

Modelling Northern Spotted Owl Habitat And Its Implications for Conservation

Angus Beaty and Rachel Shindman

Project Background

The Northern Spotted Owl (*Strix occidentalis caurina*) (Figure 1) is threatened by the destruction and fragmentation of primary forest in the Pacific Northwest. This study models suitable habitat for the Northern Spotted Owl, with the aim of assisting and enhancing preservation. The study also compares suitable habitats with current distribution of the Barred Owl (*S. varia*) which, as an invasive species, has generally displaced the Northern Spotted Owl. The purpose of this is to (a) to highlight suitable habitat locations for current conservation, and (b) if possible, speculate as to where Owl populations may be successfully (re)introduced. These measures will be used to make recommendations for further conservation.

This study is focused on Washington State (Figure 2), where the Northern Spotted Owl is most populous. The Cascade Mountain belt and the forests in the western half of the state are the most habitable areas for the Northern Spotted Owl, although some inhabit the eastern slopes of the Cascade Range. Since the year round climate is fairly mild in comparison to most other regions at this latitude, widespread movement of the species is possible throughout the area.

Washington is uncharacteristically undeveloped for a U.S. state, with large regions of protected and/or managed forests. These regions experience very high precipitation levels – up to 5000mm annually, and along with mild temperatures provide the conditions to sustain temperate rainforests, where the Spotted Owl thrives. This study attempts to incorporate much of the geographical variability described here in order to create the most accurate suitability model.



Figure 1: Northern Spotted Owl

Data

Habitat suitability factors were used as inputs for this model. Data was acquired from the United States Geological Survey (USGS), the Washington State GIS database, and the Environmental Systems Research Institute (ESRI) GIS database. Data were scaled at 1:1,000,000 and those not from Washington State covered all of North America and were clipped to the Washington State boundary.

The following data was used:

- Built-up areas
- Elevation
- Temperature (mean March-May)
- Precipitation (mean annual)
- Land Cover
- Hydrology (distance to rivers)
- Roads
- Eco-regions (biomes)
- Population distribution of Northern Spotted Owl and Barred Owl



Figure 2: Study Area (Washington State)

Methods

A weighted suitability model was used in this study; layers were classified into levels of suitability from one to nine, based on typical habitat conditions. Each layer was then given a weight to signify its comparative importance. The layers were added together according to their weight to generate a final suitability surface for the region.

Assumptions

Several assumptions were made in order to build a generalized model for the entire state. The majority of research on environmental conditions favoured by Northern Spotted Owls was from a British Columbia based source; there may be some differences in preferences between B.C. and Washington, but these are assumed to be negligible.

Climate data, including temperature and precipitation information, is from the late 1990s; this does not take into account changes that have occurred since it was collected. Temperature and precipitation variations since then due to climate change may affect forest growth and species distributions, but were not taken into account.

Preprocessing

Several steps were required to transform the data before it was used in the model. All of the vector and raster data covering North America was clipped to the outline of the State of Washington. The bird data was a coverage file in NAD 27 projection, and required reprojection. The landcover data was not labelled, and so Google Earth was used to identify specific landcover types across the region.

Most of the pre-processing in this study involved the reclassification of layers from initial data to suitability levels; this was carried out for each of the eight layers included in the model. Reasons for individual reclassifications were based on literature on ideal Northern Spotted Owl habitat characteristics.

Model

Once each of the layers had been appropriately reclassified to a scale of 1-9, they were entered into the raster calculator based on their weights. The formula to generate the final map was as follows:

$$\text{Habitat Suitability} = 0.275 * \text{Biome} + 0.175 * \text{Land Cover} + 0.125 * \text{Elevation} + 0.1 * \text{Light at Night} + 0.1 * \text{Temperature} + 0.1 * \text{Precipitation} + 0.1 * \text{Proximity to Roads} + 0.025 * \text{Proximity to Streams}$$

