The Spatial Relationships between Wolves, Moose and the Dominant Plant Community

Abstract

Grey Wolf populations have been on the rise since being listed on the IUCN red list in 1982. After the success of reintroduction of wolves into Yellowstone National Park, it peaked our curiosity to see how wolf populations were doing elsewhere. Our research drew us to wolf populations found in Minnesota where we compared wolf range to prey range and the type of vegetation and water bodies found in these areas. We downloaded appropriate datasets, converted a raster file to a shapefile, simplified our complex habitat layers, and calculated the area of each simplified habitat type. Wolf range was found to overlap with moose range and the preferred vegetation of both species was conifer and deciduous forest and wetlands. The ranges were found in Northeastern Minnesota and mapped out where the ranges overlapped and what type of land cover was located in these zones. Most of the wolf ranges closely mirrored the ranges of the Moose showing us that the wolves were interested in remaining close to their prey.

Introduction

Grey wolves feed on a variety of prey, predominantly large ungulates. In Minnesota, moose are one of the three main food sources for wolves (Chavez 2005). In this lab, we will analyze the relationship between wolves and moose as well as dominant habitat types in which they live in. With wolves being introduced and extirpated in many places, we are interested in looking at how populations are faring and what environmental and urban obstacles they are facing today. With our focus on Minnesota, we will look at what elements are affecting predator-prey dynamics and what it might mean for the future of both species. Currently, climate change is playing a role in lower fertility rates due to temperature increases in moose populations (Lenarz et al. 2010). This decrease in prey numbers may affect the wolf populations that live there as well. However, moose and other ungulates greatly affect the landscape by feeding on brush and other vegetation (Rooney and Anderson 2009). Wolves are very efficient at keeping their numbers stable and preventing overgrazing of their prey; but are regulated themselves due to the more mountainous terrain that they have to traverse to hunt their prey (Rooney and Anderson 2009). We hope to learn the habits of both species based on landscape and urban influence and how this might change the behavior and determine how the populations are dispersed throughout the state.

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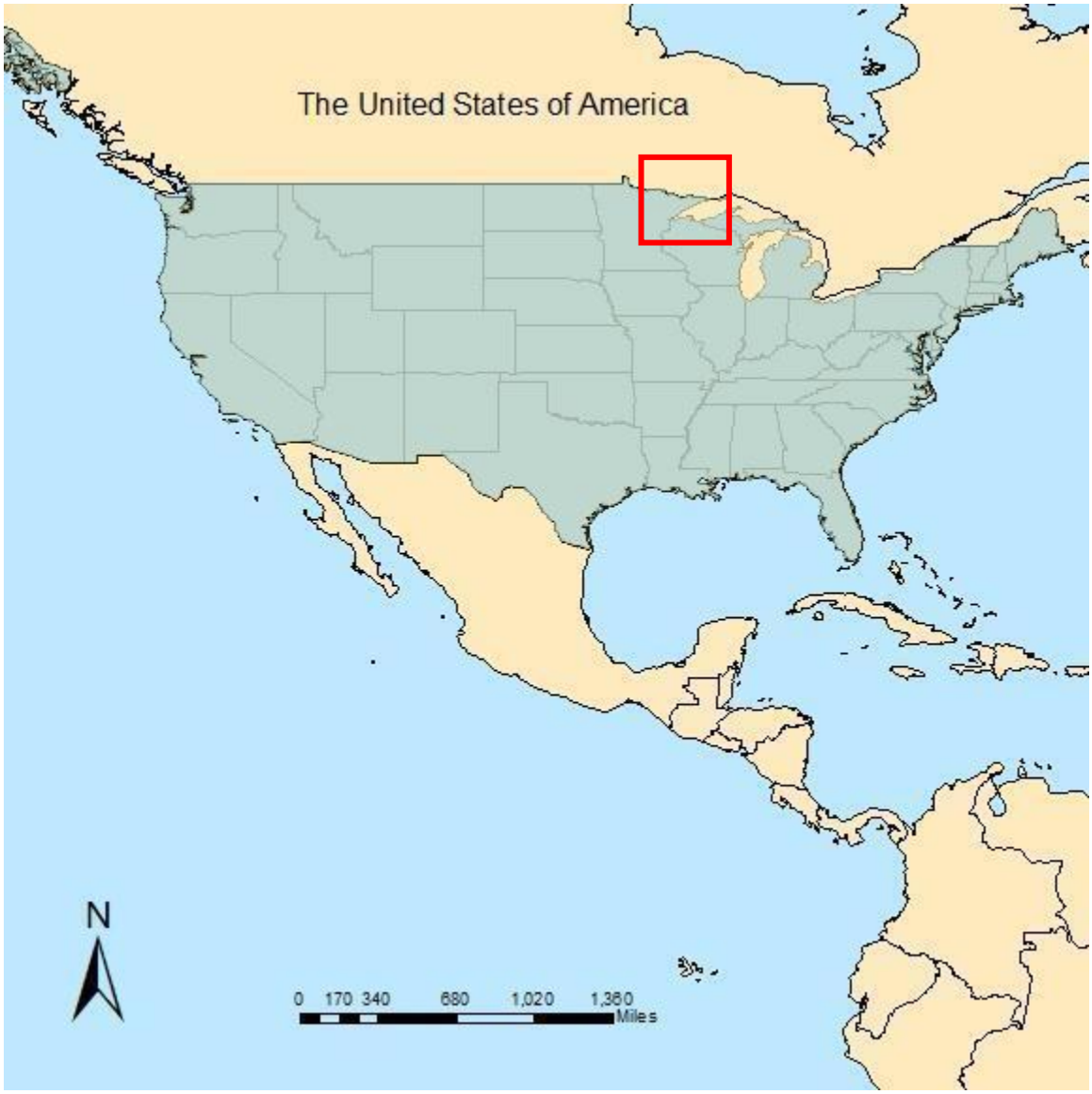

