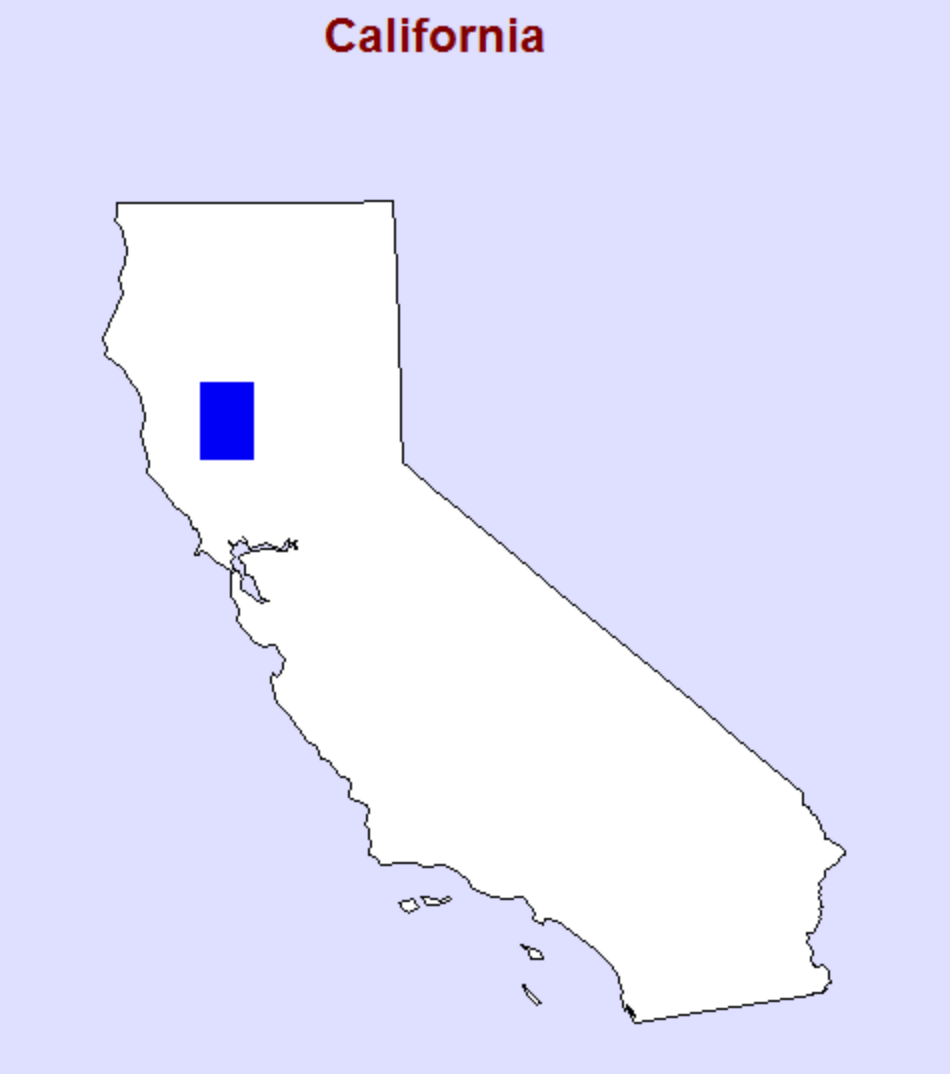
Hypothetical Mendocino Area Highway IDRISI Taiga Least Cost Model

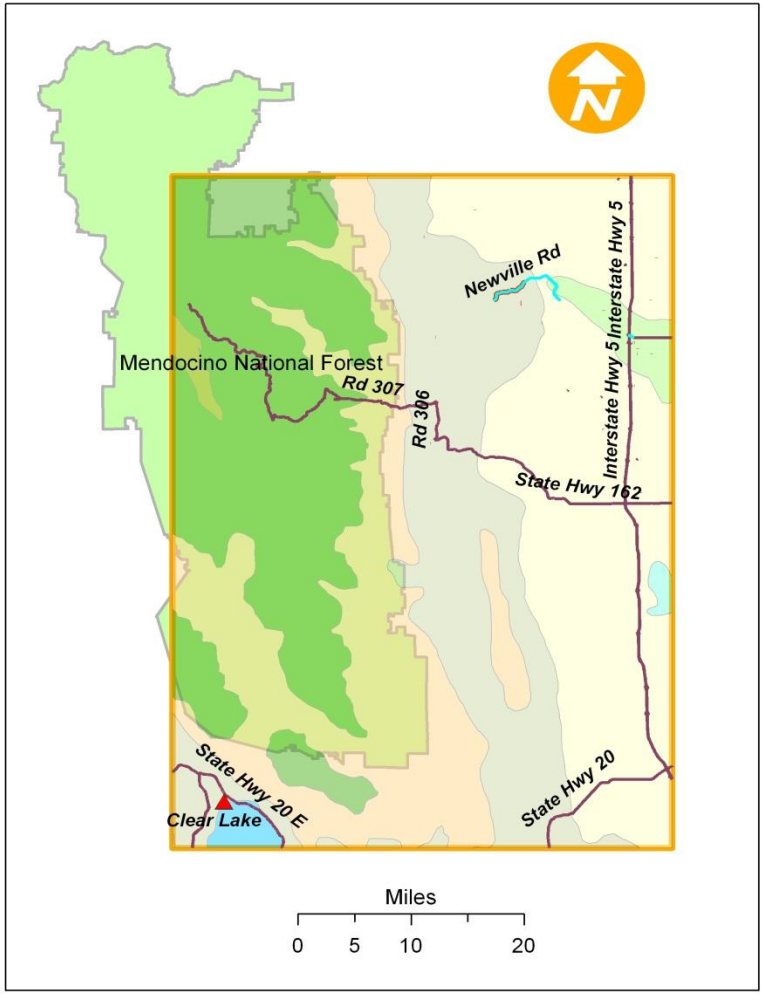
In partial fulfillment of Geography 595: Maps, Models, and GIS

John L. Marshall

Project Area



Mendocino Project Area



Mendocino Area Highway Project Least Cost Model

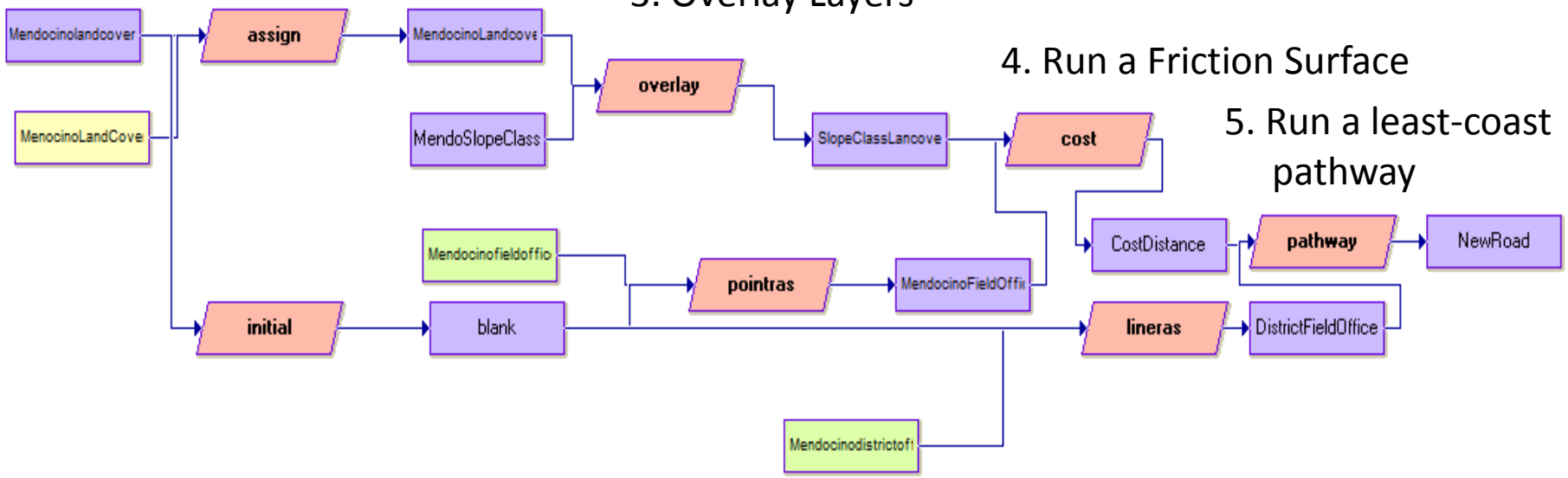
1. Add Land Cover and Slope Class Layers

