Appendix J

Adaptive Management Plan

APPENDIX J
ADAPTIVE MANAGEMENT PLAN

Adaptive management is a decision process that promotes flexible resource management decision-making. These decisions can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Carefully monitoring these outcomes both advances scientific understanding and helps with adjusting resource management directions as part of an iterative learning process.

On February 1, 2008, the Department of the Interior published its Adaptive Management Implementation Policy (522 DM 1). The Forest Service adaptive management direction is FSH 1909.12 Ch. 20, FSM 1920, and 36 CFR, Part 219.6. The adaptive management strategy presented in this Proposed LUPA/Final EIS complies with this policy and direction.

In relation to the BLM's and Forest Service's National Greater Sage-Grouse Planning Strategy, adaptive management would help identify if GRSG conservation measures presented in this Proposed LUPA/ Final EIS contain the needed level of certainty for effectiveness. Principles of adaptive management are incorporated into the conservation measures in the plan to lessen threats to GRSGs and their habitat, thereby increasing the likelihood that the conservation measures and plan would be effective in reducing threats to them.

The following provides the BLM's and Forest Service's adaptive management strategy for the Nevada and Northeastern California Greater Sage-Grouse Sub-region Proposed LUPA/Final EIS.

This Proposed LUPA/Final EIS contains a monitoring framework plan (**Appendix E**) that includes an effectiveness monitoring component. The agencies intend to use the data collected from the effectiveness monitoring to identify any changes in habitat conditions related to the goals and objectives of the plan and other range-wide conservation strategies (DOI 2004; Stiver et al. 2006; USFWS 2013). The BLM and Forest Service will use the information collected through the monitoring framework plan outlined in **Appendix E** to determine when adaptive management hard and soft triggers are met (see below).

The BLM and Forest Service cooperated with the Nevada SETT, NDOW, CDFW, and USFWS, along with GRSG research scientists from the USGS and the University of Nevada Reno in developing the adaptive management triggers, definitions, and methods of calculating population and habitat trends.

