GEG6230 - Advanced Geospatial Science

Assignment 1 - Data visualisation project

- Contact: Stuart Grieve (s.grieve@qmul.ac.uk)
- Credit: 45% module mark (6.75 credits)
- Page limit: 1 A3 page

You are working as a GIS analyst and have been instructed by your client to assist in the identification of suitable hydro power sites across the Lake District. A number of candidate catchments have been proposed but the client does not understand the data about each catchment as they have never done a GIS course.

Create a one page visualisation, highlighting **some** of the information provided by the client in a more accessible manner. **Your final visualisation should include 2 maps and 2 graphs.**

There are 4 catchments, each with a unique number: `75001, 75004, 75006, 75007`

The following data is available on QMplus for each catchment:

- DEM
- Shapefile boundary
- Landcover statistics and legend
- River daily flow measurements over time
- Precipitation over time
- Day and night temperature over time

The precipitation, temperature and flow data is from the period 1-1-2013 to 31-12-2015, with each day numbered sequentially, e.g. day number 366 will be 1-1-2014.

There is also a general DEM of the area containing all of the catchments, called `Lake_District.tif`.

If you wish, you can find additional information about these catchments from the National River Flow Archive, using the unique catchment numbers to find the 4 catchments we are interested in.

Factors which may make a catchment good for a hydro power scheme:

- Steep slopes
- High rainfall and discharge
- Consistent rainfall and discharge over the year
- Landcover types which are conducive to high runoff
- Temperatures usually above freezing

Note that which catchments you choose is unimportant, this assignment will be graded based on the presentation of the data, not the identification of the best catchments for hydro power.

Assignment 2 - Data visualisation presentation

- Contact: Stuart Grieve (s.grieve@qmul.ac.uk)
- Credit: 10% module mark (1.5 credits)
- Duration: 5 minutes

Having created your one page visualisation for assignment 1, present this visualisation. You should explain:

- What data you chose to present and why
- What design choices you have made
- What challenges you overcame to present the data

As this is a Late Summer Resit, there will not be a presentation, but rather you must submit your slides and up to 1000 words of notes outlining what you would have spoken about.

Assignment 3 - GIS project

- Contact: Stuart Grieve (s.grieve@qmul.ac.uk)
- Credit: 45% module mark (6.75 credits)
- Page limit: 4 A4 pages + code

You have a dataset of landslide scar outline polygons for the Coweeta Experimental Catchment in North Carolina, USA. As part of ongoing efforts to better understand landsliding in this area, you need to calculate the factor of safety (`Fs`) of each of these polygons.

Factor of safety is a measure of the balance between driving and resisting forces operating on hillslope material. When `Fs` is below 1 a failure is likely, and values above 1 suggest that the hillslope is stable under current conditions. We calculate the factor of safety as follows:

$$Fs = \frac{C}{h\rho_s g} + \frac{W \cos\theta \tan\phi}{\sin\theta}$$

Where:

- C : soil cohesion
- θ : topographic slope
- ϕ : friction angle
- ρ_s : soil density
- h : soil depth
- g : gravitational acceleration = 9.81 ms^{-2}
- W : hydrological constant

You have access to the following datasets on QMplus:

- Coweeta_clip.tif
- Coweeta_slope.tif (in radians)

Alongside a series of numbered polygon shapefiles, called `scar_1.shp` through to `scar_15.shp`. Each of these shapefiles has the following attributes, measured in the field:

- Friction angle (in radians)
- Soil depth
- Soil density
- Hydrological constant

Tasks

1. Develop a workflow to calculate the factor of safety of all of the scar polygons, using **ArcGIS ModelBuilder**.
2. Develop a workflow to calculate the factor of safety of all of the scar polygons, **using Python**.
3. Create a map (including a caption) showing the variations in factor of safety across some (or all) of the study area.
4. Create a boxplot of the `Fs` values calculated using Python.
5. Write a 1 page discussion of the pros and cons of these two approaches to automation, with regard to reproducibility.

What to submit

1. A 4 page document containing:

- **Page 1:** An image of the ArcGIS ModelBuilder workflow

- **Page 2:** A map of the calculated factor of safety data for some (or all) of Coweeta, **including a brief caption describing it.**
- **Page 3:** A boxplot of the Fs values for the 15 landslide scars, **including a brief caption describing it.**
- **Page 4:** One written page of discussion of the pros and cons of these two approaches to automation, with regard to reproducibility.

2. A copy of the Jupyter notebook containing the python workflow to calculate `Fs` for each catchment.

These two files should be placed in a `.zip` file, with your student number as the filename, and submitted.