2. Assign Friction Values to Layers

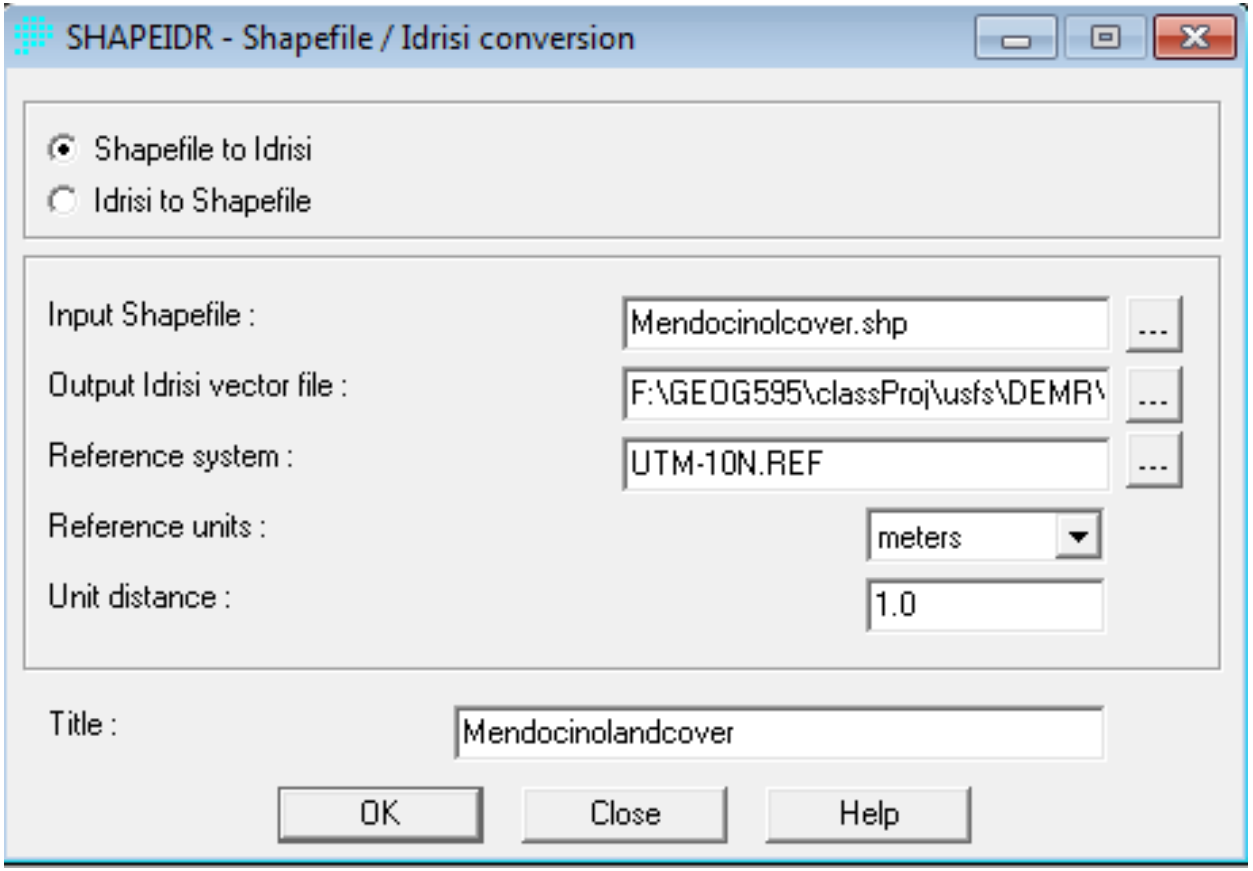
3. Overlay Layers

4. Run a Friction Surface

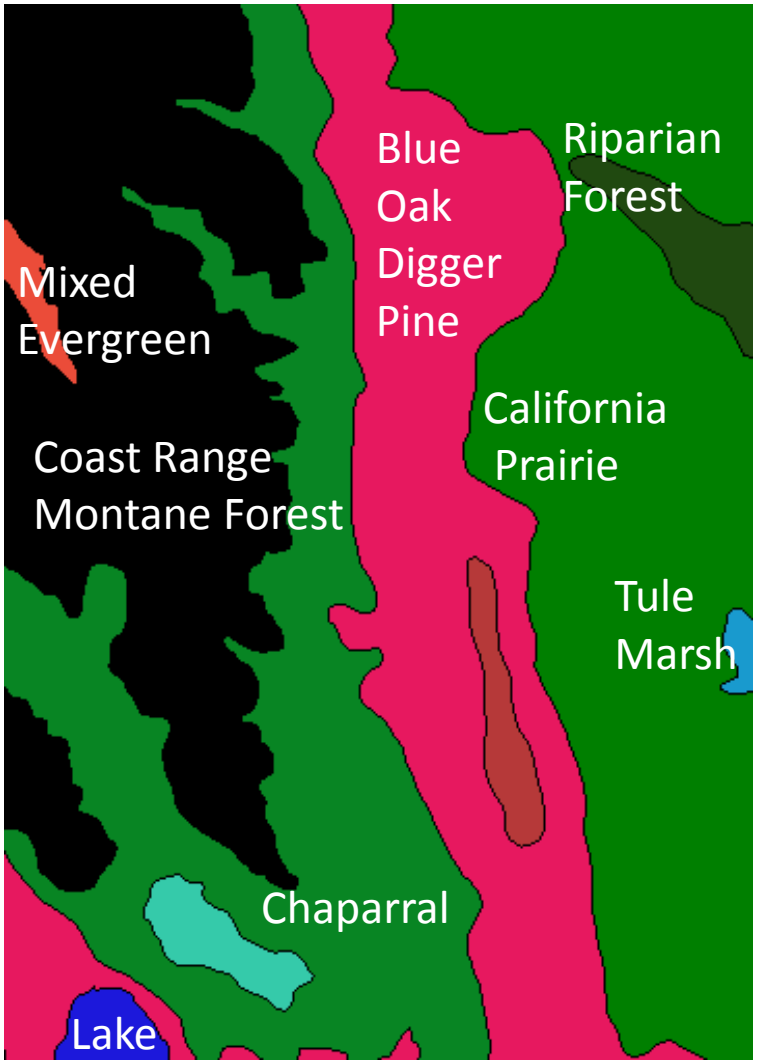
5. Run a least-coast pathway



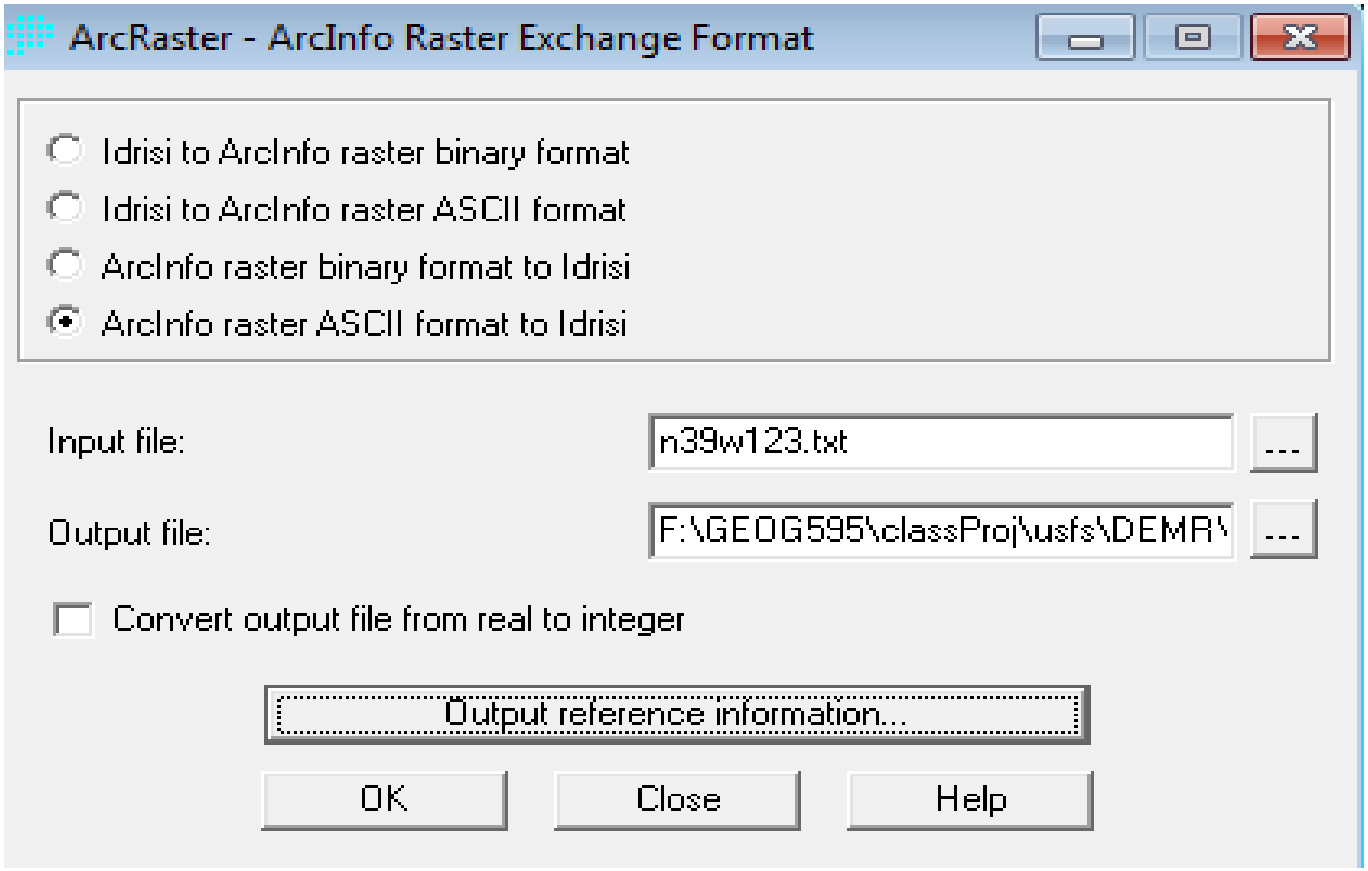
Before building the model the land cover dataset was imported and converted from an ESRI shapefile to an IDRISI vector dataset.



