GREATER SAGE-GROUSE HABITAT CATEGORIZATION
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ABSTRACT

The Nevada Department of Wildlife (NDOW) Greater Sage-grouse Habitat Categorization Map (Sage-grouse Map) is an analysis tool that incorporates the best available data (lek observations, telemetry locations, survey and inventory reports, vegetation cover, soils information, and aerial photography) into a statewide prioritization of Greater sage-grouse (sage-grouse) habitat. This tool provides resource managers with information to guide conservation and land-use planning efforts in the context of sage-grouse management at the landscape scale. Sage-grouse habitat was categorized into the following five classes:

1. Essential/Irreplaceable Habitat
2. Important Habitat
3. Habitat of Moderate Importance
4. Low Value Habitat and Transitional Range
5. Unsuitable Habitat

N/A Non-habitat

The sage-grouse habitat categorization analysis was only performed for areas within the sage-grouse population management units (PMUs) identified by the Governor’s Sage-Grouse Conservation Team (2004). Ongoing efforts will include revisions to the habitat categorization every 3-5 years based upon updated PMU boundaries, sage-grouse survey and inventory work, conservation projects, human land-use development, and wildfire events.

PURPOSE

Greater sage-grouse (sage-grouse) are broadly distributed throughout the northern two-thirds of Nevada and require extensive sagebrush habitat for survival and reproduction (Schroeder et al. 1999, Connelly et al. 2004). Since Euro-American settlement of western North America, sage-grouse range has declined substantially (Schroeder et al. 2004) and population numbers have been reduced in many states (Connelly et al. 2004), including Nevada. Sage-grouse are thought to be an important management indicator species for the health of the sagebrush-steppe ecosystem based on their specific needs at different life-stages (Patterson 1952). Furthermore, sage-grouse have been classified as an umbrella species (Rowland et al. 2006) because their populations function at relatively large spatial scales and management of sage-grouse across a landscape benefits other species of conservation concern, particularly those that function at smaller spatial scales, such as pygmy rabbit (Brachylagus idahoensis) and sage sparrow (Amphispiza belli).
Considering the current demands of increased public land use and management, several threats to sage-grouse population health and distribution in Nevada have been recognized. These include, but are not limited to:

- Reductions in habitat quantity and/or quality (Nevada Sage-Grouse Conservation Plan 2004);
- Wildfire (Nevada Sage-Grouse Conservation Plan 2004);
- Avoidance behavior by grouse of lek sites and habitats that are near anthropogenic sites (Lyon and Anderson 2003, Hall and Haney 1997, Braun 1998, Holloran 2005);
- Higher mortality rates of breeding sage-grouse in oil and gas fields (Holloran 2005, Kaiser 2006, Aldridge and Boyce 2007);
- Lower nest initiation rates and success (Hall and Haney 1997, Braun 1998);
- Lower lek attendance of males (Ellis 1984, Hall and Haney 1997, Walker et al. 2007);
- Population declines (Beck et al. 2006, Connelly et al. 2000);
- Loss or degradation of critical habitat (Braun 1998, Connelly et al. 2000, Crawford et al. 2004, Walker et al. 2007);
- Increases in avian predator populations (Ellis 1984, Braun 1998);
- Collisions with power lines and vehicles (Connelly et al. 2000);
- Noise associated with wind turbine rotor blades that is thought to reduce lek attendance (Connelly et al. 2004); and
- Displacement of nests near overhead transmission lines (Braun et al. 2002).

With these and other potential threats in mind, the Nevada Department of Wildlife (NDOW) has developed the NDOW Greater Sage-Grouse Habitat Categorization Map (Sage-grouse Map) to identify areas most important to sage-grouse populations and inform mitigation and conservation strategies to benefit the species at a landscape scale.

**USE CONSTRAINTS**

The Sage-grouse Map is intended to provide land use and resource managers and decision makers with a valuable tool to identify potential sage-grouse concerns at the landscape scale. This product is intended for general project planning and siting purposes in the context of sage-grouse use of the landscape. The map and the accompanying dataset are presented at 100-meter pixel resolution and should not be used for making planning decisions at the project design (fine) scale. To apply these data to specific locations it is recommended that a field investigation be conducted by a qualified biologist for the purpose of impact assessment.

