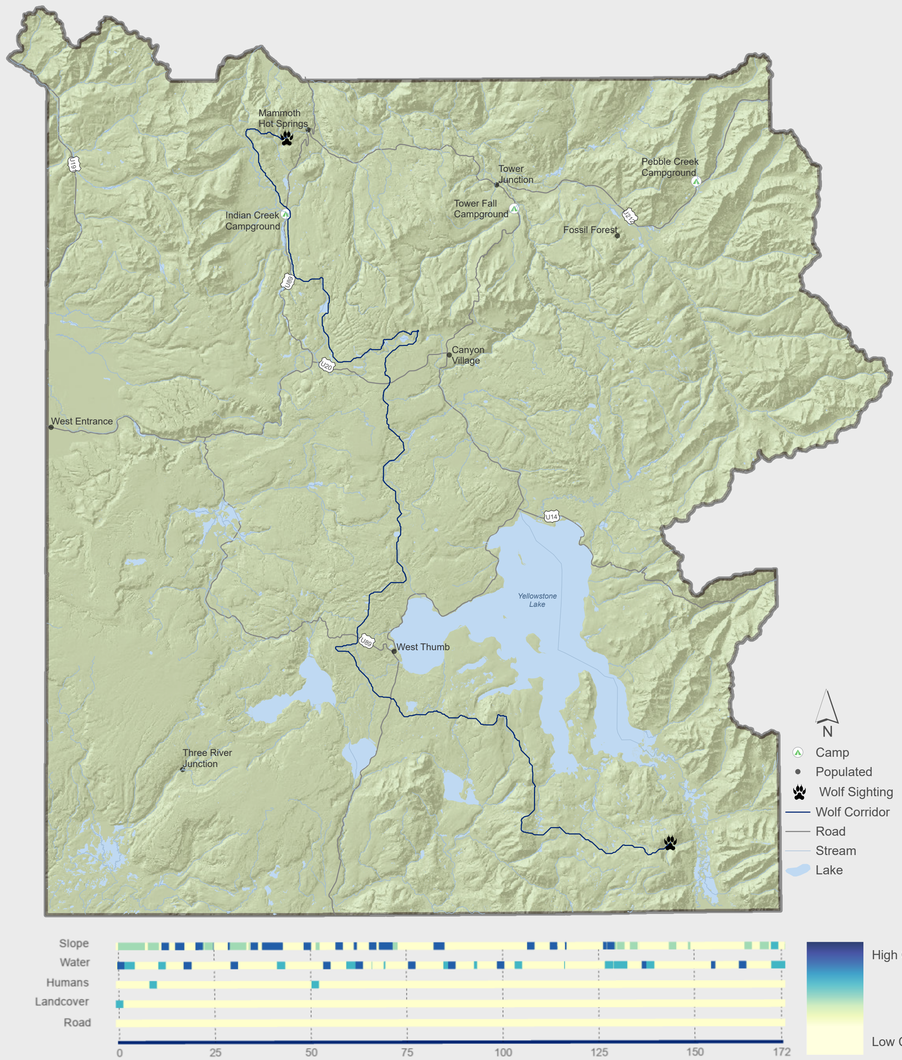
Yellowstone National Park

Discovering Wolf Corridors



Introduction

Wolves are an important keystone species that need to be protected. Their mannerisms and behavioral patterns are of our particular interest since most wolf species are becoming endangered and anthropogenic presence is on the rise.
Our habitat focus area is in Yellowstone National Park in the United States of America. There are an estimated 94 wolves in this park as of January 2020 and they inhabit most of this area (National Park Service, 2020).

With an increased popularity in tourism in Yellowstone National Park, wolves have learned to associate campgrounds, picnic area, and roads with food. This can come to be an issue in regards to public and wolf safety. With a reliance on food provided by people, wolves can become sick or aggressive forcing Park authorities to terminate the animal.

We conducted this study in order to asses common routes a wolf would trek to get from the North range of the park, to the South range. This Least Cost Path Analysis in ArcGIS Pro 2.5 was based on 5 factors of predetermined weight: human density, traffic density, distance to water, slope, and landcover type.

