 publicly available information to develop this section of the GRSG Conservation Report, some updated information became available. In some cases, updated information is included.

Wildfire in Greater Sage-Grouse Habitats

Readily available information about the amount of wildfire in Greater Sage-grouse habitats is based on the Integrated Rangeland Fire Management Strategy (U.S. Department of the Interior 2015), which promotes the integration of fire and natural resources management, protection of Greater Sage-grouse habitat, and communication of key information to land managers and fire suppression personnel. The National Interagency Fire Center (NIFC) tracks and reports fire information within a Greater Sage-grouse habitat data layer to summarize the amount of burned acres by surface management agency and state.

A seamless Greater Sage-grouse habitat data layer is used for analysis and reporting GRSG habitat burned by wildfire. The habitat data layer encompasses the BLM Greater Sage-grouse habitat management designations (e.g., PHMA, GHMA, etc.), USFWS Priority Areas of Conservation (PACs), Bi-State habitat (including connectivity areas) and the current occupied range (USFWS 2015). The analyses provide an approximation of Greater Sage-grouse habitat burned due to the coarse scale of the habitat dataset (Figure 10) and may not reflect precisely the on-the-ground habitat. In addition, the acres burned (Table 11) are calculated from daily fire perimeters, which are likely to contain areas of unburned Greater Sage-grouse habitat and

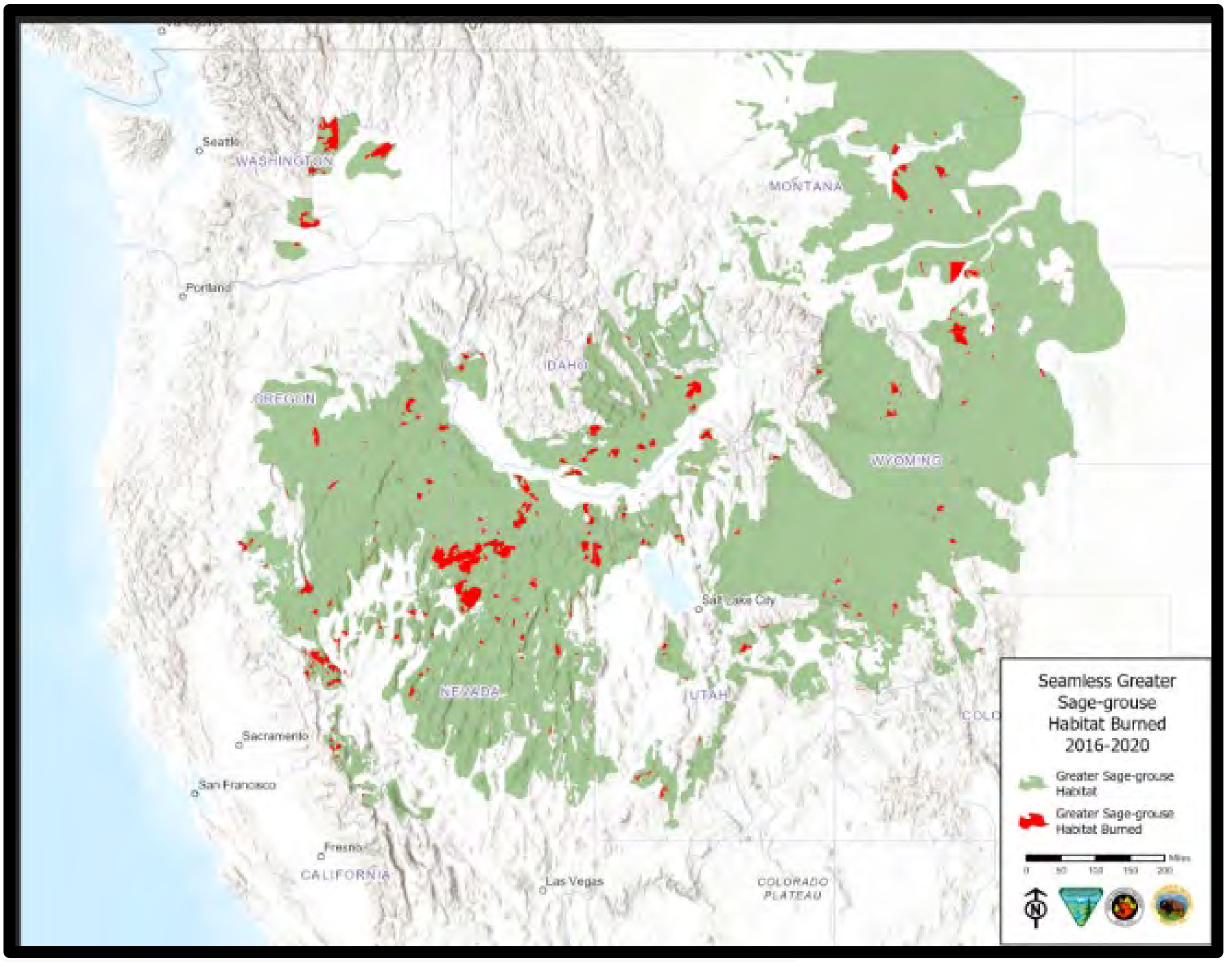


Figure 10: Wildfires in Greater Sage-grouse habitat from 2016 – 2020.

areas that have previously burned (within or across years), potentially counting habitat previously lost to fire more than once. Local reporting of Greater Sage-grouse habitat acres burned may vary from those captured through these national snapshots.

The NIFC report shows a total of 6,036,548 acres of Greater Sage-grouse habitat burned from 2016 through 2020 with a majority of burned acres occurring in NV, followed by the States of Idaho (ID) and WA. The total percentage of habitat burned was highest in WA (25 percent) followed by NV and ID (6 percent). Current and historical summaries for burned acreage within the Greater Sage-grouse habitat data layer is available on the NIFC Greater Sage-Grouse Habitat Burned Hub Site and associated National Fire Dashboard.

Wildfire is the most significant disturbance factor in the sagebrush biome in terms of converting suitable habitat in a very short time frame and is increasing annually according to the Sagebrush Conservation Strategy (Remington et al. 2021). Restoration of sagebrush communities following fires is variable among regions within the biome. Some natural processes result in the eventual return to functioning Greater Sage-grouse habitat. However, in many cases, the result is a “fire-driven conversion from native sagebrush communities to nonnative plant communities” (Remington et al. 2021).

Vast extents of sagebrush communities with a nonnative invasive species component are in need of innovative treatments or passive restoration techniques to promote establishment of native perennial bunchgrasses or more desirable understory species. Further, burned area restoration requires pragmatic prioritization due to their contemporary large extents. Currently, restoration efforts are lagging behind the rate of conversion to undesirable conditions where invasive annual grasses are the predominant species. Modern and emerging tools and mapping products may help managers identify areas for conservation and target areas for restoration post fire at a scale that is practical and meaningful to Greater Sage-grouse.

Table 11: The cumulative number of acres within the Greater Sage-grouse (GRSG) habitat data layer reported by NIFC as burned from 2016 through 2020, and percent of habitat impacted by wildfire for BLM lands, and all lands by state. Using daily fire perimeters results in totals that are likely to contain areas of unburned GRSG habitat and areas that have previously burned (within or across years).

State	BLM Total Acres of Habitat	BLM Acres Burned in GRSG Habitat (2016 - 2020)	BLM % of Habitat Burned (2016 - 2020)	All Lands Total Acres of Habitat	All Lands Acres Burned in GRSGS Habitat (2016 - 2020)	All Lands % of Habitat Burned (2016 - 2020)
California	1,526,218	83,856	5%	4,357,558	235,665	5%
Colorado	2,010,876	45,086	2%	4,744,398	92,249	2%
Idaho	9,873,004	664,241	7%	19,312,808	1,179,901	6%
Montana	6,293,539	76,993	1%	34,091,124	530,457	2%
Nevada	26,638,867	1,538,563	6%	37,729,703	2,240,929	6%
North Dakota	33,164	0	0%	703,610	0	0%
Oregon	12,178,028	248,634	2%	19,191,352	333,675	2%
South Dakota	156,511	0	0%	2,548,703	0	0%
Utah	3,772,111	124,452	3%	10,556,816	351,381	3%
Washington	149,973	57,422	38%	2,757,910	702,234	25%
Wyoming	17,541,241	143,391	1%	44,306,374	370,056	1%
Totals	**80,173,533**	**2,982,638**	**4%**	**180,300,356**	**6,036,548**	**3%**

Conifer Encroachment

Encroachment of pinyon (*Pinus* spp.) and junipers (*Juniperus* spp.) (collectively conifers) into sagebrush habitats is a primary threat which has resulted in sagebrush and Greater Sage-grouse habitat loss. Causes of conifer expansions vary, but include changes in fire return intervals, historical overstocking of livestock, increases in global carbon dioxide concentrations and climate change (USFWS 2013b, Reinhardt et al. 2017). Conifer cover in sagebrush habitats increases 0.4 to 1.5% annually (Reinhardt et al. 2020). Since European settlement, woodlands in the sagebrush biome have expanded between 125% and 625% (Miller et al. 2008).

Control of conifers in sagebrush habitat has been aggressively addressed by land management agencies since 2010 and has been effective in matching the expansion rate of conifers. These efforts generally result in an increase in herbaceous cover and biomass; 2 times to 20 times increase. (Young et al. 1985; Vaitkus and Eddleman 1987; Rose and Eddleman 1994; Bates et al. 2000; Stephens et al. 2016; Bates et al. 2017). Vegetative composition post-control has been variable, with sites with lower resilience and resistance values demonstrating more invasive weeds requiring post control weed mitigation (Chambers et al. 2014; Miller et al. 2014; Roundy et al. 2014). Conifer control efforts are most effective at reducing impacts to Greater Sage-grouse when conducted in areas of low conifer canopy cover, high resistance and resilience to wildfire and annual grass invasion, and high Greater Sage-grouse abundance (Reinhardt et al. 2017).

Conifers that cover more than four percent of the land area can result in loss of active leks (Baruch-Mordo et al. 2013). In areas of active encroachment (widely scattered small trees within sagebrush), it reduces lek activity. Female Greater Sage-grouse expanded use of mountain big sagebrush for nesting following removal of conifers (Severson et al., 2017b), presumably responding to increased habitat suitability (increased cover of herbaceous vegetation and sagebrush; Severson et al. 2017d). Greater Sage-grouse populations responded to these treatments with increased nesting density and increased productivity above the comparable values in control areas (Severson et al. 2017b).

BLM Report on Sagebrush Availability and Vegetative (Habitat) Conditions

(excerpted from the BLM Greater Sage-Grouse Plan Implementation – Rangewide Monitoring Report for 2015–2020. Herren et al. 2021) In 2015, the BLM Greater Sage-Grouse Land Use Plans included the BLM/USFS Greater Sage-Grouse Monitoring Framework that describes annual implementation reporting (with 5-year interval summary reports) and how to monitor Greater Sage-grouse habitats at several spatial scales. Methodologies for assessing sagebrush availability and vegetative condition analyses and reporting are prescribed in the monitoring framework.

Both of the BLM's sagebrush availability and vegetative condition analyses occur within the range of Greater Sage-grouse (excluding the Bi-State Distinct Population Segment and the Columbia Basin population) but differ from each other in several ways: the type of data used, the lands to which the analyses apply (all lands vs BLM-managed lands), and the geographic reporting units. Additionally, the analyses differ in timeframe based on source data availability. The differences are:

1. The BLM's sagebrush availability is estimated via geospatial analyses of ecological systems supporting sagebrush vegetation communities adjusted for threats (e.g., wildfire, mining, and infrastructure) across all landownerships within PHMA and IHMA (in ID) as defined by BLM LUPs (34,089,000 acres). A summary of BLM's rangewide and regional estimated sagebrush availability between 2012 and 2018 is provided for this GRSG Conservation Report. Additional information on BLM's estimates of sagebrush availability relative to the amount of area with the potential to support sagebrush communities, as well as the methods and datasets used to adjust for the threats, is reported in the BLM Rangewide Monitoring Report (Herren et al. 2021).
2. Vegetative condition is derived from a suite of BLM terrestrial core indicators (MacKinnon et al. 2011) and calculated using vegetation monitoring data collected on BLM lands within Greater Sage-grouse habitats. A summary of annual estimates for each indicator from 2013-2018 is provided for this GRSG Conservation Report. Additional information on vegetative conditions describing the number of monitoring locations meeting or not meeting each quantitative habitat objective from the applicable BLM land use plan is reported in BLM State Office appendices of the BLM Rangewide Monitoring Report (Herren et al. 2021).

BLM Rangewide and Regional Sagebrush Availability:

At the rangewide-scale, estimated sagebrush availability in PHMA and IHMA declined by approximately 3% (approximately 1.9 million acres total; 1.4 million acres in the GBR and 529,000 acres in the RMR) between 2012 and 2018. Collectively, wildfire accounted for approximately 72% of the sagebrush loss (approximately 87% of the loss in the GBR was from wildfire, with 12% due to impervious surfaces and the remaining 1% due to agricultural conversion). Sagebrush loss in the RMR was more evenly distributed between wildfire (34%), conversion to impervious surfaces (including urbanization) (27%), and conversion to agriculture (38%). Sagebrush loss occurred primarily on BLM-managed lands: 56% rangewide (1.1 million acres); 68% of the GBR loss was on BLM lands (951,000 acres) and 26% (135,000 acres) of the RMR loss was on BLM lands. For additional details, see the BLM Rangewide Monitoring Report (Herren et al. 2021).

BLM Rangewide Vegetative Conditions

The findings from the estimates of indicators in type I habitat areas are:

- The five indicators of Greater Sage-grouse important habitat components (percent cover of sagebrush, sagebrush height, sagebrush shape, perennial grass and forb cover, and herbaceous plant height) appeared to be static on BLM rangelands from 2013 to 2018 (Table 12). The average percentage of sagebrush cover shows a small improvement and sagebrush height is relatively static. The proportion of columnar-shaped sagebrush remains low while nearly all (87 percent) sagebrush is spreading in shape, which is thought to be more beneficial for hiding and nesting cover. The proportions of sagebrush shape have stayed generally constant through time. Average percent cover of perennial grasses and forbs increased from 2013–2018 and average herbaceous plant species height shows modest increases during the monitoring timeframe.

