GGRC30H3: Advanced GIS

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Due date: 2017-10-05

(Total of 10 Marks- 10% of the final grade)

Assignment #1: Watershed Delineation and Calculation

Learning objectives:

a. **You should be able to explore data, download data, check projections**
b. **You should be able to delineate watershed**
c. **You should be able to generate slope and hillshade information from provided data**
d. **You should be able to do basic stats extraction from the data to provide solution to given problems related to this exercise**

Data: Students to use the data from the provided links below.

Problem background: Suppose the City of Toronto has a trail master plan that connects the city's natural areas and river valley lands with a trail system. They are looking at a potential for a trail close to the University of Toronto Scarborough (UTSC), close to the Highland Creek valley lands. The trail is supposed to be close to the valley, but it should avoid the slope >=25% to avoid potential hazards. **The city also wants to know the maximum linear distance (towards the valleys) from the a site at the UTSC (provided UTSC point data)**. You can round the distance in closest 10 meters (i.e. if you get 206, you will round it to 210 m). For this exercise, just use the closest cell (southwest from the UTSC location point). The distance is rounded to 10 due to the data resolution.

Along with the trail system, the City is also interested in learning about the size of the watershed (in hectares) within the study area from the provided watershed point location (close to UTSC). This point is in the nearest pinch-point (narrowest part of the highland creek that is close to the UTSC). **You are going to delineate the watershed and calculate the watershed boundary.**

Your task is to use all the required data for this project form the provided sources below. Clip it to the study area, generate the watershed and perform the analysis to come up with the required numbers. You are going to create a map with your analysis. You are free to add some additional data or information that enhances the map. The map will contain the newly created watershed boundary, slope information within the study area and the hillshade background.

Summary of the steps for this assignment:

Watershed Delineation and Map

Download the geodatabase called "Assignment1" containing following data from blackboard under **Course Materials.**

a. Study area
b. DEM (Ontario Geospatial Data Exchange (OGDE), Ministry of Natural Resources (OMNR), last updated 2011)
c. Pour point location (for watershed creation) and UTSC site location (to measure the distance)

- Clip the DEM data to the study area boundary
- Delineate watershed within the study boundary
- Convert it to vector boundary
- Calculate the area of the watershed
- Extract rivers (use the stream threshold of 1,000 for this assignment) and calculate length
    - Note: if you get "null" value or error while extracting the streams. It is probably due to the data location issue. If it keeps repeating, download all the data on your desktop and re-run it.
- Generate a slope layer using your clipped raster file and reclassify into 3-5 classes where percent slope of >=25% can be used to answer questions later.
- Create a hillshade layer from your clipped raster file

Final submission:

1. A map with semi-transparency that shows the newly created watershed boundary with the slopes (classified in 3-5 classes) and hillshade layer underneath. (**70 % of the assignment or 7 out of 10)**
    a. The map should have pour point, watershed, rivers, slopes and hillshades-all visible.

   b. The map should include all cartographic elements that you learned in the past courses.
   c. The data sources and author's name should be clearly labelled on the map.

2. Answer following questions (1 to 2 sentences) on a separate page. (**30 % of the assignment or 3 out of 10)**
   a. What is the total area of the watershed in hectares **within the study area** (round it to two decimal places)?
   b. What is the maximum distance the City has to build a trail from the given point location? (You can manually measure the distance or extract information using a GIS tool. I am looking for an approximate number here.

      Note: Distance value: It is a straight-line distance from the UTSC point to the >25% slope raster cell. I am asking you to get what is the maximum distance (or gap if you will) there is between the UTSC point and the steep slope.

   c. What is the length of your rivers/streams (m) within the watershed that's located **within the study area**?

You are required to submit

a. Digital copy of your map in the pdf format and 1-page word or pdf document answering three questions from #2 above uploaded to the blackboard.
b. Hardcopy (from "a." above -includes the map and the word/pdf document) or the printed version by the due date before the lecture.

Late submissions should be uploaded online (digital copies). The date and time stamp will be used for the late penalty. For the digital version, if you submit the wrong file online (late or early) by mistake, and need to re-submit it, go ahead and submit the second file with the tag "Final" at the end and email me about what happened and why I should use your second file with the tag "Final".