Appendix D

Adaptive Management Strategy

APPENDIX D
ADAPTIVE MANAGEMENT STRATEGY

INTRODUCTION

Adaptive Management is a decision 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 as part of an iterative learning process. 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. Adaptive management does not represent 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 presented within 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 presented 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 Sub-region RMP Amendment.

ADAPTIVE MANAGEMENT OBJECTIVES

The overarching goal for this RMP amendment is to maintain and/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 PAC[1] that is capable of supporting sagebrush has at least five percent sagebrush canopy cover[2] 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 the either the habitat or population objective above, thus tripping an adaptive management trigger. When an individual project would trip a trigger, 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 in order to continue meeting GRSG conservation objectives. BLM will use two types of triggers for specific populations and responses: soft triggers and hard triggers. 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 will apply more conservative or restrictive implementation (project-level) conservation measures to mitigate for the causal factor(s) in the decline of populations or habitats, with consideration of local knowledge and conditions. These types of adjustments will 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 occur that trip either a habitat or population hard trigger, more restrictive management will be required.

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

[2] While minimum sagebrush cover for productive sage-grouse habitat is 10% (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 >5% to 15% 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.

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. The following sets forth the adaptive management hard and soft triggers (thresholds):

Habitat Thresholds (Triggers)

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

- 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 5 percent sagebrush canopy cover and less that 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 D-1 lists the percentage of each Oregon PAC that currently supports sagebrush cover ≥5 percent and tree cover <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 TM 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 transitions models includes burned areas, juniper encroachment, crested wheat grass plantings, agriculture, and other vegetation types capable of supporting sagebrush but not currently suitable for GRSG.

Table D-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 Wagontire	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: Integrated Landscape Analysis Project (ILAP)

Population Thresholds (Triggers)

BLM based the population thresholds on both interannual changes and a 5-year running mean in the estimated minimum number of males. BLM used the state-provided data on lek counts and procedures similar to what 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 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 approaches 300 leks or lek complexes per year. By the mid-1990s, ODFW considered the data robust enough to calculate 5-year running means. Data quantity and quality are sufficient to calculate 5-year running means for most Oregon PACs, although

data remain limited for a small number of Oregon PACs. Available data for Burns PAC is too sparse to draw any conclusions about current populations or population trends. Louse Canyon and Trout Creeks PACs do not have enough data to develop 5-year running means, requiring that BLM use only a limited amount of interannual change to assess population status. As a result, BLM developed a special hard trigger based on annual population trends for these two PACs. The hard and soft trigger thresholds calculated using data through 2014 will remain fixed for a minimum of five years. After five years, BLM, ODFW, and FWS will evaluate whether recalculating these values should occur and new thresholds established. Establishing new thresholds may require a plan amendment.

Based on observed fluctuations in both annual population and the 5-year running mean of population (**Figure D-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 5-year running mean population drops below the lower 95% confidence interval value.
- Hard Trigger:
  - For PACs with adequate population data: the 5-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.
  - Reaching soft triggers for both population and for habitat at the Oregon PAC scale

For the 5-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 of the PAC and the amount of the PAC affected. However, the response area, with the exception of the immediate hard trigger responses, could include the General Habitat Management Area 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 RMPA/EIS contains a monitoring framework plan (**Appendix G**, Greater Sage-Grouse Monitoring Framework), that includes an effectiveness monitoring component.

To determine when a soft or hard trigger for habitat has been reached, 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). 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-. 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, BLM will rely on population data collected by ODFW. ODFW is responsible for monitoring GRSG populations and typically finalizes population estimates in the fall. Each fall after ODFW has finalized its population estimates, BLM in conjunction with ODFW will calculate the latest 5-year running mean of population and the degree of population change for each Oregon PAC and evaluate whether population changes and the 5-year running mean reach a soft or hard trigger.

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

ADAPTIVE MANAGEMENT RESPONSES

Assuring meaningful adaptive responses to a soft or hard trigger for an individual Oregon PAC requires that BLM conduct a causal factor analysis. The analysis may take 3 to 6 months to complete (see discussion under Soft Trigger Responses and Hard Trigger Responses below). While the causal factor analysis is underway, BLM will consider whether certain actions should or should not proceed as planned on a case-by-case basis to limit further loss of GRSG habitat or populations. Types of actions BLM could evaluate or consider applying in or near the affected Oregon PAC during the 3 to 6 months that causal factor analysis is underway include but are not limited to:

- 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 assure best management practices for limiting the spread of invasive plants are followed on construction projects.
- Increasing surveys and survey effort 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 rights-of-way outside of existing designated corridors or where not co-located within previously authorized rights-of-ways, 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 2 miles of occupied or pending leks.
- Increasing litter patrols in and around higher recreational use areas.
- Increasing educational contacts with visitors concerning the role of litter and garbage in attracting GRSG predators.
- Increasing enforcement efforts on existing travel restrictions.

The authorizing officer will provide formal documentation for the record on what measures or actions were taken during the causal factor 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 the purposes of this adaptive management strategy, a causal factor is most likely tied to a threat USFWS identified in its 2010 listing determination (USFWS 2010). While one or more causal factors can be linked to a habitat or population decline, this does not assume a cause-and-effect relationship. A plethora of

factors has been suggested as affecting GRSG populations and habitats throughout the species' range. These factors can interact in a myriad of complex relationships that can be difficult to tease apart. It can be difficult to separate proximate factors from ultimate factors leading to population declines.

