Greater Sage-Grouse (*Centrocercus urophasianus*)

Habitat Assessment Summary Report

Snake River Valley Mid-Scale Area (2nd Order)

Upper Raft River Valley Fine-Scale Area (3rd Order)

Burley Field Office/ Idaho State Office

Salt Lake Field Office/ Utah State Office

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Table of Contents

Executive Summary

Habitat for the Greater Sage-Grouse (GRSG) Northern Great Basin and the East Central Idaho populations, as defined by the US Fish and Wildlife Service (USFWS 2015), were assessed using the mid-scale indicators from the Sage-Grouse Habitat Assessment Framework (HAF, Stiver et al. 2015. Tech Ref 6710-1). These two populations intersect with the Snake River Valley mid-scale area that occurs within Nevada, Idaho, and Utah. The Snake River Valley mid-scale assessment area encompasses 72.770 square kilometers across Idaho, Nevada, and Utah. This assessment was coordinated among the three States in early 2018 and the suitability rating was finalized in June, 2018.

The report develops an understanding of the condition of the greater sage-grouse habitat in this area, and can be used to inform land health assessments relative to the wildlife/special status species habitat quality standards(s) (BLM Handbook 4180-1, Land Health Standards) as well as applicable National Environmental Policy Act (NEPA) analyses. The habitat assessment for this area may be periodically updated as new data, analyses, and other information become available (e.g. as sub-populations across the range are better defined or regional Landfire spatial data is updated).

The mid-scale assessment resulted in a habitat suitability rating of marginal (Appendix A). The mid-scale final rating was primarily due to habitat conditions in the eastern half (particularly in Idaho). Additionally, the midscale area has approximately 60% ratio of existing sagebrush to potential- meaning almost half of the sagebrush that could exist on the ground has been lost. In eastern Idaho sage-grouse populations are isolated, and distances between occupied patches are high due to fragmentation resulting from wooded mountain ranges, in addition to higher levels of anthropogenic disturbances in the valleys. Sage-grouse populations in Nevada along the southern margin of the midscale area appear to be somewhat isolated from larger occupied areas, and would have to move considerable distances through a mixture of marginal and unsuitable habitat in order to disperse. Overall, movement distances between patches for the entire midscale are suitable; however, the isolation of sage-grouse in eastern Idaho and low levels of occupied habitat reduced the rating for this midscale area.

The Upper Raft River fine-scale area was rated as marginal. Although connectivity among the seasonal use areas is relatively high and disturbance is low, the availability of habitat has been compromised. Over time, areas have been converted to agriculture, juniper has encroached, and habitat patches have been disconnected from one another. The ability for birds to move between available habitat areas is limited within this fine-scale area. Thus, although there remain smaller, isolated home ranges that contain all of the seasonal use areas needed for a populations life cycle, the entire fine-scale is no longer providing a contiguous home range.

Site-scale suitability ratings for plots within each seasonal habitat are summarized in Table 1.

Table 1: Site Scale Proportional Suitability Summary

Site-scale Habitat Type	# of Sample Locations	Percent of Plots or Proportional Area %		
		Suitable	Marginal	Unsuitable
Breeding Habitat (Leks) (Form S-2; Percent of Plots)	31	77.4	22.6	0.0
Breeding Habitat (Nesting/Early Brood Rearing) (Form S-3; Proportional Est)	48	16.4	13.2	70.4
Upland Summer/Late Brood-Rearing Habitat (Form S-4; Proportional Est)	22	15.3	35.1	49.6
Riparian Summer/Late Brood-Rearing Habitat (Form S-5; Percent of Plots)	8	50.0	50.0	0.0
Winter Habitat (Form S-6; Proportional Est)	68	36.4	8.4	55.1

Greater Sage-Grouse Habitat Assessment Area Overview

1.1 Snake River Valley Mid-Scale Area: (Northern Great Basin & East-Central Idaho populations)

Sage-grouse habitat suitability is assessed at different spatial scales to address the ecological processes and population dynamics that occur at each scale. The boundary used for the mid-scale suitability rating primarily encompasses the Northern Great Basin and the East-Central Idaho populations (Figure 1), and was delineated in partnership with the Nevada and Utah BLM State Offices, the Idaho Department of Fish and Game, the Nevada Department of Wildlife, and the Utah Division of Wildlife Resources. BLM guidance was used to direct the boundary delineations (Guidelines for HAF Boundary Delineation, 2018). Both the Northern Great Basin and the East-Central Idaho populations occur within Management Zone #4 as delineated by the Western Association of Fish and Wildlife Agencies (WAFWA), and detailed in the USFWS Conservation Objectives Report (COT Report, 2013).

Limited data by Garton *et al.* (2011) in the 2013 COT Report suggest the conditions for the East-Central Idaho population as having a low probability of persistence. Although causal observation and some historic data suggest the study area provides adequate breeding and nesting habitat, sage-grouse numbers appear to be very low. Initial summer surveys in 2011 suggested sage-grouse were reasonably widespread throughout the area. However, given the apparent overall quality of the habitat, sage-grouse numbers seem surprisingly low. Factors that could act to reduce sage-grouse populations in this area include sagebrush treatments in breeding habitat, West Nile virus, and loss or fragmentation of winter range. Overall this population is considered high risk. The Idaho and Nevada portion of the Northern Great Basin population contains a large amount of publicly managed land (largely BLM). The area also includes among the least fragmented and largest sagebrush dominated landscapes within the extant range of sage-grouse (Knick and Hanser 2011). Despite efforts to manage wildfire risks, wildfires and invasive species have continued to reduce the quality of habitat in portions of this area. A recent rate of change analysis indicated that at least part of this large population has been stable to increasing from 2007-2010. Garton *et al*. (2011) indicated that this population had virtually no chance of declining below 50 in 30 or 100 years. Population analysis indicated that sage-grouse will fluctuate around a carrying capacity (Garton *et al.* 2011). Fire and invasive annual grasses are the major threats to the Nevada and Idaho portions of this population, and mining and infrastructure have potential to pose additional threats to sage-grouse habitat.

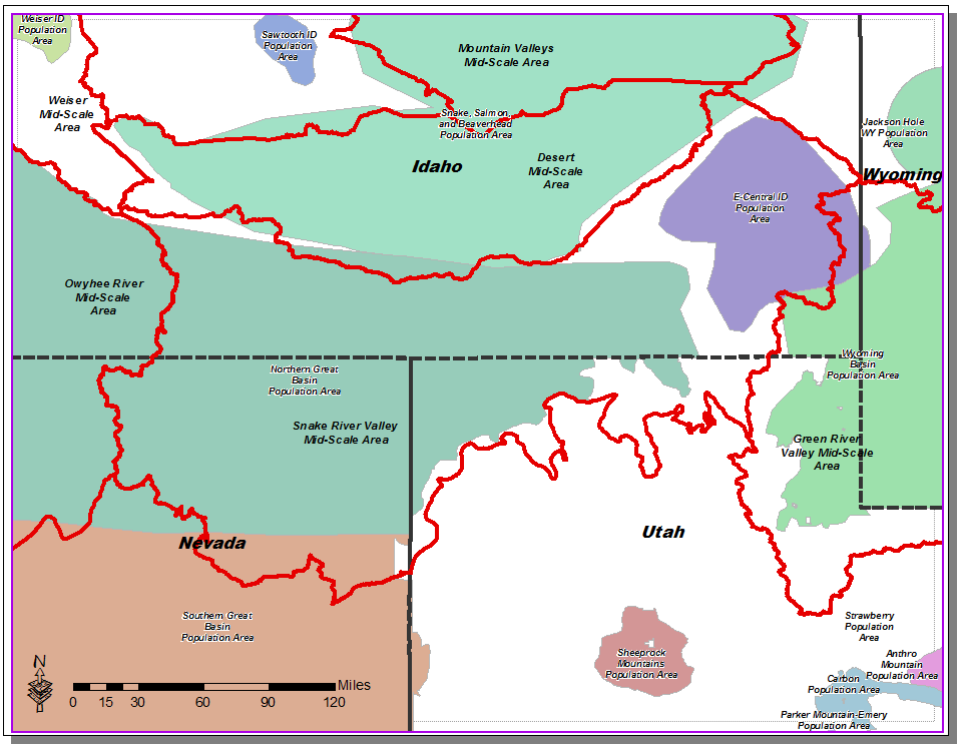


Figure 1: Snake River Valley Mid-scale Area Overview

1.2 Upper Raft River Fine-Scale Area

Within the fine-scale area (third-order), sage-grouse select seasonal habitats within their home ranges, including breeding, summer, and winter habitats (Johnson 1980; Connelly et al. 2004). Third-order habitat descriptions address factors that affect sage-grouse use of, and movements between, seasonal use areas. At this scale, sage-grouse select seasonal ranges to meet their life requisite needs (Johnson 1980; Connelly et al. 2003). Sage-grouse generally inhabit large interconnected areas of sagebrush habitat, thus, there are three fine-scale habitat indicators that influence sage-grouse use of and movements between seasonal use areas: 1. Seasonal habitat availability. 2. Seasonal use area connectivity. 3. Anthropogenic disturbances and habitat loss and fragmentation.

1.3 Site-Scale Plots Within the Fine-Scale Seasonal Use Areas

Greater sage-grouse are typically traditional in their seasonal movement patterns (Schroeder et al. 1999; Connelly et al. 2004; Holloran 2005). Some sage-grouse may move long distances (>30 km) from breeding to summer and from summer to winter seasonal use areas (SUAs). Fedy et al. (2012) reported high variability of movement distances within and among seasonal habitats. Sage-grouse diets shift from insects and forbs during breeding and summer seasons to sagebrush during winter (Berry and Eng 1985; Schroeder et al. 1999; Connelly et al. 2004).

Within the context of the HAF, the intent is to evaluate all site-scale (plot) data that occurs within GRSG SUAs within the larger fine-scale area. The site-scale information quantifies status, condition, and trend indicators that can be used to make necessary management adjustments to meet resource objectives. For the HAF report, those data are then summarized by SUA and proportional estimates and/or plot counts for areas of inference/interest are made.

1.4 Data Sources

Assessing large landscapes and maintaining consistency in analyses across the sage-grouse range requires the use of both regional and local geospatial data. Table 1 provides the name, source, and scale for which the geospatial data was used in the current assessment.

Table 1: Data sources used in the mid-, fine-, and site-scale assessments. Organizations that provided data include: *Bureau of Land Management (BLM), Idaho Department of Fish and Game (IDF&G), Nevada Division of Wildlife (NDOW), US Fish and Wildlife Service (USFWS), US Geological Survey (USGS)*.