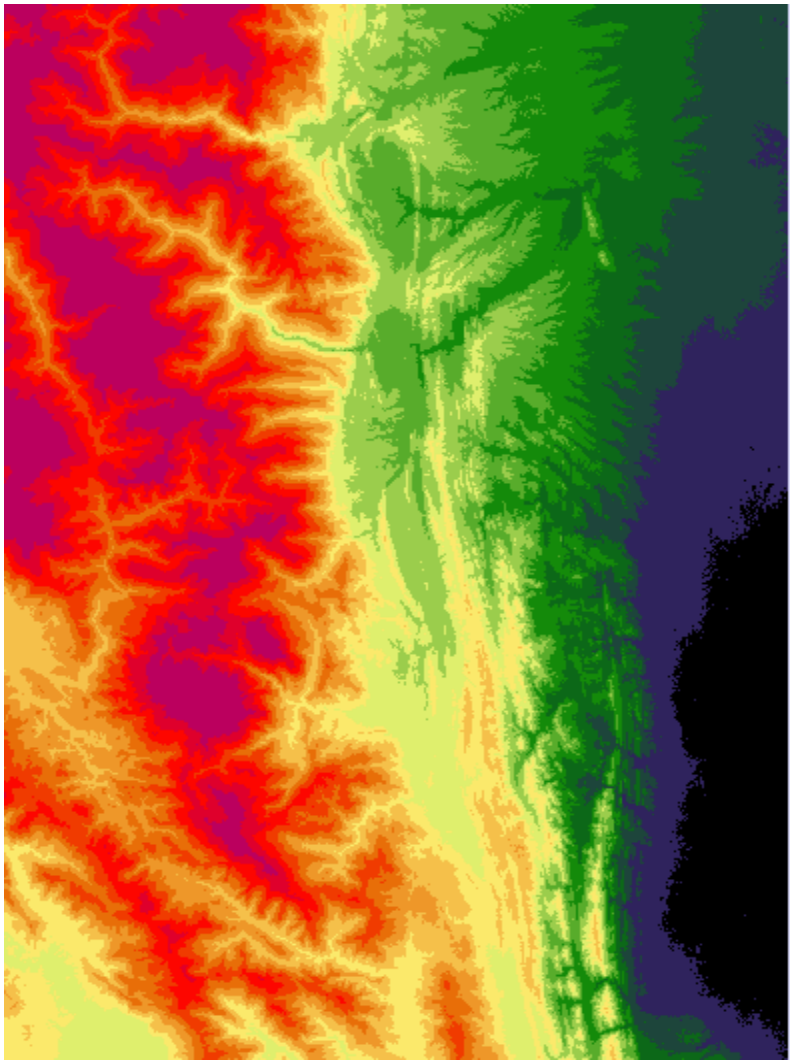
Mendocino Area Land Cover



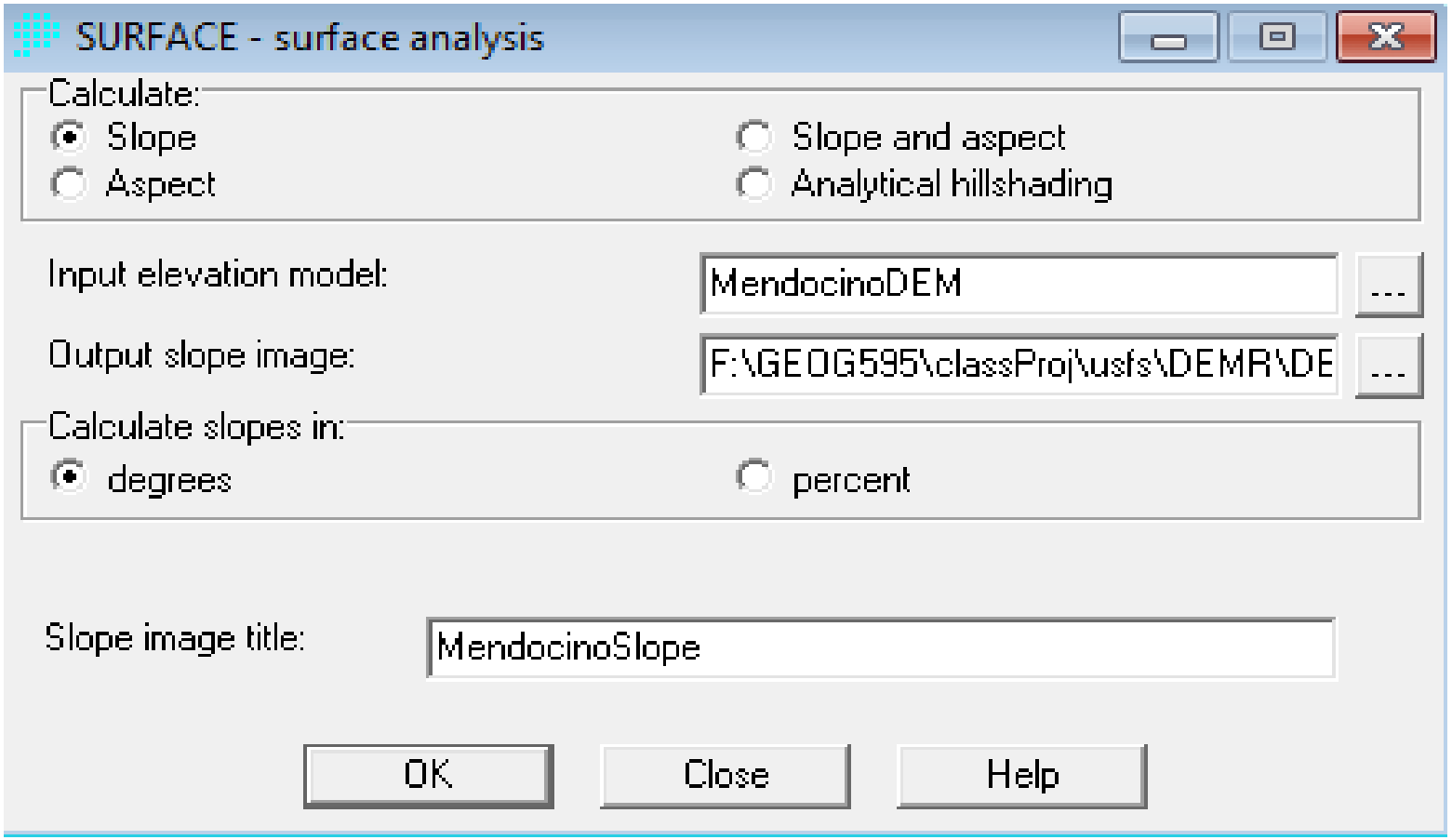
Before building the Least Cost Model the Digital Elevation Model (DEM) was converted to an ASCII text file using ArcGIS software and then imported into an IDRISI raster format.



