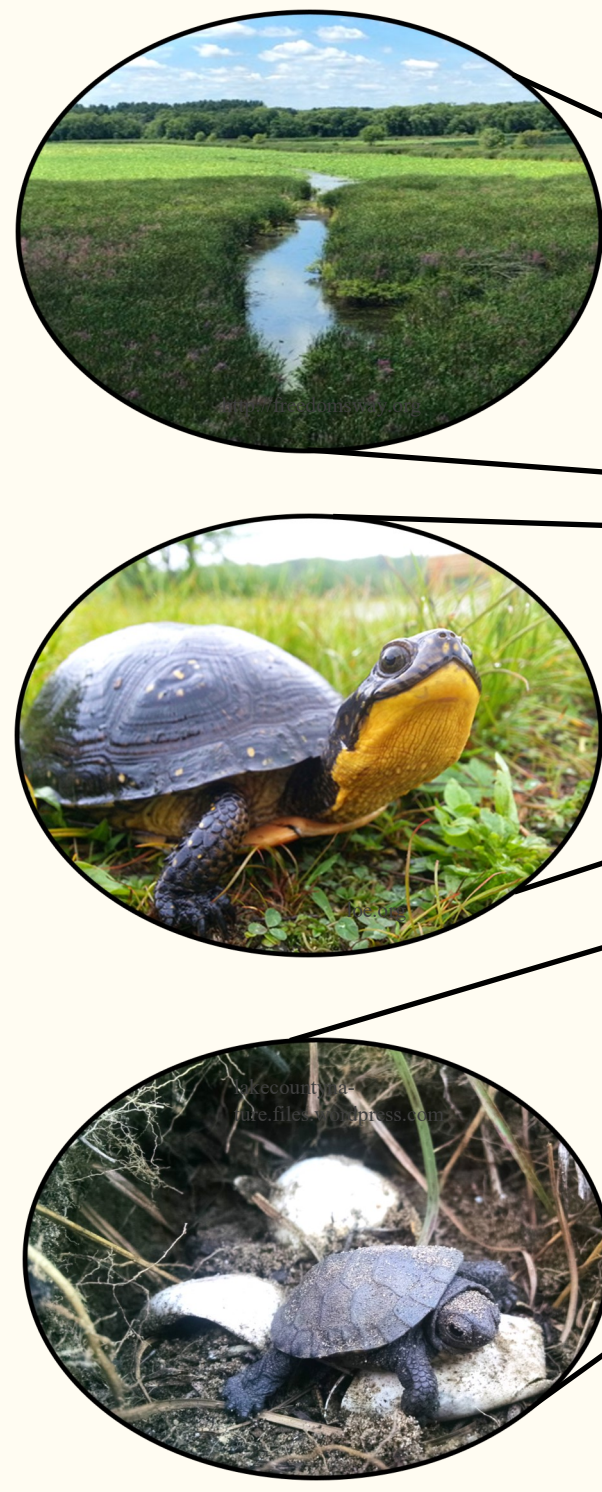


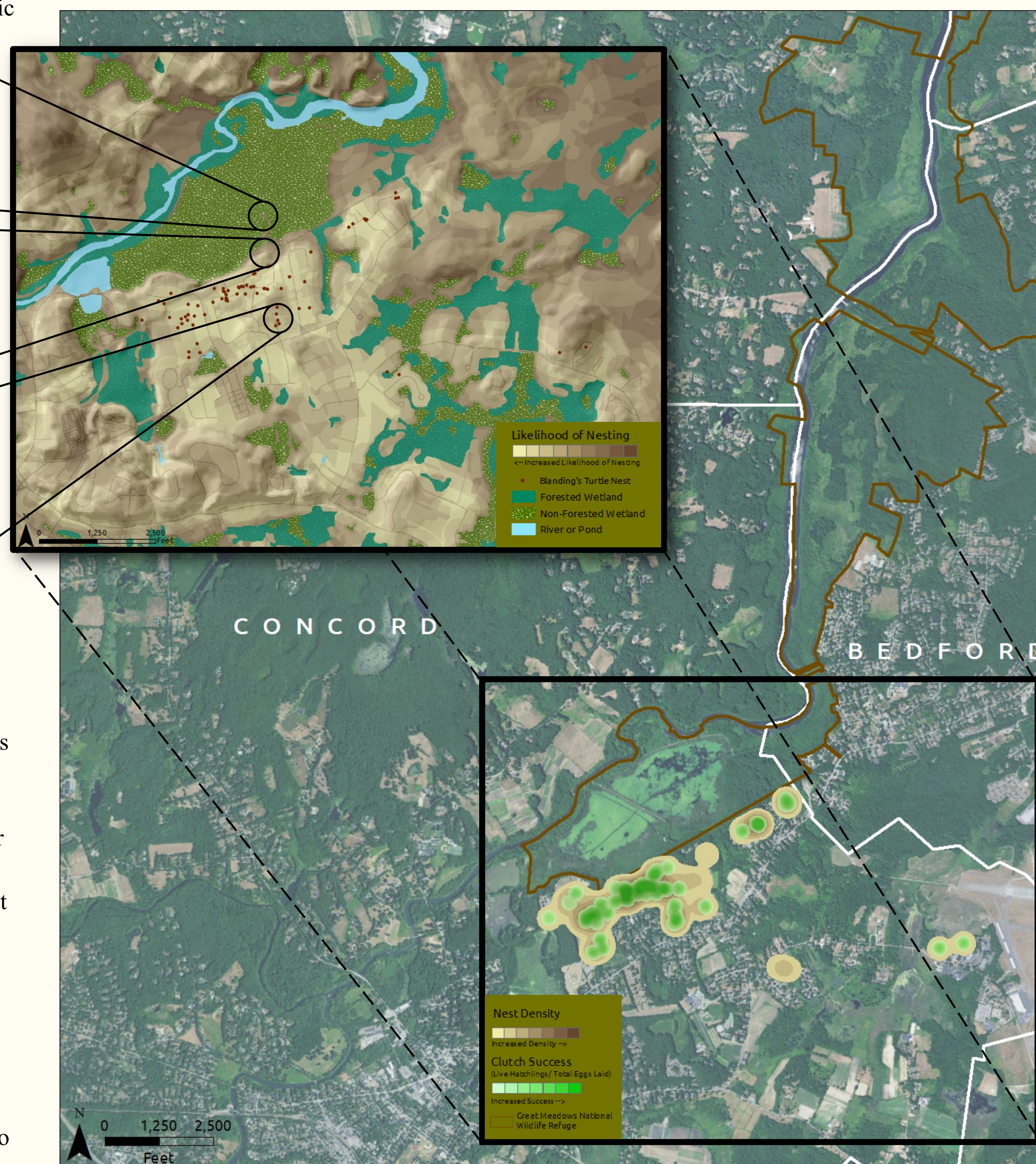
Nest Site Selection in Blanding's Turtles

Blanding's Turtles

Blanding's turtles, *Emydoidea blandingii*, are an endangered, semi-aquatic turtle species native to Canada and the US, including Massachusetts. These turtles are important ecosystem modifiers, and their declines have largely been the result of anthropogenic changes to their habitats. Blanding's turtles live in non-forested wetlands, and nesting occurs in the Summer during which females will travel some distance inland to lay eggs. Clutches are typically between 10 and 12 eggs and are laid in a shallow nest dug by the female in an area of low vegetation. The mother returns to the wetland soon after laying, and hatching occurs approximately two months later. In order to conserve the declining Blanding's turtle population at Great Meadows National Wildlife Refuge in Concord, MA, Dr. Bryan Windmiller and his colleagues at Grassroots Wildlife Conservation have closely monitored the turtles for the past 15 years. As a part of nest protection and headstarting efforts, nesting data has been collected for the past 10 years. The purpose of this GIS analysis was to gain a better understanding of nest site preference in female Blanding's turtles in order to inform potential habitat restoration practices.



