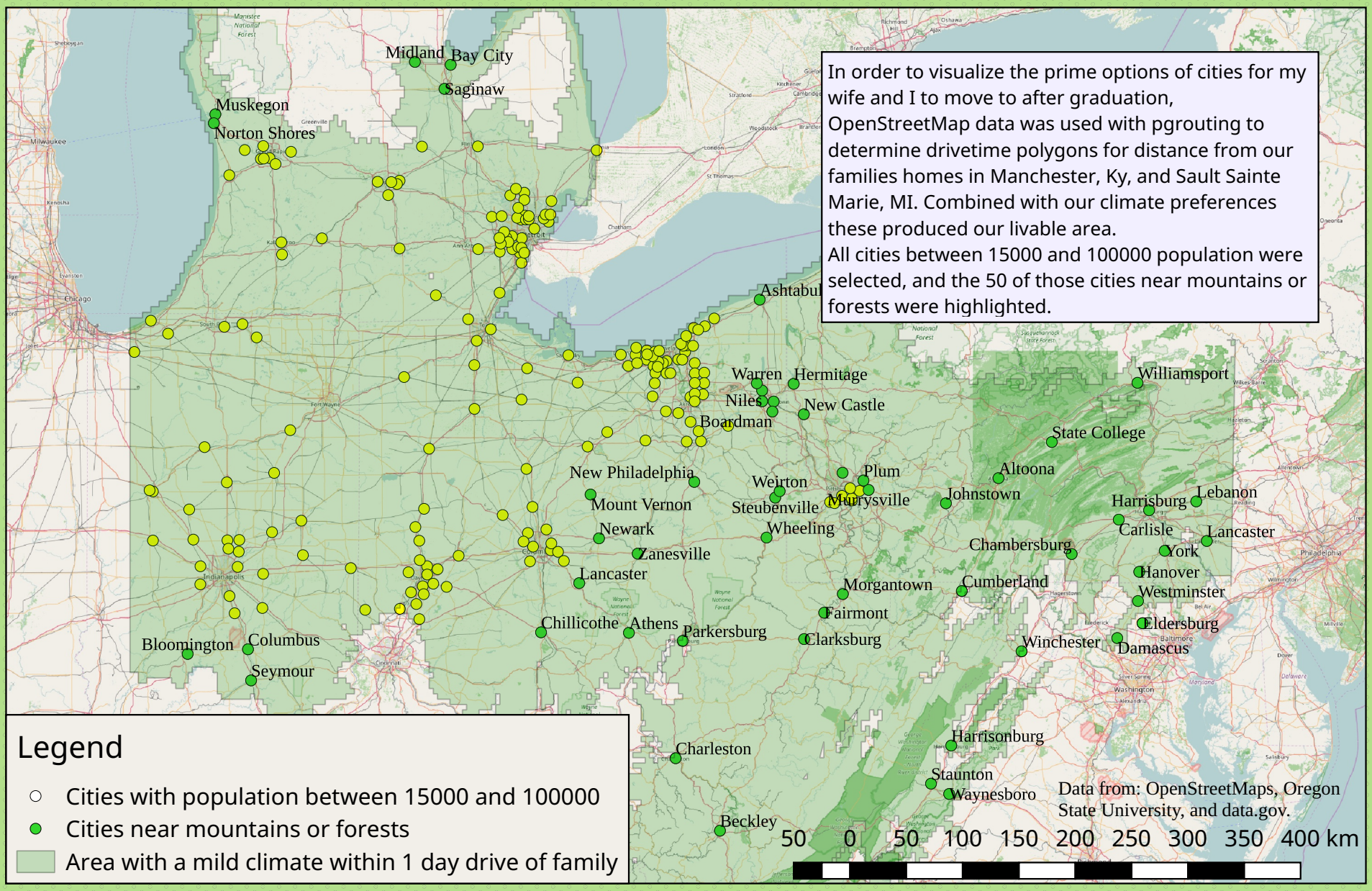
Possible Cities to Move to After Graduation



