

APPENDIX J

ADAPTIVE MANAGEMENT STRATEGY

INTRODUCTION

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

Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a trial and error process, but rather emphasizes learning while doing. It is not an end in itself, but rather a means to more effective decisions and enhanced benefits.

On February 1, 2008, the Department of the Interior published its Adaptive Management Implementation Policy (522 DM 1) and in 2009 a technical guide (Williams et al. 2009). The adaptive management strategy in this EIS complies with this policy and direction.

In relation to the BLM and Forest Service's National Greater Sage-Grouse Planning Strategy (BLM 2012), adaptive management will help identify if GRSG conservation measures in this EIS contain the needed level of certainty for effectiveness. Incorporating principles of adaptive management into the conservation measures in this plan amendment increases the likelihood that the conservation measures will be effective in reducing threats to GRSG.

The following provides the adaptive management strategy for the Oregon Subregion RMP Amendment.

ADAPTIVE MANAGEMENT OBJECTIVES

The overarching goal for this RMP amendment is to maintain or increase GRSG abundance and distribution by conserving, enhancing, or restoring the sagebrush ecosystem on which populations depend, in cooperation with other landowners and partners. This strategy has two overarching objectives:

- Habitat—Seventy percent of the landscape within each Oregon PAC¹ that is capable of supporting sagebrush has at least five percent sagebrush canopy cover² and less than five percent tree canopy cover. The remaining 30 percent can include areas of juniper encroachment, non-sagebrush shrubland, and grassland that should be managed to increase available habitat within GRSG range.
- Population—GRSG population trends within Oregon PACs as indicated by counts of males at lek complexes are stable or growing.³

Project-level effects analysis will identify an individual project's contribution toward either objective and whether a given project, as initially designed, would fail to meet either the habitat or population objective above, thus tripping an adaptive management trigger. When an individual project would trip a trigger, the project proponent should consider modifying the project to avoid tripping the trigger, dropping the project, or providing mitigation to address the trigger along with justification for why the project should proceed.

ADAPTIVE MANAGEMENT THRESHOLDS (TRIGGERS)

Adaptive management triggers are essential for identifying when potential management changes are needed to continue meeting GRSG conservation objectives. The BLM will use soft triggers and hard triggers for specific populations and responses. These triggers are not specific to any particular project but identify habitat and population thresholds.

Soft triggers represent an intermediate threshold, indicating that management changes are needed at the implementation level to address habitat or population losses. If a soft trigger is tripped, the BLM would apply more conservative or restrictive implementation (project-level) conservation measures to mitigate for the causes of the decline of populations or habitats, with consideration of local knowledge and conditions.

These types of adjustments would be made to reduce the likelihood of tripping a hard trigger, which signals more severe habitat loss or population declines. While there should be no expectation of hitting a hard trigger, if unforeseen circumstances were to occur that trip either a habitat or population hard trigger, more restrictive management would be required.

Hard triggers represent a threshold indicating that immediate and more restrictive plan-level action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the resource management plan amendment. What follows are the adaptive management hard and soft triggers (thresholds).

¹ Oregon Department of Fish and Wildlife, in cooperation with the SageCon Partnership, grouped the PACs within a WAFWA population initially created by the USFWS (2013a) into 20 individual units and gave each a unique name. The BLM Oregon refers to these units as Oregon PACs.

² While minimum sagebrush cover for productive GRSG habitat is 10 percent (Connelly et al. 2000), the vegetation and habitat management objective is based on providing sagebrush structural classes 3, 4, and 5 (Karl and Sadowski 2005; Hagen 2011). Class 3 is greater than 5 percent to 15 percent sagebrush canopy cover.

³ For smaller Oregon PACs, the only applicable scale may be the entire PAC. For larger Oregon PACs, both scales may apply.

Habitat Trigger Thresholds

Two critical thresholds have been defined, based on GRSG response to the amount of sagebrush in the landscape (Chambers et al. 2014b), as follows:

- Soft trigger—When the area with at least 5 percent sagebrush canopy cover and less than 5 percent tree canopy cover (Baruch-Mordo et al. 2013) drops below 65 percent of the sagebrush capable area within an individual Oregon PAC but remains above 30 percent (see also **Figure 2-3**)
- Hard trigger—When the area with at least 5 percent sagebrush canopy cover and less than 5 percent tree cover drops below 30 percent of the sagebrush capable area within an individual Oregon PAC or when the area supporting at least 5 percent sagebrush canopy cover and less than 5 percent tree cover drops 5 percent or more in one year in the sagebrush capable area of an Oregon PAC (see also **Figure 2-3**)

The above percentages are based on the area within each Oregon PAC that is capable of producing a sagebrush plant community, such as big sagebrush (*Artemisia tridentata*), low sagebrush (*A. arbuscula*), silver sagebrush (*A. cana*), threetip sagebrush (*A. tripartita*), black sagebrush (*A. nova*) and stiff sagebrush (*A. rigida*) community types. Other plant community types within each Oregon PAC, such as salt desert scrub, mountain brush, aspen, marsh, and historical juniper woodland, are not included in the calculations.

Table J-1 lists the percentage of each Oregon PAC that currently supports sagebrush cover equal to or greater than 5 percent and tree cover less than 5 percent. These data were derived from two datasets developed by the Integrated Landscape Analysis Program (ILAP 2013). Current vegetation is derived from 2011/2013 Landsat Thematic Mapper data, updated with information obtained from newer, post-fire plots and imagery, including the large areas burned in 2012.

Potential vegetation types developed from state-and-transition models include burned areas, juniper encroachment, crested wheatgrass plantings, agriculture, and other vegetation types capable of supporting sagebrush but not currently suitable for GRSG.

Population Trigger Thresholds

The BLM based the population thresholds on both interannual changes and a five-year running mean in the estimated minimum number of males. It used the state-provided data on lek counts and procedures similar to what the ODFW uses to fill in missing data and to estimate the minimum number of male birds each year (see *Population Analysis Process* for a detailed description).

Although the ODFW has GRSG population estimates as far back as the 1940s (Hagen 2011, p. 18), only a small number of leks were monitored prior to the 1980s. Monitored leks did not exceed 100 until the 1990s and now approach 300 leks or lek complexes per year. By the mid-1990s, the ODFW considered the data robust enough to calculate five-year running means. Data quantity and quality are sufficient to calculate this for most Oregon PACs, although data remain limited for a small number of Oregon PACs. Available data for the Burns PAC is too sparse to draw any conclusions about current populations or population trends. The Louse Canyon and Trout Creeks PACs do not have enough data to develop five-year running means, requiring that the BLM use only a limited level of interannual change to assess population status. As a result, the BLM developed a special hard trigger based on annual population trends for these two PACs.

Table J-1
Acres and Percent of Existing and Potential Sage-grouse Habitat in Oregon PACs as of 2014

Oregon PAC	Existing Habitat Acres			Potential Habitat Acres			Total Habitat Acres	Total PAC Acres
	BLM	Other	Percent	BLM	Other	Percent		
12 Mile	113,751	220,890	83.2	25,643	41,866	16.8	402,149	431,001
Baker	89,980	153,279	75.9	20,807	56,627	24.1	320,693	336,539
Beatys	496,470	262,261	93.2	24,944	30,228	6.8	813,903	840,792
Brothers/N Wagonire	164,003	71,370	86.5	18,463	18,382	13.5	272,218	293,461
Bully Creek	145,164	48,232	73.1	51,895	19,281	26.9	264,571	279,854
Burns	13,440	8,684	68.4	6,621	3,619	31.6	32,364	35,769
Cow Lakes	115,916	33,176	62.1	67,007	24,057	37.9	240,156	249,732
Cow Valley	71,242	229,366	83.2	16,003	44,823	16.8	361,433	368,615
Crowley	314,003	82,832	81.7	68,787	20,107	18.3	485,730	491,050
Drewsey	146,114	103,072	74.4	43,038	42,677	25.6	334,901	368,707
Dry Valley/ Jack Mtn.	323,954	11,111	75.1	102,374	8,737	24.9	446,175	449,389
Folly Farm/ Saddle Butte	129,440	29,802	68.5	58,442	14,696	31.5	232,381	251,558
Louse Canyon	475,389	28,097	71.4	192,900	8,930	28.6	705,317	707,150
Picture Rock	28,084	3,416	84.7	4,828	870	15.3	37,199	42,592
Pueblos/ S Steens	126,359	53,502	87.5	15,844	9,844	12.5	205,549	208,793
Soldier Creek	166,261	46,270	73.5	59,775	16,667	26.5	288,973	295,424
Steens	80,322	26,415	64.3	53,004	6,323	35.7	166,064	185,730
Trout Creeks	195,719	17,428	62.1	120,114	10,052	37.9	343,312	358,167
Tucker Hill	14,985	12,229	89.5	1,027	2,159	10.5	30,401	31,531
Warners	199,202	54,354	80.4	42,391	19,568	19.6	315,515	330,088
Total	3,409,798	1,495,787	77.9	993,906	399,513	22.1	6,299,004	6,555,941

Source: ILAP 2013

The hard and soft trigger thresholds calculated using data through 2014 will remain fixed for a minimum of five years. After that, the BLM, ODFW, and USFWS will evaluate whether these values should be recalculated and new thresholds established. Establishing new thresholds may require a plan amendment.

