Optimal Areas for Backcountry Skiing in Maine

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Abstract

This analysis identifies optimal areas for backcountry skiing in Maine using the following six parameters: elevation, distance to roads, average annual snowfall, aspect, slope, and population density. The most suitable areas correlated well with locations that were ski areas in the past, were once considered for ski area development, or are currently used for ski touring.

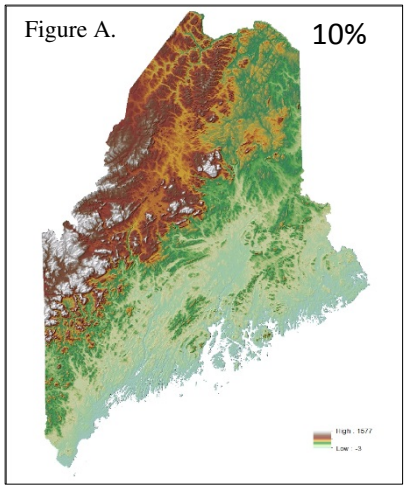
Introduction

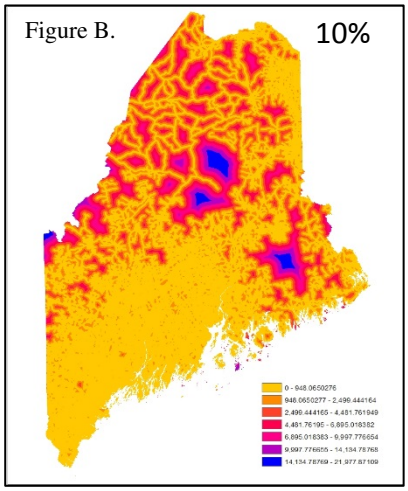
The recreation of backcountry skiing is becoming increasingly popular as people want to escape the crowds and prices of ski areas, explore new and interesting terrain, and get a better workout. From an environmental perspective, backcountry skiing also greatly reduces personal impact on nature, while still allowing people to enjoy the activity. Ski touring involves hiking unmanaged mountains for the purpose of backcountry skiing. With the huge amount of potential backcountry terrain in Maine in mind, we set out to determine the optimal areas to ski tour within conserved land using only geographic information systems (GIS) and analysis. We accounted for a variety of factors, including elevation, distance to roads, average annual snowfall, aspect and slope of the mountain, and population density, as indicators of an ideal location for skiing.

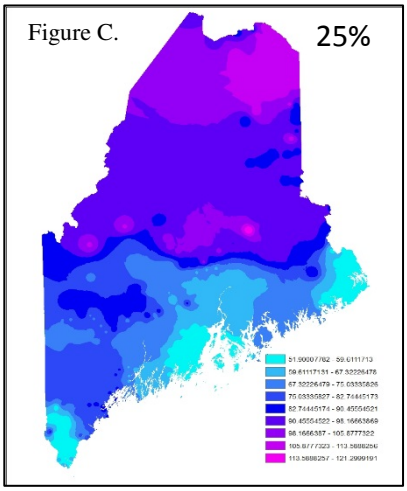
Methods

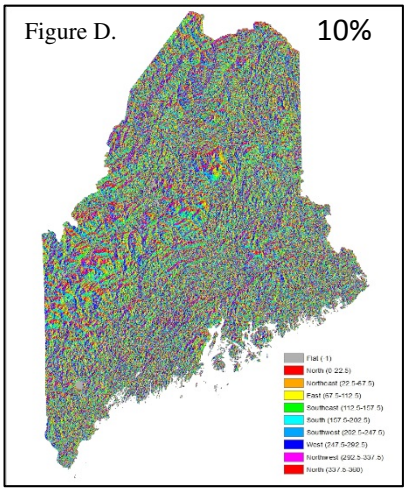
We used ArcGIS(ESRI) with data acquired from the Maine Office of GIS and the National Oceanic and Atmospheric Administration projected using NAD 1983 UTM Zone 19N to create our map. The digital elevation model (DEM) was created using data from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). Using the DEM, we determined hillshade, aspect, and slope with their respective spatial analysis surface tools. We created another layer showing the distance of land from roads by Euclidian distance. Next, we converted a census block population density layer into a raster. In order to create the snowfall layer, we created a data set using average annual snowfall for over 350 towns in Maine and their respective geographic coordinates. This data was converted from individual points into a raster and then interpolated using inverse distance weighted technique. We then reclassified all data to a uniform scale and created weighted overlay, assigning an individual value to each of our variables out of 100 percent. This overlay of variables is designed to show a Suitability Index for skiing. Values were given based on importance to skiing quality and convenience to potential skiers.