Upon determining that a soft trigger has been reached, BLM will convene an adaptive management working team at the District level consisting of local experts for the affected resource programs and field personnel from local ODFW and FWS offices to conduct the causal factor 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 FACA, the team may contact potentially affected stakeholders for suggestions and comments on potential adaptive responses. A list of recommended actions shall be developed as soon as possible, but no later than within three months of convening the local adaptive management team. The selected response(s) will be formally documented as a BLM district office memorandum. Additional project-level NEPA analysis may be required to implement some responses (e.g., to implement a temporary closure). Soft trigger adaptive responses may consist of actions such as:

- Prioritizing the affected Oregon PAC for restoration treatments, fuel break construction or maintenance, high resolution vegetation mapping to inform project planning, closure of and rehabilitation of unauthorized roads, installation of bird flight diverters on fences, rangeland health assessments, modification of new and existing water projects to reduce West Nile virus risks, or 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.
- Re-evaluating seed mixes and native seed sources for postfire restoration work.
- Cancelling planned recreational site improvements or developments, or vegetation treatments.
- Re-evaluating the location or design of recreational improvements or new developments (may require additional analysis under NEPA).
- Allowing only those special recreation permits in PHMA that have neutral or beneficial effects on PHMA [43 CFR Part 2031.3].
- Modifying season(s) of use, location of use, or activities allowed in a SRMA located within the affected Oregon PAC [43 CFR 8364.1].
- Moving wild horses and burros to other areas within the applicable Herd Management Area.

- Not permitting 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 8364.1 and 43 CFR 8341.2]).
- Applying new travel restrictions (requires a Federal Register notice and additional analysis under NEPA).
- Developing alternative right-of-way routes that avoid the affected Oregon PAC for new requests.

BLM may also choose to continue certain actions conducted while the causal factor analysis was underway, such as increased fire prevention and litter patrols, increased educational efforts, and increased enforcement efforts for existing regulations, permit stipulations, and law enforcement activities.

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 BLM in consultation with USFWS and ODFW has determined that a hard trigger has been reached, it will immediately implement the following responses 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 site-specific variables allow, use of prescribed fire for fuel breaks can be considered 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 8364.1 and 43 CFR 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]
- No 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 State Director will convene a statewide adaptive management working team at the State level consisting of experts for the affected resource programs and personnel from ODFW and FWS 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. Recommendations for additional responses shall be developed as soon as possible, but no later than within six months of convening the adaptive management team. If the ultimate cause cannot be determined, the adaptive response will be based on the proximate causes. If the final recommendations include any additional adaptive management responses beyond those in the list above, the State Director will issue a memorandum listing these additional response(s) and 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 causal factor analysis was underway, such as increased fire prevention and litter patrols, as well as site-specific project-level responses typically associated with soft triggers, such as providing additional guidance on the types and timing of vegetation treatments.

When a hard trigger is hit in Beatys, Trout Creeks, Louse Canyon, Soldier Creek, or Cow Lakes Oregon PAC (BSU; see Figure 2-3), the WAFWA Management Zone Greater Sage-Grouse Conservation Team will convene to determine the causal factor, put project-level responses in place, as appropriate, and 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 causal factor 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(s) if the disturbance cap has not been reached and:

a) As designed, the project would have no direct or indirect impact on the GRSG population or habitat, or

b) 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

Upon 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 BLM to identify the causal factor(s) that may have tripped the adaptive management trigger and provide recommendations to the appropriate BLM authorizing official (decision maker) regarding adaptive responses. Membership of the team shall consist of, at minimum, a wildlife biologist, a fuels specialist, a weed coordinator or botanist, and a range management specialist from BLM and representatives at the state or regional level from FWS and ODFW. Other specialists shall be added depending on the nature of the hard trigger and the probable ultimate cause(s).

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 non-governmental organizations.

If new scientific information becomes available demonstrating that one or more of the immediate hard trigger responses would be insufficient to stop the severe degradation and initiate recovery toward the GRSG conservation objectives set forth in the resource management plans, BLM will 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. As a result, after a causal factor analysis is complete, implementing additional hard trigger responses could take one year or longer in order 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 required design features 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:

- 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:

- 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 one of the following relevant conditions are met:

- If the hard trigger tripped was for habitat, removal of the immediate hard trigger responses can occur when 70 percent of the affected Oregon PAC that is 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), removal of the immediate hard trigger responses can occur when the 5-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 5-year running mean for population is 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, and
  - A 5-year running mean and 95th percentile confidence interval have been calculated.
- If the hard triggers for both habitat and population were tripped then removal of the immediate hard trigger responses can occur once both the habitat and population criteria above were 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 D-1 Population Status of Each PAC Relative to the Soft and Hard Triggers

