Appendix G

Anthropogenic Disturbance And Adaptive Management

This Page Intentionally Blank

G. Anthropogenic Disturbance and Adaptive Management

G.1 Part I – Baseline Map and Description of Development

The **biologically significant units (BSUs)** are geographical/spatial areas within Greater Sage-grouse habitat that contains relevant and important habitats which is used as the basis for comparative calculations to support evaluation of changes to habitat. The BSUs include all land ownerships for evaluation, although application of the anthropogenic disturbance cap is specific only to BLM and Forest Service lands. The BSUs are used in the evaluation of anthropogenic disturbance and in the adaptive management habitat trigger.

For the Idaho and Southwestern Montana Greater Sage-Grouse Plan Amendment EIS the biologically significant units are defined as:

> ***Idaho: All of the modeled nesting[1] and delineated winter habitat, which is based on 2011 data, occurring within Priority and/or Important Habitat Management Areas within individual Conservation Areas[2]***
>
> ***Montana: All of the Priority Habitat Management Area***

These BSUs form the geographic basis for the calculation of anthropogenic disturbance and in the soft and hard adaptive management habitat triggers.

While the BSUs define the geographic extent and scale of the Subregion's landscape that will be considered in evaluating anthropogenic disturbance and the adaptive management habitat triggers, how disturbance and habitat triggers are calculated differ since anthropogenic disturbance and habitat loss affect Greater Sage-grouse differently (Knick et al. 2013).

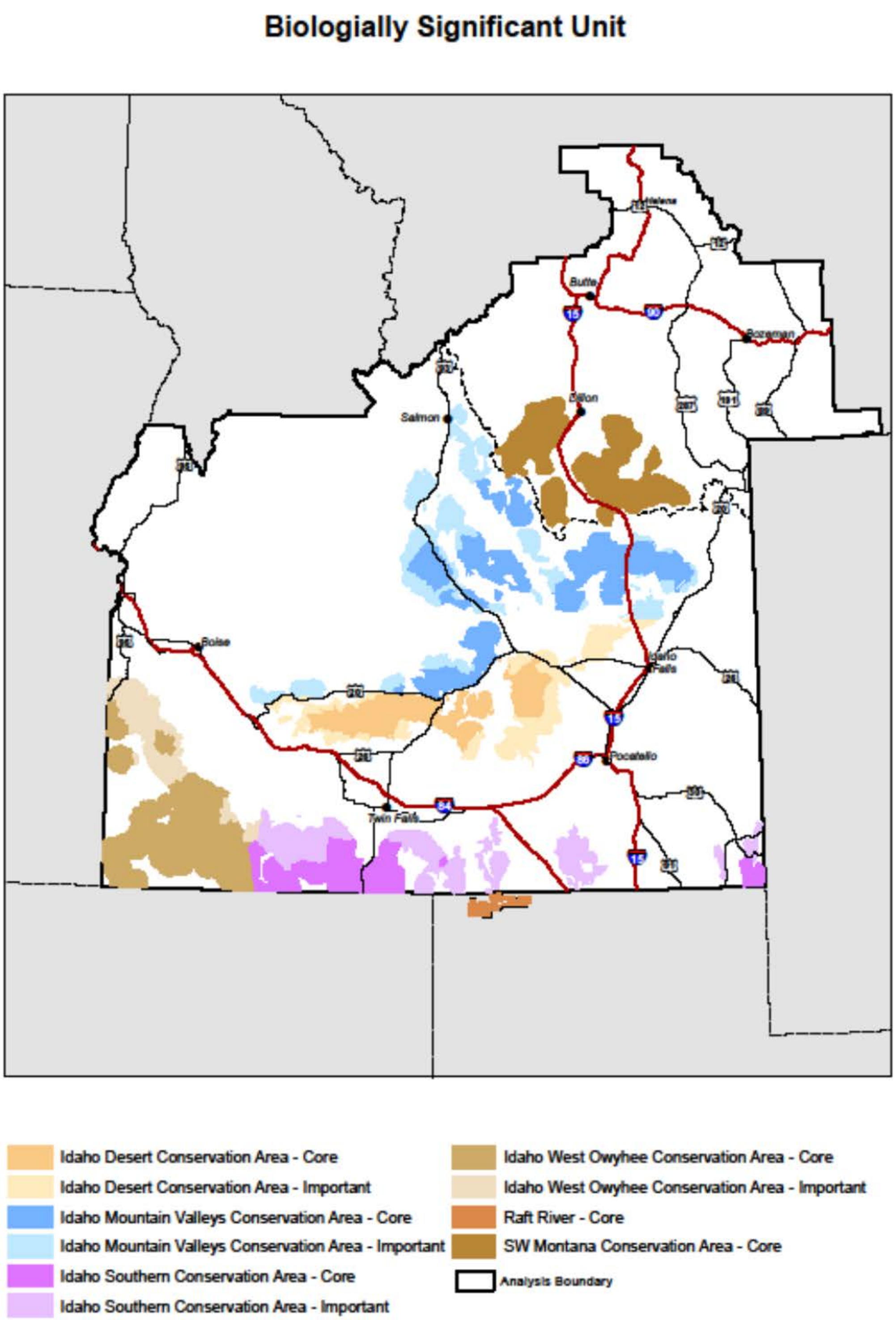
The BSU is the total area (acreage) of nesting and wintering habitat within Priority or Important Habitat Management Areas, separately, by each Conservation Area. For Idaho this results in 8 BSUs, 2 each within the Idaho Conservation Areas – 1 in Priority Habitat Management Areas and 1 in Important Habitat Management Areas. There is 1 BSU in southwest Montana and 1 BSU for the Utah portion of the Sawtooth National Forest (Raft River BSU). There are a total of 10 BSUs within the Idaho and Southwestern Montana Subregion as shown in **Map-G-1**.

In developing these BSUs it was determined at the subregional level that data from these units must be compatible with aggregation to the PAC and WAFWA Management Zone levels, in order to meet FWS needs. In addition, BSUs must be edge matched/aligned with neighboring states. All sub-regions acknowledge there may be locally important biologically significant units smaller than PACs which may or may not be rolled up to PAC level. The

[1] Modeled nesting habitat is defined as those areas of Priority or Important Habitat Management Areas within 6.2 miles of 2011 active leks.

[2] The Utah portion of the Sawtooth National Forest is calculated separately for the Southern Conservation area.

Map-G-1. Biologically Significant Unit

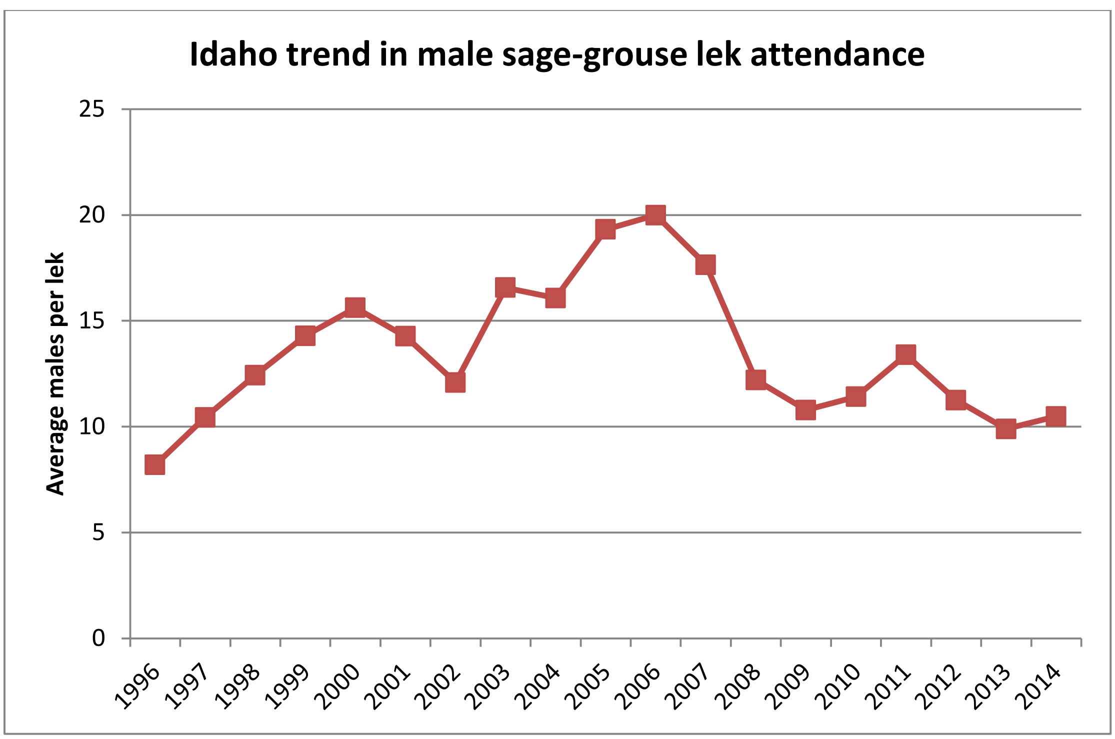


Subregions also acknowledge that assessing disturbance at larger scales such as certain PACs, or via rollup of data, provides a baseline metric for future comparison, but dilution may likely mask disturbance concerns occurring at more local scales.

The application of these calculations requires certain assumptions and associated baseline values which set an appropriate benchmark for future comparison.

For the adaptive management evaluation in Idaho the baseline year for comparison of both the population and habitat values is set at 2011. Sage-grouse have been monitored by counting males on leks since the 1950's (IDFG files). Average male lek attendance (statewide average) reached a low point in 1996 (IDFG in file). A more consistent and intensified survey of leks began with the annual monitoring of all 78 lek routes across southern Idaho in 1996. Average male lek attendance has fluctuated since 1996 (**Figure G-1**) in response to favorable or unfavorable conditions (e.g. weather, habitat improvements or loss, and West Nile virus). Peaks were in 2000, 2006, and 2011 with low points in 2002 and 2009. The increase in male lek attendance after previous declines indicates that sage-grouse populations can rebound over a relatively short time frame (e.g. 5 years) given desirable conditions. The baseline was set at 2011 because the average number of males is approximately the medium (8 higher and 7 lower years) of the counts between1996-2011. At the statewide scale, the 2011 baseline allows 10% and 20% population triggers to be above the second lowest point in 2009. Application of the trigger at a smaller (Conservation Area) scale is a more conservative approach that will indicate potential trends sooner than if applied at the state-wide scale.

Figure G-1. Idaho Trend in Male Sage-grouse Lek Attendance.



G.2 Part II – Anthropogenic Disturbance Calculation

In the USFWS's 2010 listing decision for sage-grouse, the USFWS identified 18 threats contributing to the destruction, modification, or curtailment of the sage-grouse's habitat or range (75 FR 13910 2010. The 18 threats have been aggregated into three measures:

Sagebrush Availability (percent of sagebrush per unit area)

Habitat Degradation (percent of human activity per unit area)

Density of Energy and Mining (facilities and locations per unit area)

Habitat Degradation and Density of Energy and Mining will be evaluated under the Disturbance Cap and Density Cap respectively and are further described in this appendix. The three measures, in conjunction with other information, will be considered during the NEPA process for projects authorized or undertaken by the BLM.