- Four of the six indicators of habitat degradation related to the proportion of nonnative invasive species and annual grasses increased. The average percent bare ground indicator decreased since 2013. Generally, an increase in the amount of bare ground indicates declining ecosystem health because bare ground presents an avenue for invasive annual grasses and other weed species to occupy the site or area, can contribute to soil loss during wind events or seasonal flooding and also be an indicator of overuse by livestock or feral horses.
- The proportion of rangelands with a presence of non-native invasive plants species increased from a little over 50 percent in 2013 to nearly 70 percent in 2018. The percentage of rangelands where non-native invasive plants were abundant (≥25 percent of vegetation cover) also increased, from about 10 percent in 2013 to nearly 30 percent in 2018. Annual grasses such as cheatgrass and medusahead (*Taenatherum capitatum*) are important components of invasion that make up about 15% of vegetation on average, an increase of 7 percent between 2013 and 2018. The proportion of vegetation that is composed of non-native invasive plants is also steadily increasing from 7 percent in 2013 to 17 percent in 2018.

Estimates of the same indicators across BLM rangelands outside PHMA (type II areas – Table 13) provide context for vegetative conditions and changes in indicators of habitat degradation in Greater Sage-grouse (type I) areas. In general, type II areas are more arid than type I areas and are located further south and west and at lower elevations. It is therefore not surprising that indicator values on these lands are generally less favorable for Greater Sage-grouse. Changes in all 11 indicators over time are often similar in direction between type I and type II areas although the proportion of non-native invasive is slightly higher in Greater Sage-grouse habitat (type I).

Table 12**.** Data collected through the Landscape Monitoring Framework (LMF, Karl et al. 2016) for the indicators of habitat condition (important components of habitat and potential threats to habitat condition) for BLM-managed rangelands within Greater Sage-grouse habitat (type I). Values include averages (±80% confidence intervals; data from Table 7 on page 18 in Herren et al 2021).

Type I	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Percent cover of sagebrush on BLM rangelands	12% (±1%)	12% (±0%)	13% (±0%)	13% (±1%)	14% (±1%)	14% (±1%)
Mean sagebrush species height in inches on BLM rangelands	13.5in (±0.4in)	13.9in (±0.3in)	14.6in (±0.3in)	15.5in (±0.3in)	14.9in (±0.5in)	14.5in (±0.4in)
Proportion of sagebrush that is columnar shaped on BLM rangelands	12% (±1%)	8% (±1%)	8% (±1%)	11% (±1%)	13% (±1%)	13% (±1%)
Proportion of sagebrush that is spreading shaped on BLM rangelands	88% (±1%)	92% (±1%)	92% (±1%)	89% (±1%)	87% (±1%)	87% (±1%)
Percent cover of perennial grasses and perennial forbs on BLM rangelands	27% (±1%)	29% (±1%)	29% (±1%)	34% (±1%)	35% (±1%)	33% (±2%)
Mean herbaceous plant species height in inches on BLM rangelands	7.7in (±0.2in)	10.2in (±0.3in)	10.9in (±0.2in)	11.4in (±0.2in)	11.2in (±0.2in)	10.6in (±0.3in)
Percent cover of bare ground on BLM rangelands	26% (±1%)	28% (±1%)	27% (±1%)	22% (±1%)	21% (±1%)	21% (±1%)
Proportion of BLM rangelands with nonnative invasive species present	54% (±2%)	61% (±3%)	64% (±2%)	66% (±2%)	69% (±3%)	66% (±2%)
Proportion of BLM rangelands where ≥25% of foliar cover is comprised of nonnative invasive species	10% (±1%)	16% (±1%)	19% (±1%)	22% (±1%)	23% (±2%)	29% (±2%)
Proportion of vegetation composed of annual grasses on BLM rangelands	7% (±1%)	8% (±1%)	10% (±1%)	12% (±1%)	13% (±1%)	14% (±1%)
Proportion of vegetation composed of nonnative invasive plant species on BLM rangelands	7% (±1%)	9% (±1%)	12% (±1%)	14% (±1%)	15% (±1%)	17% (±1%)

Table 13. Data collected through the Landscape Monitoring Framework (LMF, Karl et al. 2016) for the indicators of habitat condition (important components of habitat and potential threats to habitat condition) for BLM-managed rangelands within Greater Sage-grouse habitat (type II). Values include averages (±80% confidence intervals; data from Table 8 on page 19 in Herren et al 2021).

Type II	2013	2014	2015	2016	2017	2018
Percent cover of sagebrush on BLM rangelands	5% (±1%)	4% (±0%)	4% (±1%)	4% (±0%)	4% (±1%)	5% (±1%)
Mean sagebrush species height in inches on BLM rangelands	16.2in (±1.0in)	13.8in (±0.6in)	14.3in (±0.8in)	14.1in (±0.7in)	14.6in (±0.9in)	13.7in (±0.9in)
Proportion of sagebrush that is columnar shaped on BLM rangelands	14% (±4%)	10% (±3%)	11% (±2%)	11% (±3%)	17% (±4%)	13% (±4%)
Proportion of sagebrush that is spreading shaped on BLM rangelands	86% (±4%)	90% (±3%)	89% (±2%)	89% (±3%)	83% (±4%)	87% (±4%)
Percent cover of perennial grasses and perennial forbs on BLM rangelands	14% (±1%)	15% (±1%)	14% (±1%)	14% (±1%)	14% (±1%)	14% (±2%)
Mean herbaceous plant species height in inches on BLM rangelands	6.8in (±0.4in)	7.5in (±0.3in)	8.1in (±0.3in)	8.0in (±0.3in)	8.0in (±0.3in)	7.6in (±0.3in)
Percent cover of bare ground on BLM rangelands	32% (±2%)	28% (±1%)	29% (±1%)	32% (±2%)	29% (±1%)	26% (±2%)
Proportion of BLM rangelands with nonnative invasive species present	56% (±3%)	53% (±3%)	58% (±3%)	62% (±3%)	64% (±3%)	57% (±4%)
Proportion of BLM rangelands where ≥25% of foliar cover is comprised of nonnative invasive species	21% (±3%)	18% (±2%)	16% (±2%)	24% (±3%)	32% (±3%)	24% (±4%)
Proportion of vegetation composed of annual grasses on BLM rangelands	10% (±1%)	8% (±1%)	7% (±1%)	10% (±1%)	14% (±2%)	11% (±2%)
Proportion of vegetation composed of nonnative invasive plant species on BLM rangelands	13% (±2%)	11% (±1%)	11% (±1%)	15% (±1%)	20% (±2%)	15% (±2%)

Habitat Monitoring for BLM Adaptive Management

From 2016 to 2019, the cumulative total count of adaptive management habitat triggers tripped was 16 in 6 of the 9 states monitored (BLM Rangewide Monitoring Report). In CA, ID, NV, OR, UT and WY, habitat losses exceeded a soft or hard threshold in at least one year. The total cumulative count of 16 triggers tripped does not mean that 16 BSUs had habitat triggers tripped because in some cases, the data show that the previous year's trigger tripped is no longer tripped or the data show that a hard trigger has been tripped whereas the previous year, it was a soft trigger that had been tripped.

Habitat Monitoring for USFS Adaptive Management

The USFS used information supplied by state wildlife agencies and/or BLM State Offices to complete annual habitat adaptive management evaluations by state. From 2015-2019, no habitat triggers were tripped in CO or MT. One hard and one soft habitat trigger was tripped in ID. Three soft habitat triggers were tripped in UT. Two soft habitat triggers were tripped in WY. Adaptive management actions in response to triggers being tripped are considered and determined at the local unit scale, in collaboration with partners.

Chapter 2 Conclusions: Summary of Greater Sage-Grouse Populations and Habitat Conditions

This chapter meets the stated purpose of providing information that describes populations. This chapter also reports on habitat conditions such as increasing habitat losses from wildfire and anthropogenic development and increases in percent cover of non-native invasive plant species.

Population Translocation and Augmentation Summary:

Reintroductions and augmentations are costly, and logistically difficult, but they can be important in sustaining smaller populations and assisting with recovery efforts. Funds and capacity directed towards these projects provide a broader population benefit if they are also invested into habitat conservation and restoration efforts. Recently produced guidelines (Schroeder et al. 2021) should be used to support development, implementation, and assessment of translocation efforts.

Techniques for captive rearing and release of Greater Sage-grouse have improved but they have not been successful in producing viable populations (WAFWA 2017), as is the case for all species of grouse. Therefore, captive rearing is not currently recommended as a viable technique for establishment or reestablishment of viable populations.

Habitat Condition Summary:

A comprehensive analysis or assessment of habitat conditions for Greater Sage-grouse, including an assessment of intactness, was not completed. This is partially due to inconsistent reporting units, inconsistent time periods of data collection, and inconsistency in land ownership or habitat management type where data were collected.

- Habitat loss and degradation are the biggest issues facing Greater Sage-grouse and the sagebrush biome and are evident across studies cited in this report and in recent literature. For example, this report presents estimates of GRSG habitat loss from wildfire alone exceeds 6 million acres from 2016-2019 (NIFC). Similarly, this report estimates 1.9 million acres of sagebrush lost in PHMA and IHMA (a subset of GRSG habitat) from wildfire, agricultural conversion, and conversion to impervious surfaces (development) from 2012-2018 (BLM Monitoring Report). Further, a recent study conducted across the entire sagebrush biome in North America (Doherty et al. 2022) documented a shift of 1.3 million acres per year from areas with high sagebrush ecological integrity to a degraded state from 2001-2020. This loss equates to a –1.34 percent loss per year (Doherty et al. 2022). The table below highlights the differences in scale, scope, methodologies, and timeframes for estimates of loss of GRSG habitat and sagebrush.

Measure	Method	Extent of loss and scale (approx.)	Timeframe	Source
Sagebrush availability	LANDFIRE geospatial analysis	1.9 million acres lost within 34,089,000 acres of PHMA and IHMA	2012-2018	BLM Monitoring Report (see page 17)
GRSG habitat burned by wildfire	Geospatial overlay of fire perimeters and GRSG base layer	6 million acres burned within 180,300,356 acres of all GRSG habitat rangewide, including the Bi-State DPS	2016-2019	NIFC Dashboard (see page 13)
Sagebrush ecological integrity		1.3 million acres lost or degraded per year within 244,900,000 acres in the sagebrush biome	2001-2020	Doherty et al. (2022)

- BLM's estimated sagebrush availability (2012-2018) and NIFC's acres of habitat burned (2016-2019) are reported for all land ownerships however the BLM's estimate of sagebrush availability is only reported for the PHMA and IHMA subset of GRSG habitat.
- Data for five indicators of Greater Sage-grouse important habitat components and six indicators of habitat degradation are reported for BLM-managed lands only in type I and type II areas, however those areas only roughly equate to inside and outside of Greater Sage-grouse habitat.
- Conifer encroachment into sagebrush habitats is occurring at a rate of 0.4 to 1.5 percent annually), The CED reported 1,143 conifer removal efforts were implemented totaling over 1,167,000 acres from 2015 – 2019. This equates to an average of approximately 233,400 acres treated per year.

Invasive Species Summary:

This GRSG Conservation Report includes BLM data showing an increase in the prevalence and proportion of nonnative invasive species and annual grasses in type I areas (roughly equivalent to Greater Sage-grouse habitat) as well as in type II areas (outside Greater Sage-grouse habitats). The link with wildfire is discussed however, information linking invasive annual grasses to anthropogenic activities or other possible causes, is lacking.

Wildfire in Greater Sage-grouse Habitat Summary:

This GRSG Conservation Report describes the loss of Greater Sage-grouse habitat by wildfire which negatively affects populations (Coates et al. 2016c). Implementation of post-fire restoration is not presented in this chapter but is captured by the CED (Chapter 1).

Anthropogenic Disturbance Summary:

Energy development (e.g., solar, wind, geothermal, pipelines, etc.), transmission lines, roads, and communication towers among other features were not fully assessed. The amount of habitat removed by these features is monitored and reported, however, these features often have indirect effects on Greater Sage-grouse populations that can be detected at significant distances away from the features themselves (Gibson et al. 2018). These indirect effects can cause increased predation (Gibson et al. 2018). Features such as transmission lines often subsidize important avian predators such as common ravens and raptors, introducing the secondary effect of noise in an otherwise quiet landscapes (e.g., geothermal facilities) or increasing vehicle traffic within undisturbed areas. The BLM and USGS have partnered to develop a repository of disturbance data on public lands managed by the BLM. This effort, known as the Surface Disturbance and Reclamation Tracking Tool (SDARTT), has been established per policy via BLM Instruction Memorandum 2016-145 and tracks disturbance at the project level and at the Biologically Significant Unit (BSU) scale. The effort to populate SDARTT with existing amount of disturbance is partially completed within PHMA in various states within the range of Greater Sage-grouse but is not yet finished. In addition, several states have disturbance data applications that document anthropogenic disturbances on the landscape.

BLM Adaptive Management Tripped Habitat Triggers Summary:

This GRSG Conservation Report drew adaptive management trigger information from the BLM Rangewide Monitoring Report. The 16 habitat triggers tripped from 2016 to 2019 align with information from other sources in this chapter such as the approximately 6 million acres of Greater Sage-grouse habitat burned by wildfire and the increase in nonnative and invasive species. This other information, as well as over one million acres of restoration (reported in Chapter 1), may or may not be part of the BLM adaptive management habitat trigger formulas.

Chapter 3: Review of New Greater Sage-Grouse Scientific Information to Inform Conservation Delivery

Introduction to the new science

Delivery of effective conservation requires frequent review of new scientific information to ensure implementation of actions with the highest probability of success to benefit the species. New science may reveal more efficient and effective conservation actions and the development of new techniques, models, and management tools. Additionally, continuing research may reveal new threats to the species, or threats that may undermine effective conservation delivery (e.g., more robust climate models). Greater Sage-grouse is a conservation priority for most agencies, land managers, and landowners, resulting in continued research. This section provides a review of literature published since the 2015 Greater Sage-grouse Endangered Species Act finding (80 FR 59858) through September 30, 2021, to determine if new information on the biology of, or threats to, Greater Sage-grouse has emerged; if new management options are available; and if more effective conservation actions can be implemented. The following summary does not include ongoing research which has not been published.

In 2018, U.S. Geological Survey (USGS) released an annotated bibliography of 169 peer-reviewed Greater Sage-grouse scientific publications published between January 1, 2015, and January 5, 2018 (Carter et al. 2018). In 2020, USGS published an update (Carter et al. 2020) which added an additional 69 peer-reviewed Greater Sage-grouse scientific publications published between January 6, 2018, and October 2, 2019. The GRSG Conservation Report Team located an additional 74 new peer-reviewed scientific journal articles published between October 3, 2019, and September 30, 2021 (Appendix F) via Web of Science, JSTOR, Google Scholar, and professional contacts. The GRSG Conservation Report Team reviewed the 2018 and 2020 USGS publications and additional articles to identify any new information on species biology, threats, and management options to inform conservation delivery that were not available for the 2015 Greater Sage-grouse finding.