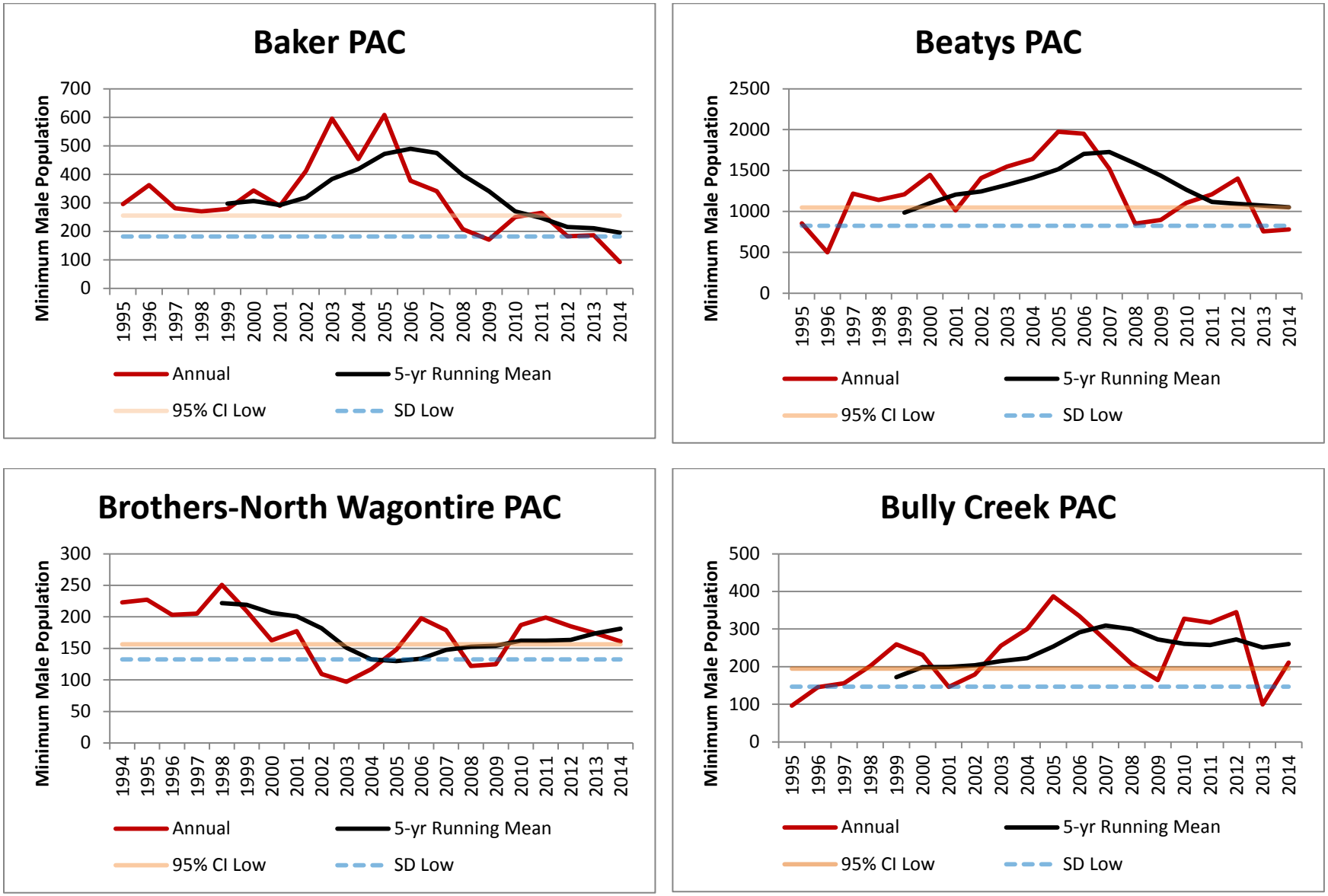
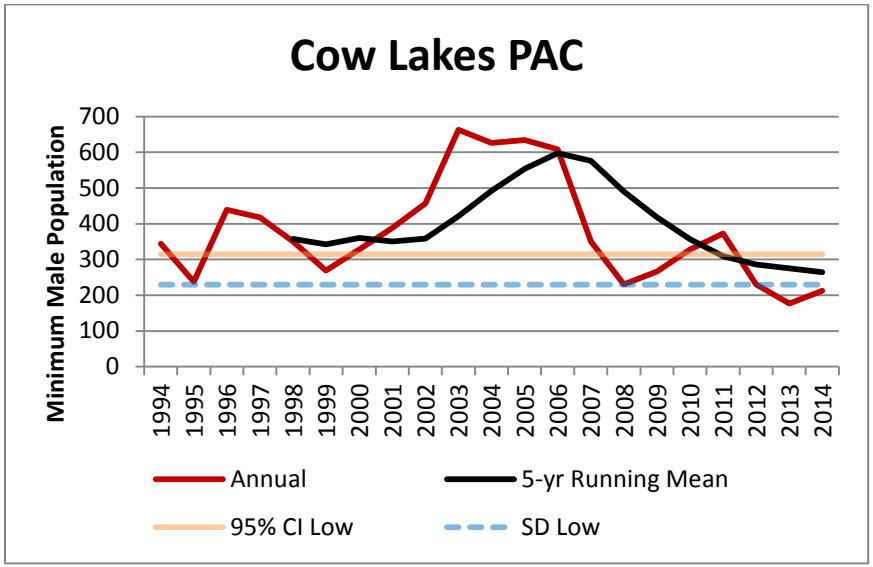
