GEOG 204: Tutorial 5

Spatial Analysis

The main objective is to go through some of the common spatial analysis functions by answering a series of questions that would help us better understand the City of Prince George using the data provided.

At the end of this tutorial, you should be familiar with some of the basic functions used in spatial analysis.

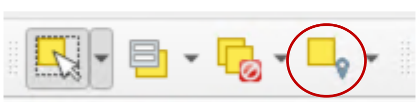
Part A: Working With Vector Data

1. Load the all data for this tutorial in QGIS. In what your coordinate system are your data?
2. What is the highest point in the City of Prince George?
   - Use the shapefile with the spot heights elevations.
     - Open the attributes table
     - Right click in the columns table to sort

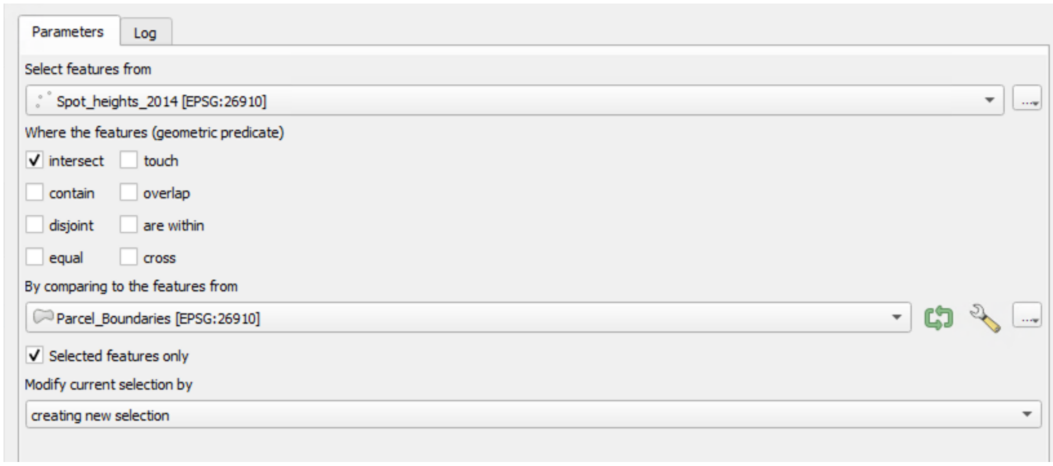
3. What is the lowest point in the City of Prince George?
4. Let us assume that UNBC is situated on parcels with PID #s 007972890, 015287467, 023384697, and 028806077. What is the average elevation at the UNBC campus? The objective is to select the points with spot heights that fall withing those parcels and then average their height values.
   - Firstly, select all the features with the above PIDs in the parcel boundaries layer
     - Open the attribute table, click the "select features using an expression" button
     - In the expression window, type the SQL code for selecting the features by following the syntax below

       PID = '007972890' OR PID = '015287467'

   - Secondly, on the Selection toolbar, choose Select by Location

     - In the dialog window that pops up
     - Select features from: **Spot heights**
     - Where the features: **intersect**
     - By comparing features from: **Parcel Boundaries**
     - **Check** Selected Features only



How many points were selected?

- Next in the Processing toolbox
  - Vector Analysis >> Basic Statistics for fields
    - Input Layer >> spot heights
    - Check selected features only
    - Field to calculate >> Elevation
- Using the Count points in polygon function to determine the number of points that fall within parcels within PID #s 007972890, 015287467, 023384697, and 028806077.
  - Vector Analysis >> Count points in polygon

5. Let us assume that the width of Ospika Blvd is 10m from the center line. How much surface area is does this particular road cover in square kilometers

   a. Use the buffer tool
   b. Use the dissolve function the layer resulting from the buffer function
   c. Calculate the area

