White-headed Woodpecker Monitoring

Pacific Northwest Region
Rocky Mountain Research Station
USDA Forest Service

Annual Monitoring Report - FY 2012

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Introduction

The white-headed woodpecker (WHWO) is a Regional Forester's sensitive species in Region 6 (R6) of the USDA Forest Service (USFS). The WHWO has also been identified as a focal species, or indicator species, for mature dry forests based on its strong association with open, dry forest habitat, and its dependence on mature ponderosa pine. WHWO feed primarily on ponderosa pine seeds during fall and winter, and mature trees produce more abundant and reliable seed crops.

Populations of WHWO are thought to be declining in the Pacific Northwest. In a Central Oregon study, reproductive success of WHWO was too low to offset adult mortality, thus the population declined to the point that occupancy of known territories steadily decreased over the 6-year study period (Frenzel 2004). Research in the Blue Mountains in the late 1970s and early 1980s found the birds to be relatively common, whereas research conducted in the early 2000s in the same areas found no WHWO (Altman 2000, Bull 1980, Nielsen-Pincus 2005).

Mature, open, dry forests (primarily ponderosa pine) have declined more dramatically than any other forested ecosystem in the Interior Columbia Basin (Wisdom et al. 2000). The Interior Columbia Basin Ecosystem Management Project (ICBEMP) found WHWO was one of only 8 of the 97 species analyzed that showed strong declines in habitat (>60% decline from historical conditions). WHWO also use large snags (primarily ponderosa pine) for nesting and roosting, and according to ICBEMP, large snag amounts have declined across the basin compared to historic amounts (Korol et al. 2002). Currently, these forests continue to be at high risk due to drought stress on mature pine, insect outbreaks, and uncharacteristically severe wildfires. Climate change is likely to exacerbate the risk.

Most of the R6 USFS restoration treatments occur in these dry forest types. Restoration is designed to reduce stand density, open up canopies, and reduce ground fuels to more closely resemble historical, sustainable conditions. Active management treatments are necessary to reduce the risk of losing the remaining mature, dry forests to uncharacteristically severe wildlife events. However, treatments have the potential to either have beneficial or negative effects on WHWO habitat. With some treatments a potential loss of large ponderosa pine trees and snags exists, especially with the use of prescribed fire. Large pines, in particular, are critical structural components of this ecosystem and take centuries to re-create. These components are important characteristics of mature, dry forests, which provide habitat for species associated with these ecosystems. In addition, fuels treatments that reduce shrub and down wood cover may reduce populations of small mammals (Smith and Maguire 2004), which are the main nest predators of WHWO (Frenzel 2004).

The Rocky Mountain Research Station (RMRS) has developed habitat suitability index (HSI) models of WHWO nesting habitat in central and south central Oregon (Hollenbeck et al. 2011, Wightman et al. 2010). The models have now been field validated in unburned forests, but will need to be calibrated for use in other areas in Oregon and Washington. Habitat suitability maps are available for central and south central Oregon to predict likely nesting areas that can be managed for breeding WHWOs.

Methods

The Monitoring Strategy

A WHWO monitoring strategy was developed for dry forest habitats. R6 has worked closely with RMRS to develop the strategy. The regional monitoring strategy focuses on:

- Broad-scale occupancy monitoring - designed to provide reliable, standardized data on the distribution, site occupancy, and population trends for WHWO across their range in Oregon and Washington.
- Treatment effectiveness monitoring – designed to assess effectiveness of stand-level treatments on WHWO occupancy and reproductive success.
- Validation monitoring – designed to validate nesting HSI models developed by RMRS and the resulting maps of habitat suitability across WHWO range in Oregon and Washington.

The purpose of the strategy is to provide guidelines and protocols for inventory and monitoring of WHWO on FS and USDI Bureau of Land Management (BLM) lands in Oregon and Washington. The strategy is designed to ensure consistent and scientifically credible sampling, data collection, and analysis protocols used by the agencies in WHWO inventorying and monitoring activities. The strategy and protocol are designed to meet standards required under the Data Quality Act.

The monitoring strategy and the protocols were developed using peer reviewed guides and protocols (Dudley and Saab 2003, Manley et al. 2006, Vesely et al. 2006). The guides and protocols used were developed by experts in ecological principles and biostatistics. This strategy was developed in consultation with WHWO species experts, research scientists, and biostatisticians.

Data analysis is conducted in coordination with Rocky Mountain Research Station (RMRS).

