HOSTAGE CRISIS

Strategic Special Force Team Routes in Eastern Democratic Republic of the Congo

BACKGROUND

The eastern part of the Democratic Republic of Congo (DRC) has been marked by organizations such as Aon and the Council on Foreign Relations as being notably high risk for violence, terrorist activities, and political uprisings. The Forces Démocratiques de Liberation du Rwanda (FDLR) is the primary Rwandan Hutu rebel group in eastern DRC, and have presented themselves as a clear danger to the public on numerous occasions. They are known for the abduction of children for use as child soldiers along with a variety of other war crimes. Following operations by the Military of the DRC (FARDC), the FDLR was forced relocate their headquarters to Katobo (also called Rushihe), where they are currently assumed to be located.

This project presents a hypothetical hostage situation in which a special operations team launches a rescue mission for hostages at the FDLR headquarters in Katobo. Navigating from the town of Karambi, which has faced attacks and abductions in the past, it will analyze the fastest, most effective route between Karambi and Katobo. A Special Forces team would ideally use a route that stays under tree cover as much as possible, avoids steep slopes, maintains proximity to a water source, and stays within 1-3 km away from roads, so as to remain covert while still having access to roadways if necessary. Following a successful rescue mission, helicopters would likely be used to remove the rescued individuals and the Special Forces team, and suitable nearby helicopter landing sites have been identified.

