FEELING WINDED:
Wind Power Suitability in Slovakia

INTRODUCTION

Over the last decade, wind power has been implemented widely across the European Union. Wind energy made up 15% of the EU's electricity demand in 2019, and wind power capacity has increased both onshore and offshore. Slovakia is a nation that has yet to take advantage of wind power, despite the countries around it doing so. Slovakia is ranked second-to-last in installed wind power capacity among EU member states, while neighboring Austria and Poland rank among the top half of EU nations.

Figure 1. Map of Slovakian regions, with four largest cities.

A 2011 report stated that there are only 9 operational wind turbines in the country. There are certainly barriers to Slovakia committing to wind power, such as overall low wind speeds in the country; however, 25% of the country has wind speeds above 6 m/s, which is an accepted minimum wind speed for commercially viable wind power projects. This project looks at the potential for new wind power sites in Slovakia, in order to determine the most suitable areas.
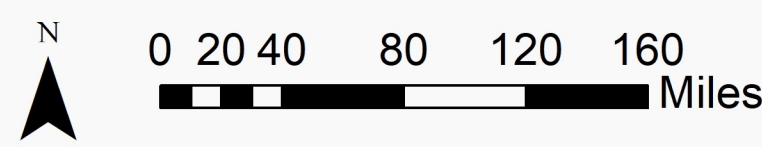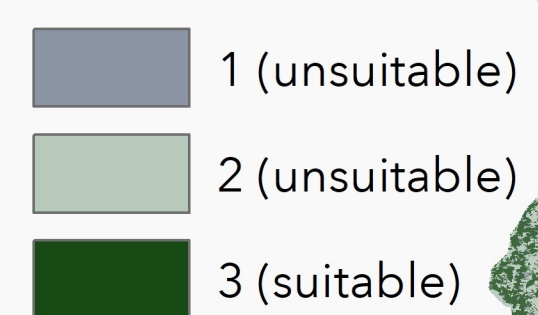
WIND SPEED

