GEOG 482/582 I GIScience II I FALL 2015

ASSIGNMENT 3: WHERE'S REESE?

Objective: During the filming of the acclaimed movie 'Wild', actress Reese Witherspoon wonders off the Pacific Coast Trail and literally gets lost somewhere in the Willamette National Forest in eastern Lane County. Your job as a geospatial guru is to find her. You set forth with vector and raster analysis skills in hand and deliver a plan of where search and rescue efforts should focus their efforts. As part of your journey to save Reese, you

- Gain a better understanding of the characteristics of raster data
- Learn how different raster surfaces are generated and manipulated
- Understand how to utilize vector and raster datasets to solve a problem

Learning Outcome: At the end of this lab you should be comfortable performing the following tasks:

- Convert data from Google Earth KML format to ESRI shapefile format
- Convert vector data to raster data
- Perform simple raster addition and reclassification
- Calculate slope from a digital elevation model (DEM)
- Generate a cost distance surface
- Find the least cost path between two points
- Perform a viewshed analysis

Deliverables:

- Basemap of search area
- Cost surface map with least cost path
- Map of viewsheds from two viewpoints
- Write up of recommendations for search priorities and answers to all lab questions

INSTRUCTIONS

PART 1: ADDING AND IMPORTING DATA

To begin you will need to have a digital elevation model (DEM) of the search area. The University of Oregon hosts a library of GIS data on their server, in which you can find vector and raster data for Eugene, Portland, Lane County and Oregon, and also national and world data sets that come with our ESRI license.

- Open a new ArcMap map document.
- Use ArcCatalog to navigate to the GIS-Data folder on the cas-fs2 server. From the folder Oregon_Rasters add lanedem_10m.

Q1: ***What does this layer show? What is the cell size and how do you know? Why is the cell size important?***

Your friend was hiking next to a few lakes, so you also want to add a layer that shows the hydrologic features of the area.

- From the folder Oregon_Vector, add the or_waterbodies.shp file

Before she left, Reese marked her starting point and destination on Google Earth. Google Earth uses a different file format to store vector data than ESRI, so you will need to convert to a shapefile.

- Set up your Lab_3 folder with appropriate subfolders (Data, Maps, Images), then go to the Shared class folder and copy the files Start_Point.kml and End_Point.kml to your Lab_3/Data folder. (Feel free to open these points in Google Earth to explore the terrain around where your friend was hiking).
- In your ArcMap document open the KML to Layer tool. Convert the start and end point KML files to layers and save in your Data folder with appropriate files names.
- Immediately change the symbology for each point to be a circle, not the Google Earth thumbtack, and change the labels so that there are no halos around the letters.

PART 2: COST DISTANCE AND LEAST COST PATH

Before you can begin narrowing down areas to look for Reese, you want to change the environment settings of your map document so that the raster analyses you perform will all be confined to the search area.

- From the Geoprocessing menu, go to Environments.
- In the Environment Settings menu, go to Processing Extent and set the Extent to "As Specified Below".
- Set the Extent to **Top:** 885,000 **Bottom:** 818,000 **Right:** 935,000 **Left:** 840,000.

NOTE: At this point, make sure that the Spatial Analyst extension is turned on. In the Customize menu, go to Extensions and make sure the box next to Spatial Analyst is checked.

To help narrow the search for Reese, you are going to generate a cost distance raster which will allow you to generate a least cost path between her start and end points. Before you can do this, however, you need to make a raster layer that assigns a difficultly of travel to each cell. You will use the slope of a cell as an indication of how difficult it is to traverse.

- Open the Slope tool.
- Using the lanedem_10m as your input raster, create a slope raster.
- Make sure that the raster you generated was created just in your processing extent.

You also want to incorporate the hydrologic features in your cost surface. To do this you need to convert the vector or_waterbodies layer into a raster.

- Open the Polygon to Raster conversion tool.
- Convert the or_waterbodies layer into a raster, making sure the cell size is set to the same cell size as the DEM (check this in the properties of the DEM if you are not sure).

You now want to combine the waterbodies raster and the slope raster to create one raster that will be our cost surface.