Based on observed fluctuations in both annual population and the five-year running mean of population (**Figure J-1**), the following soft and hard triggers have been defined:

- Soft trigger (all PACs)
 - Annual population drops by 40 percent or greater in a single year OR
 - Annual population drops by 10 percent or greater for three consecutive years OR

- The five-year running mean population drops below the lower 95 percent confidence interval value
- Hard trigger
 - For PACs with adequate population data, the five-year running mean population drops below the lower standard deviation value
 - For PACs with inadequate population data (Louse Canyon and Trout Creeks), the annual population declines by a total of 60 percent or more over two consecutive years
 - When soft triggers for both population and habitat are met within the same PAC

For the five-year running mean criteria, the population trigger would be tripped the first year the mean dropped below the identified threshold. Generally, the trigger response area would be the seasonal habitat and use locations within four miles of the lek or lek complex specifically affected or the entire Oregon PAC, depending on the size and the percentage of the PAC affected. However, the response area, with the exception of the immediate hard trigger responses, could include the GHMA linking the affected Oregon PAC to the nearest unaffected Oregon PAC, as needed.

MONITORING

Monitoring is essential to adaptive management, both to identify when a trigger has been tripped and whether management actions taken, including adaptive responses, are effective. This ARMPA/EIS contains a monitoring framework plan (**AppendixD**, Greater Sage-Grouse Monitoring Framework), that includes an effectiveness monitoring component.

To determine when a soft or hard trigger for habitat has been reached, the BLM intends 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 (US DOI 2004; Stiver et al. 2006; USFWS 2013a). The BLM intends to use the remotely sensed data collected from the effectiveness monitoring at the mid-scale (Oregon PAC), supplemented with local data where needed and available at the lek-scale to identify when a soft or hard trigger for habitat has been reached. The BLM will make its determination concerning habitat in the fall, after the wildfire season ends.

To determine when a soft or hard trigger for population has been reached, the BLM will rely on population data collected by the ODFW; it is responsible for monitoring GRSG populations and typically finalizes population estimates in the fall. Then the BLM, in conjunction with the ODFW, will calculate the latest five-year running mean of population and the degree of population change for each Oregon PAC; after that, the BLM will evaluate whether population changes and the five-year running mean reach a soft or hard trigger.

The hard and soft trigger data will be analyzed as soon as it becomes available after the ROD is signed and then, at a minimum, annually thereafter.

The State of Oregon is not developing an adaptive management strategy and has no plans to do so.

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The hard and soft trigger data will be analyzed as soon as it becomes available after the ROD is signed and then, at a minimum, annually thereafter.

The State of Oregon is not developing as adaptive management strategy and has no plans to do so.

ADAPTIVE MANAGEMENT RESPONSES

Ensuring meaningful adaptive responses to a soft or hard trigger for an individual Oregon PAC requires that the BLM conduct a cause analysis. This may take three to six months to complete (see discussion under *Soft Trigger Responses* and *Hard Trigger Responses*, below). While the cause analysis is underway, the BLM will consider whether certain actions should proceed as planned on a case-by-case basis to limit further loss of GRSG habitat or populations. Types of actions the BLM could evaluate or consider applying in or near the affected Oregon PAC during the analysis include the following:

- Halting or delaying planned broadcast burning
- Increasing fire prevention patrols and messages
- Increasing fire prevention inspections of motorized equipment
- Prohibiting open campfires outside of established fire pits and outside of stoves in designated recreation areas
- Halting or delaying planned vegetation treatments that reduce sagebrush canopy cover
- Increasing inspections to ensure BMPs for limiting the spread of invasive plants are followed on construction projects
- Increasing surveys to detect and treat new infestations of invasive plants, especially invasive annual grasses
- Delaying any planned vegetation treatments until after the breeding and early brood-rearing period
- Halting or delaying planned fuels treatments in GRSG winter range
- Delaying issuance of new authorizations for minerals and energy development, including geothermal exploration
- Delaying issuance of permits for mineral material disposal
- Installing anti-perching devices on tall structures
- Installing bird flight diverters on guy wires and fences
- Delaying issuance of new or pending ROWs outside of existing designated corridors or where not collocated within previously authorized ROWs, including Federal Highway Act authorizations
- Delaying authorizations of new tall structures outside of designated corridors
- Adjusting grazing practices to ensure retention of adequate residual plant cover and diversity in the understory
- Delaying planned construction of new recreation facilities (e.g., kiosks, toilets, and signs) within two miles of occupied or pending leks
- Increasing litter patrols in and around heavily used recreation areas
- Increasing educational contacts with visitors concerning the role of litter and garbage in attracting GRSG predators
- Increasing enforcement efforts on travel restrictions

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- Increasing educational contacts with visitors concerning the role of litter and garbage in attracting GRSG predators
- Increasing enforcement efforts on travel restrictions

The BLM Authorizing Officer will provide formal documentation for the record on what measures or actions were taken during the cause analysis period.

Soft Trigger Responses

A key part of adaptive management is to identify the potential causes of the observed change in order to develop potential adaptive responses. For this adaptive management strategy, a cause is most likely tied to a threat that the USFWS (2010) identified in its listing determination. While one or more causes can be linked to a habitat or population decline, this does not assume a cause-and-effect relationship. Many factors have been suggested as affecting GRSG populations and habitats throughout the species' range. These factors can interact in many complex relationships that can be difficult to tease apart. It can be difficult to separate proximate factors from ultimate factors leading to population declines.

On determining that a soft trigger has been reached, the BLM will convene an adaptive management working team at the district level. It will consist of local experts for the affected resource programs and field personnel from local ODFW and USFWS offices to conduct the cause analysis. This team will convene as soon as possible, but within one month of determining that a soft trigger has been reached.

Subject to the provisions of Federal Advisory Committee Act, the team may contact potentially affected stakeholders for suggestions and comments on potential adaptive responses. They will develop a list of recommended actions as soon as possible, but no later than within three months of convening. The selected responses will be formally documented as a BLM District Office memorandum. Additional project-level NEPA analyses may be required to implement some responses, such as a temporary closure. Soft trigger adaptive responses may consist of the following actions:

- Prioritizing the affected Oregon PAC for restoration treatments, construction or maintenance of fuel breaks, mapping vegetation in high resolution to inform project planning, closing and rehabilitating unauthorized roads, installing bird flight diverters on fences, assessing rangeland health, modifying new and existing water projects to reduce West Nile virus risks, or establishing wild horse and burro gathers
- Providing additional guidance for the types and timing of vegetation treatments
- Providing additional guidance on the location and design of fuel breaks
- Reevaluating seed mixes and native seed sources for post-fire restoration work
- Cancelling planned recreational site improvements or developments or vegetation treatments
- Reevaluating the location or design of recreational improvements or new developments (may require additional NEPA analysis)
- Allowing only those special recreation permits in PHMA that have neutral or beneficial effects on PHMA (43 CFR, Part 2031.3)
- Modifying seasons of use, location of use, or activities allowed in a SRMA located within the affected Oregon PAC (43 CFR, Part 8364.1)
- Moving wild horses and burros to other areas within the applicable herd management area
- Disallowing any exceptions to the NSO requirement

- Temporarily closing areas to certain uses, such as OHV travel, mineral and energy development, geothermal exploration, and mineral materials disposal, up to 24 months (requires a *Federal Register* notice and additional analysis under NEPA [43 CFR, Parts 8364.1 and 8341.2])
- Applying new travel restrictions (requires a *Federal Register* notice and additional NEPA analysis under
- Developing alternative right-of-way routes that avoid the affected Oregon PAC for new requests

The BLM may also choose to conduct certain actions while the cause analysis is underway, such as increased fire prevention and litter patrols, educational efforts, and enforcement of existing regulations, permit stipulations, and laws.

Hard Trigger Responses

As noted above, hard triggers represent a threshold indicating that immediate and more restrictive action is necessary to stop a severe deviation from GRSG conservation objectives set forth in the resource management plan amendment. Once the BLM, in consultation with USFWS and ODFW, has determined that a hard trigger has been reached, it will immediately implement the responses below within the affected Oregon PAC. These responses consist of more restrictive conservation actions from one or more other alternatives analyzed in the FEIS (the applicable action from another alternative is identified in parentheses).

- Do not use prescribed fire to treat sagebrush in less than 12-inch precipitation zones. As a last resort and after all other treatment options have been explored and as site-specific variables allow, consider using prescribed fire for fuel breaks in stands where annual grass is a very minor component in the understory (Action B-WFM 1).
- Do not conduct mechanical sagebrush treatments in known GRSG winter habitat (Action E-VG 15).
- Limit broadcast burning of juniper-invaded sagebrush to no more than 160 acres per treatment block in PHMA (Action E-VG 26).
- Issue no new geophysical exploration permits in PHMA (Action C-MLS 8).
- Make PHMA exclusion areas for new ROW authorizations (Action B-LR 1).
- Restrict OHV use to areas greater than 2 miles from leks during the breeding season (March 1 through June 30) (Action E-TM 1; 43 CFR, Parts 8364.1 and 8341.2).
- When reseeding closed roads, primitive roads, and trails, use appropriate native seed mixes and require use of transplanted sagebrush (Action F-TM 6).
- Prohibit new road construction within 4 miles of active GRSG leks, subject to valid existing rights and to protect human health and safety (Action F-TM 2; 43 CFR 8364.1).
- Prohibit construction of recreational facilities (e.g., kiosks, toilets, and signs) within 2 miles of leks (Action E-RC 8).

After the immediate hard trigger response is put in place, the BLM State Director will convene a statewide adaptive management working team at the consisting of experts for the affected resource programs and personnel from ODFW and USFWS offices. This team will convene as soon as possible, but within one month of determining that a hard trigger has been reached.

Subject to the provisions of FACA, the team will also contact potentially affected stakeholders for suggestions and comments on potential additional responses. The team will develop recommendations for additional responses as soon as possible, but no later than within six months of convening.