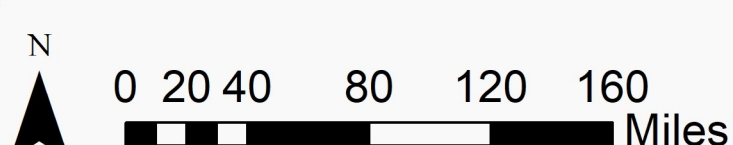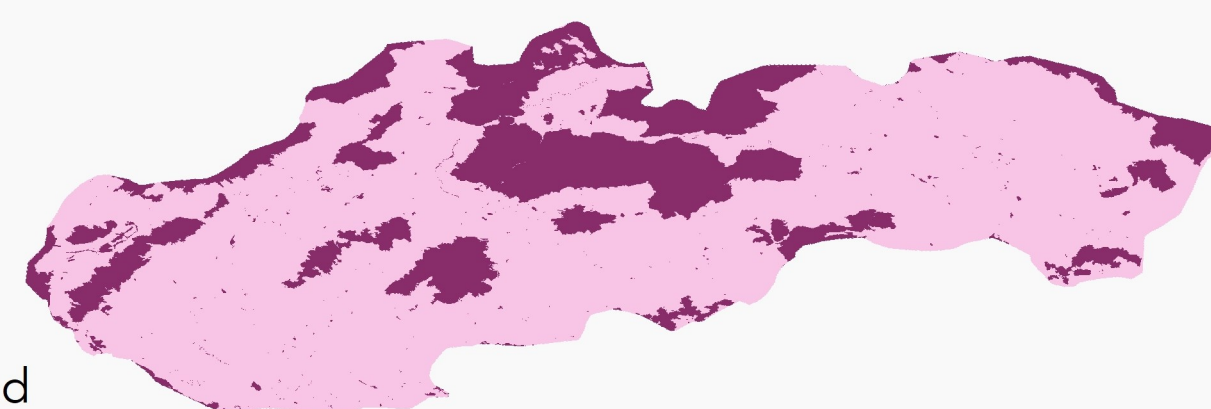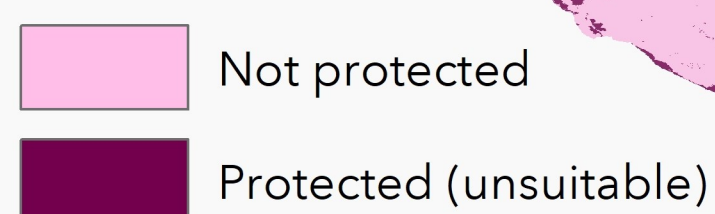Wind speed suitability
- 1 (least suitable)
- 2
- 3
- 4
- 5
- 6
- 7
- 8 (most suitable)
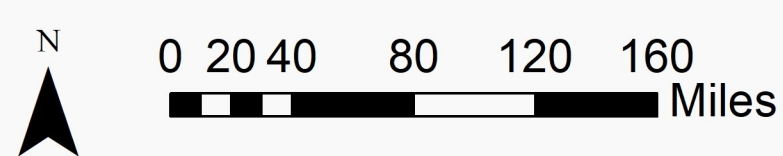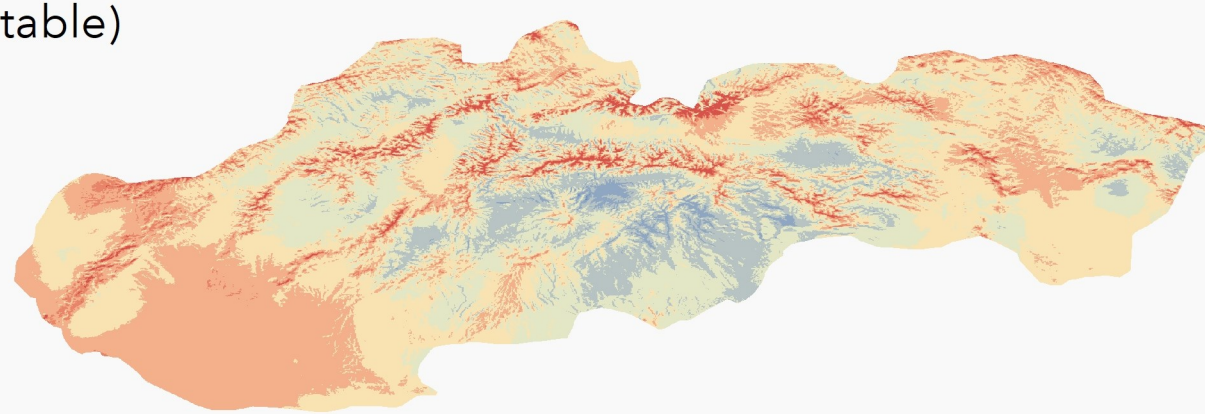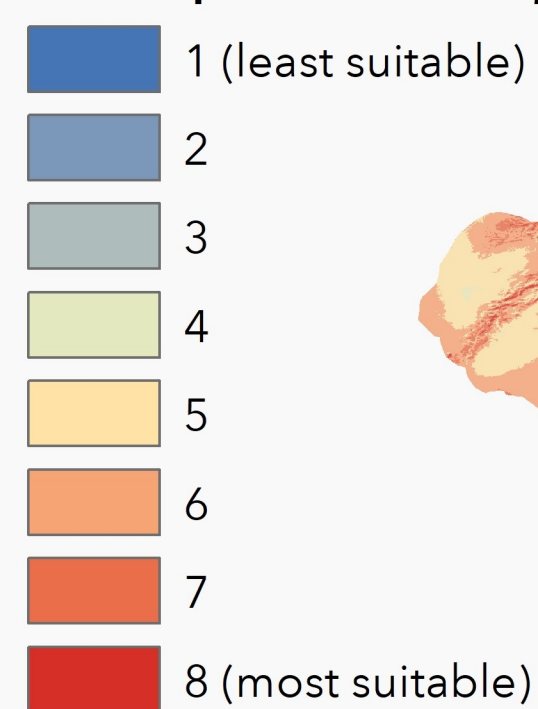
LAND COVER

Land cover suitability
- 1 (unsuitable)
- 2 (unsuitable)
- 3 (suitable)

PROTECTED AREAS

Protected areas
- Not protected
- Protected (unsuitable)

TRANSMISSION LINES

Distance to transmission lines
- 1 (suitable)
- 2 (unsuitable)
- 3 (unsuitable)
- Transmission lines