Broad-Scale Occupancy and Distribution Monitoring

This protocol is designed to provide reliable, standardized data on the distribution and site occupancy for WHWO across their range in Oregon and Washington. The data can be used to better define habitat associations of WHWO at the stand and landscape scales in the 2 states. Once base data are obtained, this protocol can be used to monitor change in the distribution and occupancy of WHWO.

The protocols for the occupancy and distribution monitoring are based on Management Indicator Species (MIS) survey protocols for WHWOs developed for the Payette NF in Idaho (Wightman and Saab 2008). The basic sample design is a point count/playback response survey at 10 points along 2700-meter transects established within potential habitat for WHWO. Two surveys are conducted beginning as early as April 20 with the 2 visits completed by July 7 (Wightman et al. 2010). Surveys start just after dawn and are to be completed by 11 am.

The standards for precision for WHWO were set at the ability to detect 20% change in occupancy with a statistical confidence and power of 80%. Higher statistical confidence would reduce power to detect change. The worst-case scenario of failure to detect change could be failure to intervene which could ultimately result in species extirpation.

Based on 2010 Pilot Data, 30 transects were established across the region (Figure 1). Transects receive 2 repeat visits per year, based on detection probabilities calculated from 2010 Pilot data.

Vegetation data are collected at each WHWO survey station along transects. One third of transects are sampled for vegetation each year. Vegetation sampling protocols are modified from those used for the Birds and Burns project (Saab et al. 2006), from Bate et al. (2008a, 2008b), and Keane and Dickinson (2007). The sample design uses variable radius rectangular plots, and/or transects to sample trees, snags, down wood, and shrubs. Canopy cover, slope, aspect, and topographic position are derived from remotely-sensed data (e.g., USGS and GNN).

Treatment Effectiveness Monitoring

This protocol is designed to provide reliable, standardized data on the effectiveness of treatments to restore or enhance habitat for WHWO, and the impacts of treatments with other objectives (e.g., fuels reduction, salvage logging) on WHWO across their range in Oregon and Washington. The data can be used to better define habitat associations of WHWO, and to design treatments at the stand and landscape scales in the 2 states.

Specifically, this protocol is designed to answer the following questions:

- Do WHWOs occupy treated stands in the same proportion to untreated (control) stands?
- Is the reproductive success of WHWO in treated stands different than WHWO using untreated stands?
- What are stand and landscape attributes of areas used by successfully reproducing WHWOs versus unsuccessful sites?

Occupancy of stands by WHWO is determined using point count/playback stations along transects using the same techniques as for the broad-scale occupancy monitoring. Nests are located during systematic nest surveys conducted within 200 m (656 ft) of the transects, across treatment and control units (Dudley and Saab 2003). Nests are monitored during multiple visits until it is determined if the nest was a failure or a success. A successful nest is one where at least 1 young fledges from the cavity (i.e. a feathered nestling leaves the nest cavity on its own).

Vegetation data are collected at nest locations and non-nest random stations that are placed 250 m apart in both treatment and control units. The vegetation sampling uses the same plot design as for the occupancy monitoring described above.

A BACI (before-after/control-impact) study design is the preferred monitoring design. In this design units are sampled before and after a treatment in both treatment and control units. Monitoring of treatment and control units should continue for at least 3 years post-treatment. Pre-treatment monitoring should occur for at least 1 year prior to treatment.

A BACI approach is not always possible. In those cases a retrospective monitoring design can be implemented in which treatment and control units are monitored only after the treatment has occurred.

Validation Monitoring

Habitat suitability models have been developed for nesting WHWO in unburned and post-fire forests by the Rocky Mountain Research Station (Hollenbeck et al. 2011, Wightman et al. 2010). A leave-one-out cross validation approach was used to confirm model performance of the models, however, validation and refinement still should be done with an independent data source. In addition, the predictive ability of the models will be lower in landscapes outside of the model origin area, thus the models need to be refined for other areas outside central and southeast Oregon. New data on additional known WHWO nesting locations in both burned and unburned landscapes are needed to accomplish model refinement and validation for other areas. Validation and refinement of the unburned forest model is a priority due to the applicability to assessing and prescribing fuels reduction activities. Validation of the post-fire model is a lower priority at this time.

Specific objectives of the model validation monitoring are:

- Assess and refine applicability of current WHWO models to other landscapes across Oregon and Washington.
- Validate the model for unburned forests with known WHWO nesting locations to better understand the predictive ability of the model.
- Verify and refine the utility of using a presence-only niche modeling approach for management purposes.