Summary of new Biological, Threat, & Management Information

Biology

Most literature published since 2015 improved, but did not alter, our basic understanding of Greater Sage-grouse biology. New research has expanded our knowledge by providing more precise and effective management opportunities. Examples include potential drivers of juvenile migration (Caudill et al. 2016), identification of areas necessary to maintain population movements (Crist et al. 2015), and improved understanding of field research techniques for Greater Sage-grouse (Fremgen et al. 2017, Gibson et al. 2015). There is also new literature on captive rearing (Apa et al. 2017, Thompson et al. 2015) and how the presence of feral horses and burros decreases lek activity (which has unknown effects on Greater Sage-grouse productivity) and may bias lek counts where feral horses and burros are present (Muñoz et al. 2021). Finally, the relationship between grass height and nesting success has been examined more thoroughly indicating that grass height and cover is an important aspect of Greater Sage-grouse habitat (Connelly et al. 1991, Gregg et al 1994), but that the reliability of specific grass height requirements is in doubt (Gibson et al. 2016, Smith et al. 2018).

Important new data about genomic analyses of Greater Sage-grouse in WA state determined that birds there are genetically dissimilar than other birds across the species range (Oh et al. 2019, Oyler-McCance et al. 2020). Additionally, further analyses detected a grouping of genes linked to the mitigation of sagebrush metabolites (Oyler-McCance et al. 2020). This information suggests that Greater Sage-grouse may be adapted to local areas based on their ability to extract nutrition from local sagebrush, potentially limiting the efficacy of Greater Sage-grouse translocation efforts.

Threats

No new threats to Greater Sage-grouse were identified in the literature review. However, on-going research continues to expand our understanding of the mechanisms and intensity of known threats which may influence management activities at the local scale. For example, in addition to direct habitat loss, wildfires create ecological traps for nesting females due to their nest site fidelity (O'Neil et al. 2020), noise levels from energy facilities impacts lek attendance (Ambrose et al. 2021), and disturbance after construction of non-renewable energy facilities reduces nest and brood survival in those areas (Kirol et al. 2020a). Impacts of coyote removal on Greater Sage-grouse were examined by Dinkins et al. (2016) who reported increased nest predation after the removal of coyotes, likely due to the expansion of mesopredators (e.g., badgers, skunks, and raccoons), and Orning and Young (2016) who reported no significant difference in nest success in areas of coyote removal but noted a small sample size.

Common ravens (*Corvus cora*x) are a known nest predator of Greater Sage-grouse and increases in their abundance presumably increases predation risk. New research by Coates et al. (2020) identified raven abundance at 0.4/km^2 as an ecological threshold, above which negative impacts to nesting Greater Sage-grouse are realized. This information encourages managers to support anthropogenic subsidy reduction (Coates et al. 2020), potentially followed by raven control as determined on a case-by-case basis. Raven occurrence is also positively associated with the presence of livestock (Coates et al. 2016a). Further, breeding ravens cache Greater Sage-grouse eggs (Howe and Coates 2015), suggesting ravens may be taking more eggs than required for immediate satiation. Application of toxicants was shown to control raven populations with subsequent increases in adult Greater Sage-grouse, but the effect was temporary as raven populations returned to pre-treatment levels or higher within a year after the treatment (Peebles and Conover 2016, Peebles et al. 2017).

Modeling efforts reflected negative population impacts to Greater Sage-grouse from feral horses where the horses exceed Appropriate Management Level (AML; Coates et al. 2021b; Muñoz et al. 2021). This resulted in a recommendation to establish a monitoring framework for free-roaming equid abundance in Greater Sage-grouse habitat and other important wildlife areas.

Management

Management options for the Greater Sage-grouse have continued to evolve. Examples include correcting lek count visibility bias (Baumgardt et al. 2017) or using auditory techniques to improve lek detection (Riley et al. 2021), strategies to reduce the impacts of hunter harvest on Greater Sage-grouse populations (Blomberg 2015, Caudill et al. 2017), methods and species for habitat restoration (Chambers et al. 2017; Coates et al. 2020; Curran et al. 2015; Fremgen-Tarantino et al. 2020; Pyke et al. 2015a, 2015b, 2017, 2020), habitat management tools and results (Fremgen-Tarantino, et al. 2021; Kohl et al. 2019; Reinhardt et al. 2020; Smith et al. 2020), effects of conifer removal on Greater Sage-grouse nest and brood survival and annual survival (Coates et al. 2016b, Sandford et al. 2017, Severson et al. 2017a, b, c, and d), and telemetry tools (Kircher et al. 2020; Kirol et al. 2020b). Many of the articles reviewed have local management implications, such as a Utah vegetation guide for nesting, early and late-brood rearing sites (Dahlgren et al. 2019) or use of ground-based lidar to characterize local nesting habitats (Zabihi et al. 2019). Further, a review of atypical molt patterns identified potential implications in aging Greater Sage-grouse from wing harvest data which may lead to biases in management and research analyses (Walker and Schroeder 2021). The knowledge of how management for Greater Sage-grouse affects other species has also grown (e.g., Carlisle et al. 2018a; Carlisle et al. 2018b). Multi-species impacts of habitat management, both positive and negative, should be considered in future actions.

Introduction to Tools for Management that Inform Conservation Delivery

Management tools, mechanisms for retrieving data and strategically implementing conservation delivery, have been developed for the conservation of Greater Sage-grouse and associated habitats. This section contains a list of many of these tools, along with a brief description. The following list is not exhaustive, but rather serves as a summary of some of the many management tools and information available or in development to inform conservation delivery in the sagebrush biome. Readers should contact the developers of these tools directly with questions on their specific utility before designing individual conservation delivery actions.

Multiscale Habitat Suitability and Mapping Tools

Publications since the release of the 2015 finding largely corroborated existing knowledge on Greater Sage-grouse habitat suitability and mapping tools. The tools summarized below complement larger scale mapping and monitoring efforts to ensure that implementation of Greater Sage-grouse conservation measures is appropriately based on regional or locally relevant habitat relations.

- SAGEMAP (USGS; https://www.usgs.gov/centers/fresc/science/sagemap): A GIS database for Greater Sage-grouse and shrub-steppe management in the Intermountain West.
- SageDAT (USGS; sagedat.org): A data-sharing platform that simplifies the search for new data, science, and tools developed for the sagebrush biome using cloud-based technology. SageDAT allows data owners to set up a virtual window into data that they want to be made visible.
- RangeSAT – Satellite-based assessment tools for rangelands (USGS 2021; https://www.rangesat.org/): An on-going project that uses Landsat data back to 1984 to generate maps and graphs of vegetation across sagebrush rangelands. The interface allows generation of vegetation amounts at specific locations and across time, and cross-references with climate variables.
- Estimates of annual exotic herbaceous annual cover in sagebrush (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/estimates-of-herbaceous-annual-cover-in-sagebrush-may-2019/): Provides spatially explicit estimate of 2020 herbaceous annual percent on May 1 to provide land managers and researchers with early season, near-real-time estimates of percent cover predictions of exotic herbaceous annual vegetation.
- Rangeland Analysis Platform (http://rangelands.app/): An online mapping tool that provides snapshots of rangeland vegetative cover and production from 1984 to present, along with other layers, allowing comparisons in rangeland resource trends through time at multiple scales. Vegetation layers provide a look at vegetative cover changes in annuals, perennials, shrubs, trees, and bare ground.

- Threat-Based Land Management in the Northern Great Basin: A Manager's Guide (Oregon State University; https://catalog.extension.oregonstate.edu/pnw722): A simplified framework to map ecological states at the project location and then assess and monitor threats at large scales to inform management decisions and actions.
- Rangeland Condition, Monitoring, Assessment, and Projection (RCMAP; USGS and BLM; https://www.mrlc.gov/rangeland-viewer/): Characterizes the landscapes of the West in units of percent coverage (0-100%) for each "building block" component of rangeland ecosystems: shrub, sagebrush, bare ground, herbaceous, annual herbaceous, and litter.
- Rangeland Assessment and Management Tools (Oregon Institute for Natural Resources; https://oregonexplorer.info/content/rangeland-assessmen-and-management-tools): A resource page that provides technical tools and guidance for leveraging newly available technology in sagebrush rangelands.
- Conservation Efforts Database (USGS/USFWS; https://conservationefforts.org/): A spatially explicit web-based tool allowing multiple users to enter information on conservation efforts implemented across the species' range.

Discrete Anthropogenic Activities

Scientific findings since 2015 largely substantiated past knowledge on the effects of discrete anthropogenic activity (e.g., energy development, power lines, roads, and cropland conversion) on Greater Sage-grouse, providing additional support in those already reported effects (e.g., Gibson et al. 2018). A substantial body of scientific literature identifies those discrete anthropogenic activities have negative effects on Greater Sage-grouse. The following management tools are currently available to track this disturbance.

- Surface Disturbance and Reclamation Tracking Tool (SDARTT; BLM and USGS; https://www.usgs.gov/centers/fort-collins-science-center/science/surface-disturbance-and-reclamation-tracking-tool): National repository and analysis tool of disturbance data pertaining to public land operations for the BLM.
- Habitat Quantification Tool; Montana (MT HQT; Montana Sage Grouse Conservation Program; https://sagegrouse.mt.gov/documents/MT_HQT_Oct2018v1p0_09Oct2018.pdf). The MT HQT quantifies gains and/or losses of Greater Sage-grouse habitat caused by development, and alternatively estimates conservation benefits resulting from activities which restore, enhance, or preserve sage grouse habitat. The results of the HQT are expressed as Functional Acres gained or lost which is used in Montana's Mitigation system.
- Density and Disturbance Calculation Tool (DDCT; Wyoming Game and Fish Department; https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management/Density-Disturbance-Calculation-Tool): Wyoming specific spatial tool that calculates number and total acreage of surface disturbance of anthropogenic activities. Required for all project proponents developing in Greater Sage-grouse core areas in Wyoming.

- Land Treatments Digital Library (LTDL, USGS 2019; https://www.usgs.gov/centers/fresc/science/sagemap): Catalogues legacy and current land treatment information on Bureau of Land Management lands in the western United States.

Diffuse Activities

The literature since 2015 did not appreciably change current knowledge of livestock grazing, hunting, fences, and recreation impacts on Greater Sage-grouse, but some studies questioned current assumptions, provided refinements, or corroborated existing understanding. New literature about feral equids (Coates et al. 2021b), predation (Coates et al. 2020), and noise impacts (Ambrose et al. 2021) have been published. For some activities, there is limited knowledge or understanding of potential direct or indirect effects on Greater Sage-grouse. No specific management tools for diffuse noise activities have been developed to address or track/monitor these threats.

Fire and Invasive Species

Science since 2015 indicates that the threat of fire and invasive plant species will pose an increasing challenge as wildland fires grow larger and more frequent and are exacerbated by nonnative annual grass invasion. New management tools, developed since 2015, primarily focus on fuel model data, climate and weather conditions, fuel treatment planning, and the development of new geospatial data layers.

- Modeling Dynamic Fuels with an Index System (LANDFIRE; https://landfire.gov/modfis.php):
- Seasonally modulates fuel model data in the Great Basin and Southwest regions by incorporating seasonal variability of herbaceous cover to capture fire behavior changes based on the current fire season herbaceous production.
- Hot Dry Windy Index (USFS; https://www.hdwindex.org): A prediction tool for wildfire based on temperature, wind, and moisture.
- National Wildfire Risk to Communities Portal (USDA USFS; https://wildfirerisk.org): Interactive website providing resources to communities to understand, explore and reduce wildfire risk.
- BLM Wildfire Dashboard (DOI, BLM; https://www.arcgis.com/apps/dashboards/1c4565c092da44478befc12722cf0486): Provides real-time fire information and aggregate data.
- WildfireSAFE (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/wildfiresafe): An integrated, web-based tool to support fire management decisions, increasing the utility of remote sensing and spatial data, and forecast wildfires.
- FireCLIME Vulnerability Assessment Tool (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tool-trainings/user-guide-to-the-fireclime-vulnerability -assessment-va-tool-a-rapid-and-flexible-system-for-assessing-ecosystem-

vulnerabilityto-climate-fire-interactions/): Allows users to compare management strategies under various climate scenarios and gauge the potential effectiveness for reducing undesirable impacts of climate on wildfire regimes and resulting impacts of wildfire on natural ecosystems.

- Interagency Fuels Treatment Decision Support System (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/iftdss-interagency-fuels-treatment-decision-support-system/): Web-based software and data integration framework that organizes fire and fuels software applications for fuels treatment planning and analysis.
- A toolkit for invasive annual grass management in the west (Western Governors' Association; https://westgov.org/images/files/FINAL_Cheatgrass_Toolkit_July_2020.pdf): A toolkit comprised of three elements – best management practices, case studies, and geospatial data to assess invasive annual grasses and support cross-boundary collaboration.
- Invasive Annual Grass Spatial Dataset Compilation and Synthesis (DOI, USGS; https://www.arcgis.com/apps/dashboards/1c4565c092da44478befc12722cf0486): Summary of spatial datasets that describe measurable aspects of invasive annual grasses across the western United States.
- The Wildfire Trends Tool (USGS; https://www.usgs.gov/centers/forest-and-rangeland-ecosystem-science-center/science/wildland-fire-trends-tool). Publicly available data visualization and analysis tool to facilitate land management needs and scientific inquiry. The tool can be used to detect and display wildfire trends and patterns based on user-defined regions of interest, time periods, and ecosystem types. Along with answering questions related to trends in the area burned by wildfire, the tool can also be used to evaluate whether fire seasons are starting earlier, ending later, and becoming longer, as well as whether spatial patterns of fire changing over time.

Restoration Effectiveness

Information provided in studies since 2015 was largely consistent with existing knowledge but provided new insights that could guide future management. New tools since 2015 primarily focused on phenology, rangeland condition, and factors affecting restoration success and restoration techniques.