If the ultimate cause cannot be determined, the adaptive response would be based on the proximate causes. If the final recommendations include any additional adaptive management responses beyond those in the list above, the BLM State Director would issue a memorandum listing these additional responses and would identify which responses require a plan amendment or additional plan-level analysis under NEPA. For example, an additional hard trigger response may be permanent closure to a particular use within the affected Oregon PAC.

Responses may include continuation of certain actions taken while the cause analysis is underway, such as increased fire prevention and litter patrols, as well as site-specific project-level responses typically associated with soft triggers; an example of this is providing additional guidance on the types and timing of vegetation treatments.

When a hard trigger is hit in the Beatys, Trout Creeks, Louse Canyon, Soldier Creek, or Cow Lakes Oregon PACs (BSU; see **Figure 2-3**), the WAFWA Management Zone Greater Sage-Grouse Conservation Team will convene to determine the cause, will put project-level responses in place, as appropriate, and will discuss further appropriate actions to be applied. The team will also investigate the status of the hard triggers in adjoining BSUs in other states and will invoke the appropriate plan response.

Exception to Hard Trigger Response

When the cause for a hard trigger is wildfire or insect outbreak, more restrictive allocations or management actions will be implemented (see bulleted list above) within the affected Oregon PAC. However, pending and new authorizations could continue within the affected Oregon PAC if the disturbance cap has not been reached and one of the following occurs:

- As designed, the project would have no direct or indirect impact on the GRSG population or habitat
- The project has been modified so that it would not have direct or indirect impacts on the GRSG population or habitat

DEVELOPING RESPONSES

Adaptive Management Working Team

On determining that a hard trigger has been reached, and in addition to the hard trigger response that is put in place, the BLM will convene the statewide adaptive management working team. This team will help the BLM identify the cause that may have tripped the adaptive management trigger and will recommend adaptive responses to the appropriate BLM Authorized Officer (decision-maker).

Team members will consist of, at minimum, a wildlife biologist, a fuels specialist, a weed coordinator or botanist, and a range management specialist from the BLM and representatives at the state or regional level from the USFWS and ODFW. Other specialists will be added depending on the nature of the hard trigger and the probable ultimate causes.

Adaptive management requires stakeholder involvement as well as agency involvement in order to succeed. The adaptive management working team will contact representatives from other federal agencies, research, environmental groups, producer groups, user groups, tribes, and local government as needed for suggestions and comments on potential final responses. The provisions under FACA may apply to input from nongovernmental organizations.

The BLM would develop a new adaptive response through a plan amendment or site specific NEPA as appropriate, based on the new information, to protect GRSG and its habitat and to ensure that conservation options are not foreclosed. This would be the case if new scientific information were to become available, demonstrating that one or more of the immediate hard trigger responses would be insufficient to stop the severe degradation. This would initiate recovery toward the GRSG conservation objectives set forth in the resource management plans. As a result, after a cause analysis is complete, implementing additional hard trigger responses could take one year or longer to complete the necessary environmental analysis or analyses.

Causal Factor Analysis

Identifying the ultimate cause of crossing a threshold and appropriate responses requires answering a series of questions, usually about the proximate cause, since that is often more easily observed. These questions should examine the factors supporting the proximate cause in order to better identify whether a portion of the resource management plan failed and which part and whether an adjustment is needed. For example, a large wildfire is a likely proximate cause for tripping both a habitat and population trigger. However, the plan includes several objectives, actions, and RDFs in the vegetation and wildland fire sections intended to reduce or minimize the potential to trigger an adaptive management response.

The review should examine the relevant plan direction and answer a series of questions, such as the following:

- Had all or some of the plan direction been implemented in the affected area?
- Did the plan direction perform as intended?
- Did the conditions associated with the event or activity exceed the design standards?
- What role did factors and events outside the affected area play in the event or activity outcomes?
- Did the event or outcome arise from the interaction of more than one potential causal factor?

Determining the appropriate adaptive response also requires asking a series of questions, such as the following:

- What is the magnitude of the impact?

- Is the impact temporary or permanent?
- Can habitat or population recover on its own without intervention?
- What is the expected length of the recovery period?
- Can the management actions already included in the plan accelerate recovery or are different actions necessary?

LONGEVITY OF RESPONSES

All immediate hard trigger responses will remain in place until a plan amendment is completed to remove them or when one of the following relevant conditions is met:

- If the hard trigger tripped was for habitat, the immediate hard trigger responses can be removed when 70 percent of the affected Oregon PAC capable of supporting sagebrush has at least 5 percent sagebrush canopy cover and less than 5 percent tree canopy cover, exclusive of retained old juniper (see vegetation management objectives and actions for details on retention of old juniper).
- If the hard trigger tripped was for population and the affected Oregon PAC has adequate population data (see the *Population Trigger Development Process* for which PACs have adequate data), the immediate hard trigger responses can be removed when the five-year running mean for population rises above the lower 95th percentile confidence interval value and is on an upward trend.
- If the hard trigger tripped was for population and the affected Oregon PAC did not have adequate population data, additional criteria apply. Once the criteria below are met, the immediate hard trigger responses can be removed if the five-year running mean for population is above or rises above the lower 95th percentile confidence interval value and is on an upward trend.
 - A minimum of 12 years of population data are available
 - At least one lek/lek complex has been monitored for the full 12 years
 - A five-year running mean and 95th percentile confidence interval have been calculated
- If the hard triggers for both habitat and population were tripped, then the immediate hard trigger responses can be removed once both the habitat and population criteria above are met.

Removal of the immediate hard trigger responses returns management direction in the affected Oregon PAC to the plan decisions that are in force within those Oregon PACs that have not tripped a hard trigger.

Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers

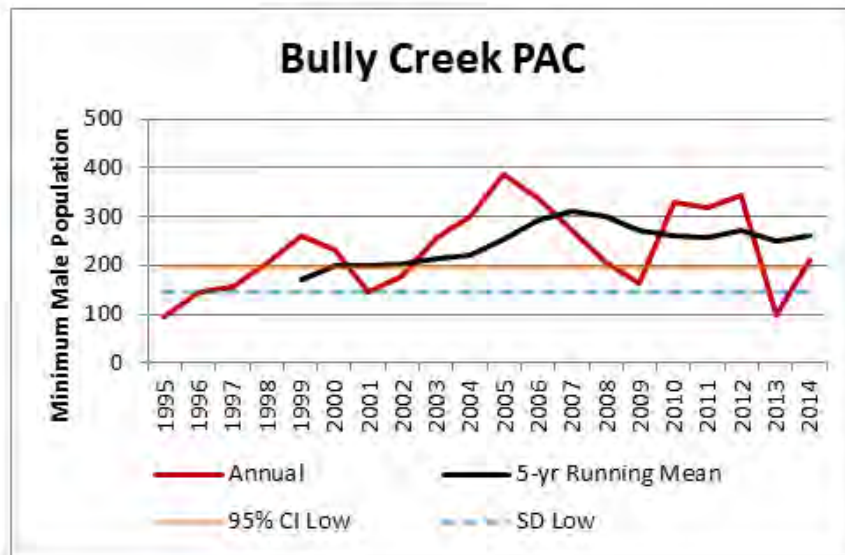
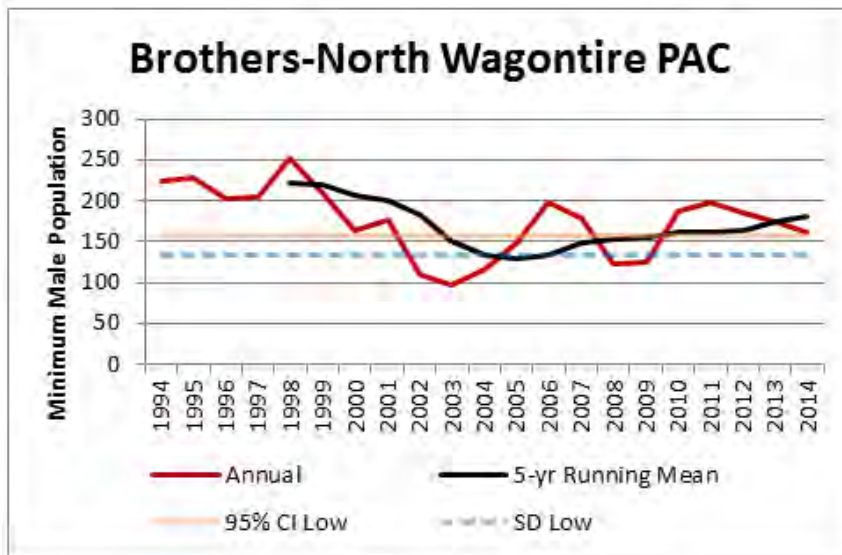
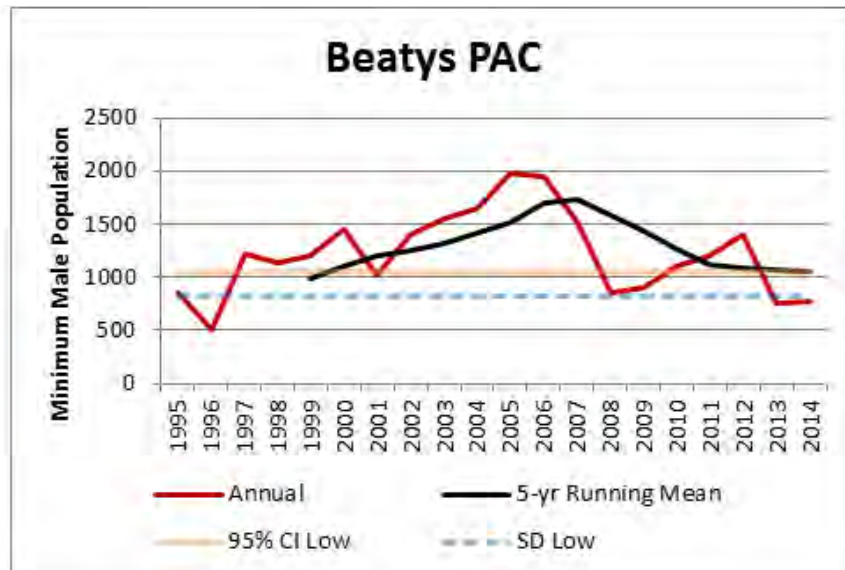
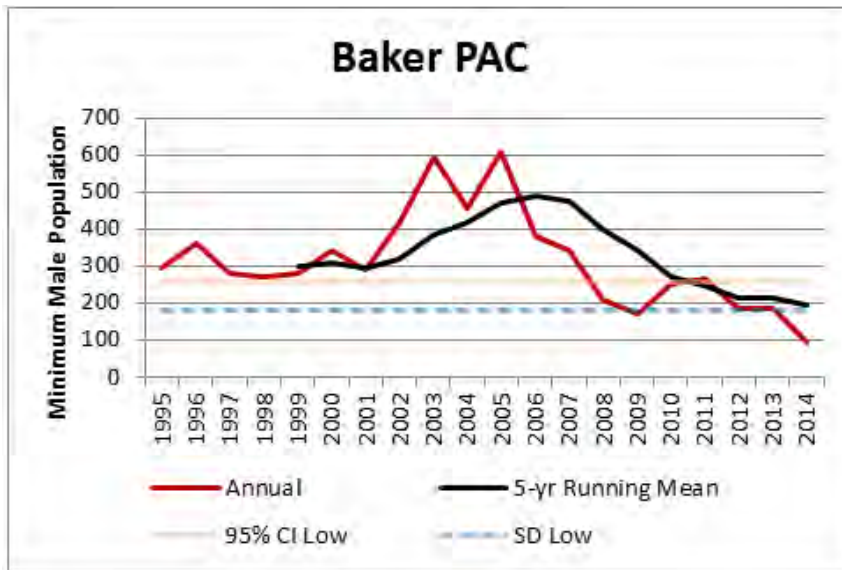


