2021 Sage-grouse Population Triggers Analysis

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Introduction

This report provides analysis results of the 2021 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) and U.S. Forest Service plan amendments for sage-grouse (BLM 2015, 2019 & USFS 2015). Along with habitat triggers (BLM Plan: MD SSS 17 and 18, USFS Plan GRSG-AM-010 & 11- Standards), the objective of population triggers is to protect priority areas, evaluate causal factors, and recommend implementation level activities on federal land (MD SSS 21 and 22, GRSG-AM-010-Standard).

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 (MD SSS 19, BLM 2015).

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 (MD SSS 20, BLM 2015)

Triggers are to remain operational until the maximum male counts on lek routes returns to or is greater than the 2011 baseline (MD SSS 24, BLM 2015 & Appendix C Responses to Triggers, USFS 2015). Operational management allocations include temporary application of all PHMA management actions to IHMA within a Conservation Area where the criteria for hard triggers have been met.

Methods

We intersected all Idaho leks with the 2015 sage-grouse habitat management areas (BLM 2015). One-hundred fifteen leks are 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). *It is important to note that there are no lek routes in West Owyhee IHMA under the 2015 BLM plan.*

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. Note that the actual number of leks counted on lek routes may vary among years as new leks are observed on the route.

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

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. 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. Garton et al.'s (2011) model accumulates changes from time t+1 to time t for each lek, for all leks in a population.

However, in our case, we are concerned about the current 3-year change, because a population decline from year 1 to year 3 would be more important biologically than a 3-year average. 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 2019 to 2021). If the 90% confidence interval (CI) is less than, and does not include 1.0, then the finite rate of change is considered to be

significantly declining. The finite rate of change and variance was calculated following Garton et al. (2011).

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 lek 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 typically focus on maintaining the occupancy status of a lek, following the Management Status categories for Idaho (See Appendix B):

1. Visiting undetermined leks that need 1 more visit to be reclassified as unoccupied (5 consecutive years 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 (i.e., pending 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 2018 to 2020 data for PHMA and IHMA in each CA to calculate sample sizes needed for 2021 surveys. 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 2019 and 2021 to produce an estimate of lambda ± 0.20.

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 2021. 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 (2019 and 2021) in each CA/HMA. We adjusted the target number upwards if we were still not meeting the estimated sample size.

We excluded 327 unoccupied leks from the 2021 random selection, resulting in 1,742 leks in our working sample. IDFG has been utilizing this sample selection procedure since 2015, such that we have been able to update the occupancy status of many leks from undetermined to occupied or unoccupied. Unoccupied leks do not contribute to the lambda analysis, since there is no change between years. IDFG will continue to visit unoccupied leks every 5-10 years to confirm status (i.e. database priority 2).

In 2021 our goal was to count a minimum of 1,095 leks statewide; of these, 431 were on lek routes, 448 were randomly assigned leks, and 216 were database or other priorities (Table 1). Other priorities included counting leks within recent fire polygons and other areas of concern (e.g., West Owyhee IHMA leks and Table Butte in Mountain Valleys PHMA).

Results and Discussion

We counted 1,303 leks in 2021 (Table 1). Of all leks counted, 605 were active in 2021, 557 were inactive, and 134 had an unknown status (following the Annual Status definitions in Appendix B). In addition, 7 pending new leks were reported. 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 the 20 pending leks in the 2020 database, 15 were confirmed as occupied leks in 2021 (see Appendix B for lek status requirements).

Statewide, male attendance at all lek routes (including routes in GHMA) in 2021 was up 13% from 2020 and up 15% from 2019 (i.e., current 3-year change). This is reflected in the 2019–2021 lambda values (which includes all leks counted) where most HMAs had stable to increasing lambda (i.e., lambda < 1.0), except West Owhyee (Table 2). Figure 2 demonstrates how the current 3-year lambda can be stable to increasing, while still below the 2011 baseline.

No new population triggers were tripped in 2021. Population triggers remain operational in Desert PHMA, Desert IHMA, Mountain Valleys PHMA, Southern IHMA, West Owyhee PHMA, and West Owyhee IHMA (Table 2). Mountain Valleys IHMA tripped a soft trigger in 2019, but not in 2020 or 2021. Southern PHMA has never tripped a population trigger, likely due to the fact that the 2011 baseline was 4 years after the Murphy Complex Fire; this fire significantly impacted a large portion of Southern PHMA. The history of tripped population triggers, 2015–2020, is shown in Table 3.

As per the Governor's Plan and the 2015 BLM ARMPA, an interagency Idaho Adaptive Management Team is directed to evaluate causal factors of soft and hard population triggers and to recommend management actions. A causal factor analysis and management recommendations report were completed for triggers that had tripped in 2019 or earlier (Desert PHMA and IHMA, Mountain Valleys PHMA, Southern IHMA, and West Owyhee IHMA) (Idaho Adaptive Management Team 2020). West

Owyhee PHMA first tripped a hard trigger in 2020. As such, the causal factor analysis was initiated by the Adaptive Management Team with a report expected later in 2021.