No land use management decisions or directives are directly attached to or implied by the map. The map is a statement of sage-grouse habitat value based upon the best available information. Ultimately, land use decisions and directives will be made by the applicable land management agency using the existing planning processes (National Environmental Policy Act). However, comments on the NDOW Greater Sage-Grouse Habitat Categorization Map are welcome and should be directed to sagegrouse@ndow.org.

**PROCESS**

The Sage-grouse Map was developed using a mapping framework produced by the Bureau of Land Management (BLM) that designates the restoration potential of sagebrush communities (R-values) within the known range of sage-grouse in Nevada. The R-values were developed in a geographic
information system (GIS) by BLM State Office staff and District personnel, with cooperation from NDOW wildlife biologists, based upon existing vegetation cover, ecological site potential, and burned areas. R-value classifications were adapted from Sather-Blaire (2000) and are defined as follows for the Sage-grouse Map:

**R-0** – Areas with desired species composition that have sufficient, but not excessive, sagebrush canopy and sufficient grasses and forbs in the understory to provide adequate cover and forage to meet the seasonal needs of sage-grouse (nesting, early brooding, summer, fall/winter).

**R-1** – Areas with potential to produce sagebrush plant communities that have good understory composition of desired grasses and forbs, but lacks sufficient sagebrush canopy. These areas could be characterized by native perennial grasslands post fire or seeded perennial grass rangelands.

**R-2** – Existing sagebrush plant communities with insufficient desired grasses and forbs in the understory.

**R-3** – Areas dominated by pinyon/juniper woodland that may have the potential to produce sagebrush plant communities. These areas include sagebrush sites that have been encroached by pinyon/juniper woodlands, as well as other pinyon/juniper dominated sites that may provide potential value to sage-grouse.

**X-3** – Pinyon/Juniper areas that have crossed the threshold from sagebrush ecological site to pinyon/juniper or juniper woodland or have only had a potential for woodland plant community.

**R-4** – Areas with potential to produce sagebrush plant communities, but are dominated by annual grasses, annual forbs, or weeds.

**X-4** – Areas that have crossed the threshold from sagebrush ecological site to annual grasses, perennial weeds or bare ground or a non sagebrush ecological site.

**Other** – Areas with some value to sage-grouse but typically not considered traditional sage-grouse habitat. These areas typically included riparian zones, salt desert scrub communities, aspen stands, mountain mahogany stands, and agricultural lands.

The original R-value data provided by the BLM was represented as 30-meter pixels. This resolution was determined to be too fine for the purposes of mapping sage-grouse habitat statewide. Therefore, the NDOW used GIS to aggregate the 30-meter pixel data to 100-meter pixel resolution using the mean aggregation technique. In order to produce landscape patches that represented homogenous R-values with minimal pixilation, the NDOW performed a majority filter to dissolve pixels based upon the majority of their eight neighboring pixel values. This process was performed five times, resulting in landscape patches that were optimized for efficient analysis while retaining the fundamental integrity of the original R-values. Finally, the 100-meter, majority filtered data was converted to vector polygons for further review and categorization.

Sage-grouse habitat categorization was performed on landscape patch polygons by NDOW staff specialists and regional field biologists. Individual polygons were reviewed and evaluated based on overall quality of habitat, patch size, and known sage-grouse activity. The 75% Core Breeding Density
dataset developed by Doherty et al. (2010) were also considered when categorizing sage-grouse habitat, especially in areas where bird activity data was missing or incomplete. Habitat quality was determined by the R-value and was assessed for accuracy by the review team. Adjustments to the R-values were made, when necessary, based upon the best available vegetation cover data (SynthMap 2008), updated aerial imagery and fire information, and on-the-ground knowledge of local land cover and land use impacts. Furthermore, landscape patch polygons were merged where patch size or type was determined to be insignificant and split to better represent local R-value or habitat quality homogeneity. Merging of polygons was determined to be an effective way to reduce any remaining pixilation and improve mapping efficiency. Landscape patches of 25 acres or less were evaluated and merged with neighboring polygons based upon the dominant vegetation cover and habitat quality. Known sage-grouse activity was represented by lek location and observation data, telemetry locations, and incidental sage-grouse sightings collected by NDOW field biologists and other qualified observers. Large, homogeneous landscape patches with variable amounts of documented sage-grouse activity were evaluated and often split to refine the habitat categorization based on bird use.

