



Utah's Own Habitat Guidelines for Sage-Grouse

David Dahlgren, Michel Kohl, Eric Thacker, Nicki Frey, and Terry Messmer

Greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) are one of the most widely distributed species of concern in western North America, currently occupying 11 states and 2 provinces. Long-term population declines led to increased conservation concerns in the mid to late 1990s (Figure 1). In the early 2000s, sage-grouse became a candidate species for the Endangered Species Act (ESA) 1973, with ESA listing decisions occurring in 2005, 2010, 2015 resulting in the current status as not listed. Sage-grouse conservation has the potential to impact more land mass, local communities, and economies than most other species of conservation concern in our recent history. Federal land management agencies and state governments have responded with planning efforts to conserve sage-grouse populations and their habitat. These efforts have called for the best available science to be used in plan development.

Sage-grouse are one of the most researched species in North America. Our current scientific literature provides insight, knowledge, and understanding of the species' needs. One of the most significant findings is that sage-grouse persistence is directly linked to large-intact sagebrush landscapes. Thus, the loss, fragmentation, and/or degradation of these large (i.e., on the order of multiple square miles) blocks of sagebrush communities remain the species' most significant threat.

However, within the sagebrush biome there exists variation in specific habitat characteristics (e.g., shrub, grass, and forb cover and height) as vegetation communities transition across sage-grouse range. To date, this variation has not been addressed directly by research. Sage-grouse thrive in northeast Montana and the Dakotas where grass-dominated communities with low sagebrush canopy cover occurs as well as areas in the Southwest, with high sagebrush and low grass and forb cover in the southern portions of Utah and Nevada. As a whole, sage-grouse habitat includes seven large floristic provinces across the West. At more localized scales, habitat characteristics can differ greatly with changing elevations. This immense variation in habitat characteristics creates a challenge for the evaluation and conservation of sage-grouse habitat range-wide.



Figure 1. Sage-grouse brood female and chicks feeding in a late brood-rearing area, with lower sagebrush canopy cover, typical of habitat selection during the summer.

PAST HABITAT GUIDELINES

Most conservation efforts have used Connelly et al. (2000) sage-grouse habitat guidelines to provide habitat standards and/or objectives to evaluate sage-grouse habitat. In the mid-1970s the Western Association of Fish and Wildlife Agencies (WAFWA) Sage-Grouse Technical Working Group asked a group of scientists to compile published information and develop habitat guidelines for the species. This first effort was published by Braun et al. (1977), which was later updated by Connelly et al. (2000), which incorporated a large amount of research published after Braun et al. (1977). Additionally, Hagen et al. (2007) conducted a meta-analysis of available habitat characteristics that largely corroborated information provided by Connelly et al. (2000).

While Connelly et al. (2000) has been a keystone publication for sage-grouse conservation, there are some important considerations. By summarizing available data, the representation of Connelly et al. (2000) data was limited to the locations chosen by published studies. Thus, this approach did not allow for a systematic or representative sampling of sage-grouse habitat across the range of the species (Figure 2). This was at no fault to Connelly et al. (2000), as they used the published information available at the time. However, many sage-grouse habitats in the southwestern sagebrush semi-deserts simply did not have published research and were not

