Slope Failure Hazard Risk Assessment

An Analysis of the Hazard Risk Posed by Slope Failure to Transportation Networks in Southern New Hampshire

Author: Kipp Callahan
CEE 194 Introduction to GIS
April 2007
Sources of Data:
- New Hampshire Granit
- Mass GIS
- Natural Resource Conservation Service
- Ridge, J.C. 1999, Surficial Geological Map of the Bellows Falls Quandrangle (7.5 x 15-minutes)
- Ridge, J.C. 1990, Surficial Geological Map of the Walpole, N.H. Quandrangle (7.5 x 15-minutes)

Goal

The goal of this study is to develop an assessment of the risk posed to transportation networks in southern New Hampshire by slope failure

Objectives

- Develop parameters to assess slope failure risk
- To use GIS raster calculations to assess slope failure risk for the area of interests
- To use GIS raster calculations to assess slope failure hazard risk in regards to the transportation networks in the area of interest

USGS :http://pubs.usgs.gov/of/2003/ofr-03-211/NisquallyFinal_files/image044.jpg

Scope of Study

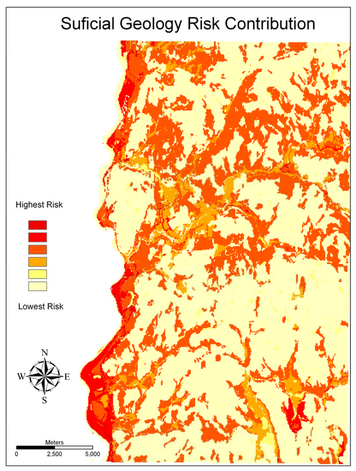
This analysis has been conducted in southern New Hampshire in the areas of the state contained by the 7.5' by 15' Bellows Falls and Walpole USGS maps.

Parameters Used to Assess Slope Failure Risk

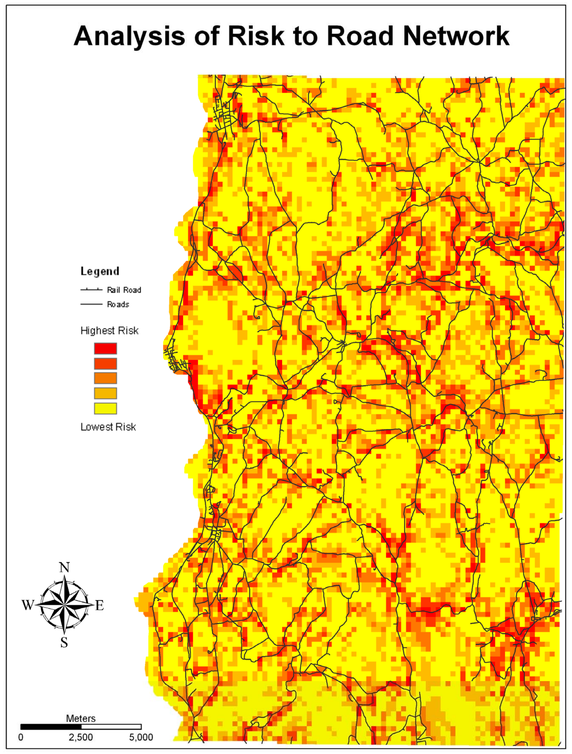
- Slope of the land surface
- Surficial geology characteristics
- Soil drainage
- Land cover

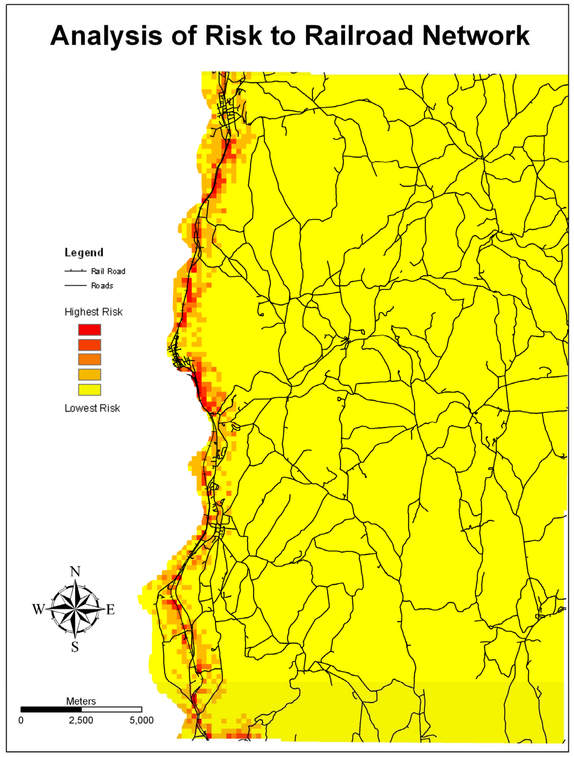
Methods

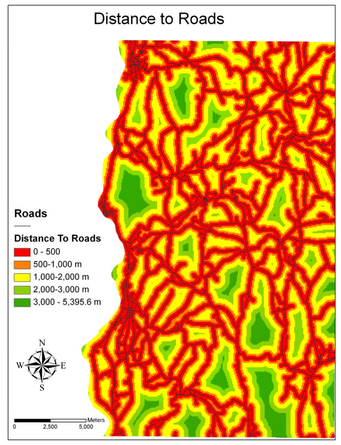
- Surficial geology, soil drainage and land cover data layers were downloaded and converted into raster data. The slope was derived using spatial analyst tools from a DEM.
- The layers were then reclassified with values reflecting their contribution to landslide risk.
- The raster calculator was then used to calculate a slope weighted analysis for the risk of slope failure with the reclassified values.

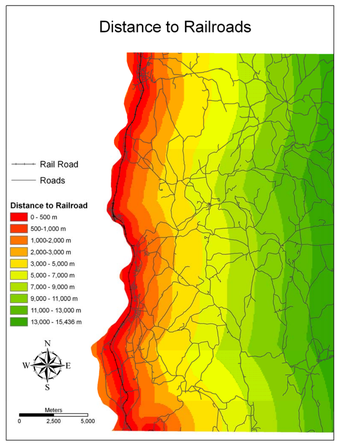


- Shapefiles containing the roads and railroads in the region were then obtained
- The Eucalid Distance tool was then used to create a raster data layers with the distance from roads and railroads.
- These layers were reclassified reflecting the distance from which a landslide would have an impact.
- The raster calculator was then used to calculate the risk posed by potential landslides, as identified by the previous slope weighted calculation, to both road and railroad transportation networks.





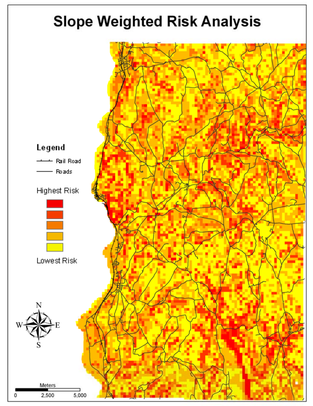




Western Washington State University: http://www.smate.wwu.edu/teched/geology/GeoHaz/eq-general/eq-general-06.JPG

Results

- The risk posed by landslides to the rail system in the area of interest is greatest in the northern portion of the area of interest
- The risk posed by slope failure to the road networks is distributed relatively evenly over the area of interest



Implications

- It would be difficult to implement a widespread risk management program to protect the road system from slope failure hazard due to the large area over which the risk is spread.
- Survey and management can be undertaken to manage the risk posed by slope failure to the rail system due to the concentrated nature of the high risk areas.

Tufts UNIVERSITY