A Spatial Analysis of Nest Site Choice by *Emydoidea blandingii* Concord, MA 2008-2017 Great Meadows National Wildlife Refuge



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Results and Conclusions

On average, females traveled 575 feet from non-forested wetlands to lay nests, indicating that females do tend to nest a fair distance away from their wetland habitats. The average nest distance from roads was 136 feet with one nest as close as 10 feet from a road, indicating that females may actively choose to nest near roads due to a perceived benefit. Mean nest site elevation was 147 feet whereas the elevation of the wetland habitat in Great Meadows NWR is 136 feet, so females are, on average, nesting at higher elevations. This may reflect an active choice by females. 55% of the nests were located in medium density residential areas indicating that females may perceive these areas as advantageous for nest success. The second most common area for nesting was cropland, which contained 22% of nests. It should be noted that the seventy-four nests used in this analysis do not include all nests laid by this population of turtles from 2008 to 2017, but only those with recorded x,y locations. This may slightly favor those nests near homes; however, exact x,y data has largely been recorded so this skew should not be so great that the findings here are negated. The map depicting success and nest density demonstrates most common nesting locations in relation to clutch success (measured in live hatchlings per total eggs laid) and depicts possible ecological traps.



Future Directions

Broadening this analysis to include additional factors and assessing the strength of these relationships with statistical techniques could provide a more comprehensive picture of nesting considerations.

Data Sources

Data Sources: MassGIS, ESRI, and US FWS.
Projected Coordinate System: NAD 1983, State Plane MA Mainland, Feet

Acknowledgements

Thank you to Dr. Bryan Windmiller for generously allowing me to analyze the data that Grassroots Wildlife Conservation has put in tremendous effort to collect. Also, thank you to Carolyn Talmadge for your continued guidance and selfless hardwork.

Methodology

Seventy-four Blanding's turtle nests in Concord, MA were mapped using data recorded from 2008 to 2017. Given precise nest locations, mean, minimum, maximum and standard deviation values were calculated for three factors that may have impacted nest site selection by females. Additionally, nest count values were calculated for a fourth factor. These values were then utilized in a suitability analysis to determine most likely nesting locations, based on the four factors considered. Most likely nesting ranges were considered as mean \pm SD, less likely nesting locations were considered as minimum to mean-SD & mean+SD to maximum, and unlikely nesting locations were considered as values outside of these ranges. Each of the four factors was weighted equally in the final analysis. Factors Considered:

1. **Distance to Non-forested Wetlands:** Female Blanding's turtles often travel up to 3000 ft from wetland habitats to nest in suitable areas.

This may be due to decreased predation risk further from wetlands, decreased risk of flooding, and/or so that suitable open or low-vegetative landscapes can be located.