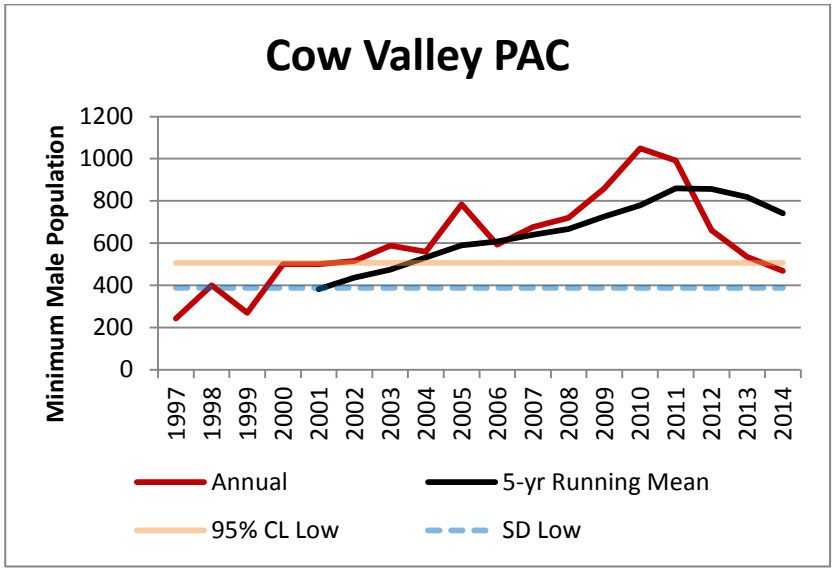
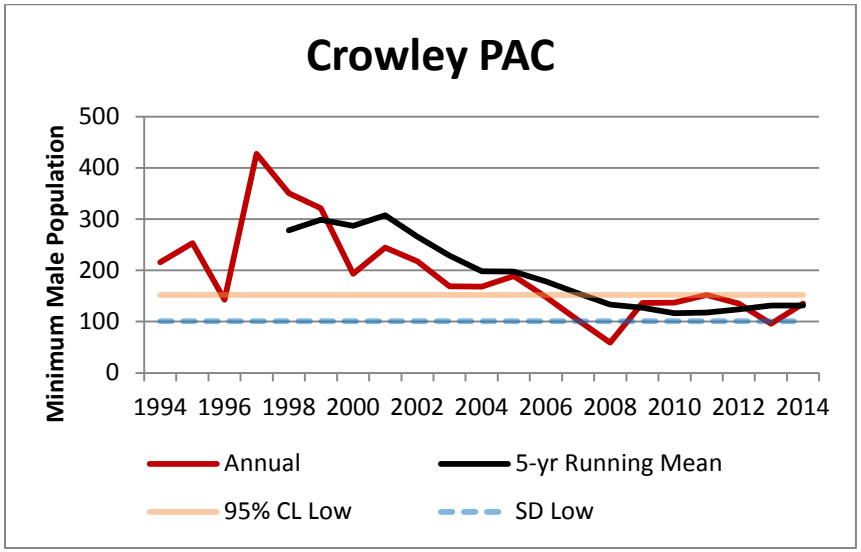