- Before you add the raster layers together, you need to reclassify them. Open the reclassify tool.
- Reclass the slope layer using 9 classes and the Quantile classification method, making it so the lowest sloped cells have a value of 1 and the highest have a value of 9.
- Reclass the waterbodies raster so that all of the Old Values are now set to 100. What should you do about the NoData values?

Q2: ***Why are we reclassifying water in this way? How will the value of the water affect our resulting cost surface?***

- Once both the slope and the waterbodies rasters have been reclassified, open the Raster Calculator and add the two reclassified rasters together. Name the resulting raster Cost_Surface

Q3: ***What other data could be used to generate a cost surface? Do you think our slope/water cost surface is the most realistic representation of how difficult it is to travel from one grid cell to another? Why or why not?***

Now you can use the cost surface you generated to calculate a cost distance surface. The cost distance is a calculation of the least accumulative cost of traveling from a particular location (in this case, the point where Reese started her hike).

- Open the Cost Distance tool.
- You will use the Start point of Reese's journey as your input feature source data.
- The cost raster is your cost surface.
- Save an output distance raster as Cost_Distance and an output backlink raster as CD_Backlink.

Once you have generated your cost distance surface, you can use it to calculate the least cost path between where Reese started her hike and her destination.

- Open the Cost Path tool.
- Use the End point as your input feature destination data.
- Use the cost distance and backlink rasters you just generated for the input rasters.
- Save the output raster as least_cost.

This should generate a raster that has a line of cells between the start and end points.

- For display purposes, you should convert this raster to a vector, using the Raster to Polyline tool.

PART 3: OBSERVER POINT ANALYSIS

You now have an idea of how Reese might have travelled between her starting point and destination. To aid further with the search, the Forest Service has two options for posting lookouts, one an abandoned fire tower and one on the ridgeline of a nearby hill. To help them prioritize which lookout to staff, you want to conduct an analysis of the viewsheds of each location. A viewshed is generated using some terrain model (in our case, our DEM) and computes which cells are visible from specific vantage points.

- Add the Lookouts shapefile from the Shared class folder.
- Open the Observer Points tool.

Note: There is also a Viewshed tool in ArcGIS, which will generate the viewshed from one or more features. We are using the Observer Points tool because it will allow you to distinguish which areas are visible from which lookout.

- Us the DEM layer for the input raster and the Lookouts file for the input point observer features.
- Save the resulting output raster as Obsv_points.
- Open the attribute table of the resulting Obsv_points raster.

Q4: ***What does the attribute table tell you?***

Q5: ***Based on the results of your observation points analysis and the least cost path you generated, which lookout would you recommend the Forest Service use to Reese? Why?***

PART 4: MAPS AND RECOMMENDATIONS

You are now going to create 3 maps to share with the search and rescue team:

- A basemap of the search area, including Reese's start point and destination, the water bodies, the lookouts, and any other contextual information you think would be useful.
- A map of the cost distance surface and least cost path.
- A map of the viewsheds of each lookout, including the least cost path.l

Map Elements Checklist

- Title
- Data citations
- Scale bar or text
- North arrow
- Legend
- Cartographer
- Projection

For creating your basemap in particular, it would be nice to have a hillshade to help give a sense of the terrain. You can generate a hillshade using your DEM and the Hillshade tool. You also might want to add contour lines, which can be generated with the Contour tool.

Q6: ***With reference to each map, explain which areas you would prioritize in searching for Reese. Make sure to also explain the steps you took to conduct your analysis, including any limitations or caveats of the techniques you used.***

- Upload your maps to your class blog and include answers to all questions

GRADING

You will be graded based on the following criteria:

• 3 maps (basemap, cost path/distance, viewsheds)	**10 POINTS**
• Write up that answers the questions listed above	**10 POINTS**
• Presentation of your work in WordPress	**5 POINTS**
TOTAL	**25 POINTS**

DUE DATE:
Monday Lab: November 2nd 10am
Tuesday Lab: November 3rd 10am
*Late submissions will be penalized 5% per day.