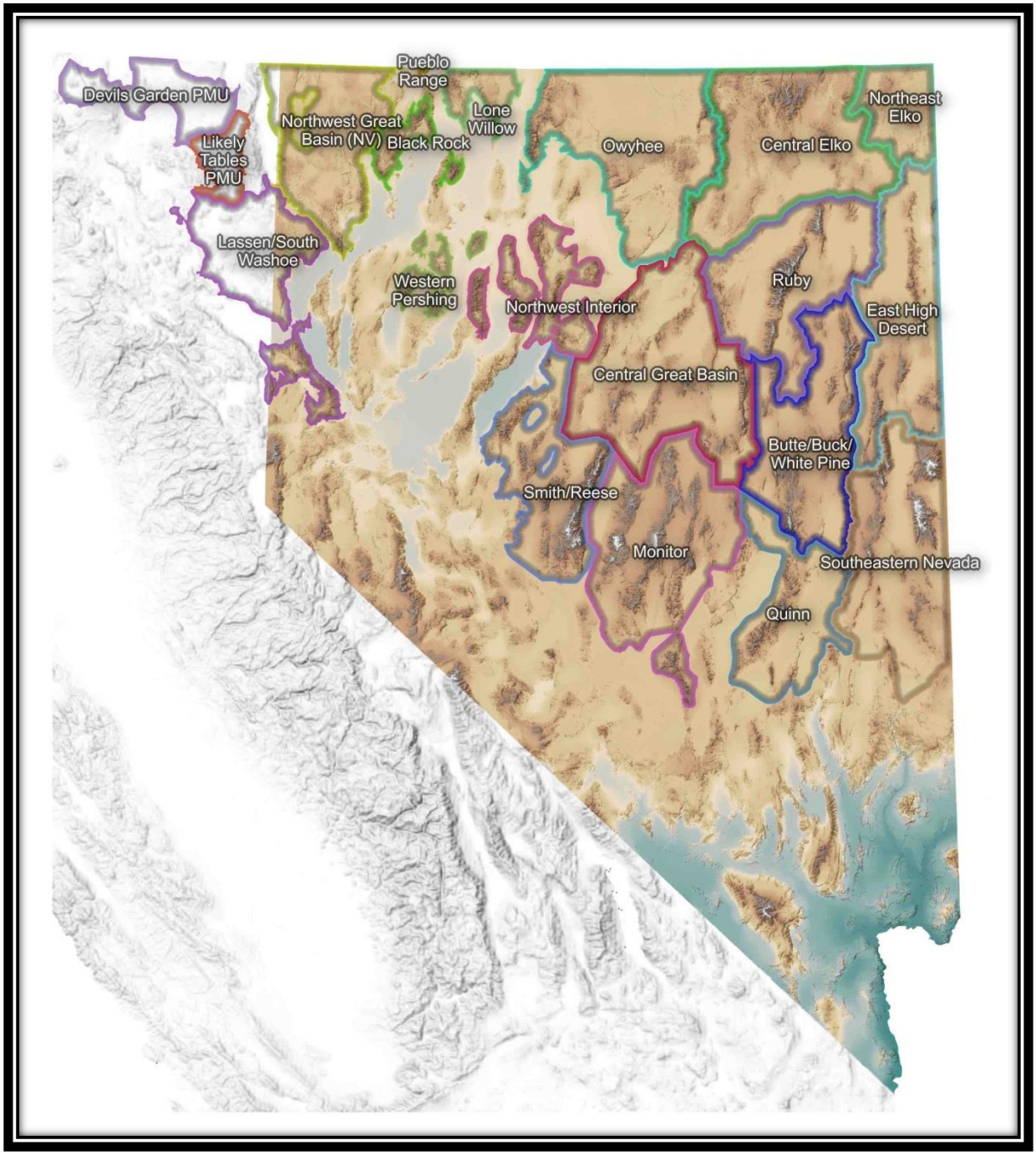
ADAPTIVE MANAGEMENT APPLICATION SCALE AND REPORTING UNITS

The scale used to monitor for application of the adaptive management triggers are the Biological Significant Units (BSUs; **Map J-1**) developed in collaboration with the Nevada SETT, NDOW, CDFW, and USGS. These areas represent local GRSG population use areas in the sub-region. The monitoring data on population and habitat can be aggregated up to the population, WAFWA management zone, or other reporting units, such as priority areas for conservation (PACs). Likewise, finer-scale management adjustments can be applied at the lek cluster-scale using population responses and triggers. The boundaries of the BSUs, lek clusters, and other reporting units may be adjusted over time, based on the understanding of local population interactions, genetic sampling and climate variation. Population monitoring methods may be updated based on new science and advances in technology (e.g., integrated population models).

Applying adaptive management responses once a soft or hard trigger is reached will be at the BSU or a finer scale, as detailed below. The hierarchy of GRSG population and habitat scales is as follows:

- Lek—Individual breeding display sites where male and female GRSGs congregate, with males performing courtship displays to gain mating opportunities with females.
- Lek cluster—A group of leks in the same vicinity, between which GRSG may interchange over time and representing a group of closely related individuals. Agencies may revise the lek clusters listed above, based on new data.
- Population management units (PMUs)—Areas delineated based on aggregations of GRSG lek locations, where the potential for genetic interchange (short-term) among populations is high.
- BSU—Based on the PMUs (defined above) where GRSG interactions have been documented between two or more PMUs and represent local GRSG population habitats and seasonal use areas in the sub-region.
- WAFWA Management Zones (MZ)—Determined by GRSG populations and sub-populations identified in seven floristic provinces (Connelly et al. 2004). Floristic provinces reflect ecological and biological issues and similarities, not political boundaries. The vegetation communities and management challenges found in the floristic provinces in an MZ are similar, and GRSGs and their habitats are likely to respond similarly to environmental factors and management actions.

Map J-1 Biological Significant Units for GRSG in the Nevada and Northeastern California Sub-region



Source: NDOW 2015

ADAPTIVE MANAGEMENT TRIGGERS—PROJECT SCALE

Soft Triggers

Soft triggers represent an intermediate threshold indicating that management changes are needed at the project/implementation level to address GRSG habitat and population losses. If a soft trigger is reached, the BLM or Forest Service would apply additional mitigation measures to alleviate the specific or presumptive causes in the decline of GRSG populations or its habitats with consideration of local knowledge and conditions.

The application of population triggers can be illustrated in the following scenario:

A soft trigger would be reached if, when an authorized project is implemented, the results of population monitoring reveal there is a decrease in male attendance at a lek in the project area, as compared to adjacent or trend leks.[1] This would initiate a project design response and require the modification of or additional mitigation to the project.[2] For example, if the data were to suggest the decline may be attributed to GRSG collisions with monitoring tower guy wires associated with the project, the BLM would modify the current authorization to apply an identified adaptive management response, which would be to flag the guy wires.