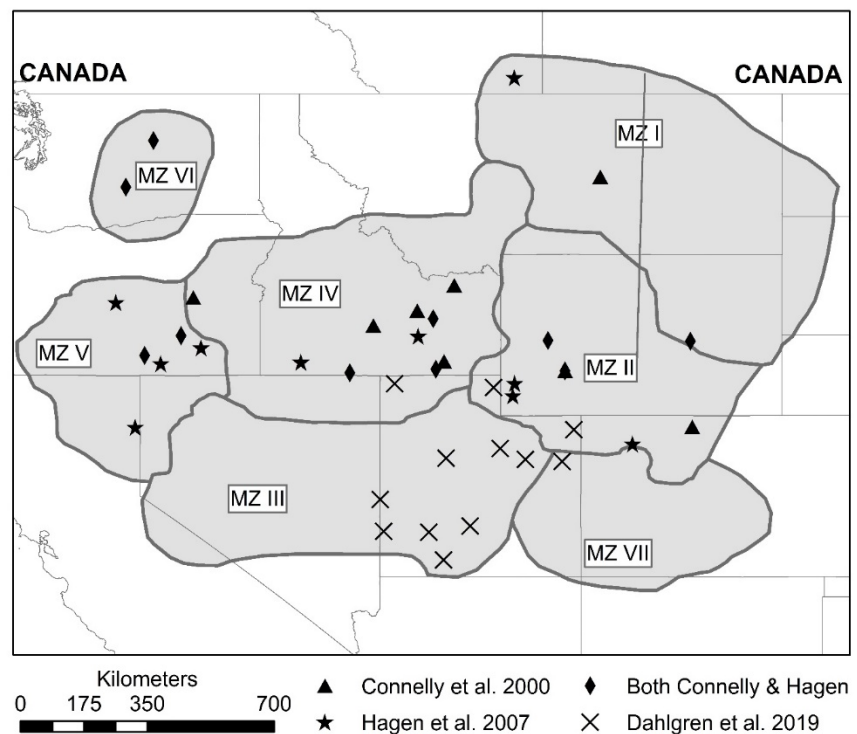


Figure 2. This map shows the locations of each study area, locations based on study area descriptions within the original publications, where data was used to develop guidelines presented in Connelly et al. (2000), Hagen et al. (2007) and Dahlgren et al. (2019). Sage-grouse management zones are represented and were based on large floristic provinces, demonstrating the potential for variation in sagebrush community vegetation characteristics. Notably, areas in the southwestern semi-deserts (MZ III) were not represented in Connelly et al. (2000) and Hagen et al. (2007) guidelines. The overall purpose of this map is to demonstrate the lack of representation in previous publications and how Dahlgren et al. (2019) efforts help rectify this situation for Utah.

considered in Connelly et al (2000). Similarly, areas in the northeastern portions of sage-grouse range were largely omitted. On the other hand, sagebrush communities in central Oregon, Idaho, and western Wyoming had multiple studies providing information for Connelly et al. (2000) efforts. Of note, no studies used in Connelly et al. (2000) or Hagen et al. (2007) occurred in Utah (Figure 2). The authors acknowledged the limitations of their data and called for the incorporation of locally available data when developing and applying habitat guidelines to specific population areas. Unfortunately, this recommendation has largely been overlooked as conservation planning for sage-grouse has moved forward.

UTAH-SPECIFIC HABITAT GUIDELINES

Many professionals working on sage-grouse conservation have recognized the unique habitat characteristics within their areas, including Utah's populations. However, previously, no published literature was available to help describe Utah's habitats and guide conservation planning. Recently, Dahlgren et al. (2019) published Utah's own breeding and brood-rearing sage-grouse habitat guidelines demonstrating some of the variation that exists in sagebrush community characteristics within the state.

Dahlgren et al. (2019) took a different approach to developing guidelines compared to past efforts. Instead of summarizing data from, or conducting meta-analyses using, other published literature, the authors compiled a large spatial database developed from multiple studies conducted by Utah State University and Brigham Young University from 1998 to 2013 in the majority of Utah's sage-grouse populations. Each study used similar methods to mark female sage-grouse with very high frequency (VHF) necklace-style radios and conducted micro-site (≤ 30 m transects) vegetation sampling of shrub, grass, and forb canopy cover and height at nest (over 1,000 nest vegetation samples) and brood (nearly 6,000 brood-site vegetation samples) locations (Figure 3).

