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## Identifying Suitable Canada Lynx Habitat in the Northeast

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# Identifying Suitable Canada lynx (*Lynx canadensis*) Habitat in Maine, New Hampshire, and Vermont

Carla Nyquist ‘16, Emily Berry ‘16

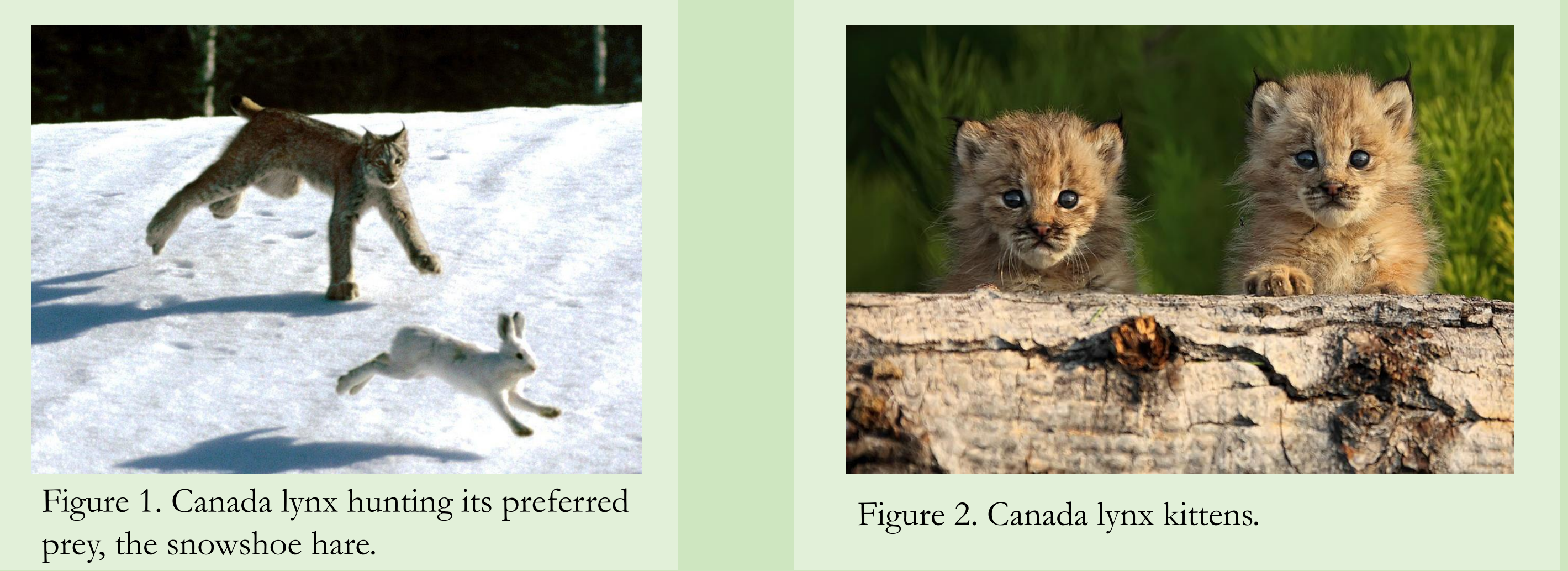
Colby College Environmental Studies Program, Waterville, ME

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## Introduction

The Canada lynx (*Lynx canadensis*) is a medium-sized predatory cat inhabiting the boreal and montane forests of North America, particularly in Canada. Its range extends slightly into the subalpine forests of the western United States as well as transitional forests in the eastern United States (Vashon et al. 2008a). Canada lynx in the United States were listed as a federally threatened species in the states at the southern end of its range in 2000, and Maine is currently the only Northeastern state with a resident breeding population of the species (Vashon et al. 2008b). However, sightings of Canada lynx have recently been reported in New Hampshire and Vermont, which are part of the species’ historic range (Vashon et al. 2008a). The distribution of Canada lynx is very dependent on the presence of the snowshoe hare (*Lepus americanus*), their primary prey, as well as the presence of early successional coniferous forests and adequate snowfall amounts, which snowshoe hare rely on for survival (Hoving et al. 2004).