Survey transects are established in study areas using the methods described for Broad-scale Distribution and Occupancy Monitoring. Nests are located by searching an area within a 400 m radius of any WHWO detection. Nest monitoring protocols are the same as for the Effectiveness Monitoring protocols. Data collected for WHWO nests through Effectiveness Monitoring protocols can also be used to calibrate and validate the habitat model for unburned forests.

Vegetation data are collected at nest locations using the same plot design as for the other types of monitoring as described above.

Results

Accomplishments prior to FY12

Broad-scale occupancy monitoring

- Development of survey protocols
- Pilot survey
- 30 survey transects identified and established across eastern Washington and Oregon (Mellen-McLean and Saab 2012)
- 1st year of 6-year monitoring strategy completed

Treatment effectiveness monitoring

- Sisters Ranger District – conducted by Ranger District employees
- Development of monitoring protocols

Validation monitoring

- Publication of 2 habitat suitability models (Wightman et al. 2010, Hollenbeck et al. 2011)
- Validation using Sisters RD nest locations – 2010
- Validation using FRE-WIN nest locations - 2011

FY12 Accomplishments

Broad-scale occupancy monitoring

Playback surveys were conducted twice on each transect. Vegetation measurement data were collected on 1/3 of transects. Data were entered into PDAs and then transferred to spreadsheets in the office.

A total of 53 WHWO were detected on 16 of the 30 transects. Seven nests were also located adjacent to transects.

Data from the FY 11 field season were entered in to the NRIS Wildlife database.

Table 1. White-headed woodpecker (WHWO) detections on survey transects from 2010 to 2012.

Year	2010	2011	2012
WHWO detected	31	36	53
Total points surveyed *	333	600	600

* Each point was visited 3 times in 2010 and 2 times in 2011 and 2012; numbers reflect number of individual surveys.

RMRS analyzed the data by fitting both transect-scale and multi-scale (transect and point scales) occupancy models to 2011 data from the 30 transects established for regional monitoring. Both models estimated similar transect-scale occupancy rates but multi-scale models also estimated point-scale occupancy rates (conditional upon transect occupancy) providing additional fine-scale information. Detection probabilities at the transect scale appear adequate for valid occupancy estimates, and a simulation-based power analysis confirmed that sampling according to the current protocol for 6 years would be adequate to detect a 20%-yearly decline in occupancy as stated in the standards for precision. Detection probabilities at the point-scale, however, were quite low, raising a strong potential for biased and imprecise occupancy estimates. Future simulation study will be aimed at elucidating the relative value of transect-scale versus multi-scale occupancy models for informing inference about occupancy trends.

A preliminary analysis of the vegetation data collected to from 2010-2012 was conducted. The analysis used descriptive statistics and t-tests to compare tree and snag densities between occupied points (n=66) and unoccupied points (n=231). A more rigorous and detailed analysis will be completed by RMRS after vegetation data is collected on the remaining transects during the 2013 field season.

Preliminary analysis indicates that mean density of smaller trees (25-50 cm (10-20 in) dbh) is less at occupied points (38.3/acre) than unoccupied points (50.1/acre) (P=0.005), and mean density of large trees (≥50 cm (20 in) dbh) is higher at occupied points (10.1/acre) than unoccupied points (8.6/acre) (P=0.08). These findings are consistent with previous findings on WHWO habitat use. Density of smaller snags (25-50 cm (10-20 in) dbh) is less at occupied points (2.5/acre) than unoccupied points (3.1/acre) (P=0.09). Densities of larger snags (≥ 50 cm (20 in) dbh) were not significantly different between occupied points (1.1/acre) and unoccupied points (0.95/acre) (P=0.26).

In addition to the Regional transects, some forests and districts conducted surveys using the protocols.

Blue Mountains Ranger District, Malheur NF – Surveys were conducted using a standardized protocol during the breeding season. Results are displayed below in Table 2.

Table 2. White-headed woodpecker monitoring on the Blue Mountains Ranger District, Malheur NF.

Year	2010	2011	2012
WHWO detected	7	12	6
Total survey points	60	36	36

Treatment effectiveness monitoring

Okanogan-Wenatchee NF - A modified regional protocol was implemented on Naches, Entiat and Cle Elum Ranger Districts to gather "pre-treatment" data for the Forest Restoration Strategy implementation. On Naches, 40 sites were surveyed in the Nelli Project Area for a total of 800 acres. On Entiat, 13 sites were surveyed in the Dinkleman Project area for a total of 189.8 acres. On Cle Elum, 24 sites were surveyed in the Swauk-Pine Project area for a total of 419.2 acres. Three WHWO detections were recorded on the Naches RD; no WHWO were detected during the surveys. The sightings on Naches RD were of a known pair which Teresa Lorenz and Jeff Kozma monitored and documented as nesting during the 2012 season of their research project.