Joel Newswanger

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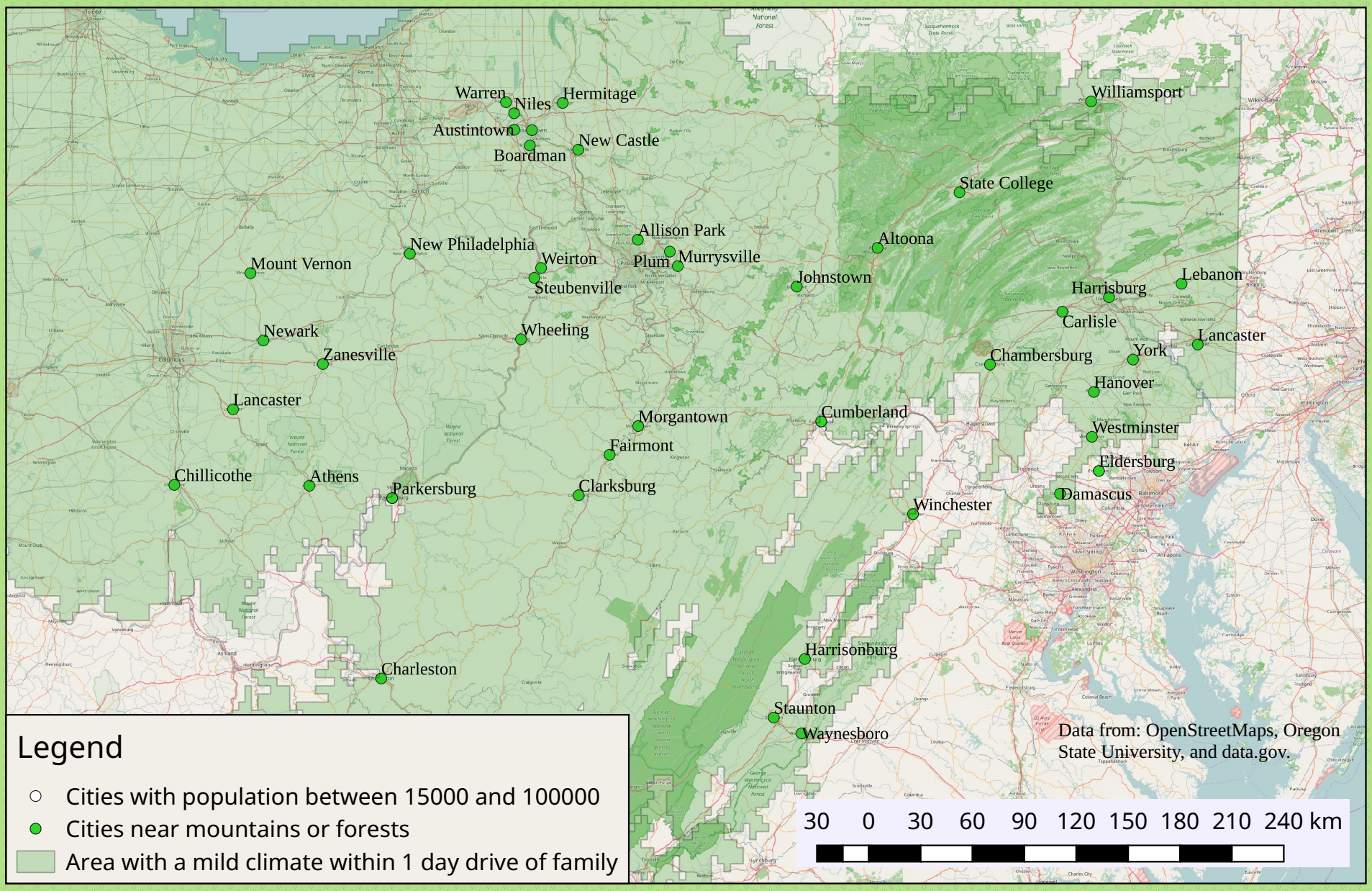

Joel Newswanger

Report on GIS Final Project

Where to Go?