Data Name	Source	Mid-Scale	Fine-Scale	Site-Scale
Existing Vegetation Types (EVT)	LANDFIRE 1.4.0	X	X	
Biophysical Settings (BpS)	LANDFIRE 1.4.0	X	X	
Management Zones & Populations	WAFWA COT Report 2013	X		
HAF Mid- and Fine-Scale Boundaries	BLM NOC	X	X	X
Sage-grouse Lek Locations	IDF&G	X	X	X
Sage-grouse Telemetry	IDF&G	X	X	
Anthropogenic Features	BLM NOC Disturbance Compilation [2017]	X	X	X
Idaho Seasonal Habitat	Idaho State Office IDF&G		X	X
NLCD Shrubland Sagebrush Cover	USGS	X	X	X
Tall Structures (Meteorological and Communication Towers)	BLM			X

Data Name	Source	Mid-Scale	Fine-Scale	Site-Scale
Tree Canopy Cover	Sage-Grouse Initiative (Falkowski et al. 2017)			X
National Elevation Data	U.S. Geological Survey. DOI, BLM, NOC, Geospatial Section OC-534			X
AIM Plots	BLM NOC TerrADat database			X
LMF Plots (NRI)	NRCS/ BLM NOC TerrADat			X
Proper Functioning Condition	BLM PFC database			X
Modified HAF Plots	Burley FO			X
OTHER				
OTHER				
OTHER				

2.0 Methods and Sample Design

2.1 Mid-scale

A mid-scale assessment describes habitat characteristics linked to bird dispersal capabilities (Stiver et al. 2015). The BLM delineated the mid-scale boundary using topographic features, telemetry and occupied lek locations, conservation areas, and local knowledge from state wildlife agencies and BLM personnel. Mid-scale indicators include habitat availability, patch size and number, patch connectivity, linkage area characteristics, landscape matrix and edge effects, and anthropogenic disturbances. Each habitat indicator and the analysis methods are described below.

*2.1.1 **Habitat** Availability*

Sage-grouse occupancy and dispersal capabilities are dependent on the extent and pattern of sagebrush within a landscape of non-habitat and unsuitable habitat. Habitat availability essentially refers to the amount of sagebrush habitat in an area and the more existing suitable sagebrush relative to potential habitat, the greater the suitability. Three inputs were used to aid in assessing habitat suitability within the mid-scale habitat assessment area: an occupancy layer, an

unoccupied layer, the existing and potential sagebrush habitat, and the occupied and unoccupied non-habitat.

Occupied habitat includes sagebrush and associated plant communities known to be used by sage-grouse within the last 10 years (Stiver et al. 2015). The occupied area for the Snake River Valley midscale area was delineated using a 6.4 km occupied lek buffer combined with a 99% kernel density estimate on telemetry points where they were available. Both existing and potential sagebrush habitat were delineated using Landfire EVT and BPS vegetation classes as defined in Stiver et al. (2015). Non-habitat includes all other land cover types.

Existing and potential suitable sagebrush habitat types were identified using two land cover data sets. The LANDFIRE 1.4.0 existing vegetation (EVT) data set was reclassified into sagebrush communities, sagebrush associated communities, and non-habitat to identify areas with currently suitable habitat. The LANDFIRE 1.4.0 biophysical settings (BpS) data set was reclassified to identify areas that could potentially support sagebrush and sagebrush associated communities in the future (Appendix B). Both reclassifications were based on BLM guidance (HAF Key Decisions for the Mid-Scale Area, 2018), and are consistent with the vegetation types capable of supporting sage-brush identified in the Greater Sage-grouse Monitoring Framework (BLM, 2014).

2.1.2 Patch Size & Number

Whether the available habitat is contained in one large habitat patch or several patches could influence sage-grouse use and dispersal between subpopulations. Dispersal could be uninterrupted in large habitat patches, whereas movement between smaller patches may be more difficult, depending on the configuration of the patches and landscape conditions in which they occur Generally, the larger and more contiguous the sagebrush patches of a population or subpopulation are, the greater the suitability of that area.

Two metrics were used to assess habitat patches; mean size of occupied habitat patches, and number of occupied patches. Habitat patches were defined according to select environmental variable criteria found in Knick et al. (2013). Environmental variables were selected from the study based on two considerations; the same or an updated version of the data source for the variable was readily available, and the variable was found to be significant in the study. Habitat patches were mapped by applying land cover criteria to the EVT and ESRI street map premium data using a 5-km radius moving window analysis that identified areas that met the land cover criteria in Table 1. The 78.54 km2 area corresponds to the area within which Knick et al. (2013) found significant relationships between environmental variables and lek presence.

TABLE 1. THRESHOLDS FOR INCLUSION OF A FOCAL AREA IN SAGE-GROUSE HABITAT PATCH AVAILABILITY. EACH 78.54 KM2 MOVING WINDOW HAD TO MEET THESE LAND COVER VALUES TO BE DEFINED AS A PATCH.

Variable	Percent Land Cover
Sagebrush Land Cover	> 79
Developed Areas Land Cover (urban and suburban areas)	<3
Interstates/Highways	0

2.1.3 Patch Connectivity

Patch connectivity is a major component of suitability in the second order. The closer the suitable habitat patches are to each other, the more likely sage-grouse can move freely between them. One metric was used to assess patch connectivity mean distance to nearest occupied patch. The shortest Euclidean distance between every adjacent pair of occupied patches was mapped and measured, and summary statistics of those distances were calculated.

2.1.4 Linkage Area Characteristics

Habitat linkage areas between occupied patches on the landscape can greatly influence habitat use and dispersal within and between occupied areas. The landscape context in which patches are located has a bearing on habitat suitability for dispersal between patches. Barriers that compromise sage-grouse movements between habitat patches are not completely understood and are variable (Connelly et al. 1988; Leonard et al. 2000; Beck et al. 2006; Knick and Hanser 2011). Linkage area suitability is believed to improve as the percent of shrub cover (not necessarily sagebrush) increases relative to tree or grass cover in the areas between the habitat patches.

Three metrics were used to assess linkage area characteristics (Figure 5); percent suitable, percent marginal, and percent unsuitable land cover in the linkage areas. A linkage area is the area between habitat patches through which sage-grouse travel to reach other suitable patches. To calculate these metrics, the EVT data set was reclassified into suitable, marginal, and unsuitable classes (Appendix B) and was then clipped to represent only the areas between patches (i.e., patches were erased from the landcover). Reclassification was guided by the methods used in Jones et al. (2015). The percentage of the linkage area in each suitability class was calculated and the results were assessed.

2.1.5 Landscape Matrix & Edge Effect

The cover type or land use immediately adjacent to a habitat patch can positively or negatively affect the quality of that patch's suitability as sage-grouse habitat. As the amount of sagebrush

edge in contact with plant communities or land uses that positively influence shrubland patch habitat increases, the landscape matrix and edge suitability increase.

Two metrics were used to assess the landscape matrix and edge effect; the mean percent of positive and the mean percent of negative patch edge. Edge was defined as areas within 5 km of the habitat patch core. Positive, negative, and neutral values for this metric reflect the inference that the cover type or land use immediately adjacent to a habitat patch can positively or negatively affect the quality of that patch's suitability as sage-grouse habitat (Stiver et al. 2015). To calculate these metrics, the EVT data set was reclassified into positive, negative and neutral classes (Appendix B). Neutral values accounted for classes that could not be determined as having either a positive or negative effect on patch suitability. The percent of positive, negative and neutral classes were calculated and assessed for the midscale area.

2.1.6 Anthropogenic Disturbance

Anthropogenic disturbances influence sage-grouse habitat, numbers, and distribution at each order of habitat selection. Anthropogenic features can affect sage-grouse demographics or habitat use in two significant ways: direct mortality affecting the long-term viability of a population and avoidance. Sage-grouse will avoid areas with a high density of anthropogenic features even if site-scale conditions are suitable.

Three metrics were used to assess anthropogenic disturbance; density of linear and point disturbance features, and area-based disturbance features within occupied patched. Occupied habitat patches, as described above, were intersected with the BLM Disturbance Compilation dataset to calculate the density and area of disturbance features. BLM *(*2016b) and Appendix D describe the disturbance feature types and data sources included in the disturbance dataset.

2.2 Fine-Scale Area

The fine-scale assessment characterizes sage-grouse seasonal habitat use within a home range(s) (Stiver et al. 2015). As with the mid-scale boundary, the BLM delineated the fine-scale boundaries using topographic feature, telemetry and occupied lek locations, a modelled habitat suitability index, and local expertise. There are five fine-scale boundaries within the Desert mid-scale area and the fine-scale boundaries are located entirely within the mid-scale boundary. Three indicators were calculated for the fine-scale areas: seasonal habitat availability, seasonal habitat connectivity, and anthropogenic disturbance.

2.2.1 Seasonal Use Area Habitat Availability

Seasonal habitat availability is the initial habitat indicator at the fine-scale. Although sage-grouse are considered a landscape species, the amount of habitat required has not been determined due to the variability in quality and juxtaposition within the landscape (Connelly et al. 2011).

Generally, the more sagebrush shrubland within seasonal use areas in the home range, the more suitable the habitat.

Six metrics were used to assess seasonal habitat availability at the fine-scale, including area of both occupied and potential breeding, summer, and winter habitat. The habitat suitability index (HSI) developed by the Idaho Department of Fish and Game was modified to delineate seasonal use areas in Idaho. Spring (March 1 - June30), Summer (July1- September 22), and Winter (December 1- February 29) telemetry locations were combined with environmental variables to model habitat suitability.

The HSI models were created using a species distribution modeling technique known as maximum entropy, or Maxent (https://www.gbif.org/tool/81279/maxent). The program Maxent uses known point locations (in our case primarily VHF and GPS telemetry points) and a suite of habitat predictor variables (GIS layers) to characterize conditions of occupied habitat. We selected habitat variables related to vegetation type, percent cover, topography, and landscape context (e.g., how much of the landscape has at least 10% sagebrush cover). Maxent models the set of conditions that are typically found at the training points, then applies that model to the full landscape, creating a wall-to-wall estimate of habitat suitability based on how similar conditions are to occupied habitat.

The HSI models were then generalized to represent sage-grouse seasonal use areas across the State. The generalized areas include the moderate and high categories from the HSI models, patch area analyses were applied, and those patches meeting size and location criteria were maintained. Final maps and spatial datasets for each of the three SUAs were generated for HAF assessments.

The occupancy layer as described in the mid-scale methods section was used for the fine-scale analyses. Seasonal use areas were identified as occupied or unoccupied/unknown occupancy by intersecting each SUA with the occupancy dataset. Additionally, the amount of existing suitable habitat, potential habitat and non-habitat were calculated by intersecting the SUAs with the habitat availability datasets used in the mid-scale analysis. Specifically, seasonal habitat availability was calculated for the following seven discreet areas: occupied spring, summer, and winter; unoccupied spring, summer, and winter; and occupied and unoccupied non-habitat.

2.2.2 Seasonal Use Area Connectivity

The connectivity, as well as the availability of sagebrush within seasonal use areas of sage-grouse home ranges, can affect overall suitability. For example, following nesting, hens often move chicks to summer ranges for food. Thus, connectivity between breeding and summer brood-rearing habitats is particularly important due to the restricted flight capability of chicks at this time. In general, the more contiguous the sagebrush cover between seasonal use areas, the more suitable the habitat.

