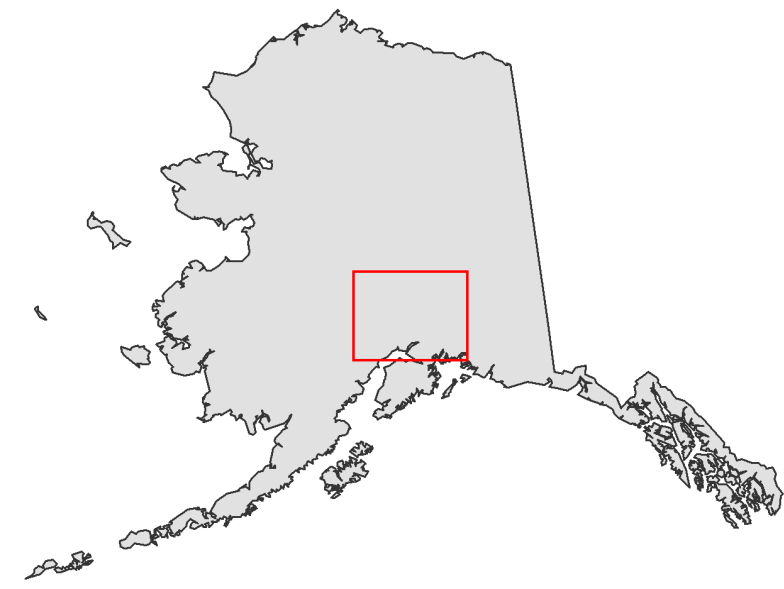# Finding Suitable Locations for Wind Turbine Farms in the Mat-Su Borough, Alaska

Project Description

This project is a wind turbine suitability project in Alaska, specifically, for the Matanuska-Susitna (Mat-Su) Borough. Alaska is blessed with peaks, valleys and coasts that create massive wind flows. However, because of Alaska's natural beauty many environmentalists and residents oppose wind projects that would destroy the beautiful views as well as the flora and fauna including forests and wetlands. Likewise, accessibility is also a large deterrent in establishing wind farms throughout Alaska because of the lack of road infrastructure throughout the state.

The project is to find the most suitable areas for wind turbine farm projects in the borough given certain criteria. Primarily, the analysis addresses the NIMBYism (Not In My BackYard) of wind farms within a defined set of criteria taking the social issues into consideration including the belief that the turbines cause both visual and audible noise and are associated with certain health issues. These specific criteria are:

· Not located in National or State Parks
· Classifications and restrictions of land cover
· Wind speeds consisting of NREL's (National Renewable Energy Laboratory) Classes 3-7
· Distance to roads for construction and maintenance
· Distance away from airports
· Avoidance of steep slopes
· Distance from developed lands

The size of the wind farm would be greater than 100 acres because NREL deems 1 turbine requires at least 0.25 acres making 1 acre available for 4 wind turbines.

The pictures below explain the opposition views in the Mat-Su Borough. In the photo on the left, only a single turbine still obstructs the scenic view in Mat-Su. The photo on the right, taken in Texas, is on farmland not in scenic views.