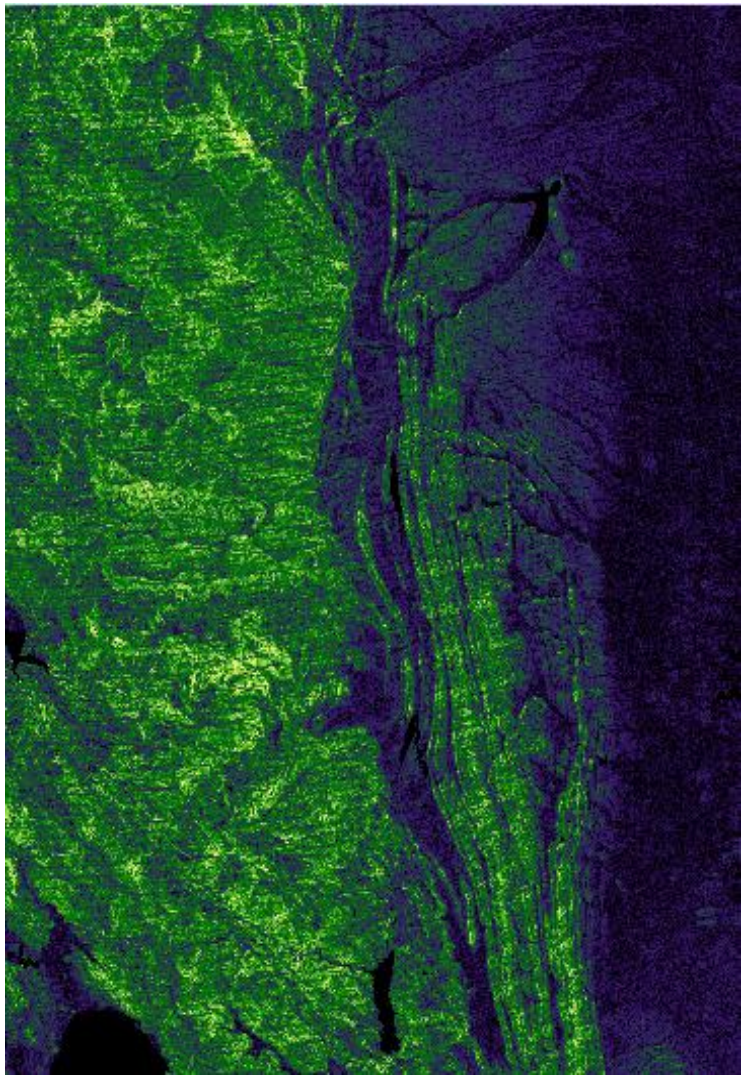
Mendocino Area Highway Project DEM



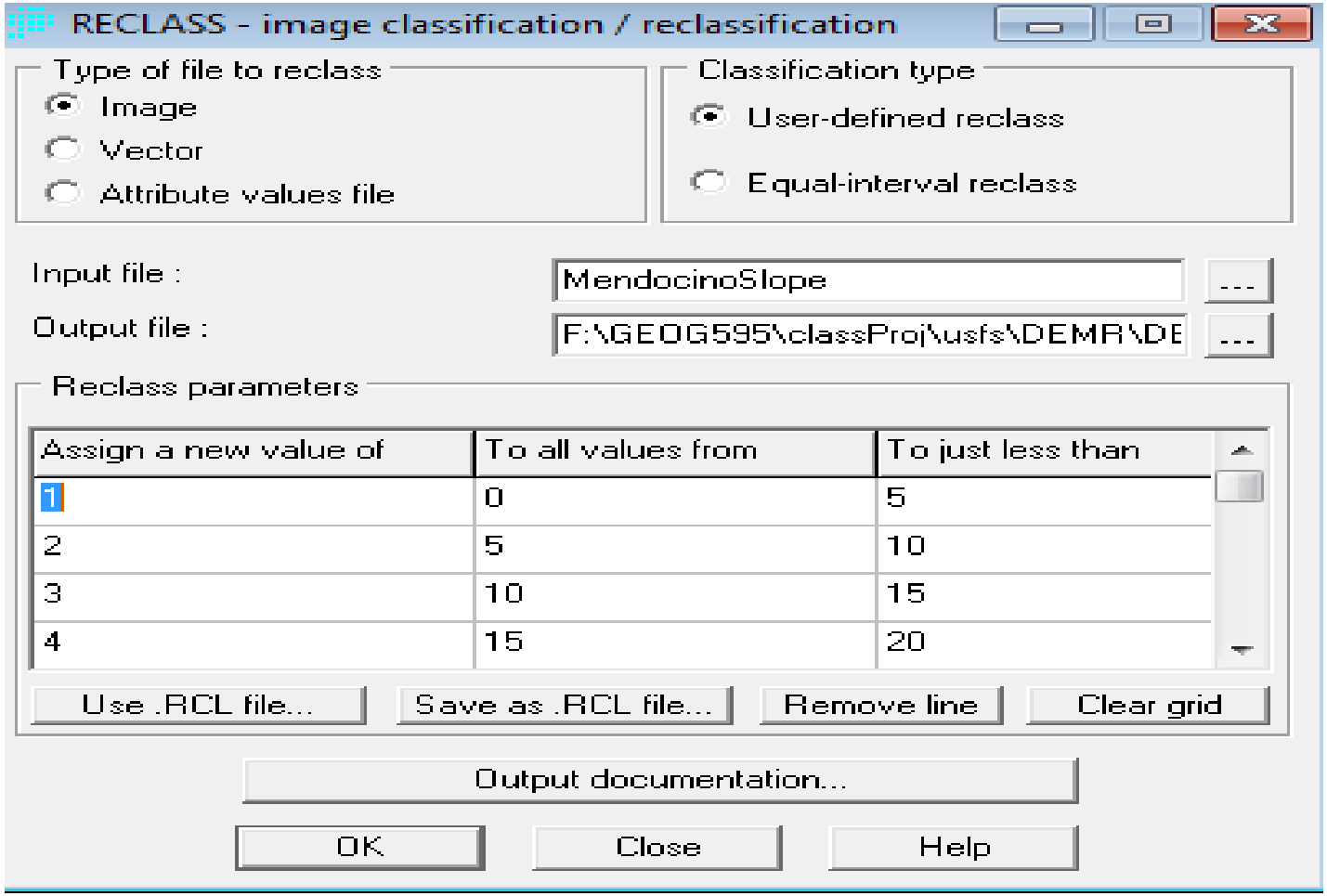
Once the Digital Elevation Model (DEM) was imported into an IDRISI raster format, a surface analysis tool was used to calculate slope in degrees.