Joel Newswanger

Introduction:

My fiance and I do not know where we should live after I graduate from Calvin and we are married. Her parents live in the Upper Peninsula of Michigan and mine live in southeastern Kentucky, and neither of us want to live more than a day's drive from our family. We both agree that we do not want to live anywhere where the average annual high temperature is higher than 85, or the average annual low temperature is lower than 15. We would prefer to live within 30 miles of mountains and forests. We want to live in or near a city/town with a population of at least 15,000, and no more than 100,000.

Problem:

We have no way of visualizing our options, and cannot decide where to live. I need to create a way of reviewing our options so that we can look for jobs and housing in the areas we find. This will greatly ease the process of beginning our lives together.

Objectives:

My objectives were to create a map that,

1. presents areas,
    a. within 1 day's drive from my parents house AND within 1 day's drive of my fiance's parent's house,
    b. that have a climate that on average does not exceed 85, NOR drop below 15,
2. highlights areas within 30 miles of mountains OR forested areas,
3. identifies cities/towns with a population between 15,000 - 100,000.

Methods:

I downloaded the entire OSM network for North America, when extracted, a file of 200GB. I attempted to use the osm2pgrouting tool to import this file into a PostgreSQL database. The osm2pgrouting tool must hold the entire file it is loading in memory, and my laptop only has 8GB of RAM, so it crashed. In response to this challenge, I wrote a python script that wrote and executed BASH commands to osmosis, which is a program capable of manipulating .osm files, to chop the portion of North America that I needed into thirty pieces that would fit in my computer's RAM, and wrote and executed the thirty separate osm2pgrouting

BASH commands necessary to load them all into the database. This script took about 48 hours to complete its tasks, and I ran it about three times before I worked out all the kinks.

I then used pgrouting to calculate the distances from the both our parents houses to all others points in the database. There were 10,000,000 ways in the database so again my computer was overwhelmed. I wrote another python script that selected an evenly dispersed half a million of the points and wrote and executed the BASH commands to compute 400 of them at a time.

The resulting tables of distances, then needed to be recombined with a table holding the geography of all the points. After much research, trial and error, I learned the necessary SQL queries to accomplish this. I then imported the database into QGIS, and displayed the results with a graduated color ramp based on distance. The results looked correct, so I selected features from the attribute table using an expression to select all the points within a day's drive of both start points. I saved these as a new layer that delineates the area that meets the driving distance criteria.

I downloaded raster maps of the average january low, and average July high temperatures from Oregon State University. I selected the area that did not on average rise above 30 C nor drop below -9.444 C and was within the driving distance criteria. I saved this area as a new layer that delineates the "habitable zone".

I downloaded a map of cities including their populations from data.gov. I selected all cities between 15,000 and 100,000 population that were located within the habitable zone and saved these as acceptable cities. I then downloaded delineations of the mountains of the east coast, and forest cover of the us, created buffer zones and selected all the cities near to a forest or mountains. I saved these as a new layer.

Results:

