Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Lab 10: Terrain Analysis

In this lab students will create slope, aspect and hillshade layers using RADAR and LiDAR derived DEMs.

## Part I: Set up your QGIS project.

1. Open your project from last Tuesday.

## Part II: Calculate slope, aspect, and hillshade for 30m DEM

We will calculate these terrain layers from our 30m DEM. Make sure this layer is in UTM18N! If not, right click🡪save as and specify UTM18N as the CRS.

1. Calculate slope (degrees): Raster🡪 Terrain Analysis🡪Slope and select dem30m as the elevation layer and dem30m\_slope as the output layer. Z factor should be 1 and click OK.
2. Style the slope layer with a singleband pseudo-color with a red to green gradient.
3. Calculate aspect: Raster🡪 Terrain Analysis🡪Aspect and select dem30m as the elevation layer and dem30m\_aspect as the output layer.
4. Calculate hillshade: Raster🡪 Terrain Analysis🡪Hillshade and select dem30m as the elevation layer and dem30m\_hillshade as the output layer.

**Questions:**

1. Why is it important that the dem be projected in UTM18N? How does this relate to the Z factor?
2. Zoom in on the high-elevation areas in eastern Rensselaer county and view your slope, aspect and hillshade layers. What patterns do you see? What do you think created these patterns?

## Part III: Smoothing the DEM

1. We are going to smooth out the dem30m layer to reduce these unwanted patterns. We will repeat the resampling process we performed with the NLCD layer last class:
2. Go to Processing🡪 GDAL/OGR🡪 Projections/Warp
3. Select your dem30m for the input file, UTM 18N for destination CRS, 0 for Nodata value and 50 for Output file resolution
4. This time, since the DEM is **a floating point** (continuous) grid we will select ‘**cubic’** as our resampling method.
5. Save the output as **dem50**.

## Part IV: Re-calculate terrain models from smoothed DEM

Now let’s re-calculate slope, aspect, hillshade and contours from this smoothed DEM: repeat the steps from part II but using your new 50m dem.

**Question:** How do the layers look now? Are the patterns gone?

## Part V: Styling your terrain analysis output layers

A common way to symbolize aspect, elevation and slope layers is to make them semi-transparent and lay them over a hillshade layer. All these will be symbolized with the ‘singleband pseudocolor’ option that gives you a lot of flexibility in terms of raster styling.

1. Elevation is typically symbolized with a color gradient. Pick a gradient you like see how it looks laid over the hillshade.
2. Slope is typically symbolized with a red to green color gradient with red being low slope areas. Try this out and see how it looks over the hillshade.
3. Aspect is usually broken down into a 4 color scheme for each direction, e.g. N=blue, E=green, S=red, W=yellow. To do this, pick ‘discrete’ for your interpolation method and classify the azimuthal values to match this color scheme. If you’re ambitious, you can symbolize by 45 degree increments: N,NE,E,SE,S,SWW,NW.
4. Save your styles as .qml files so you can easily load them into the layers you will create in the Part VI.

## Part VI: Troy 1m LiDAR DEM

NY State has high resolutions DEMs available for download here: <https://orthos.dhses.ny.gov/>. In the data folder for this lab is a zip file containing a layer downloaded from this web portal called ‘troy\_dem\_1m’. **Unzip** this, bring it in to QGIS, and make **slope**, **aspect** and **hillshade** layers from this DEM as you did for the 50m dem. Style them in a manner like that described in Part V. In addition, calculate 5m **contours** for this layer:

1. Go to Raster🡪 Extraction🡪Contour and select troy\_dem\_1m as the Input file, 5 for the contour interval and check the Attribute name box to add a field that stores the elevation value in the output shapefile. (This can be handy for labelling.) Save the output layer as troy\_5m\_contours.shp.
2. For styling, contours are usually a neutral color (gray, black white) , with a very thin line, often semi-transparent.

## Part VII: Elevation zones and forest cover

Last class you made reclassified NLCD raster that had values of 1 for forested pixels and 0 for everything else. (If you were unable to reclassify the nlcd50 layer, you can use the ‘nlcd\_forested.tif’ layer included in the data folder.) You also made a shapefile (**elev\_zones.shp)** with polygons for each 500ft elevation zone. In this lab I would like you to produce a polygon shapefile consisting of forested areas below 500ft elevation. There are a lot of ways to do this… be creative!

## Lab Report: Due Friday Feb 23.

Your report will consist of the following deliverables:

**Screenshots** (7):

* 6 screenshots of your derived terrain layers: 3 for the 50m Rensselaer County DEM and 3 for the 1m Troy DEM. Your screenshots should be of **slope**, **aspect** and **elevation**, each laid over the **hillshade** layer**. Include the 5m contours** on your **Troy elevation map.**
* One screenshot of your layer from part VII (forested areas <500ft.).

**1-2 page report**: Address the following questions:

* What created the undesirable artifacts in the layers derived from the 30m?
* What are some examples of analyses that would be negatively impacted by data problems like this?
* What are some of the plusses and minuses of smoothing and increasing the resolution of a DEM do to these artifacts.
* Discuss the differences between the 30m and 1m dems—quality of derived layers, utility for different types of GIS questions, etc.
* Discuss some features that you found interesting and/or surprising in the Troy 1m dem
* Document the steps you took to create the shapefile in part VII.