- State and transition simulation model: Predicting landscape conditions (USDA USFS; https://www.fs.usda.gov/rmrs/tools/state-and-transition-simulation-model-st-sim-predicting-landscape-conditions): Forecast tool for future rangeland conditions to prioritize sites and vegetation types that are candidates for restoration or resilience-building management regimes.
- The National Phenology Database (USGS; https://www.usanpn.org/data): Database of plant phenology. The USA-NPN brings together volunteer observers, government

agencies, non-profit groups, educators, and students to monitor the impacts of climate change on plants and animals in the United States.

- Threat and Resource Mapping PhenoMap (USDA-USFS Western Wildland Environmental Threat Assessment Center; https://www.fs.fed.us/wwetac/threat-map/TRMPhenoMap.php): Web-based maps and tools to visualize wildland threats and the resources they potentially affect using the latest geospatial technology. Tools for tracking the annual pattern of vegetation emergence/bud burst, growth, and senescence (phenology) for a wide variety of natural resource activities, including livestock grazing, seed collection, fuels assessments, and wildlife management.
- Ecoregional Revegetation Application (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/ecoregional-revegetation-application-era/): Tool to select native plants for restoration and pollinator habitat enhancement by EPA Level III Ecoregions.
- Climate-Smart Restoration Tool (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/seedlot-selection-tool/): Also known as the Seedlot Selection Tool (SST), a GIS mapping program to match seedlots with planting sites.
- Land Treatment Exploration Tool (USGS; https://www.usgs.gov/centers/forest-and-rangeland-ecosystem-science-center/science/land-treatment-exploration-tool): Provides spatial products for managers who are planning restoration and rehabilitation actions on public lands, summaries of environmental characteristics for planned treatment areas, and adaptive management practices by comparing those characteristics to other similar treatments.
- Mesic Habitat Conservation Strategy (NRCS SGI; https://www.sagegrouseinitiative.com/water-is-life/): Web application displays mesic resources across the west overtime enabling targeting of management and conservation opportunities.
- Songbird Abundance Maps (NRCS SGI; https://map.sagegrouseinitiative.com/wildlife/songbird-abundance?ll=41.0079,-92.5026&z=4 Web-based application allows users to easily visualize songbird distribution, bolstering multi-species conservation across the American West
- Cultivation Risk (NRCS, U. Montana; https://map.sagegrouseinitiative.com/ecosystem/cultivation-risk?ll=41.0079,-92.5026&z=4): Probabilistic ecoregion-wide model that used soil, topographic, and climatic variables to simulate future agricultural conversion of the sagebrush biome in the Great Plains landscape.

Other Tools

WAFWA's 2021 Sagebrush Conservation Strategy (Remington et al. 2021) identified additional challenges associated with conservation efforts to restore functional sagebrush ecosystems, including aspects such as climate change and evaluating human resource needs and values. Some new tools and approaches to help inform management of the sagebrush biome not addressed in the 2018 USGS report (Hanser et al. 2018) include:

- Climate Adaptation Integration Tool (CAIT; USGS; 2020); https://pubs.er.usgs.gov/publication/tm6C2): Decision framework to incorporate climate science and local knowledge to develop adaptation strategies at the local scale.
- Climate Engine (Great Basin Fire Science Exchange); https://greatbasinfirescience.org/tools-trainings/climate-engine-cloud-computing-and-visualization-of-climates have emerged, facilitating on-the ground management of Greater Sage-grouse and associated habitats, and assisting with add -and-remote-sensing-data/): Visualization of climate and remote sensing data.
- Climate Toolbox (Great Basin Fire Science Exchange); https://greatbasinfirescience.org/tools-trainings/climate-toolbox/): Collection of web tools for visualizing climate and hydrology across the United States.
- Great Basin Weather and Climate Dashboard (Great Basin Fire Science Exchange; https://greatbasinfirescience.org/tools-trainings/the-great-basin-weather-and-climate-dashboard/): Provides weather and climate data to inform drought management decisions.
- EcoValuator 3.2 (QGIS Python; https://plugins.qgis.org/plugins/ecovaluator/): Estimates the dollar value of a variety of ecosystem services.
- Connectivity and Climate Change Toolkit (Association of Fish and Wildlife Agencies 2021;https://www.fishwildlife.org/application/files/9216/1582/0864/Connectivity_and_Climate_Change_Toolkit_FINAL.pdf): Provides information for climate considerations for planning and implementing terrestrial and aquatic connectivity initiatives.
- Land Treatment Exploration Tool - Drought Forecast Report (USGS; https://www.usgs.gov/center-news/land-treatment-exploration-tool-website-improvements-and-new-features): Provides resource managers with information about previous habitat treatments and a structured approach for treatment planning.

Chapter 3 Conclusions: Summary of New Scientific Information and Tools for Greater Sage-Grouse and Habitats to Inform Conservation Delivery

A substantial body of scientific literature has been published since 2015 that improves our understanding of Greater Sage-grouse biology and facilitates conservation delivery. A total of 309 publications were reviewed for this GRSG Conservation Report. Multiple new management tools addressing key threats to the species have been developed.

Key new scientific findings include improvement of population trend analyses with greater rangewide consistency, models that identify early signs of population decline allowing for early management intervention, and advanced molecular techniques that enable identification of genetically unique populations. A genomic analysis of Greater Sage-grouse in WA State suggests those birds are genetically dissimilar to other birds across the species range (Oh et al. 2019; Oyler-McCance et al. 2020). Further genetic analyses detected a grouping of genes linked to the mitigation of sagebrush metabolites (Oyler-McCance et al. 2020), which may be site specific, and therefore have implications for the efficacy of Greater Sage-grouse translocations. Additional research has identified raven abundance at 0.4/km^2 as an ecological threshold (Coates et al. 2020), above which negative impacts to nesting Greater Sage-grouse are realized. The impacts of feral equids on Greater Sage-grouse persistence are quantified, identifying the need for increased management of this threat to conserve birds in many areas across their range.

Many new management tools have been developed in the past seven years that provide data and other information for the conservation of the Greater Sage-grouse and sagebrush habitats. Tools examining habitat suitability and mapping, impacts of anthropogenic activities and wildfire/invasive annual grasses, and restoration techniques are summarized. While an exhaustive list was not provided, and new tools continue to evolve, those included here provide multiple avenues for developing conservation delivery in the sagebrush biome.

WAFWA's 2021 Sagebrush Conservation Strategy (Remington et al. 2021) identified climate change as a challenge associated with conservation efforts to restore functional sagebrush ecosystems. However, there is little new information on the impacts of climate change on Greater Sage-grouse or the effects of drought/weather impacts on Greater Sage-grouse demographic rates. There are several new management tools for restoration identified in this report that address climate change, but additional research is needed to identify how management actions can minimize any impacts of climate change on Greater Sage-grouse.

No new information regarding the direct and indirect impacts of pesticides (e.g., use of neonicotinoids for control of grasshoppers) in Greater Sage-grouse habitats has been published. Although West Nile Virus is known to have detrimental effects on Greater Sage-grouse survival, there were no additional publications mentioning this or other diseases that may be affecting Greater Sage-grouse populations. These topics appear to be emerging issues important to Greater Sage-grouse.

Chapter 4:
Summary & Recommendations of the Greater Sage-Grouse Conservation Report

This Greater Sage-Grouse Conservation Report highlighted the implementation of the regulatory conservation commitments and conservation actions in Chapter 1. Chapter 2 summarized current and historical population trends and improvements in trend analysis. It also described habitat conditions related to wildfire, sagebrush availability, and vegetative and habitat degradation data. Chapter 3 described new scientific research and introduced management and conservation tools developed since 2015. As explained in Chapter 1 and Appendix A, the conservation commitments made and referenced in the 2015 FWS FR Notice (80 FR 59941–59942) continue to be achieved.
The report provides clear evidence that conservation commitments have been fulfilled. Unprecedented levels of conservation efforts have been successfully implemented across the range during the reporting time period and continue today. State wildlife management agencies continue to update, develop, and improve state policies and plans.

Sage-grouse populations across much of their range continued to decline between 2015 and 2020. Sagebrush availability within Greater Sage-grouse habitat management areas declined 3% (1.9 million acres), primarily in the Great Basin region. Wildfire accounted for approximately 87% of sagebrush loss in the Great Basin region, and 72% overall. The remainder of sagebrush loss was attributed to urbanization/infrastructure (600,000 acres) and conversion to agriculture (550,000 acres).

This Report is not intended to be an analysis to determine the exact causes of population declines (beyond the assumption of extensive loss of habitat from wildfires, as exacerbated by invasive annual grasses in the Great Basin). Comprehensive and contemporary data associated with surface disturbance (e.g., anthropogenic developments) and infrastructure are needed to complete more accurate analyses on the effects (direct and indirect) of these features on Greater Sage-grouse populations.

Many of the following recommendations (Table 14) to improve and promote conservation of Greater Sage-grouse were generated as a result of this GRSG Conservation Report. Additional recommendations were also identified based on newly published scientific papers, local expertise, and experience in the application of conservation efforts. The expansive sagebrush-dominated habitats upon which Greater Sage-grouse depend also support many other species of wildlife whose needs should also be considered when designing management actions.

Table 14: Recommendations for conservation of Greater Sage-grouse and their habitats, not in order of priority.

Objective: Continue implementation of regulatory and voluntary commitments supporting on-the-ground efforts to conserve and protect habitats that support Greater Sage-grouse populations
***Issue**: Greater Sage-grouse populations are declining, and distribution is contracting in many portions of their range*
Recommendations

- Continue to apply avoidance measures in PHMA
- Report actual changes in the amount of disturbance within Greater Sage-grouse habitats
- Support research for emerging issues to help us address population declines (e.g., demographic traits related to climate change, conifer removal, pesticide use, and disease)
- Continue to monitor and report on indicators of habitat conditions in Greater Sage-grouse habitats
  - Improve stratification across reporting units to better represent Greater Sage-grouse habitat conditions
- Amend BLM LUPs to include Greater Sage-grouse conservation in the state of Washington
- Continue to implement the population and habitat trigger thresholds to engage the adaptive management process
  - Implement conservation measures that are commensurate to the threat or initial action that precipitated a trigger
  - Ensure that all parties report on their actions taken to implement responses to tripped triggers
  - Assess the effectiveness of the responses to the tripped triggers
- Conduct an adequate number of evaluations of land health standards in federal grazing allotments to obtain a representative sample in Greater Sage-grouse habitat
  - Increase capacity to conduct a larger number of evaluations across all HMAs (Priority, Important – Idaho only, and General)
  - Increase capacity to implement changes to achieve the standards
  - Report where completed evaluations of land health standards occur in Greater Sage-grouse habitat

Objective: Maintain and expand intact sagebrush rangelands for Greater Sage-grouse habitat
***Issue**: Intact sagebrush habitats continue to decline*
Recommendations

- Ensure longevity and maintenance of restoration efforts through a committed funding mechanism increasing the feasibility of follow-up treatments that facilitates monitoring and adaptive management
  - Prioritize conservation efforts where actions will be most successful and there is a reasonable expectation for functionality to be restored (e.g., control annual invasive grasses, reducing conifer cover in nesting habitats, protecting, restoring, and improving wet meadows and riparian areas)
  - Focus conservation efforts in areas that are more climate resilient considering “Resistance and Resilience” properties, and ecological integrity
- Use the best available science to address effects of climate change on the management of Greater Sage-grouse habitats
- Restore converted native rangeland habitats where benefits can be maximized for Greater Sage-grouse
- Continue to investigate ways to eliminate avian predator use of transmission lines

- Increase efforts to reduce habitat loss and fragmentation from anthropogenic activity (e.g., roads, OHV use, energy development sites, exurban development, mines, agricultural cropland conversion)
- Increase efforts to manage conifer encroachment through targeted removal, minimizing potential impacts to pinyon jays (*Gymnorhinus cyanoecephalus*)
    - o Conservation efforts directed at conifer removal should minimally meet the rate of encroachment (305,000 acres/year) (Doherty et al. 2021).
- Reflect annual population size and trends of feral horses and burros and develop strategies to reduce populations in areas where they are having a detrimental effect on sagebrush habitats
    - o Reduce and maintain feral equids to Appropriate Management Levels within Greater Sage-grouse range (Coates et al. 2021b)
- Improve our understanding of livestock grazing on Greater Sage-grouse habitats
- Use lessons learned to improve grazing management practices to benefit Greater Sage-grouse habitat.
- Expand restoration of degraded areas that have not crossed an ecological threshold
- Understand what is needed to maintain corridors for Greater Sage-grouse population connectivity
- Expand the mapping of habitat fragmentation across all land ownerships (private, state, federal, and tribal) for a comprehensive assessment of Greater Sage-grouse habitat conditions

Objective: Reduce the frequency and intensity of catastrophic wildfires
Issue: *Wildfires in sagebrush ecosystems are the main cause of sagebrush and habitat loss*
Recommendations

- Develop and/or improve tools to detect wildfire ignitions to decrease response time and suppress fires immediately after ignition
- Continue to prioritize funding for pre-positioning resources and coordinate between State and federal agencies on priority locations for these resources
- Continue to pre-position fire-fighting resources to respond rapidly to new wildfires and reduce the number of catastrophic wildfires
- Prioritize research on effective annual invasive grass control and post fire restoration methods
- Complete analyses of impacts from various land uses (e.g., livestock grazing, feral horses and burrows, recreation, anthropogenic disturbance) on the occurrence of invasive annual grasses and their contribution to rangeland flammability
    - o Use the results to adjust management decisions to minimize the spread of invasives and reduce fire potential in sagebrush habitats
- Increase efforts to reduce the prevalence of invasive species
- Determine the effectiveness of fuel breaks in existing linear disturbed areas (e.g., roads, transmission lines) to manage wildfire
    - o Monitor vegetation in fuel breaks for presence of invasive annual grass species that may hinder its effectiveness
    - o Use existing linear disturbed areas (e.g., roads, transmission lines) for fuel breaks
    - o Prioritize maintenance of existing fuel breaks over new disturbance, and do not create new fuel breaks without maintenance plans and funding in place.