Three metrics were used to assess seasonal use connectivity: breeding to summer overlap, summer to winter overlap, and winter to breeding overlap. The metrics were calculated by overlaying the two seasons and calculating the ratio of the amount of edge between both seasons

to the total area of the seasons combined. This method allowed for the calculation of the percent of overlap between the SUAs, an indication of connectivity.

2.2.3 Anthropogenic Disturbance

There is increasing evidence that anthropogenic disturbances within a home range can cause local extirpations even if other habitat conditions appear suitable (Aldridge 2005; Holloran 2005; Aldridge et al. 2008). Anthropogenic features can affect sage-grouse in two significant ways at the fine scale: anthropogenic features directly and indirectly increase mortality or decrease recruitment, and sage-grouse may eventually avoid seasonal use areas with a high density of anthropogenic features even if site-scale conditions are suitable

Three metrics were used to assess anthropogenic disturbance: density of linear disturbance features, density of point disturbance features, and area of non-habitat inclusions (area-based disturbance features) within the fine-scale boundary. The fine-scale boundary was intersected with the BLM Disturbance Compilation dataset to calculate the density and area of disturbance features within the home range. BLM *(*2015, Appendix E) describes the disturbance feature types and data sources included in the disturbance dataset.

2.3 Site-Scale

The site-scale assessments evaluate suitability of seasonal habitat using a suite of habitat indicators that apply to each SUA. Within the context of the HAF, the site-scale is GRSG SUAs within the larger fine-scale area.

Site-scale suitability of leks was determined using geospatial data calculate the availability of sagebrush, the proximity of detrimental land uses and the proximity of trees and other tall structures. The availability of sagebrush is based on *Yang, L., Jin, S., Danielson, P., Homer, C., Gass, L., Case, A., Costello, C., Dewitz, J., Fry, J., Funk, M., Grannemann, B., Rigge, M. and G. Xian. 2018. A New Generation of the United States National Land Cover Database.* The percent of sagebrush cover >10% was derived from the *Sagebrush* component of the Homer et al. dataset. The proximity of detrimental land uses calculates the amount of disturbance. The disturbance features are derived from the NOC disturbance compilation which is updated annually and is consistent with the Monitoring Framework. This is the second of 3 indicators that will be calculated to aid in the final Lek suitability rating. The tall structures are extracted from the NOC disturbance compilation. The presence of trees is calculated by looking at areas with greater than 4% conifer cover (USGS Sage-grouse Initiative: Falkowski et al. 2017. Mapping tree canopy cover in support of proactive prairie grouse conservation in western North America. Rangeland Ecology & Management 70:15-24. **http://dx.doi.org/10.1016/j.rama.2016.08.002**). Also see, Baruch-Mordo et al 2013 and Coates et al 2017.

Site-scale (plot) data used in this analysis to inform suitability of other SUAs included Assessment, Inventory, and Monitoring (AIM) and Landscape Monitoring Framework (LMF) plot data, acquired from the BLM National Operation Center (NOC) Terrestrial AIM Database

(TerrADat) and the LMF database, respectively, and summer riparian plot data, acquired from the Burley Field Office (Table 2.3-1).

Both AIM and LMF points come from a spatially balanced sample design, where monitoring information is gathered within a landscape of interest at predetermined locations randomly identified during the design stage. During the randomization process, every possible location has a chance of being selected, which enables reporting on the condition and trend of all monitored renewable resources within an area of interest with known levels of precision and accuracy. Plot data that were both spatially and temporally valid (i.e., occurred within mapped SUAs and were collected during the appropriate time period) were used in a proportional area analysis to inform suitability of Nesting/Early Brood-Rearing (form S-3), Upland Summer/Late Brood-Rearing (form S-4), and Winter (S-6) seasonal habitats.

Suitability of seasonal habitats, including leks, were assessed using the methods described in the HAF TR (BLM 2015).

Table 2.3-1: Summary of plot data used to inform SUA suitability

Source	Project	# of Plots	S-Form(s)
Lek		31	S-2
AIM	ID Burley FO 2019	16	S-3, S-4, & S-6
	UT Salt Lake FO 2019	1	
Modified HAF	ID Jim Sage HAF 2019	56	
LMF	LMF 2011 - 2019	11	
PFC, S-5 Form		8	S-5

2.3.1 Sample Designs: Upper Raft River Valley Fine-Scale

Site-scale plots analyzed for proportional analysis within SUA in the Upper Raft River Valley Fine-Scale came from AIM, Modified HAF, and LMF projects to inform suitability of Nesting/Early Brood-Rearing (form S-3), Upland Summer/Late Brood-Rearing (form S-4), and Winter (S-6) seasonal habitats, and from the Burley Field Office breeding site data to inform suitability of Riparian Summer/Late Brood-Rearing (S-5; Table 2.3-1).

2.3.1.1 AIM

The Upper Raft River Valley fine-scale area intersects with the Burley Field Office (BFO) in Idaho and the Salt Lake Field Office (SLFO) in Utah. Thus, the AIM sample design and management objectives generated for the field office areas apply to this fine-scale area.

A two-year sample design in BFO was initiated in 2019 to address general objectives from both the Idaho Standards for Rangeland Health (ISRH; USDI, BLM 1997) and the Idaho and Southwestern Greater Sage-Grouse Approved Resource Management Plan Amendment (ARMPA; USDI, BLM 2015) and amendment (ARMPA; USDI, BLM 2019). A five-year sample design in SLFO was initiated in 2016 and focused on land use plan effectiveness for the West Desert District, with additional points as part of a 5-year GRSG HAF AIM monitoring

effort. Long-term objectives of each sample design included ensuring achievement of Rangeland Health Standards and maintaining sage-grouse habitat according to the habitat objectives described in Table 2-2 in the respective ARMPAs.

2.3.1.2 Modified HAF

Within the Upper Raft River Valley fine-scale area there was one Modified HAF sample design implemented in BFO. This was the 2019 design for the Jim Sage allotment study area. Monitoring objectives from the design included establishing Modified HAF points in upland vegetation to quantify and assess the health of Greater Sage-grouse habitat within the allotment to make baseline condition assessments of the current management practices. The collected data will supplement existing HAF data, long-term trend and fuels data across the SFAs, and be used to evaluate rangeland health assessments, HAF assessments and grazing permit renewals.

2.3.1.3 LMF

The National Landscape Monitoring Framework Data collection protocol is part of the National Resources Inventory (NRI). NRI is a natural resource inventory conducted by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). It provides updated information on the status, condition, and trends of land, soil, water, and related resources on the Nation's non-Federal lands. Non-Federal lands include privately owned lands, tribal and trust lands, and lands controlled by State and local governments. NRI provides nationally consistent data and is comparable with AIM data (i.e., plot data are statistically valid and are part of a spatially balanced random sample design). Statistical estimation and quality assurance procedures employed for the NRI survey program help ensure that trends reported using NRI data reflect true changes in resource conditions.

The NRI was designed to establish a database that would allow natural resource issues to be analyzed by portions of Major Land Resource Areas (MLRAs) within States. The NRI sample was selected on a county-by-county basis, using a stratified, two-stage, area sampling scheme. The two-stage sampling units are (1) nominally square segments of land, and (2) points within the segments. The segments are typically half-mile-square parcels of land equivalent to 160-acre quarter-sections in the Public Land Survey System. An annual or continuous approach was initiated in 2000. This approach provides efficiencies in conducting the survey and balancing of resources, and also makes it easier for the NRI to respond to newly emerging resource issues, and a *core panel* of about 40,000 segments is observed each year along with a different supplemental or rotation panel selected for each year. These panels are selected using stratification based upon geographical factors and historical data; for example, segments containing wetlands or land enrolled in the USDA Conservation Reserve Program (CRP) have a significantly higher chance of selection than those classified historically as forest land.

Results and Rationale

3.1 Mid-scale

The Nevada, Utah, and Idaho interdisciplinary team rated the Snake River Valley mid-scale area as marginal (Appendix A). The mid-scale area is 73,605 km2 (18,188,209 acres) in total size, of which 25,215 km2 (6,230,640 acres) is occupied and 19,635 km2 (4,851,810) is within a delineated patch. The team recognized that the western half of the area is well-connected and

contains substantial areas of high-quality contiguous habitat that facilitate dispersal, but habitat conditions in the eastern half (particularly in Idaho) reduce the overall suitability of this landscape substantially. Additionally, the midscale area has approximately 60% ratio of existing sagebrush to potential- meaning almost half of the sagebrush that could exist on the ground has been lost.

In eastern Idaho, sage-grouse populations are isolated and the distances among occupied patches is high because sagebrush habitat is fragmented by wooded mountain ranges and higher levels of anthropogenic disturbances in the valleys. Sage-grouse populations in Nevada along the southern margin of the midscale area appear to be somewhat isolated from larger occupied areas, and would have to move considerable distances through a mixture of marginal and unsuitable habitat to disperse. Overall, although movement distances between patches for the entire midscale are suitable, the isolation of sage-grouse in eastern Idaho and low levels of occupied habitat reduced the rating of this midscale.

One potential caveat is that there is a poor understanding of occupancy in eastern Idaho because these areas are rarely surveyed/inventoried and few (if any) telemetry data are available. Future sage-grouse research in this area could provide a much better understanding of movements and habitat use patterns in this landscape, which would ensure a more robust understanding of dispersal capabilities.

3.1.1 Habitat Availability

The habitat availability metric for the Snake River Valley mid-scale area was rated as marginal. Approximately 30% of the midscale area contains suitable existing and potential habitat within occupied areas. Although the 'unoccupied' areas have approximately 40% of existing suitable habitat, the birds do not appear to be using these areas. The Western side of the mid-scale area contains suitable contiguous habitat; however, the eastern side is fragmented (Figure 3.1-1).

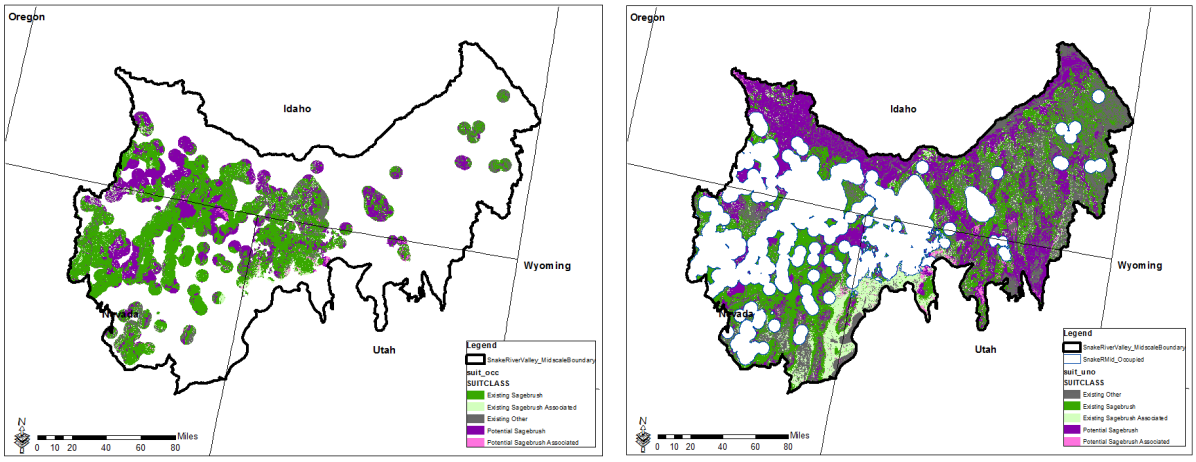


Figure 3.1-1: Snake River Mid-scale Area Occupied Suitable Habitat and Unoccupied Suitable Habitat

3.1.2 Patch Size and Number

The patches were delineated as described in the Methods and Sample Design section above. The metric was rated as marginal (Figure 3.1-2). The patches that occur on the Eastern side and southern Nevada are small, and there is a wide range of patch sizes. Some of the larger patches on the western side would be even larger but are bisected by Hwy 93 that birds do move across.