In addition, effectiveness monitoring was conducted within the Weiser-little Salmon Headwaters Collaborative Forest Landscape Restoration Project (CFLRP) using the same protocols in adjacent Region 4, Payette National Forest, Idaho. RMRS, R6, and R4 are leading the effort to provide consistency in monitoring the effectiveness of CFLRP treatments at reducing fuels and restoring dry conifer forest habitats of the Interior Northwest. Monitoring is a key component of the CFLR program and our work is designed to address how well CFLRPs are meeting their forest restoration and wildlife habitat conservation goals. Monitoring in CFLRPs contributes to the regional efforts to monitor effectiveness of silvicultural and prescribed fire treatments for white-headed woodpeckers throughout their range in Idaho, Oregon and Washington. Vegetation and fuels data collection also support modeling of fire-climate impacts on future forest conditions and wildlife habitat suitability.

Validation monitoring

Habitat Suitability Index (HSI) Models for white-headed woodpecker nesting habitat developed previously by Hollenbeck et al. (2011) were refined by Latif et al. (2012) using validation data collected in 2010 and 2011. The updated models were developed using both a partitioned Mahalanobis model (Rotenberry et al. 2006) and a Maxent model (Phillips et al. 2006). Both modeling techniques generated HSIs describing the relative suitability of each 30 x 30-m pixel on a 0−1 scale (HSIs = 0 indicate minimal suitability; HSIs = 1 indicate maximum suitability). On a broad scale there was substantial agreement between the models on areas of suitable nesting habitat (Figures 2 and 3). At finer scales, however, disagreement between the two models exists. Differences in model agreement should be considered when the HSI maps are used to guide management decisions. Maxent HSIs were more correlated with occupancy rates across the region (Latif et al. manuscript in review). Areas considered suitable by both models are considered robust and a more certain estimate of nesting habitat suitability. See Latif et al. (2012) for details.

The Rocky Mountain Research Station provided a geodatabase with spatially explicit HSI values and nest locations within Deschutes and Fremont-Winema forest boundaries. Advice on translation of HSI values (i.e., relative indices of suitability) into more easily interpretable suitability classes was also provided.

Results presented at the National Wildlife Society Meetings in Portland, OR in October.