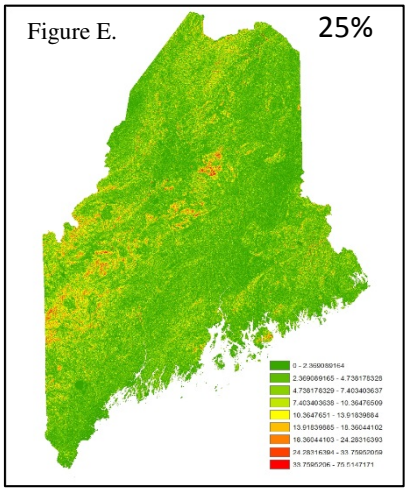
Results and Discussion

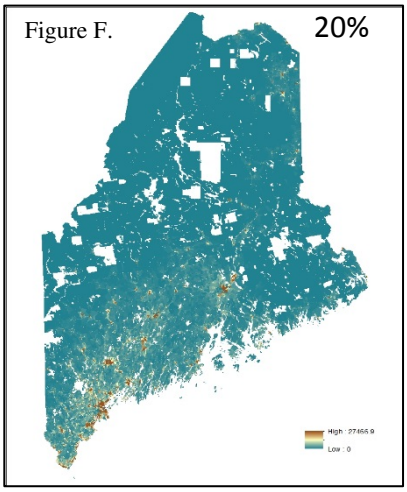












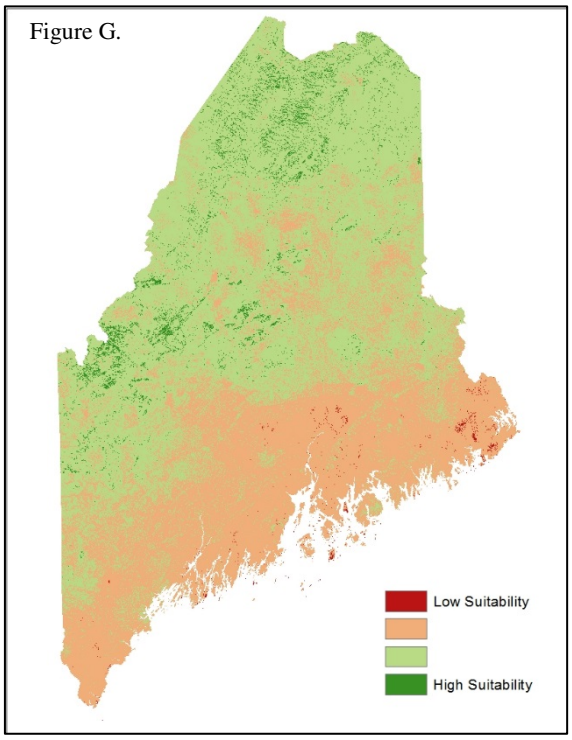


Figure A: Elevation (meters)

Figure B: Distance to Roads (meters)

Figure C: Average Yearly Snowfall (inches)

Figure D: Aspect (degrees)

Figure E: Slope (degrees)

Figure F: Population Density (population per km^2)