In this study we model the potential suitable habitat for the Canada lynx in Maine, New Hampshire, and Vermont. The model is based on a number of habitat parameters that influence the presence of lynx, including presence of snowshoe hare, annual average snowfall, land cover type, human population density, presence of urban areas, and presence of conserved areas. We visually compared the resulting habitat suitability model to current estimates of lynx distribution to identify potential areas where lynx populations could be established that they are not already.

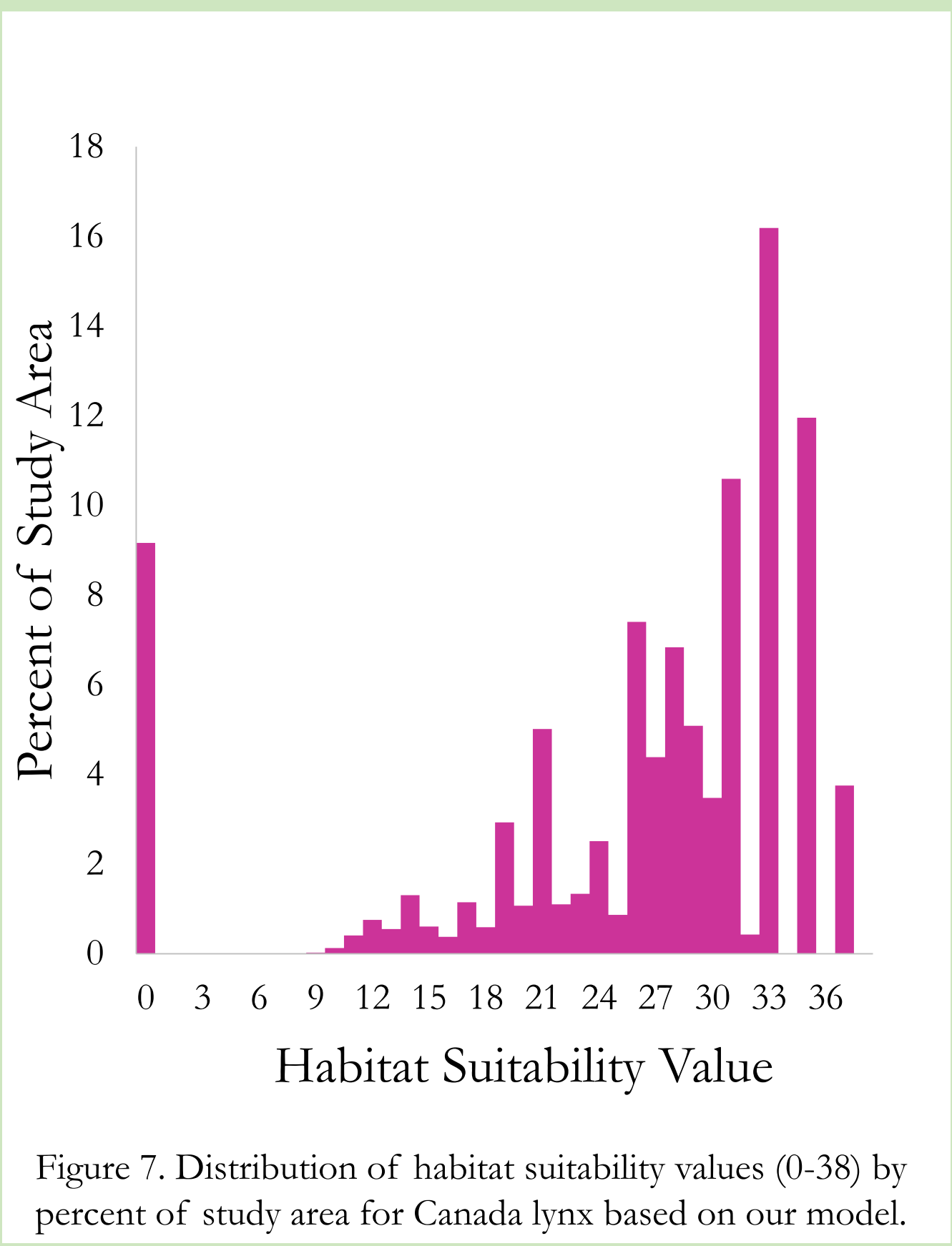