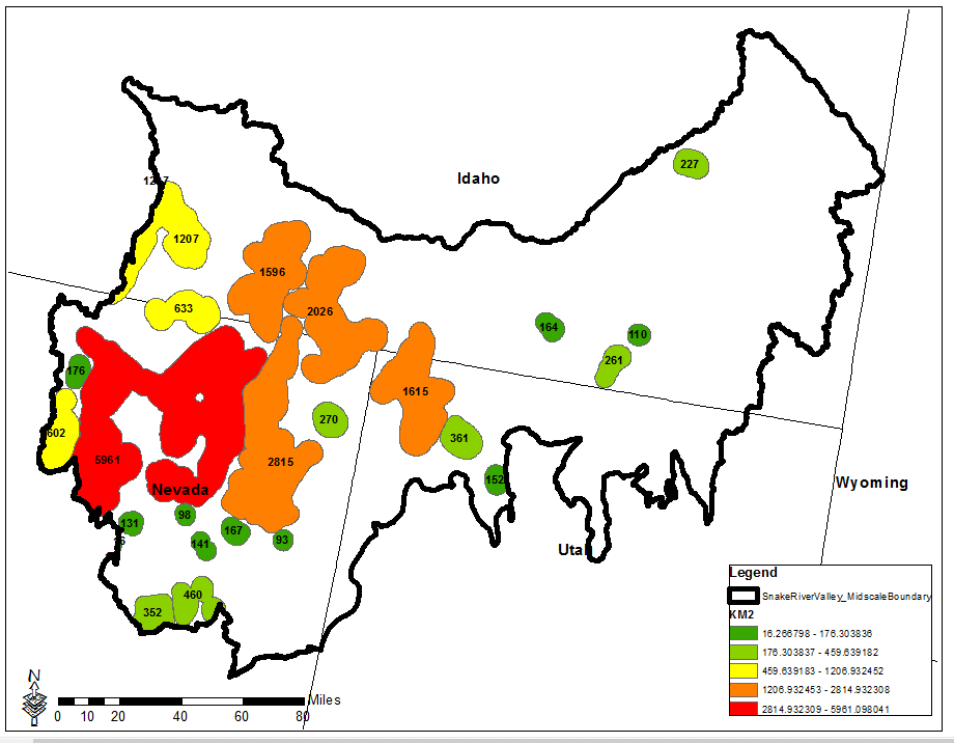


Figure 3.1-2: Snake River Valley Mid-scale Area Habitat Patches

3.1.3 Patch Connectivity

The patch connectivity metric was rated as suitable for the Snake River Valley mid-scale area. (Figure 3.1-3). The largest patches are well connected and the mean distance of 6.5 km is well within seasonal movement distances in the literature.

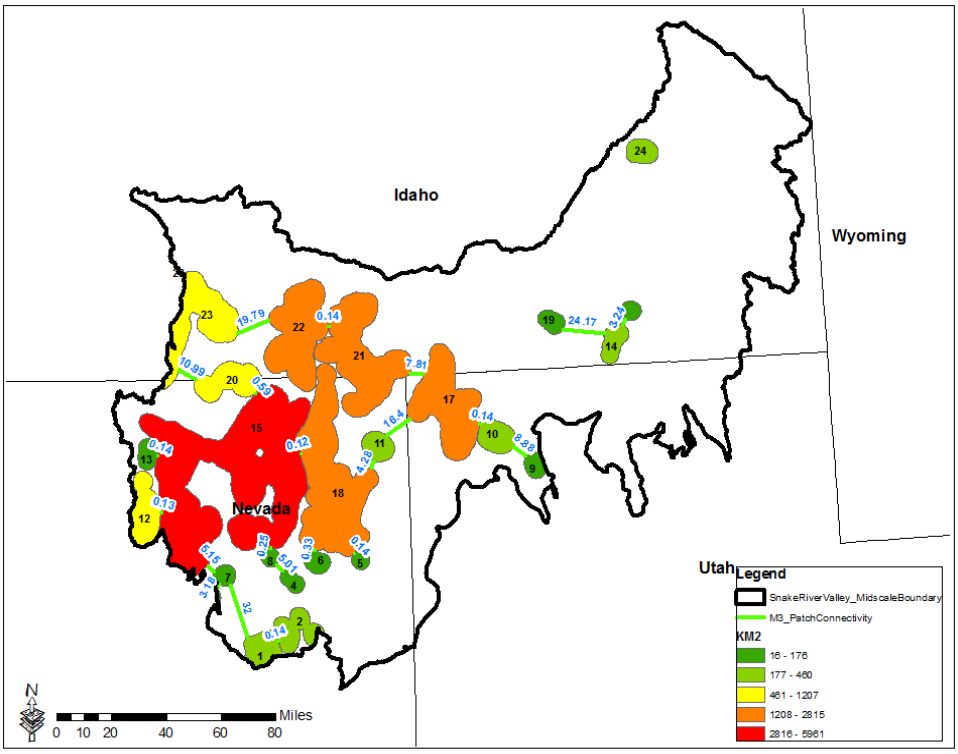


Figure 3.1-3: Snake River Valley Mid-scale Area Patch Connectivity

3.1.4 Linkage Area Characteristics

Those areas between patches that birds have to travel through from one patch to another were classified as suitable, marginal, or unsuitable (see Methods section above). For the linkage areas, the Snake River Valley mid-scale area as a whole was rated marginal (Figure 3.1-4). The area is trending towards suitable based on knowledge of restoration efforts within the Murphy Complex Fire (2007) area. If birds were to disperse to some of the small isolated patches, movement would be challenging with a mix of marginal and unsuitable linkage areas.

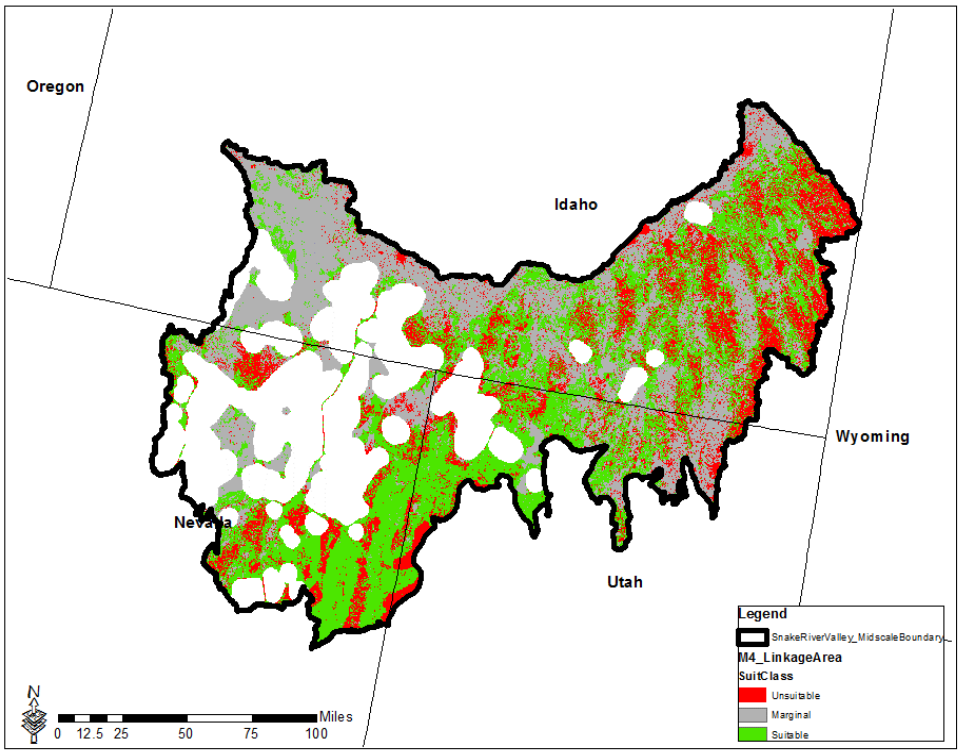


Figure 3.1-4: Snake River Valley Mid-scale Area Linkage Area Characteristics

3.1.5 Landscape Matrix & Edge Effect

The patch edge was defined as a 5km buffer around the patches, and the area was reclassified as positive, neutral, or negative (Figure 3.1-5). The *Snake River Valley* mid-scale area was rated as suitable because approximately 70% of the edge is within the positive vegetation types thus patches are not currently threatened by invasives.

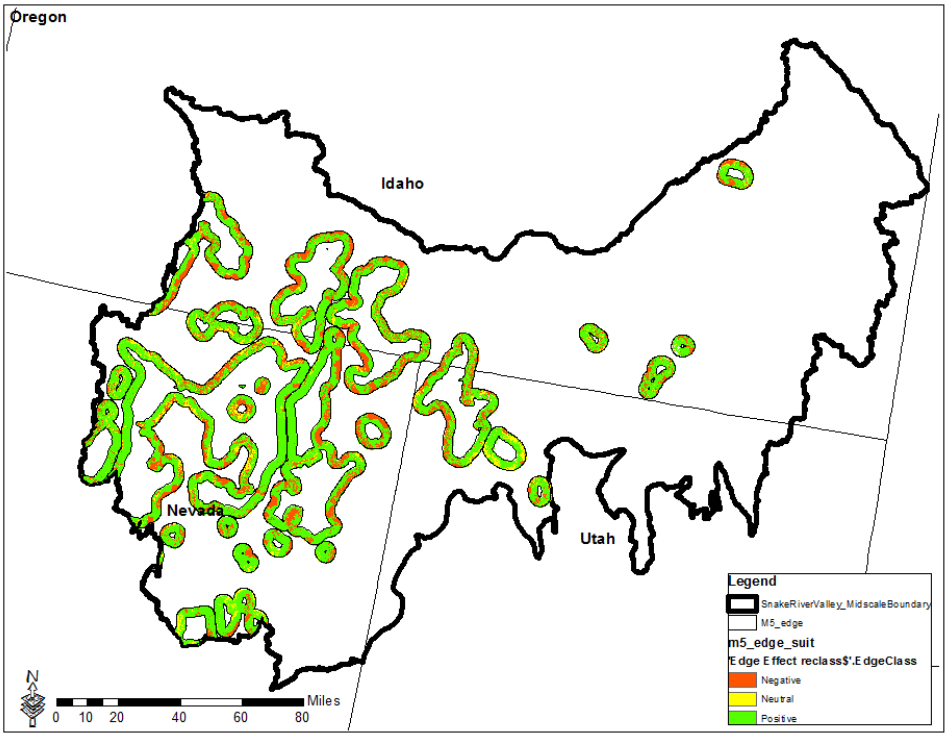


Figure 3.1-5: Snake River Valley Mid-scale Area Edge Effect Characteristics

3.1.6 Anthropogenic Disturbance

At the mid-scale, anthropogenic disturbance of linear, point, and area features are calculated within the occupied patches (Figure 3.1-6). For the Snake River Valley mid-scale, the metric was rated as suitable because within the mapped patches (indicator 2), the is a very low density of disturbance features.