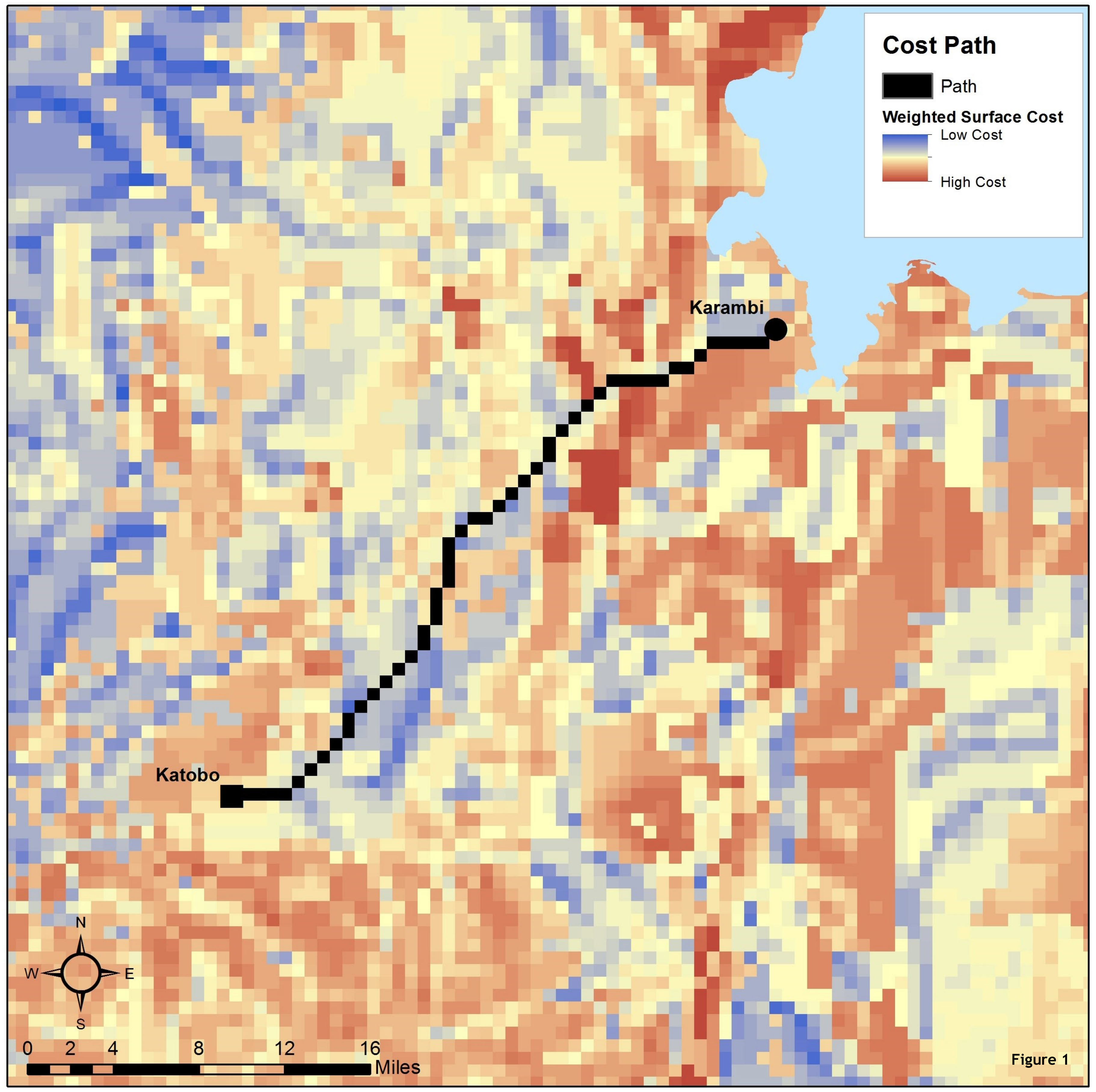
METHODS

Three major data sources were used to compile the weighted surface cost raster. The vegetation data was acquired from the World Resources Institute and was reclassified based on vegetation type and its ability to provide coverage (ex: closed deciduous forests were ranked high on the suitability scale, while bare soil ranked low). The elevation data from the Tufts database was used to derive slope and reclassified, with steep slopes ranking low and flat slopes ranking high. For road proximity, the team would want to keep within 1-3 km of roads/trails, so the Euclidean distance from roads was calculated and manually reclassified. Any areas less than 1 km or greater than 3 km from a road were ranked poorly, and the region in between was deemed more suitable for travel by the Special Forces teams.

Vegetation cover, slope, and road proximity were then given weights of 45%, 35%, and 20%, respectively. The weighted surface cost raster is the result of adding the three weighted variables in the raster calculator. After creating the cost back link, the Cost Path tool was used to derive the least cost path using the weighted surface cost raster.

A similar process was used to determine suitability for nearby helicopter landing sights by reclassifying slope and vegetation cover. A flat slope was given higher suitability; meanwhile, of the vegetation types provided in the data set, only bare soil and cropland were ranked positively since no others could *guarantee* sufficient space for a safe landing. Each raster was added together in the raster calculator with equal weights, producing the resulting map (figure 2).

LEAST COST PATH



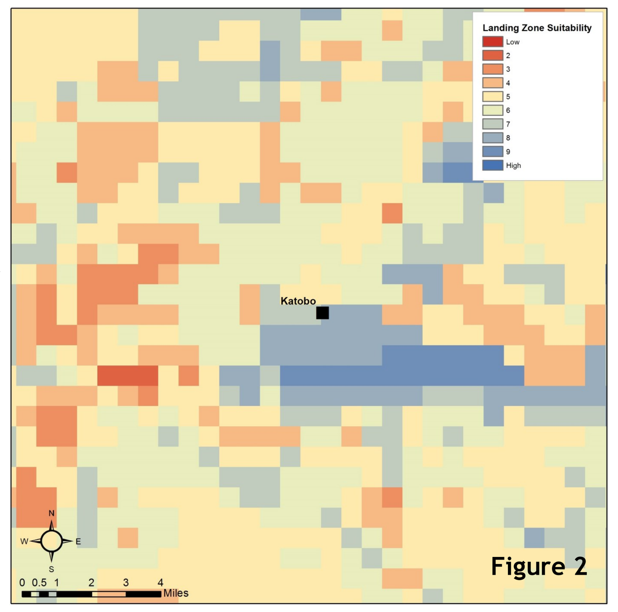
APPLICATIONS

These methods could be used to plan routes for a hostage situation or rescue mission in any location. However, each region of the globe brings with it unique challenges and factors that must be included. For example, the Iran Hostage Crisis of 1979 took place in the city center of Tehran. To plot a route in an urban area rather than the rural stretch detailed in this project would involve the consideration of complex streets and buildings.

RESULTS

The resulting least cost path displays the optimal route for a Special Forces team between the village of Karambi and the FDLR headquarters in Katobo. It is the most direct route between the villages while remaining under vegetation cover, avoiding steep slopes, and keeping within 1-3 km of roads as much as possible. The weighting gives preference to vegetation cover, as it would allow the teams to remain discrete. Clearly, a straight line would not be the most efficient option, despite being the seemingly fastest route without consideration of the variables.