Figure 1: The area in which we focused on for this lab is within the red box in the state of Minnesota.

Methods

We downloaded the data sets for the Minnesota state boundary, moose range boundary, wolf territory boundary, and an impervious layer containing open water, mixed forest (conifer and deciduous), deciduous forest, conifer forest, forested shrub and wetland, emergent wetland, row cropland, managed grassland, hay and pasture, and open water. All data sets were under the same projection coordinate system due to the Minnesota state website being the source for each one, so no projection was required. As the impervious layer was a raster, we had to convert the data set to a shapefile in order to allow for detailed analysis.

The impervious layer was highly complex, with a variation in the plant community within just a few kilometers of the other. In order to reduce the spatial complexity and bring a clearer understanding of the landscape, we had to combine similar layers into a single shapefile. We had to negate managed

grassland, hay and pasture, and row cropland because they were created for agriculture, and we were trying to understand the natural landscape. We also had to negate wolf zone three, as it was unoccupied by moose.

Next, we began the analysis of the impervious layer to estimate the land occupied by each ecosystem. The shapefile, "Mixed Forest" was created by selecting: mixed forest, deciduous forest, conifer forest. The "Wetlands" shapefile was a combination of emergent wetlands and forested shrub and wetland. The last shapefile was open water on its own. Statistics were calculated for each area to estimate the land that was occupied by the different ecosystems, the wolves, and moose. To show the sections of the wolf and moose borders that overlap, we created a polyline shapefile and manually drew over those areas in a pattern that symbolizes that they are combined. The last steps of the analysis was to eliminate distractions from the mass area the impervious layer occupied. The impervious layer was cut using wolf zones two and one.

Results

In the area that we have examined, the population of Grey Wolves is about 1,600 individuals, and the population of moose is about 4,020 individuals. In Table 1, we examined the dominant plant community within the territory moose and wolves shared.in kilometers squared. In Wolf Zone 1, mixed forest is 6,245 square kilometers, wetlands is 1,879 square kilometers, and open water is 1,209 square kilometers. In Wolf Zone 2, mixed forest is 1,857 square kilometers, wetlands is 1,338 square kilometers, and open water is 324 square kilometers. From this we can conclude that mixed forest is the most dominant type of habitat in these regions. It would make sense because the animals we are studying are terrestrial.

Table 1: This table features area in kilometers squared of mixed forest, wetlands, and open water habitats.