Objective: Increase post-fire rehabilitation efforts to treat areas of Greater Sage-grouse habitat burned by wildfire including habitat restoration
***Issue**: Burned sagebrush habitats are slow to recover to native plant communities and susceptible to conversion to invasive annual grasses*

Recommendations

- Prevent establishment and spread of annual grasses (WAFWA Weed Action Plan and BLM National Seed Strategy)
- Prioritize the use of native species in post-fire rehabilitation
- Analyze levels of success and occupancy of Greater Sage-grouse post fire and manage adaptively to improve success
- Develop an economic model that makes availability of regional/local seed sources feasible
- Increase the level of agency and political commitment and capacity to implement, monitor, and if necessary, adaptively manage long-term post-fire recovery
- Coordinate treatments in areas adjacent to burned areas with the post-fire rehabilitation and/or restoration efforts

Objective: Increase capacity to implement on the ground conservation efforts based on new science and best management practices to improve habitat conditions for Greater Sage-grouse
***Issue:** Lack of capacity is a limiting factor to increasing conservation delivery*

Recommendations

- Provide any necessary legislative, policy, and funding support
- Increase capacity to implement conservation efforts by increasing staffing and human resources to support on the ground conservation delivery and associated policy requirements (e.g., NEPA)
- Increase cross-boundary state and county-based partnership mechanisms
- Increase education on the need to maintain and improve areas of functioning habitat

Objective: Apply the appropriate science, tools, techniques, and approaches listed in Chapter 3 during planning efforts and when designing future conservation and management actions
***Issue:** New science and tools are available.*

Recommendations

- Increase efforts for technical transfer of existing research and the suite of management tools, techniques and approaches to achieve a greater understanding across the conservation community on the appropriateness of application and needs for additional tools
- Focus the development of new management tools and research necessary to prioritize and improve on the ground habitat and population management for Greater Sage-grouse
- Continue to develop new science and techniques for effective conservation delivery

Objective: Analyze the efficacy of habitat conservation delivery across the range of Greater Sage-grouse in future reports
Issue 1: *Vegetation and population response time to most on-the-ground sagebrush treatments is slow*
Recommendations

- Address the differing geographies and boundaries currently being used for collecting and reporting data
- Evaluate the 'risk' or 'risk of exposure' to various threats to prioritize conservation actions
- Expand the comparison of acres lost to acres conserved for an accurate analysis of habitat
- Determine biological efficacy of conservation actions and implications for adaptive management
- Evaluative population responses to vegetation treatments

Objective: Finalize Part B of the Guidelines for Collection, Storage, and Analysis of Sage-Grouse Lek Data
Issue: *Inconsistencies exist among lek data management and collection*
Recommendation

Provide guidance for sampling strategies, data requirements for various methods to estimate Greater Sage-grouse population size and trends, and ways to account for biases associated with lek counts

Objective: Continue and increase the level of voluntary conservation actions on private lands
Issue: *Private lands contain important habitats where conservation actions would benefit Greater Sage-grouse*
Recommendations

Work cooperatively to:

- Increase voluntary conservation actions on private lands including enhancement and restoration of mesic, riparian, and upland habitats and grazing management
- Enroll private lands in voluntary conservation easements or other agreements for the protection of key sagebrush habitats
- Remove county enrollment caps in USDA, Farm Bill programs that protect Sage-grouse habitats in critical areas (e.g. Conservation Reserve Program, Douglas County, Washington)

Objective: Address regulatory restrictions prohibiting the application of key conservation actions for Greater Sage-grouse
Issue: *Current regulations limit implementation, or takes precedence over, some types of conservation actions*
Recommendations

- Expand latitude in reducing feral horses and burros where they overlap with Greater Sage-grouse habitats and are beyond appropriate management levels
- Increase capacity to expedite NEPA for projects that are beneficial for Greater Sage-grouse
- Increase flexibility to permit the use of new herbicides, and methods for application, for the benefit of Greater Sage-grouse habitat conservation
- Land management agencies should coordinate across jurisdictional boundaries for consistency in herbicide application benefiting Greater Sage-grouse

Objective: Continue the mitigation hierarchy for Greater Sage-grouse habitats across all landownerships, and evaluate effectiveness of mitigated actions
Issue: *Increase the assessment of mitigation efforts*
Recommendations

- Track, evaluate for effectiveness, and report the implementation of avoidance and minimization measures
- Use compensatory mitigation as a mechanism to meaningfully offset anthropogenic habitat loss and fragmentation only where avoidance and minimization is not possible
- Tie compensatory mitigation to habitat services lost
- Report compensatory mitigation completed and include how much area was treated
- Consider avoidance and minimization measures in states where compensatory mitigation is voluntary
- Continue efforts to incorporate mitigation into Greater Sage-grouse habitat management
- Focus monitoring of Greater Sage-grouse leks, population demographics and trends, and habitat changes, both before and after implementation of anthropogenic development, to improve our understanding of whether mitigation measures are ecologically relevant and effective through time
- Evaluate the effectiveness of mitigation actions to determine efficacy across temporal and spatial scales

Objective: Finalize an updated citable map of Greater Sage-grouse distribution
Issue*: The current cited distribution map is from 2004 (Schroeder et al. 2004).*
Recommendation

- Increase frequency of peer-reviewed rangewide map revisions

Objective: Define seasonal habitats
Issue*: Population and habitat assessments, authorizing activities, and habitat restoration efforts in seasonal habitats could be better informed with a standard definition of seasonal habitats*
Recommendation

- Use technical expertise to collectively define seasonal habitats

Objective: Grow the understanding and use of the CED to better capture the entirety of conservation efforts being implemented to benefit Greater Sage-grouse habitat
Issue: *Use the database to its fullest capacity*
Recommendations

- Make the CED a value added tool for states
- Provide data and updates to the CED

Objective: Increase effectiveness of translocations
Issue: *Most Translocations (augmentations and/or reintroduction) have not been successful*
Recommendations

- Improve quantity, quality, and connectivity of Greater Sage-grouse habitats needed to support viable Greater Sage-grouse population before considering translocations
- Use the "Guidelines for Translocations of Greater Sage-grouse, Gunnison Sage-grouse and Columbian Sharp-tailed grouse" (Schroeder et al. 2021) and other available information to evaluate the need and increase chances for success of translocations
- Avoid the use of captive-reared Greater Sage-grouse (See Chapter 2) due to the high cost, low survival, and chances for translocation success

Objective: Reduce negative effects of common ravens to Greater Sage-grouse nest success and populations
Issue: *Expanded raven populations are negatively affecting Greater Sage-grouse populations*
Recommendations

- Improve vegetative cover for nesting Greater Sage-grouse
- Reduce anthropogenic subsidies (food, perching, and nesting)
- Control raven numbers when densities approach 0.4 ravens/km^2 threshold (see Ch 3)

Greater Sage-Grouse Conservation Report Conclusions and Considerations

This GRSG Conservation Report chronicles on-the-ground conservation delivery efforts, Greater Sage-grouse population performance, habitat condition, and habitat disturbance across the 11-state range of Greater Sage-grouse from 2015 to 2020. Additional information and updates became available during the process to review the publicly available information and develop this report therefore, some of that information was included. The GRSG Conservation Report Team is composed of technical experts on Greater Sage-grouse biology, habitat, and management from state wildlife agencies with input from federal agencies. The GRSG Conservation Report Team drew freely from resources from all conservation partners to complete this analysis. Further, additional objectives and recommendations for topics not addressed in this report were added by this team to benefit future conservation efforts. *The synthesis included in this report (Chapters 1 – 3) was completed by the GRSG Conservation Report Team and reflects publicly available information. Recommendations in this chapter do not necessarily represent the official views of each agency represented on this team.*

We have concluded that unprecedented levels of conservation efforts have been successfully implemented across the range. However, drought, wildfire and anthropogenic changes continue to affect Greater Sage-grouse populations and the habitats they require to survive. Those ecosystem level changes present challenges today and into the future to keeping habitats intact.

As reported in Chapter 2, using geospatial and vegetation monitoring data from several sources, the amount of habitat and vegetative conditions in Greater Sage-grouse habitats is declining. Additionally, in Greater Sage-grouse habitats unimpacted by stochastic events, percent cover of invasive annual species increased substantially (from 10 percent to 30 percent) between 2013 and 2018. However, percent cover of shrubs and native grasses was maintained or slightly improved.

Greater Sage-grouse populations have declined at a rate of approximately three percent per year rangewide from 1966–2019 (Coates et al. 2021a). Several factors influencing population trends were identified such as: habitat loss due to wildfire and other factors, raven abundance at 0.4/km^2 as an ecological threshold (Coates et al. 2020), and the impacts of feral horses and burros on Greater Sage-grouse persistence. Future reports need to identify causes of declines, especially in areas of seemingly intact habitat with minimal human disturbance. Impacts of diseases on Greater Sage-grouse populations (e.g., West Nile virus) requires further examination, particularly considering recent observations (one recorded death from avian flu (H1N1), and changes in disease transmission and prevalence due to climate change and other factors.

Land management agencies and partners should continue to work together to monitor habitat projects and restoration efforts for effectiveness, encourage fire suppression in sagebrush habitat to prevent further habitat loss from wildfire, and review proposed project applications for large-scale anthropogenic infrastructure projects to address habitat loss and fragmentation. More rapid deployment of aerial fire-fighting resources has the potential to reduce the number and frequency of catastrophic wildfires. While more expensive initially, such an approach has the potential to reduce overall firefighting and restoration costs as well as the number of acres burned.

Now is the time to build off successes. Using the lessons learned, the new science available, and established stakeholder relationships, state and federal agencies should continue to work in a strategic fashion on the sagebrush biome to the benefit of Greater Sage-grouse. This work is evident from the past agency actions and the fulfillment of commitments made as outlined in Chapter 1. Working strategically to address identified threats in an efficient manner will be essential to build off the work thus far. This in concert with continued work to align data, fill knowledge gaps, and obtain long-term sustainable funding will be necessary to maintain the momentum and collaborative efforts to restore, enhance and maintain healthy Greater Sage-grouse populations.

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Appendix A: Conservation Commitments

Located in an associated spreadsheet here: Appendix A. Conservation Commitments.xlsx

Evaluation of the federal and state agencies implementation of the conservation commitments from 2015-2020, the GRSG Conservation Report Team developed this spreadsheet to summarize the commitments from the FWS “not warranted” for listing determination under the Endangered Species Act (2015, 80 FR 59858 2015-24292.pdf). Conservation commitments from states not included in the FWS finding (CO, ID, NV) are also included.

Appendix B
State Mitigation Program Summaries

Several Greater Sage-grouse states have mitigation programs in statute, Executive Orders, policy, or regulation. Colorado, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming each have a program and California has a cooperative arrangement with a working group to provide mitigation remedies. A synopsis of each state is provided in this appendix and a summary table follows the descriptions.

California

California does not have a Greater Sage-grouse mitigation program. Conservation actions are designed and implemented by the Buffalo-Skedaddle Greater Sage-grouse working group. This group works with federal and state agencies, as well as with private landowners, to implement conservation and restoration projects that will improve sage-grouse habitat. The working group developed the Buffalo Skedaddle Population Management Unit Conservation Strategy (Armentrout and Hall, 2006) and continues to update and revise this plan. Some recent projects include conifer removal, riparian restoration utilizing Zeedyk structures, sagebrush plantings, weed treatments, fencing springs, fuel breaks, and green stripping.

Colorado

The State of Colorado incorporates mitigation requirements in several ways. Executive Order 2018-036 directs the Colorado Department of Natural Resources to use its full authority to apply the mitigation hierarchy and require compensatory mitigation when residual adverse impacts occur to wildlife resources, including Greater Sage-grouse or its habitat. The Colorado State Board of Land Commissioners adopted a Stewardship Action Plan in 2016 in an effort to both fulfill its mission to generate Trust revenue and support state efforts to conserve Greater Sage-grouse habitats. The Stewardship Action Plan only applies to state lands occurring within Priority Habitat Management Area (PHMA) and General Habitat Management Area (GHMA), mirroring many provisions of the Colorado BLM land use plans / amendments. The Stewardship Action Plan incorporates avoidance and minimization measures (e.g., lek buffer distances for no surface occupancy, disturbance caps), adaptive management triggers, and the mitigation hierarchy (avoid, minimize, compensate for residual impacts) for several anthropogenic activities (oil and gas development, solid minerals, rights of way, and renewable energy). The mitigation standard on state trust lands is net conservation gain. Restoration and enhancement activities are also encouraged by the Stewardship Action Plan. Specific to oil and gas development, the Colorado Oil and Gas Conservation Commission adopted new regulations which took effect in January 2021. New regulations require all newly proposed oil and gas operations on new or amended oil and gas locations to develop a wildlife protection plan or a mitigation plan, depending on habitats present. The regulations strengthen protections for Greater Sage-grouse leks by imposing a one-mile no-surface-occupancy requirement. Exceptions to that regulation require approval from the Commission after notice and public comment. Oil and gas operators must provide compensatory mitigation for direct impacts. Compensatory mitigation may also be required for any unavoidable adverse indirect impacts that can't be avoided or minimized through application of other rule provisions in rule. Direct impacts are based on a physical acre approach, whereas indirect impacts are determined based on functional acres lost using a habitat quantification tool. No specific mitigation goal or standard is stated in the Commission's regulations; however, the BLM mitigation standard is, at a minimum, no net loss of habitat. The Commission's compensatory mitigation requirements can be met by paying an in-lieu fee to the state, implementing permittee responsible actions, or by working with the Colorado Habitat Exchange or other third-party banking program. Compensatory mitigation funds paid to the state are to be redirected out and leveraged with conservation partners to restore, enhance, and protect Greater Sage-grouse habitat. Colorado Parks and Wildlife and Colorado Department of Natural Resources work together to implement wildlife protection and mitigation plans, and annual reports will be completed.

Idaho

The Idaho Governor's Office of Species Conservation and Idaho Department of Fish and Game, along with a subset of the State's Sage-grouse Task Force, developed the Idaho Sage-Steppe Mitigation Principles document (State of Idaho, 2018) to define mitigation policy. Correspondingly, an interagency science team developed a Habitat Quantification Tool (HQT) and associated HQT Scientific Methods document (State of Idaho 2019) to outline techniques in calculating impacts and benefits to Greater Sage-grouse habitat. Executive Order 2015-04 "Adopting Idaho's Sage-grouse Management Plan" initiated the ability for the State of Idaho to work with stakeholders to build the documents and tools that will guide Greater Sage-grouse mitigation in Idaho. The program is not regulatory, and enforcement is left to the authorizing land management agency (i.e., BLM, USFS, Federal Energy Regulatory Commission, or State or Federal agency) whether to require mitigation for a proposed action that impacts Greater Sage-grouse habitat. When a proposed project on State or Federal lands may impact Greater Sage-grouse habitat, Office of Species Conservation and Idaho Department of Fish and Game would work with the proponent and authorizing land management agency to estimate impacts and recommend mitigation. When a proposed project is on private land that lacks a federal nexus, the State will work with the County Land Use Planning Department and the proponent to recommend avoidance and minimization and compensatory mitigation, if needed. The program primarily focuses on a Permittee Responsible Mitigation approach where credits can be developed on private and public land and sold or transferred to those proposing an anthropogenic disturbance in Greater Sage-grouse habitat. Other options, such as a Habitat Exchange or Credit Bank, may also be used. The HQT quantifies direct and indirect impacts from an anthropogenic disturbance, as well as temporary (reclaimed) and permanent (non-reclaimed) features. The metric of credit or debit is a functional acre, which is calculated by combining the habitat quality (percent functionality using a GIS analysis and field data) and quantity (acres) of a project. A debit project must offset its impact with at least an equivalent number of credits at least for the duration of the project impacts.

