Appendix E

Greater Sage-Grouse Draft Monitoring Framework

APPENDIX E
GREATER SAGE-GROUSE DRAFT MONITORING FRAMEWORK

The purpose of this Draft US Bureau of Land Management (BLM) and US Forest Service (Forest Service) Greater Sage-grouse Monitoring Framework (hereafter, draft monitoring framework) is to evaluate the implementation and success of the BLM and Forest Service land use plans in maintaining and restoring habitat conditions necessary to support sustainable Greater Sage-Grouse (also referred to as sage-grouse or GRSG) populations. Monitoring data will also be used to help inform adaptive management under these plans.

This draft framework outlines the general monitoring approach, consisting of implementation monitoring and effectiveness monitoring. Implementation monitoring will evaluate whether (and to what extent) the BLM Resource Management Plan (RMP) and Forest Service land management plan (LMP) management to ameliorate threats to sage-grouse have been implemented. Effectiveness monitoring will consist of a multi-scale analysis of our habitat and disturbance monitoring data. Best available population data, provided by the states, will be used to supplement effectiveness analysis.

This draft monitoring framework establishes the use of measurable quantitative indicators for habitat availability and maintenance of habitat types (e.g., priority and general habitats) to ensure each agency's ability to make broad (yet consistent) generalizations about habitat across the range of the species. Monitoring methods and indicators are derived from the best available science. Corporate data-sets will be established or acquired 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/LMP area; by the six Western Association of Fish and Wildlife Agencies (WAFWA) Sage-grouse Management Zones (Stiver et al. 2006) covered by the planning efforts; by BLM and Forest Service priority and general habitat; and by Priority Areas for Conservation (PACs) as defined in the sage-grouse Conservation Objectives Team (COT) Report (US 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; Stiver et al. 2010), this approach uses the four orders of sage-grouse habitat selection (Johnson 1980): first order (broad scale), second order (mid scale), third order (fine scale), and fourth order (site scale). Because RMP/LMP management 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 to be measured at all scales.

E.1 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, an intermediate scale between the broad and mid scales 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 Sage-grouse Management Zone.

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 square miles, while populations range in area from 150 to 54,600 square miles. PACs range from 20 to 20,400 square miles.

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

E.1.1 Implementation (Decision/Direction) Monitoring

The regulations for the BLM (43 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 management. A Utah Greater Sage-Grouse LUPA/EIS Implementation Workbook will be completed within one year of the Record of Decision to track the number and type of applicable implementation actions related to each LUP management action for each resource program, and maintained as actions occur. The BLM and Forest Service will be documenting progress annually toward full implementation of the land use plan.

