American Goldfinch Breeding Habits on the Western Coast of the United States

ESS 420

Author: John-Martin Devera

Group Members: John-Martin Devera, James Eng, Harrison Tong

June 2, 2017

Introduction **3**

Methods **4**

A. Sources of Data 4

B. Study Sites 6

B.1 Oregon 7

C.2 Washington 9

.C.3 California 9

Results and Discussion **10**

Conclusion **11**

Figures **12**

Works Cited **18**

Introduction

The American Goldfinch (Spinus Tristis) is an abounding small migratory bird that resides over most of the United States. A distinctive trait of this bird is its sexual dimorphism. Males of this species are olive colored that transforms into a brilliant yellow color during the summer. Females are dull yellow-brown that brightens slightly during the summer.

Our goal was to use geographic information systems (GIS) to identify and analyze the breeding ground habits of this species for Washington, Oregon, and California. To identify breeding ground habits, we identified a list of requirements to meet. We list typical nest qualities such as the species of vegetation nested on, proximity to streams, and proximity to roads. Using this criteria we will then generate maps of the American Goldfinch's breeding grounds, and discuss interesting qualities and implications.

This are numerous benefits for this analysis to be done. Understanding where this native species can breed can help our understanding of how our local ecosystems function. Since this species is known to defend their nest with rallying cries (Knight & Temple, 1986), urban planners can use this data to avoid building in potentially noisy areas. Additionally, preserving the breeding habitat of the American Goldfinch will help keep this unique species under the "Least Concern" category of extinction risk as defined by the International Union for Conservation of Nature (IUCN). These highlight just a few reasons of why this analysis is beneficial.

Methods

A. Sources of Data

Basemap and USA State Boundaries - ESRI

Vector Data containing state borders and various census information such as population, age, and race. This data is appropriate for referencing the state boundaries of Oregon. URL:https://services.arcgis.com/P3ePLMYs2RVChkJx/arcgis/rest/services/USA_States_Generalized/FeatureServer

MAPPS Vegetation Classes for Oregon and Washington, USA - Data Basin

This data is appropriate for locating the appropriate habitat of the American Goldfinch in Oregon. Originally this was a floating point raster where classes were stored as integers in float form such as 102.000, 108.000, 112.000, etc. I converted this into an integer raster using the Raster Calculator Tool in order to use the attribute table feature on this set. URL: https://databasin.org/datasets/ae51babad0074f69a55ddd8674ea11f3

American Goldfinch Range Map - NatureServe.org

Data from NatureServe, distributed by USGS. Integer raster dataset containing observed breeding, non-breeding, and permanent resides birds which describes range of the American Goldfinch. A breeding resident describes a bird that has flown northward in the summer to breed, a non-breeding resident describes a bird that has flown southward for the winter, and a permanent resident describes a bird that has stayed in the area during the summer and winter. Overall, the whole dataset describes a slight northward migration trend into Canada in the

summer for breeding and a slight southward migration trend in the winter. This is typical and expected of a short distance migratory bird. URL: https://gapanalysis.usgs.gov/species/data/download