If the mission is successful, the hostages and Special Forces team would likely attempt to escape by helicopter. Figure 2 highlights nearby areas that would be most suitable for a helicopter to land based on slope steepness and vegetation coverage. Katobo is surrounded primarily by cropland, but sits at a point of relatively steep slope. The closest area of highest landing suitability (darkest blue) is approximately 2.4 km south of the village, with additional areas to the southeast if unforeseen circumstances prevent travel to the south.

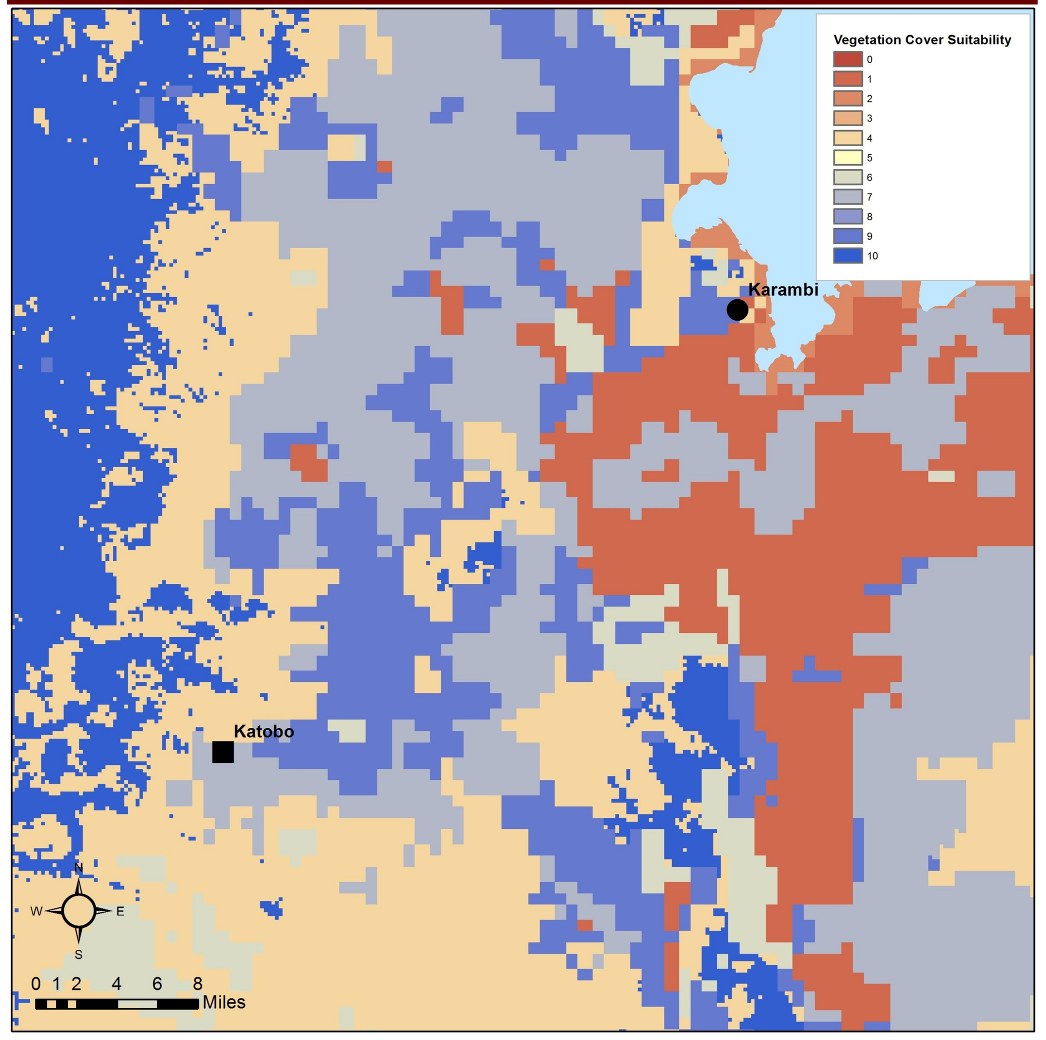


DISCUSSION & LIMITATIONS

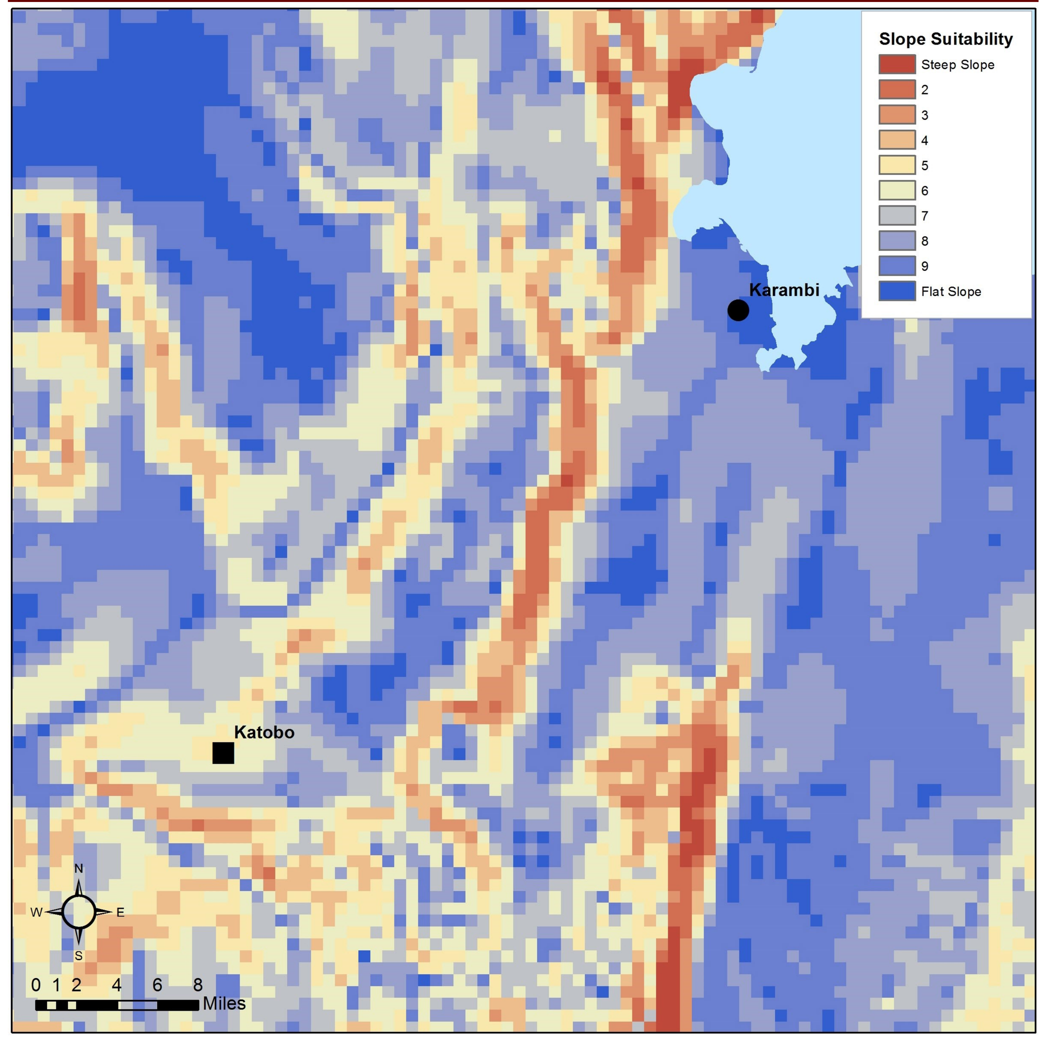
When considering the least cost path between two points for a Special Forces team, two additional factors could be considered for a more complete analysis: proximity to fresh water, and proximity to buildings. The DRC water data from the World Resources Institute did not include any fresh water sources between these two villages. However, it is unlikely that the data includes small streams or other more minor sources that may be present, making the water part of the analysis irrelevant in this project. There was also a lack of data on buildings, since it is an extremely rural area with minimal documentation on the population or its living quarters. This lack of data could affect the helicopter landing sites, since any presence of buildings would drastically alter the suitability of the area for a landing. Additionally, \the building data could provide insight on where other rebel/armed groups in the region may have set up bases. Since these groups are rarely controlled or monitored closely by any government entity, there is little data on their whereabouts, making it difficult to consider them in a least cost path analysis.