Disturbance Cap:

This land use plan has incorporated a 3% disturbance cap within Greater Sage-Grouse (GRSG) Priority Habitat Management Areas (PHMAs) and the subsequent land use planning actions if the cap is met:

For Idaho and Montana, if the 3 percent anthropogenic disturbance cap is exceeded on lands (regardless of land ownership) within GRSG PHMA (or IHMA in Idaho) Habitat Management Areas in any given BSU, then no further discrete anthropogenic disturbances (subject to applicable laws and regulations, such as the General Mining Law of 1872, as amended, valid existing rights, etc.) will be permitted by BLM within GRSG PHMAs and IHMAs in any given BSU until the disturbance has been reduced to less than the cap. As measured according to the Monitoring Framework (Appendix G) for the intermediate scale.

For Idaho, if the 3 percent disturbance cap is exceeded on all lands (regardless of land ownership) within a proposed project analysis area (Appendix G) in a PHMA (or IHMA in Idaho), then no further anthropogenic disturbance will be permitted by BLM until disturbance in the proposed project analysis area has been reduced to maintain the area under the cap (subject to applicable laws and regulations, such as the General Mining Law of 1872, as amended, valid existing rights, etc.).

For Montana, if the 3 percent disturbance cap is exceeded on lands (regardless of land ownership) or if anthropogenic disturbance and habitat loss associated with conversion to agricultural tillage or fire exceed 5% within a project analysis area in PHMAs, then no further discrete anthropogenic disturbances (subject to applicable laws and regulations, such as the 1872 Mining Law, valid existing rights, etc.) will be permitted by BLM within PHMA in a project analysis area until the disturbance has been reduced to less than the cap. If the BLM determines that the State of Montana has adopted a GRSG Habitat Conservation Program that contains comparable components to those found in the State of Wyoming's Core Area Strategy including an all lands approach for calculating anthropogenic disturbances, a clear methodology for measuring the density of operations, *and a fully operational Density Disturbance Calculation Tool, the 3% disturbance cap will be converted to a 5% cap for all sources of habitat alteration within a project analysis area.*

The disturbance cap applies to the PHMA within both the Biologically Significant Units (BSU) and at the project authorization scale. For the BSUs, west-wide habitat degradation (disturbance) data layers (**Table G-1**) will be used at a minimum to calculate the amount of disturbance and to determine if the disturbance cap has been exceeded as the land use plans (LUP) are being implemented. Locally collected disturbance data will be used to determine if the disturbance cap has been exceeded for project authorizations, and may also be used to calculate the amount of disturbance in the BSUs.

Although locatable mine sites are included in the degradation calculation, mining activities under the 1872 mining law may not be subject to the 3% disturbance cap. Details about locatable mining activities will be fully disclosed and analyzed in the NEPA process to assess impacts to sage-grouse and their habitat as well as to BLM goals and objectives, and other BLM programs and activities.

Formulas for calculations of the amount of disturbance in the PHMA in a BSU and or in a proposed project area are as follows:

- For the BSUs:

  % Degradation Disturbance = (combined acres of the 12 degradation threats[1]) ÷ (acres of all lands within the PHMAs in a BSU) x 100.

- For the Project Analysis Area:

  % Degradation Disturbance = (combined acres of the 12 degradation threats[1] plus the 7 site scale threats[2]) ÷ (acres of all lands within the PHMA in the project analysis area) x 100.

[1] see **Table G-1**. [2] see **Table G-2**

The denominator in the disturbance calculation formula consists of all acres of lands classified as PHMA within the analysis area (BSU or project area). Areas that are not sage-grouse seasonal habitats, or are not currently supporting sagebrush cover (e.g., due to wildfire), are not excluded from the acres of PHMA in the denominator of the formula. Information regarding sage-grouse seasonal habitats, sagebrush availability, and areas with the potential to support sage-grouse populations will be considered along with other local conditions that may affect sage-grouse during the analysis of the proposed project area.

Density Cap:

This land use plan has also incorporated a cap on the density of energy and mining facilities at an average of one facility per 640 acres in the PHMA in a project authorization area. If the disturbance density in the PHMA in a proposed project area is on average less than 1 facility per 640 acres, the analysis will proceed through the NEPA process incorporating mitigation

Table G-1
Anthropogenic disturbance types for disturbance calculations. Data sources are described for the west-wide habitat degradation estimates
(Table copied from the GRSG Monitoring Framework)

Degradation Type	Subcategory	Data Source	Direct Area of Influence	Area Source
Energy (oil & gas)	Wells	IHS; BLM (AFMSS)	5.0ac (2.0ha)	BLM WO-300
	Power Plants	Platts (power plants)	5.0ac (2.0ha)	BLM WO-300
Energy (coal)	Mines	BLM; USFS; Office of Surface Mining Reclamation and Enforcement; USGS Mineral Resources Data System	Polygon area (digitized)	Esri/ Google Imagery
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Energy (wind)	Wind Turbines	Federal Aviation Administration	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	3.0ac (1.2ha)	BLM WO-300
Energy (solar)	Fields/Power Plants	Platts (power plants)	7.3ac (3.0ha)/MW	NREL
Energy (geothermal)	Wells	IHS	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Mining	Locatable Developments	InfoMine	Polygon area (digitized)	Esri Imagery
Infrastructure (roads)	Surface Streets (Minor Roads)	Esri StreetMap Premium	40.7ft (12.4m)	USGS
	Major Roads	Esri StreetMap Premium	84.0ft (25.6m)	USGS
	Interstate Highways	Esri StreetMap Premium	240.2ft (73.2m)	USGS
Infrastructure (railroads)	Active Lines	Federal Railroad Administration	30.8ft (9.4m)	USGS
Infrastructure (power lines)	1-199kV Lines	Platts (transmission lines)	100ft (30.5m)	BLM WO-300
	200-399 kV Lines	Platts (transmission lines)	150ft (45.7m)	BLM WO-300
	400-699kV Lines	Platts (transmission lines)	200ft (61.0m)	BLM WO-300
	700+kV Lines	Platts (transmission lines)	250ft (76.2m)	BLM WO-300
Infrastructure (communication)	Towers	Federal Communications Commission	2.5ac (1.0ha)	BLM WO-300

Table G-2
The seven site scale features considered threats to sage-grouse included in the disturbance calculation for project authorizations.

1. Coalbed Methane Ponds
2. Meteorological Towers
3. Nuclear Energy Facilities
4. Airport Facilities and Infrastructure
5. Military Range Facilities & Infrastructure
6. Hydroelectric Plants
7. Recreation Areas Facilities and Infrastructure

Definitions:

1. **Coalbed Methane and other Energy-related Retention Ponds –** The footprint boundary will follow the fenceline and includes the area within the fenceline surrounding the impoundment. If the pond is not fenced, the impoundment itself is the footprint. Other infrastructure associated with the containment ponds (roads, well pads, etc.) will be captured in other disturbance categories.
2. **Meteorological Towers** – This feature includes long-term weather monitoring and temporary meteorological towers associated with short-term wind testing. The footprint boundary includes the area underneath the guy wires.
3. **Nuclear Energy Facilities** – The footprint boundary includes visible facilities (fence, road, etc.) and undisturbed areas within the facility's perimeter.
4. **Airport Facilities and Infrastructure (public and private)** –The footprint boundary of will follow the boundary of the airport or heliport and includes mowed areas, parking lots, hangers, taxiways, driveways, terminals, maintenance facilities, beacons and related features. Indicators of the boundary, such as distinct land cover changes, fences and perimeter roads, will be used to encompass the entire airport or heliport.
5. **Military Range Facilities & Infrastructure** – The footprint boundary will follow the outer edge of the disturbed areas around buildings and includes undisturbed areas within the facility's perimeter.
6. **Hydroelectric Plants** – The footprint boundary includes visible facilities (fence, road, etc.) and undisturbed areas within the facility's perimeter.
7. **Recreation Areas & Facilities –** This feature includes all sites/facilities larger than 0.25 acres in size. The footprint boundary will include any undisturbed areas within the site/facility.

measures into an alternative. If the disturbance density is greater than an average of 1 facility per 640 acres, the proposed project will either be deferred until the density of energy and mining facilities is less than the cap or co-located it into existing disturbed area (subject to applicable laws and regulations, such as the 1872 Mining Law, valid existing rights, etc.). Facilities included in the density calculation (**Table G-3**) are:

- Energy (oil and gas wells and development facilities)
- Energy (coal mines)
- Energy (wind towers)
- Energy (solar fields)
- Energy (geothermal)
- Mining (active locatable, leasable, and saleable developments)

<u>Project Analysis Area Method for Permitting Surface Disturbance Activities:</u>

- Determine potentially affected occupied leks by placing a four mile boundary around the proposed area of physical disturbance related to the project. All occupied leks located within the four mile project boundary and within PHMA will be considered affected by the project.
- Next, place a four mile boundary around each of the affected occupied leks.
- The PHMA within the four mile lek boundary and the four mile project boundary creates the project analysis area for each individual project. If there are no occupied leks within the four-mile project boundary, the project analysis area will be that portion of the four-mile project boundary within the PHMA.
- Digitize all existing anthropogenic disturbances identified in **Table G-1** and the 7 additional features that are considered threats to sage-grouse (**Table G-2**). Using 1 meter resolution NAIP imagery is recommended. Use existing local data if available.
- Calculate percent existing disturbance using the formula above. If existing disturbance is less than 3%, proceed to next step. If existing disturbance is greater than 3%, defer the project.
- Add proposed project disturbance footprint area and recalculate the percent disturbance. If disturbance is less than 3%, proceed to next step. If disturbance is greater than 3%, defer project.
- Calculate the disturbance density of energy and mining facilities (listed above). If the disturbance density is less than 1 facility per 640 acres, averaged across project analysis area, proceed to the NEPA analysis incorporating mitigation measures into an alternative. If the disturbance density is greater than 1 facility per 640 acres, averaged across the project analysis area, either defer the proposed project or co-locate it into existing disturbed area.

Table G-3
Relationship between the 18 threats and the three habitat disturbance measures for monitoring and disturbance calculations.

USFWS Listing Decision Threat	Sagebrush Availability	Habitat Degradation	Energy and Mining Density
Agriculture	X		
Urbanization	X		
Wildfire	X		
Conifer encroachment	X		
Treatments	X		
Invasive Species	X		
Energy (oil and gas wells and development facilities)		X	X
Energy (coal mines)		X	X
Energy (wind towers)		X	X
Energy (solar fields)		X	X
Energy (geothermal)		X	X
Mining (active locatable, leasable, and saleable developments)		X	X
Infrastructure (roads)		X	
Infrastructure (railroads)		X	
Infrastructure (power lines)		X	
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Other developed rights-of-way		X	

- If a project that would exceed the degradation cap or density cap cannot be deferred due to valid existing rights or other existing laws and regulations, fully disclose the local and regional impacts of the proposed action in the associated NEPA.

The following data sets would ***not*** be used to calculate anthropogenic disturbance, but would be used in the habitat baseline to estimate habitat availability or the amount of sagebrush on the landscape within biologically significant units.

