Hiking Difficulty Along the Appalachian Trail

A vulnerability analysis of the Appalachian Mountain Range

Background

What is the Appalachian Trail?

The Appalachian Trail is a marked hiking trail along the Appalachian Mountain Range in the eastern United States extending from Springer Mountain in Georgia to Mount Katahdin in Maine. The trail is roughly 2200 miles long, though the true length is always changing as parts are altered or re-routed. The trail is maintained by 31 trail clubs (primarily the Appalachian Mountain Club), and managed by the National Parks Service, the United States Forest Service, and the Appalachian Trail Conservancy. The Conservancy claims that the Appalachian Trail is the longest hiking trail in the world.

Objectives

The objective of this project was to identify regions along the Appalachian Trail that a particularly difficult and may require additional supplies or planning before they are attempted. This map gives through-hikers (people hiking the entire trail) a better way to plan places to stop and re-stock supplies as they can anticipate pieces of the trail that may take longer than others.

Similar Studies

One study (A mixed-modes approach for estimating hiking on trails through diverse forest landscapes: the case of the Appalachian Trail) attempted to do something similar. In this study, the author estimates how long sections of the Appalachian Trail would take based on variations in land cover and use along the trail. For example, hiking through national forest at high elevation in New Hampshire would take much longer than hiking through farmland in Pennsylvania. The sections of the trail that the study estimated would take longer can also be interpreted as more difficult areas of the trail. Interestingly, although the referenced study used an entirely different set of parameters to estimate difficulty, the results are remarkably similar to this analysis.

Methods

Difficulty Criteria

Individual layers were created based on different aspects of what makes a hike "difficult". Each layer was converted into a raster data set, the raster data sets were then overlaid and added together to create a digitized map that would rank areas along the Appalachian Mountain Range based on the difficulty parameters.

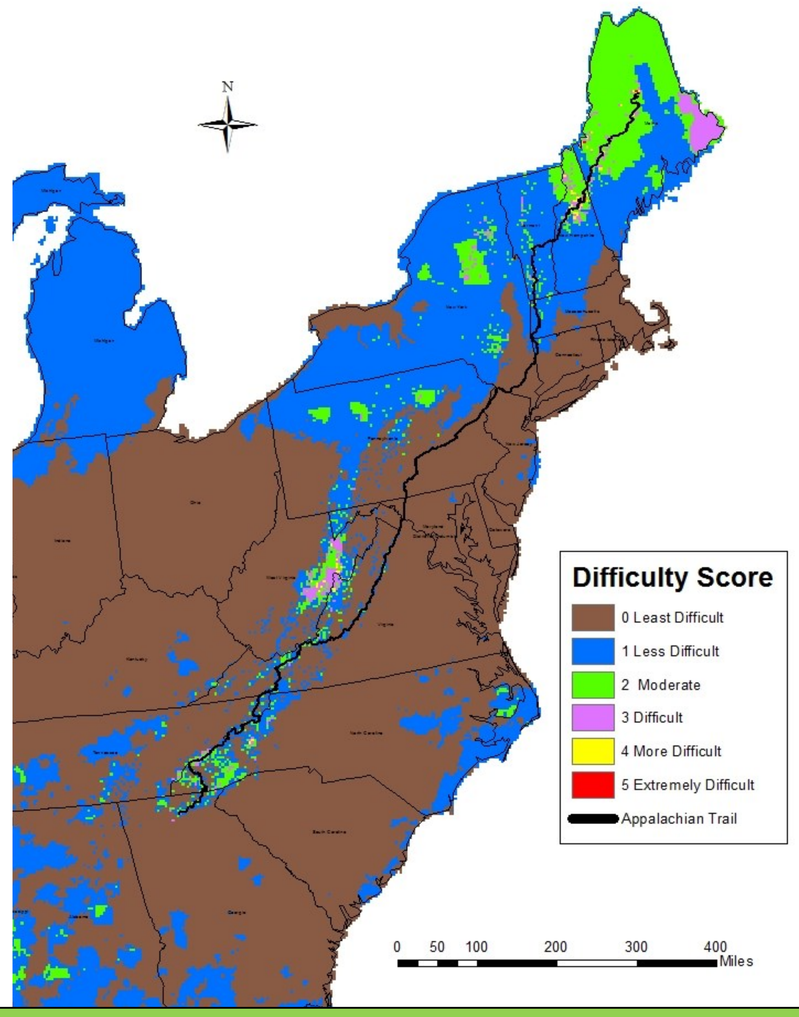
Slope: Areas of high slope (going either up or down) make for a much more difficult hike as it requires more care and energy to get through these areas efficiently without injury. For this project, any area with a slope greater than 1,250,000 percent rise was classified as a "high slope area". This limits high slope areas to steeper mountain faces, most of which are among the tallest mountains on the trail.

