2019 Sage-grouse Population Triggers Analysis

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Introduction

This report provides analysis results of the 2019 adaptive management population triggers for greater sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) in Idaho. Adaptive management triggers were identified and described in the *Federal Alternative of Governor C.L. "Butch" Otter for Greater Sage-grouse Management in Idaho* (Governor's Sage-Grouse Task Force 2012) and approved in the Bureau of Land Management (BLM) plan amendments for sage-grouse (BLM 2015, 2019).

Annually, Idaho Department of Fish and Game (IDFG) calculates two metrics to monitor sage-grouse population triggers within Priority Habitat Management Areas (PHMA) and Important Habitat Management Areas (IHMA) within 4 Conservation Areas (CA) (Figure 1). The metrics are maximum number of males on lek routes and lambda (λ), or the finite rate of population change, as calculated from all leks.

Hard population triggers are defined as:

- A 20% decline in the current 3-year average of total maximum number of males counted on lek routes compared to the 2011 maximum male baseline *and* average finite rate of change (λ) significantly below 1.0 within IHMA or PHMA within a CA over the current 3-year period.

Soft population triggers are defined as:

- A 10% decline in the current 3-year average of total maximum number of males counted on lek routes compared to the 2011 maximum male baseline *and* average finite rate of change (λ) below 1.0 within IHMA or PHMA within a CA over the current 3-year period.

Methods

We intersected all Idaho leks with the 2018 sage-grouse habitat management areas (BLM 2014, as updated 2018). One-hundred fifteen leks were not in classified habitat. Some of these leks are in agricultural areas on private land, but the birds likely nest and winter in adjacent sagebrush habitats. We used the 10-km nesting buffer identified in Appendix B of the Governor's Plan (Governor's Sage-grouse Task Force 2012), to assign each lek to the appropriate HMA. These leks are attributed as "PHMA by buffer," etc., to maintain their unique identity, but are included in the analyses for their assigned HMA. Six leks were >10 km from any mapped Priority, Important, or General habitat.

Lek Routes

IDFG utilizes lek routes to monitor population trend. A lek route, as defined by Connelly et al. (2003), is a "census of a group of leks that are relatively close and represent part or all of a single breeding population." These leks must be close enough to allow all leks on the route to be counted from 0.5 hours before official sunrise to 1.5 hours after sunrise. Lek routes are counted 3-4 times each spring, typically from late March to early May, depending on elevation. Counts are not conducted during inclement weather (e.g., rain or snow, or winds >15 kph). Observers record the number of males at

each lek on each survey day. The maximum number of males on a lek route is the highest number of males counted on one survey day.

Some lek routes are split between different HMAs. Because the data for a route cannot be split, we assigned a lek route to the HMA which had the higher proportion of its leks within it (Appendix A).

The lek route analysis compares the current 3-year average of males in each CA and HMA to the maximum number of males in 2011 (i.e., 2011 baseline). In 2011, we had 76 lek routes that qualified for inclusion in this analysis (Figure 1), which included 412 leks. This represents about 25% of the leks in the Idaho lek database.

$$\%\ change = \left(\frac{Current\ 3year\ average - 2011\ total\ males}{2011\ total\ males}\right) * 100$$

If % change is ≤ –20% then a hard population trigger has been tripped.
If % change is –10% to –20% then a soft population trigger has been tripped.

Lambda

Lambda is simply the population size in time t+1 divided by the population size in time t. A stable population is represented by a λ (lambda) value of 1.0. If λ<1.0 the population is decreasing and if λ>1.0 the population is increasing.

We defined significance for lambda by the 90% confidence interval (Scheaffer et al. 1996) around the lambda calculated from the 1st year to the 3rd year (e.g., lambda from 2017 to 2019). A population decline from year 1 to year 3 would be more important biologically than a 3-year average. If the 90% confidence interval (CI) is less than, and does not include 1.0, then the finite rate of change is considered significant. The finite rate of change and variance will be calculated following Garton et al. (2011). Garton et al. (2011) used a population reconstruction model to calculate lambda and estimate the minimum population of sage-grouse back through time. The main requirement of the model estimate is that counts on a lek must occur in at least 2 successive years or in this case every other year (i.e., 2016 and 2018).

Ratio estimation under classic probability sampling designs—simple random, stratified, cluster, and probability proportional to size—assumes the sample units (leks counted in alternate successive years in this case) are drawn according to some random process but the strict requirement to obtain unbiased estimates is that the ratios measured represent an unbiased sample of the ratios (i.e., finite rates of change) from the population or other area sampled.