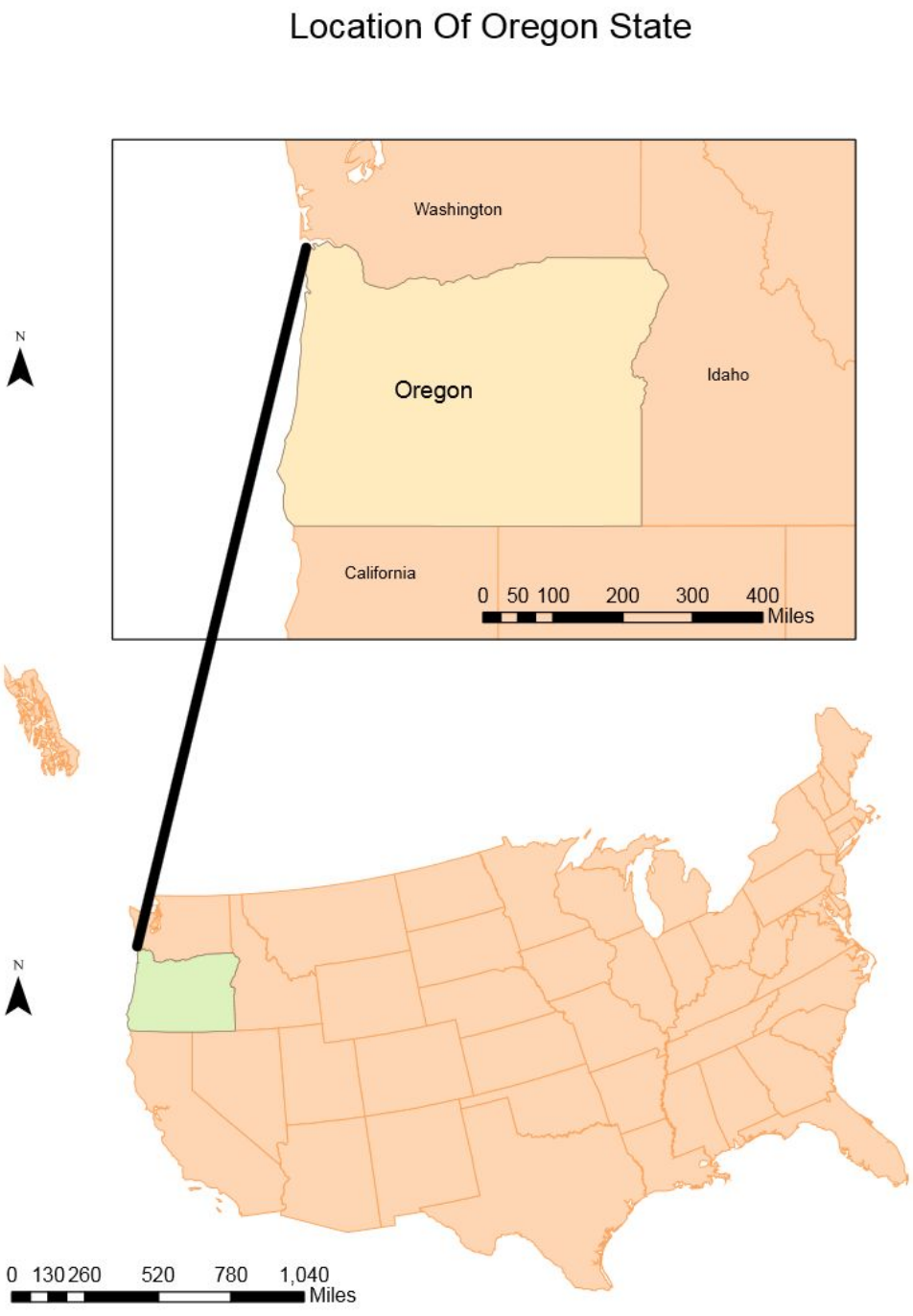
Oregon State Highways - ODOT

Highway data from the Oregon Department of Transportation in the form of vector lines. This data is useful for testing if roadsides make for attractive breeding grounds for the American Goldfinch. Found by searching “Oregon State Highways” on ArcGIS Online, owned by becca.bourson_ODOT.

Oregon Streams - ODFW

Major and detailed rivers of Oregon data in vector form. This data is appropriate for testing if riparian environments attract the American Goldfinch to nest. Found on ArcGIS Online, owned by Arthur.Rodriguez_ODFW.

B.



Study Sites

Figure 1. Locator map. We examined Goldfinch habitats in 3 different states on the United States Western Coast: Washington, Oregon, and California. In particular I studied Oregon.

B.1 Oregon

From our research, we've come up with breeding ground requirements for the American Goldfinch. They nest usually in deciduous shrubs or trees, sometimes in conifers or in dense weeds, especially areas of second growth, streams sides, roadsides, woodland edges, orchards, suburban areas. (Kauffman, 2017). They feed mostly on seeds and thistle (Seattle Audobon Society, n.d), and additionally thistle can be used as nesting material. At first, we thought that thistle would be important to the breeding behaviors of the American Goldfinch because of the aforementioned reasons. However further research reveals that since thistles are found in every county in Oregon (Oregon State University, 2006), food and building materials are not a concern.

We thus will focus on the following characteristics:

- Deciduous Vegetation
- Stream sides
- Roadsides

First I determined the appropriate breeding grounds area in the State of Oregon. From the USA_States_Generalized data, I selected Oregon and created a mask. Using this mask I used spatial analyst to extract the American Goldfinch Range data (NatureServe, 2013) for just Oregon State. I then reclassified it into a boolean raster of whether the bird was observed breeding or nonbreeding in a given cell, where 1 represents breeding. Permanent Residents and

breeding residents were considered breeding habitats, while nonbreeding residents were reclassified as NoData since we are not interested in that population.

At this point the boolean raster shows clear north-south band of non-breeding near the the western part of the state, while the rest of the state is has observed permanent resident or breeding resident birds. This is a significant feature I want to capture. I drew an approximate polygon that outlines the general shape that the American Goldfinch is not observed breeding in.

From the non-resampled boolean raster, we can see the observe the following statistics. 96,407,908 cells are summer/year-long habitats for the American Goldfinch. For a cell resolution of 30m x 30m, this translates into about 86,767 km^2 of habitat. Compared to Oregon's total area (251,425 km^2), about 34% is preferable for breeding. We will compare this data to the proximity of streams.

First, I compared this habitat raster data to the vegetation. To see what vegetation the breeding species inhabited, I multiplied the two boolean rasters together. The resulting raster has "Tree Savanna Evergreen Needle" at the most area of 23,929 cells, followed by Shrub Savanna Evergreen Micro at 19,449 cells, "Forest Mixed Warm" at 9,523 cells, and "Forest Evergreen Needle Continental" in fourth with 8,152 cells.