Part B: Working With Raster Data

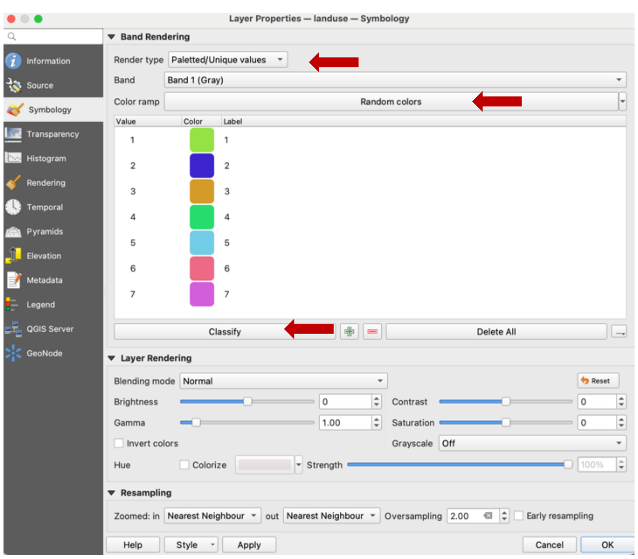
In this tutorial we will explore additional functions principles used in spatial analysis. The scenario used in this exercise is adapted from one prepared by ESRI.

In the town of Stowe, it has been decided that a new school must be built to take the strain off the existing schools, and as the town's spatial analyst you have been assigned the task of finding the potential site. The necessary data are provided the Stowe folder. Make a copy of the data in your folder for this tutorial on the K drive.

Dataset	**Description**
Elevation	Raster dataset representing the elevation of the area
Landuse	Raster dataset representing the land-use types over the area
Roads	Feature class representing the linear road network for the town of Stowe
Rec_sites	Feature class representing point locations of recreation sites
Schools	Feature class representing point locations of existing schools
Destination	Feature class representing the destination point used when finding the best route for a new road

1. Open QGIS and add the data.
2. If the coloring has not happened, right click on the landuse layer and go to Properties >> Symbology.
   In the Band Rendering Section:
      Render type – Palleted/Unique values
      Color Ramp – Random Colors
      Then click Classify

   Leave the other sections at their default settings



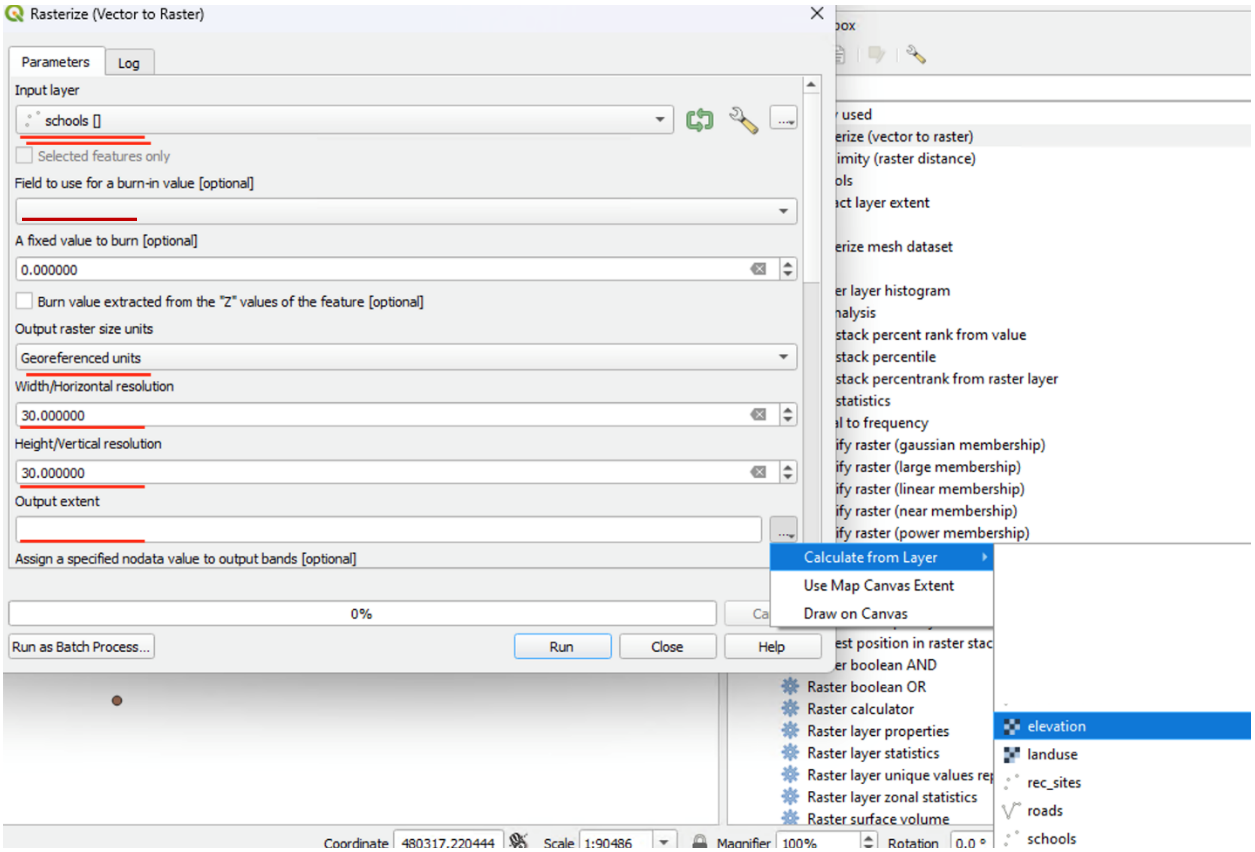
3. In the Processing Toolbox search for the Hillshade function under the Raster terrain analysis group. Apply the Hillshade function on the elevation layer using the default settings.
    - Next arrange your layers such that the resulting hillshade layer is at the top.
    - Set its transparency of the hillshade layer to 30%. (Layer Properties >> Transparency >> Global Opacity)
    - Turn off the elevation layerlope