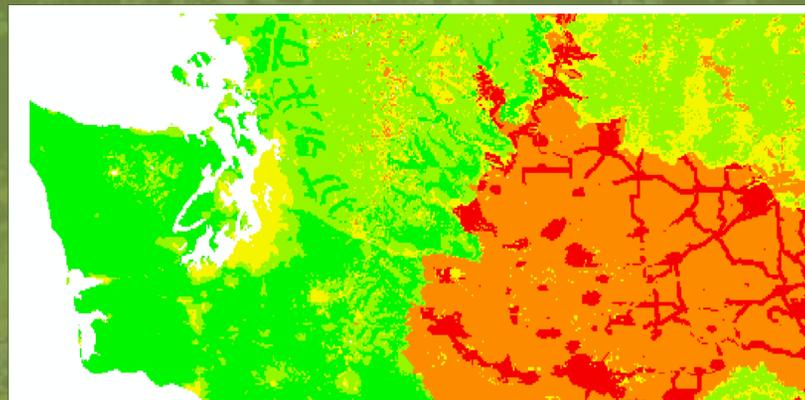


Figure 3: Habitat Suitability Map (Green = high, Red = low)

Results

A large proportion of the state of Washington is suitable habitat for the Northern Spotted Owl (Figure 3). Because the heaviest weight in the model was given to biomes/eco-regions, the suitability map closely follows the extent of forest cover; essentially all forested areas in the model are 'suitable' unless another factor lowers the suitability. The high suitability in the northeast sector of the state is somewhat surprising, given its drier and colder climate. This is likely due to the high weighting of eco-region and forest cover.

While no calculated model validation was performed, current Northern Spotted Owl population data was overlaid on the final suitability map to visually assess model accuracy (Figure 4). The majority of Owls live in areas deemed highly suitable.

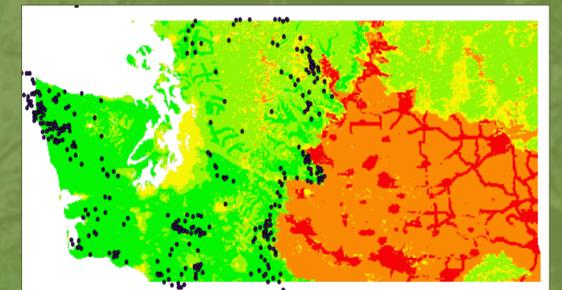


Figure 4: Habitat Suitability With Current Northern Spotted Owl Population Distribution

Discussion

Overall, this model was fairly successful in identifying suitable habitats for the Northern Spotted Owl. Unfortunately, much of this habitat is also inhabited by the Barred Owl (Figure 5). The Barred Owl is a generalist species, inhabiting nearly all forested areas in Washington State. The conservation of suitable areas that have not yet been invaded is crucial for the Northern Spotted Owl's survival. These areas should be given high priority for conservation, especially where old growth forest remnants exist. Conservation authorities must keep these habitats free of both logging activities and invasion by competitor species; hopefully, then the Northern Spotted Owl can eventually be taken off the endangered species list indefinitely.

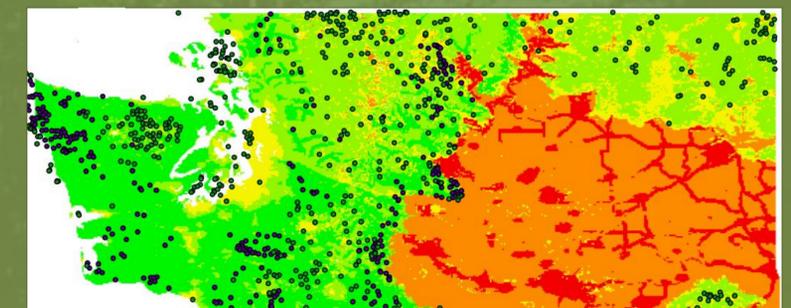


Figure 5: Habitat Suitability with Northern Spotted Owl (Purple) and Barred Owl (Green) Population Distribution

Limitations

Aside from the previous assumptions made, there are some limitations to this study. One is the lack of tree inventory data. Tree diameter and tree species type are both important in considering an adequate habitat for the Northern Spotted Owl, but unfortunately, appropriate data covering the entire study area was unavailable. Additionally, data for the chronological invasion of Barred Owls into the state of Washington was unavailable. This would have shown where the invasive species has and has not overtaken the Northern Spotted Owl. This was instead estimated from the population data.