1. Habitat treatments
2. Wildfire
3. Invasive plants
4. Conifer encroachment
5. Agriculture
6. Urbanization, Ex-urban and rural development

Travel and Transportation Disturbance in Sage-Grouse Habitat

The following would count as disturbance (see Part V for definitions):

Linear transportation features identified as roads that have a maintenance intensity of 3 or 5

Linear transportation features identified as primitive roads, temporary routes, or administrative routes that have a functional classification and a maintenance intensity of level 3 or 5

Non-Disturbance

The following items would not count as disturbance:

Linear transportation features identified as trails.

Linear transportation features identified as primitive roads, temporary routes, or administrative routes that have a maintenance intensity of either level 0 or 1.

Linear transportation features identified as primitive routes.

Linear disturbances.

Derivation of the Disturbance Formula -

There is no definitive and scientifically proven formula to determine impact to GRSG from disturbance described in current research. However, Knick et al. (2013) did describe certain relationships between GRSG and anthropogenic disturbance that have been used, in conjunction with specific assumptions to describe a mathematical relationship between human disturbance footprint, effective GRSG habitat and effects to GRSG.

The variables in the equation are defined as:

Acres of a Biologically Significant Unit (BSU)

Acres of Anthropogenic Development within the BSU

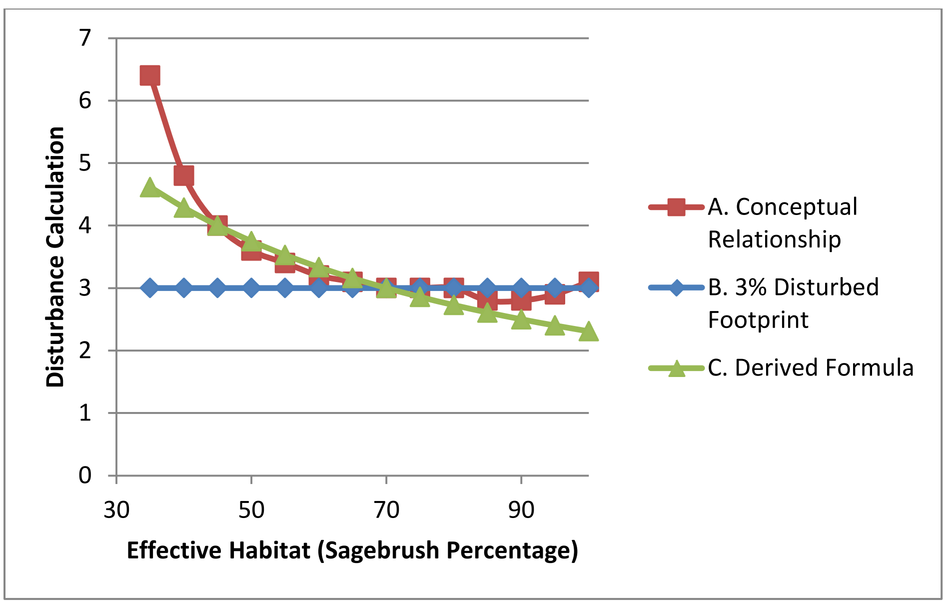
Acres of Effective GRSG Habitat (sagebrush) within the BSU

Knick et al. (2013) defined their unit of comparison (analogous to a biologically significant unit) as an area within 5 km of the lek. Within this area they also found that 79% of this area contained sagebrush (analogous to effective GRSG habitat). Results of the study show that

"Ninety-nine percent of active leks were in landscapes with <3% developed". This shows that when areas within 5 km of a lek containing 79% sagebrush were 3% developed there was a measurable effect on the presence of GRSG – this defines a disturbance threshold of 3% at which point GRSG are affected. Knick et al. developed a habitat similarity relationship between the proportion of leks and percent of sagebrush which shows the highest proportion of leks when sagebrush percentage is between 70-90% (Knick et al. 2013, Figure 5, Connelly et al. 2000, Wisdom et al. 2011). Above 90% and below 70% the proportion of leks is reduced. This helps define the optimum range for sagebrush at between 70-90% and also indicates that the disturbance threshold of 3% is also dependent upon and varies with the percent of sagebrush present (effective habitat).

These findings from Knick et al. (2013) help define some mathematical parameters to define a modeled relationship between disturbance, effective habitat and effects to GRSG. **Figure G-2** illustrates three different 'disturbance curves' that reflect the relationship between disturbance (y-axis) and effective habitat (sagebrush percentage) (x-axis) when the footprint disturbed is equivalent to 3% of the area. The red boxes (A) represent the conceptual relationship between disturbance and effective habitat as described and interpreted from Knick et al. (2013). The blue diamonds (B) represent a simple calculation based only on disturbance footprint, without regard to effective habitat. The green triangles (C) represent the derived formula to model the relationship.

Figure G-2. Disturbance Relationships



The 'A' disturbance curve shows that when the disturbance footprint is 3% of the area and the sagebrush percentage is between 70-90% the disturbance calculation would be 3. When sagebrush percent falls below 70% or rises above 90%, the change in habitat, even without a change in disturbed footprint would begin to affect the presence of GRSG. As the amount of sagebrush declines while disturbance remains the same there would be an increasing effect to GRSG presence. This disturbance curve is conceptual and Knick et al. (2013) does not explicitly define this relationship, although this relationship does reflect numerical the observations described in Knick et al. (2013).

The 'B' disturbance curve is a straight calculation based only on disturbed footprint over a specified area. It does not account for variability of sagebrush percentage, and the only variable is the acres of disturbance. For an area that is 3% disturbed the relationship 'curve' is a flat line at 3, regardless of sagebrush percentage. This 'curve' or calculation would match the conceptual curve when sagebrush percentage is between 70 and 90%. This calculation would not account for changes in effective habitat due to loss through fire or gain through restoration and rehabilitation.

The 'C' disturbance curve models and approximates the conceptual relationship described in Knick et al. (2013). It accounts for changes in effective habitat that would translate into variable effects to GRSG based on loss or gain of habitat. It includes the ability to consider habitat loss such as from fire and to consider habitat gain such as from rehabilitation efforts including conifer removal. The model matched the conceptual relationship in the range of 70% sagebrush and approximates the conceptual relationship in areas with more or less sagebrush cover. The conceptual relationship assumes a more exponential relationship to GRSG effects from loss of habitat, while the derived formula assumes a more linear relationship. There are no available scientific studies that more clearly define the nature of the relationship. The derived formula and the conceptual relationship are substantially similar from 35-90% sagebrush percentage to validate the derived formula's relative approximation of the relationship.

Development of the Modeled Formula:

In order to manage and apply a defined disturbance cap it is necessary to take the findings of the appropriate scientific research and utilize them as appropriately as possible to develop management strategies and evaluation techniques consistent with the management objective. Most scientific research is not completed with the intent to develop specific management objectives or approaches; however, it is through the management approaches that the scientific findings utilized to inform management.

Development of the modeled formula began by describing the simplest relationship of disturbance across a defined area by defining the disturbance percentage as:

$$\%\,Disturbance = \left(\frac{Footprint\ Acres\ from\ Anthropogenic\ Disturbance}{Acres\ within\ Area\ of\ Concern}\right) * 100$$

This accounts for disturbance, but does not account for changes in effective habitat or sagebrush percentage as described in Knick et al. (2013). To account for effective habitat the formula needs to include a term that adjusts the resulting calculation with regard to effective habitat. This should be reflected as an adjustment to the denominator (acres within area of concern). The denominator would be weighted based on the amount of effective habitat. In mathematical terms this would give a denominator of:

$$(Acres\ within\ Area\ of\ Concern) * (Adjustment\ Based\ on\ Effective\ Habitat)$$

The adjustment term must equal 1.0 when the effective habitat is somewhere between 70-90% as described in Knick et al. (2013). Assuming the adjustment term is related to the relative percentage of sagebrush or effective habitat then the *Adjustment Based on Effective Habitat* could be expressed as:

$$\frac{Acres\ of\ Effective\ Habitat\ within\ the\ Area\ of\ Concern}{Acres\ within\ the\ Area\ of\ Concern}$$

However, this term does not equal 1.0 when effective habitat is less than 100%. In order to meet the requirement of equaling 1.0 a constant must be added. This constant, when added to the percentage calculated in the previous term must equal 1.0 when the *Acres of Effective Habitat within the Area of Concern* is somewhere between 70-90%. In the Idaho and Southwestern Montana Subregional Plan an objective of 70% effective habitat has been defined, which is consistent with Knick et al. (2013). If the objective is 70% then the constant that must be added to this term is 0.3 in order to meet the requirement of equaling 1.0 at 70% effective habitat. This defines the following derived formula that approximates the conceptual relationship described in Knick et al. (2013).

$$Disturbance\ Percentage = \left(\frac{\text{Footprint Acres from Anthropogenic Disturbance within Area of Concern}}{\text{Acres within the Area of Concern} * \left(\frac{Acres\ of\ Effective\ Habitat\ within\ the\ Area\ of\ Concern}{Acres\ within\ the\ Area\ of\ Concern} + 0.3 \right)} \right) \text{X } 100$$

Scale:

The particular scale for which this formula is calculated is defined by the Area of Concern. The Knick et al. (2013) used a study area defined by the area within 5 km of an individual lek. The disturbance relationships described previously are applicable at this scale and begin to break down or lose their integrity at greater distances from the lek (18 km). This concern, coupled with limited availability of consistent data across broader areas undermines the reliability and accuracy of the calculation when including areas more distant from the lek.

From a management perspective there is a need to address concerns at the broader scale to help manage those threats before they become a concern at the site specific scale. In Idaho, nesting location data collected by Idaho Department of Fish and Game (IDFG), shows that most nesting habitat occurs within 6.2 miles (10 km) of the lek. IDFG has also collected telemetry data on GRSG movements and used this data to help define wintering areas. Nesting and wintering areas are the most limited and seasonal habitats in Idaho and additional disturbance in those areas could have impacts to GRSG presence. For these reasons the Area of Concern, referred to as the Biologically Significant Unit have been delineated to include nesting and wintering habitats. This results in areas that include more acres than just those associated within a 5 km area of an individual lek as described by Knick et al. (2013), but that are associated (within 6.2 miles or 10 km) with leks. While the Knick et al. (2013) study did not include winter habitat, because of their relative importance they have also been included as part of the BSU since conceivably disturbances that would cause lek abandonment would also likely cause abandonment or avoidance of other seasonal habitat areas. Using other administratively defined areas not delineated or based on specific GRSG use may undermine the utility and integrity of the disturbance relationship and calculation.

This approach, built upon the findings in Knick et al. (2013), uses those findings to help inform management at a broader scale that would help determine management actions based on disturbance evaluations. Using the BSU as the Area of Concern is a scale larger than described in Knick et al. (2013), but still within the predictive bounds described in that study. The formula can be used to calculate disturbance at the BSU scale to help inform a disturbance cap, and it can also be used at the site or project scale to help inform specific project activities.

Additional Questions and Answers Regarding the Idaho Disturbance Calculation

The measurement and application of a disturbance threshold with regard to a species using the various locations of the landscape for different parts of its life history is extremely complicated. The previous discussion is a description of the derivation of that calculation and application. What follows are specific responses to questions that have arisen based on the previous discussion. While all of the following answers are supported in the previous discussion they are not necessary described as explicitly there as they are below.

Question: Why has Idaho BLM developed a calculation apart from the rest of the Great Basin planning areas when USFWS has been looking for a consistent approach to the extent possible?