The next part of my analysis was relationships to streams. Overlaying the major stream data, it was easy to see a correlation between breeding habitats and streams. In order to see how much streamside area and breeding grounds overlapped, first I converted the stream to a raster dataset. Then I reclassified it into a boolean raster such that 1 indicates the presence of a stream. Since Goldfinch's can't build their nest in water, it makes sense to exclude the streams and include the neighboring cells. To isolate nearby cells, I run the Euclidean distance function on

the Stream, and reclassify it into a boolean raster so that 1 corresponds to up to 1km away from the stream, and 0 indicates everything else. By multiplying this boolean raster with the habitat boolean raster, we can find out how much breeding ground area coincides with streams. 6429 cells were shared by the two rasters at 6386 ft x 6386ft resolution, or about 9,141mi^2,(23,675 km^2).

Finally, I analyzed the relationship between highways and breeding area preferences. Visually, there seemed to be some correlation between the proximity of the highways. To get a more quantitative answer, I use a similar approach as before, creating a 5 km buffer from the highways layer. I then convert this to a raster and multiply it against the habitat boolean to see how many cells are shared. At 6386 ft x 6386 ft and 9291 cells the shared area comes to 13,591mi^2 or 35,201 km^2.

C.2 Washington

James Eng analyzed the state of Washington for optimal breeding grounds. He sought to find the optimum habitats via his own research and queries. He determined that areas away roads and human population were detrimental factors and did a series of buffers and intersects with a vegetation layer to find optimal breeding sites. From his analyses he determined that there were 25 sites in Washington totaling 120,462 km^2 of optimal breeding habitat.

.C.3 California

Harrison Tong analyzed the American Goldfinch's breeding habitat in California. He examined the factors of agriculture and elevation. He overlays elevation, human impact, and

environmental data to visually determine relationships. He found that Agriculture and Elevation are two possibly significant factors in the Goldfinch's breeding habits.

Results and Discussion

First, I determined the breeding habitat of the American Goldfinch using data from NatureServe (N.D). This provided critical knowledge about areas where the American Goldfinch has been breeding. Interesting to note is the large schism near the western-central part of Oregon, (See Figure 2) which may give us clues as to what they find as unfavorable factors. From this dataset, we can compare to other variables to see possible correlations that indicate a nesting preference.

Second, I analyzed the vegetation that the American Goldfinch tended to breed on. Surprisingly, despite literature saying these birds live in deciduous trees (Kauffman, 2017), my analysis has shown that they greatly prefer coniferous and evergreen trees. As can be seen in Figure 3, none of the vegetation types correspond to being deciduous. The dataset did have deciduous categories, but after boolean raster manipulations with their observed breeding grounds, none ended up as being a place where they have been observed to breed in Oregon. This may warrant further investigation and verification.

Third, I analyzed the relationship of breeding grounds to streams. Figure 4 shows that near the center of Oregon where land is farthest from water, there is a clear drop in breeding habitat density. This is about 27% of the total breeding habitat area in Oregon, which is a significant chunk. This confirms Kauffman's assertion that stream sides are preferable to American Goldfinch's. Additionally, it is important to note that on the west coast of Oregon,

there is plenty of water, but a drop in breeding habitat density, so water alone does not make breeding grounds highly preferable.

Finally, I analyzed how major highways could be related to the breeding ground habits of Goldfinch's, as shown in Figures 5 and 6. This was due to Kauffman (2017) writing that "roadsides" were one of the especially preferable places for these birds to breed near. Due to limited processing power, I used highways with a 5 km buffer as a proxy for detailed roads. This turns out to be over 40% of the total observed breeding habitat area, which is extremely significant and again confirms one of Kaufman's assertions about this avian.

James has shown that there are 25 sites in Washington totaling 120,462 km shown in Figure 7. Through further testing and review, James model has the potential to predict more specific location.

Harrison had shown that human impact has had an impact on this species' habitat. He presents an overlay of human impact on top of the American Goldfinch's observed habitat as shown in Figure 8.

Conclusion

Here we have gone over numerous analyses to determine the most impactful breeding ground conditions of the American Goldfinch on the west coast. From my analyses, conifer and evergreen vegetation, streams, and roads are huge factors that influence Goldfinches to decide to nest. From James' and Harrison's analysis, human impact and population may also be high

influencers. The American Goldfinch is one of this nation's most unique native species and by analyzing it, we further our understanding of our ecosystem.