Figure D-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*







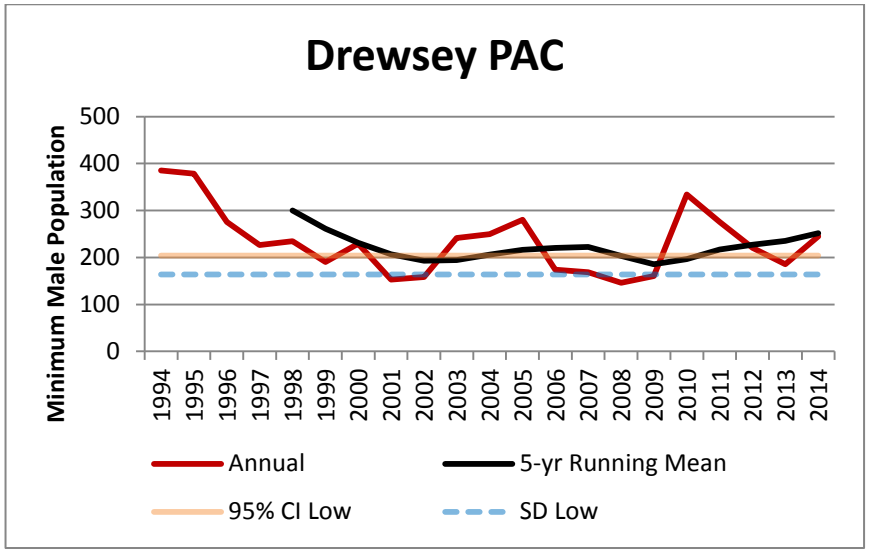
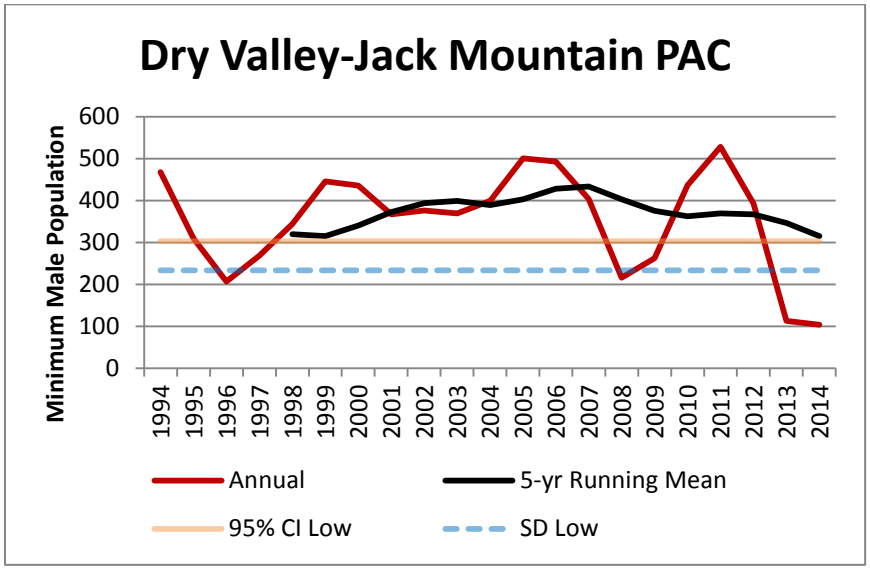
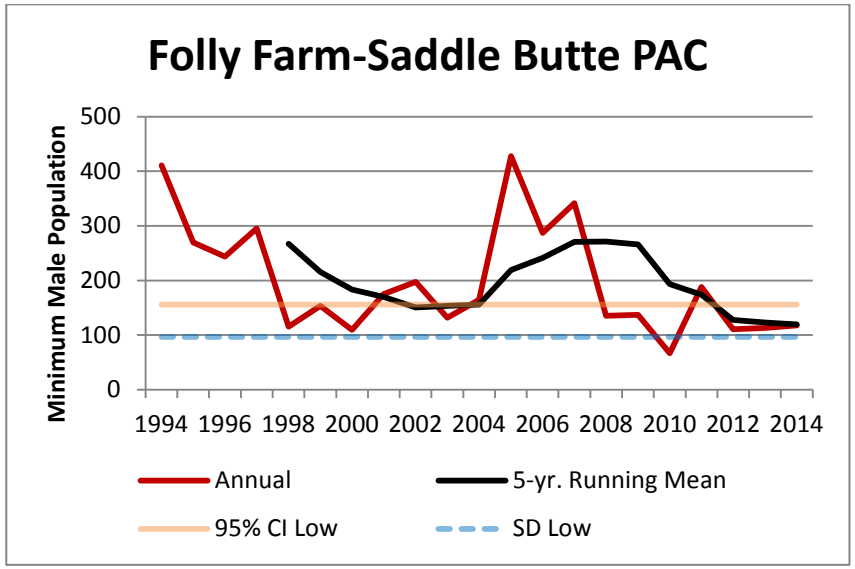
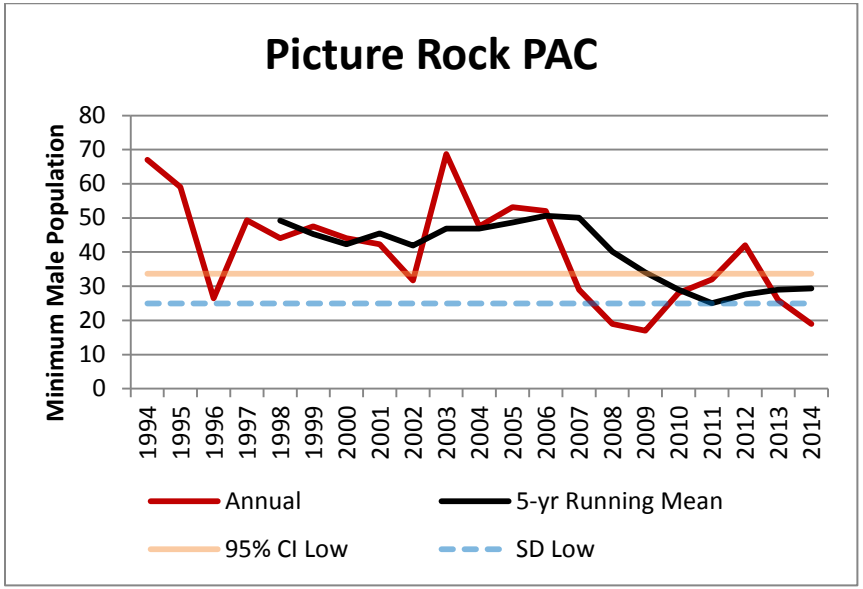