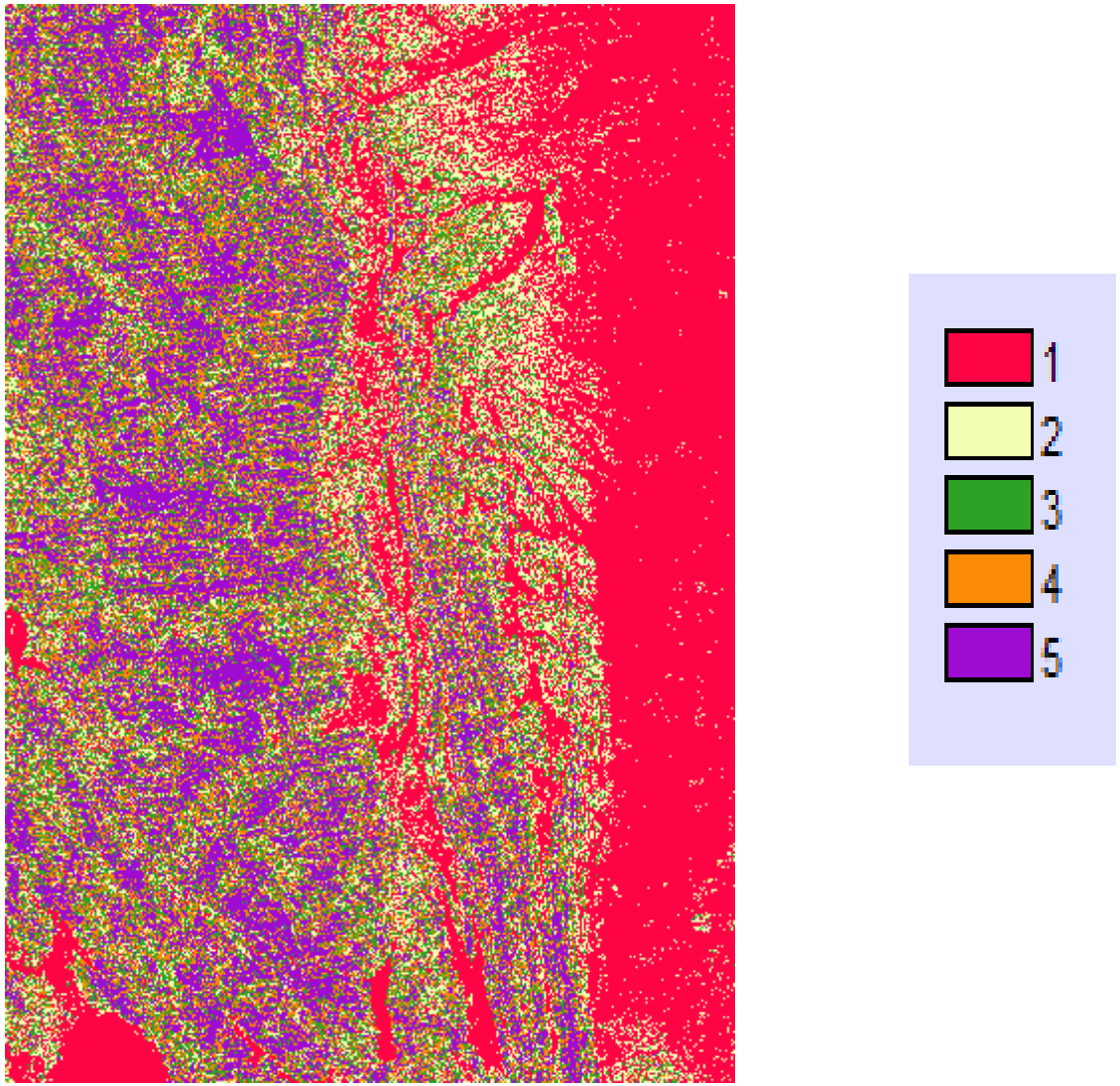
Mendocino Area Slope



The slope output raster was then reclassified to five slope classes.



Mendocino Area Slope Classes



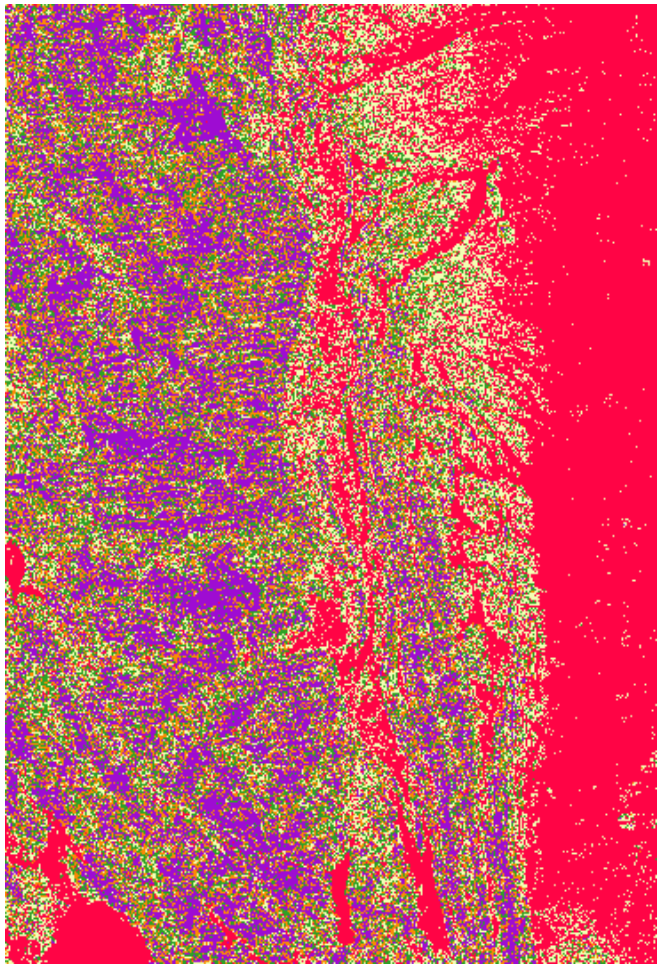
Assigning Attribute Variables for Land Cover

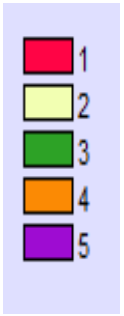
Cover Type	Cover Type ID	Friction Value
Mixed Evergreen – Rhododendron	1	2
Blue Oak – Digger Pine	2	4
Chaparral	3	5
Coast Range Montane	4	4
Tule Marsh	5	6
California Prairie	6	4
Lake	7	99

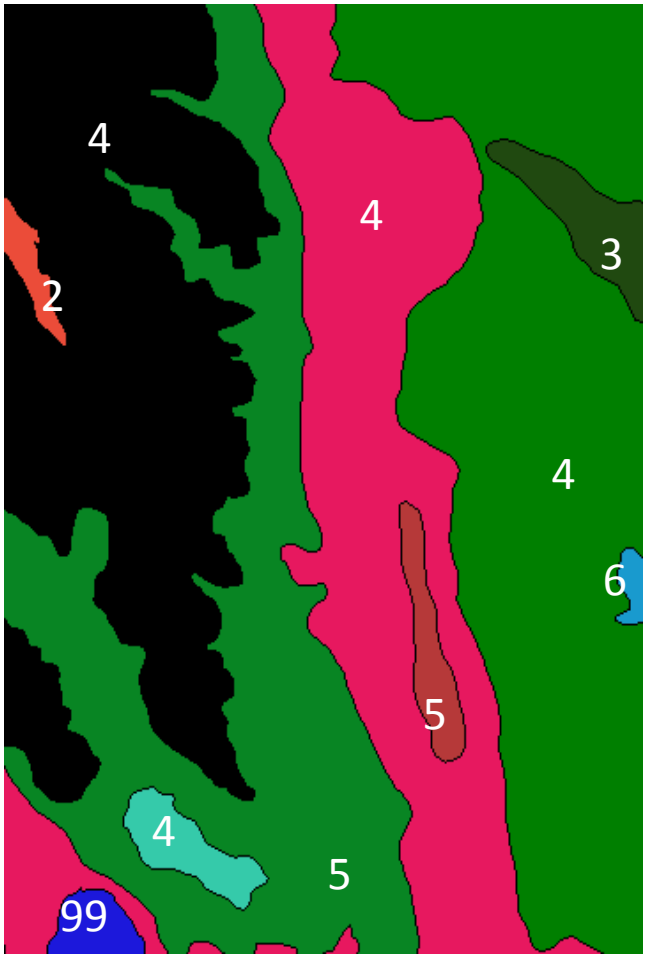
Assigning Attribute Variables for Slope Class