Any count data can go into this analysis, as long as it meets the time of day and weather requirements for counting leks. Because the model uses ratios of counts cumulated within a larger area, lek counts may be included for leks that were visited 1 or more times within the season (we are currently recommending 2 visits). Aerial survey data that has been carefully reviewed (e.g., meets time and weather requirements and conducted by experienced pilots and observers) can also be included.

Database and other lek monitoring priorities

In addition to lek trend monitoring, there are other reasons for surveying particular leks within a given year. Lek database maintenance priorities are:

1. Visiting undetermined leks that need 1 more visit to be reclassified as unoccupied (5 consecutive surveys with zero birds results in an unoccupied status).
2. Visiting unoccupied leks that haven't been visited in >5 years (unoccupied leks need to be visited every 5-10 years to maintain that status).
3. Maintaining updated occupancy status by visiting occupied leks at least once every 5 years.
4. Re-visiting newly discovered leks to validate whether the observation is of a true lek and not a random occurrence.

Other priorities for surveying leks might be to evaluate response to infrastructure projects, wildfire, or habitat improvements. Although lek surveys for database or other priorities are biased (i.e., they are not a statistical sample of the population), they are important nonetheless.

Sample size estimation for lambda

We calculated lambda and the variance based on the 2016 to 2018 data for PHMA and IHMA in each CA. Using these values, we used the sample size estimation formula for ratios from Scheaffer et al. (1986, page 139) to estimate the number of leks that need to have counts in both 2017 and 2019 to produce an estimate of lambda ± 0.20.

Rather than sampling from only leks that were counted in 2017, we opted to increase our count efforts to assure broader coverage statewide. Since lek route leks will automatically be included in leks counted both years, we wanted to assure that an unbiased proportion of other leks (i.e., leks not on lek routes) were included in the lambda calculations. We multiplied the sample size estimate by the proportion of other leks to get the number of these leks that should be sampled in 2019. After assigning database priorities 1-4 above, we randomly selected the remaining leks to reach the target number. We then counted the total number of selected leks that would be counted both years (2017 and 2019) in each CA/HMA. We adjusted the target number upwards if we were still not meeting the estimated sample size. Using this sample size estimation process, we needed to count a minimum of 1,265 leks statewide in 2019; of these, 556 were on lek routes, 566 were randomly assigned leks, and 143 were database or other priorities (Table 1). Database priorities included 23 leks for priority 1, 13 for priority 2, 17 for priority 3, and 13 for priority 4. We also targeted to survey 51 leks within recent fire polygons and 26 leks in other areas of concern (e.g., West Owyhee IHMA leks and Table Butte in Mountain Valleys PHMA).

Results and Discussion

We counted 1,501 leks in 2019. Of all leks counted, 654 were active in 2019, 681 were inactive, and 166 had an unknown status. Surveyed leks with an unknown status were either surveyed only once by air

(helicopter or fixed wing using infrared imagery) with no birds detected or the survey was conducted during inclement weather (i.e., 1 survey was insufficient to determine status). Of these 20 are potential new leks. Of the 7 new leks that were discovered in 2018, 5 were confirmed as occupied leks in 2019.

Statewide, male attendance at all lek routes in 2019 was down 25% from 2018 and down 41% from 2017 (i.e., current 3-year change). For lek routes in PHMA and IHMA, the current 3-year average of males was down 16% from the 2011 baseline. All HMAs exhibited significant declines over the current 3-year period (i.e., lambda < 1.0; Table 2).

Five hard population triggers were tripped in 2019–Desert Priority, Desert Important, Mountain Valleys Priority, Southern Important, and West Owyhee Important (Table 2). A soft trigger was tripped in Mountain Valleys Important.

West Owyhee IHMA is already operating under an adaptive regulatory trigger because >20% of the key habitat in West Owyhee IHMA was lost in the 2015 Soda Fire. In other words, the West Owyhee Important is currently being managed as Priority habitat (BLM 2015, 2019).

As per the Governor's Plan and the 2019 BLM ARMPA, an interagency Idaho Adaptive Management Team will evaluate causal factors of soft and hard population triggers and may recommend management actions. The Adaptive Management Team has completed a draft causal factor analysis for population trigger trips in 2018. These were hard population triggers in Mountain Valleys Priority and Desert Important and a soft trigger in Desert Priority. The Team will complete a comprehensive causal factor report that will address population triggers tripped in 2018 and 2019.