The authors linked each location and the associated vegetation data with landcover spatial data provided by LANDFIRE (www.landfire.gov). Once linked, a statistical analysis was used to group sites that had similar vegetation measurement data and then assess which environmental factors were driving similarities and differences. Dahlgren et al. (2019) found that elevation was the most important factor driving the grouping of habitat characteristics in Utah. Similar habitat was then separated into three distinct clusters or areas statewide. Low elevation (low), high elevation (Wasatch), and the Parker Mountain areas (Parker) were delineated across Utah's sage-grouse habitat based on analyses.

Lastly, we used percentiles to establish minimum values; i.e., guidelines, for each habitat characteristic (e.g., shrub cover, grass height, forb cover, etc.). For example, to explain percentiles, if we measured the height of 100 sagebrush plants which had minimum and



Figure 3. A radio-marked sage-grouse nest in a sagebrush stand with high canopy cover, typical of nesting habitat in Utah. The female was incubating and her head and back can be seen in the black circle.

maximum values of 20 and 60 cm, respectively, and then arranged each height value in numerical order (i.e., 20 up to 60), the middle value, or in this case the 50th value, would represent the 50th percentile. When choosing which percentile to use, authors relied on their understanding of sage-grouse habitat needs within the studied populations and attempted to maintain consistency with previously published habitat guidelines. The 20th percentile was selected as the minimum recommendation for each habitat characteristic in nest and brood vegetation data (see Table 1).

Table 1. Guidelines for greater sage-grouse (*Centrocercus urophasianus*) breeding and brood-rearing habitat in Utah, based on radio-telemetry data from 1998-2013.

	Habitat Area	Shrub Cover	Shrub Height	Sage-brush Composition	Sage-brush Cover	Perennial Grass Cover	Perennial Grass Height	Forb Cover	Forb Height
Breeding	Wasatch	≥ 19 %	≥ 23 cm	≥ 83 %	≥ 14 %	≥ 8 %	≥ 12 cm	≥ 4 %	≥ 6 cm
	Low	≥ 17 %	≥ 30 cm	≥ 36 %	≥ 7 %	≥ 5 %	≥ 15 cm	≥ 2 %	≥ 6 cm
	Parker	≥ 22 %	≥ 15 cm	≥ 71 %	≥ 18 %	≥ 4 %	≥ 9 cm	≥ 1 %	≥ 5 cm
Late Brood-Rearing	Wasatch	≥ 17 %	≥ 20 cm	≥ 77 %	≥ 15 %	≥ 8 %	≥ 10 cm	≥ 6 %	≥ 6 cm
	Low	≥ 10 %	≥ 26 cm	≥ 28 %	≥ 4 %	≥ 5 %	≥ 20 cm	≥ 2 %	≥ 8 cm
	Parker	≥ 19 %	≥ 11 cm	≥ 77 %	≥ 16 %	≥ 6 %	≥ 9 cm	≥ 2 %	≥ 5 cm