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers (continued)

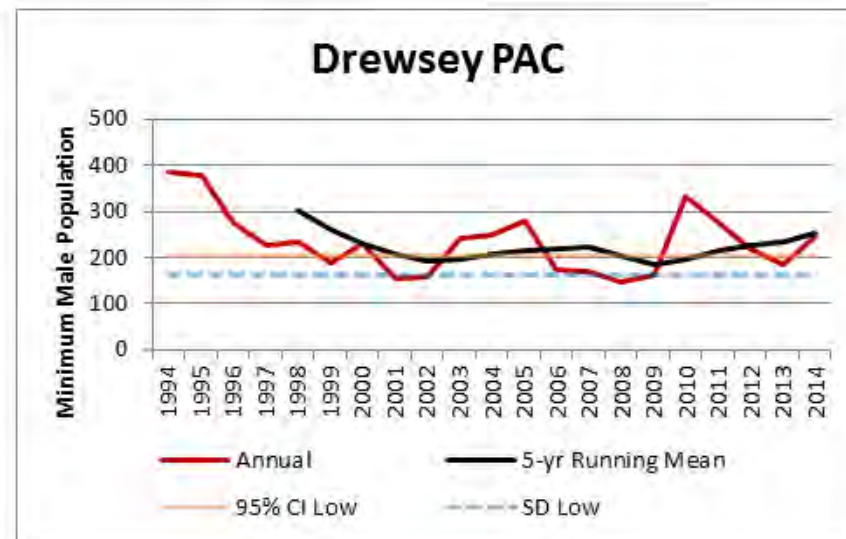
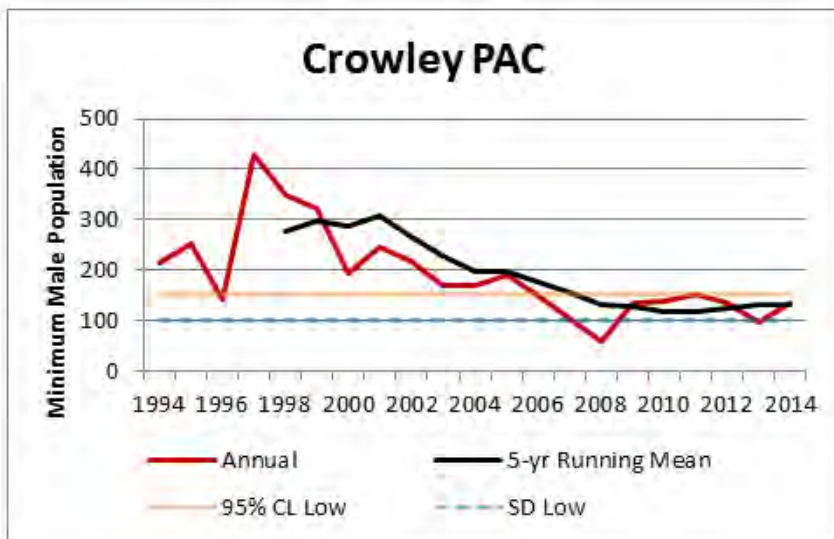
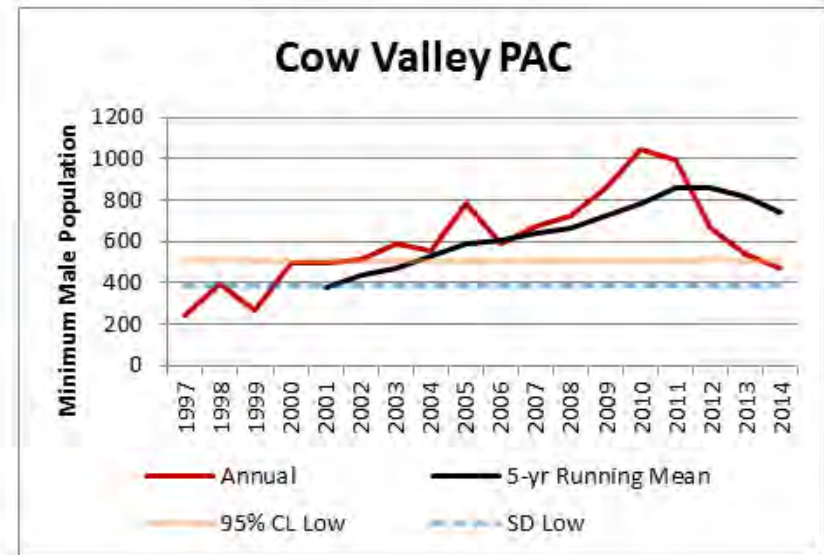
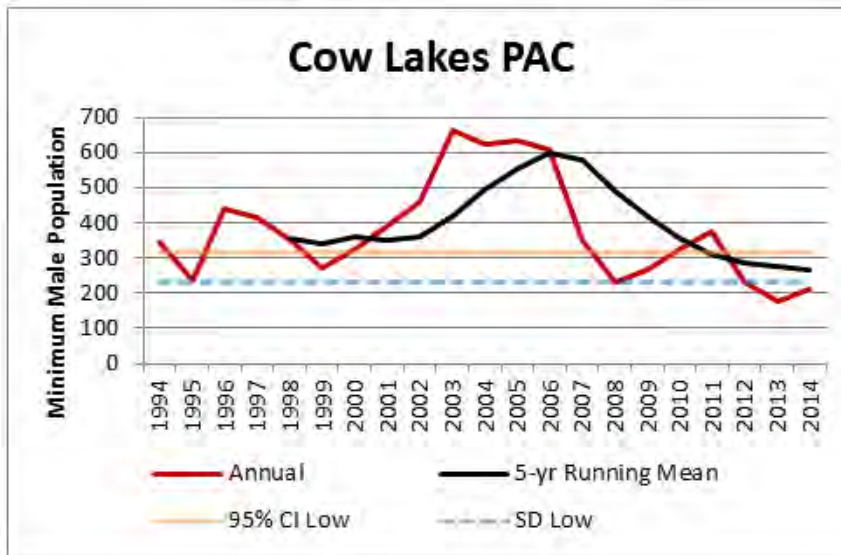


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers (continued)