	Population		**Wolf Zone**	**Mixed Forest (km^2)**	**Wetlands (km^2)**	**Open Water (km^2)**
Wolves	1600		Zone 1	6,245	1,879	1,209
Moose	4020		Zone 2	1,857	1,338	324

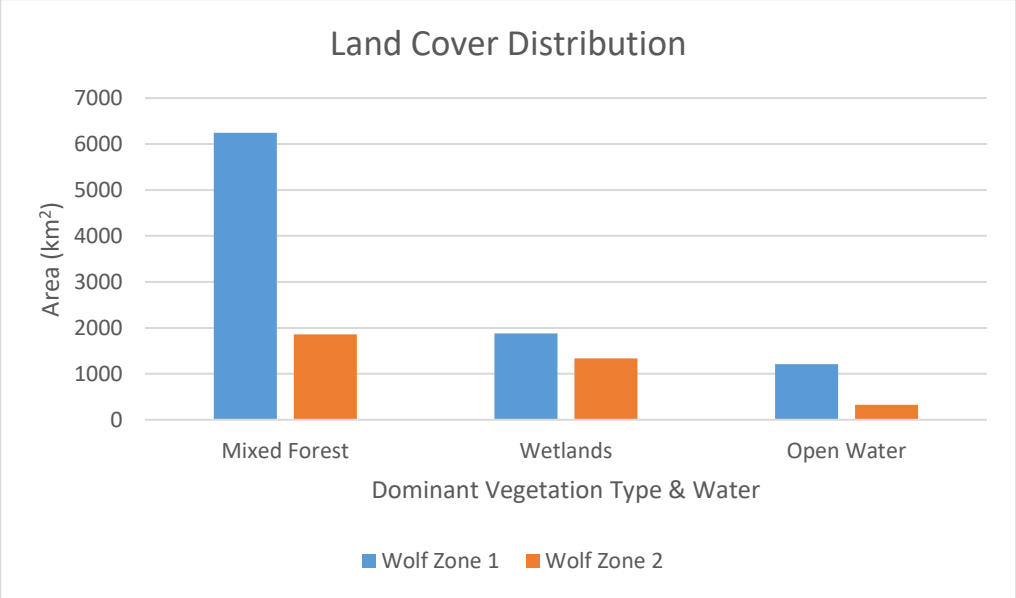

Figure 2: A visual representation of the proportion of that attributed to a dominant plant community, and open water. The graph shows the results of our spatial analysis within each wolf zone. Wolf Zone 1 is in blue and wolf zone 2 is the color orange. The y axis represents the area occupied by each land cover type in kilometers. The x axis is the different land cover types.