Figures

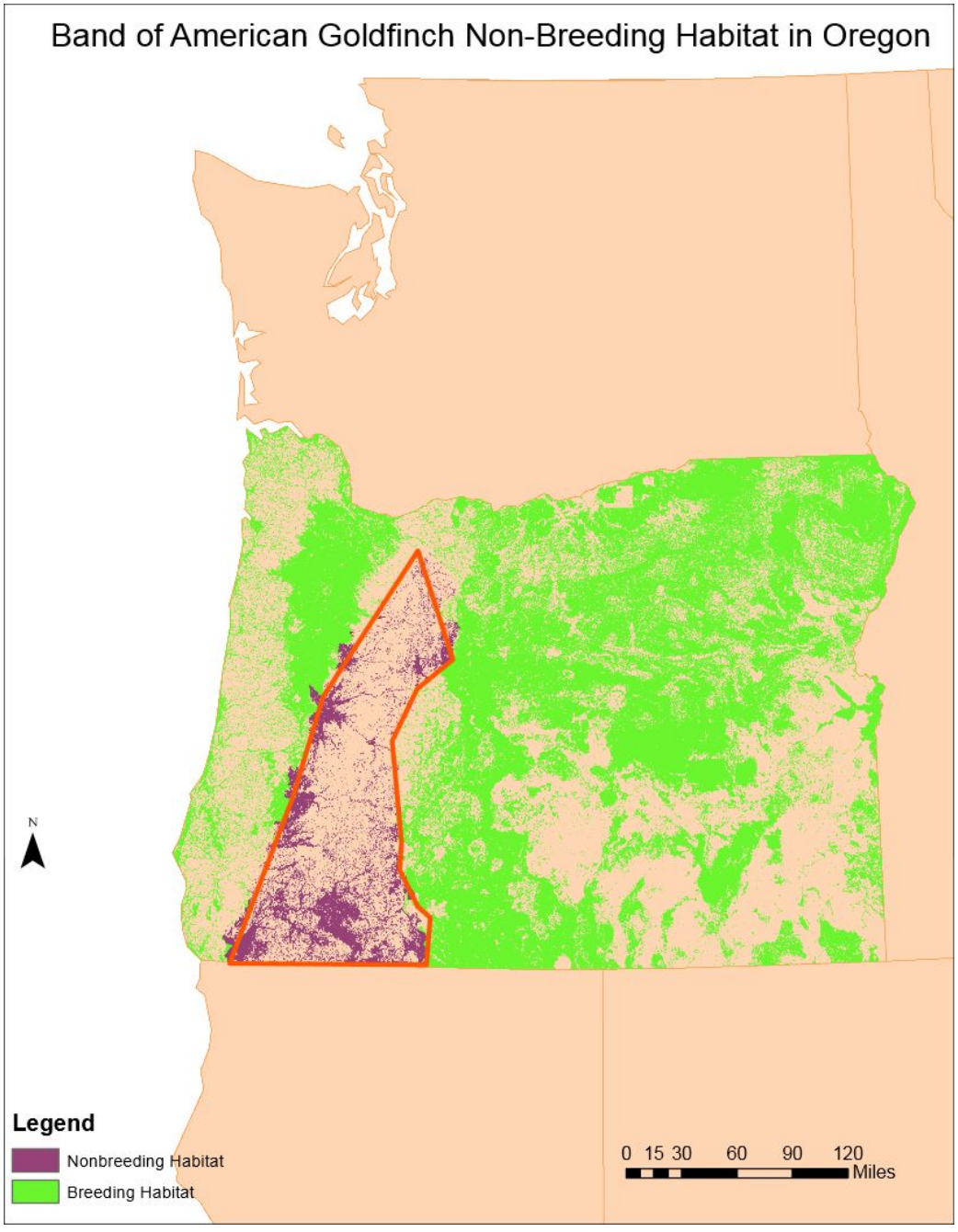


Figure 2. Breeding Habitat. There is a noticeable schism of nonbreeding habitat near the left coast of Oregon.