Response: The alternative included in the Draft EIS's describing the National Technical Team Report (Alternative B in the Idaho and Southwestern Montana DEIS) included a management action to apply a 3% disturbance cap. However, there was no description of how this would be applied, calculated or implemented in subsequent management. The Preferred Alternatives (D & E) did not include a disturbance cap since disturbance was not identified as a major concern causing loss of habitat in Idaho or Southwestern Montana and its measurement and applicability was not defined and deemed highly problematic to implement in a meaningful way. During the early 2014 Federal Family Meeting (FFM) USFWS indicated that inclusion of such a disturbance threshold was necessary in order for USFWS to have the assurance and certainty necessary when assessing GRSG listing. At that point, outside of Wyoming's Disturbance Density Calculation Tool there was no developed approach to measure or calculate disturbance to evaluate a disturbance cap against.

Idaho BLM invited Dr. Steve Knick to discuss his study regarding disturbance (the only known scientific research describing a disturbance cap). Also as a result of that FFM the BLM's NOC began working on developing a disturbance calculation process that was not as intensive as the Wyoming DDCT approach, based on BLM guidance that anthropogenic disturbance measurement would not follow that approach in other states due the intensive and workload associated with that approach would not be feasible to implement in other states.

Idaho BLM followed the provided guidance to develop biologically significant units (BSUs). The NOC developed 3 equations to try and relate disturbance and habitat. These equations were specifically applicable to broad scales but not applicable to site specific scales. Idaho BLM took the information and built a simple equation measuring and evaluating absolute disturbance to compare against the cap. That equation was defined as:

$$\frac{\textit{Acres of Anthropogenic Disturbance within the BSU}}{\textit{Acres within the BSU}}$$

At the time of the August Federal Family Meeting the Idaho BLM had further refined the previous equation to more accurately reflect the findings in Knick's research. Disturbance was discussed at that meeting and it was evident that there was no other clear guidance from either the WO, the NOC or efforts from other states in this subject. Idaho was the only state to have put effort into the need identified by USFWS and the only effort to have a reasonable, scientifically based approach. Idaho did not intentionally deviate from consistent approaches being developed apart from the other Great Basin planning areas; and in fact until late 2014 Idaho is the only Great Basin planning effort to have put an approach together.

Why is the Idaho calculation important or relevant given that an anthropogenic disturbance cap is not likely to be hit?

Response: Loss of habitat from anthropogenic disturbance is not a major issue in Idaho and Southwestern Montana; however, that does not mean that measurement and evaluation of a disturbance cap can be arbitrary, or any less supportable, or inconsistent with the scientific research available if that research can help inform the conditions and evaluation appropriately.

That is why the Idaho disturbance calculation is defined consistent with the scientific research making it reflective of the known effects to GRSG and supportable to base management decisions upon.

Is loss of habitat from fire considered in the Idaho calculation?

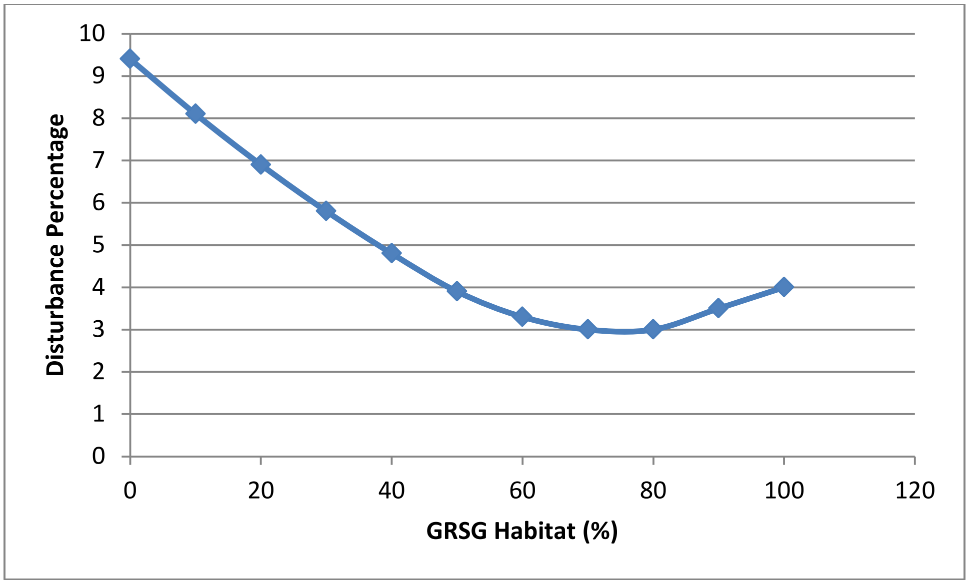
Response: The Idaho calculation does consider the effect fire has on the habitat and includes loss of habitat from fire as part of the calculation by weighting the denominator based on the actual habitat available to the GRSG. The rationale described is in direct reference to the original equation Idaho BLM used:

$$\frac{\textit{Acres of Anthropogenic Disturbance within the BSU}}{\textit{Acres within the BSU}}$$

which does not account for changes in habitat due to loss through fire or gain through restoration. As stated previously Idaho's approach was not developed as a deviation or in comparison to other planning effort attempts at calculating the disturbance cap because such attempts did not yet exist when Idaho's approach was completed.

Why does the Idaho calculation include two terms which seem to complicate the evaluation (the entire area of the BSU and the constant)?

Response: The two terms at issue here are precisely what make the equation relevant and scientifically accurate and supportable, they may make the calculation more complex but natural systems are complex and mathematical equations developed to describe those systems may be somewhat complex. That they are difficult to interpret does not invalidate their inclusion and their value, in numerical description, which those terms contribute to describing a complex situation. The actual relationship described in Knick et al., when graphed would resemble:



This graph shows the conceptual relationship curve of anthropogenic disturbance suggested by Knick et al. In that research it was shown that when anthropogenic disturbance reached 3% within an area surrounding leks (5-18km) then lek attendance was impacted through fewer birds attending on leks. In the graph above the curve assumes that the area described has 3% of its acres under some sort of anthropogenic developed. According to Knick et al. when 70-80 percent of an area is effective habitat for GRSG then anthropogenic development totaling 3% of that area will start to reduce lek attendance. That research also shows that if the effective habitat percentage within that area is over 90% or less than 70% lek attendance is affected when less than 3% of the area contains anthropogenic development. This relationship would mathematically be described using a parabolic (as opposed to a linear) equation, making it a much more accurate reflection of a complex system but also making it even more complex and difficult to interpret. In addition, while Knick et al. suggests this relationship, and defines the effects at a 3% anthropogenic disturbance level in conjunction with 70-80% effective habitat. Knick et al., and we are aware of no other scientific studies, does not describe the trajectory of the curve above 80% or below 60%, so actually developing a more accurate, parabolic formula, is not possible at this time.

The Idaho equation is:

$$Disturbance\ Percentage\ = \left(\frac{\text{Footprint Acres from Anthropogenic Disturbance in the BSU}}{\text{Acres within the BSU}*\left(\frac{Acres\ of\ Effective\ Habitat\ within\ the\ BSU}{Acres\ within\ the\ BSU}+0.3\right)}\right)\ X\ 100$$

This equation is meant to describe a spatially reality, for that reason it is imperative that the terms be linked with that spatially reality. Without this link any equation descriptive of a spatial reality would become meaningless to the reality it is trying to describe. The purpose of a disturbance cap and a supporting disturbance calculation is to measure and evaluate anthropogenic disturbance over a given area. For the purposes of application this area is defined as the biologically significant unit or BSU. For Idaho the BSU was delineated consistent with BLM guidance and reflective of the Knick et al. research. Idaho's BSU are defined as: all of the modeled nesting and delineated winter habitat, which is based on 2011 data, occurring within Priority and/or Important Habitat Management Areas within individual Conservation Areas for all land ownerships. Modeled nesting habitat is defined as a 10 km area around leks. Based on Idaho Department of Fish and Wildlife surveys and monitoring information this area around leks encompasses a vast majority of the nesting habitat (i.e. IDFG data show that over 90% of nesting occurs within 10 km of the lek). This 10 km is within the 5-18 km range for which Knick et al. identified their research was applicable. Knick communicated to the Idaho ID Team that beyond 18 km the disturbance relationship to lek attendance described in his research was not discernable). The equation calculates a disturbance value within that BSU area by totaling the acres of disturbance within that area and dividing by that area appropriately adjusted by effective habitat within that area to reflect a higher impact of disturbance when effective habitat is lower than the low end of the 70-80% optimum range (This optimum range is also supported by Connelly et al. 2000 (80%) and the BLM's National Technical Team Report (70%)). The equation does not accurately depict the disturbance relationship when effective habitat is greater than 80%. This is due to the fact the equation is linear as opposed to parabolic (discussed earlier) and that the areas within Idaho of most concern for continued presence of GRSG and impacts from anthropogenic disturbance do not exceed 80% effective habitat. Areas of effective habitat greater than 80%, only occurs in the Mountain Valleys Conservation Area where existing disturbance is well below 2%. Therefore the applicability of the equation to these conditions is limited.

Anthropogenic disturbance is being measured and evaluated within the entire BSU, not just the effective habitat area, which is why it is important to define the denominator across the BSU scale, not just a portion of the BSU, which is where the spatial link becomes critical. How the denominator is described mathematically defines the scale over which the numerator is measured; changing that scale would also require adjustments to the numerator to be mathematically correct and maintain the spatial link critical for using a numeric equation to describe a spatial effect.

The presence of the constant (0.3) is a mathematical necessity that defines the relationship, it is neither irrelevant, nor is it a 'correction' factor. Correction implies there is something incorrect or erroneous in the equation. The effective habitat denominator adjustment term:

$$\left(\frac{Acres\ of\ Effective\ Habitat\ within\ the\ BSU}{Acres\ within\ the\ BSU} + 0.3\right)$$

This entire term, in order to accurately reflect Knick et al. (see previous conceptual curve graph), must equal 1 when effective habitat within the BSU represents 70% of the BSU. Without the constant 0.3 added to the effective habitat proportion this term would not equal 1 when effective habitat is at 70%, it would not be a mathematical correct approximation of the disturbance relationship, it would lose its spatial link since this term needs to account for 100% of the acres in the BSU at the 70% habitat/3% disturbance intercept and would therefore become meaningless with respect to the spatial relationship that is being approximated.

Does the Idaho equation allow for more disturbance before hitting the cap than other calculations?

Response: This conclusion would need to be qualified based on the validity of the equation being used for comparison. For example and equation represented by the disturbance relationship expressed as:

$$\frac{Acres\ of\ Disturbance}{Effective\ Habitat}$$

This equation has the benefit of simplicity; however there are several fundamental flaws with this simple calculation which without further refinement to link the spatial reality with the mathematical formula make any comparisons invalid. This equation does not appropriately address: 1) spatial representation; 2) scale of the calculation; 3) consistency with known science; or 4) multiple considerations of single disturbances (i.e. double counting, which links back to the spatial representation aspect of the equation).