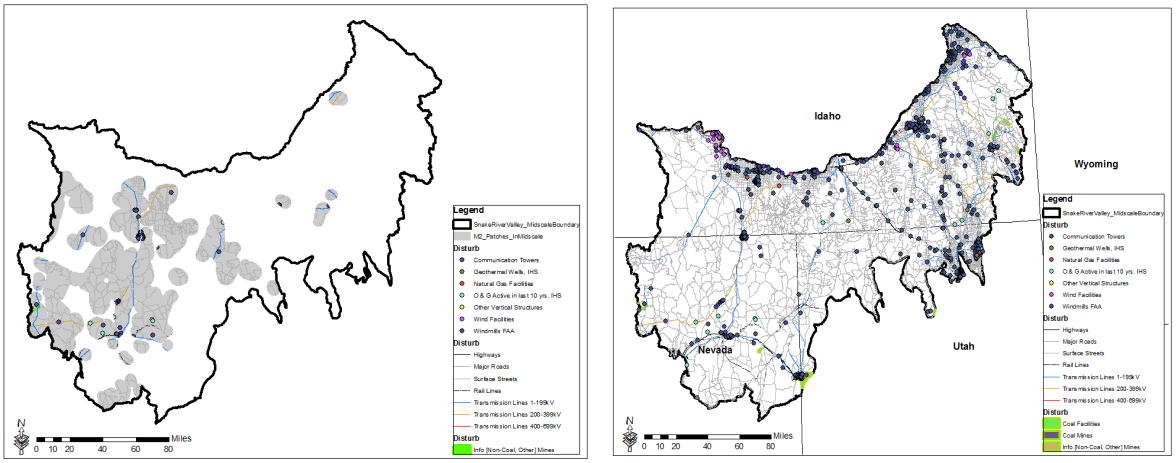


Figure 3.1-6: Snake River Valley Mid-scale Area Anthropogenic Disturbance within habitat patches and across the mid-scale area

3.2 Fine-Scale

3.2.1 Upper Raft River Fine-Scale

The overall suitability rating for the Upper Raft River fine-scale area was marginal. The fine-scale area is 3,220 km2 in total size, of which 1,844 km2 is within a seasonal use area. The habitat availability indicator was rated as marginal based on the analysis that showed that there are relatively low percentages of existing and potential sagebrush within the occupied seasonal use areas. Additionally, movement between SUAs is limited by large areas of agriculture and juniper. The connectivity indicator was rated as suitable because the areas of seasonal habitat that overlap are high (i.e. there is high connectivity among the three seasonal habitat types). Finally, the disturbance indicator was also rated as suitable. Both point and area density are very low, and surface streets are driving the linear density which as compared to other fine-scale areas in Idaho is moderate.

3.2.1.1 Seasonal Use Area Habitat Availability

The square kilometers and the percent of the fine-scale area of both occupied and unoccupied suitable habitat that occurred within each of the SUAs was calculated (Table 3.2-1). See figures 3.2-1a-3.2-1c to see the area of each SUA that is occupied and suitable sage-grouse habitat.

The seasonal habitat availability metric for the Upper Raft River fine-scale area was rated as marginal. The availability of habitat has been compromised. Over time, areas have been converted to agriculture, juniper has encroached, and habitat patches have been disconnected from one another. The ability for birds to move between available habitat areas is limited within this fine-scale area. Thus, although there remain smaller, isolated home ranges that contain all of the seasonal use areas needed for a populations life cycle, the entire fine-scale is no longer providing a contiguous home range.

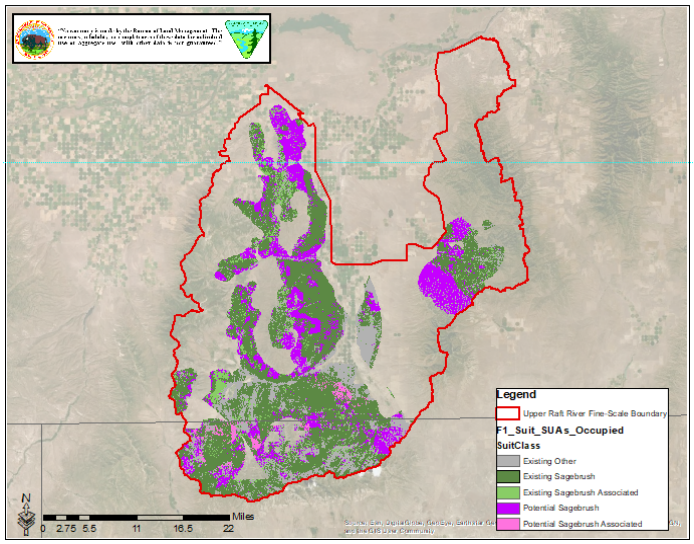
See Figures 3.2-1a - 3.2-1c to see the area of each SUA that is occupied and suitable sage-grouse habitat.

Table 3.2-1: Upper Raft River Fine-Scale Area SUAs and Habitat Suitability

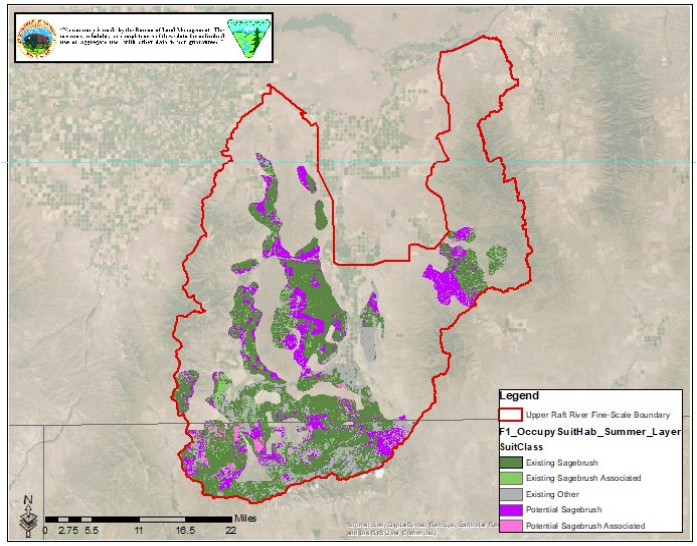
Occupancy	Habitat	km² Spring	% Spring	km² Summer	% Summer	km² Winter	% Winter	km² Fine-scale	% Fine-scale
Occupied	Suitable	953.89	67%	959.93	71%	920.23	67%	1228.02	67%
Unoccupied	Suitable	241.15	17%	126.96	9%	226.40	17%	277.07	15%
Occupied & Unoccupied	Non-habitat	238.46	17%	265.13	20%	223.68	16%	339.34	18%

Figure 3.2-1: Upper Raft River Fine-Scale SUAs and Habitat Suitability

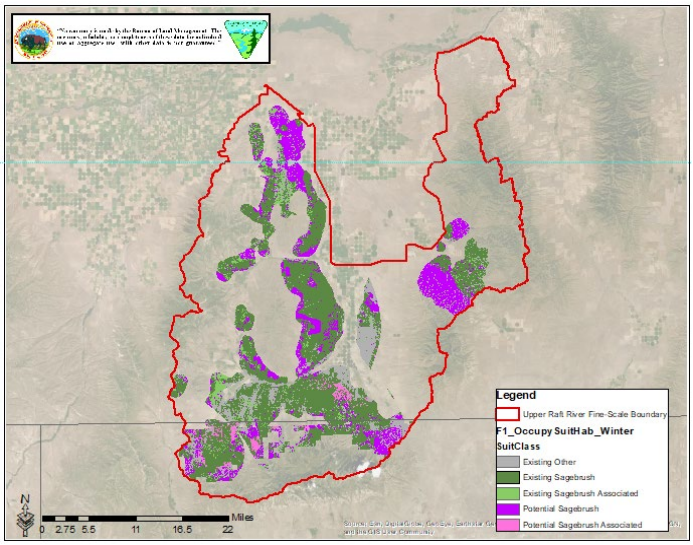
a. **Upper Raft River** fine-scale occupied spring suitable habitat



b. **Upper Raft River** fine-scale occupied summer suitable habitat



c. **Upper Raft River** fine-scale occupied winter suitable habitat



3.2.1.2 Habitat Connectivity

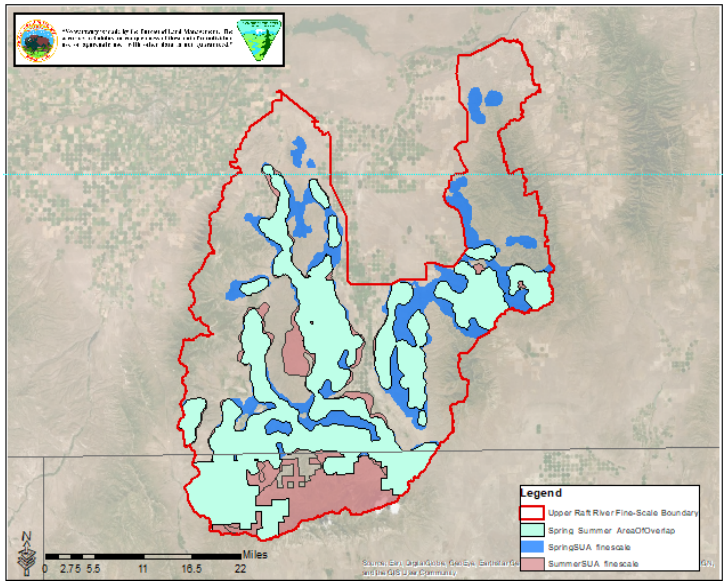
The seasonal use area connectivity metric was rated suitable in the Upper Raft River fine-scale area. The connectivity indicator was rated as suitable because the seasonal use areas that overlap are high (i.e. there is high connectivity among the three seasonal habitat types). Both a major highway and a large transmission corridor that run north/south bisect the fine-scale area and could impede movements among and between the seasonal habitats. Table 3.2.2 & Figure 3.2.2 a - c