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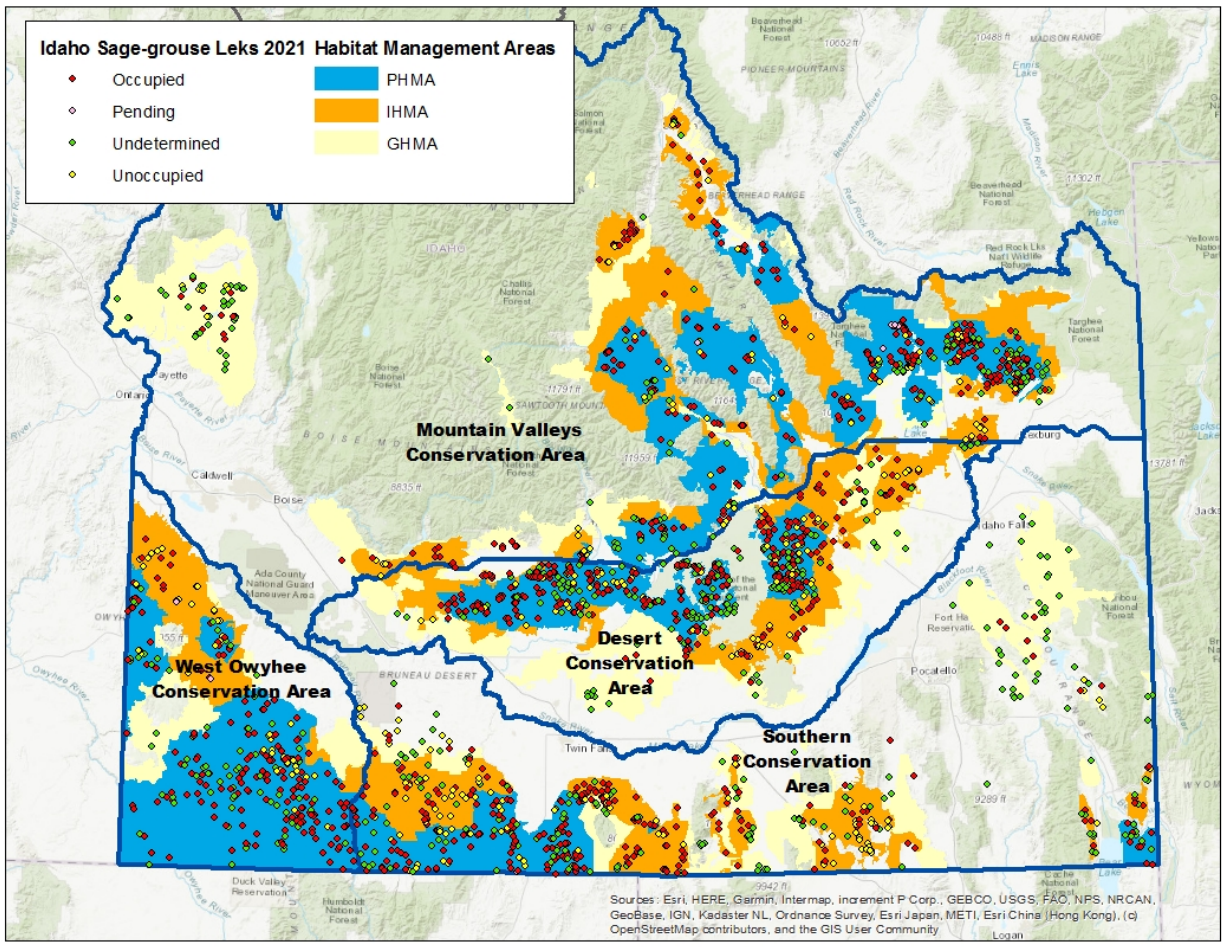

Figure 1. Location of sage-grouse lek routes and leks in each Conservation Area and Habitat Management Area.