Montana

Montana's conservation strategy includes a regulatory mitigation system guided by the Greater Sage-Grouse Stewardship Act, Montana Administrative Rules 14.6.1.101-106, and Executive Order 12-2015. Montana has a statutory goal of "no net loss of habitat and a net gain preferred." Montana takes an "all hands, all lands" approach to sage grouse conservation efforts, including mitigation. The state and the Montana-Dakotas Bureau of Land Management (BLM) have a strong collaborative partnership. Among its other duties, the Sage Grouse Habitat Program (Program) implements the mitigation system while reviewing newly proposed anthropogenic development in designated sage grouse habitats. The Program plays an active role in helping state permitting agencies and the BLM secure adequate mitigation for impacts to sage grouse habitat due to development activities that require a state permit/or and federal authorization. The Program also provides technical services and contributes expertise to BLM, as requested. Montana implements the full mitigation hierarchy, including compensatory mitigation, as outlined in the Montana Mitigation System Policy Guidance v1.0 (October 2018) and the Montana Mitigation System Habitat Quantification Tool Technical Manual v. 1.0 (October 2018). A Geographic Information System (GIS) model called the Habitat Quantification Tool (HQT) is used to calculate functional acres lost as a result of anthropogenic development or alternatively, functional acres gained as a result of a mitigation project implemented to offset development. Additional policy multipliers are incorporated to incentivize developers to keep impacts as low as possible and to implement development consistent with specific provisions of Executive Order 12-2015 and BLM land use plans. Policy multipliers also incentivize restoration or enhancement of lower quality habitat. Credits or debits reflect functional acres gained or lost, respectively, after application of policy multipliers. Developers must offset debits with an equal number of credits at a 1:1 ratio. Developers can implement permittee-responsible credit projects, contribute to the Montana Stewardship Account as an in-lieu fee payment, work with a habitat exchange, or work with a conservation bank. Presently, no habitat exchanges or conservation banks exist. Funds deposited into the Stewardship Account are redirected to through competitive grants to third parties directly engaged in mitigation to implement preservation projects (e.g., perpetual conservation easements, term leases 30 years or longer), habitat restoration, or habitat enhancement projects. The Program maintains a credit registry. Adaptive management reviews occur annually.

Nevada

The State of Nevada has developed the Conservation Credit System, a regulatory, compensatory mitigation program to offset anthropogenic disturbances proposed in Greater Sage-grouse habitat. The Conservation Credit System is administered by the Sagebrush Ecosystem Technical Team under the guidance of the Sagebrush Ecosystem Council. The Nevada Greater Sage-Grouse Conservation Plan was developed in 2014 with revisions in 2019 (State of Nevada, 2019). The primary Conservation Credit System documents include the Nevada Conservation Credit System Manual (State of Nevada 2020) that defines mitigation policy and the Nevada Habitat Quantification Tool Scientific Methods Document (State of Nevada 2021) that describes the methodology in calculating functional acres, credits, and debits. Executive Order 2018-32 "Establishing the use of the Nevada Greater Sage-Grouse Conservation Plan and Credit System" directed all qualifying proposed actions on federal and state lands in Greater Sage-grouse habitat to mitigate using the Conservation Credit System; subsequent regulations define its policy and requirements and are outlined in Nevada Administrative Code 232.400 – 232.480. The Conservation Credit System is a Habitat Exchange where credits can be developed on private and public land and sold or transferred to debit projects proposing an anthropogenic in Greater Sage-grouse habitat. The Habitat Quantification Tool describes the methods to quantify habitat quality for debit and credit projects, and the same methods are used for both. The metric of a credit or debit is a functional acre, which is calculated by combining the habitat quality (percent functionality using a GIS analysis and field data) and quantity (acres) of a project. A debit project must have a minimum 30-year duration with an additional 10 years added for reclamation and monitoring and must offset their impact with an equivalent number of credits plus any additional credits if a proximity factor or phasing factor is applied. Debit and credit project terms must match. Credit projects must enter the program for a minimum 30-year commitment but can be longer or can be in perpetuity. Credit projects can have any combination of preservation, enhancement, or restoration components.

Oregon

The Oregon Department of Fish and Wildlife has developed a regulatory Sage-grouse Mitigation Program in coordination with the Sage-grouse Conservation Partnership in 2015. The Sage-grouse Conservation Partnership is a collaborative effort comprised of private and non-governmental organizations, and state and federal agencies that coordinate Greater Sage-grouse conservations efforts and leverage funding to address resource concerns in the sagebrush landscape. The Oregon Department of Fish and Wildlife and the Sage-grouse Conservation Partnership have developed a Greater Sage-Grouse Habitat Mitigation Program Operations and Administration Manual (State of Oregon, 2019a) and corresponding Habitat Quantification Tool (HQT) Rationale and User Guide documents (State of Oregon, 2019b, 2019c) to define mitigation policies and quantification of Greater Sage-grouse habitat. Oregon's

Mitigation Program is guided by two primary Oregon Administrative Rules (OAR): The Department of Land Conservation and Development's "Goal 5 Greater Sage-Grouse Rules" (OAR 660-023-0115) that identifies when a proposed action requires compliance with the Oregon Department of Fish and Wildlife mitigation hierarchy (avoid, minimize, mitigate) and Mitigation Program; and Oregon Department of Fish and Wildlife "Greater Sage-Grouse Conservation Strategy" (OAR 635-140-0000-0025) that identifies Greater Sage-grouse habitat, target population objectives, and the mitigation hierarchy. A qualifying proposed project in Greater Sage-grouse habitat on federal, state, or private lands would require assessment through the Sage-grouse Mitigation Program if a county, state, or in some cases, a federal land use permit is needed. This triggers the need for the project proponent to coordinate with the Oregon Department of Fish and Wildlife to follow the mitigation hierarchy and offset any residual impacts with compensatory mitigation. The program offers three options for developers to conduct compensatory mitigation: 1) permittee responsible mitigation, 2) payment into the programs In-Lieu Fee fund, and 3) purchase of mitigation credits from a program approved mitigation bank. Regardless of the selected option, the resulting mitigation should consist of habitat uplift or restoration actions that are protected through a conservation easement and maintained for the life of project impact. The Oregon HQT is used to quantify debits that result from direct and indirect impacts from temporary (reclaimed) and permanent (non-reclaimed) anthropogenic development features, as well as identify the amount of credit that results from mitigation actions. The metric of a credit or debit is in functional acres of habitat gain or loss, which is calculated by a GIS analysis and field verification. A debit project proponent must offset impacts with the equivalent amount of functional acres loss plus a net benefit amount of 15% to achieve the programs net conservation gain standard. A debit project must offset for a minimum of 30 years duration. Similarly, proposed credit projects would have to be on the landscape for a minimum of 30 years or life of project impacts, whichever is longer. Oregon's Mitigation Program has not finalized any credit projects; however, the mitigation hierarchy has aided several projects to fully avoid or minimize impacts to Greater Sage-grouse habitat and has deterred one project from moving forward in Greater Sage-grouse habitat to avoid the need for mitigation. The Oregon Department of Fish and Wildlife is currently engaged with several development projects and working through the In Lieu fee to establish its first mitigation siting through the Sage-Grouse Mitigation Program.

Utah

The Utah Department of Natural Resources developed The Sage-grouse Compensatory Mitigation Program under direction from Utah Administrative Code Rule R634-3 (November 2017); the program developed the Utah Conservation Plan for Greater Sage-Grouse (State of Utah, 2019) and outlines how mitigation credits are calculated and when they could be required. The program is not regulatory, and enforcement is left to the authorizing land management agency (i.e., BLM, USFS, or State agency) whether to require mitigation for a proposed action that impacts Greater Sage-grouse habitat. The program uses a Habitat Exchange where credits can be developed on private and public (State) land and sold or transferred to those proposing an anthropogenic disturbance in Greater Sage-grouse habitat. Credits are maintained and tracked through the Department of Natural Resources' Credit Exchange Service. A credit is equivalent to 1 acre of improved or protected habitat; a debit is equivalent to 1 acre of permanent disturbance that lasts for 5 years or more in Greater Sage-grouse habitat. The program recommends a 4:1 mitigation ratio, where 1 debit is offset by 4 credits, which accounts for both the direct and indirect impacts. Credits are allowed to be developed and sold by the State or private landowners, but permittee driven credit development is also an option. There is no current authority or process to sell credits developed on federal public lands. Debit terms must match credit term lengths, but a protection credit project must maintain habitat quality for a minimum of 20 years. To date, several credit projects totaling approximately 3,500 Credits have been developed by the Department of Natural Resources on State Lands, but no transactions or sales have occurred.

Wyoming

Wyoming Executive Order 2019-3 (EO 2019-3 or Order) took effect in August 2019, replacing prior Executive Orders 2015-4 and 2017-2. The Order directs implementation of avoidance and minimization measures for all development. Compensatory mitigation may be required when development projects do not adhere to EO 2019-3 thresholds and stipulations, and a state permit is not otherwise denied (Wyoming Executive Order 2019-3 Attachment F). Compensatory mitigation debits are assessed based on specific criteria and which specific EO 2019-3 threshold is exceeded. Debits are calculated using a pre-determined number of debits multiplied by the number of physical acres of impacted habitat. Debits may also be assessed on specific activity types that exceed EO 2019-3 thresholds, for short term activities, and for new surface occupancy within 0.25 miles of active leks in non-core areas. The compensatory mitigation framework also establishes requirements for all conservation credits which maintain existing habitats and remove potential threats, incorporating for example: bird occupancy, durability, financial assurances, additionality, and risk reduction. Compensatory mitigation may also be fulfilled through restoration credits, which restore previously lost or severely impacted habitats. A Memorandum of Agreement (MOA) between the State of Wyoming and BLM was signed in April 2019. The MOA enhances coordination between the signatories and sets forth how the state and BLM will jointly review proposed development on BLM-managed public lands and implement mitigation, including compensatory. In October 2020, the Wyoming Greater Sage Grouse Compensatory Mitigation Act (Act) took effect (W.S. §§ 9-19-201-4). The Act codified most of EO 2019-3 Attachment F, established statutory definitions, minimum standards, and established a multi-agency compensatory mitigation oversight group. Statutory authority to oversee the compensatory mitigation system was assigned to the Wyoming Board of Land Commissioners (Board). The Board promulgated administrative rules to implement the

Act. Credit providers must be certified by the Board. Presently, one USFWS-approved compensatory mitigation bank is recognized by the Board.

Abbreviations for Appendix B

BLM Bureau of Land Management

CA California

CO Colorado

EIS Environmental Impact Statement

EO Executive Order

FWS Fish and Wildlife Service

GHMA General Habitat Management Area

GIS Geographic Information System

HQT Habitat Quantification Tool

ID Idaho

IM Instruction Memorandum

LUP Land Use Plan

NV Nevada

OAR Oregon Administrative Rules

OR Oregon

PHMA Priority Habitat Management Area

SO Secretarial Order

USDA United States Department of Agriculture

USFS United States Forest Service

UT Utah

WY Wyoming

References for Appendix B

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Table B1. Synopsis of State Mitigation Program Summaries

State	Mitigation Program?	Regulatory?	Type of Program Presently Available	Durability Requirements?	Additional Requirements?	Penalties for Non-Compliance?	Number of Mitigated Debit projects
Montana	Y	Y	3, 4[1]	Y	Y	N	100+
Nevada	Y	Y	1, 2, 4[2]	Y	Y	N	13
Oregon	Y	Y	2, 3, 4	Y	Y		0
Wyoming	Y	Y	1, 2	Y	Y	?	?
California	N	N	NA	NA	NA	NA	NA
Colorado	Y	Y[3]	1, 3, 4	N	N	N	0
Idaho	Y	N	1, 2, 3, 4	Y	Y	NA	0
Utah	Y	N	1, 2, 3, 4	Y	N	NA	0
Washington	N	N	NA	NA	NA	NA	NA

Y – Yes; N – No; NA – Not applicable; ? - Unknown

Type of program: 1 - Habitat Exchanged; 2 - Bank; 3 - In Lieu Fee; 4 - Permittee Responsible

[1] State law also provides for a habitat exchange and conservation banks; none are presently operating.

[2] Barrick Bank Enabling Agreement. Not part of CCS but a FWS approved conservation bank.

[3] Required for new oil and gas activity after January 15, 2021.

Appendix C: Federal Greater Sage-Grouse Mitigation Policy since 2015

Federal Mitigation Policy Review

One Executive Order (EO), several Department of the Interior (DOI) Secretarial Orders (SO), and Bureau of Land Management (BLM) policy issued since 2015, along with the 2019 BLM Greater Sage-Grouse land use plan revisions and amendments provided new guidance that created challenges for federal agencies to implement compensatory mitigation for Greater Sage-grouse. Some of the applicable policy changes, the EO, and the SOs issued since 2015, are described below.

Presidential EO 13783 (March 28, 2017) repealed a Presidential Memorandum issued on November 3, 2015 "Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment," which reinforced the avoid, minimize, and compensate policy in the federal plans and encouraged private investment of restoration for mitigation to ensure consistency and transparency across federal agencies to implement and continue development of mitigation policy. A series of Department of the Interior (DOI) SOs followed. Subsequent DOI SO 3349 "American Energy Independence" (March 29, 2017) revoked SO 3330 "Improving Mitigation Policies and Practices of the Department of the Interior" and was only applicable to BLM. SO 3349 directed a 14-day review of all Interior Department Actions adopted or in the development process relating to the Presidential Memo and SO 3330. Within 30 days, the Deputy Secretary would provide guidance on whether to proceed with reconsideration, modification, or rescission of all projects identified within the 14-day review period. Secretarial Order 3360 "Rescinding Authorities Inconsistent with Secretary's Order 3349, "American Energy Independence" (December 22, 2017) rescinded the BLM Mitigation Manual and Handbook (BLM mitigation policy that was consistent with the 2015 land use plans) and replaced these documents with the Compensatory Mitigation Instruction Memorandum (IM 2019-018).