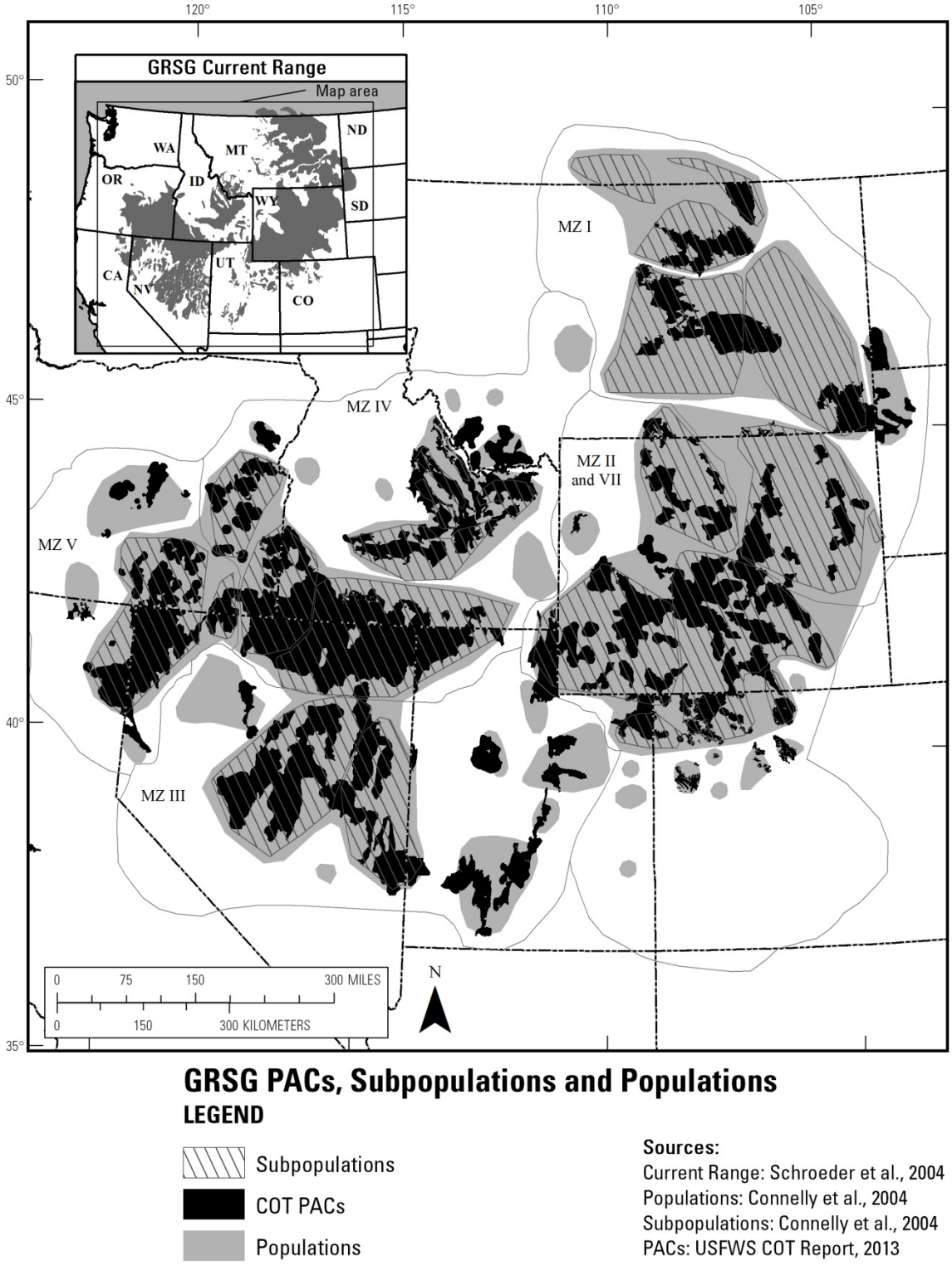
Table E.1
Indicators for Monitoring Implementation of Management, Sage-Grouse Habitat, and Sage-Grouse Populations at the Broad and Mid Scales

Geographic Scales	Implementation	Habitat		Population (States)
	Management	**Disturbance**	**Vegetation**	**Demographics**
Broad Scale: From the range of sage-grouse to WAFWA Management Zones	RMP/LMP objectives, thresholds and management actions	Distribution of sagebrush within occupied habitat		WAFWA Management Zone population level and population trends
Mid Scale: From WAFWA Management Zone scale, subpopulation, and PAC scale	RMP/LMP management, vegetation/ mid scale management direction	Percent of sagebrush per unit area, anthropogenic footprint, density of energy development	Sagebrush patch characteristics, sage-grouse habitat indicators	Subpopulation scale, dispersal and lek complex trends

E.1.2 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 the Existing Vegetation Type (EVT) layer in LANDFIRE (2006). LANDFIRE EVT was selected to serve as the base sagebrush layer for five reasons: 1) it is the only nationally consistent vegetation layer that has been updated since 2001; 2) the ecological systems classification includes multiple sagebrush type classes that, when aggregated, provide more accurate (compared to individual classes) and seamless sagebrush base layer across jurisdictional boundaries; 3) LANDFIRE performed a vigorous spatial accuracy assessment from which to derive the range-wide uncertainty of the base map 4) LANDFIRE EVT can be compared against the geographic extent of land that has the capability to support sagebrush vegetation using LANDFIRE Biophysical Setting (BpS) to provide a reference point for understanding how much sagebrush can be supported in a defined geographic area, and 5) LANDFIRE is consistently used in several recent analyses of sagebrush habitats (Knick et al, 2011; Leu and Hanser 2011; Knick and Hanser 2011). The BLM has determined that LANDFIRE provides the best available data at broad and mid scales to serve as an initial base layer for monitoring habitat characteristics and by which disturbance changes are measured, incorporated, and reported. Along with the aggregated sagebrush base map, the BLM will aggregate the accuracy assessment reports from LANDFIRE to document the cumulative accuracy for our final base map. The BLM, through its AIM program and specifically the Landscape Monitoring Framework, will provide field data to the LANDFIRE program to support overall accuracy improvements in their products over the long term.

