

Modeling Wilderness User Behavior: A proof of concept for GIS and Agentive Modeling

Paul Manson

School of Government, Public Administration

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Project Goals

- Understand Agentive Modeling
- Develop methods to include GIS data
- Integrate agents and geography
- Demonstrate possibilities for development

NetLogo Agentive Modeling

- Java-based application - multiple platform
- Open and collaborative development community
- Simple programming language

FOR MORE INFO...

<http://ccl.northwestern.edu/netlogo/>

NetLogo Agentive Modeling

- Creates environment, actors, and rules
- Study macro and micro behavior over time
- Can include multiple human inputs: HubNet

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NetLogo Agentive Modeling

- Three logical levels in the model:
 - ✓ Observer
 - ✓ Turtles
 - ✓ Patches
- Commands and interactions specific at each level

FOR MORE INFO...

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NetLogo Agentive Modeling

- Sample script:

```
to go
  ask turtles
  [
    ifelse pcolor-of patch-ahead 1 = blue
      [ lt random-float 360 beep ]
      [ fd 1 ]
  ]
end
```

FOR MORE INFO...

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Examples of NetLogo Models

- Simple Walking Turtle
- Forest Fire
- Breeding Species
- Pac Man

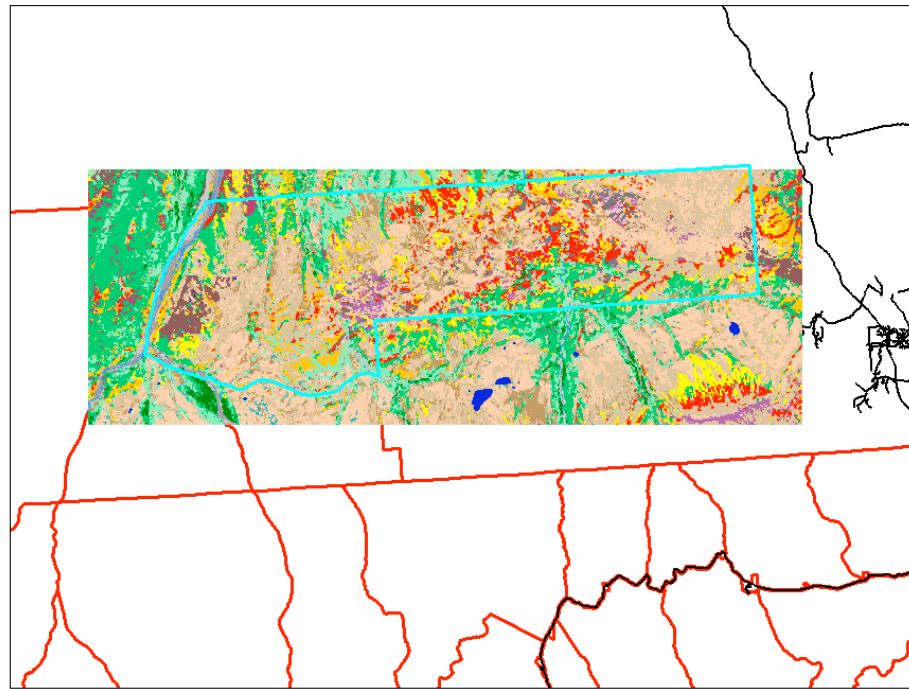
Proof of Concept with GIS

- **Model Design**
 - **Physical - GIS**
 - Land Cover
 - Slope
 - Distance
 - Proximity to Services/Detractors
 - **Social - NetLogo**
 - Personal Preferences
 - Other Actors or Types of Actors

Proof of Concept with GIS

- **Physical Component**
 - **Denali National Park GIS Data**
 - Backcountry Boundaries
 - Land Cover
 - Roads
- **Why use Denali?**
 - ✓ Trail structure
 - ✓ Topography
 - ✓ Proximity