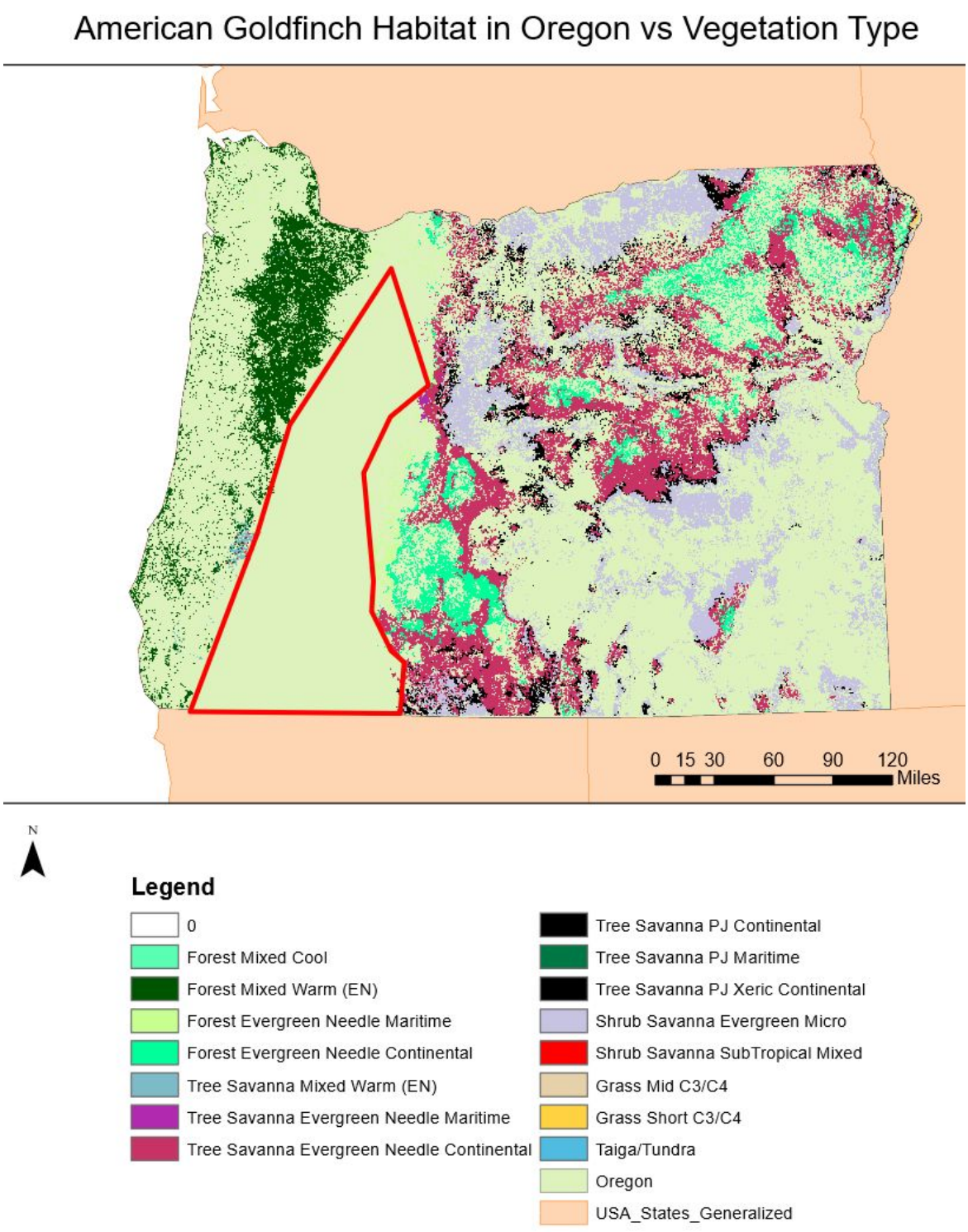


Figure 3. Goldfinch Habitat vs. Vegetation Type. Notice how there is no deciduous vegetation chosen as breeding habitat.

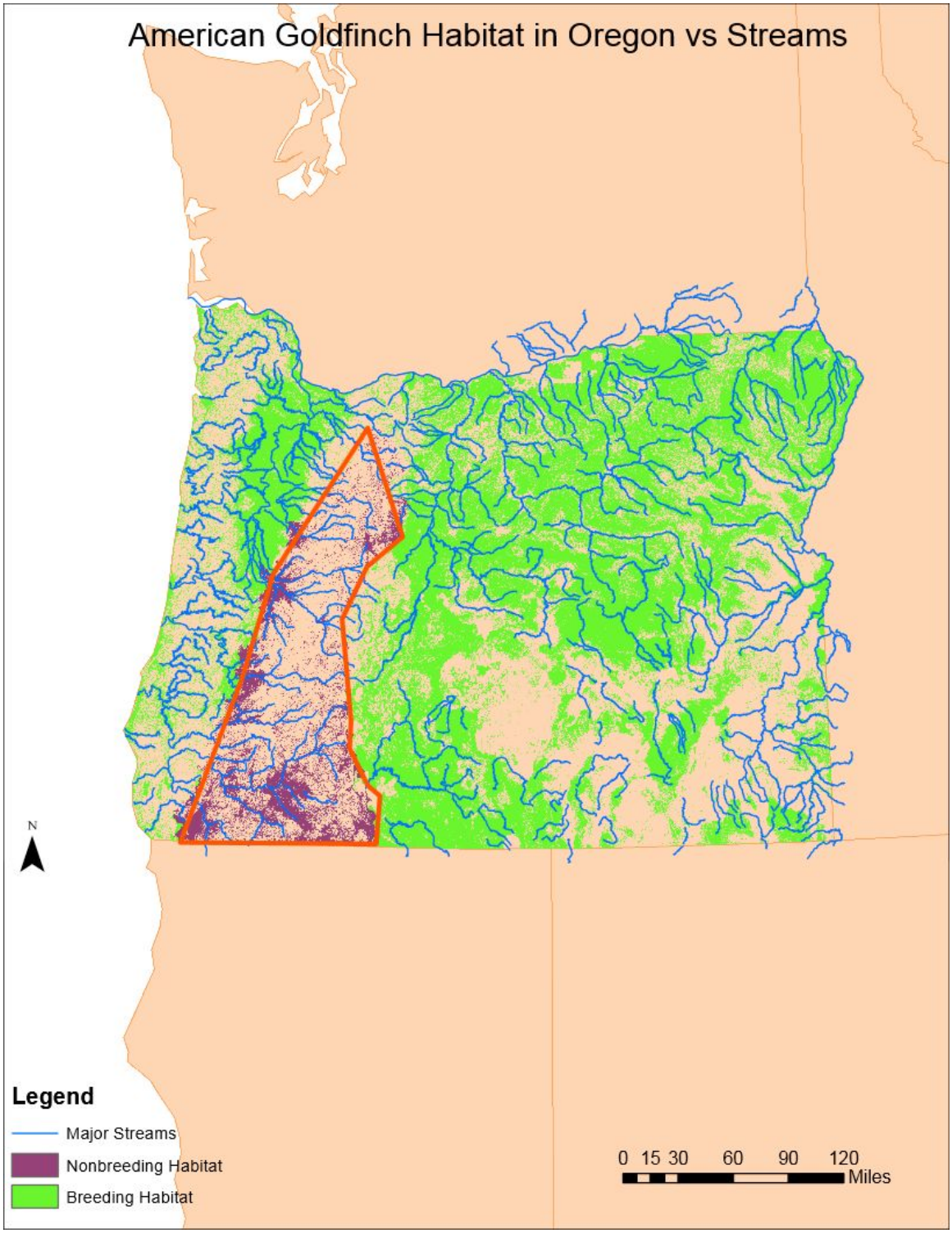


Figure 4. Goldfinch Breeding Habitat vs. Streams. On the Eastern half water seems to play a bigger role in breeding habitat density than the left.