Photo: Jason Meyer of Alaska Center for Energy and Power

Photo: Jeremy Hsu of POPSCI

Methodology

The project uses the entire Mat-Su Borough for the analysis area. The first step was to select relevant wind speeds not located within parks by using the select by attribute and location tools. NREL classifies wind classes 1-7, with classes > 3 sufficient for wind farms of larger sizes. Wind classes > 3 were selected. The land cover data set was used for land cover and to extract a developed land layer. The elevation data was obtained in 4 files. By using the mosaic tool, one raster file was created. The spatial analyst tools were used to perform spatial and reclassification analyses of distance to roads, distance from developed areas, distance from airports, slope, relevant wind speeds, and land use classifications. For reclassifications, it was necessary to assign values 1-5, which remained the same for each input criteria, 5 always being the best scenario, 1 always being the worst scenario. The weighted overlay tool was used to perform an equal weighted analysis and determine the best sites that include all of the 6 input criteria. Finally, the analysis was completed by applying the grouping tool to find raster cells (areas) next to each other to determine areas over 100 acres. Using a combination of this tool, the field calculator and converting the output into acres, the analysis yielded results that indicate the most suitable sites for wind farms in significance order.
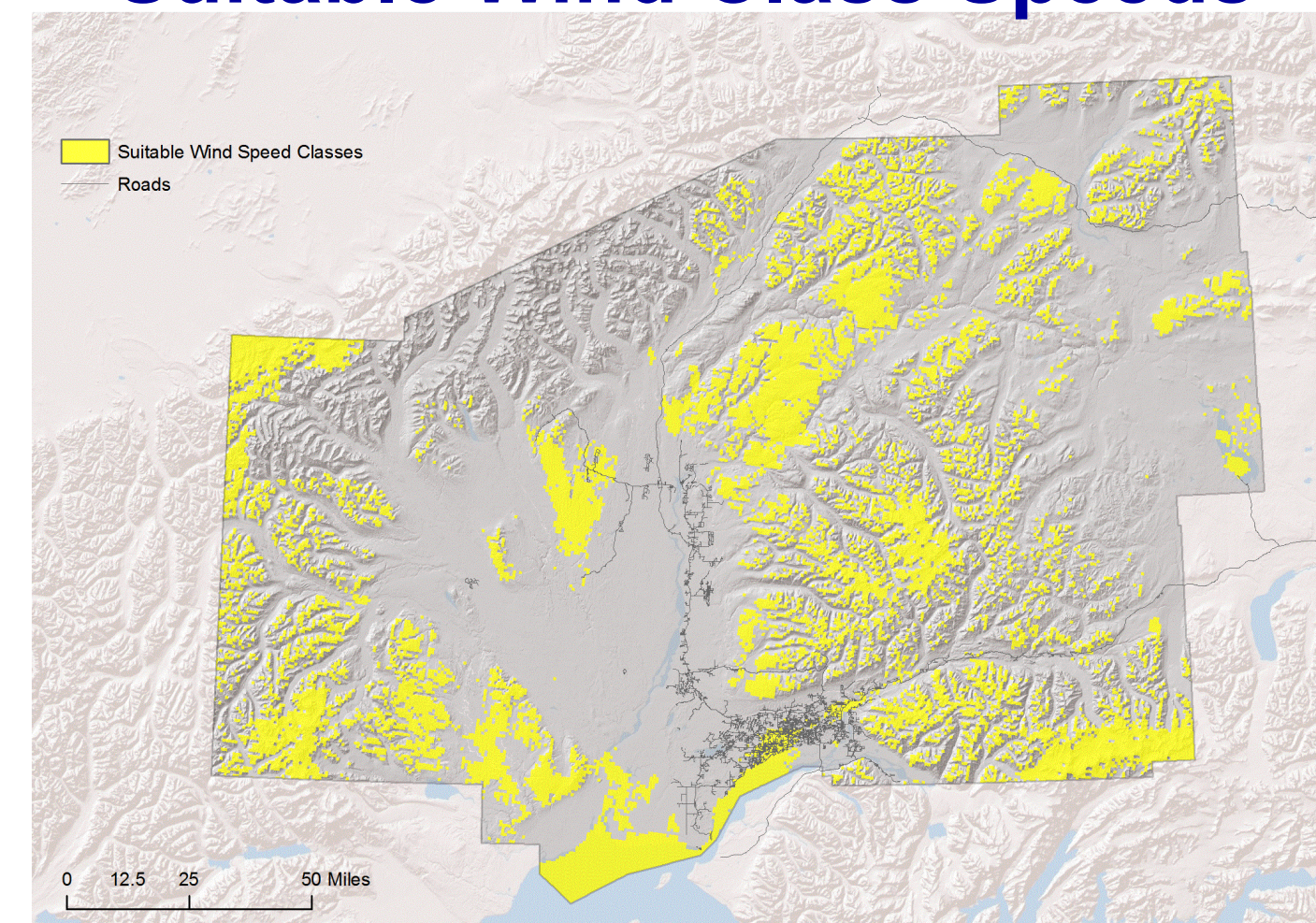
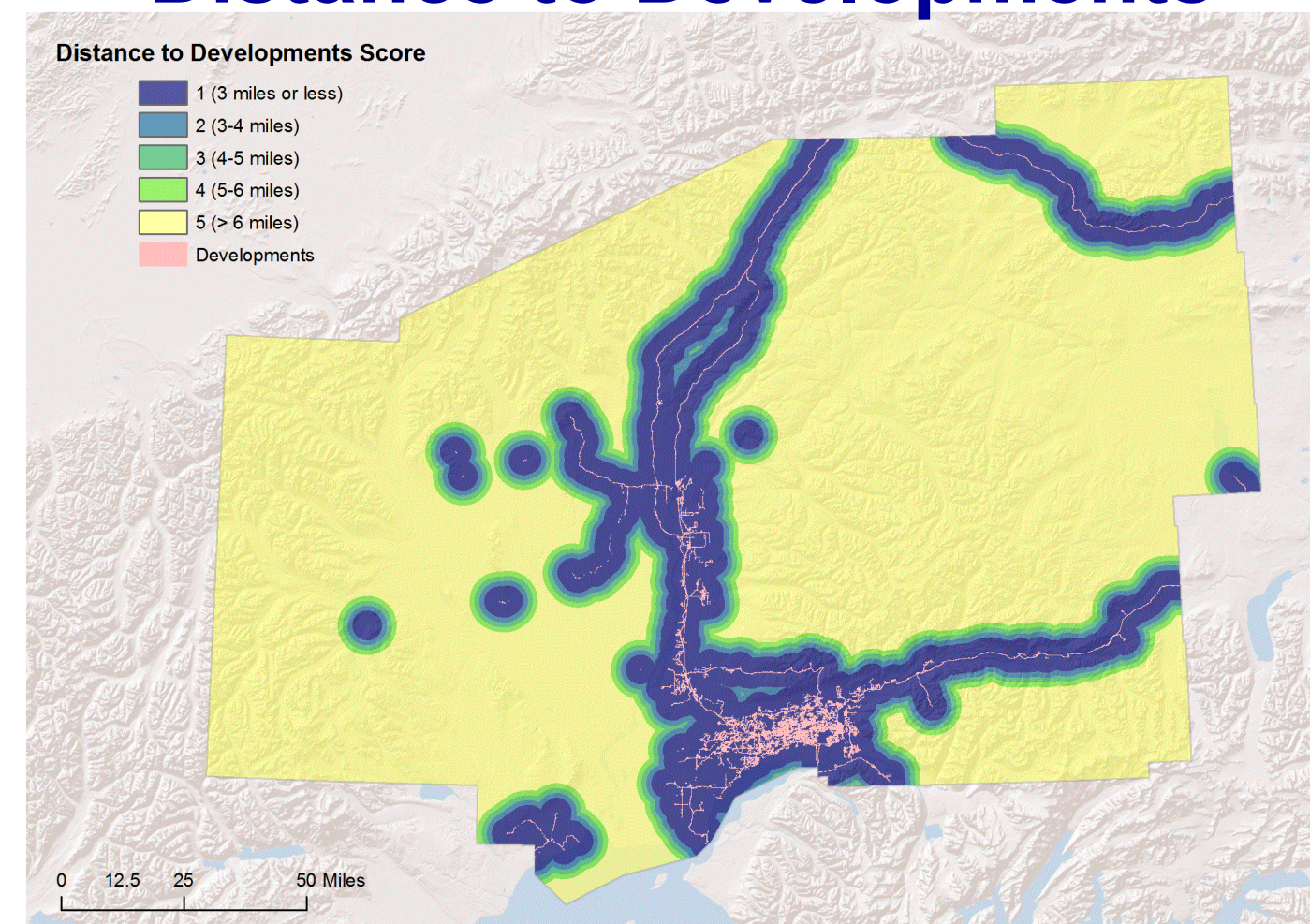## Suitability Criteria Input Maps