Figure D-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*







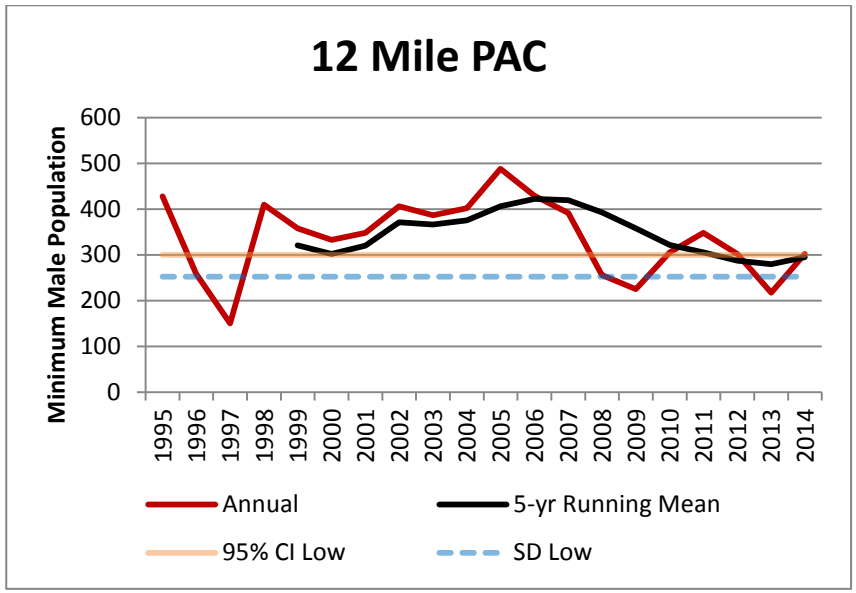
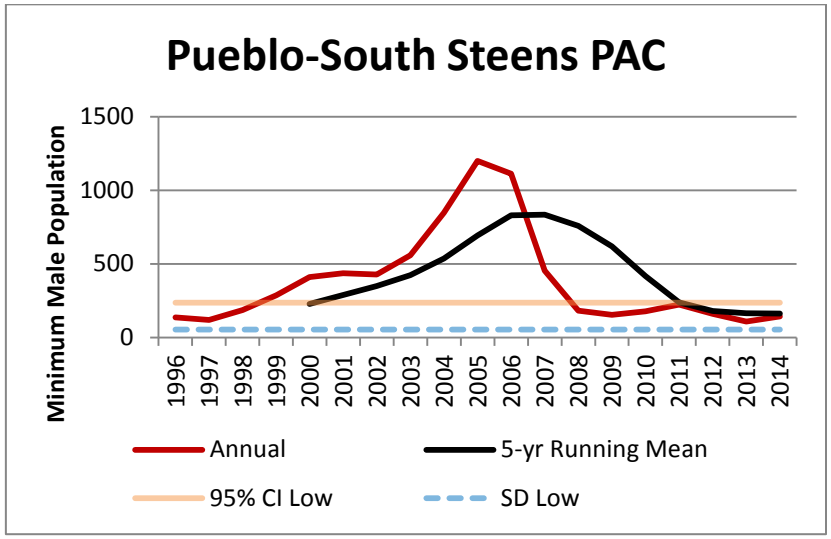
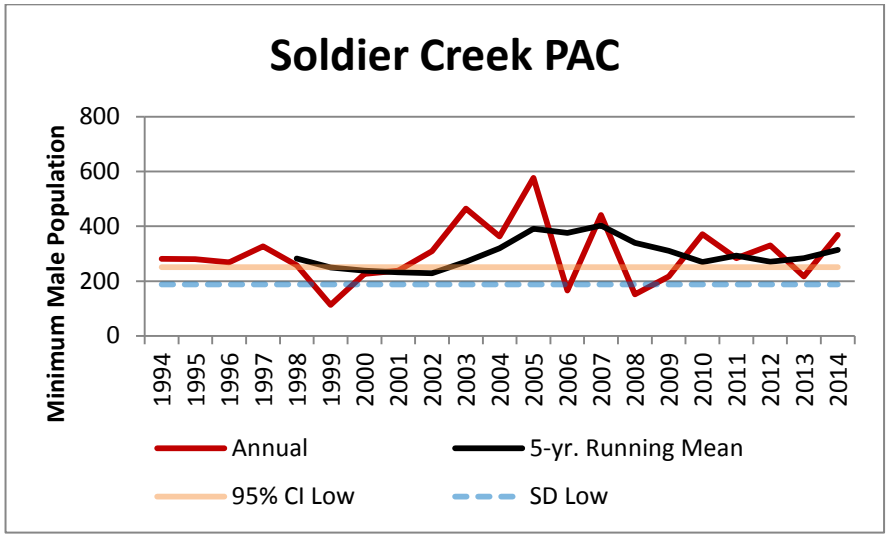
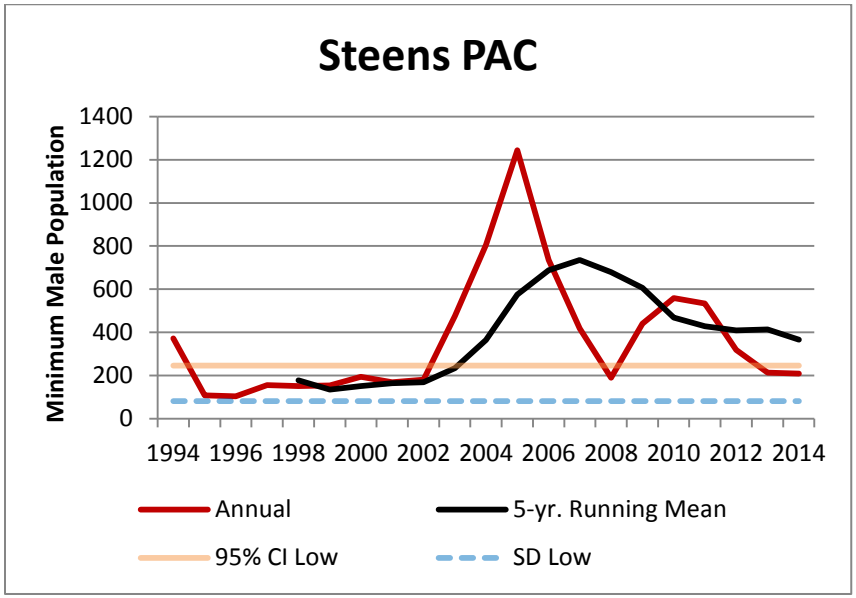