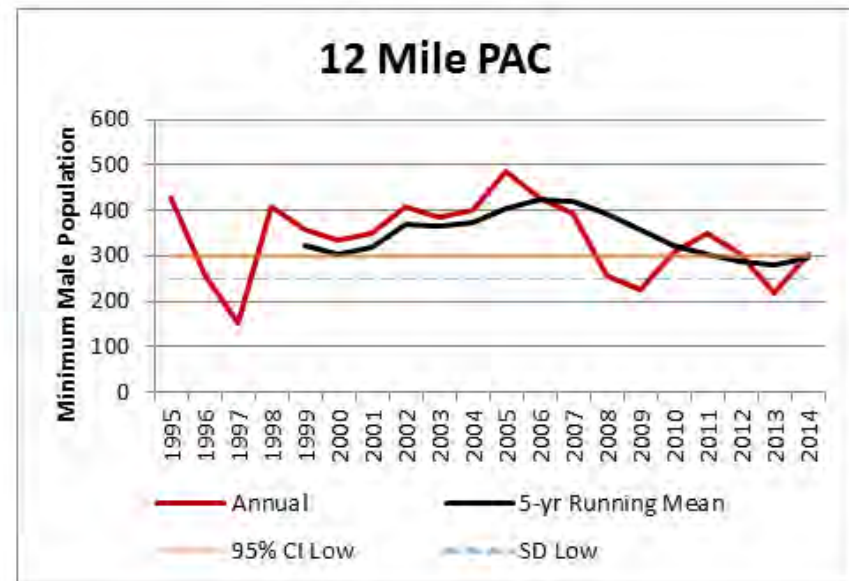
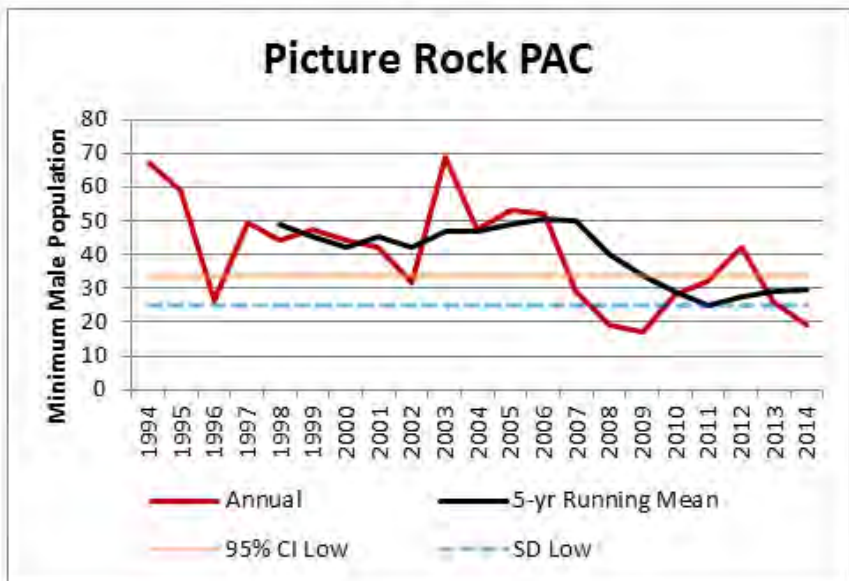
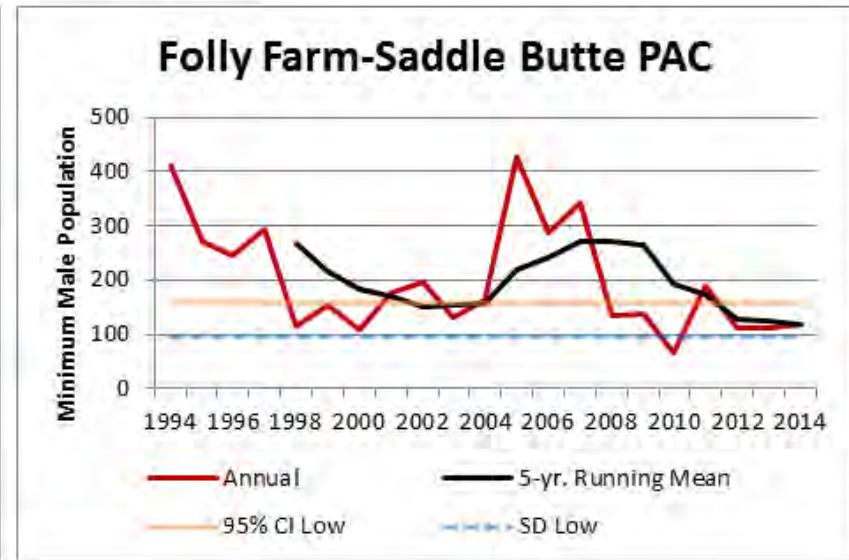
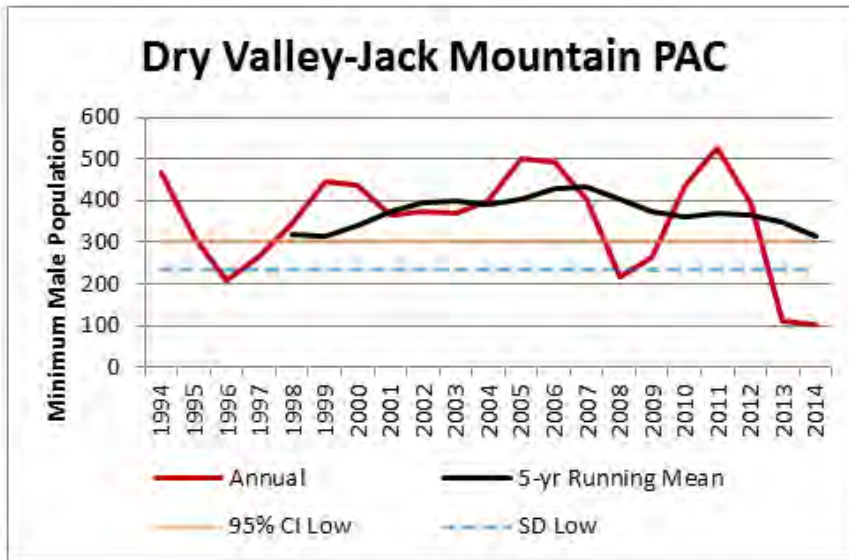


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers (continued)