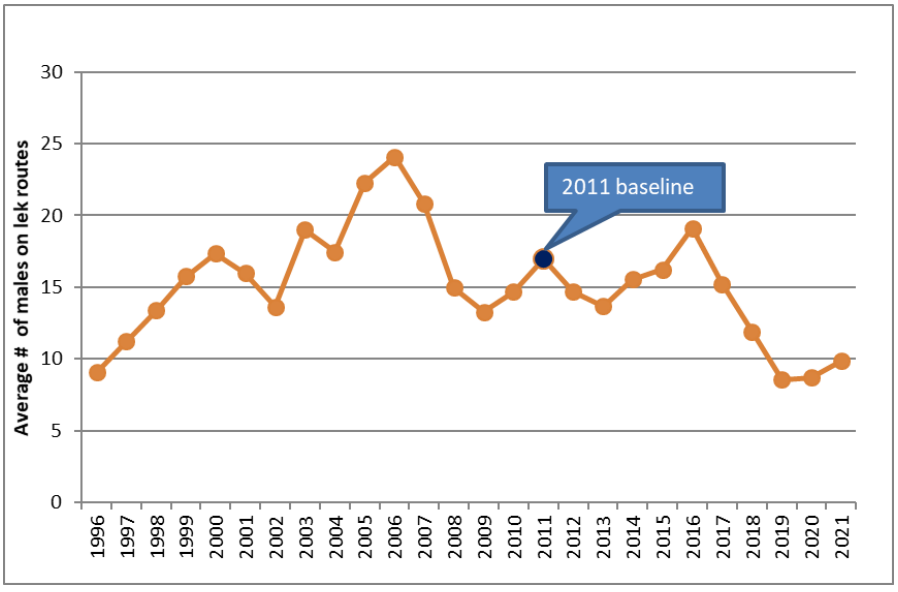

Figure 2. Average number of males per lek for all lek routes in Idaho, 1996-2021.

Table 1. Estimate of number of leks to count by Conservation Area and Habitat Management Area (HMA) in Idaho in 2021, statistical sample needed of leks counted in 2019 and 2021 for lambda estimation, and actual 2021 results.

Conservation Area/HMA	Total sample leks[a]	# of sample leks on lek routes[b]	Total leks to count 2021[c]	Actual # leks counted 2021[d]	Sample size needed of leks counted 2019 & 2021[e]	Actual # leks counted 2019 & 2021	Statistical power reached
Desert PHMA	382	122	237	267	46	210	Yes
Desert IHMA	89	26	85	89	51	96	Yes
Mountain Valleys PHMA	338	110	248	265	81	221	Yes
Mountain Valleys IHMA	86	32	86	82	50	80	Yes
Southern PHMA	175	42	127	131	64	102	Yes
Southern IHMA	202	43	133	170	67	161	Yes
West Owyhee PHMA[f]	247	36	122	206	40	171	Yes
West Owyhee IHMA[f]	20	0	20	23	19	22	Yes
Desert General	37	1	9	13			NA
Mountain Valleys General	64	11	12	23			NA
Southern General	93	7	15	33			NA
West Owyhee General	3	0	0	0			NA
Not categorized or non-habitat	6	1	1	1			NA
Statewide	1,742	431	1,095	1,303			--

[a] Leks in 2020 database, excluding 327 unoccupied leks.

[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 pending leks

[e] Number of leks that needed to be counted in both 2019 and 2021 to produce an estimate of lambda ± 0.20 (Scheaffer et al. 1986).

[f] HMA assignments following BLM (2015).

Table 2. Lek triggers evaluation for lek routes and lambda (λ) by Conservation Area/Habitat Management Area in Idaho, 2021.

	Total males on lek routes														Lambda (λ)		
Conservation Area/HMA	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Current 3-year avg[a]	% change from 2011[b]	Route trigger tripped[c]	λ 2019 to 2021	90% confidence interval[c]	λ trigger tripped[d]
Desert PHMA	1713	1434	1526	1394	1346	1710	1412	1097	746	619	796	720	-58%	Hard	0.970	0.835-1.105	2019
Desert IHMA	233	186	194	194	190	241	164	138	124	110	98	111	-53%	Hard	0.982	0.792-1.171	2018
Mountain Valleys PHMA	1801	1719	1456	1608	1589	1663	1439	1173	874	952	1087	971	-46%	Hard	1.160	1.016-1.303	2018
Mountain Valleys IHMA	336	290	317	334	390	432	370	306	203	253	247	234	-30%	Hard	1.209	0.945-1.472	No
Southern PHMA	276	263	265	345	403	490	450	363	342	403	418	388	+40%	No	0.943	0.792-1.093	No
Southern IHMA	567	468	470	416	555	576	468	372	284	278	311	294	-49%	Hard	0.927	0.774-1.080	2019
West Owyhee PHMA	693	600	527	566	837	1108	935	617	506	447	379	444	-36%	Hard	0.894	0.773-1.015	2020
West Owyhee IHMA[e]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.857	0.480-1.234	2019

[a] Current 3-year average.

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

[c] For a lambda trigger trip, the 90% confidence interval would be less than and not include 1.0.

[d] For a population trigger to trip, both lek route and lambda must meet the trigger requirements. Once a hard trigger is tripped, untripping a trigger requires the current 3-year average of males on lek routes to return to or exceed the 2011 baseline.