When using mathematical equations to describe real-world conditions it is imperative that the link between the spatial conditions and the mathematical representation of those conditions be understood and maintained. Otherwise any comparison does not have an appropriate foundation for comparison and is ultimately of limited, if any, use. To help illustrate this equation would more accurately be written:

$$\frac{\text{(Acres of Disturbance within Effective Habitat + Acres of Disturbance outside Effective Habitat)}}{\text{(Acres of Concern (BSU) – Acres outside Effective Habitat)}}$$

While more complicated, this equation is more accurate in depicting the actual formula used in a spatially representative way. This is further described when all the acres within the Area of Concern or BSU are Effective Habitat; Acres outside Effective Habitat would be zero, effectively eliminating that term and similarly Acres of Disturbance outside Effective Habitat would be zero since there are no acres outside Effective Habitat, therefore eliminating that term as well; leaving the original simplified version of this equation. However, when there are no Acres outside Effective Habitat within the Acres of Concern is the ONLY condition where this simplified equation actually represents and links to the real-world spatial conditions which are being described. So it is ONLY at this point (when the BSU contains 100% Effective Habitat) that the Idaho methodology and this simple equation can be appropriately compared. As described earlier the Idaho methodology (equation) does not accurately reflect the spatial conditions (according to Knick et al.) above 80% Effective Habitat (See previous discussion regarding why this is not a significant issue in need of resolution). Below 70% Effective Habitat where the Idaho methodology reflects the scientific relationships comparisons; the simple equation loses its spatial link and comparisons are not valid or appropriate.

So why is the spatial link lost?

Response: A key principle in translating spatial conditions to mathematical equations is, in this instance, each acre of either disturbance, within effective or outside effective habitat in the equation represents a real acre of disturbance, a real acre within effective habitat or a real acre outside effective habitat. If there are acres outside Effective Habitat within the Area of Concern the more accurate equation described above shows that those acres are REMOVED through subtraction from the denominator. This changes the scale of the calculation effectively redefining the spatial extent over which the Acres of Disturbance appropriate to the new scale/denominator can be measured. So this equation redefines the spatial extent for comparison through removing acres from the denominator, while at the same time it includes acres of disturbance in the numerator. The spatial representation is lost when the same acres are both included in the numerator but removed from the denominator.

Why is the Idaho calculation not applied more broadly, i.e. within other planning areas?

Response: Using Idaho's methodology in other states will be problematic because the site-specific data available in the Key Habitat Map needed to support Idaho's methodology are not readily available in other states. Idaho has collected, reviewed and updated on an annual basis for 12+ years a GRSG Key Habitat Map. This map tracks effective habitat, effects to that habitat from fire, restoration efforts and use by GRSG. This is the data utilized in the adjustment factor for the denominator and it is critical to the use of the equation, without this data actual meaningful application of the equation would not be possible or relevant.

How is effective habitat defined?

Response: For Idaho's methodology effective habitat is taken to be the Key Habitat areas described by the Idaho Key Habitat Map. Key habitat includes areas of generally intact sagebrush that provide sage-grouse habitat during some portion of the year. This map also identifies areas that could provide GRSG habitat or currently provide habitat at less than optimum levels. These areas are also spatially depicted and as described as: R1 – perennial grass areas with limited sagebrush presence; R2 – annual grassland areas with limited perennial grasses or sagebrush presence; and R3- juniper encroachment within areas previously dominated by sagebrush.

Example 1 – Anthropogenic Disturbance

In the Southern Conservation Area the Priority BSU was delineated to include 784,958 acres and the Important BSU was delineated to include 1,036,455 acres, which represent the acres of the Biologically Significant Unit to be used in the denominator. The acres of Effective Habitat in the Priority BSU are 424,656 and in the Important BSU are 447,497. This sets up two equations – one for Priority Habitat Management Areas and one for Important Habitat Management Areas.

The existing footprint acres of disturbance within the Priority BSU are 17,661 acres and the footprint acres of disturbance within the Important BSU are 12,748 acres.

This gives the following two equations to define the baseline disturbance condition in the BSUs:

$$Priority = \frac{17661}{(784958 * ((\frac{424656}{784958}) + 0.3)} * 100$$

Or $$(\frac{17661}{784958*((0.54)+0.3)}) * 100$$

Or $$\left(\frac{17661}{784958*(0.84)}\right) * 100$$

Yielding a percent disturbance in the Priority BSU of 2.68%

$$Important = \frac{12748}{(1036455 * ((\frac{447497}{1036455}) + 0.3)} * 100$$

Yielding the percent disturbance in the Important BSU of 1.68%

If by 2015 we project additional development within the Priority BSU to be 2120 acres (a 12% increase) and development within the Important BSU to be 4000 acres (a 30% increase) then the Priority footprint acres becomes 20,161 acres and the Important footprint acres becomes 16,748 acres. The resulting evaluation for this cumulative disturbance is calculated by:

$$Priority = \frac{19781}{(784958*((\frac{424656}{784958})+0.3)} * 100 \quad Important = \frac{16748}{(1036455*((\frac{447497}{1036455})+0.3)} * 100$$

Yielding the percent disturbance as: Priority = 3.00% and Important = 2.21%

In the examples, given the existing disturbance footprint it would require development of an additional 2,120 acres in the Priority BSU and an additional 10,005 acres in the Important BSU before the 3% cap would be engaged.

G.3 Part III – Montana Disturbance Calculation

Montana will use a 3% disturbance cap until the state of Montana strategy, similar to WY's Core Area Strategy that uses a 5% disturbance cap for all lands and all disturbances, is fully implemented. BLM MT will develop, and include in their plans, the conditions to be met prior to the change in the disturbance cap.

I. Use of west-wide habitat degradation data as well as the use of locally collected disturbance data to determine the level of existing disturbance:

   a) In the GRSG Priority Habitat Management Areas in any given Biologically Significant Unit, use the west-wide data at a minimum and/or locally collected disturbance data as available (e.g., DDCT) for the anthropogenic disturbance types listed in **Table G-4**.

II. Use of locally collected disturbance data for project authorizations:

   a) In a proposed project analysis area, digitize all existing anthropogenic disturbances identified in the GRSG Monitoring Framework and the 7 additional features that are considered threats to sage-grouse (**Table G-5**). Using 1 meter resolution NAIP imagery is recommended. Use local data if available.

III. Fire-burned and habitat treatment areas will not be included in the project scale degradation disturbance calculation for managing sage-grouse habitat under a disturbance cap. These areas will be considered part of a sagebrush availability when rangewide, consistent, interagency fine- and site-scale monitoring has been completed and the areas have been determined to meet sage-grouse habitat requirements. These and other disturbances identified in **Table G-4** will be part of a sagebrush availability evaluation and will be considered along with other local conditions that may affect sage-grouse during the analysis of the proposed project area.

IV. Planning units are directed to use a density cap related to the density of energy and mining facilities (listed below) during project scale authorizations. If the disturbance density in a proposed project area is on average less than 1/ 640 acres, proceed to the NEPA analysis incorporating mitigation measures into an alternative. If the disturbance density is greater than an average of 1/ 640 acres, either defer the proposed project or co-locate it into existing disturbed area *(subject to applicable laws and regulations, such as the 1872 Mining Law, valid existing rights, etc.)*.

   - Energy (oil and gas wells and development facilities)
   - Energy (coal mines)
   - Energy (wind towers)

- Energy (solar fields)
- Energy (geothermal)
- Mining (active locatable, leasable, and saleable developments)

V. Planning units are directed to continue using the baseline data from the 2013 USGS Baseline Environmental Report (BER) in the Affected Environment section of the proposed plans/ FEISs. West-wide sagebrush availability and habitat degradation data layers will be used for the Priority Habitat Management Areas in each population for monitoring (see the GRSG Monitoring Framework in the Monitoring Appendix of the EIS) and management purposes as the LUPs are being implemented. The BER reported on individual threats across the range of sage-grouse while the west-wide disturbance calculation consolidated the anthropogenic disturbance data into a single measure using formulas from the GRSG Monitoring Framework. These calculations will be completed on an annual basis by the BLM's National Operation Center. Planning units will be provided the 2014 baseline disturbance calculation derived from the west-wide data once the RODs are signed that describe the Priority Habitat Management Areas.

VI. Planning units are directed to use the three measures (sagebrush availability, habitat degradation, density of energy and mining) in conjunction with other information during the NEPA process to most effectively site project locations, such as by clustering disturbances and/or locating facilities in already disturbed areas. Although locatable mine sites are included in the degradation calculation, mining activities under the 1872 mining law may not be subject to the 3% disturbance cap. Details about locatable mining activities should be fully disclosed and analyzed in the NEPA process to assess impacts to sage-grouse and their habitat as well as to BLM goals and objectives, and other BLM programs and activities.

Additional Information/Formulas

Disturbance Calculations for the BSUs and for the Project Analysis Areas:

- For the BSUs: **% Degradation Disturbance = (combined acres of the 12 degradation threats*) ÷ (acres of all lands within the PHMAs in a BSU) x 100.**
- For the Project Analysis Area: **% Degradation Disturbance = (combined acres of the 12 degradation threats[1] plus the 7 site scale threats[2]) ÷ (acres of all lands within the project analysis area in the PHMA) x 100.**

  [1] see **Table G-6**. [2] see **Table G-5**

Table G-4
Anthropogenic disturbance types for disturbance calculations. Data sources are described for the west-wide habitat degradation estimates
(Table copied from the GRSG Monitoring Framework)

Degradation Type	Subcategory	Data Source	Direct Area of Influence	Area Source
Energy (oil & gas)	Wells	IHS; BLM (AFMSS)	5.0ac (2.0ha)	BLM WO-300
	Power Plants	Platts (power plants)	5.0ac (2.0ha)	BLM WO-300
Energy (coal)	Mines	BLM; USFS; Office of Surface Mining Reclamation and Enforcement; USGS Mineral Resources Data System	Polygon area (digitized)	Esri/ Google Imagery
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Energy (wind)	Wind Turbines	Federal Aviation Administration	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	3.0ac (1.2ha)	BLM WO-300
Energy (solar)	Fields/Power Plants	Platts (power plants)	7.3ac (3.0ha)/MW	NREL
Energy (geothermal)	Wells	IHS	3.0ac (1.2ha)	BLM WO-300
	Power Plants	Platts (power plants)	Polygon area (digitized)	Esri Imagery
Mining	Locatable Developments	InfoMine	Polygon area (digitized)	Esri Imagery
Infrastructure (roads)	Surface Streets (Minor Roads)	Esri StreetMap Premium	40.7ft (12.4m)	USGS
	Major Roads	Esri StreetMap Premium	84.0ft (25.6m)	USGS
	Interstate Highways	Esri StreetMap Premium	240.2ft (73.2m)	USGS
Infrastructure (railroads)	Active Lines	Federal Railroad Administration	30.8ft (9.4m)	USGS
Infrastructure (power lines)	1-199kV Lines	Platts (transmission lines)	100ft (30.5m)	BLM WO-300
	200-399 kV Lines	Platts (transmission lines)	150ft (45.7m)	BLM WO-300
	400-699kV Lines	Platts (transmission lines)	200ft (61.0m)	BLM WO-300
	700+kV Lines	Platts (transmission lines)	250ft (76.2m)	BLM WO-300
Infrastructure (communication)	Towers	Federal Communications Commission	2.5ac (1.0ha)	BLM WO-300

Table G-5
The seven additional features to include in the disturbance calculation at the project scale

1. Coalbed Methane Ponds
2. Meteorological Towers
3. Nuclear Energy Facilities
4. Airport Facilities and Infrastructure
5. Military Range Facilities & Infrastructure
6. Hydroelectric Plants
7. Recreation Areas Facilities and Infrastructure

Table G-6
Relationship between the 18 threats and the three habitat disturbance measures for monitoring and disturbance calculations.