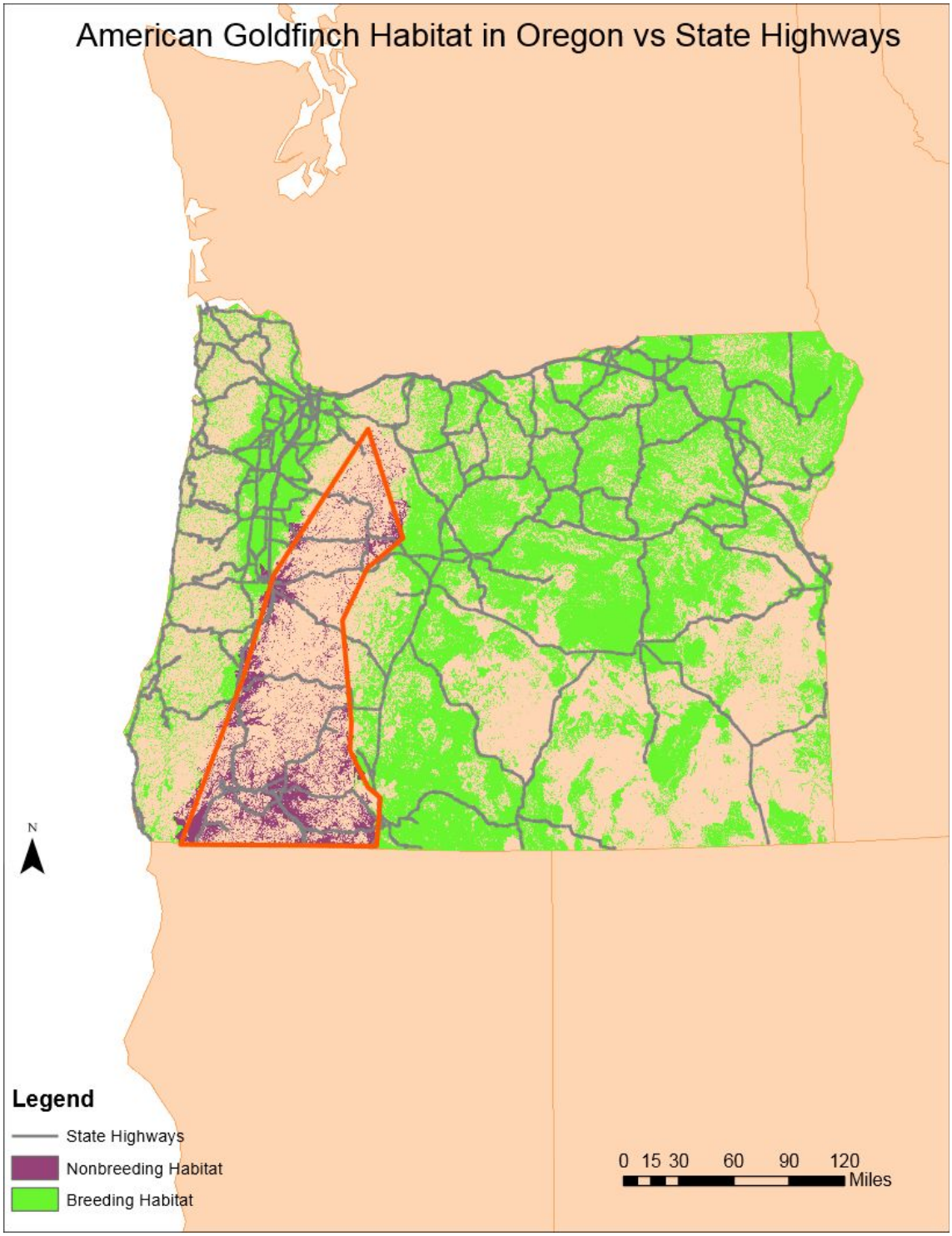


Figure 5. Breeding Habitat vs. Highways. In the northwestern part of Oregon, there is a high breeding habitat density that looks to be strongly correlated with the highway density

Figure 6. These breeding areas within 5km of a highway represent 40% of the total observed breeding area of Oregon.