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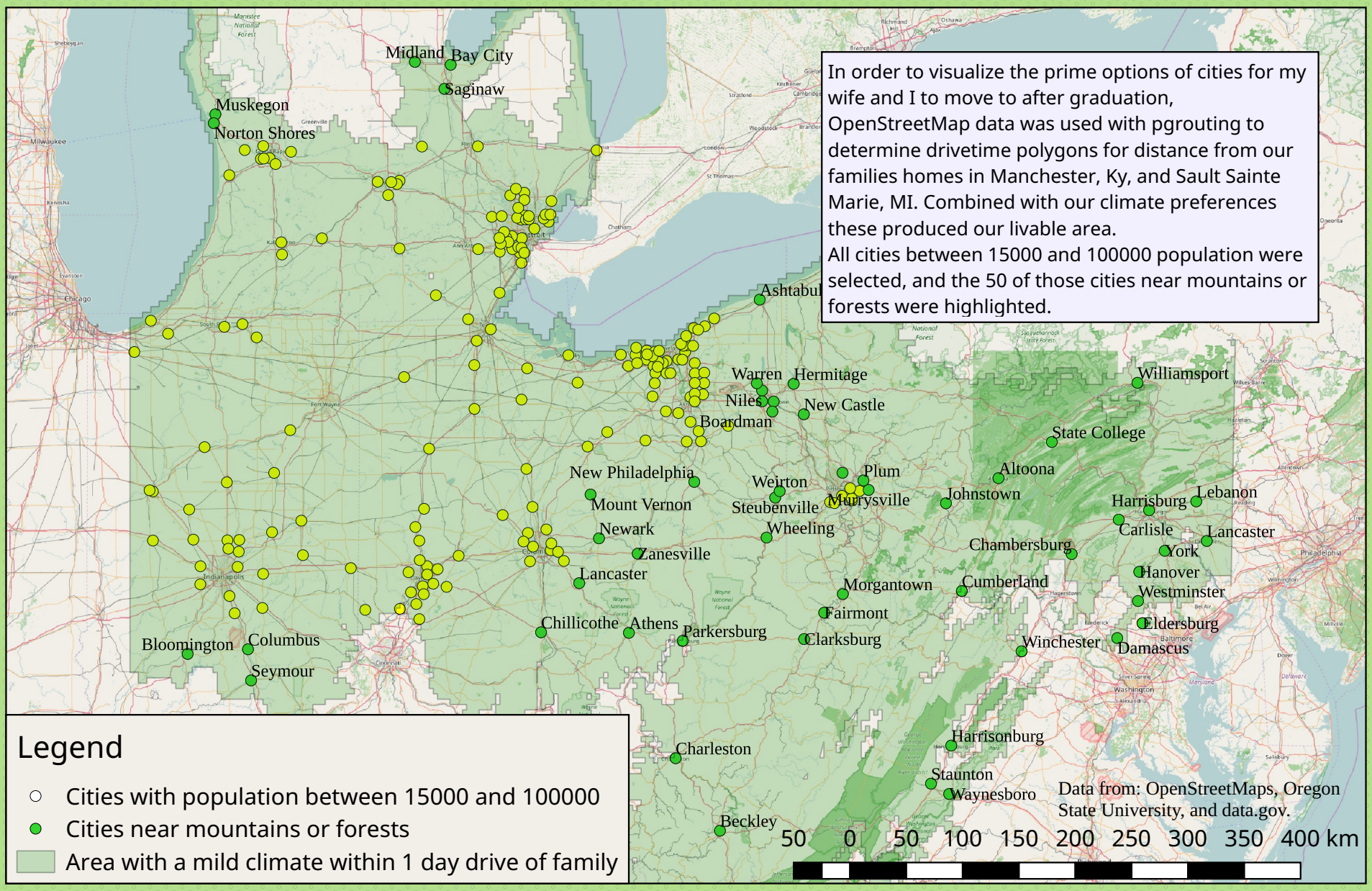

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The results were a layer of ~ 300 cities that were habitable, and 54 that met all the criteria. The prefered locations were clustered in PA, and WV, where mountains provide the climate and environment that we desire. Eastern OH had several good options, and MI around the shores of the great lakes had a few. Noticeable features include the rise in temperature due to the metropolitan area of Cincinnati that excludes it from the habitable zone, the milder temperatures near the shore of the great lakes, and the absence of anything interesting in the Ohio, Indiana, Southern Michigan area.

Conclusions:

I can look for jobs in the cities of Johnstown, Altoona, Chambersburg, State College, Harrisburg, Carlisle, York, Hanover, or others in PA and WV, where we have some family and friends in addition to the criteria of the map.

