Questions and Answers for Lab 2: An Overview of Digital Terrain Modelling and Multi-Criteria Analysis

Note: As in the last lab, the 20 marks possible here will be divided by 2 to rescale them to the maximum of 10 points on the Canvas assignment.

Question 1. Can you suggest some reasons why contours are not typically used in GIS analyses but are often used to visualize topography? (1 Mark)

Contour lines are great for mapping out topography because they show elevation in terms of lines and helps the reader visualize the area of interest. They aren't great for GIS analyses because they only show the areas where elevation is changing. For flat areas there is not as many contour lines giving us minimal ata.

Question 2. Looking at the feature attributes listed in your `geog feature code catalogue` query results, what type of lake is very unlikely to be found in this arid area of southern BC? What types of lake are especially known from this area? Of the 13 possible feature classes, which ones are actually present in the `water` layer? (1 Mark)

Lakes in this area tend not be marshy or dry. Lakes in this areas are intermittent lakes, which dry up during the summer months of the year. This is due to climate of Southern BC which don't allow lakes to be marshy or dry. Out of the 13 possible feature classes, there are two outliers, while the rest is either intermittent or semi-permanent.

Question 3: Can you provide an explanation as to why, in the TRIM `geog feature code catalogue`, there is a field called **Custodian**? Who are some of the custodians of the different features (list 5)? (1 Mark)

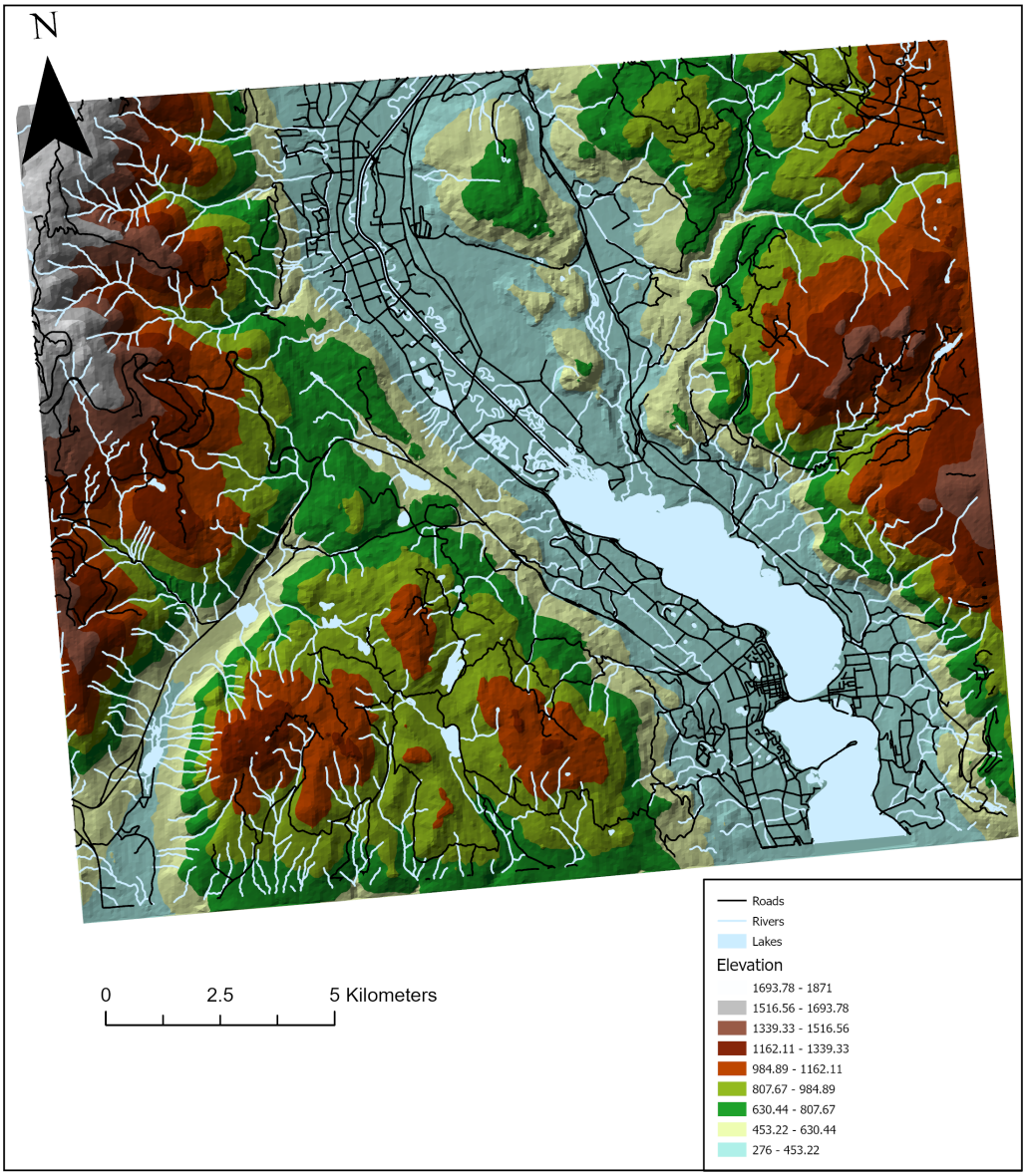
The custodian field is used for managing the process of correcting and updating the database. Custodian is a group, organization, or individual responsible for maintenance of the material. These custodian include MOF, CCSM, TRIM, TER, and WLD.