Temperature: Colder areas are naturally more difficult to get through especially for through hikers or people who are camping on the trail. For this project, any area with a mean annual temperature less than 8 degrees Celsius was classified as a "cold area". This limited cold areas primarily to the northeast, with some isolated pockets in the higher elevations of the southern portion.

Precipitation: More precipitation can lead to slippery conditions on the trail regardless of temperature. It can also effect visibility depending on the intensity of the storm. For this project, any area that receives more than 1500mm of precipitation annually was considered a "high precipitation area".

Population: Areas with very low population density can make life very difficult for through hikers as it often means venturing well away from the trail to re-stock supplies. Low population density is also an indicator of the availability help if something were to go wrong along the trail. In these areas, help from a rescue team or emergency medical services can be many hours before they are able to reach a hiker who needs help. For this project, any county with a population density of less than 20 people per square mile was classified as "unpopulated".

Elevation: Areas of high elevation make a hike difficult because the air is thinner, and exposure to elements is much greater. At higher elevations along the trail the wind is often gusting in excess of 50mph which can be very difficult and dangerous to hike through particularly on exposed ridges and cliffs. For this project, areas over 2700ft in elevation were considered "high elevation areas'.



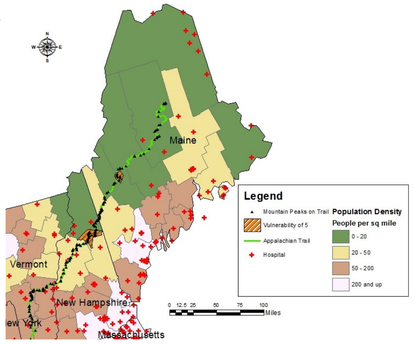
Scoring System

Each layer had a maximum value of 1 point, with five layers, this means that the most difficult areas would receive a score of five as they meet all of the aforementioned criteria. In other words, an area would receive a score equal to the number of criteria it met. In this analysis, all of the layers and criteria were rated equally. Therefore, an area can receive a score of two because it has a population density under 20 people per square mile, and a mean annual temperature under 8 degrees Celsius; while another area can receive a score of two because it receives more than 1500mm of precipitation annually and it is at an elevation over 2700ft. Because of the scoring system, these two areas would be considered equally difficult, even though they are difficult for entirely different reasons.

Results and Limitations

The results show the remarkable variability in difficulty along the length of the trail. Assuming a hiker is moving from south to north (as most through-hikers do) they can expect to have a relatively difficult initial portion of the trail as they move out of Georgia, through North Carolina, and into Virginia; with many areas in this region receiving scores of 1, 2, or 3. As they continue north, there is a very large portion of the trail through Virginia, Maryland, Pennsylvania, New Jersey, and New York with a difficulty score of 0. This implies that this portion of the trail should go relatively quickly and smoothly. As they get into New England, the scores begin to increase with scores of 1 or 2 through Massachusetts and Vermont. As they make their way into the northernmost portion of the trail, the difficulty increases with the remainder of the trail receiving scores ranging from 2 to 5. This confirms what many through hikers would have asserted: that the portions of the trail in the White Mountains in New Hampshire and the 100 Mile Wilderness in Maine are the most difficult of the entire trail. These two locations are the only ones to receive a difficulty score of 5. There are several limitations with regards to the accuracy of this study. One limitation is that it is difficult to account for the time of year hikers would attempt the trail. Very few people would attempt to hike the Appalachian Trail (particularly the northern section) in winter, so the mean annual temperature values are not necessarily representative of the conditions one would experience in the summer. Also, population density is a good estimate, but it does not account for the location of individual towns or stores. Finally, it would be interesting to do this project with the factors weighted differently, or with a wider variety of scores for each layer and score areas from 0 to 20 instead of just 0 to 5. This would give a much more in depth look at how difficult different sections are.