Slope (degrees)	Slope Class	Friction Value
0 – 5	1	1
5 – 10	2	2
10 – 15	3	3
15 – 20	4	4
> 20	5	5

Slope Class Friction Value + Land Cover Class Friction Value







Overlay “Discrete Cost Surfaces”

LAND COVER VALUE

4	4	4	99	99
4	4	5	99	99
4	5	5	3	3
5	5	3	3	3
5	5	3	3	3

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SLOPE CLASS VALUE

1	1	1	1	1
3	3	1	1	1
3	3	2	1	1
5	4	3	4	2
5	3	3	4	3

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5	5	5	100	100
7	7	6	100	100
7	8	7	4	4
10	9	6	7	5
10	8	6	7	6

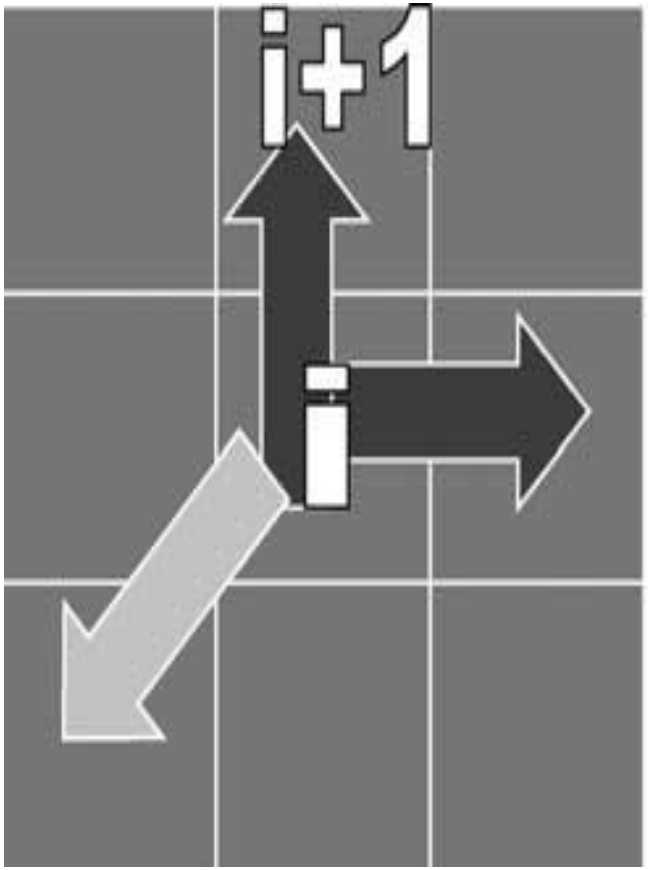
Cumulative Cost Surface

20	19	24	32	37
17	18	25	33	40
11	15	18	20	22
7	100	103	23	28
0	103	103	28	32

Optimal Route - Least Cost Path

20	19	24	32	37