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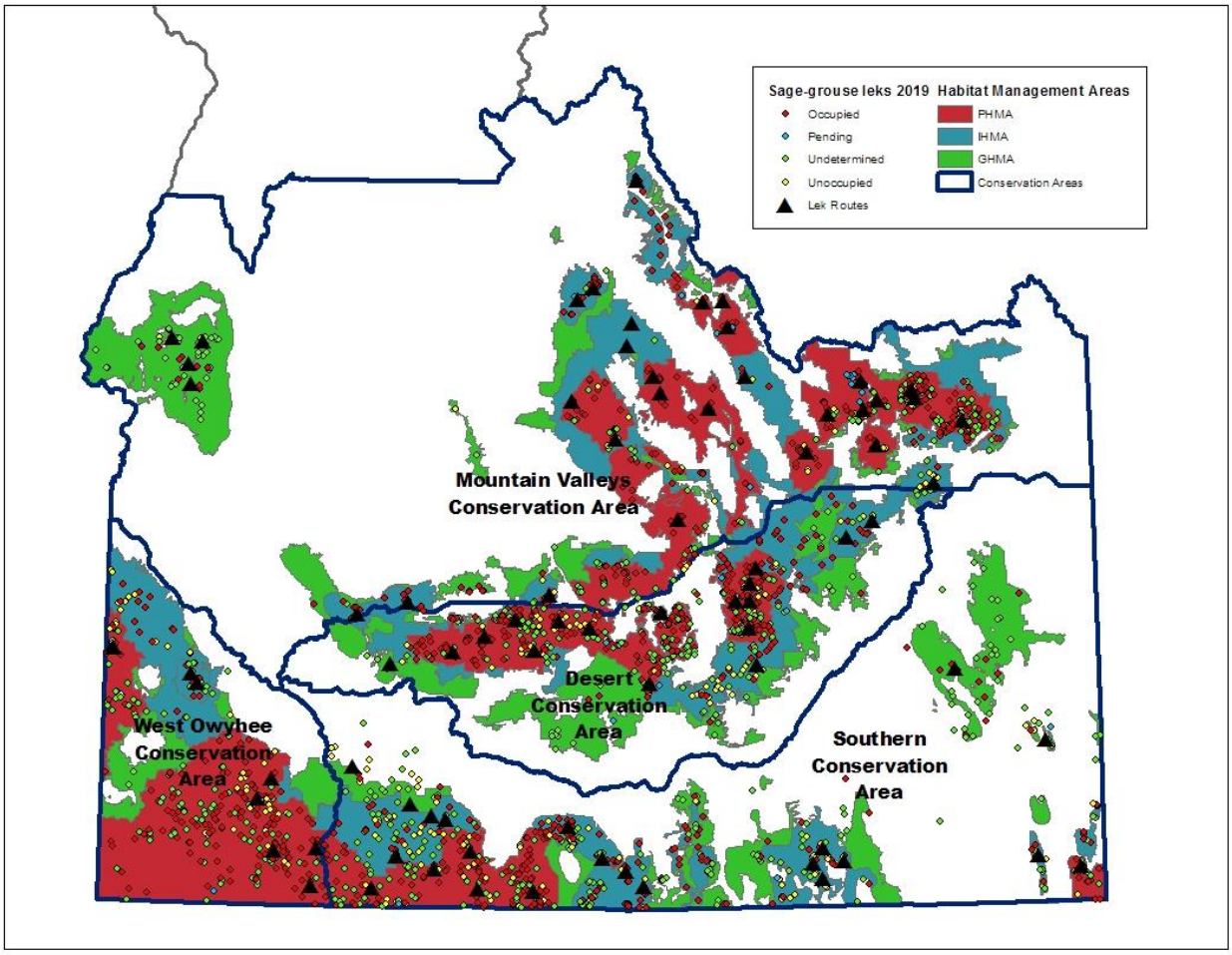

Figure 1. Location of sage-grouse lek routes and leks in each Conservation Area and Habitat Management Area.

Table 1. Estimate of number of leks to count by Conservation Area and Habitat Management Area (HMA) in Idaho in 2098, statistical sample needed of leks counted in 2017 and 2019 for lambda estimation, and actual 2019 results.