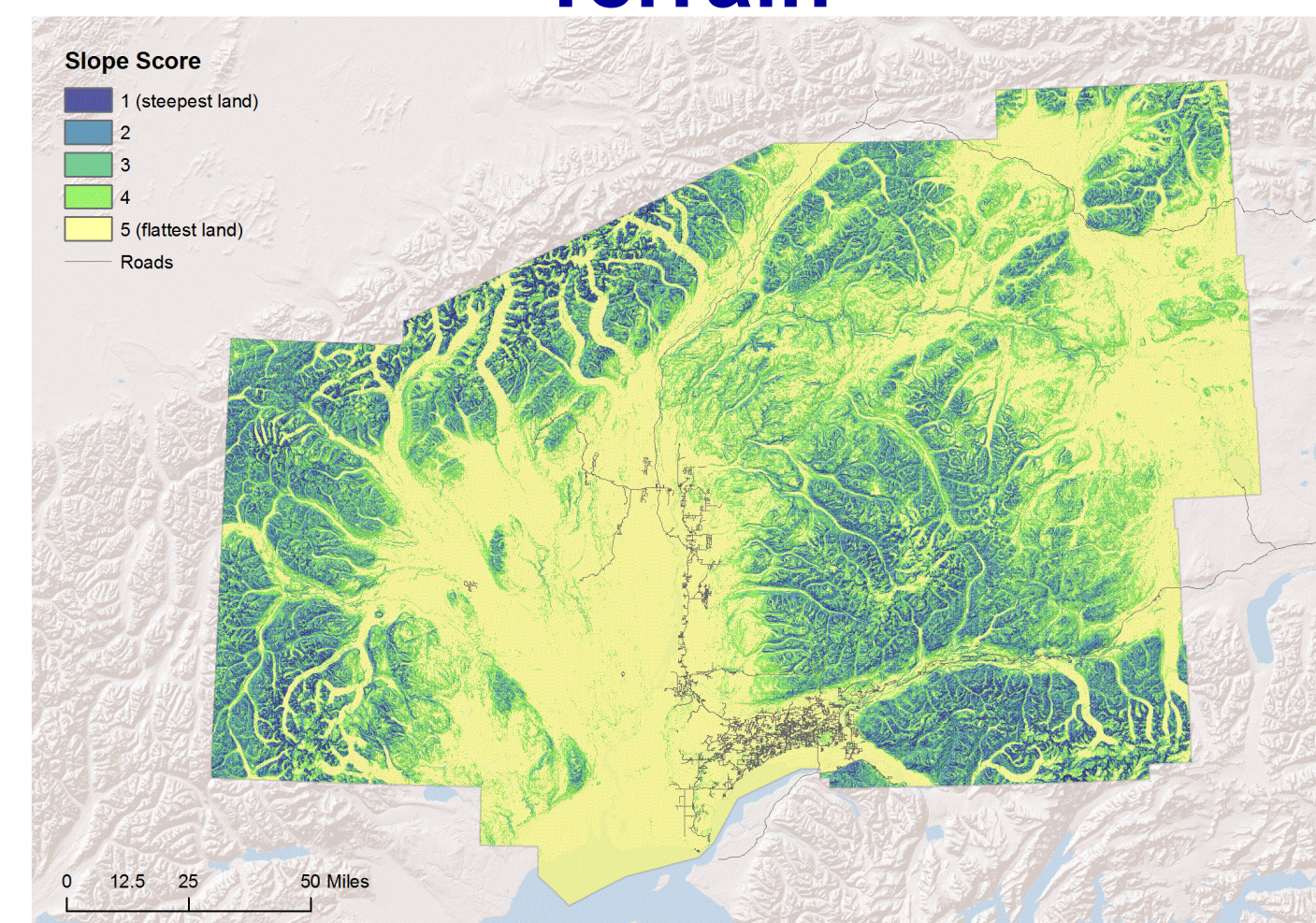### Distance to Airports