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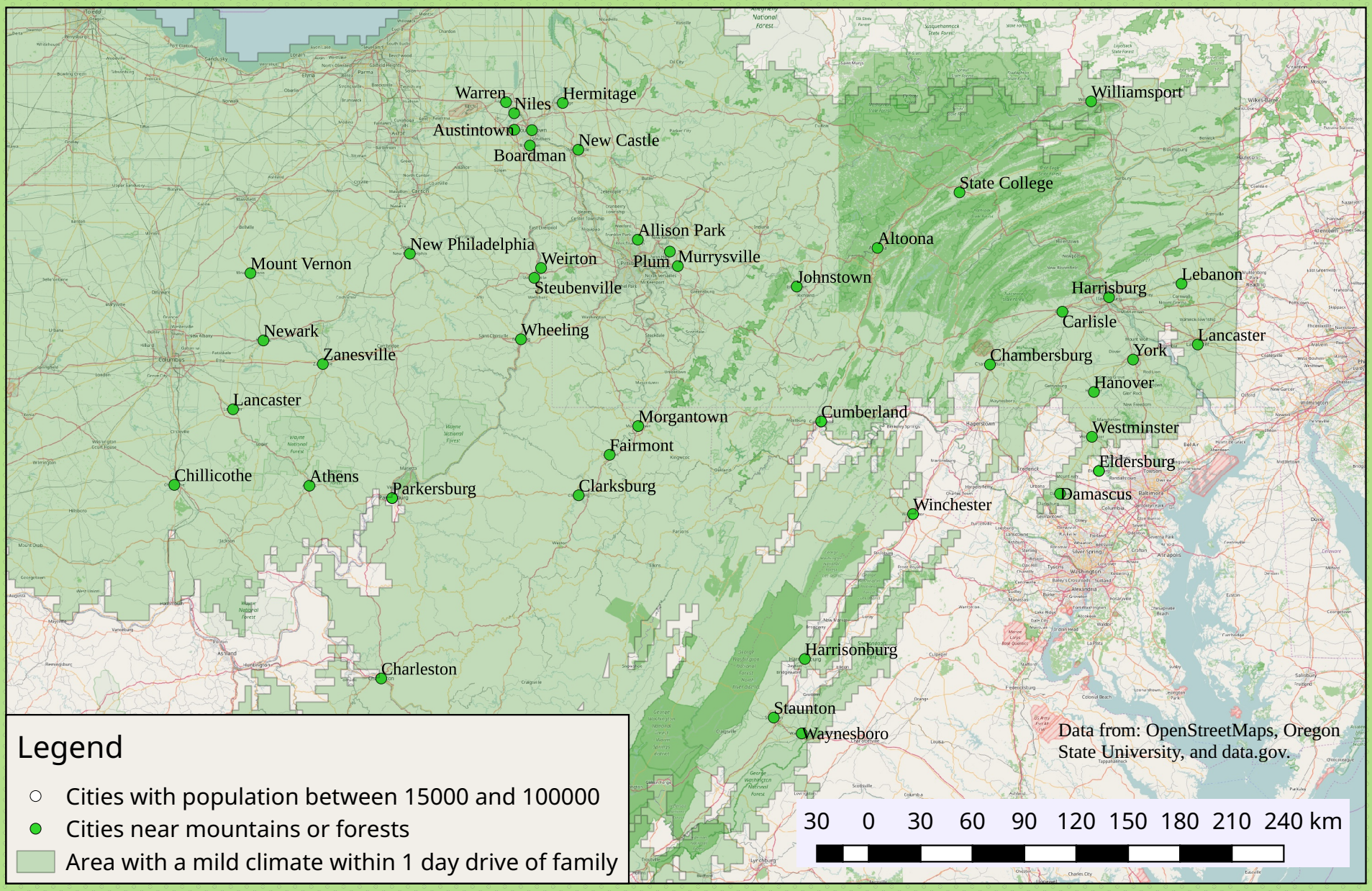

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References:

Data.gov
Oregon State University
OpenStreetMaps
Calvin College