Question 4. Create and display here a map layout showing the TIN you just created. You should include the lakes, rivers and roads (appropriately symbolized) on your map. (2 marks)

> For Data Source, note in small print:
>
> "Terrain Resource Information Management Program – (TRIM)", http://hdl.handle.net/11272/10166 BCGOV ILMB Crown Registry and Geographic Base Branch

[Distributor] V3 [Version]

Okanagan TIN



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Question 5: When running the Slope and Aspect tools, look at the choices you are given with respect to Method. In what circumstance would you select the Geodesic method over the Planar method? (1 mark)

"Planar - The calculation will be performed on a projected flat plane using a 2D Cartesian coordinate system.

Geodesic - The calculation will be performed in a 3D Cartesian coordinate system by considering the shape of the earth as an ellipsoid." (ArcGIS Help)

You would use the Geodesic method if you need a 3D spherical coordinate system to get aspect or slope. Geodesic method produces more accurate results but at a much smaller scale. Also the Geodesic methods assumes some local normal planes.

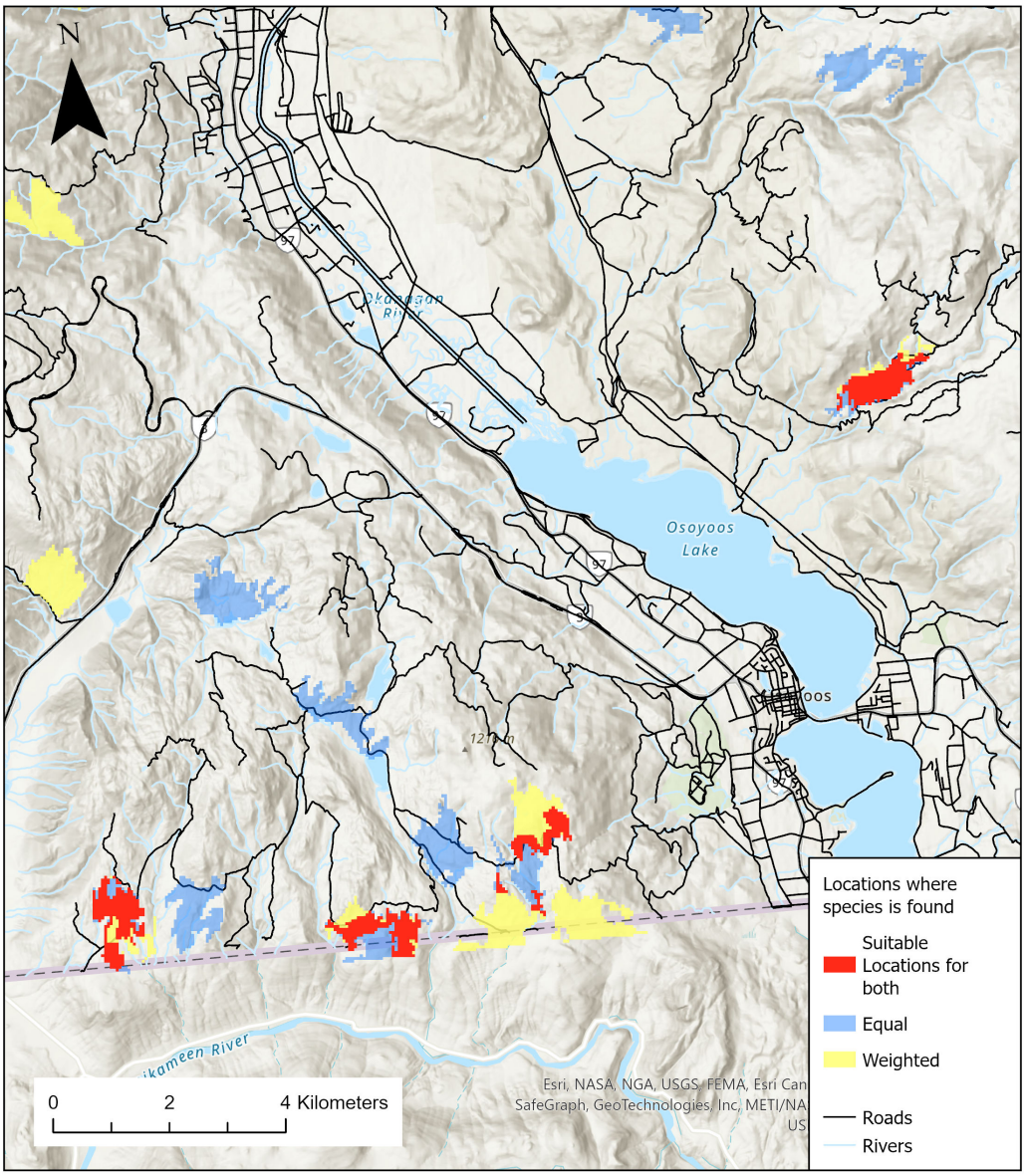
Question 6: There are other transformation methods that could be used to transform the slope values. What are some of the other methods that could (reasonably?) be used for this situation? Would you have to alter any of the methods' parameters when applying them to the slope data? (2 marks)