When the BLM receives a new application for a proposed monitoring tower in the same GRSG population area, it would require the new authorization's monitoring tower guy wires to be flagged. These types of adjustments would be made to preclude reaching a hard trigger (which signals more severe GRSG habitat loss or population declines). While there should be no expectation of hitting a hard trigger, if unforeseen circumstances occur that trip either a habitat or population hard trigger, more restrictive management would be required.

Hard Triggers

Hard triggers represent a threshold indicating that immediate action is necessary to stop a severe deviation from GRSG conservation goals and objectives, as set forth in the BLM and Forest Service plans.

If soft triggers are hit for both GRSG populations and its habitat, this would result in a hard trigger response for the BSU.

POPULATION TRENDS FOR TRIGGERS

Counts of male GRSGs attending breeding leks provide reliable data for analyzing population growth trends (Fedy and Aldridge 2011). Lek counts can inform statistical estimation of population growth rates (see below) at each scale. "Trend leks" have been identified by NDOW, USGS and CDFW within each BSU. Trend leks are monitored consistently each year and have more available data than adjacent leks within the BSU. These trend leks will be used to estimate the population trends/averages within each

[1]Thresholds regarding soft and hard triggers for GRSG populations are identified below under Population Hard and Soft triggers.

[2]The specific response would be identified as a project adaptive management response. If the project authorization does not include an adaptive management strategy, adjustments of the proposal could be limited. All projects implemented consistent with the GRSG LUPA/FEIS would contain a project-specific adaptive management strategy (response).

BSU. Triggers for changes in population growth will be evaluated at three scales: individual lek (smallest scale), lek cluster, and BSU (largest scale).

Lek cluster delineations may be determined by movement data from radio-marked GRSG when available and by ongoing and future genetic analyses when results are provided. Lek clusters may be separated from each other by physical barriers to dispersal (e.g., mountain ranges and expansive salt flats). Hence, lek clusters take into account spatial connectivity and are associated with high probabilities of GRSG movement among individual leks. However, emerging science associated with genetic analysis may allow for a more comprehensive demonstration of population connectivity or fragmentation. Analyses are being conducted and may be incorporated when available. Estimates for lek clusters may then be scaled up to inform regional population trends at the BSU scale.

Analyses of population changes at the three scales allow for detailed examination of how and where changes are occurring (for example, individual leks describe site-level changes, lek clusters describe local population changes, and BSUs describe changes relative to variation in climate within the sub-region.

These scales are compared at immediate hierarchical levels (i.e., lek to lek cluster, lek cluster to BSU, BSU to MZ) to decouple the trend and subsequent soft and hard triggers at the appropriate hierarchy at which adaptive management actions will be applied. This approach maximizes the level of inference that can be drawn at each scale because it allows information from leks with larger amounts of available data (trend leks) to inform estimates from lek clusters where data are sparse, which in turn provides greater precision to sub-regional (BSU) estimates.

Comparison across regions can also be conducted while accounting for different climatic effects at the lek cluster scale. Trends at the BSU are measured against trends at the MZ for distinguishing local effects from other extrinsic influences (e.g., climate change).

POPULATION GROWTH RATE CALCULATIONS FOR TRIGGERS

GRSG state-space models (Coates et al. 2014) will be used to estimate the rate of GRSG population growth (increase or decrease in population numbers) and the number of males at individual lek, lek cluster, BSU, and MZ scales. Lek count data collected by NDOW and CDFW from 2000 to present will be used in the model. Some lek clusters may need additional monitoring to gain adequate sampling data in order to be modeled, although the state-space model method will incorporate uncertainty levels from limited samples into each analysis and in threshold determinations (Coates et al. 2014).

POPULATION HARD AND SOFT TRIGGERS

Modeled growth rates from GRSG population estimates will be calculated at the relevant management level annually as lek data are finalized by the state wildlife management agencies. The GRSG state-space model will be used to establish population growth rates using lek data in BSUs for the sub-region. When lek cluster data is adequate, the same method may be applied at the individual lek (i.e., when individual lek triggers are reached) or the local population (i.e., when lek cluster triggers are reached) to provide adaptive management strategies at the most appropriate scales.

