
APPENDIX D—MONITORING FRAMEWORK

D.1 INTRODUCTION

Land use planning establishes intervals and standards for monitoring to report progress on the implementation and effectiveness of the conservation actions outlined in the plans. This “Greater Sage-Grouse Draft Monitoring Framework” (hereafter, draft monitoring framework) outlines the process and methodology that the U.S. Bureau of Land Management (BLM) and U.S. Forest Service (Forest Service) will use to monitor implementation and effectiveness of resource management plan (RMP) and land and resource management plan (LRMP) decisions affecting Greater Sage-Grouse (hereafter, sage-grouse). The BLM and Forest Service are undertaking this planning effort to provide regulatory certainty that land management actions reduce threats to habitats and populations that area under agency control, thereby maintaining or restoring habitats necessary to support viable sage-grouse populations. Implementation monitoring will evaluate whether (and to what extent) decisions to ameliorate threats to sage-grouse have been implemented. Effectiveness monitoring will consider the results of sage-grouse population monitoring with results of sage-grouse habitat monitoring in the context of existing conditions described in the baseline environmental report (Manier et al. 2013). Habitat monitoring includes both vegetation monitoring and disturbance monitoring.

This draft monitoring framework establishes the use of measurable quantitative indicators for habitat availability and maintenance of habitat types (e.g. priority/core and general habitats) to ensure each agency’s ability to make broad (yet consistent) generalizations about habitats across the range of the species. Monitoring methods and indicators are derived from the best available science. Corporate data-sets will be established so that data can easily be “rolled up” for reporting monitoring results across the range of sage-grouse, as defined by Schroeder et al. (2004), by populations and subpopulations as defined by Connelly et al. (2004), by RMP/LRMP (hereafter, land use plans [LUP]) area, by the seven Western Association of Fish and Wildlife Agencies (WAFWA) Sage-grouse Management Zones (Stiver et al. 2006), and by Priority Areas for Conservation (PAC) as defined in the sage-grouse Conservation Objectives Team (COT) Report (United States Fish and Wildlife Service [USFWS] 2013). Funding support and dedicated personnel for broad and mid-scale monitoring will be renewed annually through the normal budget process.

Sage-grouse are a landscape species, and conservation is a scale-dependent process whereby priority landscapes are identified across the species range and appropriate conservation actions are implemented within seasonal habitats to benefit populations. Following guidelines established by multiple agencies in the Sage-grouse Habitat Assessment Framework (HAF), this approach uses the four orders of sage-grouse habitat selection: first order (broad scale), second order (mid-scale), third order (fine scale), and fourth order (site scale) (Stiver et al. 2010, Johnson 1980). Because LUP decisions are made largely at the broad and mid-scale, this draft monitoring framework focuses on these two larger spatial scales. The need for fine and site scale habitat monitoring may vary by area depending on existing conditions, habitat variability, threats, and land health; however, indicators at these scales will be consistent with the HAF. Thus, this draft monitoring framework includes methods, data standards, and intervals of monitoring at the broad and mid-scales, while outlining indicators that should be measured at all scales.

D.2 BROAD AND MID-SCALES

First order habitat selection at the broad scale describes the selection of physical or geographical range of a species. There is one first order habitat, the range of the species defined by populations of sage-grouse associated with sagebrush landscapes (Schroeder et al. 2004; Connelly et al. 2004). Additionally, there is

an intermediate scale between the broad and mid-scales that was delineated from floristic provinces within which similar environmental factors influence vegetation communities. This scale was developed by WAFWA and is referred to as the WAFWA Management Zones (Stiver et al. 2006).