> Help files in ArcGIS Pro for raster reclassification are here. There are also detailed help files for the related Fuzzy Membership tools of ArcMap that are described here.

You could also use 'Small' to transform the slope values. You would have to alter the mean and stdv multipliers as 'small' isn't as closely defined as MSSmall is. Use the MSSmall function if the very small values are more preferred because the "definition of the function is based on specified mean and standard deviation multipliers". The method 'Small' has a midpoint that it bases the values. Values greater than the midpoint has a decrease in preference and vise versa.

Question 7: Final Map: Your final map should let the reader understand the `Suitable_Locations_Compared` layer in the manner discussed above ("A good map..."). It should be at least as informative as the map that you would get if you just added a basemap (topographic) with the transportation layer (call it roads) so that it draws above the `Suitable_Locations_Compared` layer (as that would help the botanist plan her route arond the sites). We will be grading on the insights the map offers, some of which may become clearer for us upon reading your report (Question 8). As always, include a legend, title, your name, data source, etc. in the layout. (6 marks)

Suitable Locations of Spiranthes diluvialis



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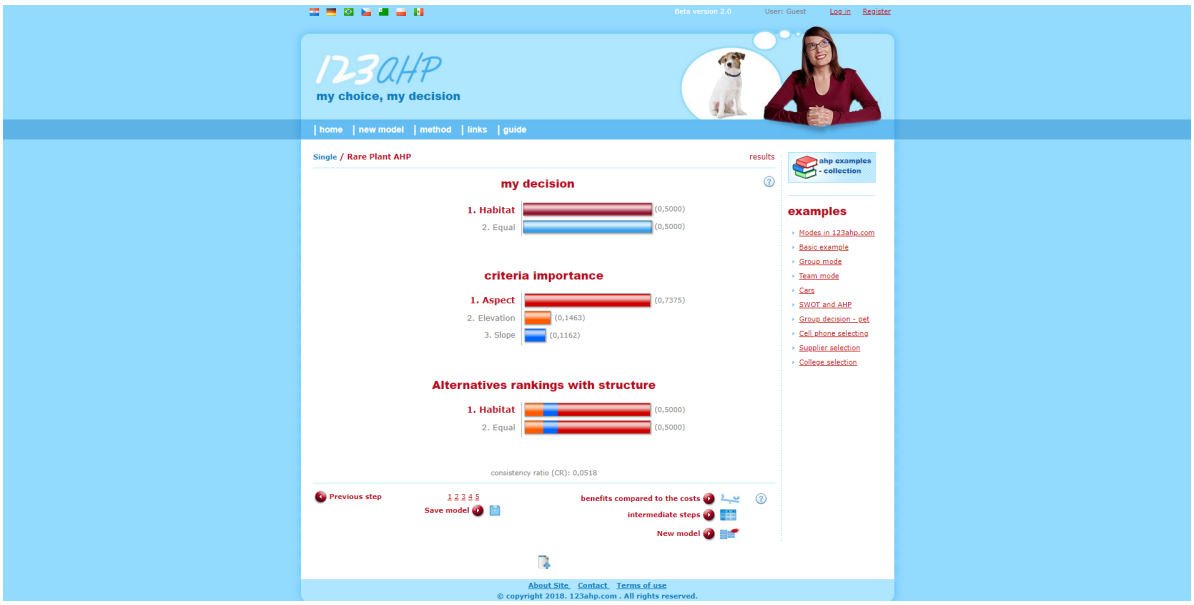
Question 8: Final Report: Write a 300-word report. You can include as many images/maps as needed. The report will briefly summarize (1) the steps you took in order to produce the final map and (2) outlines the differences identified in `Suitable_Locations_Compared` (i.e., provide an explanation to the botanist as to how you conducted the MCE analysis and as to what the sensitivity analysis showed). You should tell the botanist how many hectares occur in each class (internally called 1, 2 & 3 in the raster, but that wouldn't mean anything to a reader) on your map (Hint: Look at the attribute table for MCE_Comparison and consider the cell size [and note that the count reflects how many cells are assigned to each category]). You should