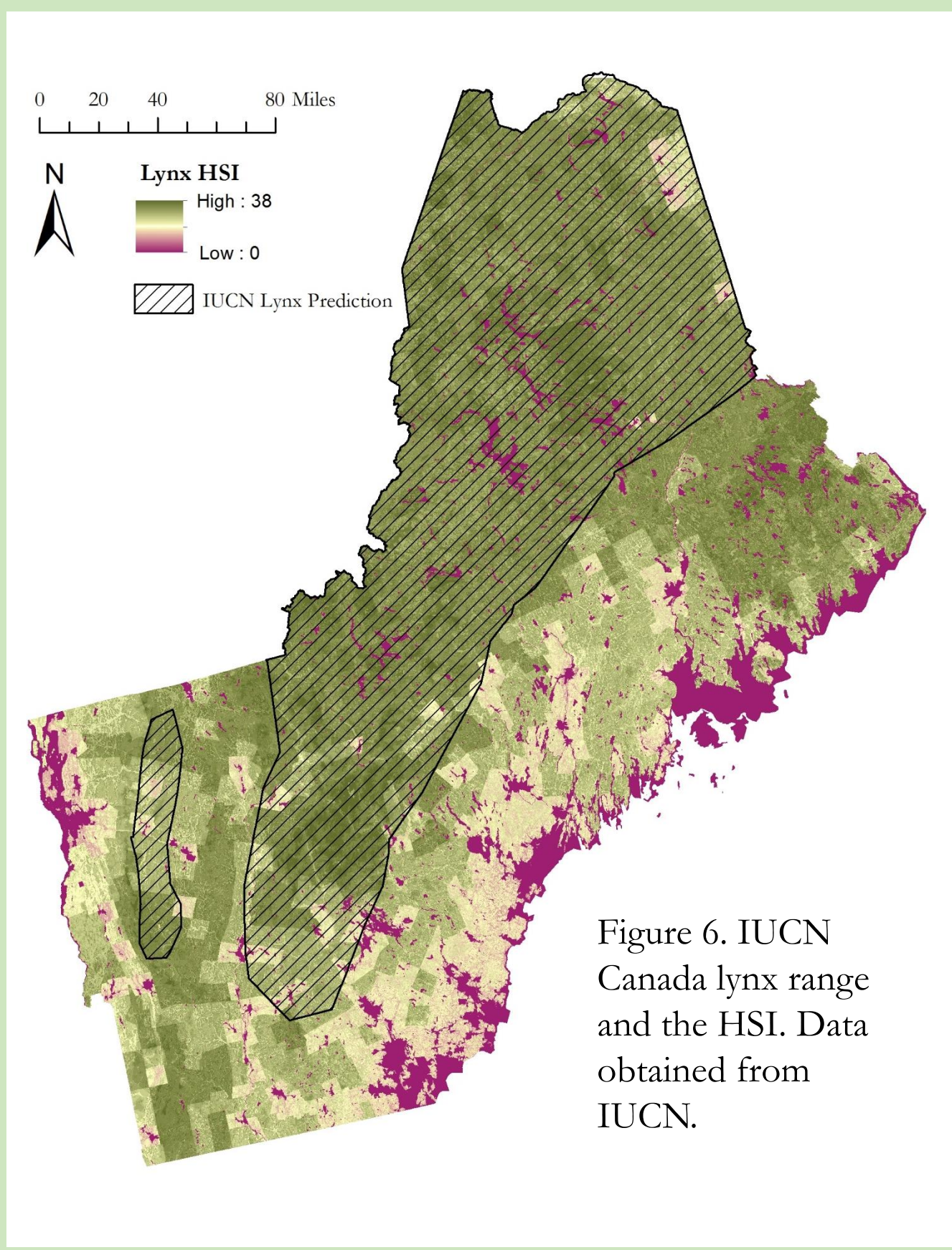
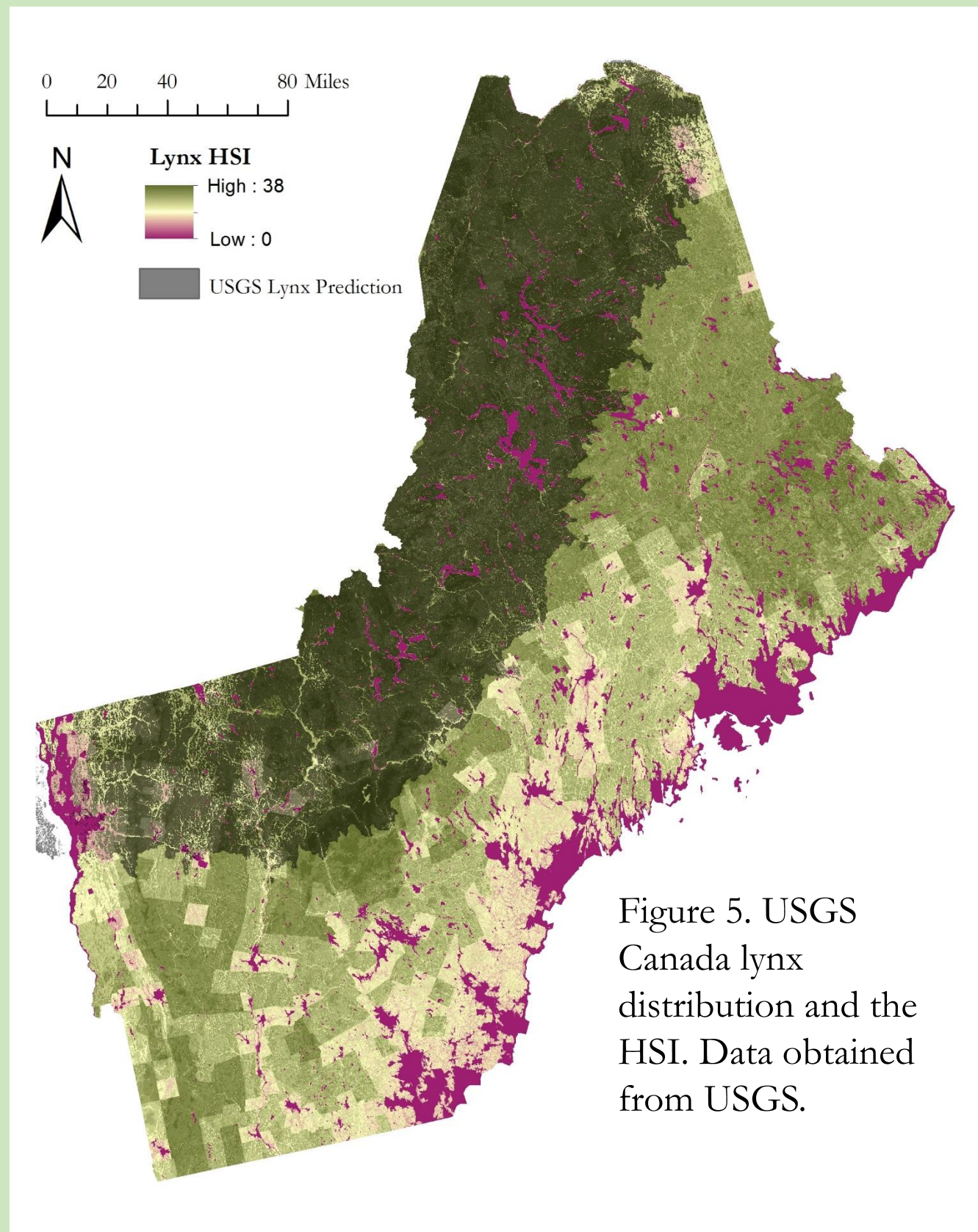
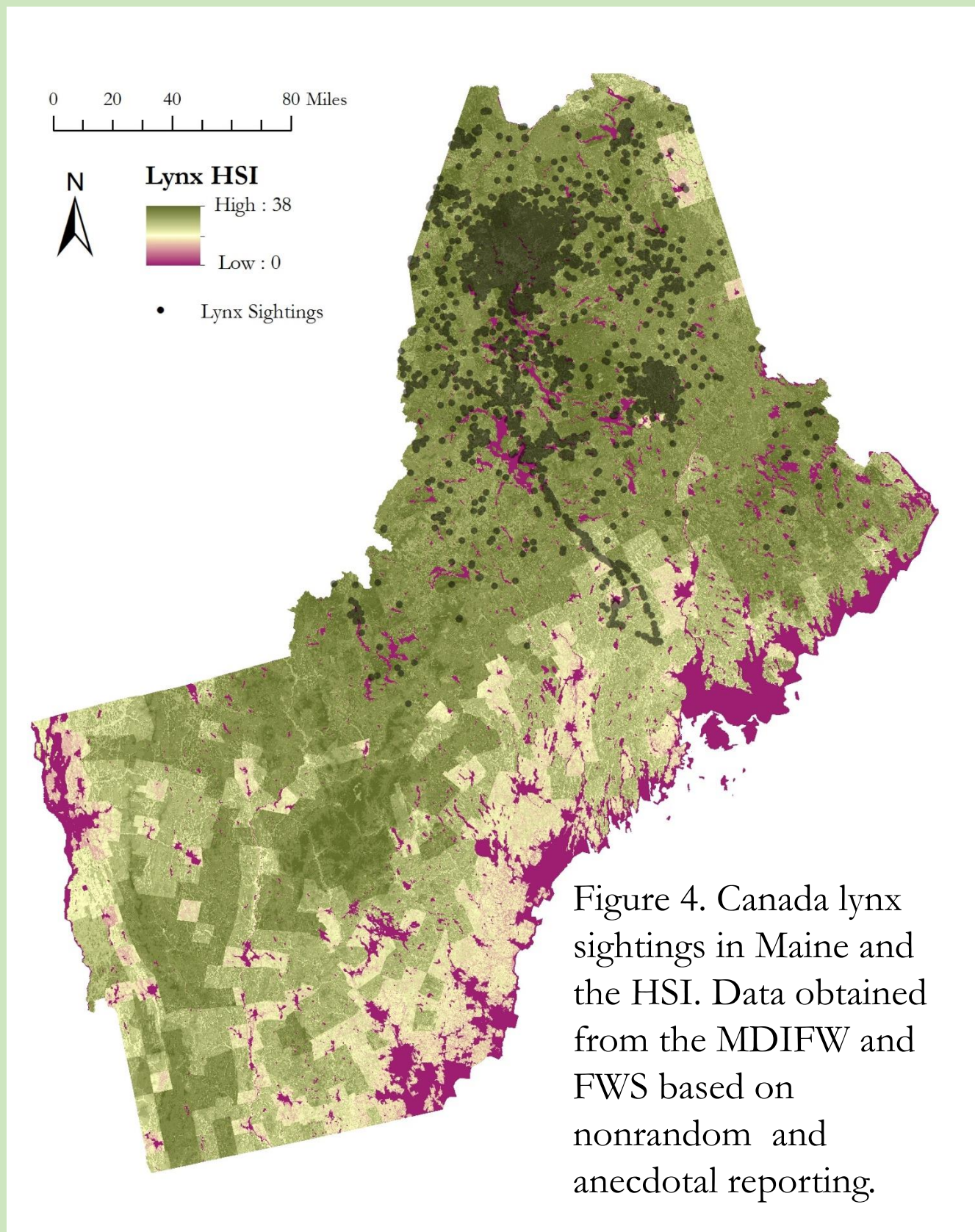
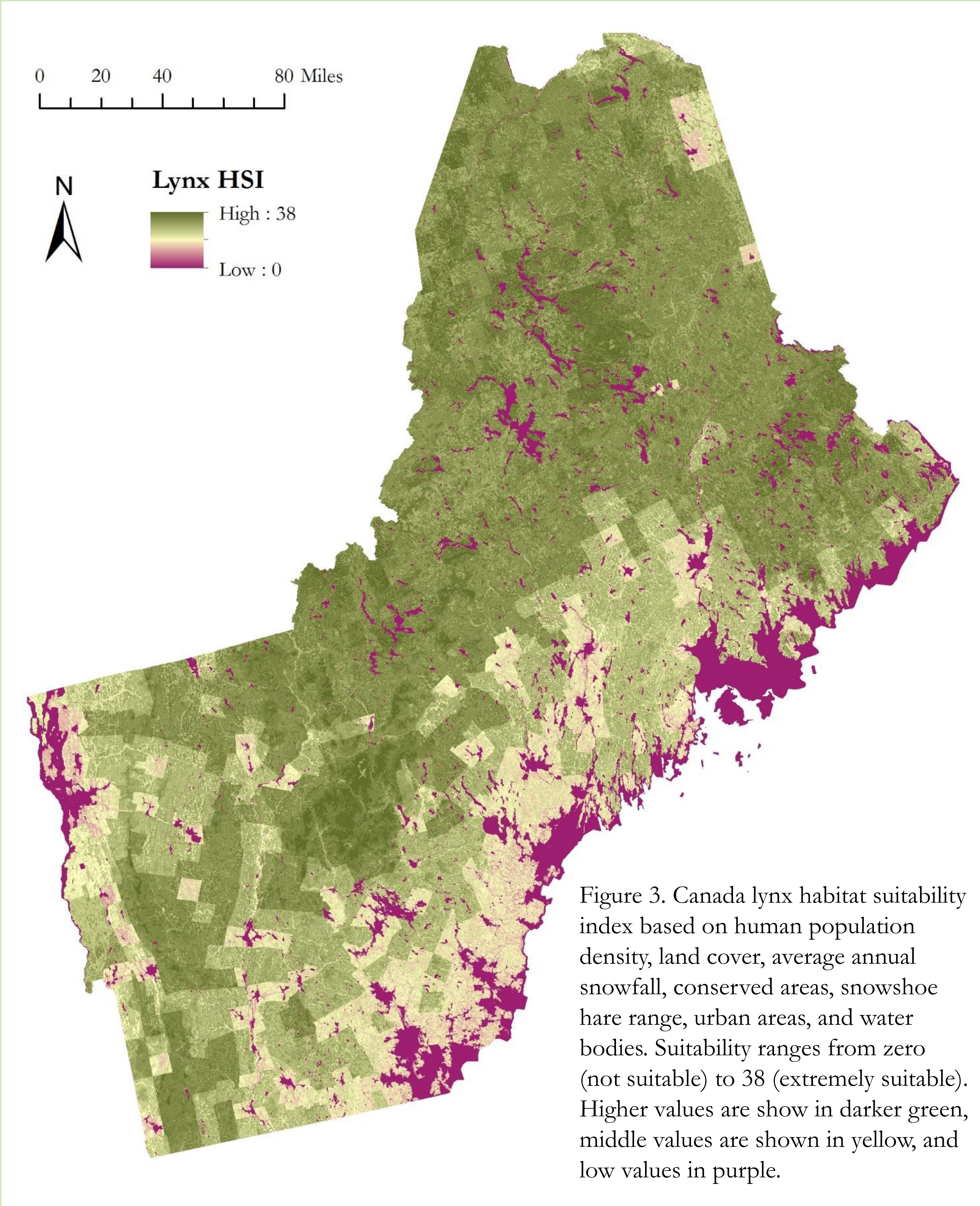