[e] No lek routes in West Owyhee IHMA under BLM (2015); thus, trigger is evaluated only on the lambda analysis. West Owyhee IHMA is also operating under a hard habitat trigger due to the 2015 Soda Fire.

Table 3. History of tripped population triggers in Idaho, 2015–2021. Hard triggers remain operational[a] until the maximum male counts on lek routes return to the 2011 baseline.

Conservation Area/HMA	2015	2016	2017	2018	2019	2020	2021
Desert PHMA	None	None	None	Soft	**Hard**	Operational	Operational
Desert IHMA	None	None	None	**Hard**	Operational	Operational	Operational
Mountain Valleys PHMA	None	None	None	**Hard**	Operational	Operational	Operational
Mountain Valleys IHMA	None	None	None	None	*Soft*	None	None
Southern PHMA	None	None	None	None	None	None	None
Southern IHMA	None	None	None	None	**Hard**	Operational	Operational
West Owyhee PHMA	None	None	None	None	None	**Hard**	Operational
West Owyhee IHMA	None	None	None	None	**Hard**	Operational	Operational

[a] Operational management allocations include temporary application of all PHMA management actions to IHMA within a Conservation Area where the criteria for hard triggers have been met.

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	2015 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	Priority	
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	
Dry Creek	Southern	Core	Important	

Lek Route	Conservation Area	Governor's Alt Management Zone	2015 BLM Habitat Management Area	Notes
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	Priority	
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
Rock Creek	Mountain Valleys	Important	Priority	Most of route in Priority
Rocky Knoll	West Owyhee	Core	Priority	

Lek Route	Conservation Area	Governor's Alt Management Zone	2015 BLM Habitat Management Area	Notes
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.

Appendix B. Status Designations and Definitions for Idaho Sage-grouse Leks

Annual Status – Lek status is assessed annually based on the following definitions:

- **Active** – A previously identified lek that has been attended by >1 displaying male sage-grouse during the current breeding season.
- **Inactive** – Any lek where sufficient data suggests that there was no male attendance throughout the current breeding season. Absence of male grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of an absence of birds on the lek during at least 2 ground surveys separated by at least 7 days. These surveys must be conducted under acceptable weather conditions (clear to partly cloudy and winds <10 kph) and in the absence of obvious disturbance. The second annual visit to a potentially inactive lek can be a ground check later in the strutting season; inactive status can be confirmed if no fresh droppings or feathers are found at the lek site.
- **Unknown** – Leks that were not surveyed this breeding season or for which status as active or inactive could not be determined. Leks surveyed 1 time by air with 0-1 birds observed will receive an unknown status.
- **Pending** – An observation of >1 displaying male in a new location. The new location should be thoroughly examined to assure that the observation is not one of a lek that has moved. Typically, new leks should be at least 0.5–1 km from other lek locations and/or separated topographically.

Management Status – Based on its annual status, a lek is assigned to one of the following categories for management purposes:

- **Occupied** – A lek that has been active during at least 1 breeding season within the current 5-year period.
- **Unoccupied** – An unoccupied lek is one that has not been active during a period of 5 consecutive years. To be designated unoccupied, a lek must be "inactive" (see above criteria) in 5 consecutive breeding seasons. A lek may also be unoccupied if it has been surveyed in 7 of the last 10 years and no birds have been observed in any year. The site of an unoccupied lek should be re-visited at least once every 7-10 years to determine whether it has been reoccupied by grouse.
- **Undetermined** – Any lek that has not been surveyed or documented as active in the last 5 years, or has had insufficient survey information to designate the lek as unoccupied.
- **Pending** – A newly discovered lek. A "pending" status is assigned to a location of >1 displaying male as defined above. Because grouse may temporarily display in a random location, the status of the lek observation must be determined within the following 4 years. If >1 displaying males are observed at the location in at least 1 of the following 4 years, the leks status converts to "occupied." If the location is surveyed in at least 2 of the next 4 years, and 0 birds are observed, it is determined that the observation was not a true lek and the observation is converted to a "not verified" status. If the "new" lek is not surveyed in the next 4 years, the status reverts to "not verified."

- **Not Verified** – Not Verified leks are those that have a single observation of birds in one year, but are not confirmed as active following the initial observation. Some leks that are not verified may have been from an historical document where the location is suspect; in some cases a lek may have been found in the general vicinity, then the lek remains in the database with an updated location. Documentation of Not Verified leks remains on file with IDFG, but are not exported to the annual lek database update. Criteria for Not Verified status includes:
    - An historical lek observation prior to 1980 that was recorded in one year, but no lekking birds have been observed at or near the location in at least 7 different years following the initial recorded observation.
    - Any lek observation that was recorded in one year, but no lekking birds have been observed at the location in the most-recent 5 years or in at least 7 different years following the initial recorded observation.
    - Any Pending lek that is not confirmed as above converts to Not Verified.