also ensure that the botanist knows which areas on your map should be surveyed. You also need to include the image of your AHP results in your report. This should be included on the answer sheet as the last page. (6 marks)

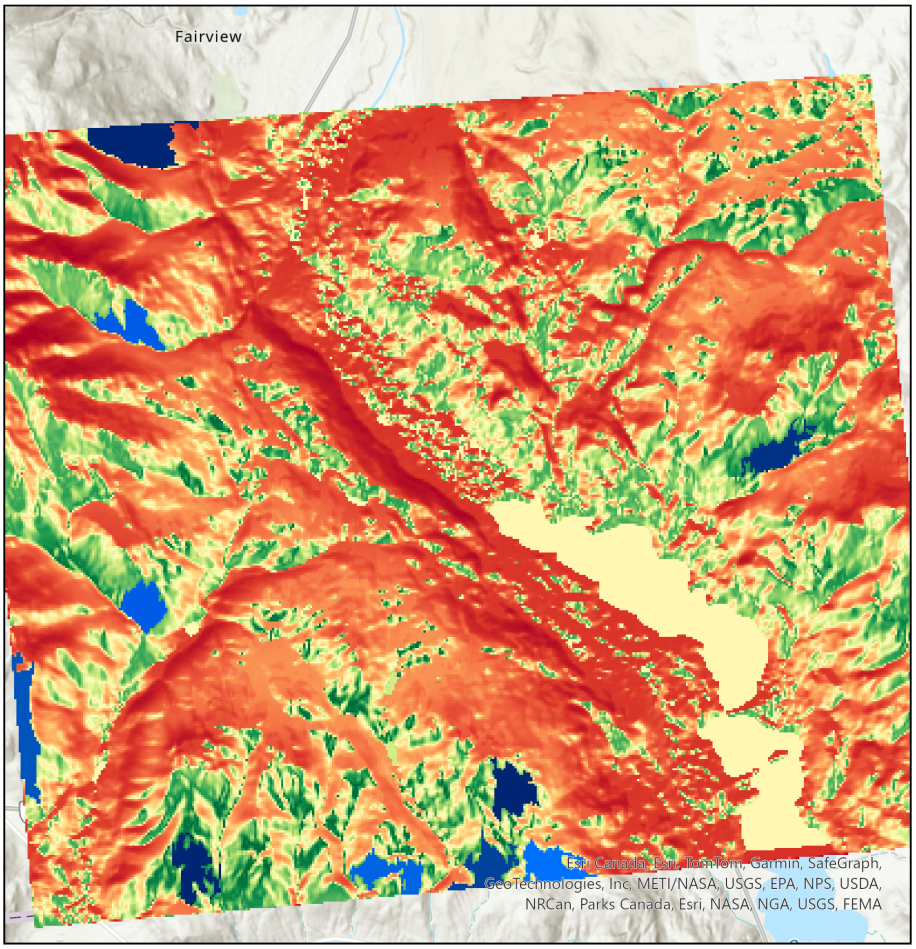
(Recall: The AHP weights that you need to use in building your MCE model are listed under **criteria importance** on the last page of the website. You saved the criteria importance chart as an image to be included in your lab report and noted down the value associated with the **consistency ratio** toward the bottom of the page, which you also need to include here.)