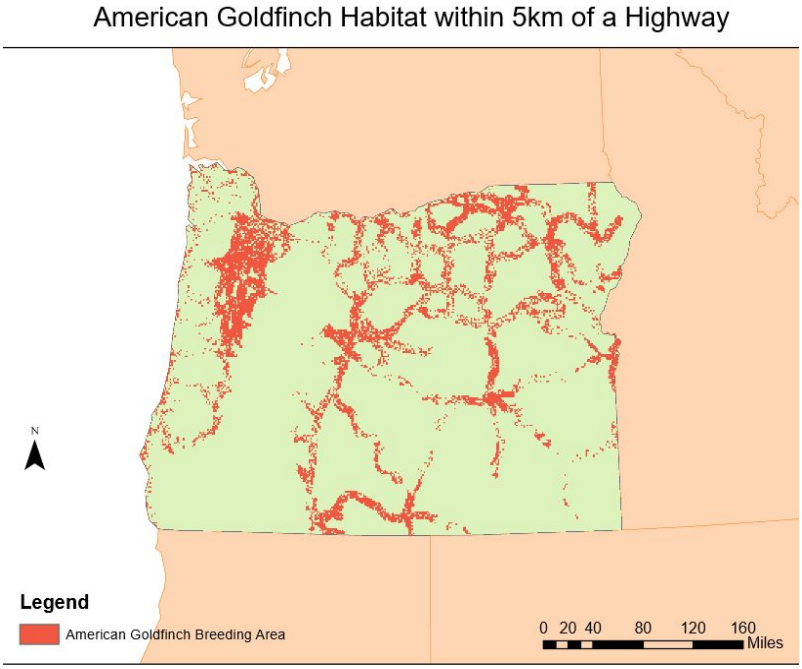
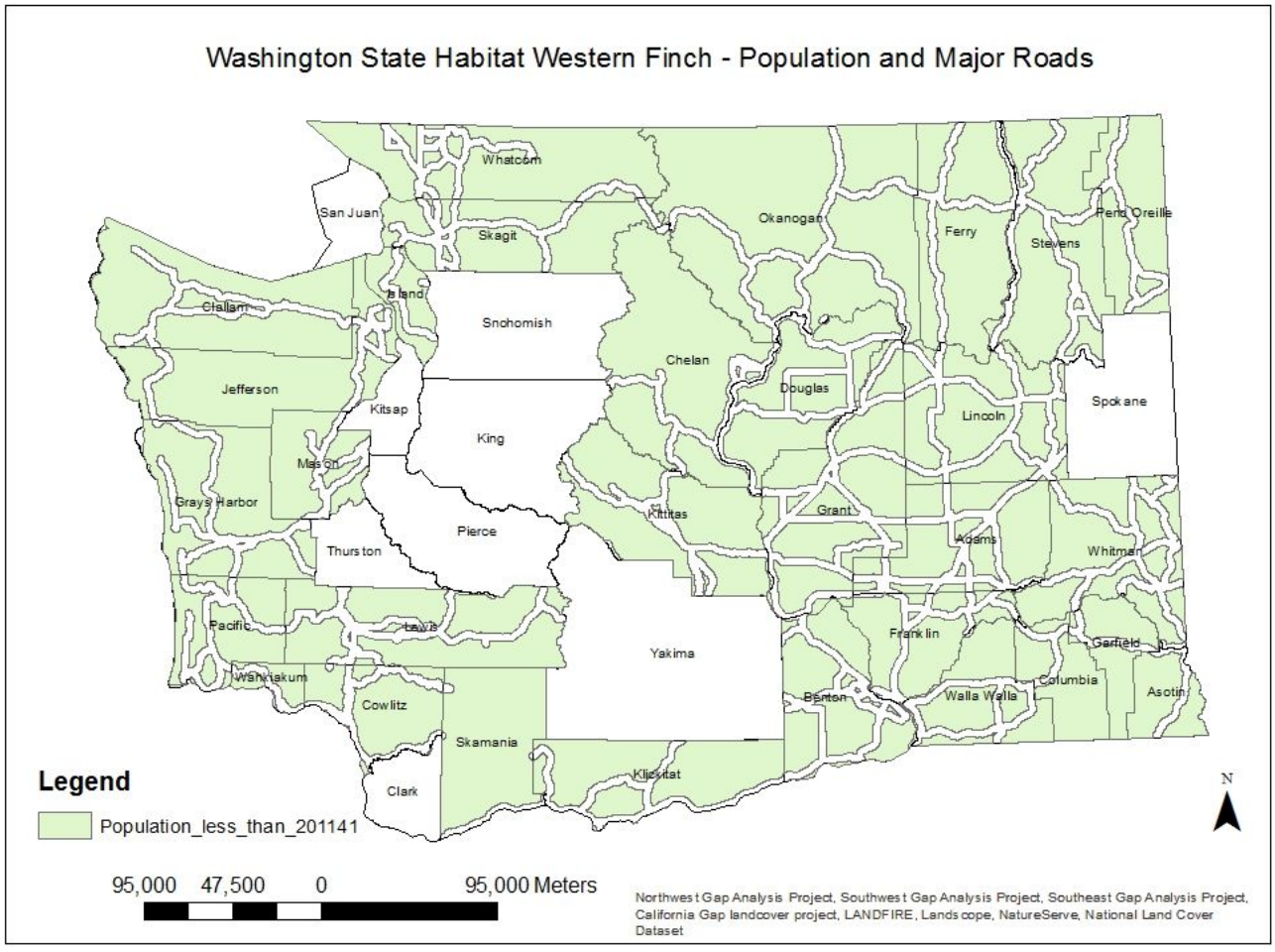


Figure 7. Analysis of population and major roads in Washington in search for suitable breeding habitat.