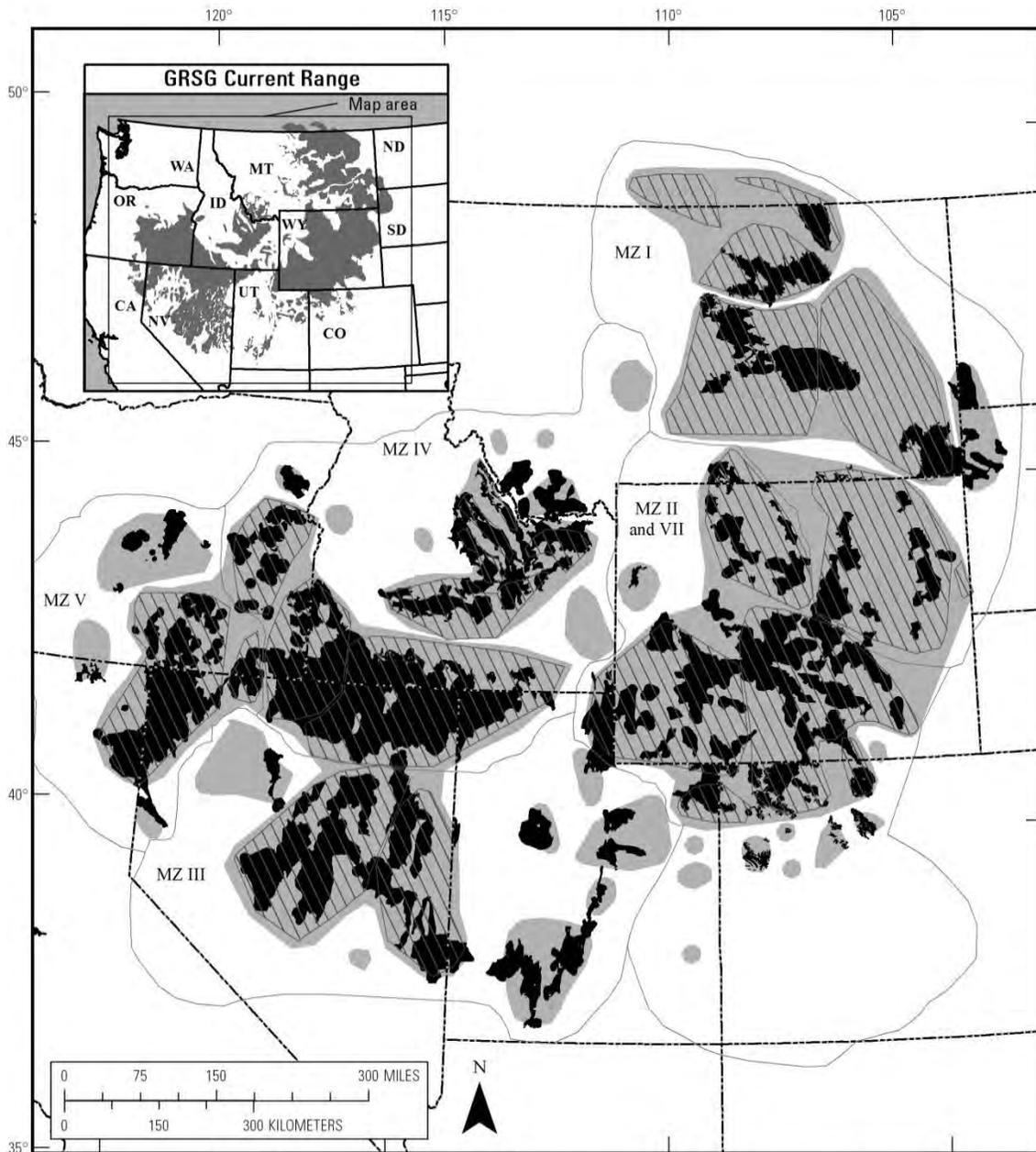
Second order habitat selection at the mid-scale includes sage-grouse populations, subpopulations, and PACs. The second order includes at least 40 discrete populations and subpopulations (Connelly et al. 2004). Subpopulations range in area from 300 to 22,400 mi², while populations range in area from 150 to 54,600 mi². PACs range from 20 to 20,400 mi².

Broad and mid-scale monitoring results will be reported at the appropriate and applicable geographic scale (Table D-1 and Figure D-1).

Table D-1. Monitoring for Sage-grouse at the Broad and Mid-Scales

Geographic Scales	Implementation	Habitat		Population (States)
	Decisions	Disturbance	Vegetation	Demographics
Broad Scale: From the range of sage-grouse to WAFWA Management Zones	LUP objectives, thresholds and management actions	Priority and general habitat delineation (occupied habitat)	Existing national level vegetation monitoring and mapping efforts (remote sensing)	WAFWA Management Zone population level and population trends
Mid-Scale: From WAFWA Management Zone scale to subpopulation/PAC scale	LUP decisions, vegetation/mid-scale decisions	Percent of sagebrush per unit area, anthropogenic footprint, density of energy development	National data augmented with locally collected data using core indicators and statistical study design	Subpopulation scale, dispersal and lek complex trends

Figure D-1. Greater Sage-Grouse Range, Populations, Subpopulations and Priority Areas for Conservation



**GRSG PACs, Subpopulations and Populations
LEGEND**

-  Subpopulations
-  COT PACs
-  Populations

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

*GRSG=Greater Sage-Grouse

D.2.1 Implementation (Decision) Monitoring

The regulations for the BLM (43 Code of Federal Regulation [CFR] 1610.4-9) and Forest Service (36 CFR 219.12) require that land use plans establish intervals and standards for monitoring and evaluations, based on the sensitivity of the resource decisions involved. Implementation monitoring is the process of tracking and documenting the implementation (or the progress toward implementation) of land use plan decisions. Because sage-grouse conservation actions will occur on a fairly regular basis, the BLM and Forest Service will be documenting progress annually toward full implementation of the land use plan.