USFWS Listing Decision Threat	Sagebrush Availability	Habitat Degradation	Energy and Mining Density
Agriculture	X		
Urbanization	X		
Wildfire	X		
Conifer encroachment	X		
Treatments	X		
Invasive Species	X		
Energy (oil and gas wells and development facilities)		X	X
Energy (coal mines)		X	X
Energy (wind towers)		X	X
Energy (solar fields)		X	X
Energy (geothermal)		X	X
Mining (active locatable, leasable, and saleable developments)		X	X
Infrastructure (roads)		X	
Infrastructure (railroads)		X	
Infrastructure (power lines)		X	
Infrastructure (communication towers)		X	
Infrastructure (other vertical structures)		X	
Other developed rights-of-way		X	

Project analysis area method for permitting surface disturbance activities:

- Determine potentially affected occupied leks by placing a four mile boundary around the proposed area of physical disturbance related to the project. All occupied leks located within the four mile project boundary and within PHMA will be considered affected by the project.
- Next, place a four mile boundary around each of the affected occupied leks.
- The PHMA within the four mile lek boundary and the four mile project boundary creates the project analysis area for each individual project. If there are no occupied leks within the four-mile project boundary, the project analysis area will be that portion of the four-mile project boundary within the Priority Habitat Management Area.
- Map disturbances or use locally available data. Use of NAIP imagery is recommended. In Wyoming, burned areas are included in this step.
- Calculate percent existing disturbance using the formula above. If existing disturbance is less than 3%, proceed to next step. If existing disturbance is greater than 3%, defer the project.
- Add proposed project disturbance footprint area and recalculate the percent disturbance. If disturbance is less than 3%, proceed to next step. If disturbance is greater than 3%, defer project.
- Calculate the disturbance density of energy and mining facilities (listed above). If the disturbance density is less than 1 facility per 640 acres, averaged across project analysis area, proceed to the NEPA analysis incorporating mitigation measures into an alternative. If the disturbance density is greater than 1 facility per 640 acres, averaged across the project analysis area, either defer the proposed project or co-locate it into existing disturbed area.
- If a project that would exceed the degradation cap or density cap cannot be deferred due to valid existing rights or other existing laws and regulations, fully disclose the local and regional impacts of the proposed action in the associated NEPA.

Background

In the USFWS's 2010 listing decision for sage-grouse, the USFWS identified 18 threats contributing to the destruction, modification, or curtailment of the sage-grouse's habitat or range (75 FR 13910 2010). In April 2014, the Interagency GRSG Disturbance and Monitoring Sub-Team finalized the Greater Sage-Grouse Monitoring Framework (hereafter, framework) to track these threats. The 18 threats have been aggregated into three measures to account for whether the threat predominantly removes sagebrush or degrades habitat. The three measures are:

Measure 1: Sagebrush Availability (percent of sagebrush per unit area)
Measure 2: Habitat Degradation (percent of human activity per unit area)
Measure 3: Density of Energy and Mining (facilities and locations per unit area)

The BLM is committed to monitoring the three disturbance measures and reporting them to the FWS on an annual basis. However, for the purposes of calculating the amount of disturbance to provide information for management decisions and inform the success of the sage-grouse planning effort, the data depicting the location and extent of the 12 anthropogenic types of threats will be used at a minimum in the BSUs and those same 12 anthropogenic and the additional 7 types of features that are threats to sage-grouse will be used in the project analysis areas.

		Scales		
		Broad/Mid (Populations)	**Intermediate (BSU)**	**Local/Project (Seas. Hab.)**
Habitat Degradation	**Unit:**	WAFWA Populations	Biologically Significant Unit	Project/Local Habitat Area[6]
	Area of Interest:	PHMAs	PHMAs	PHMAs
	Data:	Westwide degradation data	Westwide[2], State, Local	State, Local
	Formula (Measure 2a):	12 Degradation Threats / PHMAs in Populations	12 Degradation Threats / PHMAs in BSUs	12 Degradation Threats + 7[7] / PHMAs in Proj.[6]
	Management:	Internal BLM & FS estimates	3% Cap, Adapt. Mgmt[4]	3% Disturbance Cap
	All Lands:	Yes	Yes	Yes
	Fire Included:	No	No	No
	Who:	BLM NOC	BLM NOC[5] or State Offices	State Offices or Field Offices
Sagebrush Availability	**Unit:**	WAFWA Populations	Biologically Significant Unit	n/a
	Area of Interest:	PHMAs	PHMAs	
	Data:	LANDFIRE Updated EVT	Updated EVT or State data	
	Formula (Measure 1a):	Existing Updated Sagebrush / PHMAs in Populations	Existing Updated Sagebrush / PHMAs in BSUs	
	Management:	Internal BLM & FS estimates	Adaptive Management[4]	
	All Lands:	Yes	Yes	
	Fire Included:	Yes	Yes	
	Who:	BLM NOC	BLM NOC[5] or State Offices	
Energy and Mining	**Unit:**	WAFWA Populations	n/a	Project Area & Seasonal Hab.
	Area of Interest:	PHMAs		PHMAs
	Data:	Westwide well & mine data		Westwide[2], State data
	Formula (Measure 3):	Well Pads and Mines[1] / Square Mile		Well Pads and Mines[1] / Square Mile
	Management:	Internal BLM & FS estimates		Project Authorization
	All Lands:	Yes		Yes
	Fire Included:	No		No
	Who:	BLM NOC		BLM NOC or SOs or FOs

ACRONYMS

PHMA = Priority Habitat Management Area *BSU = Biologically Significant Unit*
EVT = Existing Vegetation Type *BpS = Areas of Biotic Potential*

[1] *Only mines with a Plan of Operation (>5 acres of disturbance) will be included.*
[2] *Westwide data will be used only if state or local data are not available.*
[3] *This footnot was removed from the table. January 2015.*
[4] *This may be one of several variables used to inform Adaptive Management. The BSU is the scale at which Adaptive Management will be applied.*
[5] *A moving window analysis will be conducted at this scale by the NOC using westwide data. If available, state and local data/analysis should be used for Adaptive Management*
[6] *The project analysis area will be based on a 4-mile radius project boundary combined with a 4-mile lek boundary for leks within the 4mi project boundary in PHMA (DDCT methodology).*
[7] *See Table 2*

G.4 Part IV - Adaptive Management

Adaptive Management Habitat Trigger-

The specific formula for the change in habitat for the habitat trigger is defined by the following

Within Idaho and Utah all factors are measured within the modeled nesting and wintering habitat within Priority or Important Habitat Management Areas (calculated separately) by Conservation Area; in Southwest Montana all factors are measured within the Priority Habitat Management Area.

In simple description the adaptive management habitat trigger calculation is the percentage of Effective Habitat (defined as areas of generally intact sagebrush that provide Greater sage-grouse habitat during some portion of the year) within modeled nesting and wintering areas within Priority or Important Habitat Management Areas by Conservation Area within a particular year when compared to the Effective Habitat within modeled nesting and wintering areas within Priority or Important Habitat Management Areas by Conservation Area as of the 2011 baseline. Using Effective Habitat as the metric of comparison removes non-habitat acres from the calculation. The calculation is evaluated within both Priority and Important Habitat Management Areas separately within each of the 10 BSUs.

For purposes of evaluating the adaptive management habitat triggers, Effective Habitat in Idaho is tracked using the Key Habitat Map which is updated annually by BLM in coordination with IDFG, Forest Service, US FWS and Local Working Groups and tracks the areas of generally intact sagebrush providing Greater sage-grouse habitat during some portion of the year. Effective habitat equates to areas described as Key Habitat on the Key Habitat Map. Appendix F contains a description of the Key Habitat Map maintenance and update process including the inclusion of disturbances from fire and temporary disturbances and habitat restoration/rehabilitation.

Factors:

EHP(Y) – where Y is the year and EHC is the acres of Effective Habitat for that year within the baseline 2011 nesting and wintering areas within the Priority Habitat Management Area by Conservation Area

EHI(Y) - where Y is the year and EHI is the acres of Effective Habitat for that year within the baseline 2011 nesting and wintering areas within the Important Habitat Management Area by Conservation Area

ADP(Y) – where Y is the year and AD is the acres of anthropogenic disturbance within Effective Habitat for that year within the 2011 nesting and wintering areas within the Priority Habitat Management Area by Conservation Area

ADI(Y) – where Y is the year and AD is the acres of anthropogenic disturbance within Effective Habitat for that year (Y) within the baseline 2011 nesting and wintering areas within the Important Habitat Management Area by Conservation Area

EHP(2011) – the Effective Habitat within the baseline 2011 nesting and wintering areas within the Priority Habitat Management Area by Conservation Area

EHI(2011) - the Effective Habitat within the baseline 2011 nesting and wintering areas within the Important Habitat Management Area by Conservation Area

ADP(2011) – the acres of anthropogenic disturbance within Effective Habitat within the baseline 2011 nesting and wintering areas within the Priority Habitat Management Area by Conservation Area

ADI(2011) – the acres of anthropogenic disturbance within Effective Habitat within the baseline 2011 nesting and wintering areas within the Important Habitat Management Area by Conservation Area

Formulas:

$$\text{Priority Habitat Management Area} = 100 - \left(\frac{EHP(Y) - ADP(Y)}{EHP(2011) - ADP(2011)}\right) * 100$$

$$\text{Important Habitat Management Area} = 100 - \left(\frac{EHI(Y) - ADI(Y)}{EHI(2011) - ADI(2011)}\right) * 100$$

When this calculation equals or exceeds 10 then an adaptive trigger has been engaged as per AM-7 & AM-8.

Tables 2-7 describe the acreages associated with the BSUs by Conservation Area for the Idaho and Southwestern Montana Subregion. The tables contain values for the entire BSU (Priority and Important), including all ownerships, acres of effective habitat within the BSUs and acres of anthropogenic disturbance within the BSUs.

These values will be used to provide several examples applying the anthropogenic disturbance and adaptive management habitat trigger evaluations. These are for illustrative purposes and do not represent an actual evaluation of ground conditions.

Example 2 – Adaptive Management – Habitat

In the Southern Conservation Area the Priority BSU was delineated to include 784,958 acres, of which 424,656 acres were Effective habitat; therefore EHP(2011) is equal to 424,656 acres. Development within the Effective Habitat in 2011 was measured at 10,074 acres; therefore ADP(2011) is equal to 10,074 acres.

If in 2015 we project a cumulative loss of 42,000 Effective habitat acres due to wildfire (10% loss) and an additional 1000 acres of anthropogenic development (10% increase), then EHP(2015) is equal to 424,656 – 42,000 or 382,656 and ADP(2015) is equal to 10,074+1000 or 11,074. The evaluation for the adaptive management trigger is calculated by:

$$100 - \left(\frac{382656 - 11074}{424656 - 10074}\right) * 100$$

This simplifies to: $100 - \left(\frac{371582}{414582}\right) * 100$

Or $100 - (0.896 * 100)$

Or 100 - 89.6

Or 10.4 – equivalent to 10.4%

This evaluation shows a loss of greater than 10 percent and less than 20 percent which would engage the soft habitat trigger as described in AM-8 and not the hard habitat trigger described in AM-7.