- Unsuitable
- Suitable
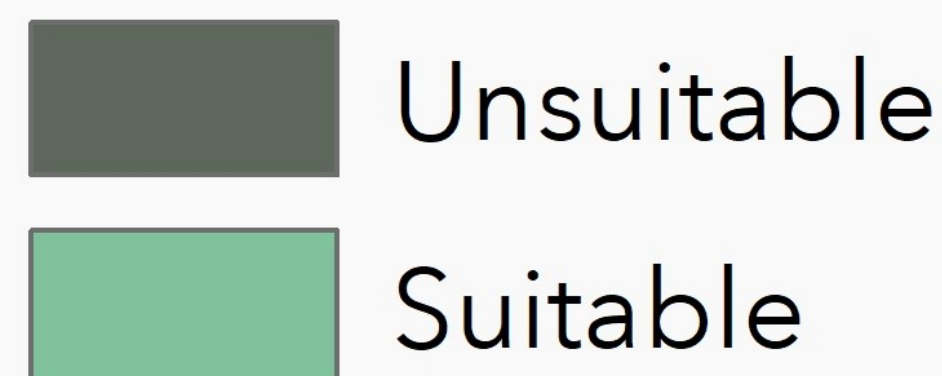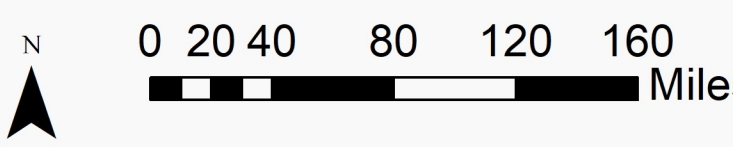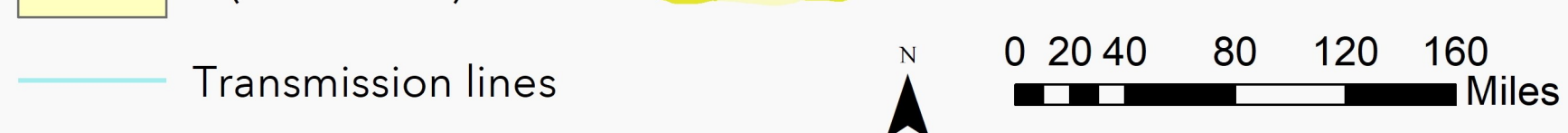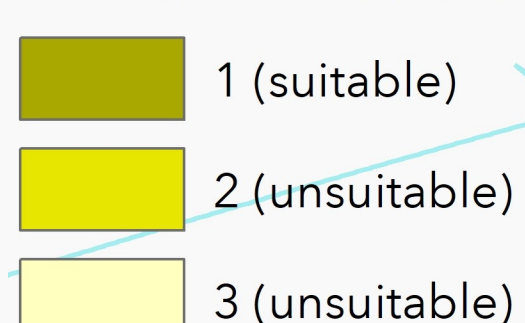
Wind speed (m/s)	Reclassified value	Percent of total area
0 - 2	1	0.003%
2 - 3	2	0.86%
3 - 4	3	9.33%
4 - 5	4	23.89%
5 - 6	5	35.67%
6 - 7	6	24.90%
7 - 8	7	3.83%
8 - 21.57	8	1.52%

Figure 2. Wind speeds in Slovakia.

METHODS

This suitability analysis was conducted in Modelbuilder, producing four reclassified factor maps as well as the final assessment.

1. Reclassify the wind speed raster into eight classes based on speed

2. Extract by mask on the land cover raster to match the wind speed raster extent, reclassify into three classes using metadata to determine which land cover types are suitable

3. Use the feature to raster tool on the protected areas shapefile, extract by mask on raster to match the wind speed raster extent, reclassify into two classes to distinguish protected and non-protected areas

4. Use the XY to line tool to turn transmission line tabular data into line data , use the Euclidean distance tool to find each pixel's distance from transmission lines, extract by mask to match the wind speed raster extent, reclassify into three classes based on distance

5. Use raster calculator to find most suitable sites based on reclassified values, where wind speed > 5, land cover = 3, non-protected areas only, transmission line distance = 1

6. Use majority filter tool with 8 neighbors to remove optimal areas that are too small

RESULTS AND CONCLUSIONS

According to this suitability analysis, around 9% of the country's area is suitable for wind power installations. The largest suitable area for wind power sites is in southwest Slovakia, fairly close to the capital Bratislava. This area could power the largest city in the country and smaller cities and villages around it. There are other smaller suitable areas, like in eastern Slovakia, near the second-largest city, Košice. There is potential for the country to catch up to some of its neighbors and move out of its extremely low ranking for wind power capacity in the EU. Further analysis of wind power potential in Slovakia could focus on financial implications, such as determining which areas would benefit most from the employment created by these installations, and lower electricity rates.

Figure 3. Dobrá Voda village, Trnava region (western Slovakia).

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Projection: GCS_WGS_1984

References:

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