Methodology

The analysis to assess wolf corridors was done using a least cost path analysis with many preprocessing steps involved to accurately produce a cost surface.
Note: All attributed were reclassified based on the criteria in Table 1.

1. Created a cost surface for each attribute

- Traffic Density
  Combined the roads and hiking trails using Merge and Kernel Density to see where a congestion of traffic would be distributed throughout the park.

- Distance to water
  Used major hydrological systems (excluding small streams) that a wolf wouldn't be able to cross or get to via Euclidean distance and Reclassify tools.

- Landcover
  Reclassified to included areas of undesirable cover types such as non-forested areas, water bodies, thermal or wetland areas.

- Slope
  Used a DEM to generate slope that identified areas of higher inclines and rougher terrain that a wolf wouldn't surpass.

- Human Density
  Delineated areas where humans were more likely to be present using the Kernel density tool

2. Combined Cost Surface

Used each cost surface to apply a weighted sum based on the percentage of risk that was predetermined based on literature provided (indicated above each surface below)

3. Least Cost Path

Created a final route that a wolf would take to avoid our named risks using the cost distance tool and cost path as polyline tool.

Table 1. Cost criteria used for reclassifying cost surfaces based on themes.

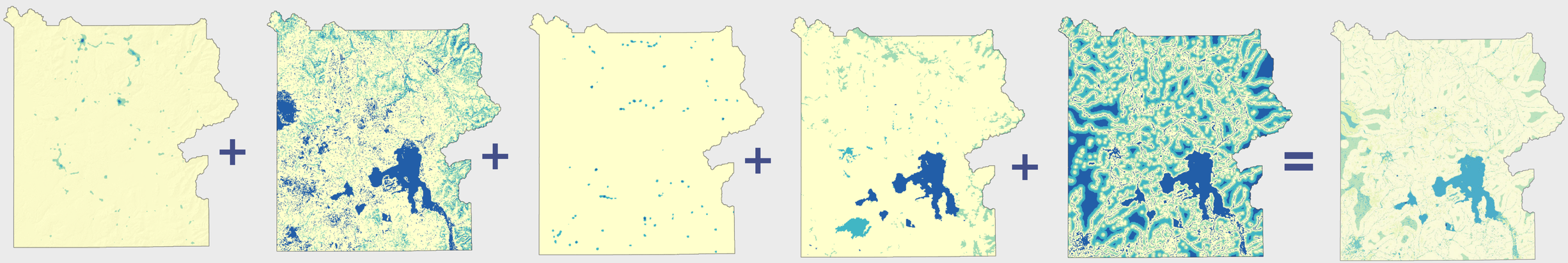
Theme	Criteria Cost - 1	Criteria Cost - 20	Criteria Cost - 40	Criteria Cost - 999	Weight
Landcover	Welland; Coniferous Forest; Mixed Forest	Non-forested	Thermal; Plateau	Water	10
DEM - Slope	1 - 20 degrees	20 – 30 degrees	30 – 45 degrees	Greater than 45 degrees or less than 1 degrees	10
Human Density	Very Low	Low	Medium	High	30
Distance to Water	50m - 500m	500m – 1000m	1000m – 2000m	Greater than 2000m or Less than 50m	20
Road Density	Very Low	Low	Medium	High	30

Results

The least cost path analysis combined with a corridor performance evaluation allowed us to visualize the lengths that a wolf would go to get from North to South in Yellowstone National Park. It demonstrates that over a predicted route of 172km, the wolf would encounter many obstacles and avoid many threats to itself including people and road traffic.

This analysis and visualization allows us to become equipped to make informed decisions based for the protection of tourists and the Gray wolf species that inhabit this study area.

Traffic Density (30%) + Slope (10%) + Human Density (30%) + Landcover (10%) + Distance to Water (20%) = Cost Surface



Submission by Rylie Nellis of Fleming College 2020; ArcGIS Pro 2.5; Source: https://sagemap.wr.usgs.gov/listData.aspx: Landcover/1996; http://www.wsgs.wyo.gov/pubsmaps/gis: DEM, Placename, Park Boundary, Water, Road, POI/2016);