Determining archaeological potential in high altitude passes and trails in the Pennine Alps

Stephanie Rogers
Introduction

• **Main goals**
  ▫ To understand, from a historical perspective, how people travelled through the Alps
  ▫ Want to find the ‘best’ sites for the conservation of historic artefacts and archaeological material in high altitude locations
    * Create an Archaeological Potential Model using GIS tools

• **Purpose**
  ▫ To protect and conserve precious artefacts that can act as indicators of pre-historic or historic climate and culture

• **Research Directions**
  ▫ Historical perspective – archival text analysis
  ▫ Geographic perspective – GIS approach
SNF Project Collaborators

University of Fribourg: Geography

- Claude Collet - Geomatics
- Reynald Delaloye - Geomorphology
- Martin Hoelzle - Glaciology
- Matthias Huss - Glaciology
- Ralph Lugon - Project Manager
- Stephanie Rogers - Geomatics (PhD student)

University of Lausanne: History

- Pierre Dubuis
- Muriel Eschmann-Richon

Canton of Valais: Archaeology

- Philippe Curdy
- François Wiblé
Study area
Historical Perspective

• High altitude passes used as trade and travel routes for thousands of years

• Alpine areas were first thought to be marginal and uninhabitable by humans

• Recent archaeological findings have proven these areas have been used intensively in the past
Archaeological Finds and Potential Passes of Interest in the Pennine Alps

Created by: Stephanie Rogers, University of Fribourg. Date: June 3, 2011. Source: SwissTopo, Etat du Valais Service des Bâtiments, Monuments et Archéologie, IVS: Inventaire des voies de communication historiques de la Suisse. Projection: CH1903 LV03
Geographic Perspective

- Current warming period is causing glaciers to retreat

- Glaciers have been thinning and retreating since the mid-19th century
  - Switzerland’s have declined a third in volume since 1860 (Krajick, 2002)
Glacial archaeology

- There have been many examples of relics found in high altitude environments all over the world
  - Including the Théodulpass between Switzerland and Italy
Mountainous Archaeological Findings

• Ötzi the ‘Iceman’
  ▫ Italian/Austrian border, 1991
  ▫ Approx. 5,300 years old
Previous Research in Modelling Alpine Archaeology

- Dixon et al, 2005
  - Used a GIS based model ‘MAPIS’ (Modelling Archaeological Potential of Ice and Snow)
  - Combined biologic, geologic and cultural datasets
  - Alaska’s Wrangell-St. Elias National Park and Preserve
Theory for an Archaeological Potential Model in the Pennine Alps

- Develop a method to predict sites with highest probability of archaeological remains
  - Based on:
    - Past archaeological find locations and historic trails
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    • Results from analysis with GIS tools
      • Quantifying terrain landforms
      • Study area: Sion to Lenk
Quantifying Terrain Landforms
Quantifying Terrain Landforms: 25m DEM

Derive new surfaces from the DEM that aren’t originally apparent.
Steep slopes are a deterrent for people travelling through high mountain regions so this tool can indicate which areas to avoid.
Quantifying Terrain Landforms: Aspect

North facing slopes are more likely to have snow or ice cover compared to south facing ones due to solar radiation levels.
Quantifying Terrain Landforms: Hillshade

Creates a shaded relief model of the study area. The angle and illumination of the sun can be altered to model different time periods.
Solar Radiation tools

Areas of lower solar radiation are more likely to contain ice or snow and thus, have a higher archaeological potential.
Least Cost Path analysis
Determining potential historic travel routes
Least Cost Path analysis

• To determine the paths that require the least amount of energy for people walking through the mountains

• Determining factors:
  • Landcover
  • Slope

• Reclassify and weight factors
Model Inputs

**Legend**

**Landcover**
- Bush
- Dam
- Forest
- Glacier
- Glacier Scree
- Grass Runway
- Gravel
- Lake
- Orchard
- Others
- Quarry
- Residential
- River
- Rock
- Scree
- Scree in Forest
- Scree in Open Forest
- Scree with Bushes
- Sparse Forest
- Swamp
- Swamp in Forest
- Track on Hard Surface
- Tree Nursery
- Vineyard

**Slope**
- Degrees
  - 0 - 5
  - 5.01 - 10
  - 10.01 - 15
  - 15.01 - 20
  - 20.01 - 25
  - 25.01 - 30
  - 30.01 - 35
  - 35.01 - 79.5
Preliminary results of least-cost paths

• **Red Path:**
  • Weighted 75% Landcover, travels along « easier » walking surfaces

• **Purple Path:**
  • Weighted 75% Slope, travels along less steep slopes

• **Green Path:**
  • Equal weighting, Median path
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Future Archaeological Potential Model

Influences

• Archaeological find locations
• Historical trails and passes
• Altitude of pass
• Glaciated areas
• North facing slopes
• Results of Least-cost paths
• Bed topography
• Colder than 0° for thousands of years
• Flat passes

Restrictions

• Non-glaciated areas
• Steep slopes
• Rapidly moving ice
• Altitudes lower than 2500m
• Areas of high solar radiation

Archaeological Potential
Thank you!