Analyzing Maine's Section of the Appalachian Trail

A Suitability Analysis for Emergency Care Sites

Background

The Appalachian Trail is a continuous marked footpath extending from Springer Mountain in Georgia to Mt. Katahdin in Maine (about 2,160 miles). Each year over 2,000 "thru-hikers" attempt to make the entire journey, and about one in four actually complete it. The AT links 8 national forests, 6 national parks, and over 60 state parks, forests, and wildlife areas.

According to the Appalachian Trail Conservancy, Maine's 281 miles of trail are generally considered the most difficult of all 14 states. Notable parts include the high-risk Kennebec River crossing, the "Hundred Mile Wilderness" between Mt. Katahdin and Mt. Monson that have scarce opportunity for resupply, and the notorious mile-long boulder scramble up Mahoosuc Notch. Over 82% of AT hikers reporting injury and/or illness along the trek, and the final stretch through Maine's rugged southwestern corridor is where a majority of these occur.

Although the intent of the trail's creation was to be a "respite from everyday lives", the dangers of this part of the trail prove to require closer attention to the emergency needs of thru-hikers and section hikers alike. Currently, emergency

Image 1. Appalachian Trail marker

care can respond to a 911 call (requiring cell phone service which is usually sparse) or a personal locator beacon (upwards of $150) from off-trail somewhere.

I will attempt to determine the best areas along the Maine portion of the AT in which to place an Emergency Care Station (with an exhaustive First Aid kit and direct communication to the closest off-trail emergency team).

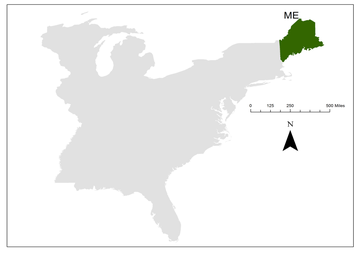


Figure 1. Inset map highlighting Maine

Optimal ECS Locations

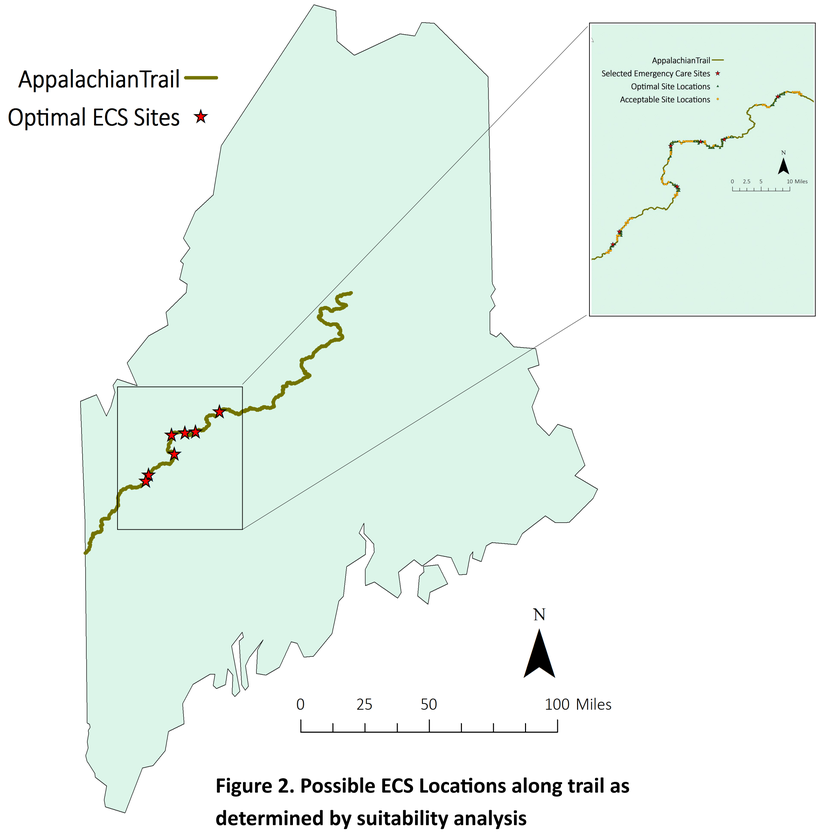


Figure 2. Possible ECS Locations along trail as determined by suitability analysis

Factor Analysis

Figures 3, 4, and 5 are examples of several processing steps of the various factors included in this project. Density of parking locations and shelter locations (not shown) were combined with proximity to ambulances and hospitals (not shown), as well as a slope model (not shown), to create the raster suitability layer in Fig. 5.