D.2.2 Habitat (Vegetation) Monitoring

The current geographic extent of sagebrush vegetation within the range-wide distribution of sage-grouse populations will be ascertained using the most recent version of “Existing Vegetation Type” (EVT) layer in LANDFIRE. The resulting geospatially explicit map will be compared against the geographic extent of land that has the capability to support sagebrush vegetation as determined using LANDFIRE Biophysical Setting (BpS) to ascertain the areas within the range-wide distribution of sage-grouse populations that have the potential to support sagebrush vegetation. The resulting sagebrush map will become the base layer against which disturbance changes are measured, incorporated, and reported.

LANDFIRE lacks specificity of types of sagebrush vegetation and has relatively low accuracy; however, it is currently the best available range-wide mapping product. The BLM is extending the Grass/Shrub mapping product that spatially depicts the percent cover of sagebrush vegetation as well as three other components (percent bare ground, percent herbaceous vegetation, and percent shrubs) range-wide (Homer et al. 2009). As the Grass/Shrub mapping base product is developed over the next five years, it will refine the EVT in LANDFIRE and better depict the current geographic extent of sagebrush vegetation.

The geographic extent of sagebrush vegetation will be reported at a maximum of five-year intervals. The BLM and Forest Service will use sagebrush cover estimates from the Landscape Monitoring Framework points within the range-wide distribution of sage-grouse populations to ground-truth, refine, and improve the accuracy of sagebrush vegetation within the Grass/Shrub and LANDFIRE mapping products.

The Grass/Shrub mapping product will allow for estimation of patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (mid-scale indicators; see Stiver et al. 2010). Until the Grass/Shrub mapping product is available, these landscape metrics will be calculated annually using the LANDFIRE EVT as the sagebrush base layer and integrating the spatial extent of new disturbances into the database. Once the disturbance updates have been included into the base layer, the landscape metrics will be recalculated to examine changes in pattern and abundance of sagebrush at the various geographic boundaries.

D.2.3 Habitat (Disturbance) Monitoring

Most of the decisions in these land use plans are in response to “Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range” in the USFWS’s 2010 listing decision for sage-grouse (75 FR 13910 2010). The USFWS identified several “threats” affecting factor A, therefore the BLM and Forest Service will monitor the relative extent of these threats on sagebrush, both spatially and temporally, to report on conditions at the appropriate and applicable geographic scales and boundaries.

Disturbance monitoring will focus on three general measures:

- 1) Percent of sagebrush per unit area
- 2) Percent of non-habitat (human footprint) per unit area

3) Number of energy facilities and mining locations per unit area (density)

To accomplish disturbance monitoring, the BLM and the Forest Service will begin with a base layer of sagebrush described above in Section 1.2.2. Restored areas will also be considered when evaluating the percentage of sagebrush on the landscape.

Next, the BLM and Forest Service will use corporate, range-wide, and best available data (Manier et al. 2013) to evaluate anthropogenic and natural disturbances (direct physical footprint) of the sage-grouse habitat based on threats (Attachment A) listed in Factor A of the USFWS listing decision. Most of these data are from external data sources and are considered the best available data at the range-wide scale. A subset of these data (e.g. mine and energy sites), provided by BLM field and state offices and Forest Service forests and regional offices, will be updated and reported to agency headquarters annually.

Disturbance data will include:

1. Agriculture
2. Urbanization
3. Habitat treatments
4. Wildfire
5. Invasive plants
6. Conifer encroachment
7. Energy (coal mines)
8. Energy (oil and gas wells and development facilities)
9. Energy (wind towers)
10. Energy (solar fields)
11. Energy (geothermal)
12. Mining (active developments; locatable, leasable, saleable)
13. Infrastructure (roads)
14. Infrastructure (railroads)
15. Infrastructure (power lines)
16. Infrastructure (communication towers)
17. Infrastructure (other vertical structures)
18. Other developed rights-of-ways

D.2.4 Population (Demographics) Monitoring

State wildlife management agencies are responsible for monitoring sage-grouse populations within their respective states. The BLM and Forest Service have initiated a process to establish WAFWA to coordinate collection of annual population data by state agencies, and facilitate analysis of these data at least once every five years. Data collection will be coordinated at the population/subpopulation level to help address effectiveness of conservation measures outlined in the conservation objectives report and implementation of land use plan decisions related to sage-grouse. These population data will also be available for analysis at the WAFWA Sage-grouse Management Zones and range-wide scale to demonstrate overall effectiveness of management actions across the range of the species. State wildlife agencies will provide annual lek data and five-year population summaries to BLM state offices and Forest Service regional offices to convey that information to the BLM National Operations Center for long-term reference, use and storage. The existing memorandum of understanding signed by WAFWA, the BLM, the Forest Service, the Natural Resources Conservation Service, and the USFWS (http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/fish_wildlife_and_sage-grouse.Par.6386.File.dat/MOU%20on%20Greater%20Sage-Grouse.pdf) will be revised to outline

collaboration, process, and responsibilities for data analysis and transfer related to management of sage-grouse.