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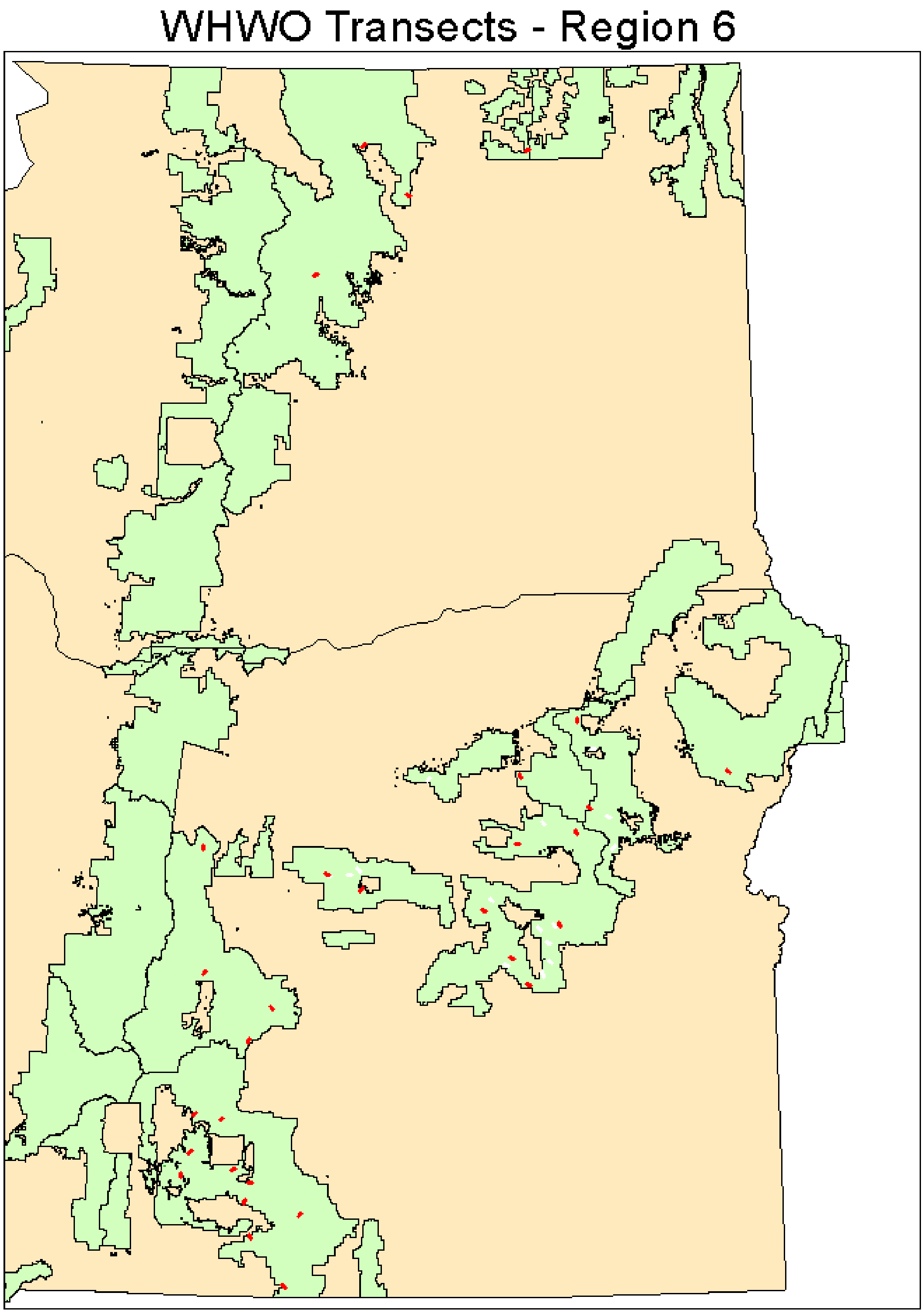

Figure 1. The 30 FY11 WHWO transects are shown here in eastern Oregon and Washington as red dots. The National Forests are the green polygons.

