

Seasonal Habitats

When planning and implementing conservation actions that benefit sage-grouse populations, it is essential to understand their seasonal movements and habitats (USFWS 2013). Generally, sage-grouse seasonal habitats have been defined using four broad categories: breeding, summer, transitional and winter.

- **Breeding habitats** consist of areas where pre-nesting, lekking, nesting and early brood-rearing activities occur.
- **Summer habitats** consist primarily of late brooding areas.
- **Winter habitats** are areas where sagebrush is available above the snow throughout the winter for food and cover.
- **Transitional habitats** are those that link or connect seasonal habitats through migration corridors.

Some individual sage-grouse are considered non-migratory, using a specific landscape to meet all their seasonal habitat requirements, while others may migrate more than 30 miles between seasonal habitats (Connelly et al. 2000b). Within populations, individuals may also exhibit unique movement strategies between seasonal habitats (Connelly et al. 2000b).

To better understand where seasonal habitats occur in Utah and how they are being used, researchers and biologists at USU, Brigham Young University (BYU) and UDWR — with help from private, local, state and federal government partners — have been collecting Very High Frequency (VHF) and Global Positioning System (GPS) telemetry-based locations from sage-grouse for more than two decades. Those records are maintained in a database of more than 500,000 sage-grouse seasonal location and habitat-use records. That database is the most comprehensive, single source for local sage-grouse population occurrences in existence, and it is fundamental to conserving populations of sage-grouse in Utah. Therefore, where site-specific data is available, this Plan emphasizes the protection and enhancement of those seasonal habitats, rather than just lek locations and coarsely defined seasonal buffers around those leks.

In general, the seasonal movements of Utah's sage-grouse populations reflect the amount of habitat available to them. Populations occupying smaller isolated habitats move shorter distances than populations occupying larger contiguous habitats (Dahlgren et al. 2016a), which are more typical of habitats in other states. The seasonal movement distances for Utah's sage-grouse populations were generally less than those reported rangewide, but were reflective of the localized and naturally non-contiguous nature of many sagebrush habitats in the southern Great Basin and Colorado Plateau. Therefore, the best-available science suggests that sage-grouse populations in Utah are limited by the amount of habitat that is available to them (i.e., "space limited").

Within each SGMA, seasonal habitats have been mapped and classified, based on current or potential sage-grouse habitat conditions (Appendix 5). If in the review of any proposal or other action, differences between seasonal habitat maps and the on-the-ground situation become apparent, the on-the-ground boundaries shall be the authoritative resource.

Mapping Seasonal Habitats and Non-habitat

In 2016, researchers at Utah State University (USU) developed a statewide sage-grouse habitat map using a database of hundreds of lek locations and more than 20,000 sage-grouse telemetry locations collected statewide from 1998 – 2014. The map depicted habitat suitability on a scale from 0 to 100 at 1 km spatial resolution, based on comparing environmental (vegetation, topography, soils, climate) and anthropogenic (developed land cover, road density, powerline density) conditions at active lek and sage-grouse use locations, versus inactive lek and random background locations statewide. Multiple telemetry locations were often associated with a single brood-rearing or non-breeding bird, so the median values of environmental and anthropogenic variables at these telemetry locations were used in the model.

A random forest model was used to create a draft sage-grouse habitat map (Breiman 2001, Cutler et al. 2007). Random forest modeling is a highly accurate non-parametric classification technique that predicts the probability of an outcome (in this case, habitat vs non-habitat) by averaging the results of many classification trees, each of which was trained on a random subset of the available data. The habitat map was reclassified into 'habitat' and 'non-habitat' classes such that habitat areas captured 99% of all sage-grouse use locations. These habitat areas were used to constrain preliminary predictions of seasonal habitats.

Sage-grouse radio-telemetry locations in the database were then classified into three seasonal habitat types based on time of year and type of use. Breeding habitat was defined as areas used by greater sage-grouse for lekking, nesting, and early brood-rearing, from March 1 – June 14. Summer habitat was defined as areas used by brood-rearing and non-breeding sage-grouse from June 15 – August 31. The June 15 cutoff date between breeding and summer use locations was selected based on the temporal distribution of nesting and brooding use locations (Fig. ?). Winter habitat was defined as areas used by non-breeding sage-grouse from November 1 – February 29. As in the habitat modeling approach, environmental conditions at annual brood-rearing or non-breeding locations associated with the same bird were measured as medians over the multiple locations.

Seasonal habitats were modeled using the same predictors as the habitat model, with the addition of distance to leks due to its association with breeding habitat. A random forest model was used to estimate the suitability of general habitat areas statewide (from step 1 above) for breeding, summer, and winter use. For each seasonal use class, a suitability threshold was selected such that 85% of all seasonal use locations were captured in the resulting seasonal habitat map. This resulted in models that were neither overly restrictive nor overly liberal. To reduce the 'salt and pepper' effect of isolated or scattered habitat pixels, a 3x3 km smoothing window was applied to each of the seasonal habitat layers, assigning the majority value (habitat or non-habitat) to the center pixel.

An overview of the general and seasonal mapping methodology and preliminary maps were presented to biologists and managers from the Utah Division of Wildlife Resources (UDWR), Bureau of Land Management (BLM) and Forest Service (USFS). Using their feedback, minor changes were made to the seasonal mapping methods to reflect local expertise and knowledge. Because the breeding seasonal use model was not picking up areas around all active leks,

distance to leks was dropped as a predictor variable from the seasonal habitat random forest model, and a 3 km buffer around all active leks was manually included in the breeding habitat model.

Updated seasonal sage-grouse habitat-use models were sent to UDWR, where they were made available for review by biologists with local area knowledge. An ArcGIS Online webpage was used to share the models with biologists, and allow for them to provide recommended additions / deletions to areas captured by the models. Accompanying the spatial data was an 8 minute webinar communicating the modelling procedure. UDWR returned updated seasonal use models with biologists' comments, additions, and deletions to USU researchers. Most but not all areas in the state received substantive feedback and comments from UDWR biologists.

USU researchers reviewed biologist edits and added/removed areas from the seasonal habitat-use models based on available telemetry data, and subsequently met with UDWR biologist about the areas in question to determine their status. Based on this meeting, it was determined that it would be preferable to have the final seasonal habitat products reflect both use and potential suitability, as opposed to only areas of known use. This decision resulted in rejecting some areas flagged for deletion by biologists, as biologist comments indicated they were conceptualizing the map as primarily a use map only.

We made a number of small edits to the seasonal use layers, including several edits to include seasonal use locations not captured by preliminary models. Finally, all single, isolated habitat pixels were removed from the habitat map. These seasonal maps will be updated in 2019 using sage-grouse location data collected from over 300 global positioning system transmitters that were deployed on sage-grouse in 2015. By 2019, over 1 million new sage-grouse locations will be available to update the existing maps.