Corridors For Wolf Reintroduction To Maine

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ES 212: Introduction to GIS and Remote Sensing

Introduction

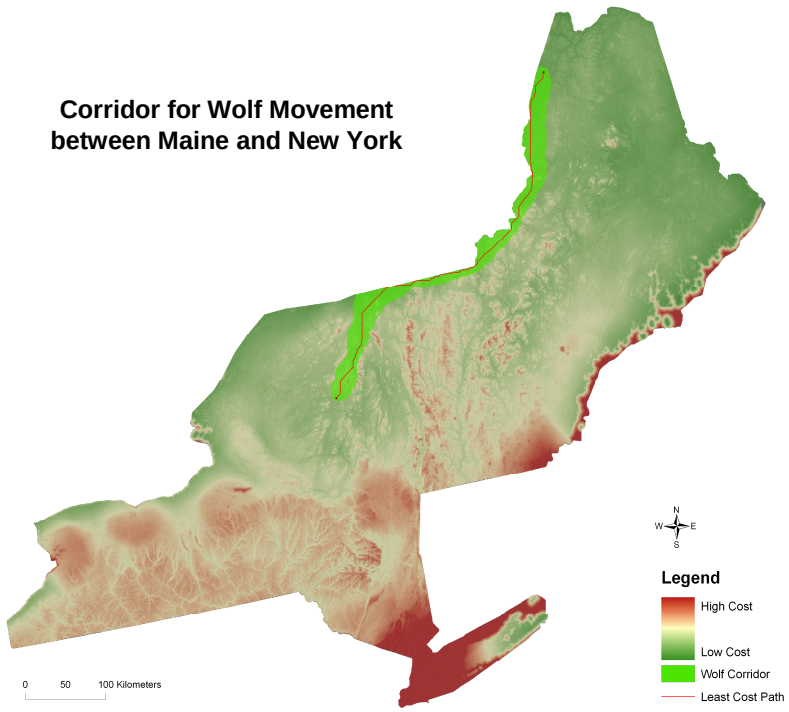
This project is an effort to display the corridors that wolf populations are most likely to use for movement, if reintroduced to Maine. With wolf populations returning as far east as Michigan, studies have suggested potential for suitable wolf habitat within Northern New England and upstate New York (Mladenoff and Sickley, 1998). I use GIS to locate a corridor that is best suited for wolf movement between the potential habitat in New York and Maine that was identified by Mladenoff and Sickly (1998). These corridors are based on the negative association between wolf presence and road density and the positive association between wolf presence and coniferous or mixed forest (Mladenoff and Sickley, 1998). The output of this analysis shows the likely path taken by wolves as they move to and from suitable habitat in Maine.

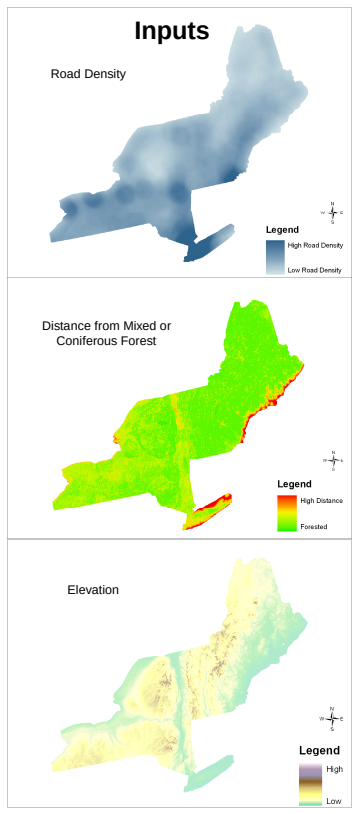
Methods

Arc GIS 9.2 was used to create a least cost path and corridor analysis. The three main inputs in this analysis were road density, distance from forest cover, and elevation. Road density was determined by computing the area of roads per kilometer squared from road data for New York, Vermont, New Hampshire, and Maine. Land cover data from NOAA was used to determine which cells contained coniferous or mixed forest. For cells that did not contain either forest type, the distance to the nearest cell containing mixed or coniferous forest was computed. My third layer was an elevation map of the region. For all layers, I normalized my data on a scale of 0-1, with 1 representing the highest value in all cases.