Figure D-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*







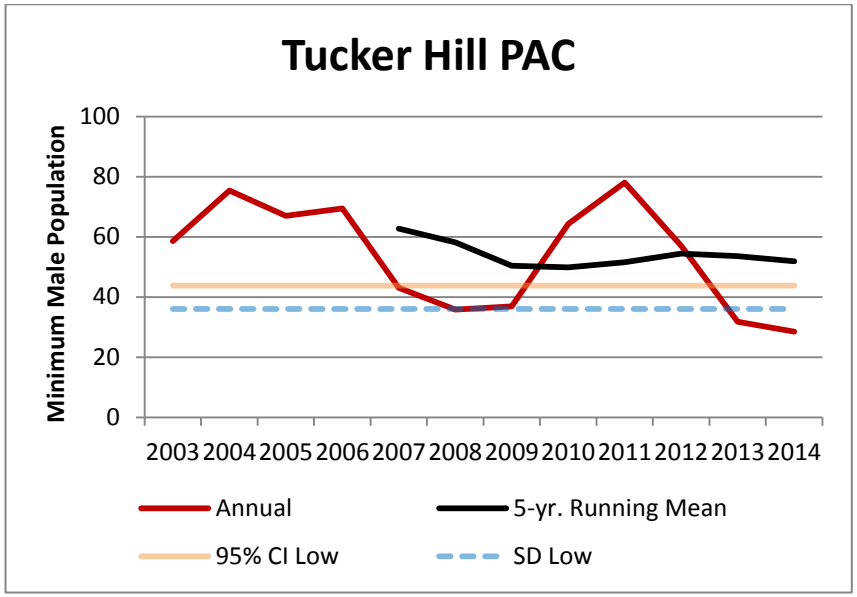
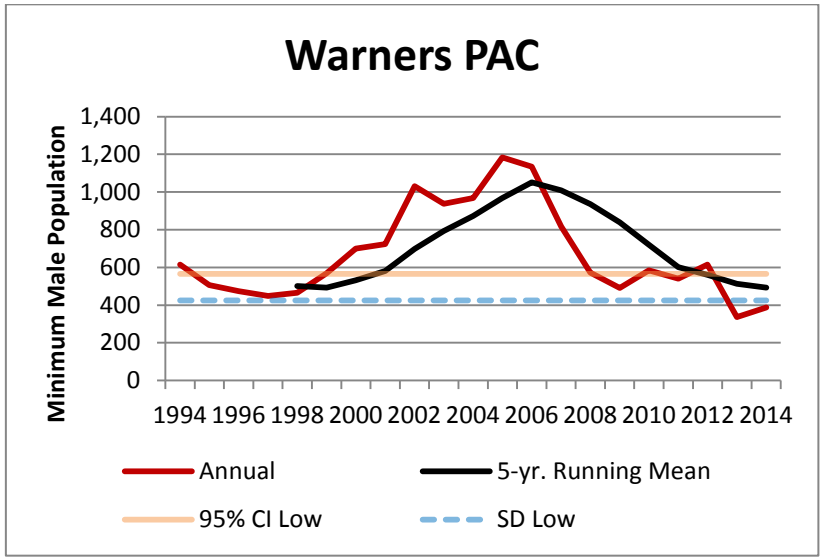
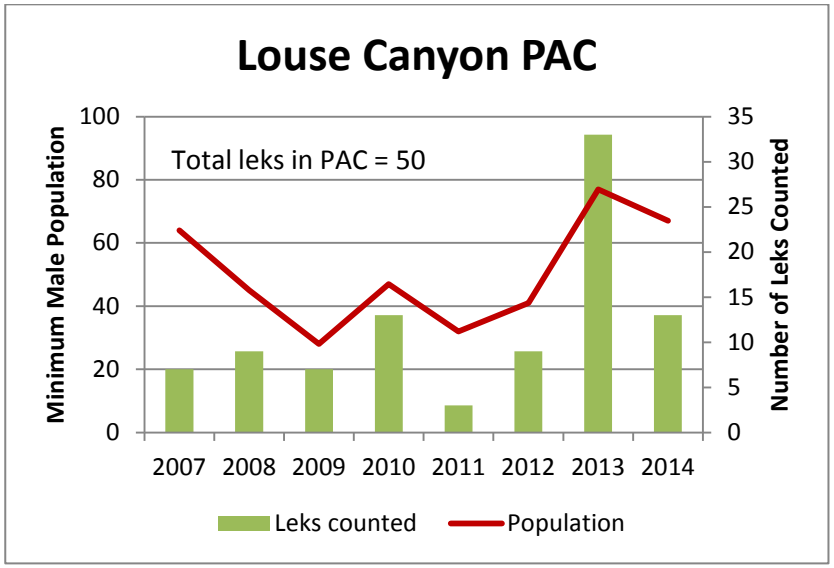
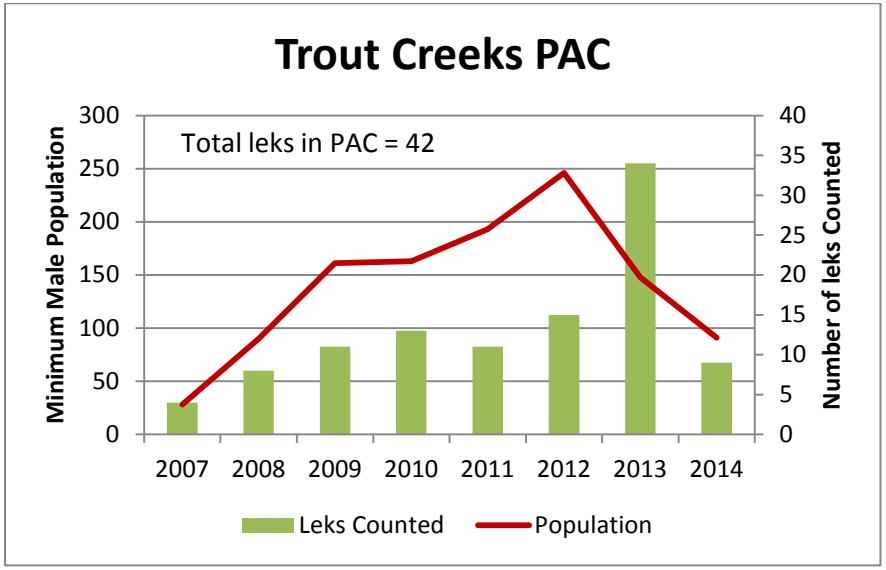


