Lab 1: Manual Digitizing and Analysis in QGIS and R

Part 1: Manual Digitizing in QGIS (1hr)

1. **Sentinel-2 Image**

Download a Sentinel-2 image of Tabor Lake, just east of Prince George, using, for example, Copernicus Open Access Hub, Sentinel Hub EO Browser, Copernicus Browser.

2. **Load the Image into QGIS**

Open QGIS and load the Sentinel-2 image.

3. **Create a False-Color Composite**

Combine bands for SWIR (Band 11 or Band 12), NIR (Band 8), and Red (Band 4) as RGB.

4. **Create a GeoPackage**

In QGIS, create a new GeoPackage named "GEOG450_Lab1_AB.gpkg" (replace AB with your initials): Go to Layer > Create Layer > New GeoPackage Layer. Set the CRS to EPSG:3157. Add a new layer for polygons.

5. **Digitize the Lake Manually**

Using the **Digitize** tool, manually draw the boundary of Tabor Lake. Ensure the polygon fully encloses the lake area. Save edits!

6. **Add Attributes to the Layer**

Add the following fields in the attribute table:
- lake_name (Text) = "Tabor Lake"
- analyst_initials (Text) = Your initials (e.g., "AB")
- image_source (Text) = "Sentinel-2 MSI"
- image_date (Date) = Date of the Sentinel-2 image (e.g., "2025-01-01")
Save edits!

7. **Calculate the Lake Area**

Add a field lake_area (Numeric) to store the area. Use the **Field Calculator** in QGIS to calculate the area in square kilometers or meters: This the expression $area to get the area in square metres. Save edits!

8. **Submit GeoPackage to** alex.bevington@unbc.ca

Part 2: Class Comparison and Analysis in R

1. **Read all available GeoPackages**

Load all GeoPackages in L:\GEOG450\Lab_1 into R Studio using the sf package. If there are not enough files in the folder, start working and more will appear. For example:

R

```
Install.packages("sf")
library(sf)
files <- list.files("L:/GEOG450/Lab_1", pattern = "\\.gpkg$", full.names = TRUE)
geodata <- lapply(files, st_read)
combined_data <- do.call(rbind, geodata)
```

2. **Clean Metadata**

Check for consistency in attribute names, CRS, and data formats.
Standardize attributes if necessary using R functions like dplyr::rename.

3. **Plot All Lakes**

Use ggplot2 to visualize all the lakes on a single map. For example:

R

```
Install.packages("ggplot2")
library(ggplot2)
ggplot(combined_data) +
 geom_sf(aes(fill = lake_name)) +
 theme_minimal()
```

4. **Analyze Variability**

Analyze the variability of the polygons. For example, compute summary statistics (mean, median, standard deviation). Which is best? What do you notice?

Part 3: Write it up (max 2 pages including figures)

Short report should have at least 2 figures, for example: 1) Map of the satellite image with all of the lake polygons; and 2) A figure from your analysis of the polygons. Describe your work like a mini 2 page research paper with a title (intro, methods, results, discussion, conclusion). Note: maps should have a legend, scale bar, coordinates, and title. Send as a PDF to alex.bevington@unbc.ca by the start of the next lab on Jan 16.
Points: Intro (1), Methods (2), Results (4), Discussion (2), Clarity (1)