6.0 Mapping

The SEP contracted with the USGS to serve in a lead technical role and science advisory capacity for the development of a habitat suitability index (HSI) for sage-grouse in Nevada using resource selection function (RSF) modeling. The SEP used the HSI to develop habitat and management maps to be implemented through this State Plan. The SETT assembled an Expert Review Team, comprised of local sage-grouse technical experts from the UNR, BLM, NDOW, USFWS, and HTNF to advise the SETT on technical aspects of the mapping process.

Methods

The State's process for developing spatially explicit maps for sage-grouse habitat and sage-grouse management areas was completed in four stages: 1) development of the HSI; 2) classification of the HSI into suitability categories; 3) development of a space use index; and 4) merging the habitat suitability categories and space use index to develop management categories. The methods for each of these stages are outlined below.

Habitat suitability index

Model averaged RSFs were used to develop HSIs that ranked areas of the State based on a continuum of sage-grouse selection, from highly selected for to strongly avoided. The modeling is driven by actual location data obtained using radio-telemetry information, informed by >31,000 telemetry locations from >1,500 radio-marked sage-grouse across 12 study areas within Nevada and California collected over a 15-year period, and by environmental factors including land cover composition, water resources, habitat configuration, elevation, and topography, each at multiple spatial scales that are relevant to sage-grouse movement patterns. The modeling process contrasted these environmental factors for sites used by sage-grouse (telemetry data) with available sites (randomly generated locations). Contrasting the environmental factors of used versus available sites provided information about what factors were correlated with greater sage-grouse selection or avoidance (e.g., streams, pinyon-juniper).

RSFs were applied to calculate an overall probability of use per pixel[1]. This created a single sage-grouse HSI and resulted in a surface of predicted use by sage-grouse across Nevada. This surface, the HSI, is represented by probability values that range across a continuous spectrum of 0.0 to 1.0 (Figure 4).

Habitat Suitability Categories

To identify suitable habitat, the HSI described above was classified into three categories of suitability (high, moderate, and non-habitat) using cutoff values based on the standard deviation (SD) from the mean HSI ($\bar{x}$) value. High suitability habitat was comprised of all HSI values greater than 0.5 SD below $\bar{x}$. Moderate suitability habitat was comprised of HSI values between 1.5 and 0.5 SD below $\bar{x}$. Non-suitable habitat was comprised of HSI values 1.5 SD below $\bar{x}$. This bottom cut-off point was validated by a cost-benefit ratio looking at the trade-off between additional area to telemetry points. The equalization point occurs at 1.5 SD. The resulting habitat categories were then aggregated at the 1 km scale to account for corridors and smoothed at the 1.2 km scale to remove "islands" (Figure 2).

Space use index

An index of space use was developed based on lek attendance and density coupled with probability of sage-grouse occurrence relative to distance to nearest lek. This index was then categorized in to two

[1] Pixels are the 30 x 30 meter resolution of the RSFs.

categories high use and low to no use area. High use areas consisted of areas that included up to 85 percent of the highest SUI density and low-to-no use area consisted of areas with less than 15 percent.

Management Categories

To create a management prioritization for the implementation of this State Plan, the habitat suitability classes were intersected with the space use categories as follows:

Core Management Areas – areas of suitable sage-grouse habitat use found within areas of estimated high space use;

Priority Management Areas – high suitability habitat that is found in areas of estimated low space use, and areas of non-habitat that overlap with areas of estimated high space use;

General Management Areas – moderate suitability habitat that is found in areas of estimated low space use; and

Non-habitat Management Areas – non-suitable habitat that is found in areas of estimated low space use (Figure 3).

Full methods for the development of the Nevada HSI, Habitat Suitability Map, and Management Category Map are detailed in "Spatially Explicit Modeling of Greater Sage-Grouse Habitat in Nevada and Northeastern California: A Decision Support Tool for Management" (Coates et al. 2014).

The Nevada sage-grouse habitat and management mapping process is a product of the SETT and is a collaborative group process with state and federal agency review and input and with the USGS serving as the scientific contractor on the habitat suitability model.

Map revisions

The habitat and management mapping process will be reviewed and refined every 3 to 5 years. New or improved spatial data (*e.g.*, additional sage-grouse telemetry data, updated or improved vegetation community data) will be incorporated during the refinement process. The review and refinement process will be scientifically based and included review and input from SETT, NDOW, BLM, USFS, and USFWS. It is anticipated that the habitat suitability modeling processes will be the basis for refinements, unless more rigorous methods are developed.

Literature Cited:

Coates, P.S., Casazza, M.L., Brussee, B.E., Ricca, M.A., Gustafson, K.B., Overton, C.T., Sanchez-Chopitea, E., Kroger, T., Mauch, K., Niell, L., Howe, K., Gardner, S., Espinosa, S., and Delehanty, D.J. 2014, Spatially explicit modeling of greater sage-grouse (*Centrocercus urophasianus*) habitat in Nevada and northeastern California—A decision-support tool for management: U.S. Geological Survey Open-File Report 2014-1163, 83 p., http://dx.doi.org/10.3133/ofr20141163.