Sage-grouse habitat was categorized into the following five classes using definitions established by the Nevada Energy and Infrastructure Standards to Conserve Greater Sage-Grouse (Nevada Governor’s Sage-Grouse Conservation Team 2010):

**Category 1 – Essential/Irreplaceable Habitat**

The lek itself and associated nesting habitat is categorized as essential and irreplaceable habitat. The interrelationships between the vegetal characteristics of a given area, female nest site selection, and movement patterns of the population that drive males to establish a lek in areas of female use is spatially and temporally dynamic and has yet to be successfully recreated (ODFW correspondence 2008). However, focusing solely on the lek location and a certain buffer around the lek does not always adequately represent those areas that are crucial to the long term survival of particular populations, especially those that are migratory. Several telemetry monitoring efforts, particularly in eastern Nevada, have shown that females will move up in elevation from the lek sites to more mesic habitats to both nest and raise their broods. These habitats should also be considered as Category 1 habitats that are essential and irreplaceable. Category 1 habitat often corresponds to the R-0 habitat definition (see definitions above).

**Category 2 – Important Habitat**

Suitable and diverse winter habitats and high quality brood rearing habitats are critical to the long-term persistence of sage-grouse populations. Winter habitats are very important to sage-grouse due in large part to their complete dependence on sagebrush during the late fall and winter months (Connelly et al. 2000). Depending on the year and the snowpack in a given area, winter habitats elevate in importance as snow accumulations rise. Because of the loss of sagebrush in Nevada over the last decade (approximately 2.6 million acres or 12% of available sage-grouse habitat), winter habitat is at a premium and depending on the particular PMU, could actually be considered essential and irreplaceable. Considering this further, the loss of Wyoming big sagebrush over the last decade coupled with the long recovery period of 50-120 years (Baker 2006) for this species, a “no net loss” or “net increase” policy should be adopted for this seasonal habitat. In Nevada, winter habitats are essentially comprised of mountain big sagebrush, Wyoming big sagebrush and/or low sagebrush communities. Plants within these communities are usually taller than at random sites (Connelly 1982, Schoenberg 1982). Also,
sagebrush canopy cover is typically greater than 20% at wintering sites (Hanf et al. 1994, Eng and Schladweiler 1972, Homer et al. 1993). High quality winter habitat may correspond to the R-2 habitat definition, but there are situations where important winter habitats could be nested within R-0 habitats as well.

Brood rearing habitats are also a very important component of sage-grouse habitats. A mosaic of upland sagebrush vegetation intermixed with mountain meadows and spring systems compose brood rearing habitat. These habitat types are fairly limited in Nevada because of the dry climate exhibited throughout the majority of the Great Basin. These habitats have been impacted by improper livestock grazing practices (whether prior or current), overutilization by wild horses, and pinyon and juniper encroachment. Due to past and current perturbations to these habitat types, a “no net loss” or “net benefit” policy should be adopted for this seasonal habitat type. In theory, high quality brood rearing habitat corresponds best to the R-0 habitat definition; however, there are instances where high quality brood rearing habitat could be nested within R-1 and R-2 habitat definitions.

Category 3 – Habitat of Moderate Importance

These habitats are those that are not meeting their full potential due to any number of factors, but serve some benefit to sage-grouse populations. These habitats can serve as nesting, brood rearing, winter or transitional habitat, but are marginal. For the short-term, these habitats may only be of limited value on a seasonal basis, but could serve additional long-term values if certain habitat components (most importantly sagebrush) return to the site.

Habitats within this Category could correspond to R-1, R-2 or R-3 habitat definitions. R-1 habitats generally tend to be upper elevation sagebrush habitats, normally mountain big sagebrush communities that have recently burned. These areas are likely to return to a mountain big sagebrush community within 35-100 years (Baker 2006) and would then serve greater value to sage-grouse, but presently may only be of marginal value during the brood rearing period for example. R-2 habitats with ample sagebrush, but little understory exist at various elevation and topography types. These areas can often be treated with passive management techniques, which are recommended in xeric sagebrush communities that receive ≤12” of precipitation. Pinyon and juniper encroached sagebrush habitats, or R-3 habitats that have not crossed a threshold, may be of value to sage-grouse depending on the level of encroachment. These areas can be restored through a number of treatment techniques such as hand thinning, mechanical treatment using equipment or prescribed fire and certainly be of future value.