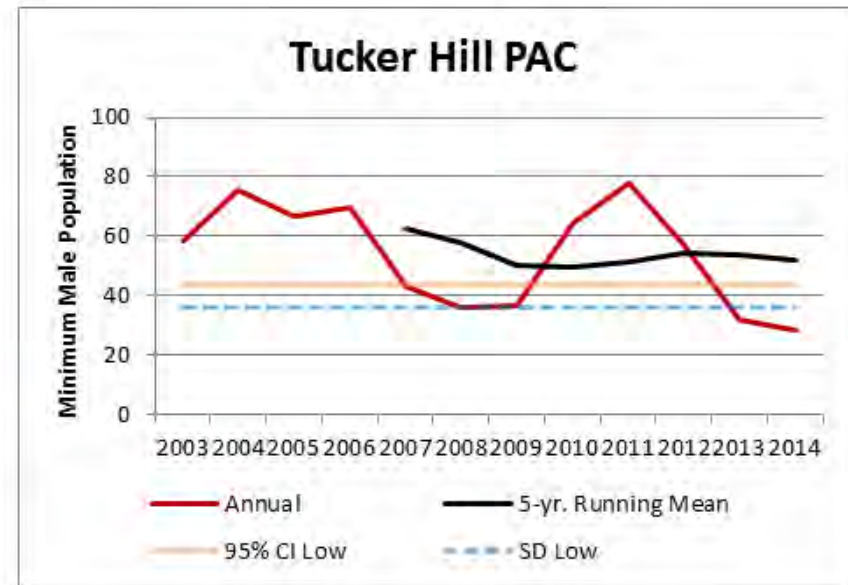
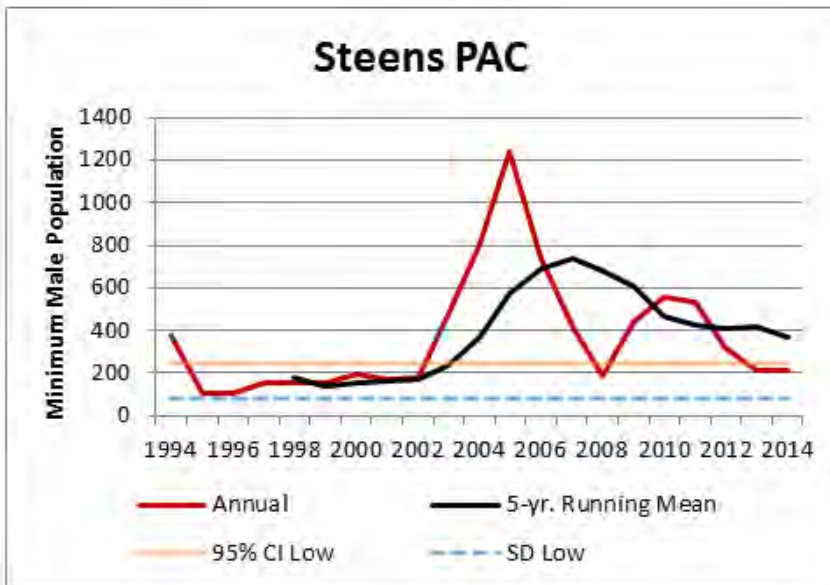
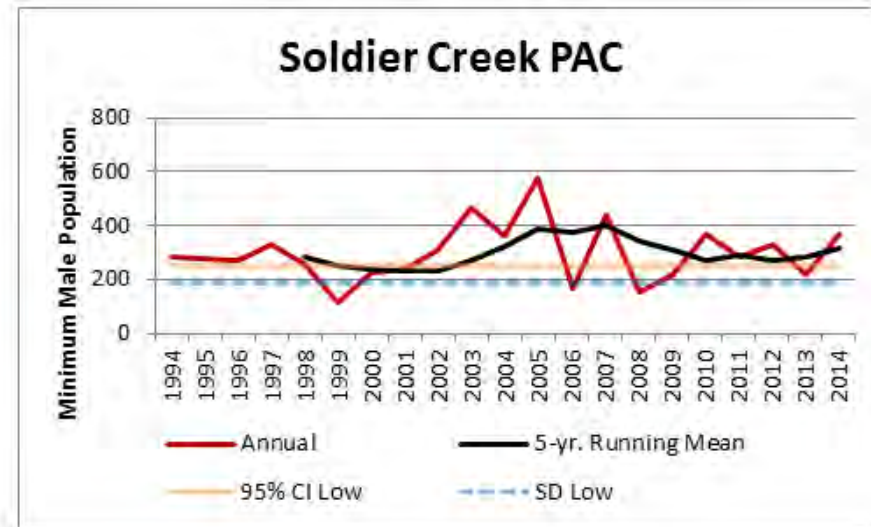
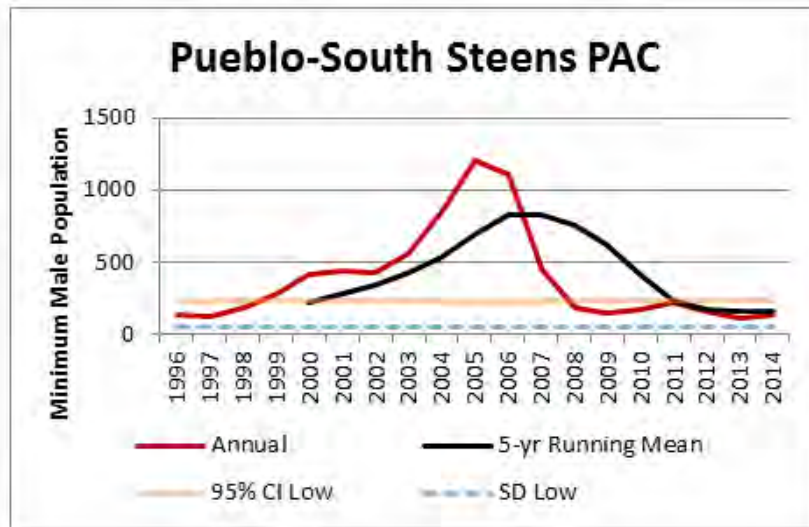
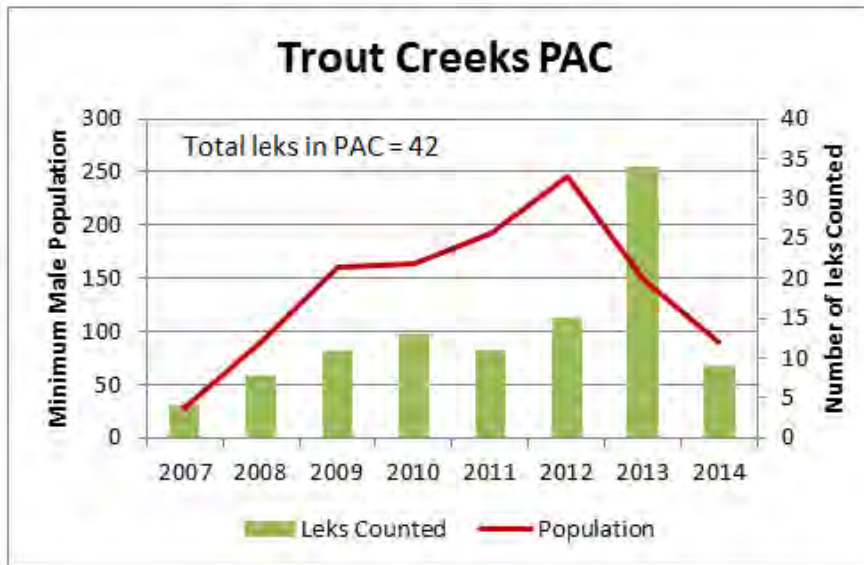
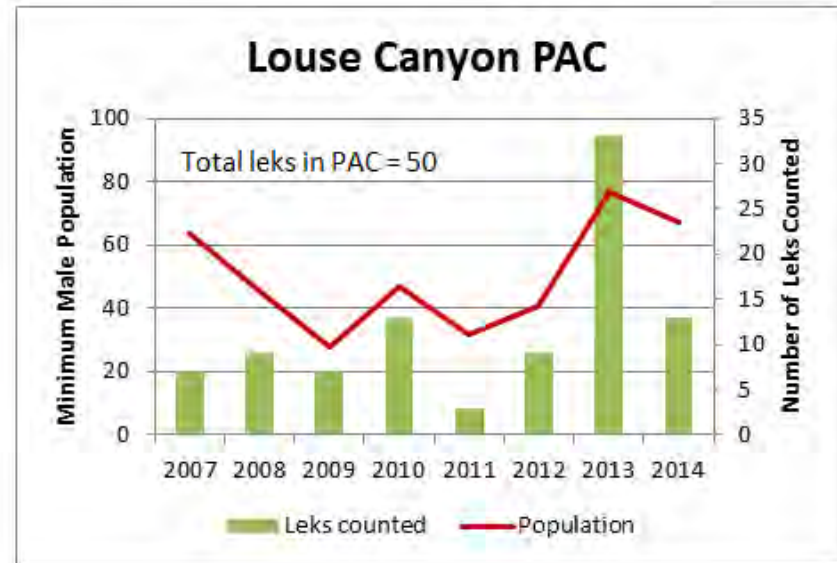
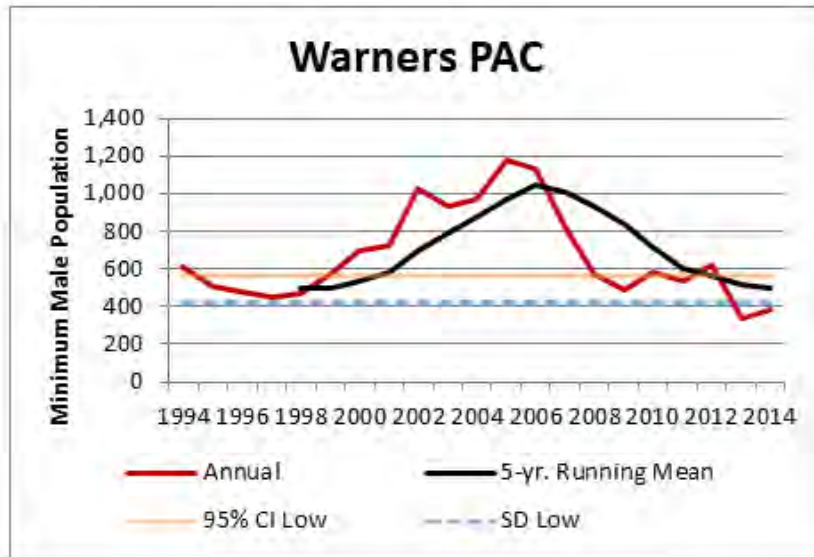


Figure J-1 Population Status of Each PAC Relative to the Soft and Hard Triggers (continued)



HABITAT TRIGGER DEVELOPMENT PROCESS

Understanding that there are natural minor fluctuations in sagebrush cover, its percent cover in the landscape serves as an indicator for GRSG habitat quality (Karl and Sadowski 2005; Hagen 2011). Short-term losses of sagebrush due to such factors as fire or insect defoliation are to be expected, recognizing that recovery rates vary considerably between the type and scale of disturbance and the specific ecological sites involved. However, sagebrush landscape cover of less than or equal to 25 percent has a low probability of maintaining GRSG leks, while greater than 65 percent sagebrush landscape cover has a high probability of sustaining GRSG populations (Aldridge et al. 2008; Wisdom et al. 2011; Knick et al. 2013; Chambers et al. 2014b).

The BLM developed habitat objectives for the plan based on the scientific information cited above (see **Tables 2-2** and **2-3**). The soft trigger indicates the level of landscape sagebrush cover that still provides some use by GRSG but does not meet the level of cover indicated by scientific studies and recommended by the NTT report to sustain GRSG populations. The hard trigger indicates the level of landscape sagebrush cover that does not provide sufficient habitat to sustain GRSG populations over the long term.

POPULATION TRIGGER DEVELOPMENT PROCESS

In order to set adaptive management soft and hard triggers for GRSG populations, the BLM analyzed male GRSG population data provided by the ODFW in spreadsheets. The state uses counts of males at leks to estimate populations of both males and females (see Hagen 2011, Section III, for details on state methods for estimating population based on lek counts). The data provided assigned leks and lek complexes to individual PACs as well as the statewide data.

The initial data consisted of survey results conducted as far back as 1980. However, because the survey effort was much less, involving far fewer leks, and survey effort increased beginning in the mid-1990s, the BLM discarded data prior to the mid-1990s. This resulted in approximately 20 years of data for most PACs and on a statewide basis.

The State of Oregon does not survey every lek every year due to limited resources and accessibility problems. The lack of roads in the largest PACs along Oregon's southern border with Nevada as well as the sheer distance limits the State's ability to survey these areas in particular. Years with high snowpack or wet conditions during the mating period often limit the State's ability to reach more remote leks; as a consequence, data are sparse, particularly for smaller and more remote PACs. Before analyzing population trends, the BLM used a similar process to what the State uses to fill in missing data, projecting forward and backward from actual counts.

For this analysis, the BLM defined a trend lek as one with no more than one year of missing data over the analysis period and identified trend leks for each PAC. This definition differs from the definition used by the ODFW for a trend lek (Hagen 2011, p. 14).

The: Burns, Louse Canyon, and Trout Creeks PACs did not have any leks that met the BLM definition. The BLM did not conduct a population analysis or establish PAC-specific soft and hard population triggers for these PACs. Ten PACs had usable population data back to 1994 (21 years), four had usable data back to 1995 (20 years), the Pueblos-South Steens PAC had usable data back to 1996 (19 years), the Cow Valley PAC had population data back to 1997 (18 years), and the Tucker Hill PAC had usable data back to 2003 (12 years).