Close Up of High Vulnerability Areas



References

Sources: US Census Bureau (2010), Maine Office of GIS (2015), United States Geological Survey (2010), National Aeronautics and Space Administration (2002), National Oceanic and Atmospheric Administration (2006), Appalachian Trail Conservancy (2012), Class GIS data folders (2015)

Class: CEE – 187 Geographical Information Systems, Fall 2015

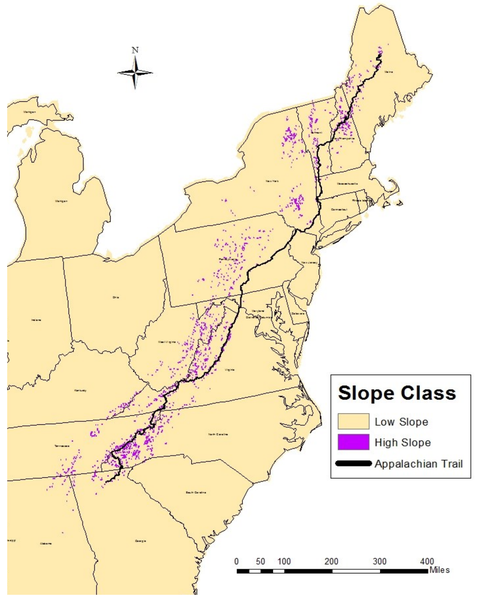
Projection: North America Equidistant Conic

Cartography: Bradford Pineau

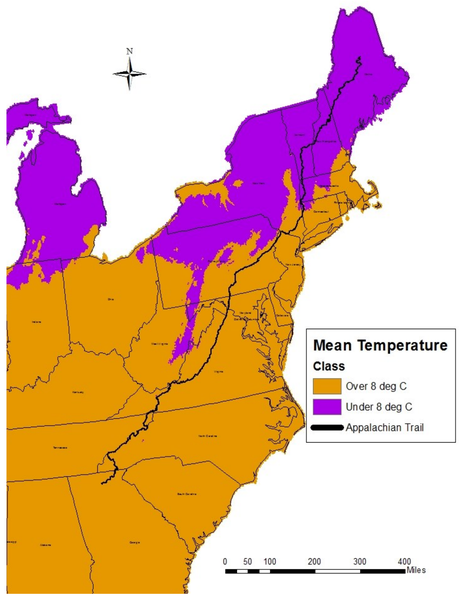
Date: December 15, 2015

Tufts University School of Engineering

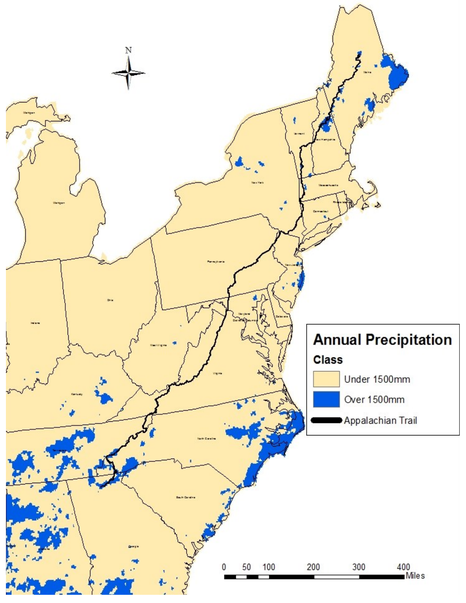
Slope



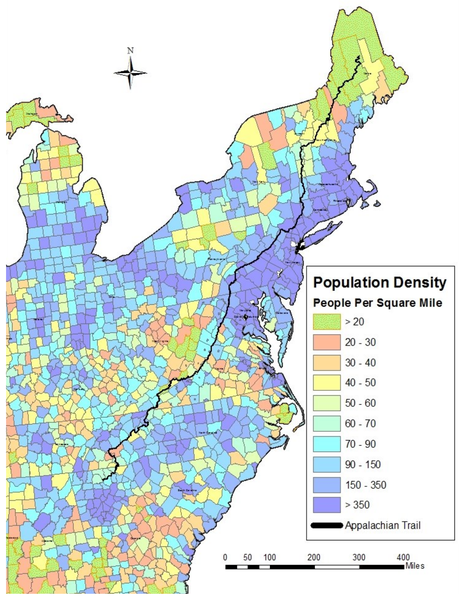
Temperature



Precipitation



Population



Elevation