Figure E.1
Map of Greater Sage-Grouse Range, Populations, Subpopulations and Priority Areas for Conservation (PACs).



Within National Forest System land and isolated areas of BLM-administered land, forest-wide and field office-wide existing vegetation classification mapping and inventories are available that provide a much finer level of data than provided through LANDFIRE. Where available, these products are useful below the mid scale for establishing baseline conditions for monitoring. The fact that they are not available everywhere however limits their utility for monitoring at the broad and mid scale where consistency of data products is necessary regardless of land ownership.

The BLM is improving the quality of vegetation map products for broad and mid scale analyses through the Grass/Shrub mapping effort in partnership with the Multi-Resolution Land Characteristics Consortium (MRLC). The Grass/Shrub mapping effort applies the Homer et al. (2009) methodology to spatially depict fractional percent cover estimates for four components range and west-wide. These four components are the percent cover of sagebrush vegetation, percent bare ground, percent herbaceous vegetation (grass and forbs combined), and percent shrubs. One of the benefits of the design of these fractional cover maps is that they facilitate monitoring "with-in" class variation. This "with-in" class variation can serve as one indicator of sagebrush quality that we cannot derive from vegetation type information from LANDFIRE.

The base sagebrush layer, whether derived from LANDFIRE or Grass/Shrub, will allow for estimation of mid scale indicators, e.g. patch size and number, patch connectivity, linkage areas, and landscape matrix and edge effects (Stiver et al. 2010). The actual methods used to calculate these metric will be derived from existing literature (Knick et al, 2011, Leu and Hanser 2011, and Knick and Hanser 2011). Disturbance updates, generated annually, will be included into the base layer and the landscape metrics will be recalculated to examine changes in pattern and abundance of sagebrush at the various geographic boundaries. The appropriate geographic boundaries for this base layer include the range, management zone, population, subpopulation, and PAC. Other data sources would need to be used to report landscape metrics any finer than the PAC.

The sagebrush base layer and disturbance data provide the ability to calculate landscape metrics as one element of habitat monitoring at the broad and mid scales. Habitat quality, however, will be monitored using field data collected with a statistically valid sampling design (e.g., Landscape Monitoring Framework, a collaborative effort with NRCS on BLM lands (USDI-BLM 2011); AIM monitoring data (Toevs et al. 2011); and see "II. Fine and Site Scales"). These efforts can quantify indices such as percent annual grasses, species composition, sagebrush height, and bare ground at the PAC scale with known error estimates that are continually reduced as more data are collected. Point data will also be used to enhance the accuracy and precision of the Shrub/Grass mapping product. This product can in turn provide additional information about habitat quality at the mid scale. Long-term, BLM will be able to provide a suite of monitoring metrics for the PACs and larger scales that will provide a comprehensive view of sagebrush and sage-grouse habitat condition when combined with population data supplied by the states.

E.1.3 Habitat (Disturbance) Monitoring

Most of the management actions in this land use plan 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 GRSG (75 *Federal Register* 13910 2010). The USFWS identified several

"threats" affecting Factor A. 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 data will include:

- Agriculture
- Urbanization
- Habitat treatments
- Wildfire
- Invasive plants
- Conifer encroachment
- Energy (oil and gas wells and development facilities)
- Energy (coal mines)
- Energy (wind towers)
- Energy (solar fields)
- Energy (geothermal)
- Mining (active developments; locatable, leasable, saleable)
- Infrastructure (roads)
- Infrastructure (railroads)
- Infrastructure (power lines)
- Infrastructure (communication towers)
- Infrastructure (other vertical structures)
- Other developed rights-of-way

Cumulative disturbance monitoring will aggregate these 18 threats into the following three general measures (see Attachment A):

- Percent of sagebrush per unit area
- Percent of non-habitat (human footprint) per unit area
- 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 previously in **Section E.1.2**, Habitat (Vegetation) Monitoring. Restored areas will also be considered when evaluating the percentage of sagebrush on the landscape.