## Methods

To create a habitat suitability index for Canada lynx in Maine, New Hampshire, and Vermont, we used ESRI ArcGIS 10.2.2. We obtained snowshoe hare range data from the IUCN, average annual snowfall data from WeoGeo using NOAA data, land cover data from the Multi-Resolution Land Characteristics (MRLC) consortium National Land Cover Database (NLCD), human population density and urban area data from the U.S. Census Bureau, and conserved areas data from the USGS. Additionally, water bodies data was obtained from the USGS SRTM Water Body Dataset. All data were converted to raster layers and are projected using the USA Contiguous Albers Equal Area Conic projection.

In ArcGIS we reclassified each data layer based on importance for Canada lynx habitat. We then created a weighted sum of our snowfall, land cover, conserved area, and population density layers and multiplied them by our snowshoe hare range, urban areas, and water bodies layers (Equation 1). Studies show that the most suitable habitat for lynx is where average annual snowfall is high and human population density is low, as well as in adequate coniferous, deciduous, or mixed forest (Vashon et al. 2008a,b; Hoving et al. 2004; Fuller et al. 2007). We determined areas to be more suitable if conserved areas were present. If they fell in urban areas, water bodies, or were not in the range of snowshoe hare we determined that they have zero suitability for a lynx population. Therefore, the most ideal lynx habitat in our model is where snowfall is high, human population density is low, coniferous forest is present, a conserved area is present, snowshoe hare are present, and water bodies and urban areas are not present.

Equation 1.  
Canada lynx HSI = (CA + HPD + SF + LC) \* (WB) \* (UA) \* (SH)  
Where  
CA: Conserved areas (0 or 3)  
HPD: Human population density (0 → 15)  
SF: Average annual snowfall (0 → 10)  
LC: Land cover (0 → 10)  
WB: Water bodies (0 or 1)  
UA: Urban areas (0 or 1)  
SH: Snowshoe hare range (0 or 1)



## Results

Highly suitable Canada lynx habitat is present in all three states in the study area (Figure 3). Although Maine is the only state in the Northeast with a resident breeding lynx population, our model indicates that suitable habitat for a lynx population occurs in Vermont and New Hampshire as well. When visually compared to the Canada lynx range published by the IUCN and the distribution data published by the USGS, our model suggests that highly favorable habitat exists throughout both. However, our model also suggests that suitable Canada lynx habitat occurs outside of these areas as well (Figures 5 and 6). Almost one third (32%) of our study area is between the suitability values of 33-38, meaning that these areas are very or extremely suitable Canada lynx habitats based on our model (Figure 7). The most common single value was 33, with 16% of the study area showing this result. 9% of our study area showed zero suitability for Canada lynx habitat based on our model.

## Discussion

The goal of this project was to model suitable habitat for Canada lynx in Maine, New Hampshire and Vermont. Figure 4 shows the Maine Department of Inland Fisheries and Wildlife (MDIFW) lynx sighting data overlaid on top of our model, and based on this we can visually see that many of the confirmed lynx sightings in Maine have fallen within areas that our model suggests are highly favorable habitat. Spatial data on confirmed lynx sightings are not available for New Hampshire and Vermont, but our model suggests that the distribution of Canada lynx populations could include suitable areas in those states as well. It is also important to note that our model shows areas of suitable habitat extending continuously from northern Maine through to central Vermont, indicating that populations in Vermont and New Hampshire could possibly maintain contact with current Canada lynx populations in Maine.

Current predictions of Canada lynx range and distribution are highly variable in the Northeastern United States. The IUCN and USGS have both published estimates of lynx distribution which differ slightly, and the Maine Department of Inland Fisheries and Wildlife has data reporting lynx sightings which extends outside of these areas (Figure 4, Figure 5, Figure 6). The variability in predictions indicates the need for further research into the factors that influence Canada lynx populations and the need for more data on the occurrence of these factors in areas of potential habitat. Highly suitable areas in our model overlap with the IUCN and USGS ranges, with the added benefit of showing relative suitability rather than a binary outcome (Figure 5, Figure 6). It also shows possible areas where lynx populations could extend to or be established in the future with the help of strong conservation and management practices.

## Conclusion

Current data on the range and density of Canada lynx in the Northeastern United States is sparse and mostly anecdotal. Most of the information on lynx distributions comes from the production of models that assign importance to different factors. Our model has the benefit of showing a gradient of habitat suitability, but could be improved by more supporting literature on the relative importance of different factors influencing Canada lynx populations as well as more specific data about forest type and density of snowshoe hare.




Figure 8. Canada lynx in its preferred coniferous forest habitat.

## Acknowledgements

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