D.2.5 Effectiveness Monitoring

Effectiveness monitoring for the Wyoming Greater Sage-Grouse LUP Amendments will involve evaluating the change in habitat conditions from the baseline conditions, in relation to the goals and objectives of the plan and other range-wide conservation strategies (BLM 2004i, Stiver et al. 2006, and USFWS 2013). The BLM and the Forest Service will evaluate those data to characterize the relationship among the disturbance, habitat condition, and population trends at the appropriate and applicable geographic scale or boundary, identify emerging issues and research needs, and suggest implications for management. This process will involve the compilation of broad and mid-scale data and population trends needed for the evaluation of effectiveness with a five-year reporting schedule, or more often as needed.

D.3 FINE AND SITE SCALES

Third-order habitat selection at the fine scale describes the physical and geographic area within home ranges. At this level, maps of seasonal habitats (breeding, summer, winter) and the connectivity between these seasonal use areas can be examined to determine limiting factors for populations, subpopulations, and PACs.

Fourth-order habitat selection at the site scale is based on physical conditions and the geographic area within seasonal ranges to meet life requisite needs (e.g. nesting and brood-rearing). Specific habitat measures are used at this scale as microsite conditions within the seasonal range to determine distribution and use. These measures are typically sampled across a defined area to inform third-order habitat selection.

Details and application of these two scales will be determined during implementation of the Wyoming Greater Sage-Grouse LUP Amendments. The need for fine and site scale specific habitat monitoring will vary by area depending on existing conditions, habitat variability, threats, and land health. For example, implementation monitoring will track decisions in priority habitat; habitat vegetation monitoring will be conducted to evaluate projects targeting sage-grouse habitat enhancement and/or restoration; habitat disturbance monitoring will be conducted where mid-scale monitoring indicates the need for fine scaled anthropogenic disturbance footprints; and population monitoring (in cooperation with state wildlife agencies) will be analyzed below the subpopulation/PAC level, where needed, for more specific effectiveness monitoring (some LUP objectives, activity plans, development plans, leasing plans, etc.).

At a minimum, the habitat indicators at the fine and site scales will be consistent with the HAF and the core indicators in assessment, inventory and monitoring (AIM) strategy (Toevs et al. 2011); however, the *metrics* and *interpretation* for the indicators can be adjusted for regional conditions. When evaluating the land health habitat standard in designated sage-grouse habitats, the BLM will analyze core indicators and other supplemental site scale (HAF) indicators as appropriate for the seasonal habitat. The activity level plans will describe a sampling scheme for collecting indicators with a non-biased sampling design for vegetation treatments or management actions implemented at the site scale. In addition, the consistent collection of these data will be used to inform the classification and interpretation of imagery used at the mid-scale as described above.

For examples of current applications of disturbance and reclamation monitoring at the fine scale, see the BLM Wyoming Density and Disturbance Calculation Tool (DDCT) and the BLM White River Data Management System (WRDMS) in development with the United States Geological Survey (USGS).

D.4 FINAL MONITORING PLAN

This draft monitoring framework was developed for draft environmental impact statements to describe the proposed monitoring activities for this plan. The BLM and Forest Service will consider public comments and collaborate with other agencies to finalize the Wyoming Greater Sage-Grouse LUP Amendments Sage-grouse Monitoring Plan.

ATTACHMENT A

Geospatial data layers were used to determine three factors for Greater Sage-Grouse habitat disturbance monitoring at the broad and mid scales.

Geospatial Data Layer	Percent of Sagebrush	Percent of Non-habitat (Human Footprint)	Number of Energy and Mining Facilities
Sagebrush	X		
Areas with biotic potential for sagebrush	X		
Agriculture	X		
Urbanization	X		
Habitat treatments	X		
Wildfire	X		
Invasive plants	X		
Conifer encroachment	X		
Energy (oil and gas wells and development facilities)		X	X
Energy (coal mines)		X	X
Energy (geothermal)		X	X
Energy (wind towers)		X	X
Energy (solar fields)		X	X
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Infrastructure (power lines)		X	
Infrastructure (railroads)		X	
Infrastructure (roads)		X	
Mining (active locatable, leasable, and salable developments)		X	
Transmission corridors and other developed rights-of-way		X	