Next, the BLM and Forest Service will use the best available range-wide data (external and/or internal data) to evaluate anthropogenic and natural disturbances (direct physical footprint) of

sage-grouse habitat based on threats listed in Factor A. The Sage-Grouse Baseline Environmental Report (BER; Manier et al. 2013) essentially provided a baseline collection of datasets across jurisdictions where available, however for some threats, the data were for federal lands only. Most of the data used in the BER were from external data sources. The BLM will use the most currently available versions to evaluate changes (additional footprints) from the baseline dataset. A subset of these data (e.g. fire perimeters, 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. The BLM will report the change in footprints for each of the 18 threats as well as cumulatively for the three general measures described previously.

E.1.4 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 that WAFWA will coordinate collection of annual population data by state agencies. To establish certainty that the data will be provided to the BLM and the Forest Service, 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) could be revised to outline collaboration, process, and responsibilities for data analysis and transfer related to management of sage-grouse. These population data will be used for analysis at the applicable scale to supplement habitat effectiveness monitoring of management actions.

E.1.5 Effectiveness Monitoring

The BLM and the Forest Service will analyze the monitoring data to characterize the relationship among the disturbance, implementation actions, and habitat condition at the appropriate and applicable geographic scale or boundary to accomplish effectiveness monitoring for the Utah Greater Sage-Grouse LUPA/EIS. This will involve evaluating the change in habitat conditions from the baseline conditions in relation to the goals and objectives of the plan and other rangewide conservation strategies (DOI 2004; Stiver et al. 2006; USFWS 2013). When available from WAFWA and/or state wildlife agencies, effectiveness monitoring can be supplemented with population trends (taking into consideration the lag effect response of populations to habitat changes [Garton et al. 2011]). The compilation of broad and mid scale data (and population trends as available) will be on a 5-year reporting schedule or as needed to respond to emerging issues. In addition, effectiveness monitoring will be used to identify emerging issues and research needs and will be consistent with and inform the BLM and the Forest Service adaptive management strategy (see **Section 2.3**, Adaptive Management).

E.2 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, and 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 monitoring at these two scales will be determined during implementation of the Utah Greater Sage-Grouse LUPA/EIS. The need for fine- and site-scale specific habitat monitoring will vary by area depending on proposed projects, existing conditions, habitat variability, threats, and land health. For example, implementation monitoring will track management 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 (e.g., some RMP/LMP objectives, activity plans, development plans, and leasing plans).

Habitat indicator data collected at the fine and site scales will be consistent with the HAF and information provided in the sage-grouse guidelines (Connelly et al. 2000) as well as the core indicators in the assessment, inventory and monitoring (AIM) strategy (Toevs et al. 2011), and applicable Forest Service monitoring techniques. However the metrics for quantifying the indicators can be adjusted for local conditions. If local adjustments to metrics are made, the adjustments will be appropriate to the floristic province/sage-grouse management zone where the data were collected and reflect local plant productivity and sage-grouse habitat data collected within the area. In short, adjustments will be science-based (i.e., predicated on data collected locally and published in a peer-review outlet) and ecologically defensible (i.e., generally supported by the broad base of knowledge on sagebrush and sage-grouse provided in the peer-review literature). When evaluating the land health habitat standard in designated sage-grouse habitats, the BLM will analyze core indicators and other supplemental site scale sage-grouse habitat indicators (see HAF) 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 and habitat quality 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 (http://ddct.wygisc.org/) and the BLM White River Data Management System (WRDMS) in development with the USGS.

E.3 FINAL MONITORING PLAN

This draft monitoring framework was developed for draft EISs 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 Utah Greater Sage-Grouse LUPA/EIS Sage-grouse Monitoring Plan.

E.4 LITERATURE CITED

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ATTACHMENT A. Geospatial data layers 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 (wind towers)		X	X
Energy (solar fields)		X	X
Energy (geothermal)		X	X
Mining (active locatable, leasable, and salable developments)		X	
Infrastructure (roads)		X	
Infrastructure (railroads)		X	
Infrastructure (power lines)		X	
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Other developed rights-of-way		X	

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