Introduction to GIS
Computer Science in Modern Biology Workshop 2021
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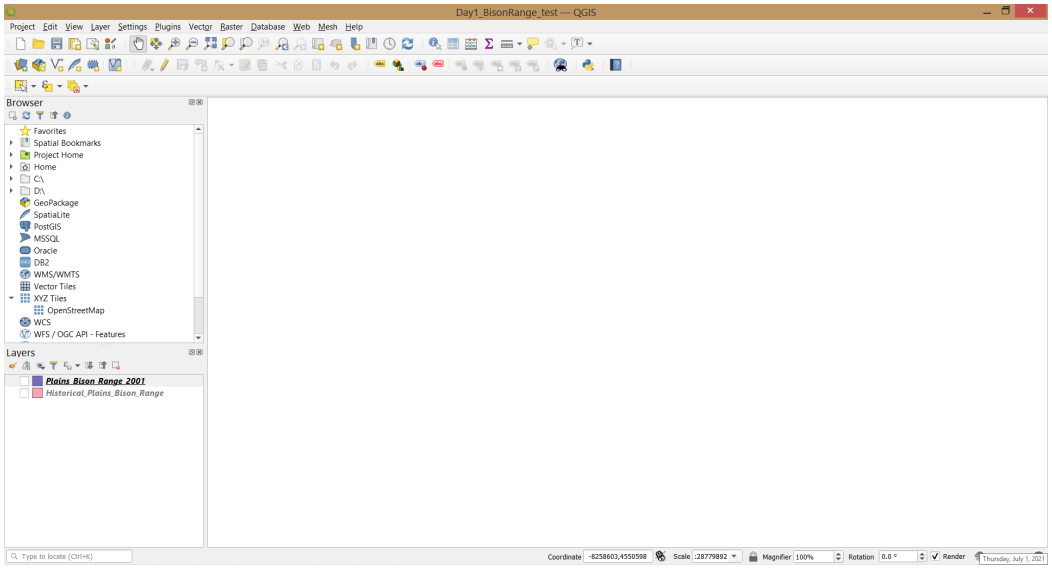
Bison Range Variation: Day 1

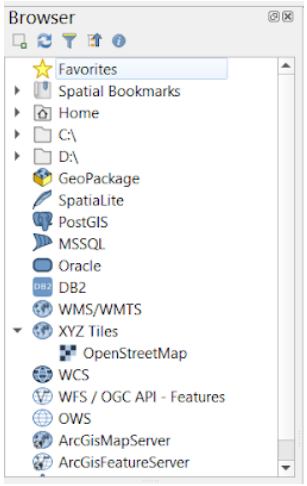
Task: Understanding how historical and modern bison ranges vary.

Part 1: Understanding the Data and Software

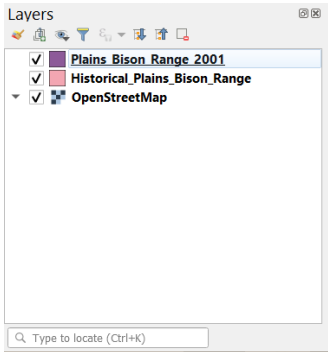
1. Open the file *Day1_BisonRange.qgs* from the Intro to GIS folder. This will be where we will do all our analyses and make our maps. Your screen should look like this:



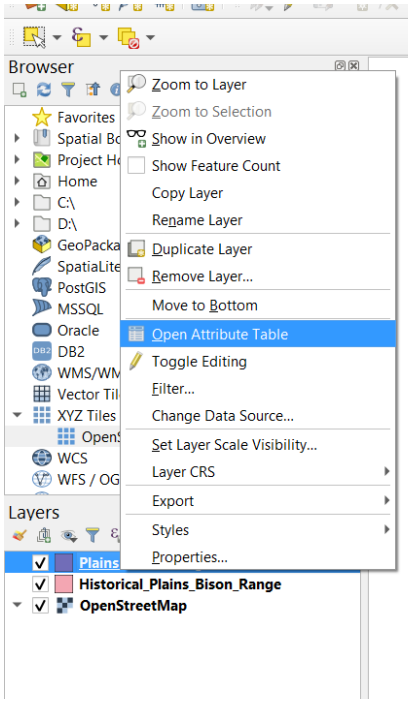
2. The data we are using today will be historical and modern bison ranges. On the left side of the screen there are two menus: Browser and Layers. In the Browser menu, open the dropdown menu *XYZ Tiles* and double click to open *OpenStreetMap*. This should add a map of the United States that looks like what you would find on Google Maps.