Denali NP: Stampede BC Unit



Hiking Models

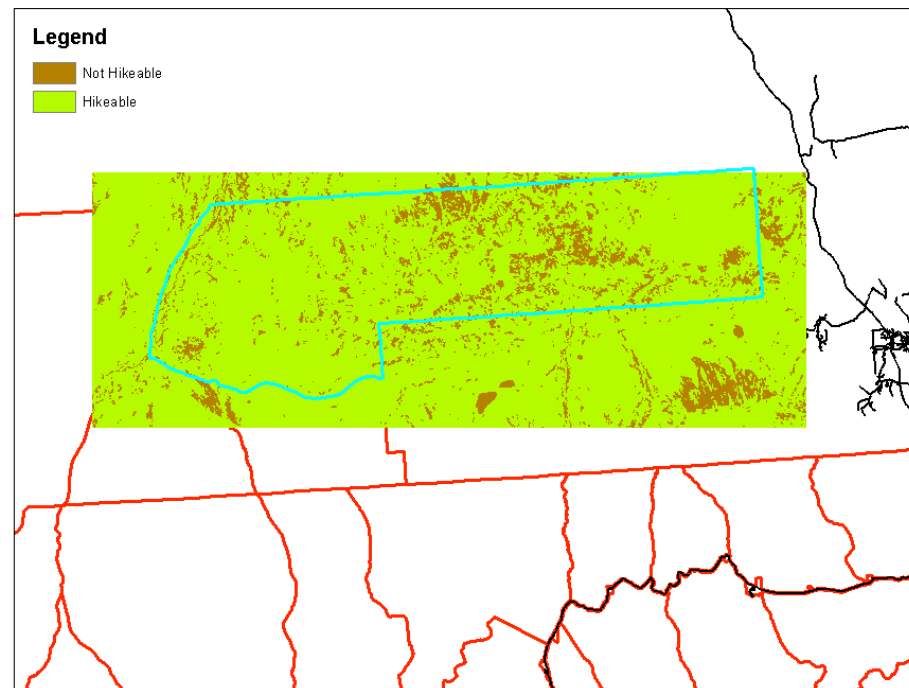
● Model One

Open - Woodland Spruce
Open - Woodland Stunted Spruce
Broadleaf Forest
Mixed Spruce - Broadleaf Forest
Closed Low Birch Shrub
Low Shrub Birch-Ericaceous-Will
Low Shrub - Sedge
Peatland
Herbaceous - Shrub
Dwarf Shrub
Dwarf Shrub - Rock
Dry - Mesic Herbaceous
Wet Herbaceous
Sparse Vegetation
Bare Ground
Shadow- Indeterminate
Burn

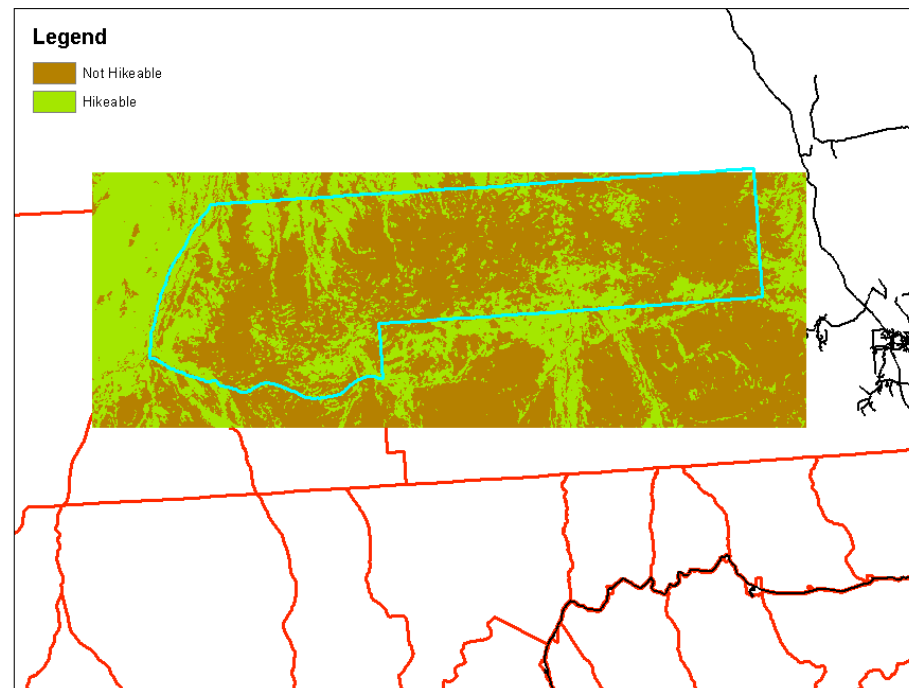
● Model Two

Open - Woodland Spruce
Open - Woodland Stunted Spruce
Broadleaf Forest
Mixed Spruce - Broadleaf Forest
Peatland
Herbaceous - Shrub
Dwarf Shrub - Rock
Dry - Mesic Herbaceous
Wet Herbaceous
Sparse Vegetation
Bare Ground
Shadow- Indeterminate
Burn

Stampede BC Unit: Model One



Stampede BC Unit: Model Two



Model Implementation

- Raster clipped to Backcountry Unit
- Reclassified to the two models
- Exported through various graphical converters to PGM format
- PGM loaded as map in NetLogo
- Model informed about the map

Social Modeling

- **Turtles and Patches, Patches and Turtles**
 - Turtles have vision limitations...
 - Turtles have decision making issues...
 - Turtles deal with limited inputs...
 - But, Turtles can deal with each other!

Social Modeling

- **Application**

- Reclassified raster creates zones
- Turtles told to look for zones
- Turtles go for a walk in the woods
- We can track where the turtles go

Looking Forward...

- **Other Tools to Include**
 - **Multi-Species Hikers**
 - **“Vision”**
 - **Long-term or persisting goals**
 - **Integration with Utility Curves**

Resources and References

- National Park Service, Alaska Service Office GIS
<http://www.nps.gov/akso/gis/>

- Lawson and Manning.

2002 Tradeoffs among Social, Resource and Management attributes of Denali Wilderness Experience. Leisure Sciences, 24:297-312.

- Murdock, Erik.

2004 Understanding Recreation Flow to Protect Wilderness Resources at Joshua Tree National Park, California. Finnish Forest Research Institute 2.

<http://www.metla.fi/julkaisut/workingpapers/2004/mwp002.htm>

Resources and References

- NetLogo Software and Support
<http://ccl.northwestern.edu/netlogo/>
- GRASS Open Source GIS
<http://grass.baylor.edu//>
- NetLogo Scripts adapted from:
Uri Wilensky