When creating the weighted surface cost raster, the weights were chosen based on personal opinion. The weights could be altered to prefer slope suitability, for example, and would achieve a different least cost path. The addition of other factors, such as buildings or fresh water sources, would also affect the weighting system. For a more complete analysis, one could test a variety of different weighting patterns and evaluate the differences between the resulting cost paths.

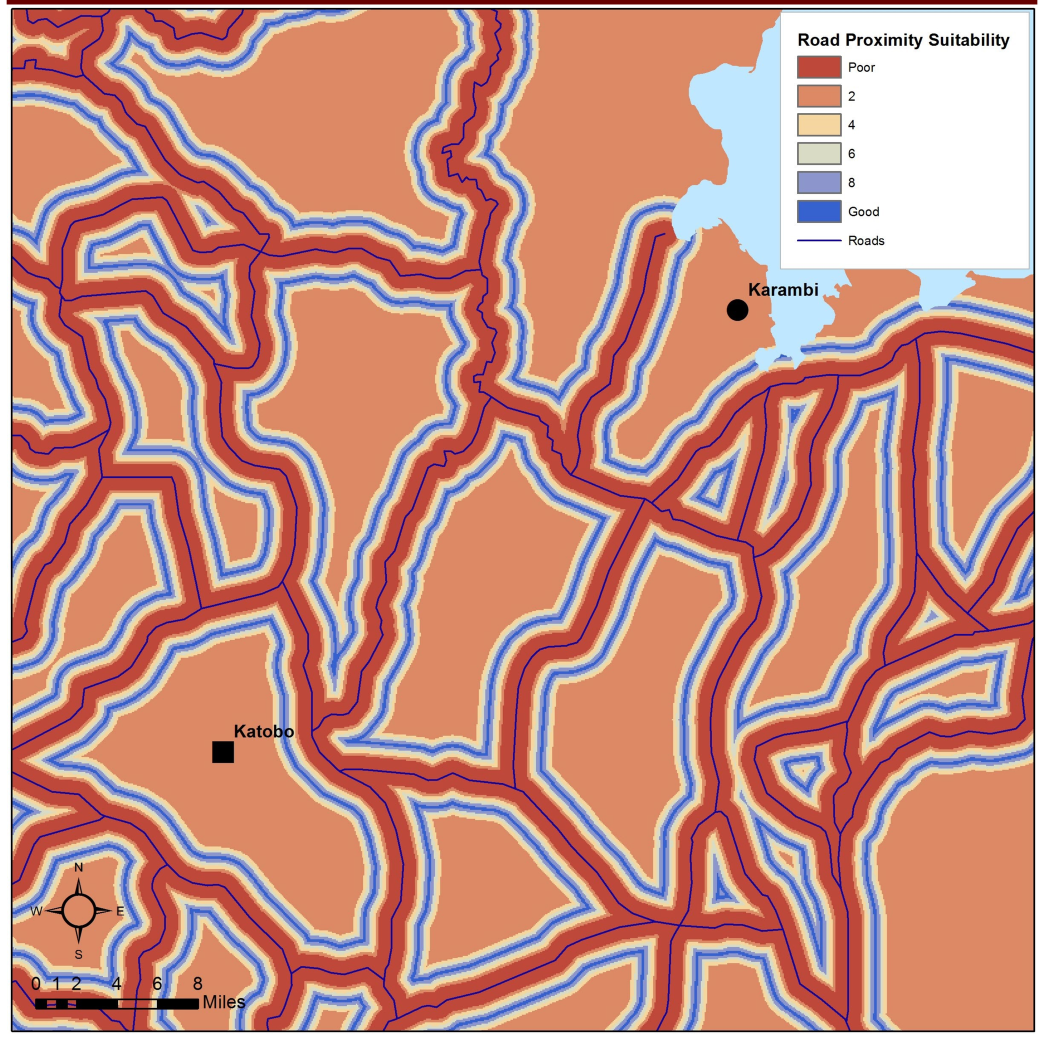
Vegetation Cover Suitability



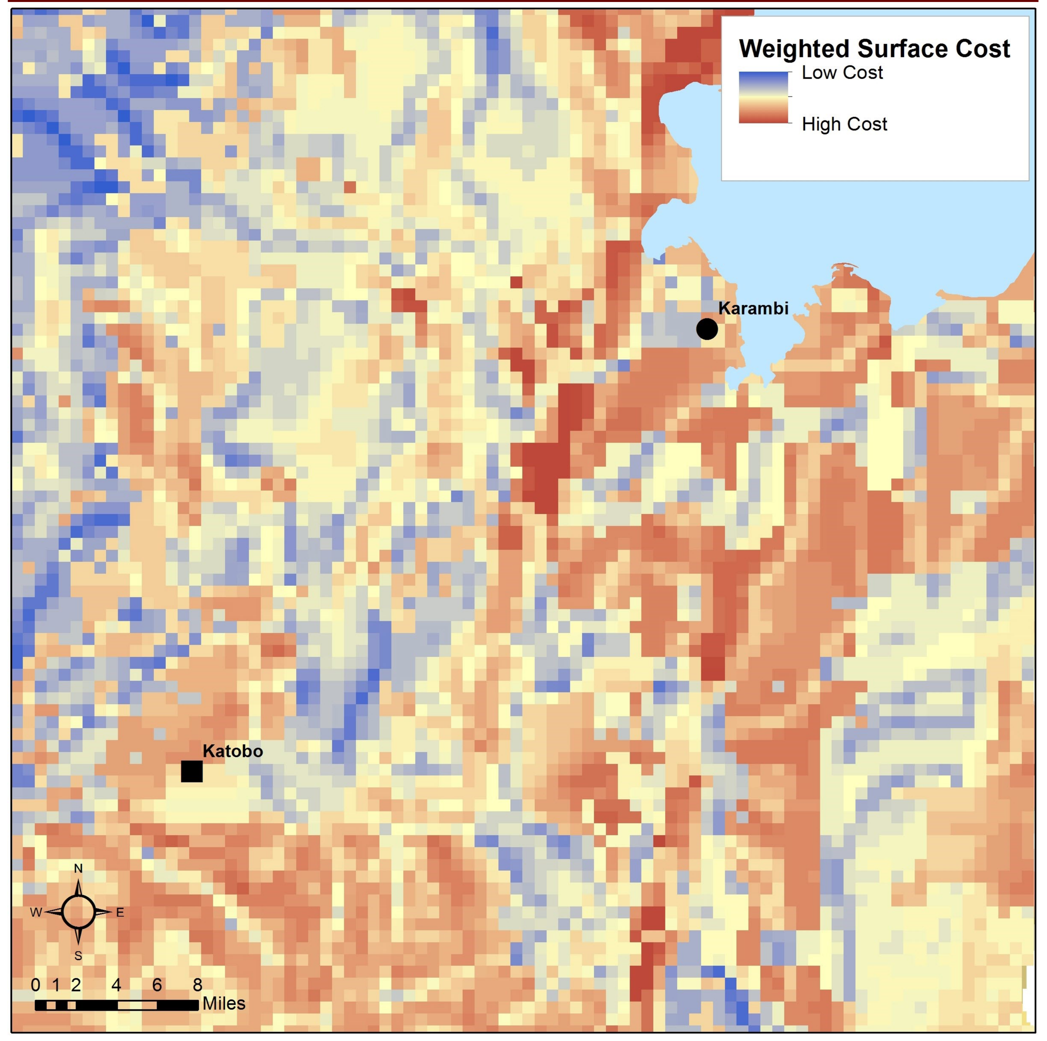
Slope Suitability



Road Proximity Suitability



Weighted Surface Cost



Resources

Sources

"1km Elevation Raster." Tufts University. Accessed December 16, 2015. M:\World\ESRIDataMaps906\Raster\Elevation\gtopo30\.

"Congo Basin Forest Atlases." World Resources Institute. Accessed December 16, 2015. http://www.wri.org/our-work/project/congo- basin-forests/democratic-republic-congo.

"Download Data by Country." DIVA-GIS. Accessed December 16, 2015. http://www.diva-gis.org/gdata.

Cartographer: Paige Newman

GIS101: Intro. To GIS

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Projected Coordinate System:

UTM_Zone_35N

Tufts University