Table 3.2-2: Upper Raft River Fine-scale Area SUA Connectivity

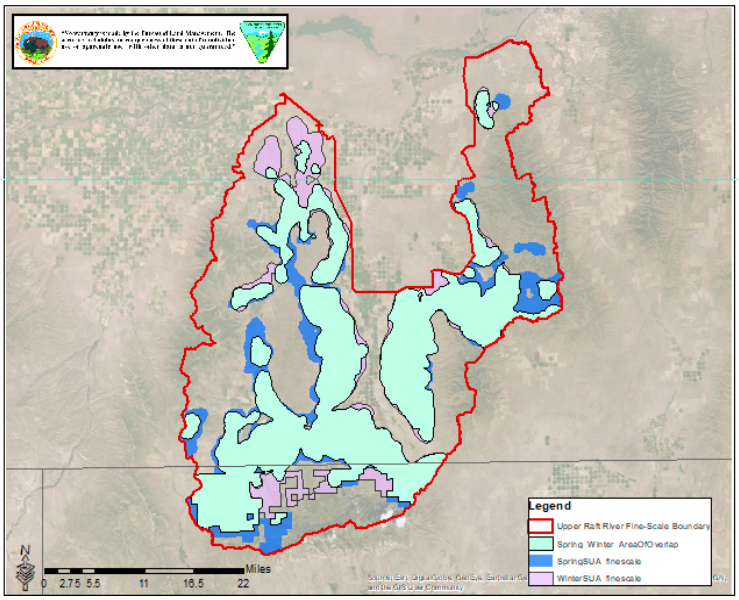
Overlap between Seasonal Use Areas			
Seasons	**Combined Area km²**	**Overlapping Area km²**	**% Overlap**
Spring x Summer	1,726	1,060	**61%**
Spring x Winter	1,628	1,176	**72%**
Summer x Winter	1,772	951	**54%**

Figure 3.2-2: Upper Raft River Fine-Scale SUA Connectivity

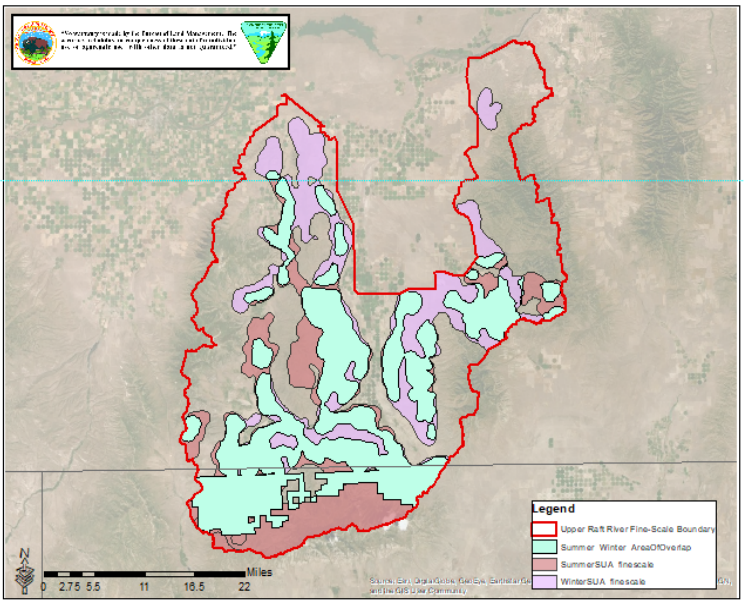
a. Spring x Summer Combined Area & Area of Overlap



b. Spring x Winter Combined Area & Area of Overlap



c. Summer x Winter Combined Area & Area of Overlap



3.2.1.3 Anthropogenic Disturbance

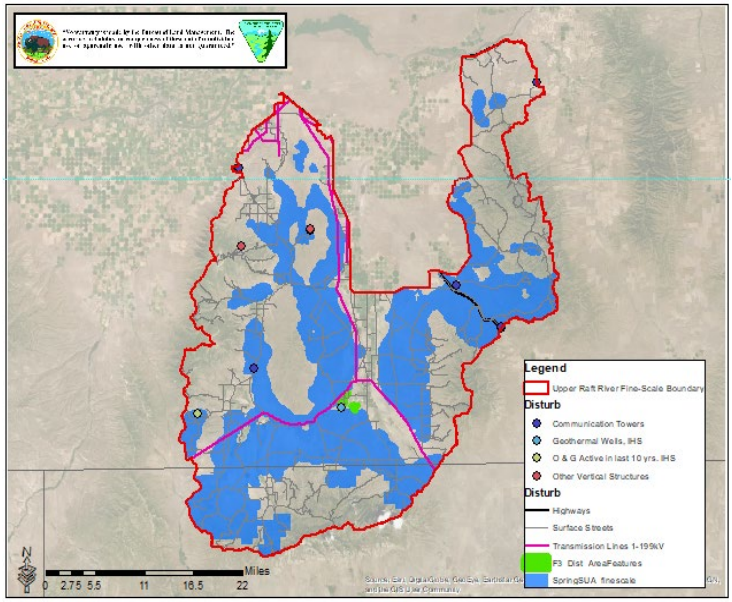
The anthropogenic disturbance metric was rated suitable due to the density of both points and areas being very low and the density of lines being moderate (Table 3.2-3 & Figure 3.2-3). Additionally, the linear feature density was primarily based on the presence of surface streets, many two-track roads that have been found to not affect sage-grouse habitat.

Figure 3.2-3: Upper Raft River Fine-Scale Anthropogenic Disturbance

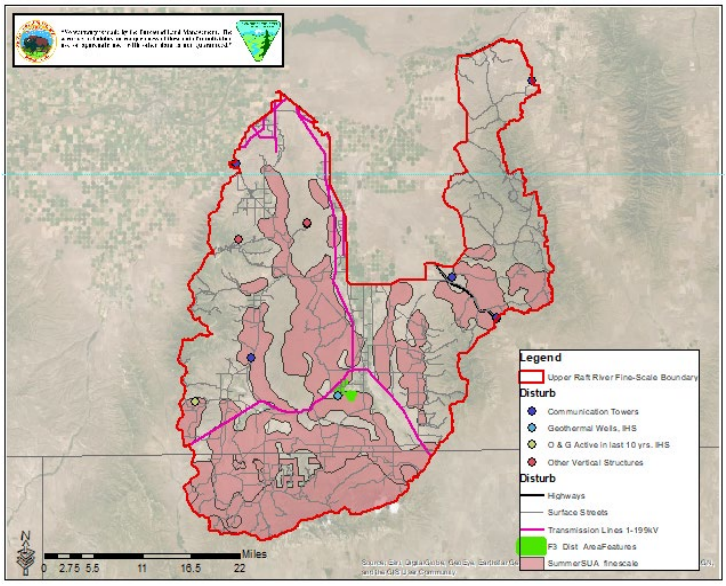
Anthropogenic Disturbance in the Fine-Scale Boundary		
	Units in Fine-scale	**Density**
Disturbance - Linear Features (km)	1, 515	0.47
Disturbance - Points Features (count)	13	0.004
Disturbance - Area Features (km^2)	0	0.0000
Fine-scale Boundary	4,223 km^2	

Figure 3.2-3: Upper Raft River Fine-Scale Disturbance Features

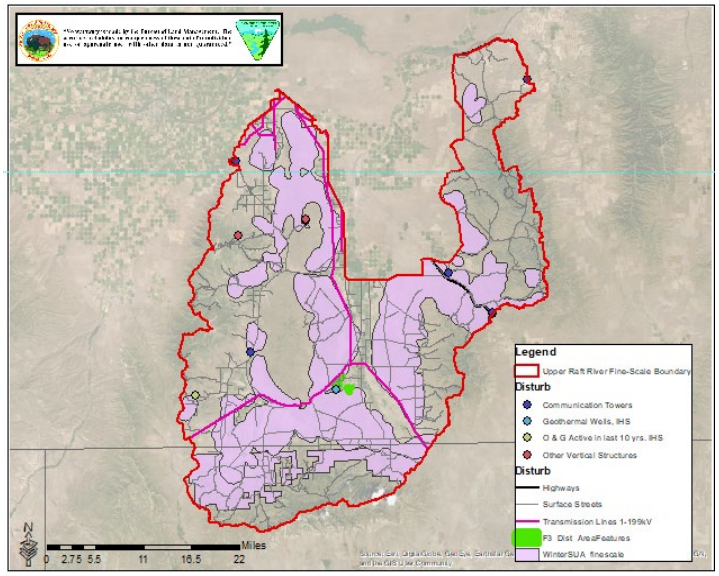
a. In Spring SUA



b. In Summer SUA



c. In Winter SUA



3.3 Site-Scale

Site-scale habitat suitability is divided into five categories based on the season and type of use. These include:

1. Breeding Habitat: Leks
2. Breeding Habitat: (Nesting/Early Brood-Rearing)
3. Upland Summer: Late Brood-Rearing
4. Riparian Summer: Late Brood-Rearing
5. Winter Habitat

Thirty-one leks that occur on BLM managed lands were assessed within the Upper Raft River Valley fine-scale area. AIM, LMF, Modified HAF and PFC plots were assessed to inform suitability for other seasonal habitats (Table 3.3-1).

Table 3.3-1: Number of plots located within each Seasonal Use Area and surveyed during the appropriate seasonal period.

Season	# of plots				
	Total	AIM	LMF	Modified HAF	PFC
Nesting/Early Brood Rearing	48	2	2	44	
Upland Late Brood Rearing	22	10	4	8	
Riparian Late Brood Rearing					8
Winter	68	14	11	43	

3.3.1.1 Breeding Habitat (Leks) Site-Scale Suitability (S2)

Thirty-one leks (S-2) are known to occur on BLM managed lands in the Upper Raft River Valley fine-scale area (Figure 3.3-1). Seventy-seven percent of the leks were rated suitable and 22% marginal. No leks were rated unsuitable (Figure 3.3-2).