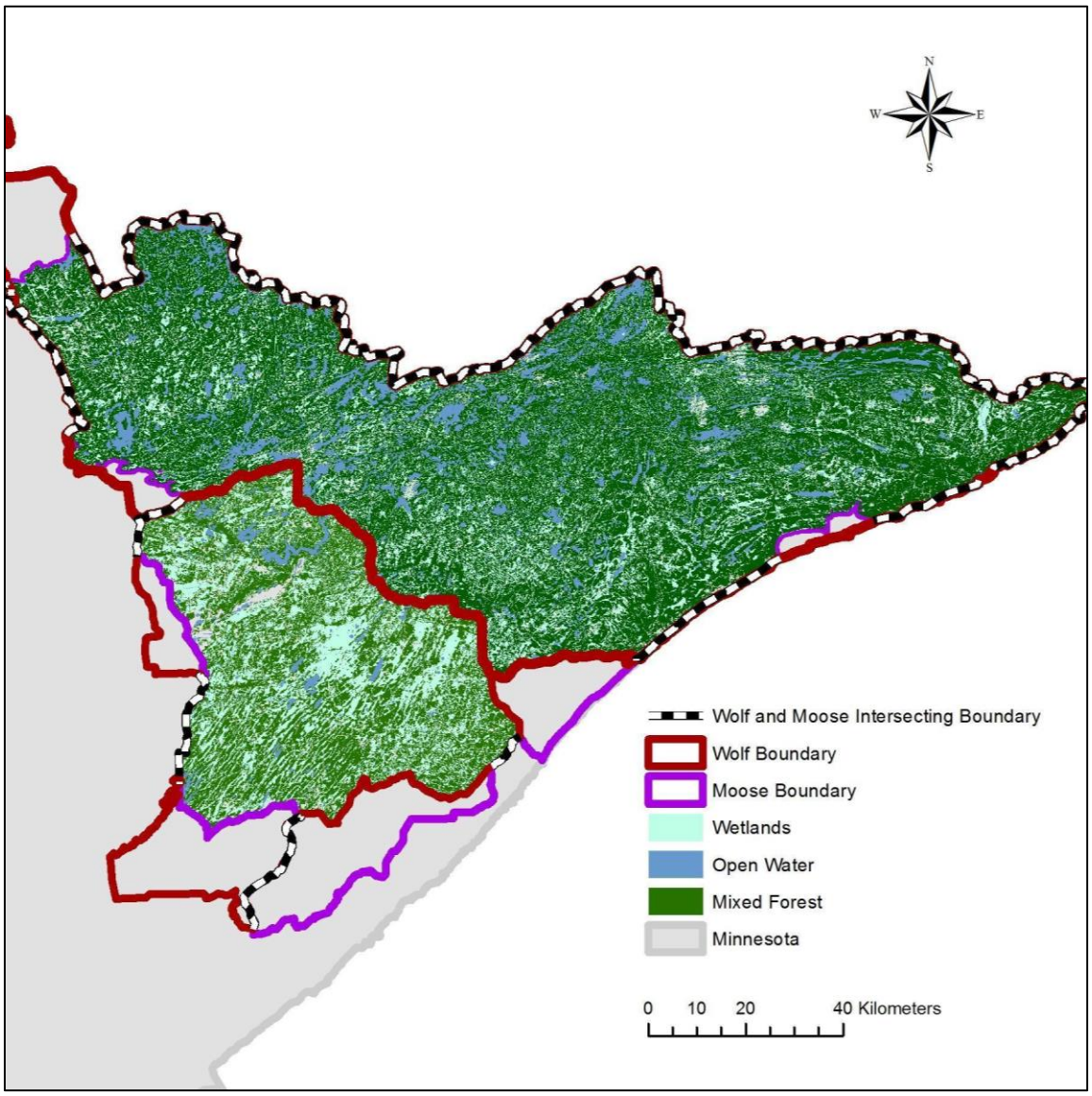

Figure 3: This map shows the wolf (red) and moose (purple) territories in northeastern Minnesota, as well as the habitat types within these territories: wetlands, open water, and mixed forest.

Conclusion

In this project, we wanted to observe the spatial relationships between wolves, moose, and types of habitat they occupy. Wolves and moose primarily occupy the northeastern region of Minnesota. Because large ungulates, like moose, are a large part of wolf diet, wolves tend to inhabit similar ranges as their prey. In our area of study it is clear that this population of wolves almost exclusively live within the same boundaries as moose. The habitat present in the moose and wolf territory is composed mixed forest, wetlands, and open water. After analyzing the data, we have come to the conclusion that the most dominant habitat types in which the wolves and moose co-occur is mixed forest; however, there are different proportions of habitat types that are within each wolf zone. Wolf zone 1 is composed

of 66% of mixed forest with only 20% wetlands. Wolf zone 2 contains a more equal distribution of wetlands to forested lands with 52% mixed forest and 38% wetlands. This is a 14% difference compared to the 46% discrepancy between mixed forest and wetlands in wolf zone 1. Dense forests provide shelter, protection, and cover for local species, and that is the reason why the wolves and moose inhabit such areas.

Our study, and others like it, can provide important information for wildlife management and conservation. It is important for us to understand the habitats and resources of keystone species so that we can take necessary actions to make sure ecosystems continue to thrive. We have explored a topic of interest while applying GIS knowledge that we have learned from this semester's GSP 270 class. To be given the opportunity to spend our time, newly acquired knowledge, skills, and concepts into a project that was built from our passion for animals and the ecosystems of which they reside was a monumental moment in our education. It was a significant learning experience overall, as we worked as a team and organized our jobs by our strengths while improving on our weaknesses.

Acknowledgements

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