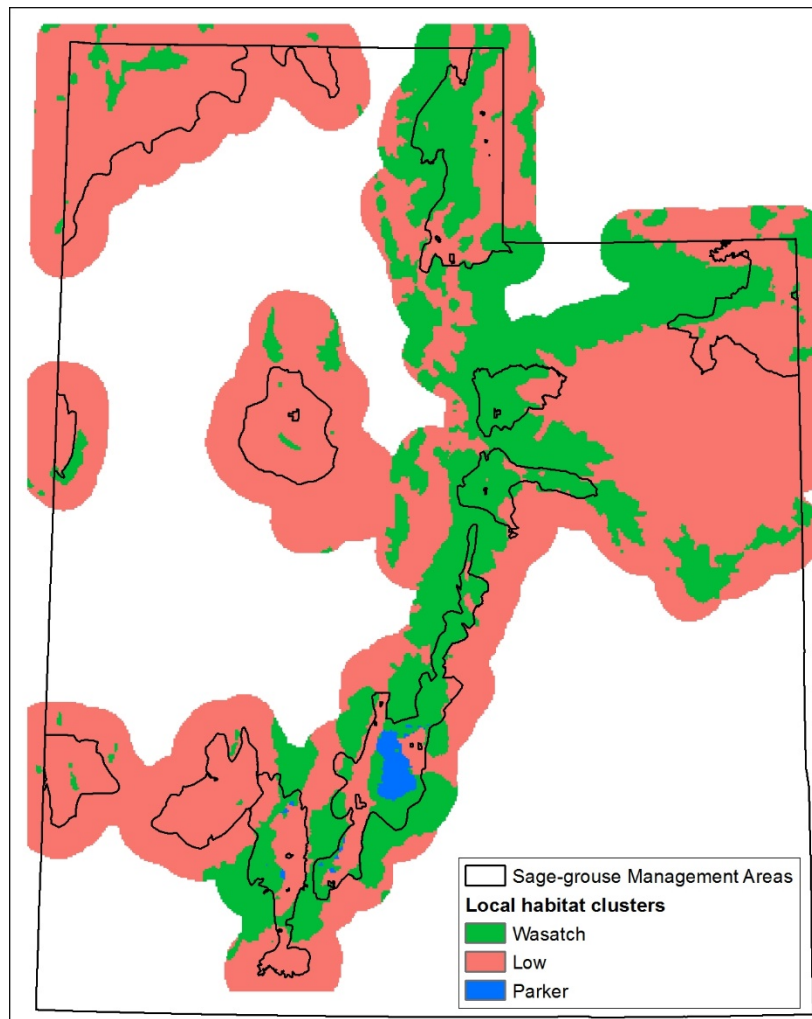


Figure 4. Area clusters for sage-grouse habitat in Utah. Each area represents where sage-grouse habitat characteristics were most alike within and different from the other areas; in other words, a cluster. These clusters provide boundaries where Utah's sage-grouse habitat guidelines can be applied for both breeding and brooding habitat. To obtain spatial data (e.g., shapefile) for the Wasatch, Low, and Parker areas, please contact David Dahlgren at dave.dahlgren@usu.edu

IMPLICATIONS

Managers and planners working in Utah now have guidelines for vegetation canopy cover and height based on habitat that was selected by the very sage-grouse using the areas these habitat objectives and standards will be applied to. Utah's sage-grouse habitat guidelines have both similarities and differences compared to previously published guidelines in Connelly et al. (2000) and Hagen et al. (2007). Sagebrush cover throughout Utah was generally higher and herbaceous (i.e., grasses and forbs) cover and heights were lower compared to published values from other areas. Dahlgren et al. (2019) results may simply reflect the vegetation within semi-desert communities where sage-grouse habitat occurs in most of Utah. Additionally, the percent composition of sagebrush within shrub communities in sage-grouse habitat was reported, a variable previous guidelines have not addressed.

By using locally-driven data to develop habitat guidelines, land-use plans and policies can be set to meet the potential of the habitat on our local landscapes rather than attempting to apply habitat objectives and standards derived from sage-grouse habitat for other areas. Utah's sage-grouse habitat guidelines will better serve those developing and implementing conservation for sage-grouse, as well as land-users, such as public land grazing permittees, who rely on sagebrush communities in Utah to provide goods and services other than just sage-grouse habitat.

SUMMARY

Those living and working within western North America's sagebrush landscapes have most likely been exposed to sage-grouse issues for many years now and may have felt anxiety concerning the potential impacts that could result from implementing conservation measures designed to help this iconic species persist. Society's challenge to seek the delicate balance between the conservation of nature and the growth related to human endeavors exemplifies the need to use the best available science as we move forward. Representative information, especially at the landscape level related to sage-grouse, has been hard to come by. However, due to the vast amount of research conducted within Utah's sage-grouse populations and the yeoman efforts carried out by many individuals, Utah researchers have had the unique opportunity to quantitatively assess sage-grouse habitat characteristics across the vast variation in vegetation communities in most of Utah's sage-grouse populations. From this assessment, representative habitat guidelines have been developed to help all affected parties responsibly move sage-grouse conservation forward in our state.

LITERATURE CITED

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