This is also added into the Layers menu now, with a checkmark next to it. You can toggle showing this map and other data by clicking on the checkbox. You may also notice that I changed the order of the layers by dragging the names - the first layer is on top and the last is on the bottom.



3. Our data is made up of **shapefiles**, or geographic features. Each layer is a different shapefile. Each shapefile has an **attribute table** and **metadata** where we can see the data within the shapefile.
   Our metadata is two website links, one from a non-profit and one from USGS (both looking really different):
   https://www.sciencebase.gov/catalog/item/59f5ec59e4b063d5d307e657
   https://www.arcgis.com/apps/MapJournal/index.html?appid=66218c3ddce945bd9c84d690ef074b01
   Open the attribute table for one of the shapefiles by right clicking on it and selecting *Open Attribute Table*.

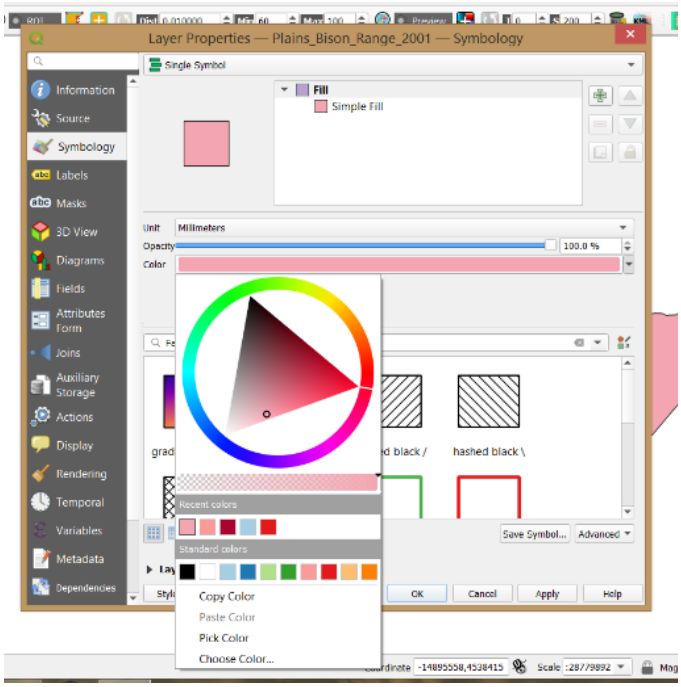


   A **metadata** file typically explains the variables included in the attribute table.
   What information do we learn about our data from the attribute table and the metadata?

Part 2: Layer Properties

You may notice that the two shapefiles are the same color so the boundaries are the only distinction. Let's fix that!

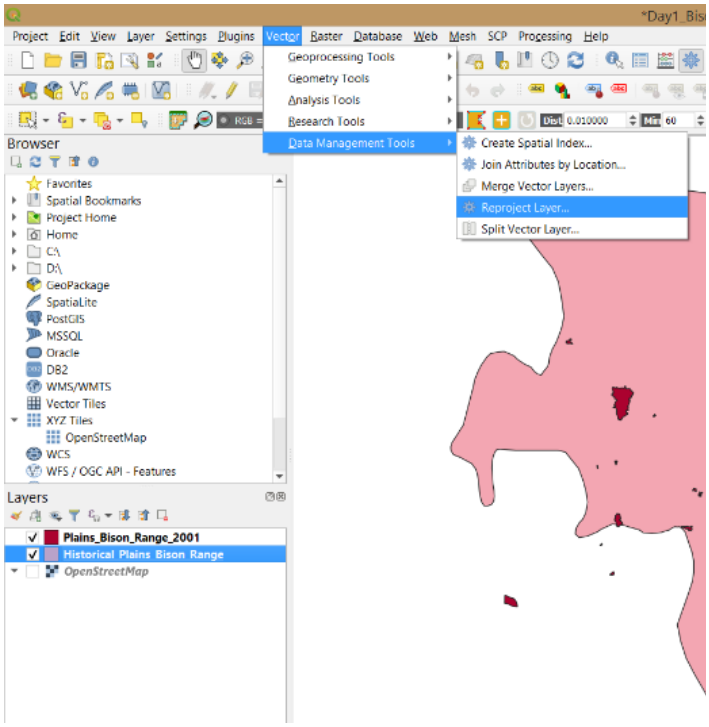
1. Right click on the layer that you want to change the color for, and select *Properties* → *Symbology*.
2. Click the color dropdown to change the color.