In order to create this habitat map I first had to create a accurate digital elevation model of the area. Once I created the DEM, I could obtian slope and aspect layers. Moving onto the MCE model, we will use an analytical hierachical approach to get weights of factors that will depend on the importance of each factor (see picture below). Using the Suitability Modeler we can use the weights according to sort out importance. Then we can transform elevation, slope, aspect into the requirements that the botanist stated. Combining all the parameters toegther we will get a raster of places where the species could be located. Then we have to use the locate tool to find the best location for this species to reside in. In the MCE Model we have to conduct a sensitivity analysis which means how sensitive the results are to the specific parameters selected during the MCE modeling process. This resulted in areas of suitabily of the plant to move to different locations. The layer Suitable_Locations_Compared shows which areas overlaps from the MCE anaylsis and the sensitivity analysis (areas that are for sure where the species resides in) and is shown in red in my map. Yellow is the areas of suitablity of MCE anayalsis and blue is suitablity of the sensitivity analysis. The weighted class (MCE analysis) has a cell size of 2701, Equal (sensitivity analysis) has a cell size of 2309, and overlaping class has cell size of 939. The best area for the botanist to survey would be the overlapping areas as it highest chance that the species would reside there.

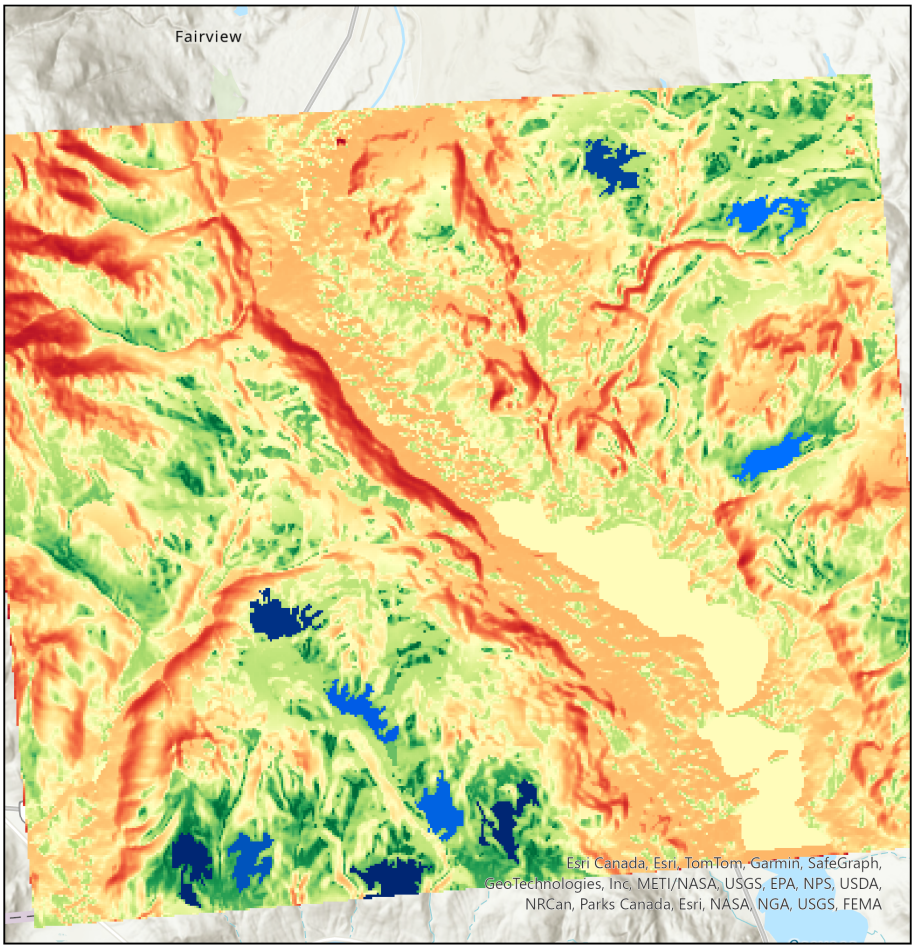


analytical hierachical approach to obtain weights of each factor

consistency ratio: 0.0518



MCE analysis with suitable areas in blue



sensitivity analysis with suitable areas in blue