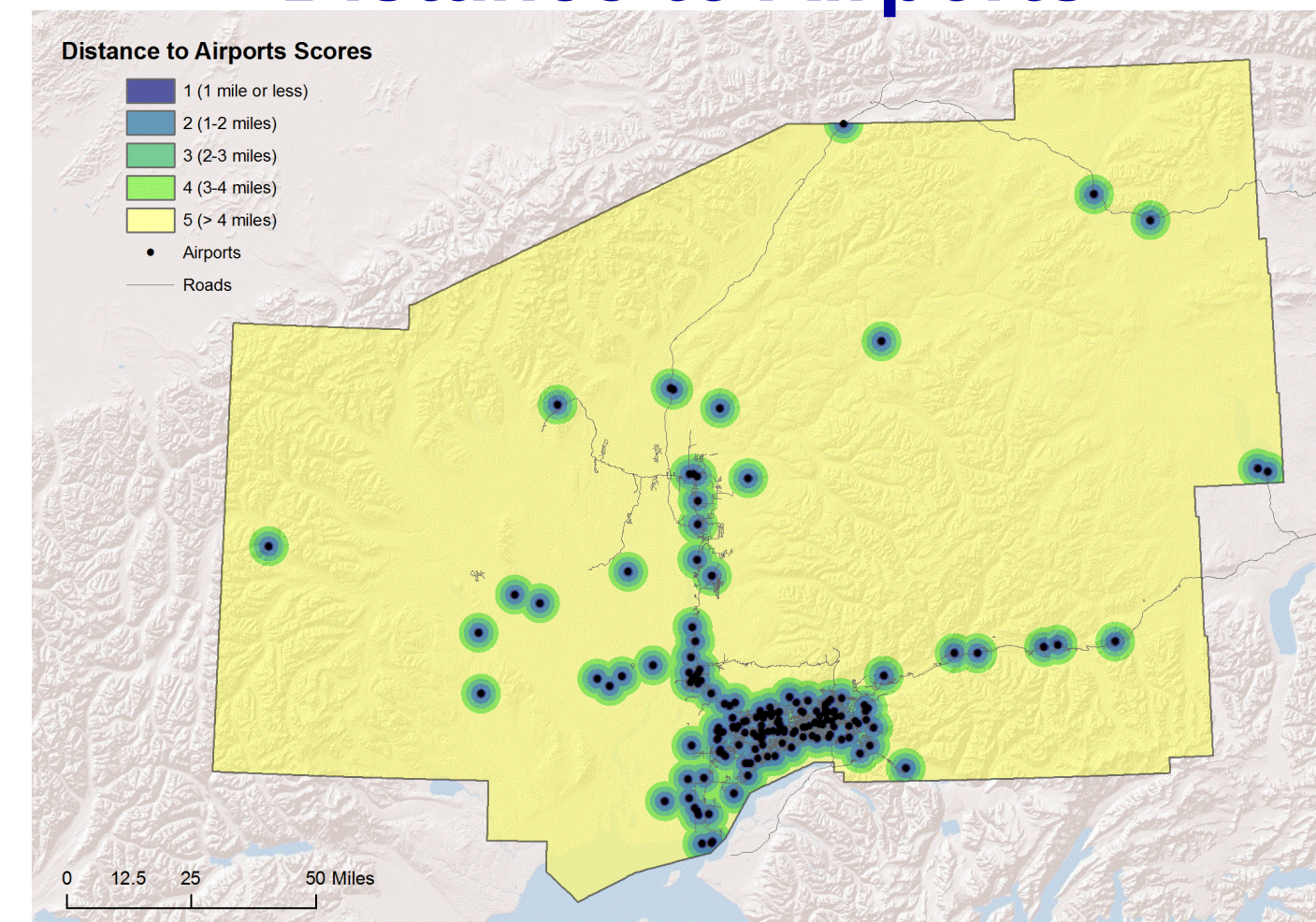
Distance to Roads
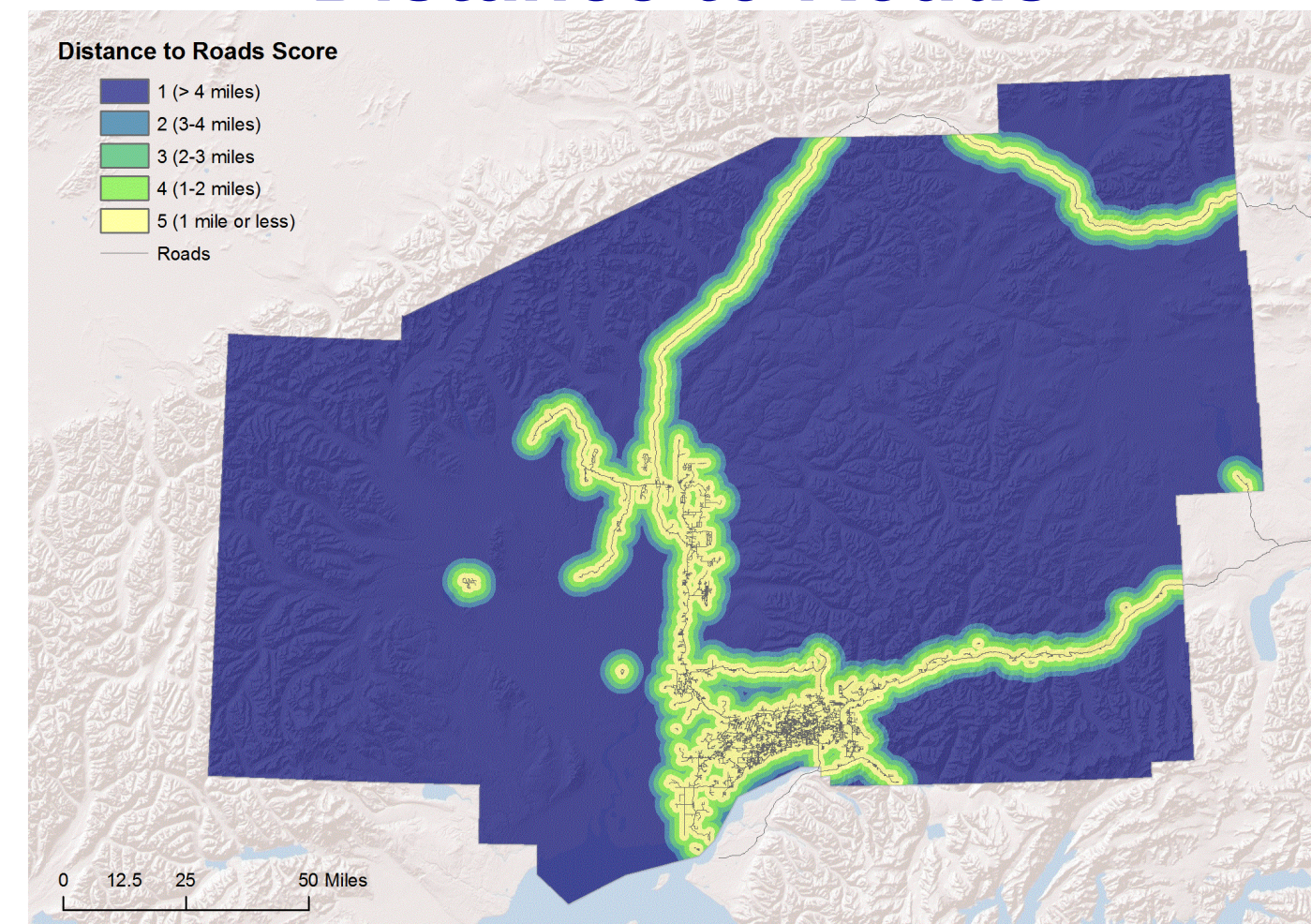