In order to identify suitable sites for the new school, we need to consider:

- the slope angles around the town,
- the distance to recreation sites
- as well as the distance from the existing school.

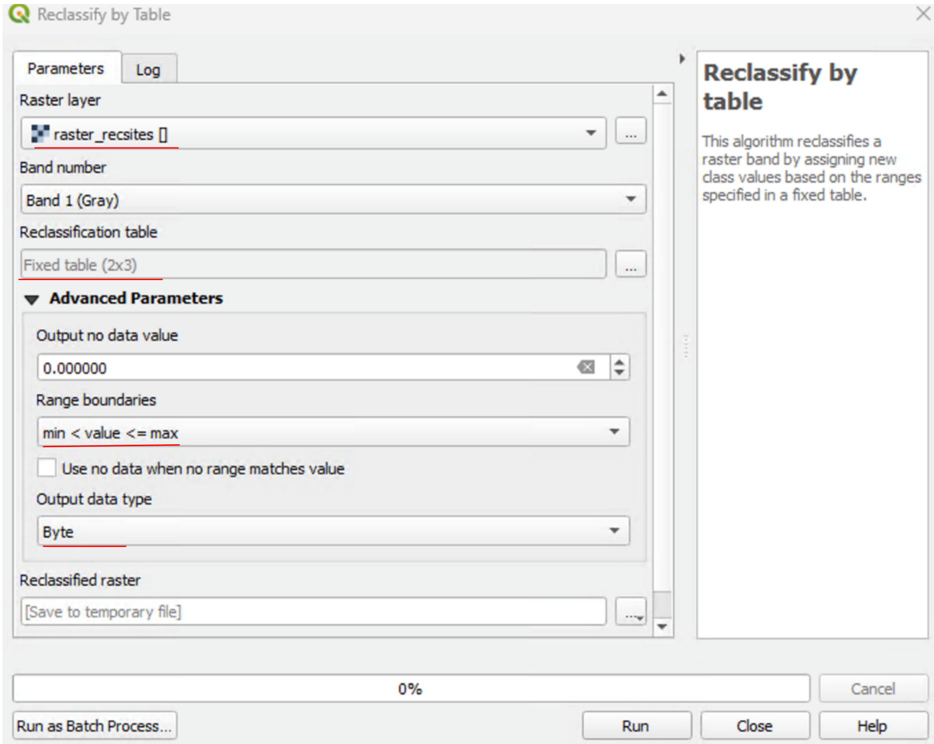
4. Apply the Slope function to the elevation layer. Save your slope file as a tiff format
    - In the Processing toolbox >> Choose Slope under the Raster terrain analysis category