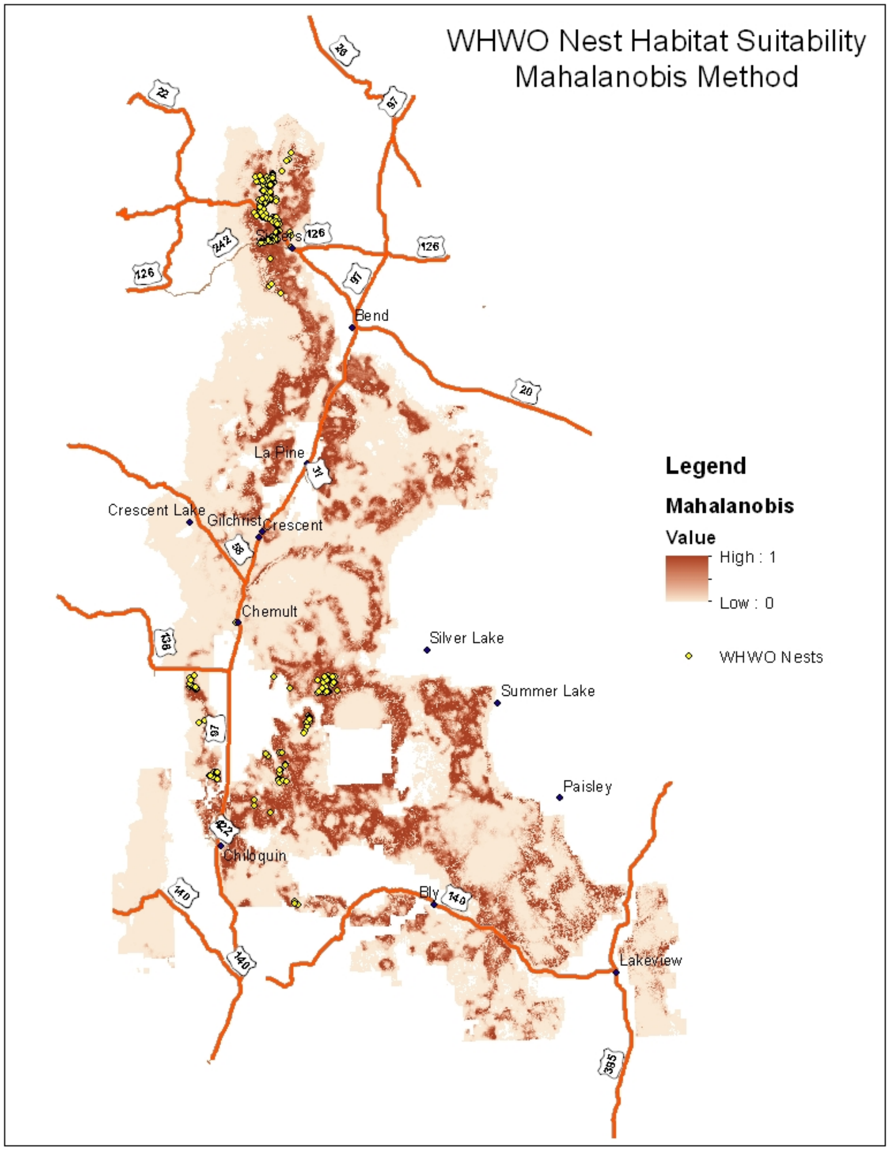

Figure 2. HSI model using Mahalanobis method.

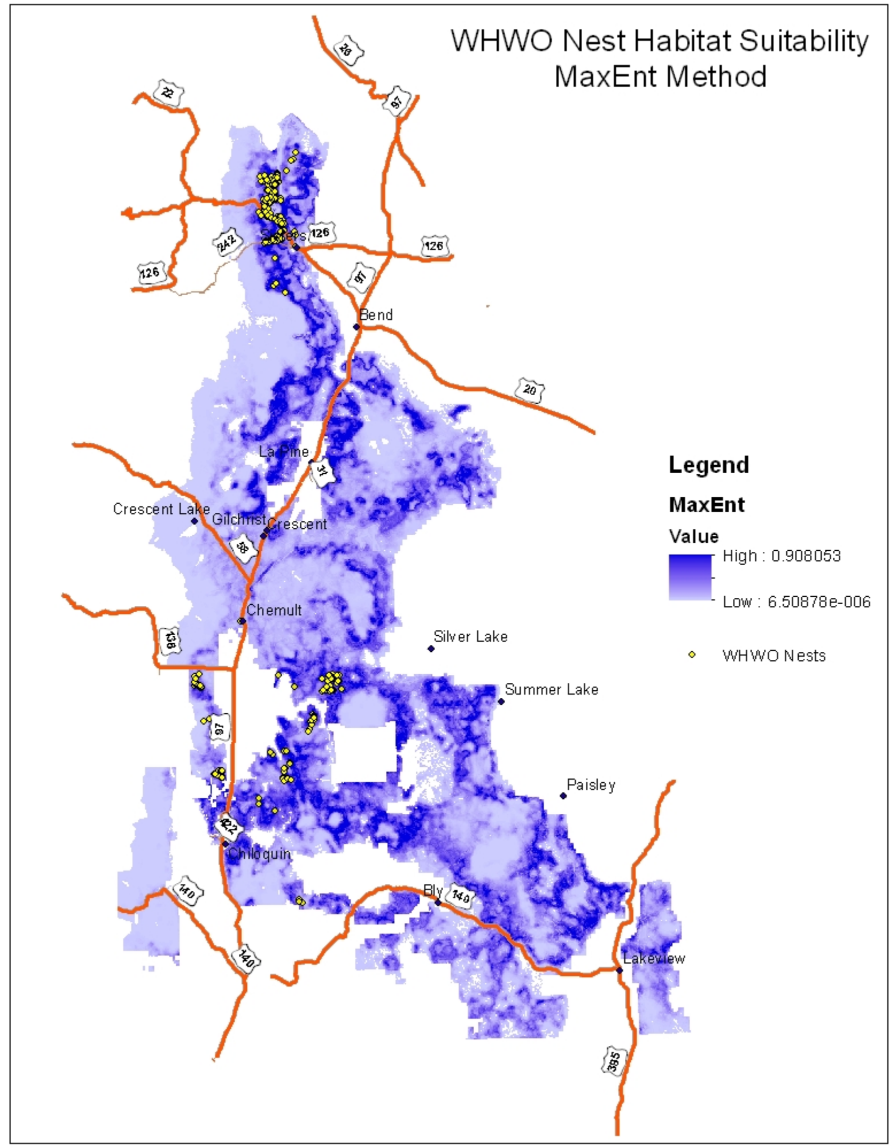

Figure 3. HSI model using MaxEnt method.