To fill in missing data and allow population levels to fluctuate over time, the BLM summed the observations for all trend leks in each PAC and calculated the interannual rate of change (lambda) for each PAC by dividing the total for the current year by the total for the previous year. The BLM assumed that population change for the PAC as a whole followed the same pattern as in the trend leks. Rates of change varied between 0 and 3 using this method. A lambda of less than one indicated a population decline, while a lambda greater than one indicated a population increase.

When there were one or more observations, the BLM projected backward by dividing the observation in the source cell by the lambda associated with the source cell year and projected forward by multiplying the observation in the source cell by the lambda associated with the destination cell year. For example, to project backward in 2000 from an observation in 2001, the BLM divided the observation in 2001 by the lambda for 2001; to project forward to 2002, the BLM multiplied the observation in 2001 by the lambda for 2002.

Where two numbers (excluding zero) bracketed a period of no surveys, the BLM projected half the years backward and half the years forward.

Where a positive number and zero bracketed a period of no surveys, the BLM projected backward or forward from the positive number to the year with a zero. The BLM could not make projections when the observation was zero males because multiplying by zero yields zero and dividing by zero is mathematically undefined. Thus, population estimates over time remain incomplete both statewide and in all PACs analyzed.

To deal with this remaining data gap, the BLM followed a procedure used by the ODFW for estimating total male GRSG population. The BLM calculated the average male population over the most recent eight years and grouped leks and lek complexes based on estimated annual lek population size. Using ODFW definitions, the BLM created between two and five strata per PAC, as follows:

- Inactive—average male population = 0
- Small—average male population = 0.01-10
- Medium—average male population = 11-25
- Large—average male population = 26-50
- Extra large—average male population = 51+

The BLM estimated the annual population for each stratum by averaging the population estimate in each year and multiplying that average by the number of leks and lek complexes in that stratum. The BLM often did not estimate stratum population for inactive leks because all values were either “not surveyed” or zero. However, it did include the inactive stratum for PACs where the population earlier than the most recent eight years was largely positive. Most PACs had some leks or lek complexes where no surveys had occurred over the analysis period; these were not included in the estimate.

The BLM then summed the strata population estimate for each year. Both the BLM and ODFW consider the resulting estimate to be a minimum male population estimate.

To set the soft and hard triggers for population, the BLM estimated the average population over the analysis period for each PAC and calculated the standard deviation, the 95 percent confidence interval of the average, and five-year running mean. The five-year running mean equals the average of the current year plus the previous four years.

The BLM used large drops in the annual population estimate as soft trigger criteria and the five-year running mean population estimates in relation to the lower 95 percent confidence interval and the lower standard deviation values for both soft and hard trigger criteria.

The BLM established all triggers in consultation with the ODFW and USFWS. The State GRSG management strategy (Hagen 2011, p. 35) was to use a greater than 7 percent decline for three consecutive years in the state-wide five-year running mean. The BLM used 10 percent since greater fluctuation in estimated populations should be expected at the smaller scale. At the state-wide scale, decreases in some PACs are often partially offset by increases in other PACs.

PAC Name	Number of Leks/Lek Complexes	Number of Trend Leks	Effective Period of Record	Average Minimum Male Population	Lower 95th Percentile Confidence Interval Value	Lower Standard Deviation Value
Baker	36	3	1995-2014	313	256	182
Beatys	74	2	1995-2014	1221	1048	825
Brothers/North Wagontire	19	9	1994-2014	174	156	132
Bully Creek	30	2	1995-2014	232	195	147
Burns	2	0	N/A	N/A	N/A	N/A
Cow Lakes	40	2	1994-2014	377	314	230
Cow Valley	38	2	1997-2014	606	506	388
Crowley	33	3	1994-2014	190	152	101
Drewsey	22	2	1994-2014	234	204	164
Dry Valley/Jack Mountain	20	6	1994-2014	354	302	233
Folly Farm/ Saddle Butte	17	1	1994-2014	200	156	97
Louse Canyon	50	0	2007-2014	N/A	N/A	N/A
12 Mile	36	1	1995-2014	337	300	252
Picture Rock	5	2	1994-2014	40	34	25
Pueblos/South Steens	20	2	1996-2014	386	237	54
Solider Creek	30	4	1994-2014	298	251	188
Steens	10	3	1994-2014	368	246	82
Trout Creeks	42	0	2007-2014	N/A	N/A	N/A
Tucker Hill	5	1	2003-2014	54	44	36
Warners	46	4	1994-2014	672	566	424

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Species	Status¹	Determination²	Rationale
Bull trout <i>Salvelinus confluentus</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by bull trout.
Bull trout Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for bull trout.
Lahontan cutthroat trout <i>Oncorhynchus clarkii henshawi</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by Lahontan cutthroat trout.
Chinook salmon <i>O. tshawytscha</i>	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in chinook salmon habitat.
Chinook salmon Critical habitat	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact primary constituent elements described for this evolutionarily significant unit (ESU).
Foskett speckled dace <i>Rhinichthys osculus</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Hutton tui chub <i>Gila bicolor</i> ssp.	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Steelhead trout <i>Oncorhynchus mykiss</i>	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical habitat	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Steelhead trout <i>O. mykiss</i>	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical Habitat	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Warner sucker <i>Catostomus warnerensis</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Warner sucker Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Howell's spectacular thelypody <i>Thelypodium howellii</i> ssp. <i>spectabilis</i>	T	No effect	Howell's spectacular thelypody does not occur in PHMA or GHMA. Because the Proposed Plan would apply only to BLM-administered lands, and all known occurrences are on private lands, the proposed RMPA would not affect this species.

Species	Status¹	Determination²	Rationale
MacFarlane's four-o'clock <i>Mirabilis macfarlanei</i>	T	No effect	MacFarlane's four-o'clock habitat does not overlap with PHMA or GHMA, and no occurrences are known to exist on BLM-administered lands; therefore, the proposed RMPA would not affect this species.
Malheur wire-lettuce <i>Stephanomeria malheurensis</i>	E	No effect	Although GRSG habitats are nearby, Malheur wire-lettuce does not occur in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows Area of Critical Environmental Concern (ACEC) already excludes livestock grazing and off-road vehicle use, the proposed RMPA would not affect this species.
Malheur wire-lettuce Critical habitat	E	No effect	Malheur wire-lettuce critical habitat does not exist in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows ACEC already excludes livestock grazing, off-road vehicle use, and mining, the proposed RMPA would not affect the designated critical habitat for this species.
Spalding's catchfly <i>Silene spaldingii</i>	T	No effect	Spalding's catchfly occurrences and suitable habitat are found only to the north of PHMA and GHMA; therefore, the proposed RMPA would not affect this species.

Species	Status¹	Determination²	Rationale
MacFarlane's four-o'clock <i>Mirabilis macfarlanei</i>	T	No effect	MacFarlane's four-o'clock habitat does not overlap with PHMA or GHMA, and no occurrences are known to exist on BLM-administered lands; therefore, the proposed RMPA would not affect this species.
Malheur wire-lettuce <i>Stephanomeria malheurensis</i>	E	No effect	Although GRSG habitats are nearby, Malheur wire-lettuce does not occur in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows Area of Critical Environmental Concern (ACEC) already excludes livestock grazing and off-road vehicle use, the proposed RMPA would not affect this species.
Malheur wire-lettuce Critical habitat	E	No effect	Malheur wire-lettuce critical habitat does not exist in PHMA or GHMA. Because the Proposed Plan would apply to PHMA and GHMA habitats only, and the South Narrows ACEC already excludes livestock grazing, off-road vehicle use, and mining, the proposed RMPA would not affect the designated critical habitat for this species.
Spalding's catchfly <i>Silene spaldingii</i>	T	No effect	Spalding's catchfly occurrences and suitable habitat are found only to the north of PHMA and GHMA; therefore, the proposed RMPA would not affect this species.

Appendix K

Biological Assessment Summary

APPENDIX K

BIOLOGICAL ASSESSMENT SUMMARY

BACKGROUND

The Bureau of Land Management (BLM) has prepared an amendment to its Resource Management Plans (RMP), resulting in a Proposed RMP Amendment (RMPA) and Final Environmental Impact Statement (FEIS). Its purpose is to provide direction for the conservation of greater sage-grouse (*Centrocercus urophasianus*, GRSG) in the following plans in Oregon:

- Andrews RMP (Andrews Resource Area)
- Baker RMP (Baker Resource Area)
- Brothers/La Pine RMP (Central Oregon Resource Area)
- Lakeview RMP (Lakeview Resource Area)
- Southeastern Oregon RMP (Jordan and Malheur Resource Areas)
- Steens Mountain Cooperative Management and Protection Area RMP (Andrews Resource Area)
- Three Rivers RMP (Three Rivers Resource Area)
- Upper Deschutes RMP (Deschutes Resource Area)

Section 7(a)(2) of the US Endangered Species Act (ESA) of 1973, as amended (16 US Code, Section 1531 et seq.), requires each federal agency to consult with the US Fish and Wildlife Service (USFWS) on any action authorized, funded, or carried out by such agency that it has reason to believe will likely affect any endangered, threatened, or proposed species or designated or proposed critical habitat. Section 7(c) requires each federal agency to conduct a Biological Assessment (BA) for the purpose of identifying any listed or proposed species or designated or proposed critical habitat that is likely to be affected by such action.

The BLM in cooperation with USFWS and National Marine Fisheries Service (NMFS) conducted a BA for the Proposed Plan in the RMPA/FEIS. Because the RMPA is a planning document, the BA focuses on the effect of management actions to be implemented as a part of this planning. This appendix summarizes

the findings from the BA (BLM 2015). For purposes of brevity, only the findings from the BA are presented in this appendix.