Specific triggers at each GRSG population scale (Coates et al. in prep) are as follows:

1. Individual lek;
    a. Two criteria are needed to reach a soft trigger.
        i. The population rate of change of a lek is less than 0.85-0.95 for two consecutive years; and
        ii. The population rate of change of the lek in relation to the lek cluster reference is less than 0.85-0.95 for both years.
    b. Two criteria are needed to reach a hard trigger:
        i. The population rate of change of a lek is less than 0.01-0.15 for one year; and
        ii. The population rate of change of the lek in relation to the lek cluster is less than 0.01-0.15 for one year.
    c. Three consecutive soft triggers will result in a hard trigger.
    d. The causal factor(s) evaluation area is the GRSG seasonal habitats and use areas associated with the lek (Space Use Index [SUI]; Coates 2014). If the seasonal habitats have not been defined, then the SUI would be applied.
    e. The trigger response area is the GRSG seasonal habitats and use areas associated with the lek that is specifically affected by the causal factor(s). If the seasonal habitats have not been defined, then the SUI would be applied.
2. Lek cluster (project level)
    a. Two criteria are needed to reach a soft trigger:
        i. The population rate of change of the lek cluster is less than 0.90 for two consecutive years; and
        ii. The population rate of change of the lek cluster in relation to the BSU is less than 0.90 for both years.
    b. Two criteria are needed to reach a hard trigger:
        i. The population rate of change of the lek cluster is less than 0.10 for one year; and
        ii. The population rate of change of the lek cluster in relation to the BSU is less than 0.10 for one year.
    c. Three consecutive soft triggers would result in a hard trigger.
3. BSU (sub-regional scale)
    a. Two criteria are needed to reach a soft trigger.
        i. The population rate of change within the BSU is less than 0.90 for two years; and
        ii. The population change of the BSU in relation to the MZ is less than 0.90 for both years.

b. Two criteria are needed for a hard trigger.

   i. The population rate of change is less than 0.10 for one year; and

   ii. The population rate of change in relation to the MZ is less than 0.10 for one year.

c. Three consecutive soft triggers would result in a hard trigger.

The rate of GRSG population decline and the time frame over which populations are evaluated would be monitored and adjusted as understanding of GRSG population thresholds emerge. The BLM, Forest Service, NDOW, USGS, and CDFW would pursue a program to collect and incorporate additional demographic data into the GRSG space-use model.

HABITAT TRENDS FOR TRIGGERS

Triggers for habitat trend would be evaluated at the lek and BSU scales. Lek scale trends incorporate the project boundary and adjoining GRSG seasonal habitats. The adjoining GRSG seasonal habitat is defined as the GRSG habitat and use areas within four miles of the disturbance perimeter, unless otherwise specified in an accepted protocol. Site-level habitat trends would be based on changes in habitat components using the methods in the HAF. These changes would be compared to the GRSG habitat objectives in Table 2-2 of the Final EIS.

The BSUs would be based on the percentage of sagebrush cover across the landscape. The categories of the percent landscape sagebrush cover that would apply are the 25 to 65 percent level and the above 65 percent level, as identified in the Matrix Based on Concepts of Resistance and Resiliency (Chambers et al. 2014).

HARD AND SOFT HABITAT TRIGGERS

Habitat trends would be evaluated by changes in GRSG habitat characteristics identified in the GRSG habitat objectives (see Table 2-2 of the Final EIS) and the percent of landscape sagebrush cover.

1. At the lek or lek cluster, if the habitat disturbance were to exceeds five percent of any individual GRSG seasonal habitat component used by the local population, then a soft trigger would be hit; if the disturbance exceeds 10 percent, than a hard trigger would be hit.
2. At the BSU, the two components would have separate triggers.
   a. In areas with 25 to 65 percent sagebrush cover, if there were a decline in sagebrush cover of 2 percent, then a soft trigger would be hit. A hard trigger would be hit if there were a decline of 5 percent or greater of sagebrush cover or if the disturbance were to reduce the landscape sagebrush cover below 30 percent.
   b. In areas with greater than 65 percent landscape sagebrush cover, a soft trigger would be hit if there were a decline of 5 percent in landscape sagebrush cover. A hard trigger would be hit if there were a decline of 10 percent or greater in landscape sagebrush cover or if the disturbance were to reduce the landscape sagebrush cover below 70 percent.