Soft Trigger Considerations and Implementation Actions

The Sage-Grouse Implementation Task Force, in coordination with BLM and Forest Service would utilize monitoring information to assess when triggers have been tripped. When information indicates that the soft habitat or population trigger may have been tripped, a Sage-Grouse Implementation Task Force, in coordination with BLM and Forest Service - aided by the technical expertise of IDF&G - would assess the factor(s) leading to the decline and identify potential management actions. The Sage-Grouse Implementation Task Force may consider and recommend to BLM possible changes in management to the PHMA. As to the IHMA, the Sage-Grouse Implementation Team may review the causes for decline and potential management changes only to the extent those factors significantly impair the state's ability to meet the overall management objective. It is anticipated IDF&G will collect data annually and will make recommendations to the Implementation Team by August 31st for population triggers and January 15th for habitat triggers.

Only where the monitoring information indicates the cause(s) of the decline is not a primary threat will the Sage-Grouse Implementation Task Force would analyze the secondary threats to the species and determine whether further management actions are needed.

Adaptive Management Population Trigger

Framework

Population & Habitat Trigger Justification

Triggers

Because unexpected events (e.g., wildfire, West Nile Virus) may result in a substantial loss of habitat or decline in sage-grouse populations, adaptive management triggers have been developed. These triggers are intended to improve sage-grouse population trends, protect the overall baseline population, preserve a buffer population, and conserve sage-grouse habitat.

The triggers have both population and habitat components. Population components consider population growth and change in lek size. The habitat component considers loss of breeding and/or winter habitat. Lek size has been related to population change in numerous studies (Connelly and Braun 1997, Connelly et al. 2004, Baumgart 2011, Garton et al. 2011). Garton et al. (2011) used both characteristics as well as number of active leks to assess change for sage-grouse populations throughout the west. A variety of researchers (Swensen et al. 1987, Connelly et al. 2000a, Miller et al. 2011) have shown that loss of winter or breeding habitats resulted in decreased sage-grouse populations. The adaptive management triggers set at a lambda value less than one, a 20% decline in males counted on lek routes, and a 20% loss of breeding or winter habitat as break points that would initiate a population or habitat trigger.

Population Growth (Finite Rate of Change)

Although populations cannot be accurately estimated, lek counts of males provide a robust method for assessing population trend and estimating population growth (λ) in an unbiased fashion. Calculating λ (finite rate of change) between successive years for a sage-grouse population is described in Garton et al. (2011). The ratio of males counted in a pair of successive years estimates the finite rate of change (λ_t) at each lek site in that one-year interval. These ratios can be combined across leks within a population for each year to estimate λ_t for the entire population (or Conservation Zone) or combined across all leks to estimate λ_t for the state between successive years as:

$$\lambda(t) = \frac{\sum_{i=1}^{n} M_i(t+1)}{\sum_{i=1}^{n} M_i(t)}$$

where $M_i(t)$ = number of males counted at lek i in year t, across n leks counted in both years t and $t+1$. Ratio estimation under classic probability sampling designs—simple random, stratified, cluster, and probability proportional to size (PPS)—assumes the sample units (leks counted in two 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. This assumption seems appropriate for leks and the possible tendency to detect (or count) larger leks than smaller leks does not bias the estimate of $\boldsymbol{\lambda}_t$ across a population or region (Garton et al. 2011), but makes it analogous to a PPS sample showing dramatically increased precision over simple random samples (Scheaffer et al. 1996). Also precision can be estimated for $\boldsymbol{\lambda}$.

Because small game populations (including sage-grouse) typically fluctuate among years due to weather and other environmental variables, a $\boldsymbol{\lambda}_t$ for any given year is not very meaningful. However, a series of years where $\boldsymbol{\lambda}_t$ remains at or above 1.0 indicates a stable to increasing population. Moreover, this situation would also provide strong evidence of the effectiveness of conservation actions that may have been employed.

Definition of "Significance" for Hard Population Trigger:

The Governor's Alternative (E) did not define criteria for "significantly less than 1.0". For purposes of the Plan, IDFG proposes to use a 90% confidence interval around lambda over a three-year period. to evaluate whether λ is significantly less than 1.0. If the 90% confidence interval is less than and does not include 1.0, than λ is significantly less than 1.0. The λ and variance will be calculated following Garton et al. (2011). A 90% confidence interval is justified because:

1. Under a 90% confidence interval the probability of making a false conclusion is 10%, however, the error will be on the conservative side; i.e., the error would benefit the sage-grouse population.

2. The λ criteria would not be used alone; as stated in the ADPP, λ would be used in concert with trend in maximum number of males.

<u>Males Counted on Leks</u>

Lek attendance by males has been used as an indicator of population trend in some areas since at least the early 1950s. For many years it was the only indicator used to assess status of sage-grouse populations. However, recent research has shown that male attendance at leks can be affected by severity of the previous winter, weather, timing of counts during spring, and a variety of other factors (Emmons and Braun 1984, Hupp 1987, Baumgart 2011). Baumgart (2011) indicated the probability of male sage-grouse attending leks in south-central Idaho varied among years and appeared to be tied to winter severity. Although lek data provide a powerful data set for assessing population trends over time (Garton et al. 2011), counts for a single year may not reflect trends very well. Thus using lek counts as a trigger must consider the inherent variation in these counts. Moreover, males counted on leks appear to have the most value for assessing population change when used in conjunction with other indicators of population status (e.g., finite rate of change).

Emmons and Braun (1984) reported that lek attendance rates varied from 86% for yearling males to 92% for adult males. These rates were pooled over 5 day periods and may have overestimated attendance (Connelly et al. 2011). In contrast, Walsh et al. (2004) reported average daily male attendance rates of 42% (range = 7-85%) and 19% (range = 0-38%) for adult and yearling sage-grouse, respectively but these rates were not adjusted for detection rate and were likely biased low (Connelly et al. 2011). Moreover, this study involved very small sample sizes (17 adult males, 9 yearling males over 15 leks) and only one breeding season and it was not clear whether all leks in the study area were known and sampled. Preliminary data from Utah (D. Dahlgren, personal communication) indicated that in a study area about 30 miles south of Idaho male sage-grouse lek attendance rates varied from roughly 60% at the beginning of April to about 90% at the end of the month. Recent findings in Idaho (Baumgart 2011) predicted the probability of lek attendance for an adult male following an "average" winter would range from 0.894 (SE = 0.025) on week 3 (~1 April) to 0.766 (SE = 0.040) on week 8 (~ 5 May). Published information suggests that a change in maximum number of males counted on leks of say 10-15% cannot confidently be considered a reflection of population status. However, a 20% decline in maximum number of males counted on leks would likely not be related to lek attendance patterns but instead would reflect a population decline. Thus, the trigger was set at 20%.

Habitat Trigger

Numerous studies have documented the negative effects of habitat loss including fire and energy development on sage-grouse (Connelly et al. 2000b, Fischer et al. 1996, Nelle et al. 2000, Doherty et al. 2008), but few studies have related the amount of sagebrush habitat lost to population change. In a Montana study area with a non-migratory sage-grouse population, there was a 73% decline in breeding males after 16% of the study area was plowed (Swenson et al. 1987). Walker et al. (2007) indicated that the lowest probability for lek persistence within a landscape occurred where, within 6.4 km of a lek center, the area has < 30% sagebrush. Similarly, Wisdom et al. (2011) reported sage-grouse occupying landscapes with <27% sagebrush as dominant cover would have a low probability of persistence. Connelly et al. (2000a) showed that a fire in 1989 that removed 58% of the sagebrush cover in sage-grouse breeding and winter habitat led to an almost 95% decline in the breeding population a few years later. Similarly, a fire that removed about 30% of breeding/winter habitat resulted in substantial population declines over the next few years (J. W. Connelly, unpublished data; **Table G-7**). A 30% loss of breeding and winter habitat is thus far the lowest amount of habitat loss for which a population response could be detected and landscapes with < 30% area in sagebrush within 6.4 km of lek center have the lowest probability of lek persistence. Idaho is taking a more conservative approach than suggested by the literature. A soft trigger is set at a 10% loss of breeding or winter habitat in Core or Important management zones of a Conservation Area, which initiates a review of the management approach. A hard trigger is set at a 20% loss of breeding or winter habitat within a Core Habitat Zone of a Conservation Area, which automatically causes a change in management status of the corresponding Important Habitat Zone.

Table G-7
Nest success (%) in SE Idaho study areas before and after a fire in the Table Butte study area. The fire occurred in August 2000.

Year	Area	
	Table Butte	Upper Snake
1999	54	
2000	45	61
2001[a]	18	56
2002	20	65

Literature Cited

Baumgart, J. A. 2011. Probability of attendance and sightability of greater sage-grouse on leks: relating lek-based indices to population abundance. Dissertation, University of Idaho, Moscow.

Connelly, J. W., and C. E. Braun. 1997. A review of long- term changes in sage grouse populations in western North America. Wildlife Biology 3:123-128.

Connelly, J. W., C. A. Hagen, and M. A. Schroeder. 2011a. Characteristics and dynamics of greater sage-grouse populations. Studies in Avian Biology 38: 53-68.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies, Cheyenne, WY.

Connelly, J. W., K. P. Reese, R. A. Fischer, and W. L. Wakkinen. 2000a. Response of a sage grouse breeding population to fire in southeastern Idaho. Wildlife Society Bulletin 28:90-96.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000b. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28:967-985.

Doherty, K. E., D. E. Naugle, B. L. Walker, and J. M. Graham. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management 72:187-195.

Emmons , S. R. and C. E. Braun. 1984. Lek attendance of male sage grouse. Journal of Wildlife Management 48:1023-1028.

Fischer, R. A., K. P. Reese, and J. W. Connelly. 1996a. An investigation on fire effects within xeric sage grouse brood habitat. Journal of Range Management 49:194-198.

Garton, E. O., J. W. Connelly, J. S. Horne, C. A. Hagen, A. Moser, and M. A. Schroeder. 2011. Greater sage-grouse population dynamics and probability of persistence. Studies in Avian Biology 38: 293-382.

Hupp, J. W. 1987. Sage grouse resource exploitation and endogenous reserves in Colorado. Dissertation, Colorado State University, Fort Collins.

Leonard, K. M., K. P. Reese, and J. W. Connelly. 2000. Distribution, movements, and habitats of sage grouse *Centrocercus urophasianus* on the Upper Snake River Plain of Idaho: changes from the 1950's to the 1990's. Wildlife Biology 6:265-270.

Miller, R. F., S. T. Knick, D. A. Pyke, C. W. Meinke, S. E. Hanser, M. J. Wisdom, and A. L. Hild. 2011. Characteristics of sagebrush habitats and limitations to long-term conservation. Studies in Avian Biology 38: 145-184.

Nelle, P. J., K. P. Reese, and J. W. Connelly. 2000. Long- term effects of fire on sage grouse nesting and brood-rearing habitats in southeast Idaho. Journal of Range Management 53:586-591.