Conservation Area/HMA	Total leks[a]	# of leks on lek routes[b]	Total leks to count 2019[c]	Actual # leks counted 2019[d]	Sample size needed of leks counted 2017 & 2019[e]	Actual # leks counted 2017 & 2019	Statistical power reached
Desert Priority	436	149	257	305	54	208	Yes
Desert Important	125	24	85	104	53	87	Yes
Mountain Valleys Priority	382	144	273	284	57	184	Yes
Mountain Valleys Important	109	43	88	91	49	84	Yes
Southern Priority	224	45	175	180	79	118	Yes
Southern Important	272	66	196	228	68	151	Yes
West Owyhee Priority[f]	288	42	103	184	27	128	Yes
West Owyhee Important[f]	33	1	33	45	22	44	Yes
Desert General	44	4	8	10			NA
Mountain Valleys General	75	20	24	31			NA
Southern General	106	17	22	38			NA
West Owyhee General	3	0	0	0			NA
Not categorized or non-habitat	6	1	1	1			NA
Statewide	2103	556	1265	1501			--

[a] Leks in 2018 database.

[b] When ran in lambda analysis, lek route leks are separated from their lek route and assigned to the HMA they plot in (See Appendix A).

[c] Includes lek route leks, random leks, and database priorities.

[d] Includes 20 pending (new) leks observed in 2019.

[e] Number of leks that needed to be counted in both 2017 and 2019 to produce an estimate of lambda ± 0.20 (Scheaffer et al. 1986).

[f] 19 leks in the Browns Creek and Oreana area were reclassified from Priority to Important Habitat in the 2019 BLM ARMPA.

Table 2. Lek triggers evaluation for lek routes and lambda (λ) by Conservation Area/Habitat Management Area in Idaho, 2019.

	Total males on lek routes												Lambda (λ)		
Conservation Area/HMA	2011	2012	2013	2014	2015	2016	2017	2018	2019	Current 3-year avg[a]	% change from 2011[b]	Route trigger tripped[c]	λ 2017 to 2019	90% confidence interval	λ trigger tripped[c]
Desert Priority	**1713**	**1434**	**1526**	**1394**	**1346**	**1710**	**1412**	**1097**	**746**	**1085**	**-37%**	**Hard**	**0.618**	**0.543 - 0.693**	**Yes**
Desert Important	**233**	**186**	**194**	**194**	**190**	**241**	**164**	**138**	**98**	**133**	**-43%**	**Hard**	**0.563**	**0.459 - 0.666**	**Yes**
Mountain Valleys Priority	**1790**	**1716**	**1456**	**1603**	**1589**	**1663**	**1439**	**1165**	**874**	**1159**	**-35%**	**Hard**	**0.583**	**0.495 - 0.671**	**Yes**
Mountain Valleys Important	336	290	317	334	390	432	370	306	203	293	-13%	Soft	0.514	0.413 - 0.616	Yes
Southern Priority	276	252	249	323	403	436	411	329	319	353	+28%	No	0.692	0.568 - 0.816	Yes
Southern Important	**600**	**508**	**488**	**502**	**624**	**664**	**557**	**455**	**335**	**449**	**-25%**	**Hard**	**0.568**	**0.468 - 0.669**	**Yes**
West Owyhee Priority[d]	548	453	398	456	680	948	793	532	426	584	+7%	No	0.487	0.433 - 0.540	Yes
West Owyhee Important[d]	**145**	**147**	**129**	**110**	**157**	**160**	**142**	**85**	**80**	**102**	**-29%**	**Hard**	**0.525**	**0.479 - 0.571**	**Yes**

[a] Current 3-year average.

[b] % change in current 3-year average from 2011 total.

[c] For a population trigger to trip, both lek route and lambda must meet the trigger requirements.

[d] 19 leks in the Browns Creek and Oreana area were reclassified from Priority to Important habitat in the 2019 BLM ARMPA.

Appendix A. Lek Routes.

Lek routes used in the population triggers analysis[a], assigned Habitat Management Zone and Habitat Management Area and notes on assignments.

Lek Route	Conservation Area	Governor's Alt Management Zone	2019 BLM Habitat Management Area	Notes
Antelope Creek	Mountain Valleys	Core	Priority	
Antelope Pocket	Southern	Core	Priority	Most of route in Priority
Big Desert #1	Desert	Core	Priority	
Big Desert #3	Desert	Core	Priority	Most of route in Priority
Big Desert #5	Desert	Core	Priority	
Big Jack's Creek	West Owyhee	Core	Priority	
Birch Creek	Southern	Important	Important	
Blair Trail	Desert	Important	Important	
Bliss-Hill City Road	Desert	Core	Priority	
Bloomington	Southern	Important	Important	
Brown's Bench	Southern	Core	Priority	
Brown's Creek	West Owyhee	Important	Important	Moved from PHMA to IHMA in 2019 BLM ARMPA
Carlson Cabin	Mountain Valleys	Core	Priority	
Cottonwood Ridge	Southern	Important	Important	4 leks in Important, 3 in Priority; small pocket of Priority here
Cow Creek	West Owyhee	Core	Priority	
Crane Creek	Mountain Valleys	General	General	
Crooked Creek	Mountain Valleys	Core	Priority	
Crow's Nest-Clover	Southern	Important	Important	Only occupied lek is in Important, others in Important, 1 in general, 3 not in mapped habitat
Curlew East	Southern	Important	Important	1 lek in non-habitat
Curlew North	Southern	Important	Important	1 lek in non-habitat
Curlew South	Southern	Important	Important	2 leks in non-habitat
Curlew West	Southern	Important	Important	
Dishpan	Southern	Core	Priority	