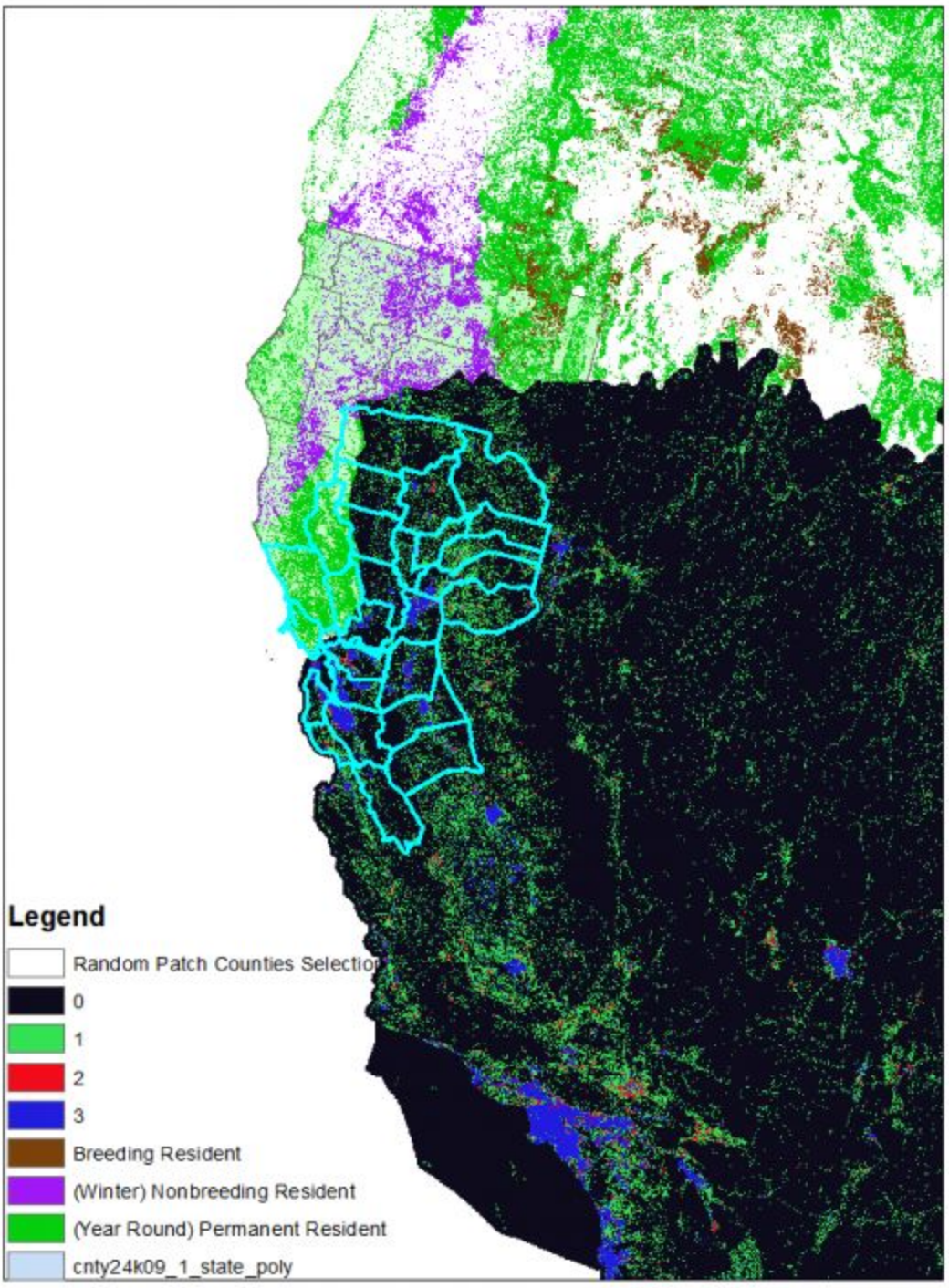


Figure 8. Harrison's overlay of human impact (0 low- 3 high) vs. American Goldfinch's breeding areas.

Works Cited

Coutlee, Ellen L. “Agonistic Behavior in the American Goldfinch.” *The Wilson Bulletin*, vol. 79, no. 1, 1967, pp. 89–109. *JSTOR*, www.jstor.org/stable/4159565.

Kaufman, Kenn. "American Goldfinch." Audubon. N.p., 01 Mar. 2016. Web. 03 June 2017.

Knight, Richard L., and Stanley A. Temple. "Nest Defence in the American Goldfinch." Animal Behaviour 34.3 (1986): 887-97. Web.

Terres, John K. The Audubon Society Encyclopedia of North American Birds. New York: Knopf, 1980. Print.

Seattle Audubon Society. "American Goldfinch." BirdWeb. n.d. Web. 03 June 2017.

Oregon State University. Problem Thistles of Oregon. Corvallis, OR: Oregon State U, 2006. OSU Libraries. Oregon State University. Web. 3 June 2017.