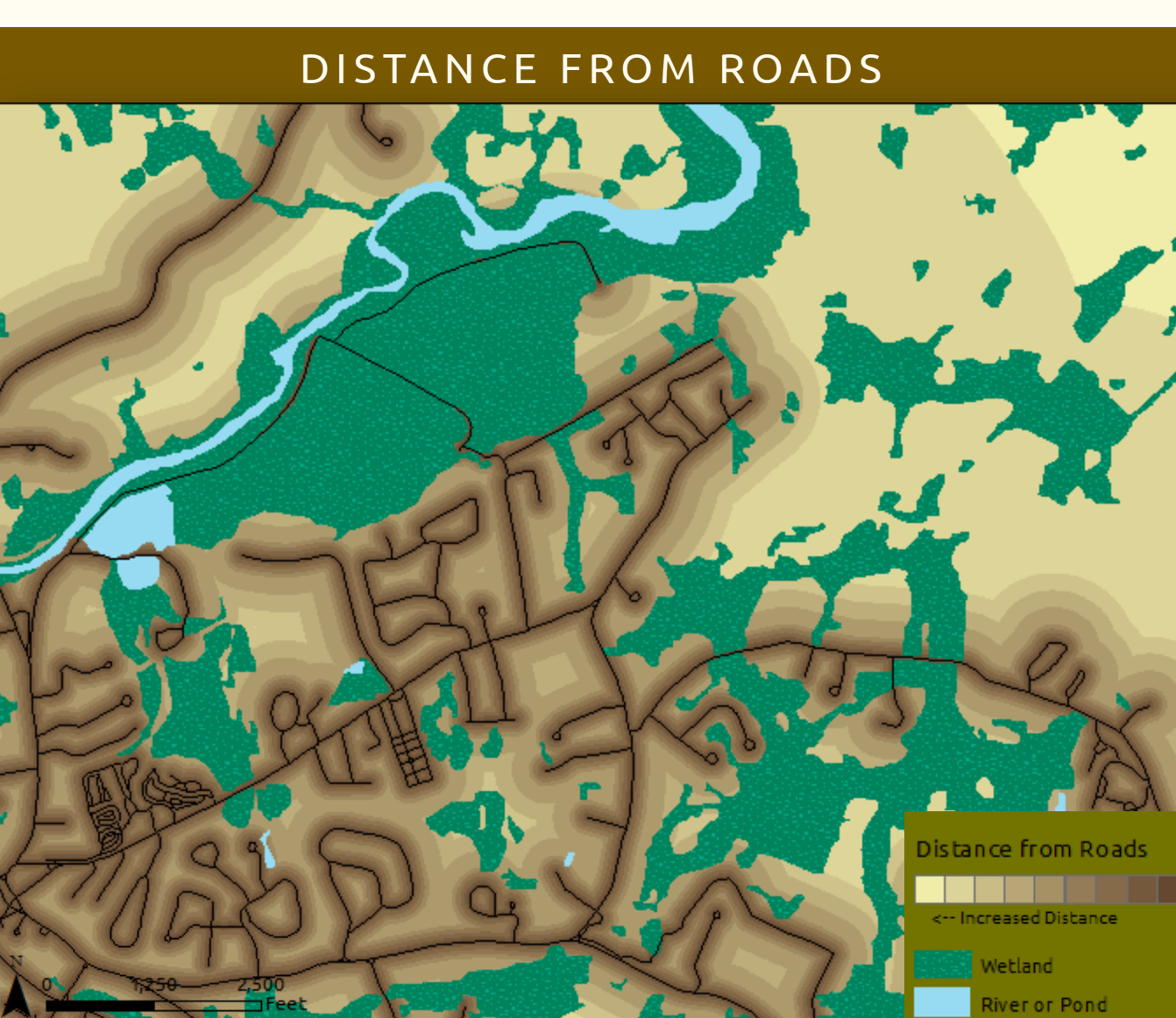
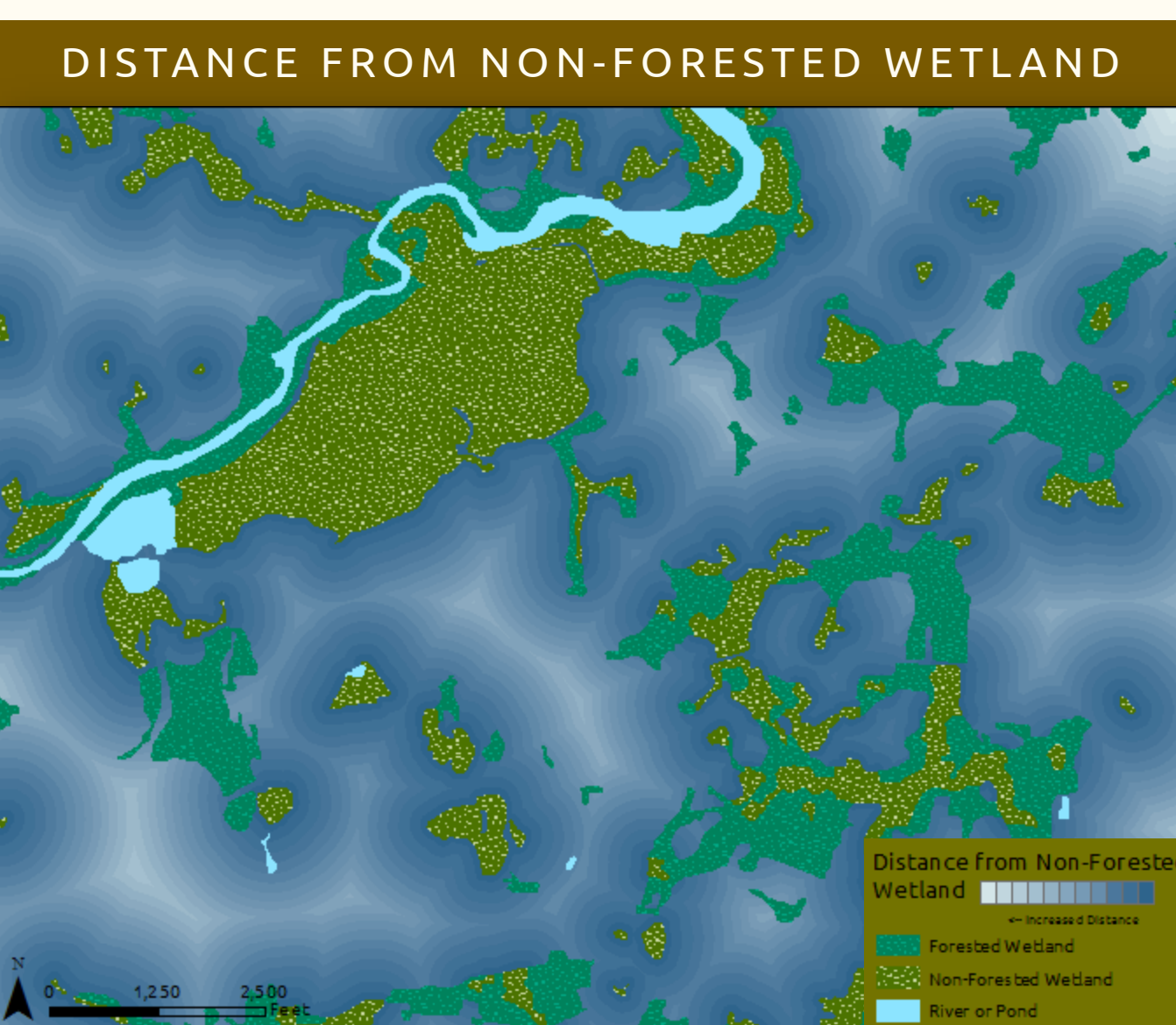
2. **Distance to Roads:** Due to proximity of human development to Great Meadows National Wildlife Refuge, there are many roads located near known nesting sites. It is thought that females may choose to nest near paved regions so that eggs will be sufficiently warmed by concrete during development.

3. **Elevation:** Elevation may impact nest site selection for a variety of reasons including relative risk of flooding (which can lead to embryo death), risk of predation, and accessibility.

4. **Land Use:** Nests are often laid in residential areas which is thought to be a result of well manicured lawns and proximity to concrete driveways that trap heat from the sun.

Factor	Mean	Min	Max	SD
Distance to Non-forested Wetland	575 feet	60 feet	1218 feet	274 feet
Distance to Roads	136 feet	10 feet	600 feet	147 feet
Elevation	142 feet	128 feet	194 feet	9.5 feet
Land Use Type	# of Nests Located in this Type	Average Clutch Success		
Medium Density Residential	41	67%		
Cropland	16	61%		
Low Density Residential	5	47%		
Forest	5	58%		
Waste Disposal	3	32%		
Commercial	2	95%		
Open Land	2	75%		

Table 1. Values calculated by GIS analysis using nest locations and incorporated factors.



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