Figure D-1 Population Status of Each PAC Relative to the Soft and Hard Triggers *(continued)*







HABITAT TRIGGER DEVELOPMENT PROCESS

Understanding that there are natural minor fluctuations in sagebrush cover, the percent of sagebrush 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 factors such 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 ≤25 percent has a low probability of maintaining GRSG leks, while >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).

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 amount 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, BLM analyzed male GRSG population data provided by Oregon Department of Fish and Wildlife (ODFW) in Excel 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 survey effort was much less, involving far fewer leks, and survey effort increased beginning in the mid-1990s, BLM discarded data prior to the mid-1990s, resulting in approximately 20 years of data for most PACs and on a statewide basis.

The state 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 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 across the state. As a consequence, data are sparse, particularly for smaller PACs and more remote PACs. Before analyzing population trends, BLM used a similar process to what the state uses to fill in missing data, projecting forward and backward from actual counts.

For the purposes of this analysis, 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 ODFW for a

trend lek (Hagen 2011, p. 14). Three PACs did not have any leks that met the BLM definition: Burns, Louse Canyon, and Trout Creeks. 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), Pueblos-South Steens PAC had usable data back to 1996 (19 years), Cow Valley PAC had population data back to 1997 (18 years), and Tucker Hill PAC had usable data back to 2003 (12 years).

To fill in missing data and allow population levels to fluctuate over time, 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. 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 indicates a population decline while a lambda greater than one indicates a population increase.

When an observation was a positive integer (1 or more), 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, BLM divided the observation in 2001 by the lambda for 2001; to project forward to 2002, BLM multiplied the observation in 2001 by the lambda for 2002. Where two positive numbers bracketed a period of no surveys, BLM projected half the years backward and half the years forward. When this period involved an odd number of years, BLM alternated whether one more year was projected backward or forward. Where a positive number and zero bracketed a period of no surveys, BLM projected backward or forward from the positive number to the year with a zero. BLM could not make projections when the observation was zero males as 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, BLM followed a procedure used by ODFW for estimating total male GRSG population. BLM calculated the average male population over the most recent eight years and grouped leks/lek complexes based on estimated annual lek population size. Using ODFW definitions, BLM created between two and five strata per PAC:

- 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+

BLM estimated the annual population for each stratum by averaging the population estimate in each year and multiplying that average by the number of lek/lek complexes in that stratum. BLM often did not estimate stratum population for inactive leks as all values were either "not surveyed" or zero. However, BLM did include the inactive stratum for PACs where the population earlier than the most recent eight years was largely positive. Most PAC had some leks/lek complexes where no surveys had occurred over the analysis period; these leks and lek complexes were not included in the estimate. BLM then summed the strata population estimate for each year. Both BLM and ODFW consider the resulting estimate to be a minimum male population estimate.

To set the soft and hard triggers for population, BLM estimated the average population over the analysis period for each PAC and calculated the standard deviation, 95% confidence interval of the average, and 5-year running mean. The 5-year running mean equals the average of the current year plus the previous four years. BLM used large drops in the annual population estimate as soft trigger criteria and the 5-year running mean population estimates in relation to the lower 95% confidence interval and the lower standard deviation values for both soft and hard trigger criteria. BLM established all triggers in consultation with ODFW and FWS. The State sage-grouse management strategy (Hagen 2011, p. 35) using a greater than 7 percent decline for three consecutive years in the statewide 5-year running mean. BLM used 10 percent since greater fluctuation in estimated populations should be expected at the smaller scale. At the statewide 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

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
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

	Habitat		Population		Both Soft Triggers
PAC Name	Soft Trigger	Hard Trigger	Soft Trigger	Hard Trigger	
Baker	No	No	Yes (5-yr Mean)	No	No
Beatys	No	No	No	No	No
Brothers/North Wagontire	No	No	No	No	No
Bully Creek	No	No	No	No	No
Burns	No	No	N/A	No	No
Cow Lakes	Yes	No	Yes (5-yr Mean)	No	Yes
Cow Valley	No	No	Yes (Annual)	No	No
Crowley	No	No	Yes (5-yr Mean)	No	No
Drewsey	No	No	No	No	No
Dry Valley/Jack Mountain	No	No	No	No	No
Folly Farm/ Saddle Butte	No[4]	No	Yes (5-yr Mean)	No	No
Louse Canyon	No	No	No	No	No
12 Mile	No	No	Yes (5-yr Mean)	No	No
Picture Rock	No	No	Yes (5-yr Mean)	No	No
Pueblos/South Steens	No	No	Yes (5-yr Mean)	No	No
Solider Creek	No	No	No	No	No
Steens	Yes	No	No	No	No
Trout Creeks	Yes	No	No	Yes	Yes
Tucker Hill	No	No	Yes (Annual)	No	No
Warners	No	No	Yes (5-yr Mean)	No	No

[4] Does not include potential impact of Buzzard Complex of fires from 2014