Figure G: Suitability Index

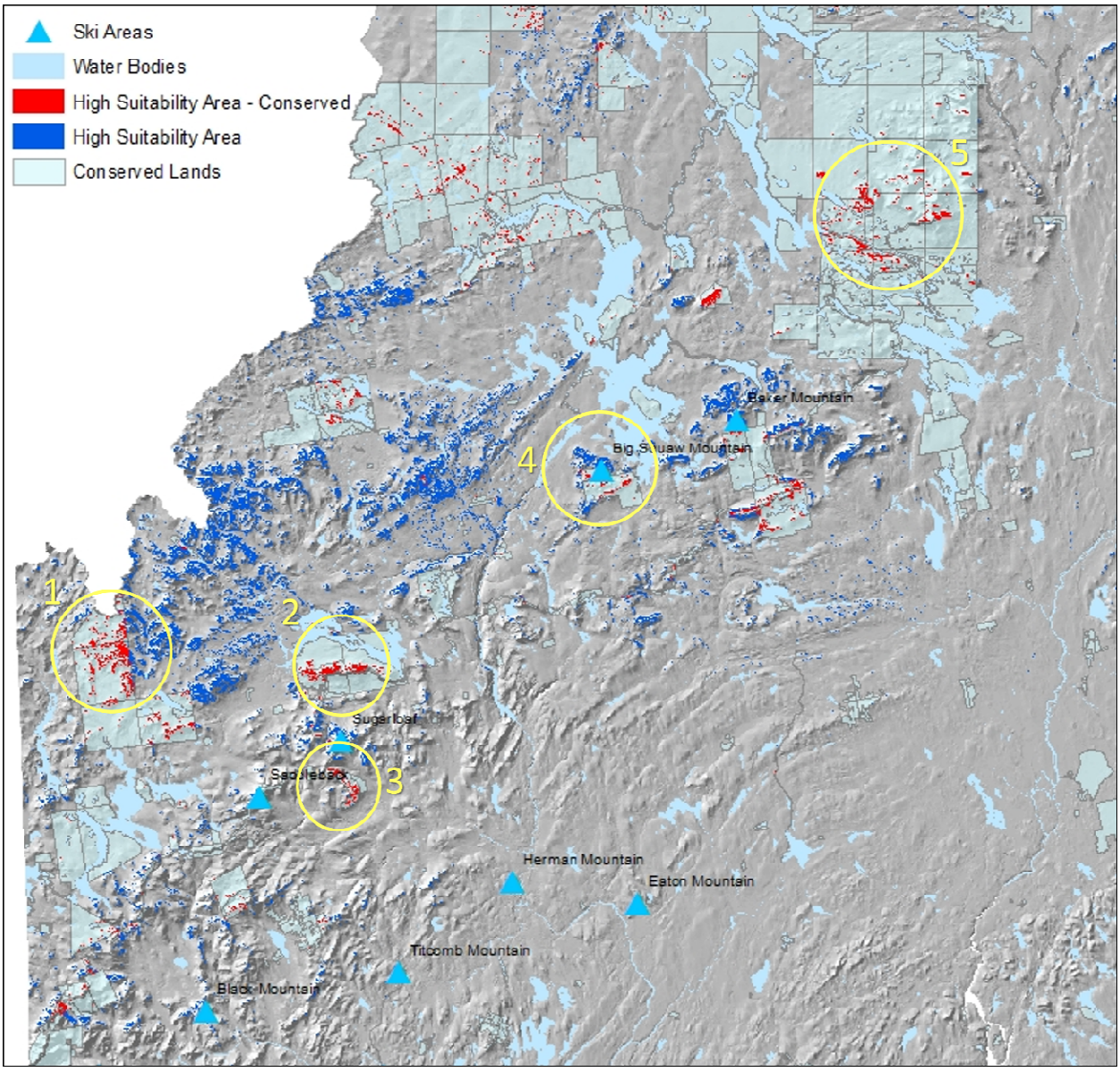


Figure H: Inset Map of Most Optimal High Suitability Areas

1) Snow Mountain, Kennebago Divide, & White Cap Mountain - Nearly in Canada, these peaks lie in the protected Pingree Easement.

2) Bigelow Mountain - A small range of steep mountains along Flagstaff Lake, once seriously considered for a ski area and now used for backcountry skiing.

3) Mt. Abraham - Previously considered as an area for Olympic skiing, this mountain south of Sugarloaf is now protected

4) Big Moose & Little Moose Mountains - Newly defunct Big Squaw ski area offers conserved terrain along Moosehead Lake. Ski touring is currently very active in the area.

5) Mount Katahdin & Surrounding Peaks - At the heart of Baxter State Park, Katahdin is the tallest mountain in Maine with challenging terrain to match and another common mountain for backcountry skiing.

The Suitability Index Model we derived for optimal skiing areas was created after determining the impact each factor should have. We found the most important factors for skiing to be slope and snowfall, giving each a weight of 25%. We gave population density a 20% weight to restrict results to more inhabited areas. Aspect is important as north-facing slopes retain more snow, having less direct contact with the sun in winter months. Shorter distance to roads helps assure an easier hike for skiers. Higher elevation usually makes for colder temperatures, thinner forests, and longer snow retention, all important factors to skiing. We gave each of these three variables weights of 10%.

The suitability index found an area of 2,335,780.82 km^2 to be highly suitable. We expected such a huge area, as Maine has a great deal of mountains. However, much of this area is used for timber or otherwise inaccessible. We concluded that restricting the optimal skiing areas to conserved lands would eliminate this issue and increase likelihood of existing trails for hiking and skiing down. The area of highly suitable land within conserved areas is 357,586.52 km^2, which is 3.08% of the total conserved land in Maine.

As a way to see the accuracy of our model, we compared the high suitability areas to the established ski areas of Maine. We ignored small ski areas in more urban or coastal areas, as their construction was likely determined primarily by population centers and convenience. Sugarloaf, Sunday River, Saddleback, and the recently closed Big Squaw all fall within high suitability areas, suggesting an applicability of the model. Upon assessing several large conserved high suitability areas, listed above, we found that many were once considered for ski area construction or have established ski touring operations nearby.

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