SOFT AND HARD TRIGGER RESPONSES

Soft Trigger Responses

When a soft trigger is reached, the causal factor would be identified and management actions would be adjusted to lessen the cause by applying project-level adaptive management contained in the authorization and for future similar authorizations. The adjustment in management would be based on the causal factor and would affect only the area being impacted in the lek cluster or appropriate scale. GRSG populations and habitat would continue to be monitored annually. If the causal factor were not readily discernable, then an interdisciplinary team, including the BLM, Forest Service and state wildlife agency representative, would identify the appropriate mitigation or adjusted management actions in a timely manner.

Hard Trigger Responses

When a hard trigger is reached due to a disturbance (anthropogenic, fire, drought, etc.), more restrictive allocations and/or management actions would be implemented within the BSU.

Specific hard trigger responses due to anthropogenic disturbances are identified in **Table J-1** and **Table J-2**.

Table J-1
Hard Trigger Responses in PHMAs Under the Proposed Plan

Program	Proposed Plan Allocation	Adaptive Management Response
Land use authorizations—existing corridors	Open	Manage as a ROW avoidance area.
Land use authorizations—major outside corridors	Avoidance areas for all major ROWs	Management of the affected BSU would change to exclude high voltage transmission lines (≥100 kV) and major pipelines (≥24 inches).
Land use authorizations—minor ROWs outside corridors	Avoidance areas for all minor ROWs	Limit ROW authorizations, leases, and permits to those needed for public safety and valid existing rights.
Wind energy development	ROW exclusion for utility-scale commercial wind energy facilities.	No change
Industrial solar	ROW exclusion for utility-scale solar energy facilities.	No change
Fluid minerals (Oil, gas, and geothermal in California) (Oil and gas in Nevada)	• In SFAs, manage as NSO with no waiver, exception, or modification. • In PHMAs outside of SFAs, manage as NSO, with two limited exceptions.	• No change • Manage as NSO, with no waivers, exceptions, or modifications.
Fluid minerals (Geothermal in Nevada)	• In SFAs, manage as NSO with no waiver, exception, or modification. • In PHMAs outside SFAs, manage as NSO with three specific limited exceptions.	• No change • Manage as NSO, with no waivers, exceptions, or modifications.
Locatable minerals	In SFAs, recommended for withdrawal; manage locatable mineral development to minimize effects on GRSG habitat.	No change

Table J-1
Hard Trigger Responses in PHMAs Under the Proposed Plan

Program	Proposed Plan Allocation	Adaptive Management Response
Salable minerals	Closed to new mineral disposal.	No change
Nonenergy leasable minerals	Closed to new nonenergy leasable mineral leasing.	No change
Vegetation management	Identify and prioritize landscape-scale enhancement, restoration, fuels reduction, and mitigation projects based on ecological site potential, state and transition models, and other data that would contribute to decision-making informed by science to increase rangeland resilience before and following wildfire.	BSUs where a hard trigger has been reached would be the first priority for regional mitigation habitat restoration and fuels reduction treatments.

Table J-2
Hard Trigger Responses in GHMAs Under the Proposed Plan

Program	Proposed Plan Allocation	Adaptive Management Response
Land use authorizations—existing corridors	Open to new uses.	Manage as ROW avoidance area.
Land use authorizations—major ROWs outside corridors	Avoidance areas for wind, high-voltage transmission lines, and major pipeline ROWs.	Manage affected BSU as exclusion for high-voltage transmission lines (≥100 KV), major pipelines (>24 inches), and wind energy.
Land use authorizations—minor ROWs outside corridors	Open for minor ROWs.	Manage as avoidance area for ROWs, leases, and permits.
Wind energy development	ROW avoidance for utility-scale commercial wind energy facilities.	Manage as exclusion for utility-scale commercial wind energy facilities.
Industrial solar	ROW exclusion for utility-scale solar energy facilities.	No change
Fluid minerals	Apply moderate stipulations (CSU and TL).	Apply an NSO stipulation, with limited exceptions.
Locatable minerals	Manage locatable mineral development to minimize effects on GRSG habitat.	No change
Salable minerals	Open to new mineral disposal.	Manage as closed to new mineral disposal.
Nonenergy leasable minerals	Open to new nonenergy leasable mineral leasing.	Manage as closed to new nonenergy leasable mineral leasing.
Vegetation management	Identify and prioritize landscape-scale enhancement, restoration, fuels reduction, and mitigation projects, based on ecological site potential, state and transition models, and other data that would contribute to decision-making informed by science to increase rangeland resilience before and following wildfire.	BSUs where a hard trigger has been reached would be the first priority for regional mitigation habitat restoration and fuels reduction treatments.

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