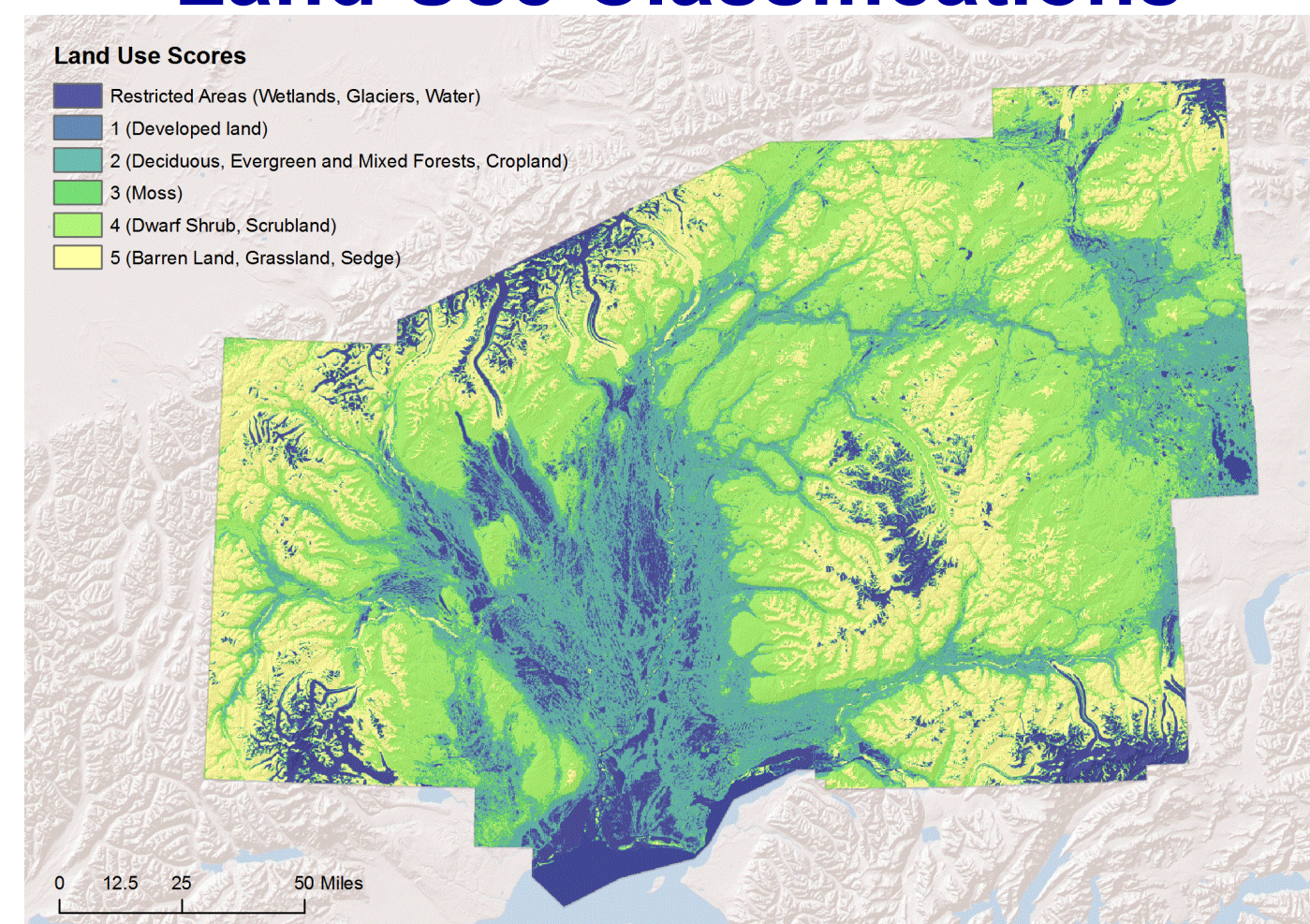### Suitable Wind Class Speeds