Category 4 – Low Value Habitat and Transitional Range

Habitats within this category currently contribute very little value to sage-grouse other than transitional range from one seasonal habitat to another or minimal foraging use. Habitats within this category that correspond to R-3 habitat definitions have not completely crossed a threshold where restoration efforts would be ineffective, but would be very expensive with secondary work needed to recover the understory. The cost/benefit ratio is too high to apply recovery efforts at this time. Similarly, habitats that correspond to the R-4 habitat definition may not have necessarily crossed the restoration threshold, but restoration would be very expensive and also require secondary or tertiary treatments to control invasive plant species post treatment.
Category 5 – Unsuitable Habitat

This category, in essence, represents non-habitat at this time unless greater strides are made with respect to restoration techniques. In general, habitat is in such poor condition that restoration efforts would not be feasible or effective. Non-habitat can either be designated non-habitat areas delineated within seasonal distribution maps or areas that have undergone substantial change and are not likely to recover. These areas could be lower elevation sagebrush habitats that have burned and are now annual grasslands dominated by various invasive weeds. Areas such as these are not likely to recover without substantial effort and expense. Other examples of habitat alteration that could render an area to be considered “non-habitat” include agricultural conversion, or cultivation, and urban/suburban development. Category 5 habitat could correspond to the R-3 or R-4 habitat definitions. These areas have little potential to produce sagebrush plant communities and are currently dominated by pinyon/juniper woodlands or annual grasses and forbs.

Not Applicable – Non-habitat

The Not Applicable (N/A) category identifies areas of no consequence to sage-grouse, such as dense conifer stands, alpine cliffs and rock outcrops, playas, and human disturbances such as highways, gravel pits, mines, and populated places.

The final sage-grouse habitat categorization dataset was converted back into 100-meter raster format to reduce computational demand and improve performance. These 100-meter pixels become apparent when attempting to use the data at the local scale. For this reason the Sage-grouse Map should not be used for fine scale project design planning. The sage-grouse habitat categorization analysis was only performed for areas within the sage-grouse PMUs identified by the Governor’s Sage-Grouse Conservation Team (2004). Ongoing efforts will include revisions to the habitat categorization every 3-5 years based upon updated PMU boundaries, continual sage-grouse survey and inventory work, conservation projects, human land-use development, and wildfire events.

KNOWN ISSUES

While every effort was made to produce an accurate map of sage-grouse habitat quality, the NDOW has identified the following known issues that may affect the use of this product:

- The R-3 category was not consistently applied to areas of pinyon/juniper encroachment vs. areas of true pinyon/juniper woodland. Therefore, R-3 landscape patches should be evaluated on a case by case basis to determine the true potential for meeting future sage-grouse needs.
- A key component of high quality sage-grouse habitat is the understory composition of sagebrush communities (Connelly et. al. 2000). The R-value mapping effort attempted to identify understory quality using the existing vegetation cover and the ecological site potential identified in the United States Department of Agriculture soil surveys. However, over the course of this project, it was determined the accuracy of the R-0 vs. R-2 classifications was variable. Further refinement of the Sage-grouse Map should include a more robust method for determining sagebrush understory composition and quality.
- Burned areas often dramatically alter the quality and composition of the landscape. The Sage-grouse Map used burned area perimeters provided by the BLM to categorize sage-grouse
habitat that had been affected by fire. It was assumed that fires affected burned areas uniformly within a given fire perimeter. No effort was made to account for the nuances of individual fire behavior and intensity. However, when categorizing burned areas, aerial photography, on-the-ground knowledge, time since burned, elevation, rehabilitation efforts, and other factors were considered. Furthermore, the BLM burned area dataset is not comprehensive and does not include fires on non-BLM managed lands (i.e. Humboldt-Toiyabe National Forest).

- Given the time constraints of providing the Sage-grouse Map to the public, the following areas were not categorized:
  - Steptoe-Cave PMU;
  - Nightingale PMU;
  - Sahwae 1 and 2 PMUs;
  - Limbo PMU;
  - Majuba 1, 2, 4, and 5 PMUs;
  - East Range PMU; and
  - Duck Valley Indian Reservation.

These areas will be completed and available in subsequent versions of the Sage-grouse Map.

**DISTRIBUTION**

The NDOW Greater Sage-Grouse Habitat Categorization Map is available to the public through the Nevada Department of Wildlife’s website at:

[www.ndow.org/wild/conservation/sg](http://www.ndow.org/wild/conservation/sg)

Comments to the Sage-grouse Map can be sent to:

[sagegrouse@ndow.org](mailto:sagegrouse@ndow.org)

**LITERATURE CITED**