Figure 3. Parking density

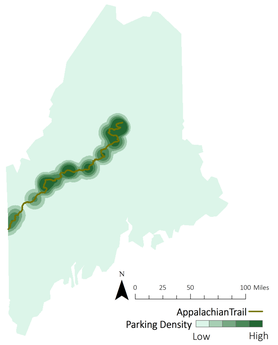


Figure 4. Ambulance proximity

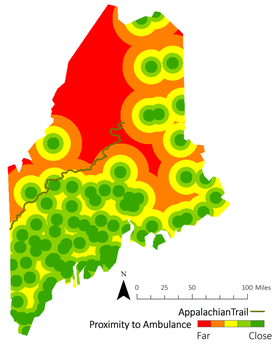
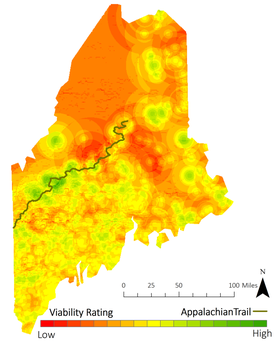


Figure 5. Statewide suitability



Methodology

The factors of ECS-viability were determined to be trail slope, density of shelters and trailheads (Figure 3), and proximity to hospital/ambulance locations (Figure 4). I acquired the AT data from the Appalachian Trail Conservancy and the Maine emergency data from the MEGIS online database.

I masked the AT data (centerline, shelter locations, and parking locations) to Maine, and projected all data into the UTM Zone 19. I then created a slope layer using a contour model from MEGIS.

I then reclassified all of the factors into levels of desirability (Table 1), based on personal Wilderness First Aid training and backcountry emergency care research, and used the raster calculator to combine these factors and identify the most desirable areas for an ECS (Figure 5).

To tailor these areas to the AT corridor, I masked them to a 100-foot buffer on the AT centerline. Finally, I converted the most ideal areas into a point layer, and selected 7 optimal locations to highlight (Figure 2).

Table 1. Suitability Score Breakdowns

Factors	1 -BAD	2	3	4	5
Hospital Distance (m)	0—13,000	13,000—22,000	22,000—34,000	34,000 —54,000	54,000—130,000
Ambul. Distance (m)	42,000—121,000	25,500—42,000	15,000—25,500	9,000—15,000	0—9,000
Parking Density	0	$0-1x10^{-9}$	$1x10^{-9}$—$4x10^{-9}$	$4x10^{-9}$—$8x10^{-9}$	$8x10^{-9}$—$4x10^{-8}$
Shelter Density	0.015—0.019	0.011—0.015	0.008—0.011	0.004—0.008	0—0.004
Slope	15—27%	9—15%	6—9%	3—6%	0—3%

Results & Conclusions

This suitability analysis reveals 7 different clusters of 62 optimal locations for an ECS (Figure 2). There also 55 acceptable site locations, for a total of 117 possible ECS locations . All of these points are either in the Hundred Mile Wilderness section or the Kennebec River area, suggesting that these areas have both high risk and lack of emergency care access.

I arbitrarily chose one site from each of the optimal clusters to highlight as proposed locations, but if this project were to be implemented, an in-person analysis would be required by the builders to determine actual locations within the optimal site cluster areas. They would need to see the trail sections in order to make an informed decision about structure design and accessibility. It would also be wise to work in conjunction with the AT Trail Runners since they have high levels of experience with the trail itself.

Although the project would cost a significant amount to implement (building costs, material costs, response technology & preparedness costs), it would both eliminate negative stigmas surrounding the AT journey as well as be beneficial to a majority of people that hike this final leg. It would give the AT Conservancy more legitimacy while enabling the yearly pilgrimage to continue into the future with a much lower risk.

Limitations

The biggest limitation was the lack of a Digital Elevation Model for the entire state of Maine. Instead, I had to convert a contour data set from the MEGIS database into a TIN (Triangulated Irregular Network) layer and then convert that into a raster that I could then use as a DEM, decreasing the accuracy of my slope modelling.

Another limitation was a lack of information on existing shelters, which resulted in choosing new sites for emergency care structures based on a raster analysis of factors as opposed to conducting a vector analysis on shelters that could be possible candidates for emergency response program implementation.

Additionally, I was not able to find sufficient hydrology data to do this, but it would have been helpful to add in river crossing locations on the trail as an added danger factor in the analysis.

Image 2. Lehigh Gap Lean-to Shelter

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Date: 12/12/2013, GIS101

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Data Sources: MEGIS, Appalachian Trail Conservancy

Scale: 1 : 1,800,000

Projection: NAD 1984 UTM Zone 19N

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