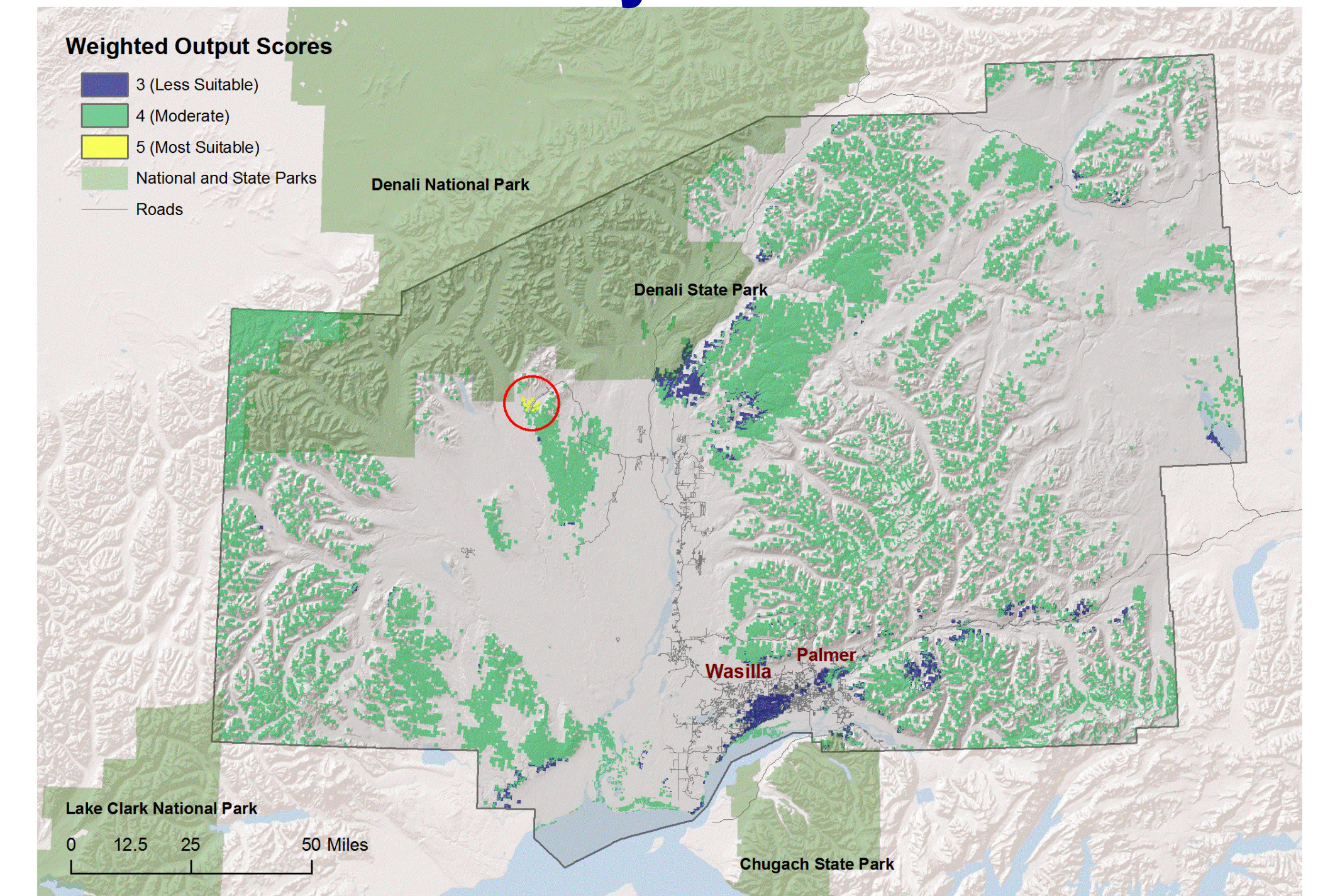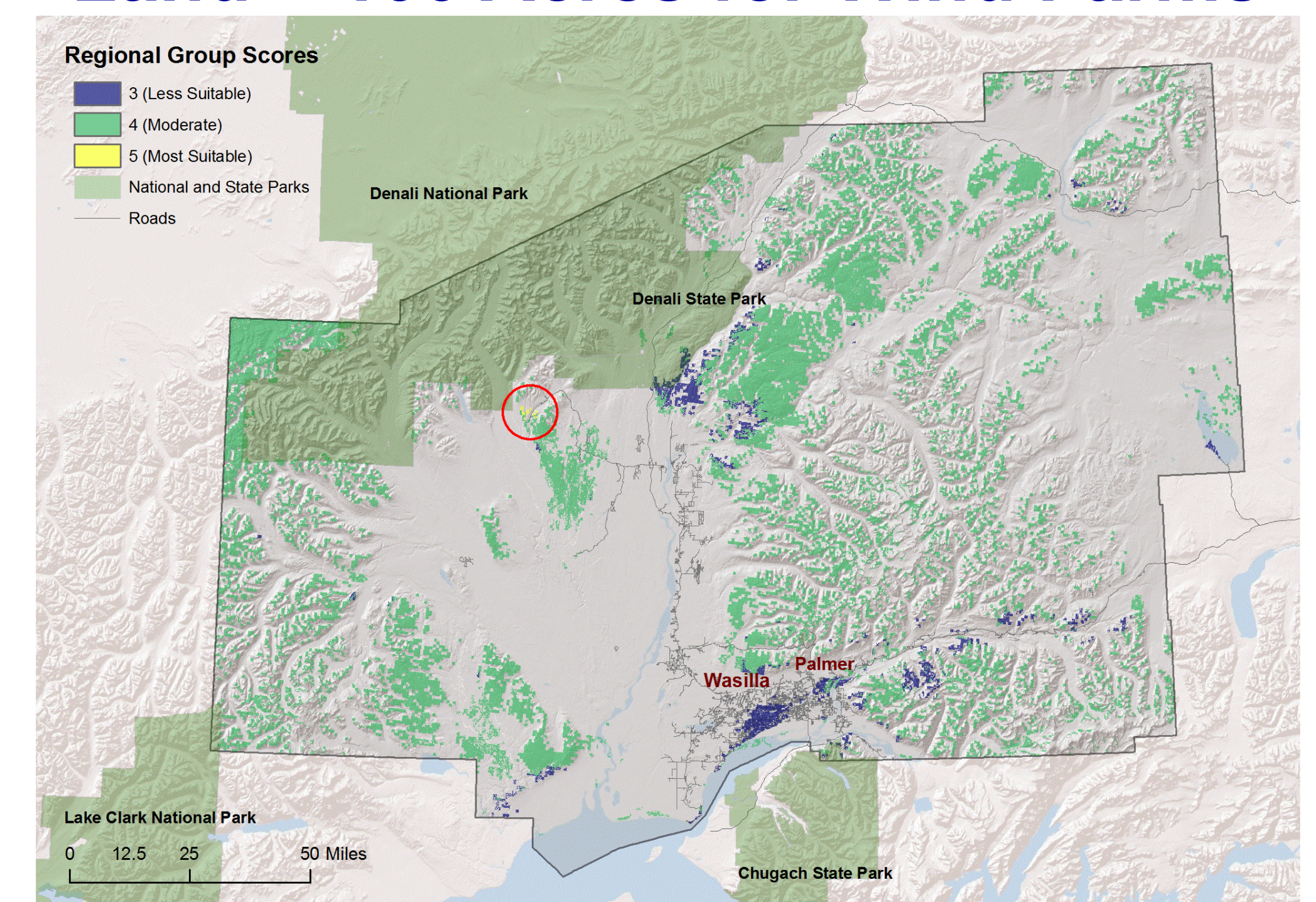### Distance to Developments

Terrain

Land Use Classifications

Land Suitability for Wind Farms

Land > 100 Acres for Wind Farms

Results

This project shows the difficulty in locating a suitable wind farm site while addressing the NIMBY criteria. The best site that addresses all of the criteria is located far from the most developed areas and is shown above circled in red. The project does not address the utility aspect that would be necessary to transfer the stored energy to more populated areas and thus would only be beneficial if the wind energy were used relatively close to the wind farm site. It is possible to use the weighted overlay tool to assign different weightings to obtain more sites; for example, less weighting for distance to developed land. However, doing so would not be addressing the NIMBY factors. Clearly, there are many high wind areas, but they do not meet the project's criteria primarily due to spatial isolation.