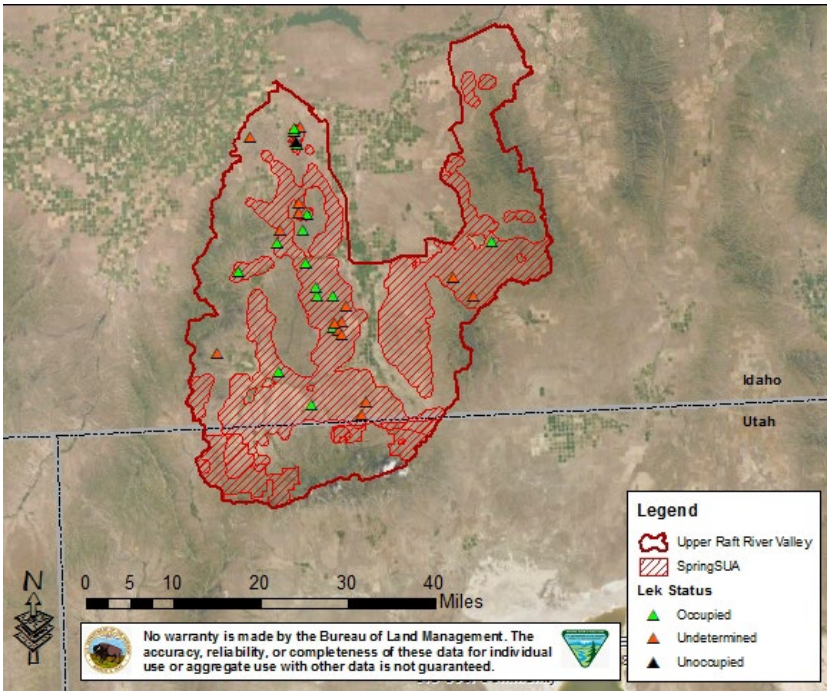


Figure 3.3-1: Upper Raft River Fine-Scale SUA Lek Locations and Management Status

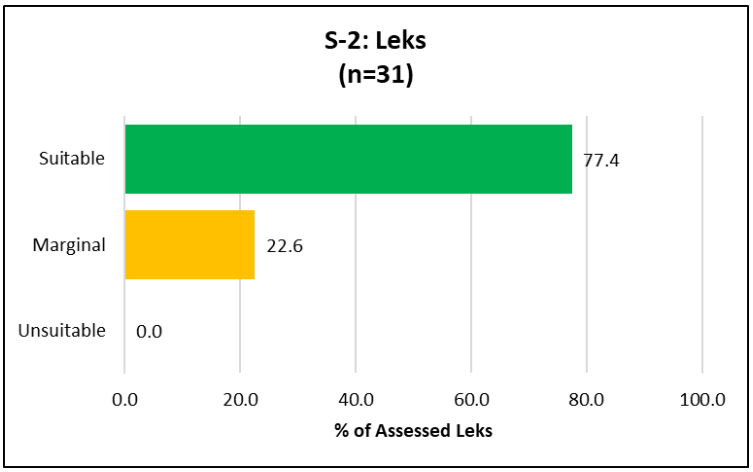


Figure 3.3-2: Overall Suitability of Leks

3.3.1.2 Breeding Habitat (Nesting/Early Brood-Rearing) Site-Scale Suitability (S3)

Forty-eight plots fell within mapped spring habitat, were visited during the appropriate seasonal period (May 1 to June 30 in Idaho, March 1 – June 30 in Utah), and were from sample designs appropriate for a weighted analysis (Figure 3.3-3). Of the spring SUA in the Upper Raft River

Valley fine scale, about 52% was in the inference area of a weighted analysis. Approximately 16% of the area of inference was suitable, 13% was marginal, and 70% was unsuitable (Figure 3.3-4). This falls far below the desired 80% suitable benchmarks set in both the Idaho and Southwestern Montana Greater Sage-Grouse Approved Resource Management Plan Amendment (IDSM ARMPA; USDI, BLM 2015) and the Utah Greater Sage-Grouse Approved Resource Management Plan Amendment (UT ARMPA; USDI, BLM 2015). Among plots that were rated, it appears that the sagebrush and perennial forb cover indicators contributed most negatively across the fine scale (Figure 3.3-5), with total shrub height also contributing negatively in Utah (Figure 3.3-5b).

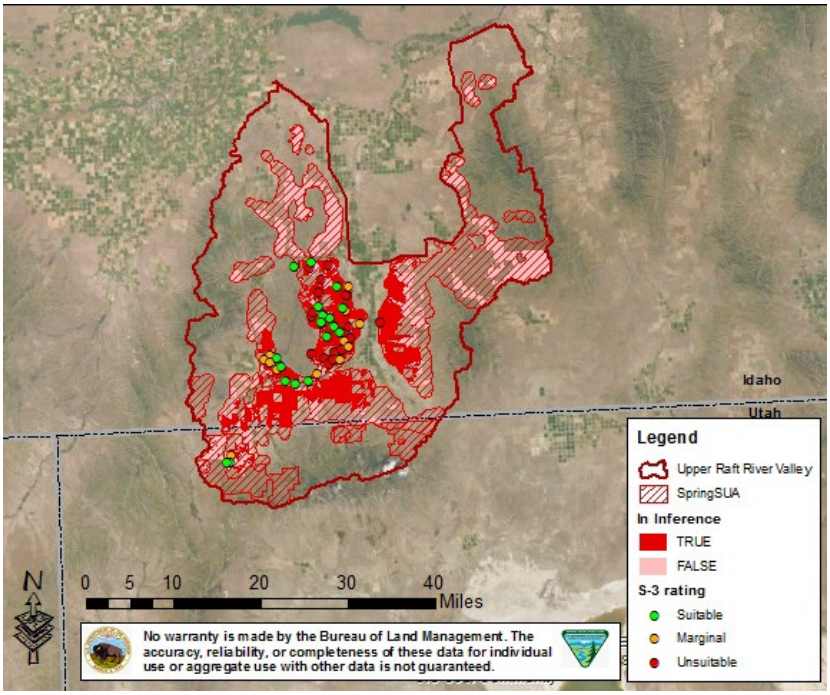


Figure 3.3-3: Nesting/Early Brood Rearing Inference Area and Plot Condition

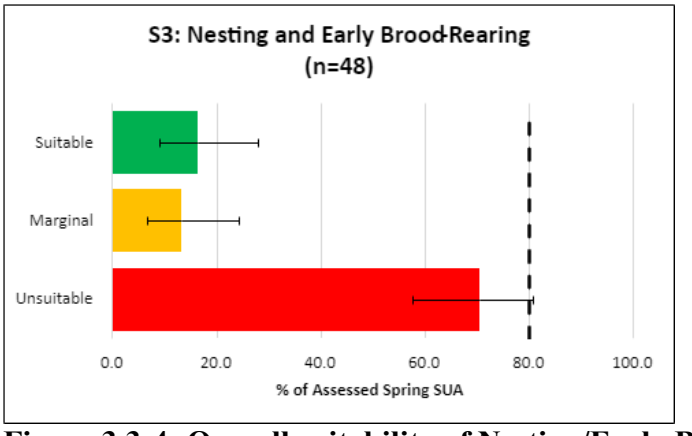


Figure 3.3-4: Overall suitability of Nesting/Early Brood-Rearing habitat

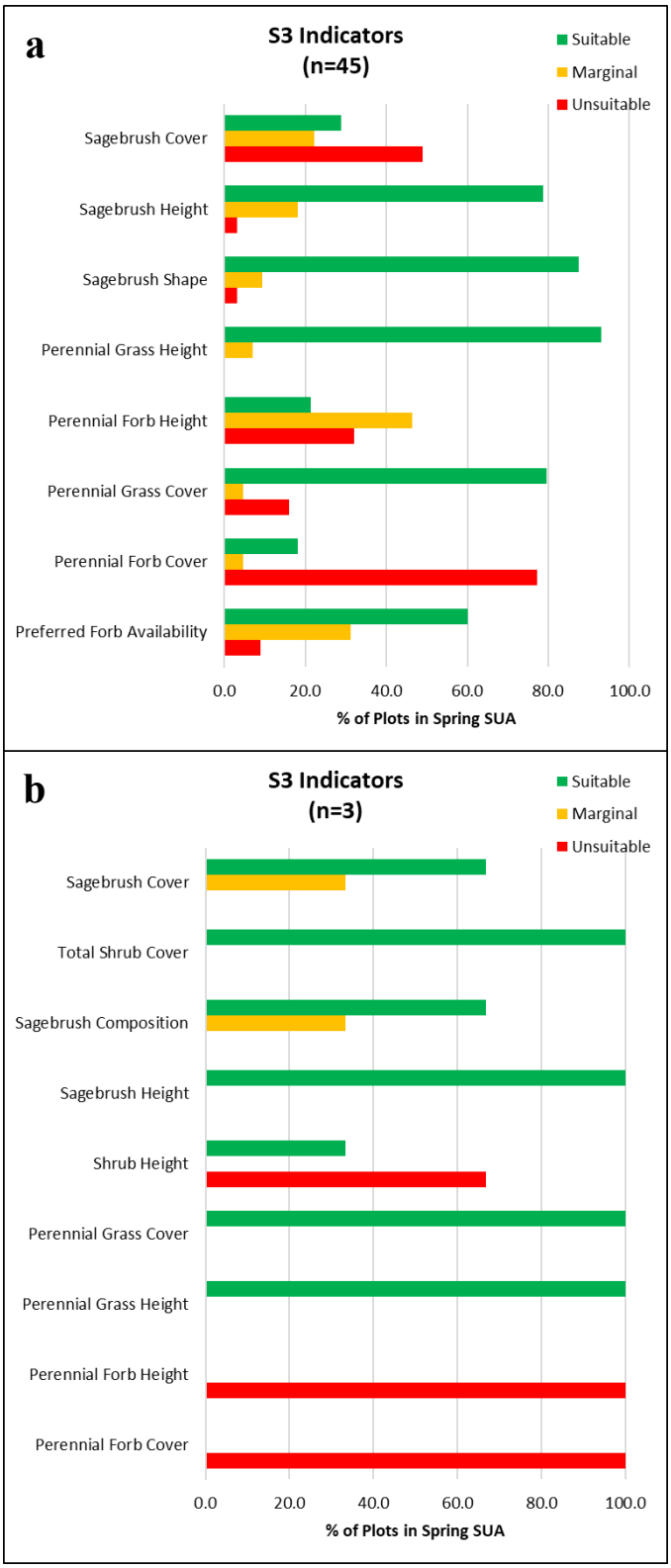


Figure 3.3-5: Suitability by indicator for Nesting/Early Brood-Rearing plots for a) Idaho and b) Utah

3.3.1.3 Upland & Riparian Summer: Late Brood-Rearing Site-Scale Suitability (S4, S5)

Twenty-two plots were rated that occur in mapped summer habitat (S-4), were visited during the correct seasonal period (July 1 – September 30 in Idaho, June 15 – August 31 in Utah), and were from sample designs appropriate for a weighted analysis (Figure 3.3-6). Eight riparian (S-5) areas were assessed (Figure 3.3-7).

Of the upland summer SUA in the Upper Raft River Valley fine-scale, about 55% was in the inference area of a weighted analysis. Approximately 15% of area of inference was suitable, 35% was marginal, and 70% was unsuitable (Figure 3.3-8). This falls far below the desired 40% suitable benchmarks set in both the IDSM ARMPA (USDI, BLM 2015) and UT ARMPA (USDI, BLM 2015). Among plots that in Idaho, it appears that the sagebrush and preferred forb availability contributed most negatively (Figure 3.3-9). Individual indicators were not compared in Utah because there was only 1 plot.

Of the riparian summer plots, 50% were suitable and 50% marginal. No summer riparian plots were rated unsuitable (Figure 3.3-10). This exceeds the desired 40% suitable benchmarks set in both the IDSM ARMPA (USDI, BLM 2015) and UT ARMPA (USDI, BLM 2015).