17	18	25	33	40
11	15	18	20	22
7	100	103	23	28
4	103	103	28	32

Algorithm underlying ‘least-cost’ modeling



$$N_{i+1} = N_i + (r_i + r_{i+1})/2$$

or

$$N_{I+1} = N_i + 2^{**}0.5 * (r_i + r_{i+1})/2$$

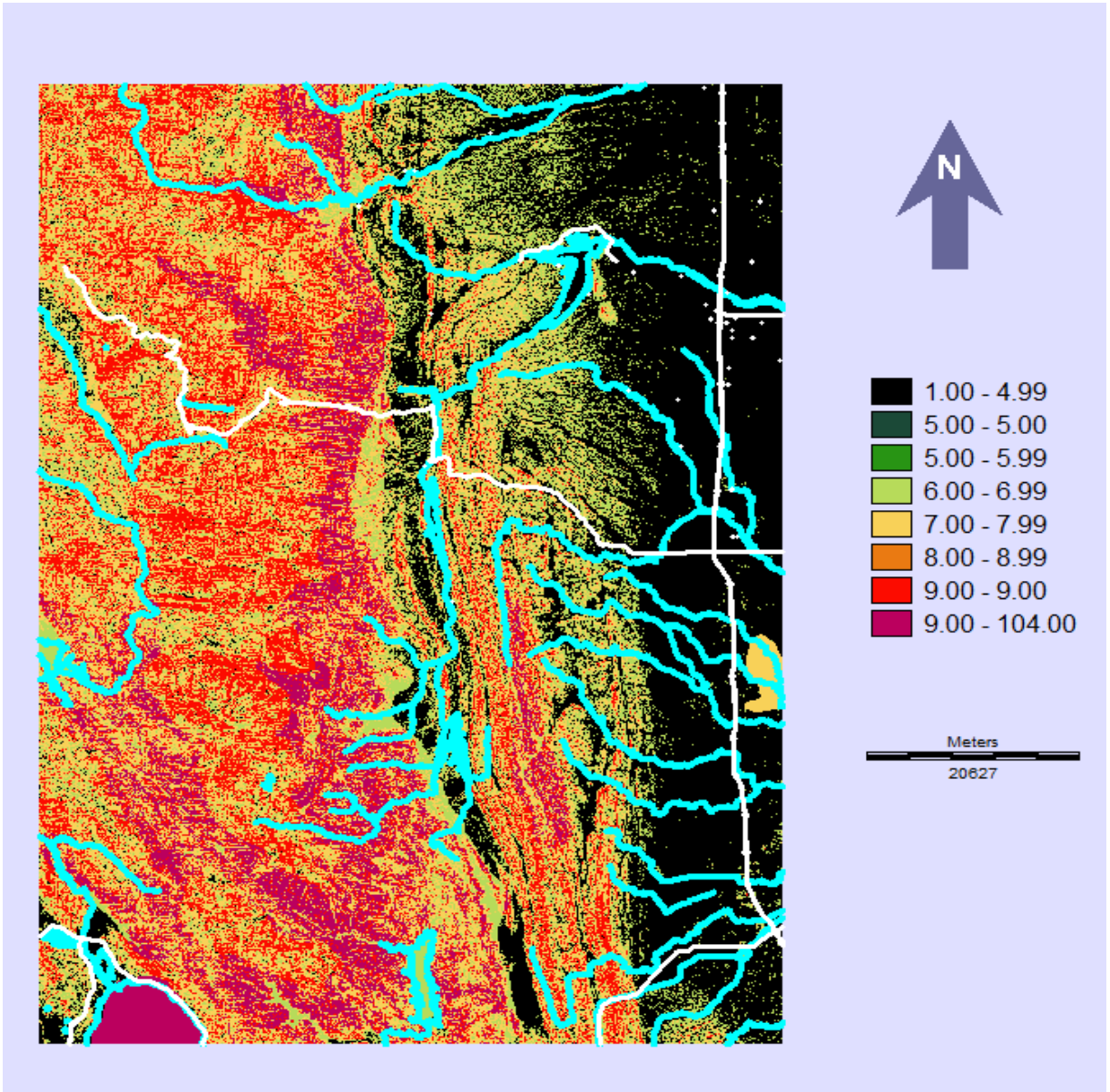
N_i = accumulated cost in cell i

r_i = resistance value in cell I

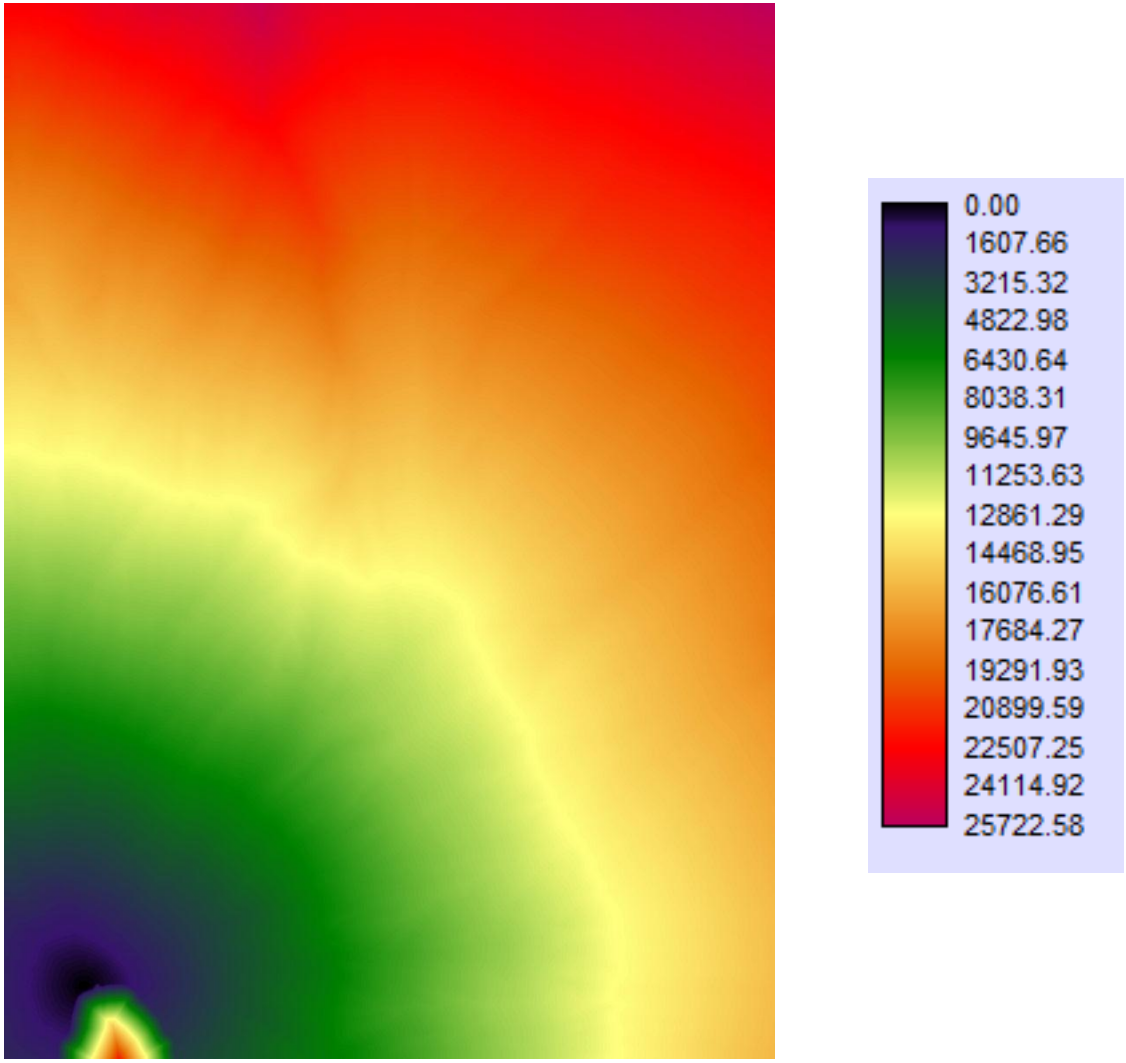
i: source cell

i+1: target cell

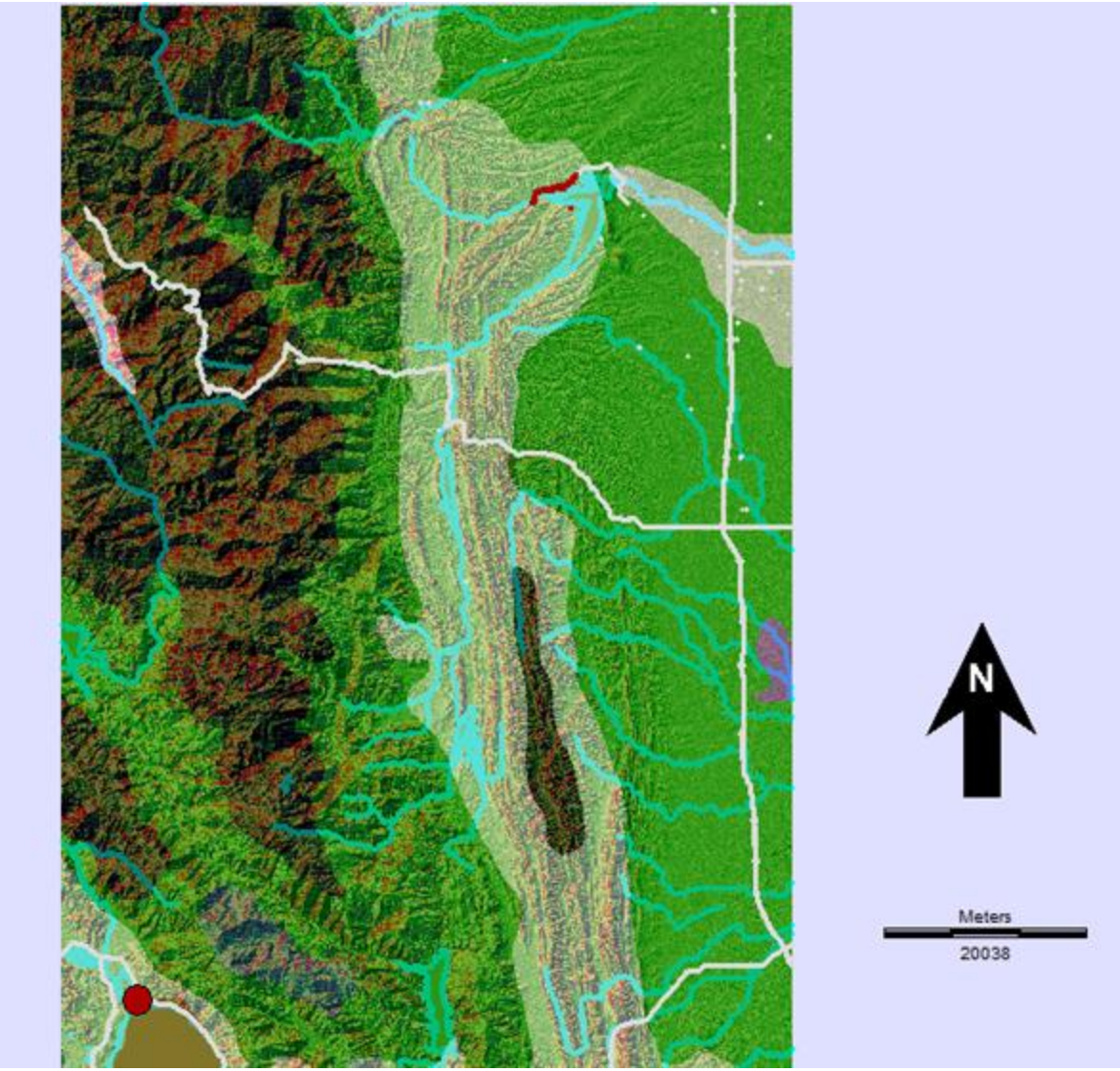
Discrete Cost Surface



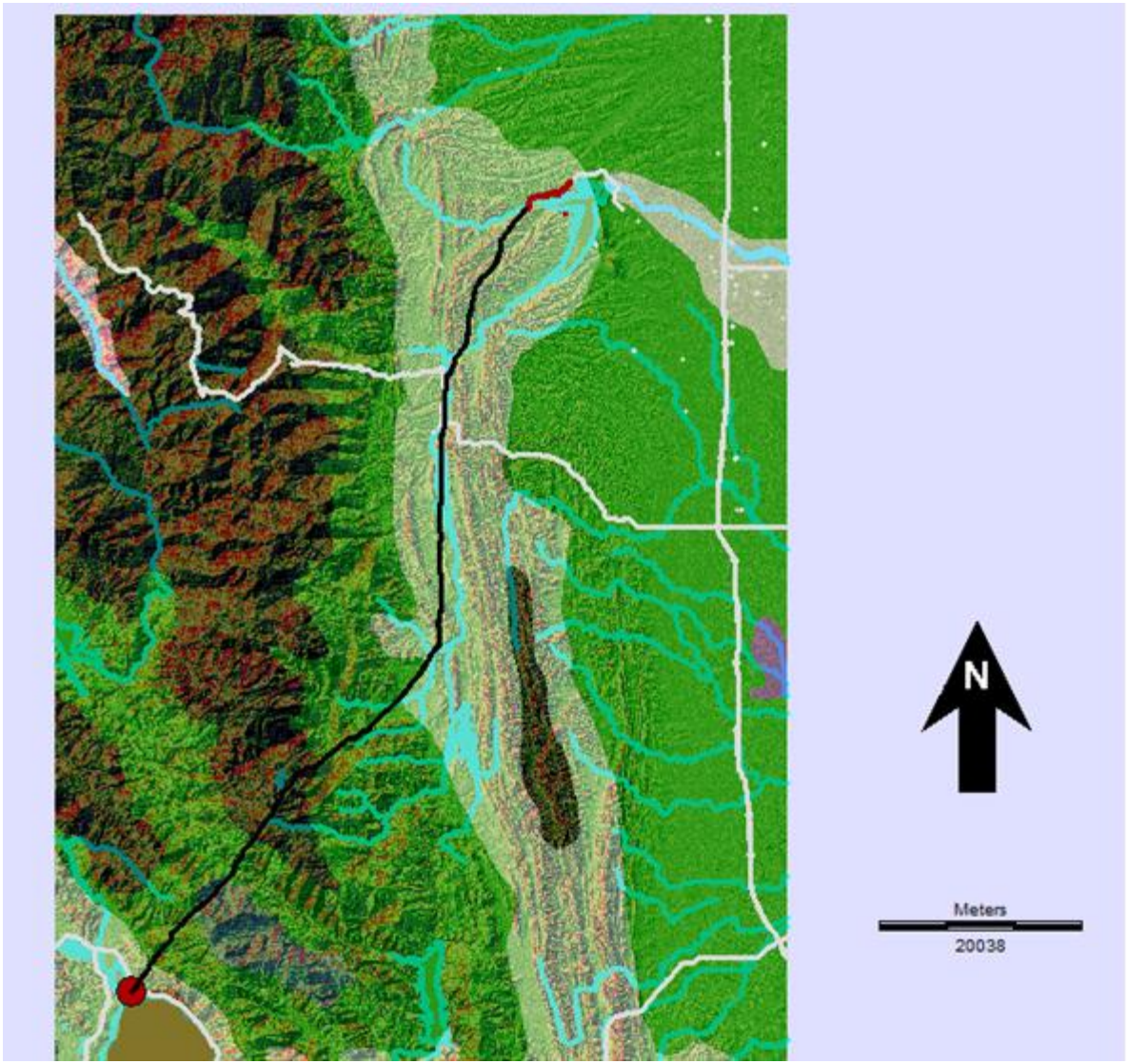
Cumulative Cost Surface



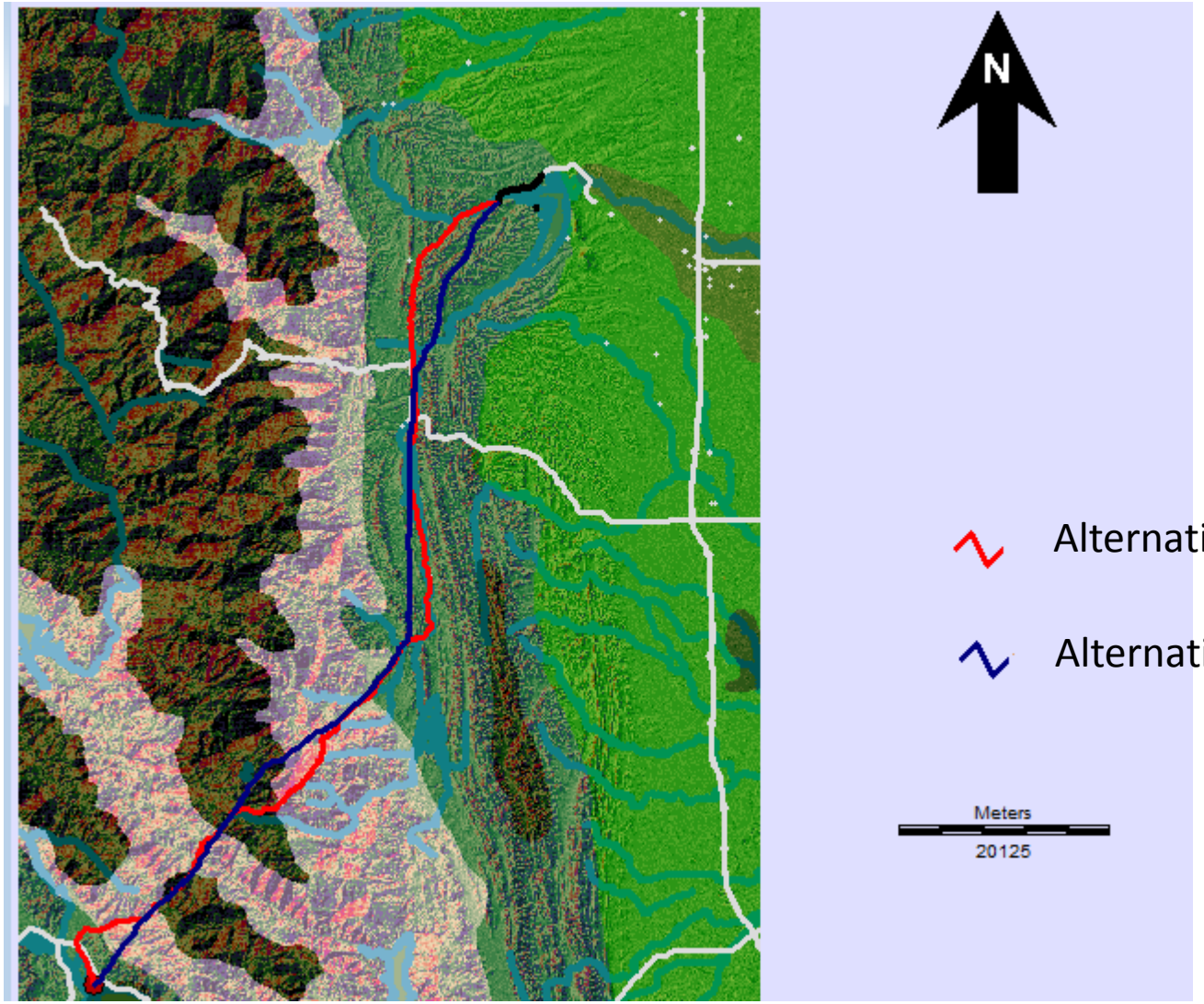
Mendocino Area Highway Project Baseline



Model Produced Least Cost Route of Mendocino Area New Highway Project



Mendocino Area Highway Alternatives A and B



Data Sources

http://edcsns17.cr.usgs.gov/NewEarthExplorer/

U.S. Geologic Survey - DEM (n39w123.bil)

http://atlas.ca.gov/download.html#/casil/inlandWaters

U.S. Bureau of Reclamation MPGIS Service Center – hydrologicfeatures (streams)

http://atlas.ca.gov/download.html#/casil/transportation

U.S. Census Bureau – TIGER_MRoads

http://www.atlas.ca.gov/download.html#/casil/imageryBaseMapsLandCover/landCover

U.S. Bureau of Reclamation MPGIS Service Center – Veg1976Kuc (1996 edition)

Kuchler Land Cover Layer (U.S. Bureau of Reclamation MPGIS Service Center – 1996)

Environmental Systems Research Institute (ESRI) 2000-11-01, vector digital data: United States.