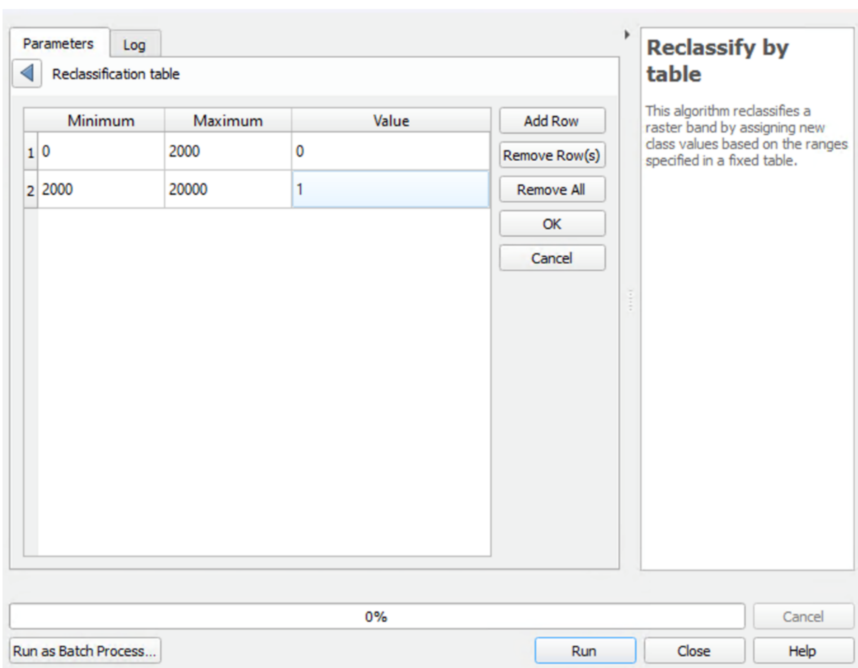
5. Next you will need to convert your point layers i.e the schools and recreational sites - into raster layers.
  - Apply the vector to raster conversion on both the schools and rec-sites layers. Save your files in the geotiff format as raster_schools and raster_recsites respectively.
    - In the Processing toolbox >> Choose Rasterize(vector to raster) conversion under the GDAL vector conversion category
        - Input layer: schools or rec-sites accordingly
        - Burn in Field: ObjectID
        - Output raster size units: Georefenced Units
        - Horizontal Resolution: 30 (30 is the resolution of the elevation layer and the slope layer)
        - Vertical Resolution: 30 (30 is the resolution of the elevation layer and the slope layer)
        - Output extent, make it the same as the elevation layer



6. Apply the proximity function to the raster_schools and raster_recsites layers generated in the step above. This function generates a continuous surface that indicates, for each cell, the distance to the closest facility (i.e. school or recreation facility). Name your layers dist_school and dist_recsites accordingly, using the geotiff format.
    - In the Processing toolbox >> Choose the Proximity under the GDAL Raster Analysis category
        - Input layer: raster_schools, raster_recsites accordingly
        - Distance Units: georeferenced coordinates

7. Next you will create a binary layers indicating distances that are greater than 2000 meters for the recreation sites and schools layers.
    - In the Processing toolbox choose Reclassify by table under the Raster Analysis category.
    - Name your layers as binary_recsites and binary_schools accordingly





8. Repeat the above procedure to reclassify the slope layer. Slopes less than 30 should be assigned a value of 1, those equal to or greater than 30 should be assigned a value of 0. Name your output layer binary_slope

9. Apply the Raster Calculator under the Raster Analysis category to the 3 binary layers.
    - The operation should be a multiplication of binary layers
    - Use the elevation layer as your reference layer