Secretarial Order 3398, "Revocation of Secretary's Orders Inconsistent with Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" (April 16, 2021), revoked SO 3349 and SO 3360, which were found to be inconsistent with Executive Order 13990 "Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis" (January 20, 2021), and directed that all policies and instructions that implemented the above revoked SOs or that are otherwise inconsistent with the policies set forth in EO 13990 be reviewed and revised, as necessary. The Compensatory Mitigation

Instruction Memorandum (IM, IM 2019-018) is inconsistent with EO 13990 and SO 3398. The BLM is working to issue mitigation policy consistent with SO 3398 that will supersede IM 2019-018.

In 2017, BLM and the U.S. Forest Service (USFS) began revisions to the 2015 Land Use Plans (LUP) in conjunction with their respective states. Details provided in the following section.

Bureau of Land Management

BLM issued Instruction Memorandums 2018-093 and 2019-018 in July and December 2018, respectively, directing that "BLM must not require compensatory mitigation from public land users" except where mitigation is required by other state or federal law; the BLM would consider voluntary compensatory mitigation but could not accept any monetary payment for any voluntary mitigation. Upon issuance of this memorandum, individual states and the BLM offices, respectively, worked together to develop or further refine mitigation approaches.

Following these policy changes, BLM initiated a planning effort to better align the 2015 Greater Sage-grouse land use plans with the recent DOI, BLM, and state compensatory mitigation policies. Six Records of Decision were signed March 20, 2019 that amended Greater Sage-grouse land use plans in seven states (CA, CO, ID, NV, OR, UT, and WY).

Mitigation measures of avoidance and minimization and other plan components from the 2015 LUPs were retained in the 2019 LUPs, however the retraction of compensatory mitigation requirements in the 2019 LUP decisions led to the development of new BLM and state-specific processes to address mitigation. This led to new state-developed compensatory mitigation programs, some of which became regulatory frameworks (see Appendix B).

Federal decisions to amend the 2015 LUPs were challenged in federal court. A preliminary injunction issued on October 16, 2019 blocked the 2019 LUP Records of Decision, with the exception of Montana and North and South Dakota because these states did not amend their 2015 Greater Sage-grouse plans. Six RODs were completed on January 11, 2021 for the final supplemental EIS that stated that no further planning or environmental analysis was warranted. As of this writing, the 2015 Greater Sage-grouse LUPs remain in effect under the October 2019 preliminary injunction.

U.S. Forest Service

The USFS also amended the 2015 Greater Sage-grouse LUPs; however, as of this writing, the 2019 Greater Sage-grouse plans are still under review by the Chief of the USFS and the U.S. Department of Agriculture. Both the 2015 and the proposed 2019 plan amendments describe that mitigation will follow the mitigation hierarchy of avoidance and minimization of impacts, then compensating for remaining residual impacts proposed within Greater Sage-grouse habitat. The USFS did not issue any other major policy changes regarding the use and implementation of the mitigation hierarchy and compensatory mitigation.

U.S. Fish and Wildlife Service

In 2014, the FWS issued the Greater Sage-Grouse Rangewide Mitigation Framework. It was initially identified for review per SO 3349 but is currently unchanged.

Abbreviations for Appendix C:

BLM Bureau of Land Management
CA California
CO Colorado
DOI Department of the Interior
EIS Environmental Impact Statement
EO Executive Order
FWS Fish and Wildlife Service
ID Idaho
IM Instruction Memorandum
LUP Land Use Plan
NV Nevada
OR Oregon
ROD Record of Decision
SO Secretarial Order
USFS United States Forest Service
UT Utah
WY Wyoming

Appendix D: BLM Greater Sage-Grouse Compensatory Mitigation Summary 2016 – 2020

A Summary for the WAFWA Greater Sage-Grouse Conservation Report Compiled by BLM from BLM Compensatory Mitigation Reports

February 26, 2021

To compile BLM Greater Sage-grouse compensatory mitigation information, BLM Headquarters wildlife and mitigation staff used three sources of compensatory mitigation information (May 2018 and October 2019 reports and December 2020 data sheets) to identify and summarize BLM compensatory mitigation actions implemented specifically for Greater Sage-grouse. The BLM compensatory mitigation information, covering mitigation plans, agreements and actions taken by the BLM since 2016, was collected from BLM State Offices by the BLM National Mitigation Lead.

- Based on the three sources of information, BLM authorized 36 projects in 7 states between 2016 and 2020 that included compensatory mitigation for Greater Sage-grouse (see Table D1):
- The May 2018 BLM report included 6 projects for Greater Sage-grouse in 3 states in 2016 and 56 projects in 3 states in 2017.
- The October 2019 BLM report included 6 projects for Greater Sage-grouse in 4 states during Fiscal Year 2018.
- The December 2020 BLM data sheets provided included 8 projects for Greater Sage-grouse in 3 states in 2019 and 11 projects for Greater Sage-grouse in 4 states in 2020.

Table D1. BLM projects authorized by a land use decision that incorporated compensatory mitigation[1] for Greater Sage-grouse between 2016 and 2020. Acronyms are listed below the table.

Year	State	Resource Management Plan (RMP)	Name(s) of Projects	BLM Office	Federal Partners	State Partners
2016	CO, UT, WY	TransWest ROD	TransWest Express Transmission Line (mitigation in progress)	Multiple	Not collected	USFWS, WGFD, CPW, UTDWR, USBOR, Moffat County CO
	CO, UT, WY	Energy Gate-way South ROD	Energy Gateway South Transmission Line (mitigation in progress)	Multiple	Not collected	UTDWR, Pacificorp, BLM, USFS, and USFWS
	ID	Not collected	Raft River Flood Control District and Ground Water District Flood Control Ditch	Burley FO	Not collected	Not collected
	ID	Not collected	Idaho Power Company Anaconda-Grace 161kV Transmission Line Rebuild and Access Road Right-of-Way Amendment	Upper Snake Field Office - Idaho Falls District-Idaho	Not collected	Not collected
	NV	Not collected	Coeur Rochester POA10 Heap Leach Expansion/ Coeur Rochester Inc.	Humboldt River FO Winne-mucca	Not collected	Not collected
	WY	Not collected	Continental Divide-Creston EIS/ROD	Rawlins FO	Not collected	Not collected
2017	ID	Not collected	Cassia County Road and Bridge Department	Burley FO	Not collected	Not collected
	ID	Not collected	Grasmere Emitter Site ROW	Bruneau FO	Not collected	Not collected
	NV	Not collected	F1104600 Sage Grouse Fence Flagging Project	Winne-mucca DO	Not collected	Not collected
	NV	Not collected	Gold Bar Mine EIS	Battle Mountain District - Mt Lewis FO	Not collected	Not collected
	WA	1992 Spokane RMP Amendment	Pacific Power's Vantage to Pomona Heights 230 kV Transmission Line Project	Oregon/ Washing-ton SO	Not collected	Idaho Fish and Game

Year	State	Resource Management Plan (RMP)	Name(s) of Projects	BLM Office	Federal Partners	State Partners
2018	ID	Sage-Grouse ARMPA	Rock Creek Hydro Electric	Challis FO	NRCS	Idaho Fish and Game
	NV	Ely District RMP	Bald Mountain Mine, Gold Rock Mine	Ely DO/ Bristlecone FO	USFWS	NDOW
	NV	Shoshone RMP/2015 Sage-Grouse ARMPA	a. McGinnis Hills Geothermal Development Project (Ormatt), b. Gold Bar Mine (McEwen), c. Greater Phoenix (Newmont)	Battle Mountain DO	a. and b. (McGinnis and Gold Bar) -USFWS, NRCS.c. (Greater Phoenix) -USFWS, USFS, NRCS	a. and b. (McGinnis and Gold Bar) -NDOWc. (Greater Phoenix) - Nevada SETT, NDOW
	UT	Price RMP	West Tavaputs Programmatic Agreement	Price FO	None	9-Mile Coalition
	UT	Vernal RMP	Enefit Utility Project EIS	Vernal FO	None	None
	WY	Pinedale RMP	a. Jonah Infill Drilling Project, b. Pinedale Anticline Oil and Gas Exploration and Development Project	Pinedale FO	None	a. and b. (Jonah and Anticline) –WDA, WGFD, WY DEQ b. Anticline – plus Sublette County
2019	ID	Revised Forest Plan, Caribou/Targhee National Forest; BLM Pocatello RMP	Caldwell Canyon Mine and Reclamation Plan (monetary contribution to habitat project)	Idaho Falls DO	USFS	Idaho Governor’s Office
	MT	Billings Field Office ARMP 2015	ACC Amendment 5 MTDEQ Opencut Permit 8 Plan of Operations	Billings FO	NA	NA
	MT	Miles City Field Office ARMP 2015	Denbury Mission Canyon 5 Well APDs; 2018-064-EA+A7:A11	Miles City FO	NA	NA
	MT	Miles City Field Office ARMP 2015	Denbury Bell Creek 2 Well APDs; 2018-071-EA	Miles City FO	NA	NA
	MT	Miles City Field Office ARMP 2015	Whitetail Detention Dam Repair; DOI-BLM-MT-C020-2019-0003-EA	Miles City FO	NA	NA
	MT	Miles City Field Office ARMP 2015	Carter County Pits 2018; DOI-BLM-MT-C020-2019-0012-EA	Miles City FO	NA	NA
	NV	Winnemucca RMP	Twin Creeks Mine Sage Tailings Storage Facility EA	Humboldt River FO	None	Nevada Sagebrush Ecosystem Technical Team (SETT)

Year	State	Resource Management Plan (RMP)	Name(s) of Projects	BLM Office	Federal Partners	State Partners
2020	CO	Kremmling ROD and ARMP; Northwest Colorado Greater Sage-Grouse ARMPA	Sandridge APDs: PRU High Point 0880 S28 Pad	Kremm-ling FO	NA	Colorado Parks and Wildlife
	ID	BLM Pocatello RMP	Dairy Syncline Mine (land donation)	Idaho Falls DO	None	Idaho Governor's Office
	MT	Miles City, MT	Denbury 3 Well APDs; 2020-034-EA	Miles City FO	None	None
	MT	Miles City, MT	Denbury Replacement Flowlines; 2020-035-DNA	Miles City FO	None	None
	MT	Miles City, MT	Continental APD; 2020-042-EA	Miles City FO	None	None
	MT	Miles City, MT	Bell Creek 8-11 APD; 2020-059-DNA	Miles City FO	None	None
	MT	Miles City, MT	Pinnacle Ranch Scoria Pit; 2020-061-CX	Miles City FO	None	None
	MT	Miles City and HiLine	Keystone XL Pipeline ROW	Miles City FO, Glasgow FO, Malta FO	State Department (Lead Federal)	None
	NV	Ely District RMP	Pattern Energy - Spring Valley Wind - Southeast Schell Habitat Restoration	Ely DO	None	NDOW
	NV	Ely District RMP	Pattern Energy - Spring Valley Wind - Snake Range Aspen Restoration	Ely DO	None	NDOW
	NV	Winnemucca RMP	Coeur Rochester and Packard Mines Plan of Operations Amendment 11 EIS	Winne-mucca DO	None	Nevada SETT

[1]Only offsite compensatory mitigation is reported for 2018-2020

Abbreviations:

ACC American Colloid Company
ARMP Approved Resource Management Plan
ARMPA Approved Resource Management Plan Amendment
APD Application for Permit to Drill
CO Colorado Parks and Wildlife
CPW Colorado Parks and
CX Categorical Exclusion
DO District Office
DOI Department of the Interior
EA Environmental Assessment
EIS Environmental Impact Statement
FO Field Office
ID Idaho
MT Montana
MTDEQ Montana Department of Environmental Quality
NA Not applicable
NDOW Nevada Department of Wildlife
NRCS Natural Resources Conservation Service
NV Nevada
POA Plan of Operations Amendment
RMP Resource Management Plan
ROD Record of Decision
ROW Right of Way
SETT Sagebrush Ecosystem Technical Team
SO State Office
USBOR United States Bureau of Reclamation
USFS United States Forest Service
USFWS United States Fish and Wildlife Service
UT Utah
UTDWR Utah Division of Wildlife Services
WA Washington
WDA WY Department of Agriculture
WGFD Wyoming Game and Fish Department
WY Wyoming
WY DEQ WY Department of Environmental Quality.
XL export limited

Appendix E: Washington State Greater Sage-Grouse Update

October 6, 2023

The preliminary population estimate for sage-grouse in Washington State was 429 in 2023, this was a decrease of 23% from 2022 and a 60% decline from 2020 (Figure E1). The vast majority of Washington sage-grouse are located in the Moses Coulee population (Douglas County WA), with an estimated 390 birds in 2023. The Yakima Training Center (YTC) population had 36 birds and the Crab Creek reintroduced population had 3 birds in 2022. The long-term declines observed in Washington are similar to those observed in other peripheral sage-grouse populations in California, Utah, Colorado, North Dakota, South Dakota, Alberta, and Saskatchewan (Connelly and Braun 1997, Connelly et al. 2004, Garton et al. 2011).

Declines of greater sage-grouse in Washington are linked to conversion, degradation, and fragmentation of shrubsteppe habitat. Historically, the primary driver was conversion for agriculture, however, recently wildfire and energy production are playing a larger role (WDFW 1995, Hays et al. 1998, Stinson et al. 2004, Shirk et al. 2015). In particular, the 2020 wildfires had a larger impact on greater sage-grouse habitat in WA than any other wildfires in recorded history (Figure E2). The largest wildfire in Washington State history (Cold Springs Canyon/Pearl Hill fire) impacted about 164,000 ha total, 89,000 ha in the Moses Coulee population. The Whitney fire impacted the Crab Creek population, and will likely lead to the re-extirpation of this population. The Taylor Pond fire impacted the YTC population. The threat of wildfire to shrubsteppe habitat in Washington is not unique to WA, it is the same threat that is playing out across the range of sage-grouse.