Lek Route	Conservation Area	Governor's Alt Management Zone	2019 BLM Habitat Management Area	Notes
Dry Creek	Southern	Core	Important	
Dry Gulch	Mountain Valleys	Important	Important	
EIU Sheep Creek (2B032 only)	Southern	Important	Important	2B032 was only lek counted in 2011, it is in Important
Fingers Butte	Desert	Core	Priority	Most of route in Priority
Fir Grove	Desert	Core	Priority	
Grassy Hills	Southern	Core	Priority	
INL/Tractor Flat	Desert	Important	Important	1 lek in General
Jacoby	Mountain Valleys	Core	Priority	
Kinyon	Southern	Important	Important	
Leadore East	Mountain Valleys	Core	Priority	
Leadore West	Mountain Valleys	Core	Priority	1 lek in non-habitat
Lidy	Mountain Valleys	Core	Priority	3 leks in non-habitat
Lincoln/Minidoka	Desert	Core	Priority	1 lek in General
Little Hat Creek	Mountain Valleys	Important	Important	
Little Lost	Mountain Valleys	Core	Priority	
Little Sagehen Flat	Mountain Valleys	Important	Important	
Lower Birch Creek	Mountain Valleys	Core	Priority	
Lower Lemhi	Mountain Valleys	Important	Important	
Lower Pahsimeroi East	Mountain Valleys	Important	Important	
Lower Pahsimeroi West	Mountain Valleys	Important	Important	
Macon Flat	Desert	Core	Priority	
Medicine Lodge	Mountain Valleys	Core	Priority	2 leks in non-habitat
Middle Mountain	Southern	Important	Important	
Midvale Hill	Mountain Valleys	General	General	
Monday Gulch	Mountain Valleys	General	General	
Moores Flat	Mountain Valleys	Important	Important	
North Shoshone	Desert	Core	Priority	
Oreana	West Owyhee	Important	Important	Moved from PHMA to IHMA in 2019 BLM ARMPA
Paddelford Flat	Desert	Core	Priority	1 lek in non-habitat
Picabo	Desert	Core	Priority	1 lek in non-habitat
Plano	Mountain Valleys	Important	Important	
Red Road	Mountain Valleys	Core	Priority	4 leks in Important, 6 in Priority

Lek Route	Conservation Area	Governor's Alt Management Zone	2019 BLM Habitat Management Area	Notes
Rock Creek	Mountain Valleys	Important	Priority	Most of route in Priority
Rocky Knoll	West Owyhee	Core	Priority	
Roland Road	West Owyhee	Core	Priority	
Roseworth	Southern	Important	Important	5 leks in Important, 2 in Priority
RWMC/INL	Desert	Core	Priority	5 leks in Priority, 3 in Important
Sheep Creek	West Owyhee	Core	Priority	
Sheep Station	Mountain Valleys	Core	Priority	
Shoshone Basin	Southern	Core	Priority	
Slug Creek	Southern	General	General	
Soulen Center	Mountain Valleys	General	General	
South Big Desert	Desert	General	Important	
Stible Road	Desert	Important	Important	
Sunday Creek	Southern	General	General	
Table Butte	Mountain Valleys	Core	Priority	
Timmerman	Desert	Core	Priority	
Upper Big Lost	Mountain Valleys	Core	Priority	
Upper Birch Creek	Mountain Valleys	Core	Important	
Upper Lemhi	Mountain Valleys	Core	Priority	
Upper Pahsimeroi	Mountain Valleys	Core	Priority	
Wickahoney	West Owyhee	Important	Priority	
Yellow Sign Road	Southern	Core	Important	

[a] Two lek routes, Spring Gulch and Winter Camp, are not included because they were not surveyed in 2011.