Scheaffer, R. L., W. Mendenhall, III, and R. L. Ott. 1996. Elementary survey sampling. Wadsworth Publishing, Belmont, CA.

Swenson, J. E., C. A. Simmons, and C. D. Eustace. 1987. Decrease of sage grouse *Centrocercus urophasianus* after plowing of sagebrush steppe. Biological Conservation 41:125-132.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

Walsh, D. P., G. C. White, T. E. Remington, and D. C. Bowden. 2004. Evaluation of the lek-count index for greater sage-grouse. Wildlife Society Bulletin 32:56-68.

Wisdom, M. J., C. A. Meinke, S. T. Knick, and M. A. Schroeder. 2011. Factors associated with extirpation of sage-grouse. Studies in Avian Biology 38: 451--472.

Potential Implementation Level Actions to Consider in the Event Soft Trigger Criteria are Met

- Increase monitoring and evaluation of sage-grouse populations in Priority Habitat Management Area (area of concern).
- Implement Priority Habitat Management Area management strategy in corresponding Important Habitat Management Area of the same Conservation Area.
- Implement Priority Habitat Management Area RDFs in corresponding Important Habitat Management Area of the same Conservation Area.
- Not allow any new (large) infrastructure development within the Priority Habitat Management Area (no exceptions allowed).

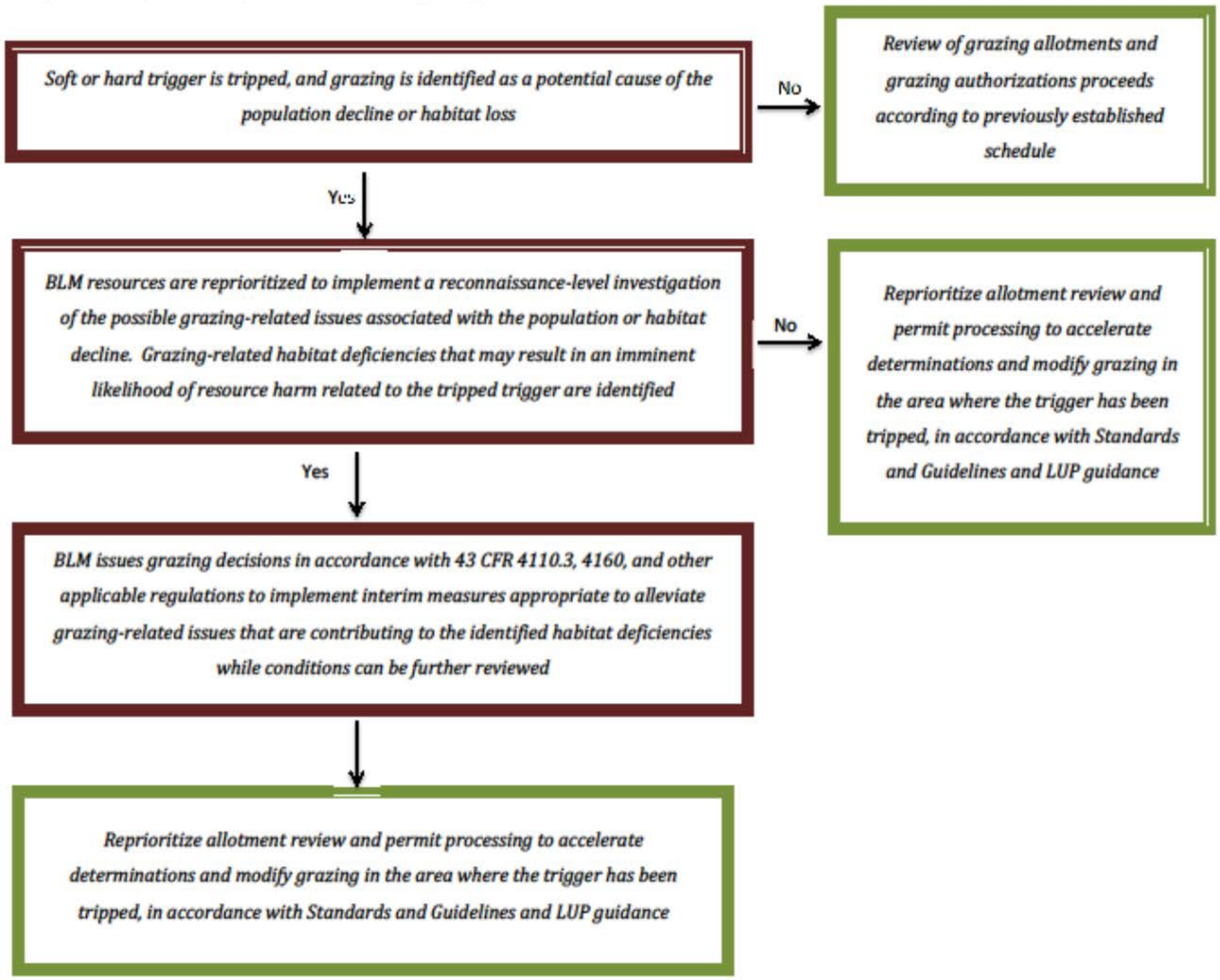
- Reallocate resources to focus on primary threats in the Priority Habitat Management Area (e.g. direct resources from other parts of the state to the area of concern).
- Reallocate resources to focus on secondary threats in the Priority Habitat Management Area (e.g. direct resources from other parts of the state to the area of concern).
- Apply Priority Habitat Management Area criteria for all primary threats, and/or all secondary threats to the Important Habitat Management Area.
- Reallocate resources to focus on primary threats in the Important Habitat Management Area (e.g. direct resources from other parts of the state to the area of concern).
- Reallocate resources to focus on secondary threats in the Important Habitat Management Area (e.g. direct resources from other parts of the state to the area of concern).

Adaptive Grazing Management Response

Improperly managed livestock grazing generally affects seasonal sage-grouse habitat at the site level. Therefore, the specific issues contributing to tripping an adaptive management trigger would need to be defined. Generally, these might be nesting cover from perennial grasses in breeding/nesting habitat, condition and forb availability in brood rearing habitat, and possibly sagebrush cover in winter habitat.

BLM would focus resources to accelerate land health assessments and/or assessment of specific habitat metrics in the areas where deficiencies in site-level habitat metrics are suspected to be a causal factor in tripping a soft or hard trigger. If it is identified that one or more site-level habitat objectives is not being met due to livestock, and an imminent likelihood of resource damage may occur from continued grazing, decisions could be issued in accordance with 4110.3-3(b) to provide immediate protection of resources while a full review of the grazing allotments and grazing permits is conducted. BLM would then focus resources at the state level to accelerate the grazing permit renewal in the area where the trigger has been tripped in order to expedite progress towards meeting land health standards.

Adaptive management response for livestock grazing



G.5 Part V - Travel and Transportation Management Definitions for Use in Anthropogenic Disturbance Calculation

Roads are linear routes managed for use by low clearance vehicles having four or more wheels, and are maintained for regular and continuous use.

Primitive Roads are linear routes managed for use by four-wheel drive or high-clearance vehicles. They do not normally meet any design standards.

Trails are linear routes managed for human-powered, stock, or OHV forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high-clearance vehicles.

Linear Disturbances are human-made linear features that are not part of the designated transportation network are identified as "Transportation Linear Disturbances." These may include engineered (planned) as well as unplanned single and two-track linear features that are not part of the BLM's transportation system.

Primitive Routes are any transportation linear feature located within a WSA or lands with wilderness characteristics designated for protection by a land use plan and not meeting the wilderness inventory road definition.

Temporary routes are short-term overland roads, primitive roads or trails which are authorized or acquired for the development, construction or staging of a project or event that has a finite lifespan. Temporary routes are not intended to be part of the permanent or designated transportation network and must be reclaimed when their intended purpose(s) has been fulfilled. Temporary routes should be constructed to minimum standards necessary to accommodate the intended use; the intent is that the project proponent (or their representative) will reclaim the route once the original project purpose or need has been completed. Temporary routes are considered emergency, single use or permitted activity access. Unless they are specifically intended to accommodate public use, they should not be made available for that use. A temporary route will be authorized or acquired for the specific time period and duration specified in the written authorization (permit, ROW, lease, contract etc.) and will be scheduled and budgeted for reclamation to prevent further vehicle use and soil erosion from occurring by providing adequate drainage and re-vegetation.

Administrative routes are those that are limited to authorized users (typically motorized access). These are existing routes that lead to developments that have an administrative purpose, where the agency or permitted user must have access for regular maintenance or operation. These authorized developments could include such items as power lines, cabins, weather stations, communication sites, spring

Maintenance Intensities

Level 0

Maintenance Description:

Existing routes that will no longer be maintained and no longer be declared a route. Routes identified as Level 0 are identified for removal from the Transportation System entirely.

Maintenance Objectives:

- No planned annual maintenance.
- Meet identified environmental needs.
- No preventative maintenance or planned annual maintenance activities.

Level 1

Maintenance Description:

Routes where minimum (low intensity) maintenance is required to protect adjacent lands and resource values. These roads may be impassable for extended periods of time.

Maintenance Objectives:

- Low (Minimal) maintenance intensity.
- Emphasis is given to maintaining drainage and runoff patterns as needed to protect adjacent lands. Grading, brushing, or slide removal is not performed unless route bed drainage is being adversely affected, causing erosion.
- Meet identified resource management objectives.
- Perform maintenance as necessary to protect adjacent lands and resource values.
- No preventative maintenance.
- Planned maintenance activities limited to environmental and resource protection.
- Route surface and other physical features are not maintained for regular traffic.

Level 3

Maintenance Description:

Routes requiring moderate maintenance due to low volume use (for example, seasonally or year-round for commercial, recreational, or administrative access).

Maintenance Intensities may not provide year-round access but are intended to generally provide resources appropriate to keep the route in use for the majority of the year.

Maintenance Objectives:

- Medium (Moderate) maintenance intensity.
- Drainage structures will be maintained as needed. Surface maintenance will be conducted to provide a reasonable level of riding comfort at prudent speeds for the route conditions and intended use. Brushing is conducted as needed to improve sight distance when appropriate for management uses. Landslides adversely affecting drainage receive high priority for removal; otherwise, they will be removed on a scheduled basis.
- Meet identified environmental needs.
- Generally maintained for year-round traffic.
- Perform annual maintenance necessary to protect adjacent lands and resource values.
- Perform preventative maintenance as required to generally keep the route in acceptable condition.
- Planned maintenance activities should include environmental and resource protection efforts, annual route surface.
- Route surface and other physical features are maintained for regular traffic.

Level 5

Maintenance Description:

Route for high (maximum) maintenance due to year-round needs, high volume of traffic, or significant use. Also may include route identified through management objectives as requiring high intensities of maintenance or to be maintained open on a year-round basis.

Maintenance Objectives:

- High (Maximum) maintenance intensity.
- The entire route will be maintained at least annually. Problems will be repaired as discovered. These routes may be closed or have limited access due to weather conditions but are generally intended for year-round use.
- Meet identified environmental needs.
- Generally maintained for year-round traffic.
- Perform annual maintenance necessary to protect adjacent lands and resource values.

- Perform preventative maintenance as required to generally keep the route in acceptable condition.
- Planned maintenance activities should include environmental and resource protection efforts, annual route surface.
- Route surface and other physical features are maintained for regular traffic.