What is unique to Washington is the extensive historic conversion of shrubsteppe to agriculture (primarily dry land crops) and the opportunity for habitat restoration these deeper soils offer. Because the majority of the Moses Coulee population occupies private land in Douglas County, most management efforts have focused on private land programs designed to encourage practices that benefit sage-grouse. Chief among these are federal conservation programs such as the CRP-General and CRP-State Acres For Wildlife Enhancement (SAFE) which support nesting sage-grouse (Schroeder and Vander Haegen 2011, Shirk et al. 2017). Given the annual total CRP acreage in Douglas County (gray bars in Figure E3) it is easy to see its potential to impact sage-grouse populations. However, CRP total acreage and sage-grouse population trends do not line up quite as one would initially expect. This is likely due to the lag-time between CRP enrollment and habitat functionality, simply put shrubsteppe does not grow overnight, it typically takes around 5 years for a CRP field to become functional habitat. By functional we do not necessarily mean good nesting habitat for sage grouse, but at least usable habitat for sage grouse foraging, loafing, etc. This delay in functionality can be seen in the initial CRP enrollment of the mid 1980s and again around 2010 (Figure E3). In 2010 a large number of CRP contracts ended resulting in a conversion of CRP to wheat, CRP to a different type of CRP (e.g., SAFE), and wheat to CRP. Even though at the end of the transition period, there was roughly the same acreage enrolled in conservation programs, there was a lag effect associated with the time it takes for a field of newly planted vegetation to reach maturity (Schroeder and Vander Haegen 2011).

Another unique factor to take into account for WA sage-grouse is their genetic distinctness. A recent genetic analysis comparing Gunnison Sage-grouse to Greater Sage-grouse, showed that after the difference between the two species was accounted for, that within the remaining Greater Sage-grouse samples Washington's population showed the greatest divergence (Oh et. al. 2019). Samples for the Greater Sage-grouse analysis came from Alberta, Jackson Hole, Piceance Basin, Bi-state, and Washington populations; giving rangewide coverage. Additionally, this coverage would indicate that Washington sage-grouse are at least as distinct a population as the Bi-state (a federally listed DPS) if not more so. The genetic analysis also indicated that this divergence was not only due to geographic isolation during the Pleistocene glacial period, but also likely tied to local dietary adaptations, in particular adaptations to distinct sagebrush defensive compounds (Oh et. al. 2019).

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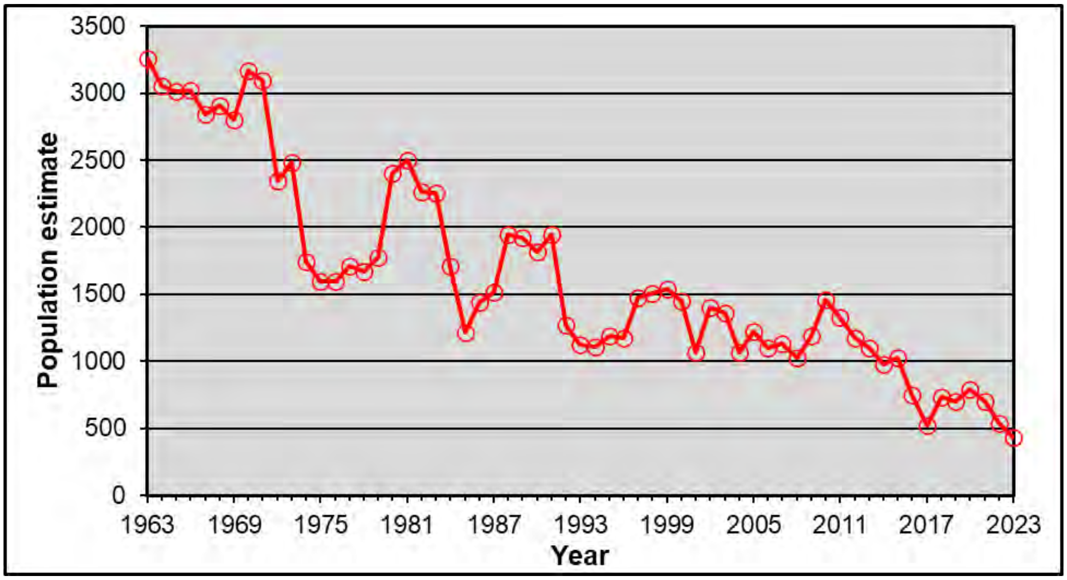

Figure E1. Population trend for greater sage-grouse in Washington State.

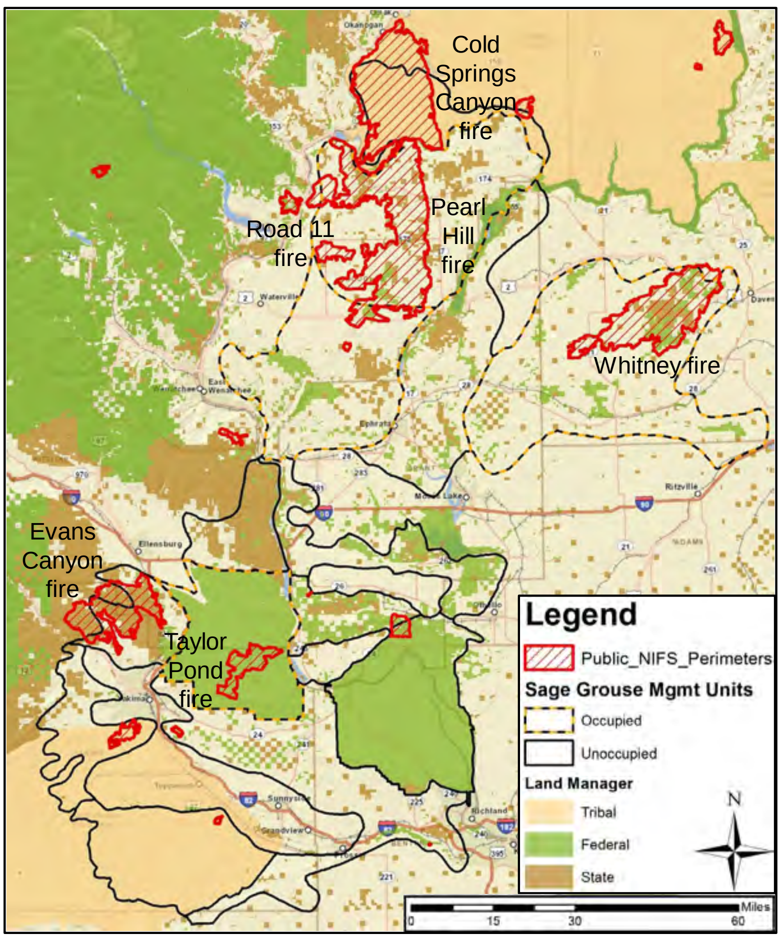

Figure E2. Wildfire perimeters in 2020 in relation to the greater sage-grouse management units in Washington State.

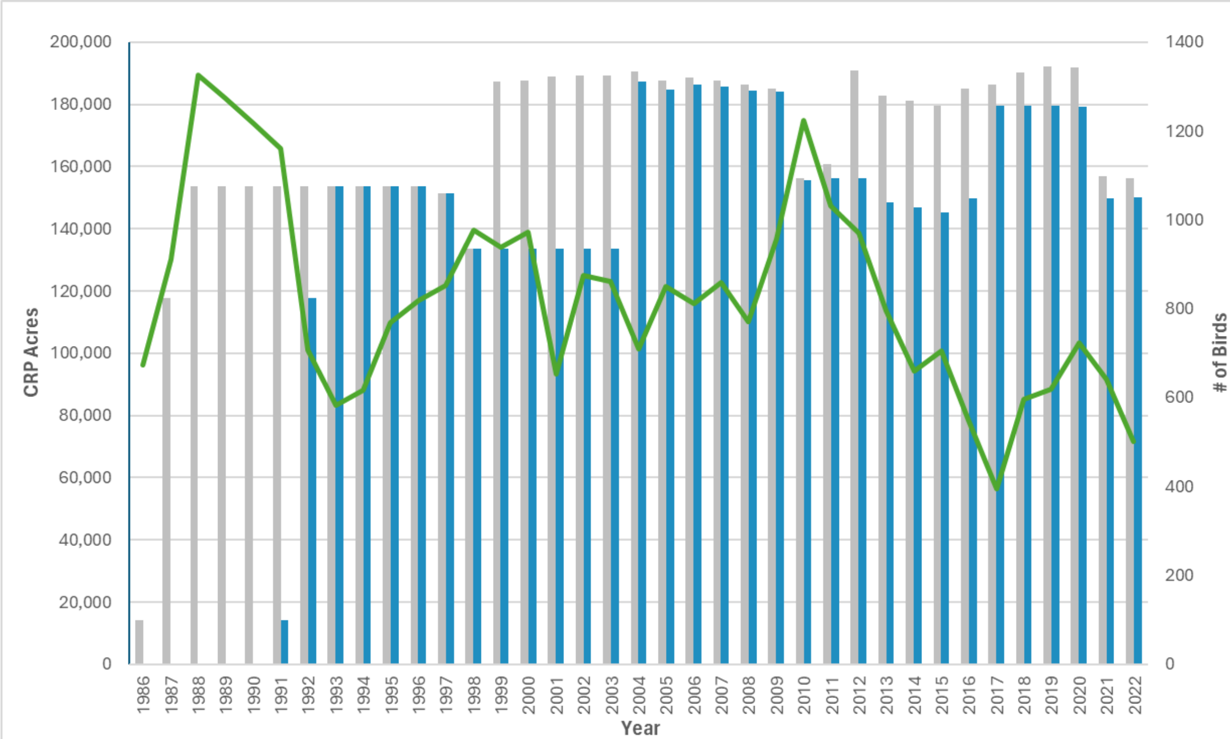

Figure E3. Moses Coulee sage-grouse population (green line) relative to total annual CRP acreage (gray bars) and functional habitat for sage-grouse CRP acreage (blue bars) in Douglas County WA. CRP was estimated to become functional habitat 5 years post enrollement into the program. The data supplied by FSA website (https://www.fsa.usda.gov/programs-and-services/conservation-programs/reports-and-statistics/conservation-reserve-program-statistics/index) does not supply annual acres expiring, re-enrolling, and new. So to get a very rough estimate WDFW used the acreage of year X minus the acreage of year X-1 to get the amount of new or lost acreage for year X.

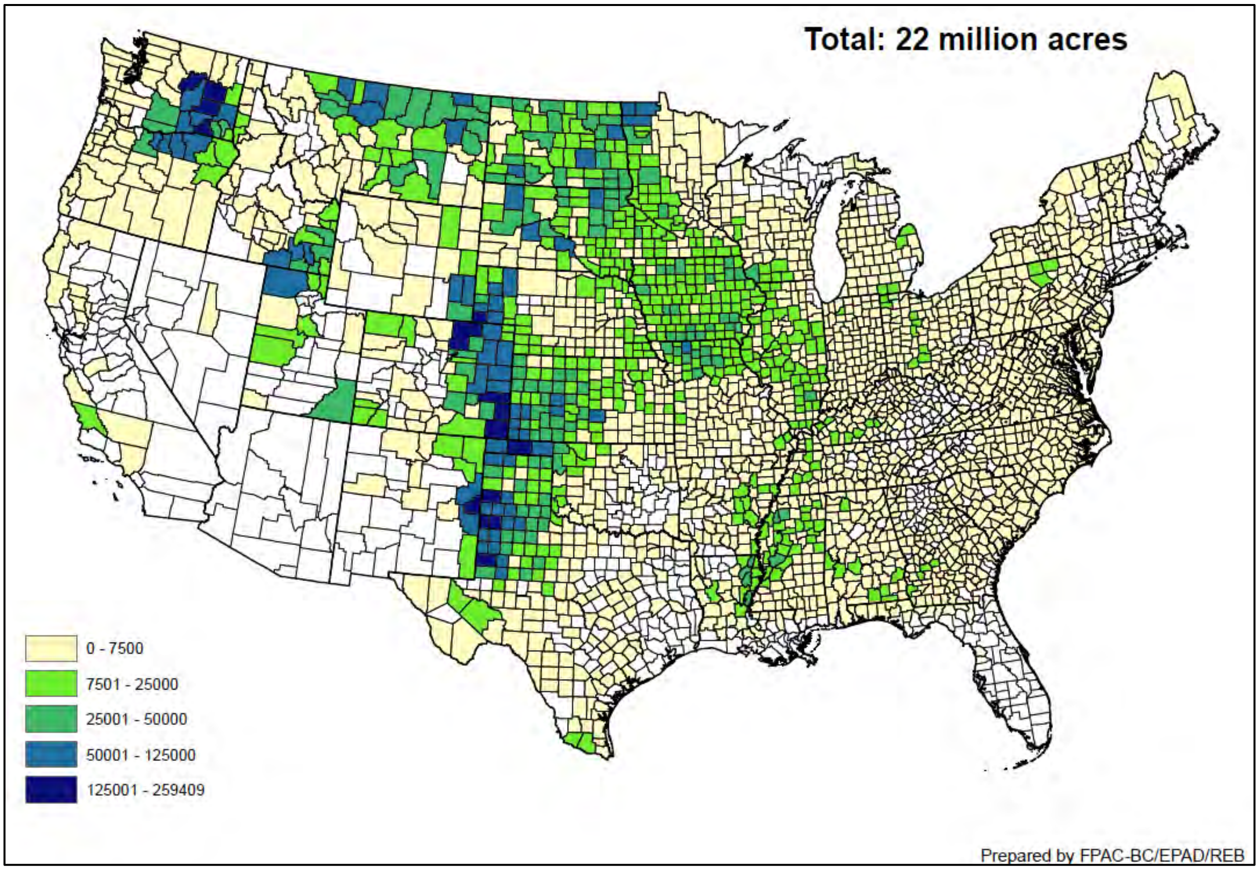

Figure E4. CRP acreage nationally as of October 2019, note the dark blue color of Dougals County WA. Just an interesting map that shows graphically why CRP is an issue for WA, but is not typically an issue for other western states with sage-grouse.

Appendix F: Greater Sage-Grouse References Applicable to the Greater Sage-Grouse Conservation Report

This appendix contains references specific to research and management of the Greater Sage-grouse (*Centrocercus urophasianus*) published from October 3, 2019, to September 30, 2021, which is a subset of the total articles reviewed for this report. Only references that were specific to Greater Sage-grouse or management of the species are listed below. These references were published after the annotated bibliographies of scientific research on Greater Sage-grouse previously released by the United States Geological Survey (Hanser et al. 2018; Carter et al. 2020).

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Appendix F.1.

A bibliography of the greater sage-grouse. This bibliography contains 67 references on research and management of the Greater Sage-grouse published during October 3, 2019 – 2021 and provides an update on the annotated bibliographies of scientific research on Greater Sage-grouse previously published by USGS.

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