SUMMARY

The effects determinations from the BA are summarized in **Table K-1**. The BLM has determined the Proposed Plan will have no effect to any of these species or critical habitat. The BLM coordinated the determination with USFWS and NMFS. No consultation, formal or informal, was required.

Table K-1
Summary of the Species Analyzed in This RMPA/EIS and Their Determinations

Species	Status ¹	Determination ²	Rationale
Gray wolf <i>Canis lupus</i>	E	No effect	There is no known overlap between the area occupied by the wolves where federally listed in Oregon and priority habitat management areas (PHMA) or general habitat management areas (GHMA). In the event that the gray wolf occupies the decision area, any effects would be addressed under project-specific National Environmental Policy Act (NEPA) analysis.
Canada lynx <i>Lynx canadensis</i>	T	No effect	There is currently no known occurrence of Canada lynx in the decision area. In addition, there is no overlap of habitat described as suitable for Canada lynx and GRSG PHMA and/or GHMA.
Western yellow-billed cuckoo <i>Coccyzus americanus</i>	T	No effect	The decision area may overlap with riparian habitat. However, the type or intensity of the activity in the Proposed Plan is expected to have no effect on this species or its habitat.
Western yellow-billed cuckoo Proposed critical Habitat	T	No effect	No critical habitat proposed for the yellow-billed cuckoo occurs in the decision area.
Oregon spotted frog <i>Rana pretiosa</i>	T	No effect	Potential habitat for the species does not occur in the decision area.
Oregon spotted frog Proposed critical habitat	T	No effect	Proposed critical habitat for the species does not occur in the decision area.
Borax Lake chub <i>Gila boraxobius</i>	E	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or cause water depletions in lakes, rivers, or streams occupied by this species.
Borax Lake chub Critical habitat	E	No effect	There are no actions within this RMPA decision that would impact aquatic habitat or cause water depletions in Borax Lake or aquatic environments associated with its outflow.

¹E = Endangered; T = Threatened; P-T = Proposed threatened

²NE = No effect (will not affect the species)

Appendix K

Biological Assessment Summary

APPENDIX K

BIOLOGICAL ASSESSMENT SUMMARY

BACKGROUND

The Bureau of Land Management (BLM) has prepared an amendment to its Resource Management Plans (RMP), resulting in a Proposed RMP Amendment (RMPA) and Final Environmental Impact Statement (FEIS). Its purpose is to provide direction for the conservation of greater sage-grouse (*Centrocercus urophasianus*, GRSG) in the following plans in Oregon:

- Andrews RMP (Andrews Resource Area)
- Baker RMP (Baker Resource Area)
- Brothers/La Pine RMP (Central Oregon Resource Area)
- Lakeview RMP (Lakeview Resource Area)
- Southeastern Oregon RMP (Jordan and Malheur Resource Areas)
- Steens Mountain Cooperative Management and Protection Area RMP (Andrews Resource Area)
- Three Rivers RMP (Three Rivers Resource Area)
- Upper Deschutes RMP (Deschutes Resource Area)

Section 7(a)(2) of the US Endangered Species Act (ESA) of 1973, as amended (16 US Code, Section 1531 et seq.), requires each federal agency to consult with the US Fish and Wildlife Service (USFWS) on any action authorized, funded, or carried out by such agency that it has reason to believe will likely affect any endangered, threatened, or proposed species or designated or proposed critical habitat. Section 7(c) requires each federal agency to conduct a Biological Assessment (BA) for the purpose of identifying any listed or proposed species or designated or proposed critical habitat that is likely to be affected by such action.

The BLM in cooperation with USFWS and National Marine Fisheries Service (NMFS) conducted a BA for the Proposed Plan in the RMPA/FEIS. Because the RMPA is a planning document, the BA focuses on the effect of management actions to be implemented as a part of this planning. This appendix summarizes

the findings from the BA (BLM 2015). For purposes of brevity, only the findings from the BA are presented in this appendix.

SUMMARY

The effects determinations from the BA are summarized in **Table K-1**. The BLM has determined the Proposed Plan will have no effect to any of these species or critical habitat. The BLM coordinated the determination with USFWS and NMFS. No consultation, formal or informal, was required.

Table K-1
Summary of the Species Analyzed in This RMPA/EIS and Their Determinations

Species	Status ¹	Determination ²	Rationale
Gray wolf <i>Canis lupus</i>	E	No effect	There is no known overlap between the area occupied by the wolves where federally listed in Oregon and priority habitat management areas (PHMA) or general habitat management areas (GHMA). In the event that the gray wolf occupies the decision area, any effects would be addressed under project-specific National Environmental Policy Act (NEPA) analysis.
Canada lynx <i>Lynx canadensis</i>	T	No effect	There is currently no known occurrence of Canada lynx in the decision area. In addition, there is no overlap of habitat described as suitable for Canada lynx and GRSG PHMA and/or GHMA.
Western yellow-billed cuckoo <i>Coccyzus americanus</i>	T	No effect	The decision area may overlap with riparian habitat. However, the type or intensity of the activity in the Proposed Plan is expected to have no effect on this species or its habitat.
Western yellow-billed cuckoo Proposed critical Habitat	T	No effect	No critical habitat proposed for the yellow-billed cuckoo occurs in the decision area.
Oregon spotted frog <i>Rana pretiosa</i>	T	No effect	Potential habitat for the species does not occur in the decision area.
Oregon spotted frog Proposed critical habitat	T	No effect	Proposed critical habitat for the species does not occur in the decision area.
Borax Lake chub <i>Gila boraxobius</i>	E	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or cause water depletions in lakes, rivers, or streams occupied by this species.
Borax Lake chub Critical habitat	E	No effect	There are no actions within this RMPA decision that would impact aquatic habitat or cause water depletions in Borax Lake or aquatic environments associated with its outflow.

¹E = Endangered; T = Threatened; P-T = Proposed threatened

²NE = No effect (will not affect the species)

Species	Status¹	Determination²	Rationale
Bull trout <i>Salvelinus confluentus</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by bull trout.
Bull trout Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for bull trout.
Lahontan cutthroat trout <i>Oncorhynchus clarkii henshawi</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by Lahontan cutthroat trout.
Chinook salmon <i>O. tshawytscha</i>	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in chinook salmon habitat.
Chinook salmon Critical habitat	T	No effect	Snake River spring/summer run—There are no actions in this RMPA decision that would impact primary constituent elements described for this evolutionarily significant unit (ESU).
Foskett speckled dace <i>Rhinichthys osculus</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Hutton tui chub <i>Gila bicolor</i> ssp.	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Steelhead trout <i>Oncorhynchus mykiss</i>	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical habitat	T	No effect	Middle Columbia River ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Steelhead trout <i>O. mykiss</i>	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in steelhead trout habitat.
Steelhead trout Critical Habitat	T	No effect	Snake River Basin ESU—There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Warner sucker <i>Catostomus warnerensis</i>	T	No effect	There are no actions in this RMPA decision that would impact aquatic habitat or deplete water in lakes, rivers, or streams occupied by this species.
Warner sucker Critical habitat	T	No effect	There are no actions in this RMPA decision that would impact primary constituent elements described for this ESU.
Howell's spectacular thelypody <i>Thelypodium howellii</i> ssp. <i>spectabilis</i>	T	No effect	Howell's spectacular thelypody does not occur in PHMA or GHMA. Because the Proposed Plan would apply only to BLM-administered lands, and all known occurrences are on private lands, the proposed RMPA would not affect this species.

Appendix L

Greater Sage-Grouse Noise Protocol

APPENDIX L

GREATER SAGE-GROUSE NOISE PROTOCOL

The following protocol provides direction for collecting noise measurements in areas of existing and proposed development in GRSG habitat. The intent is to provide guidelines to **experienced personnel** so that measurements are made in a consistent and accurate manner and to highlight areas where specialized training and equipment is required. The goal is to develop a protocol that is efficient, effective, and produces consistent results. The protocol was written to facilitate the gathering of noise measurements relevant to stipulations for GRSG protection. Use of a standard protocol for noise monitoring will ensure that future measurements are comparable across locations, times, and surveyors. This protocol should be updated, as data needs and availability change (Blickley and Patricelli 2013).

SUMMARY OF NOISE-MONITORING RECOMMENDATIONS

- Measurements should be made by qualified personnel experienced in acoustical monitoring.
- Measurements should be made with a high quality, calibrated Type I (noise floor < 25 dB) sound level meter (SLM) with a microphone windscreen and (where applicable) environmental housing.
- Measurements should be collected during times when noise exposure is most likely to affect GRSG—nights and mornings (i.e., 6 pm – 9 am) and should be taken for ≥1 hour at each site, ideally over multiple days with suitable climactic conditions. To capture typical variability in noise levels at the site of interest, deployment of SLM units for multiple days is preferred.
- Environmental conditions should be measured throughout noise measurement periods so that measurements made during unsuitable conditions can be excluded.
- Measurements should be made at multiple (3-4) locations between each noise source and the edge of the protected area (NSO or PHMA boundary, or lek perimeter). On-lek measurements should exclude time periods when birds are lekking.
- Accurate location data should be collected for each measurement location. Surveyors also should catalog the type and location of all nearby sources of anthropogenic noise.
- Critical metrics should be collected: L50, L90, L10, Leq, and Lmax. All measurements should be collected in A-weighted decibels (dBA) and, if possible, also collected in unweighted

(dBF) and C-weighted (dBC) decibels. If possible, SLM should log 1/3-octave band levels throughout the measurement period. Additional metrics may be collected, depending on the goals of the study.

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