I combined both the forest distance layer and the road density layer to create one single layer representing total land cover costs. I used the following equation to weight each value equally: (forest distance layer + road density layer)/2 = total land cover cost layer. I scaled this layer from 0-1 with 1 representing the highest costs. I combined this new layer with an elevation layer. In my model, I did not weigh the layers equally, but gave more value to land cover, because wolves prefer areas with low road density and mixed or coniferous forest (Mladenoff and Sickley 1998). I used the following equation: (0.75*total land cover cost) + (0.25*elevation cost) = total scaled cost.

I then used least cost path analysis (spatial analysis extension) to compute the single line of least cost from two points that have been identified as potential wolf habitat by Mladenoff and Sickely (1998). I then used corridor analysis (spatial analysis extension) to calculate the land that fit into the top 20% cost values and identify them as a corridor for movement.





Results

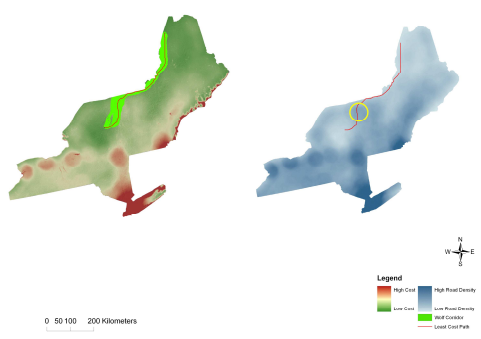
The results show the least cost path running along northern New Hampshire and Vermont into Maine. The corridor output represents the top 20% of the most suitable land values. This represents the tract of land with low road densities and low distance from mixed or coniferous forests. It also takes into account avoidance of high elevation, such as the large mountains in New Hampshire.

Discussion

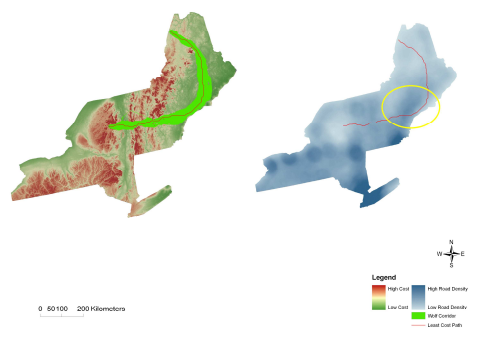
Both the least cost path and its associated corridor represent viable locations for wolf movement throughout the Northeast. However, it is important to note that the analysis may have been influenced by the lack of data for Canadian road densities. This may have been a factor in the creation of such a northern route, as the area above the United States does not have an associated road density value. The model still shows an accurate response to land cover and elevation, and highlights the potential reaction that wolf corridor selection has in relation to road density, distance from forest cover, and elevation.

Why Weight Values Differently?

The maps below represent the corridor and least cost path created when total land cover costs and elevation costs are weighted equally: (total land cover cost + elevation cost) / 2 = total scaled cost. While the output may appear similar to the above map, when placed over a road density layer, it is clear that the path of least cost moves through an area of relatively heavy road density near Burlington, VT (see yellow circle). This is unlikely, given wolves' avoidance of such areas.



In a more extreme example, elevation was weighted at a higher importance than land cover: (0.25*total land cover cost) + (0.75*elevation cost) = total scaled cost. The result is a drastically different output that places the least cost path along heavily trafficked areas, in order to avoid large elevation gains. The area encompassed in yellow shows some of the higher road densities in Maine and parts of the least cost path could easily be confused with Interstate 95 on any other map.



Acknowledgements
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Sources

Data Layers:
Land use data layers supplied by the National Oceanic and Atmospheric Association. http://www.csc.noaa.gov/crs/lca/northeast.html
Road coverage supplied by Street Map USA layer. ESRI.
Elevation layer supplied by Global Data. ESRI
Other Information:
Mladenoff, David J. and Theodore A. Sickley. "Assessing Potential Gray Wolf Restoration in the Northeastern United States: A Spatial Prediction of Favorable Habitat and Potential Population Levels." 1998. *The Journal of Wildlife Management*. 62:1. 1- 10
Wolf Picture: http://animals.nationalgeographic.com/animals/printable/wolf.html