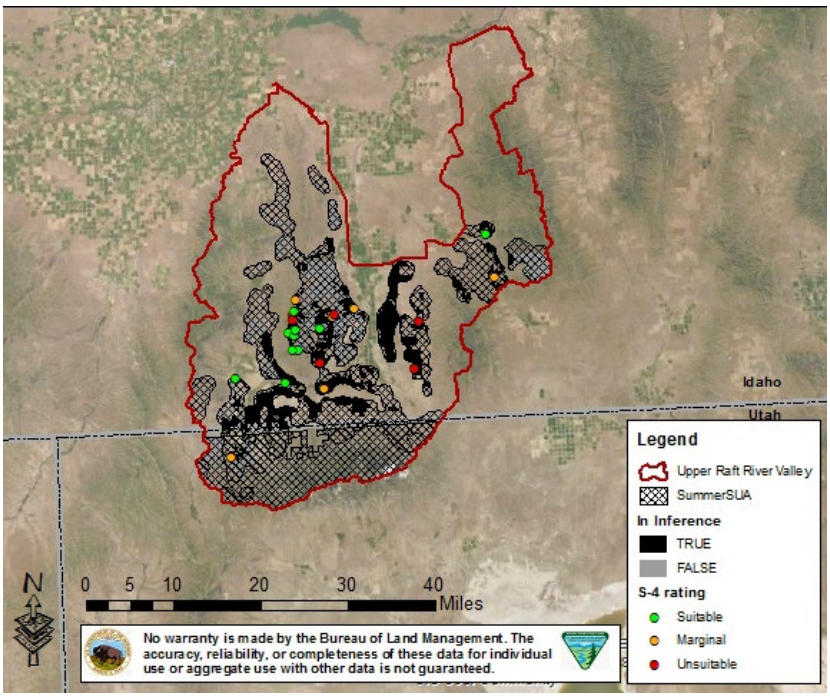


Figure 3.3-6: Late Brood-Rearing (Upland Summer) Inference Area and Plot Condition

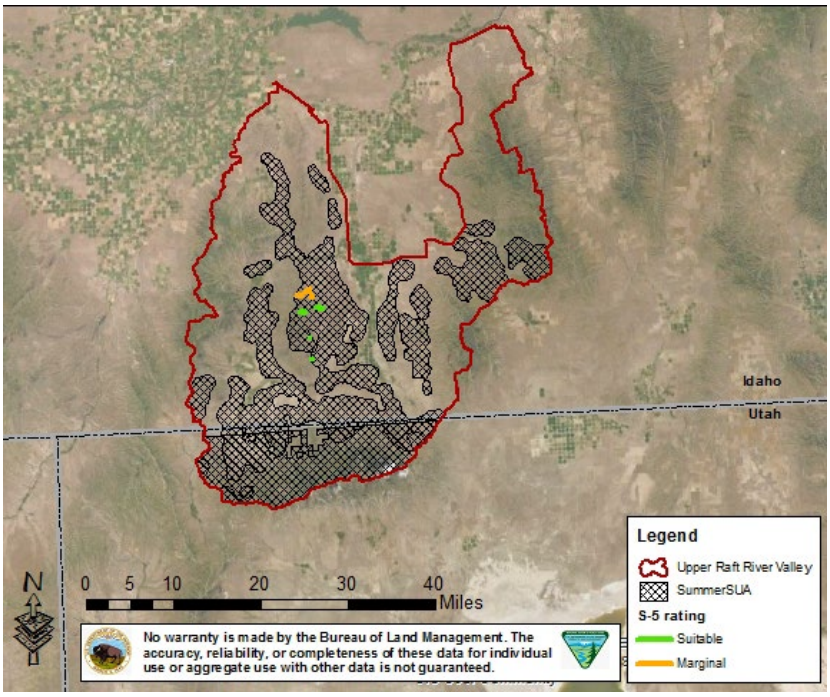


Figure 3.3-7: Late Brood-Rearing (Upland Riparian) Plot Condition

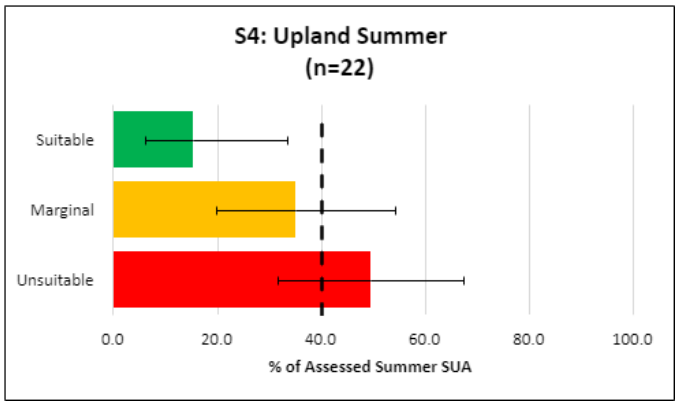


Figure 3.3-8: Overall suitability of Summer/Late Brood-Rearing upland habitat

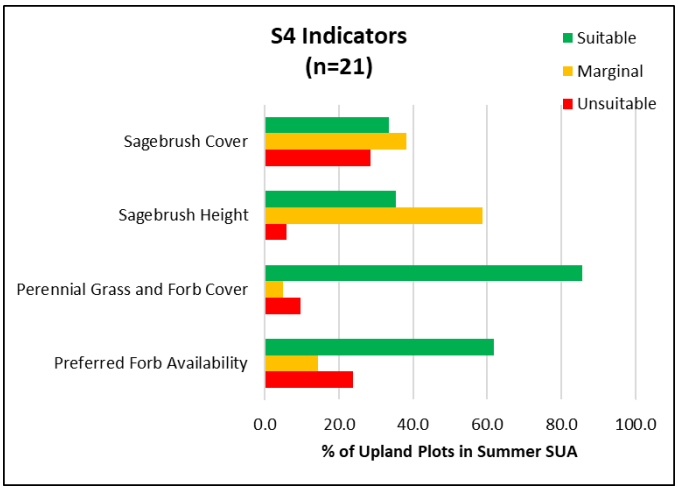


Figure 3.3-9: Suitability by indicator for Upland Nesting/Early Brood-Rearing plots in Idaho

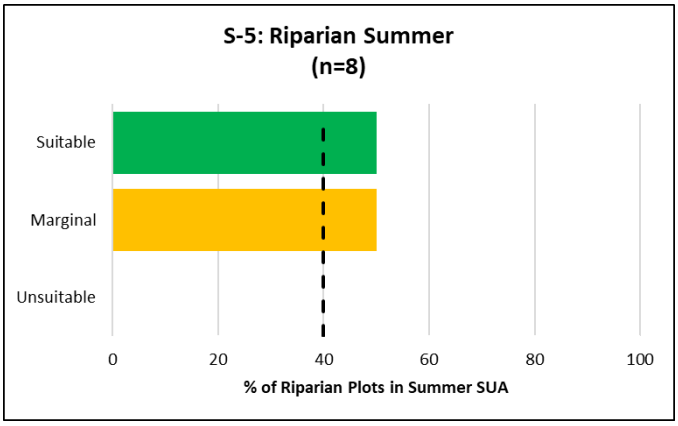


Figure 3.3 -10: Overall suitability of riparian plots in Summer SUA

3.3.1.4 Winter Site-Scale Suitability (S6)

70 plots were rated that fall in winter habitat (S-6).

Sixty-eight plots fell within mapped winter habitat and were from sample designs appropriate for a weighted analysis (Figure 3.3-11). Of the winter SUA in the Upper Raft River Valley fine scale, about 86% was in the inference area of a weighted analysis. Approximately 36% of the area of inference was suitable, 8% was marginal, and 55% was unsuitable (Figure 3.3-12). This falls far below the desired 80% suitable benchmarks set in both the IDSM ARMPA (USDI, BLM 2015) and UT ARMPA (USDI, BLM 2015).

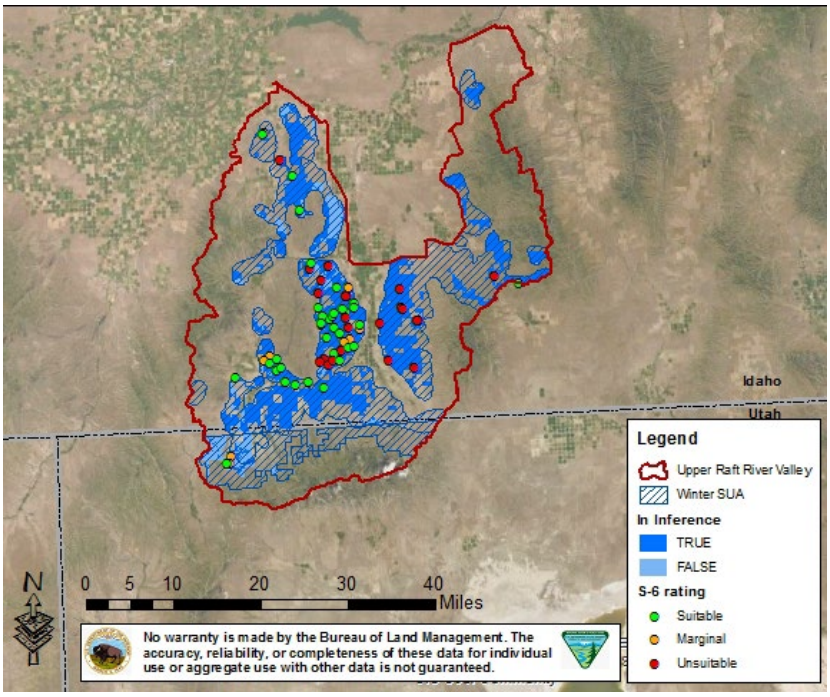


Figure 3.3-11: Winter Inference Area and Plot Condition

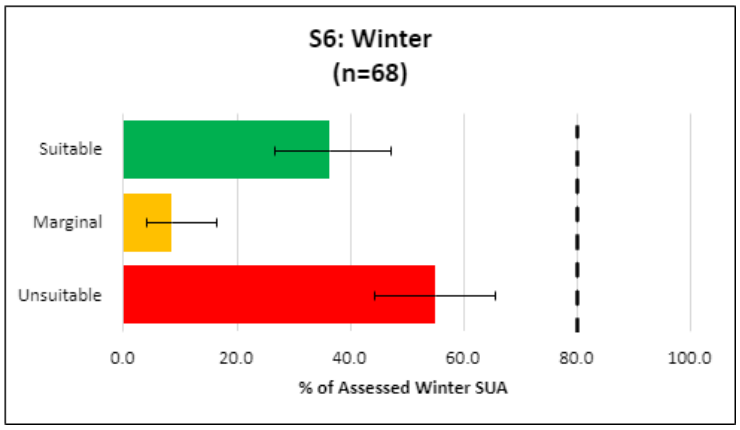


Figure 3.3.1-12: Overall suitability of Winter habitat

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