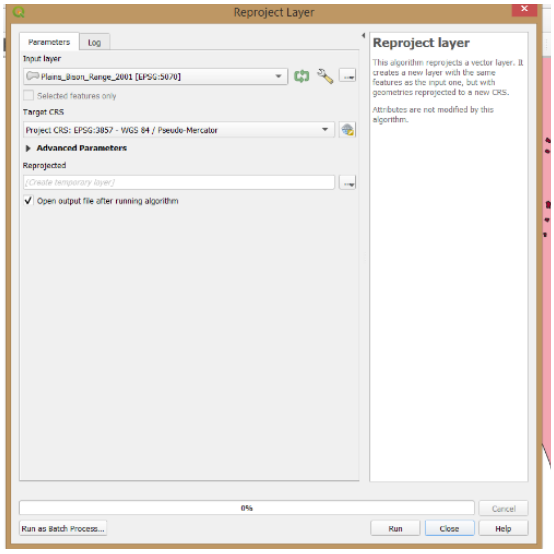
3. Press Apply to make these changes, and repeat the process as needed.
4. Before we start analyzing the data we have one last thing to check! Within the properties window, select *Information* from the side menu to look at the CRS (Coordinate Reference System) for both datafiles:

Layer Name	**Coordinate Reference System**

5. You should notice that they are different- let's fix that. Here we will use our first vector tool: open the *Vector* menu → *Data Management Tools* → *Reproject Layer...*



6. In this case, I want to change the Plains_Bison_Range_2001 to the same CRS as the Historical Plains Bison Range:
EPSG:3857 - WGS 84 / Pseudo-Mercator - Projected
Do do so the Input Layer is the Plains Bison layer, and my Target CRS is the same as the Historical Plains Bison Range CRS.



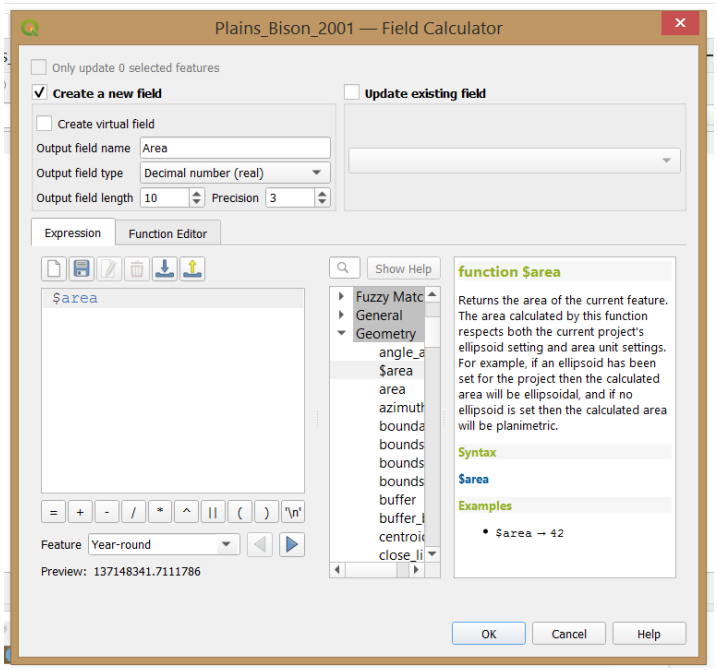
7. A new file is created called “Reprojected”. Rename it to something that is more readable like “Reprojected_PlainsBison” under the Properties window selecting *Source* from. From here on out, we will be using this layer for analyses.

Part 3: Analyzing your data

Looking at visual differences between the two datasets is good, but getting statistical values is better! For this section, we will be comparing the change in area between the historical and current range.

<u>What is the largest patch size? What is the smallest patch size?</u>

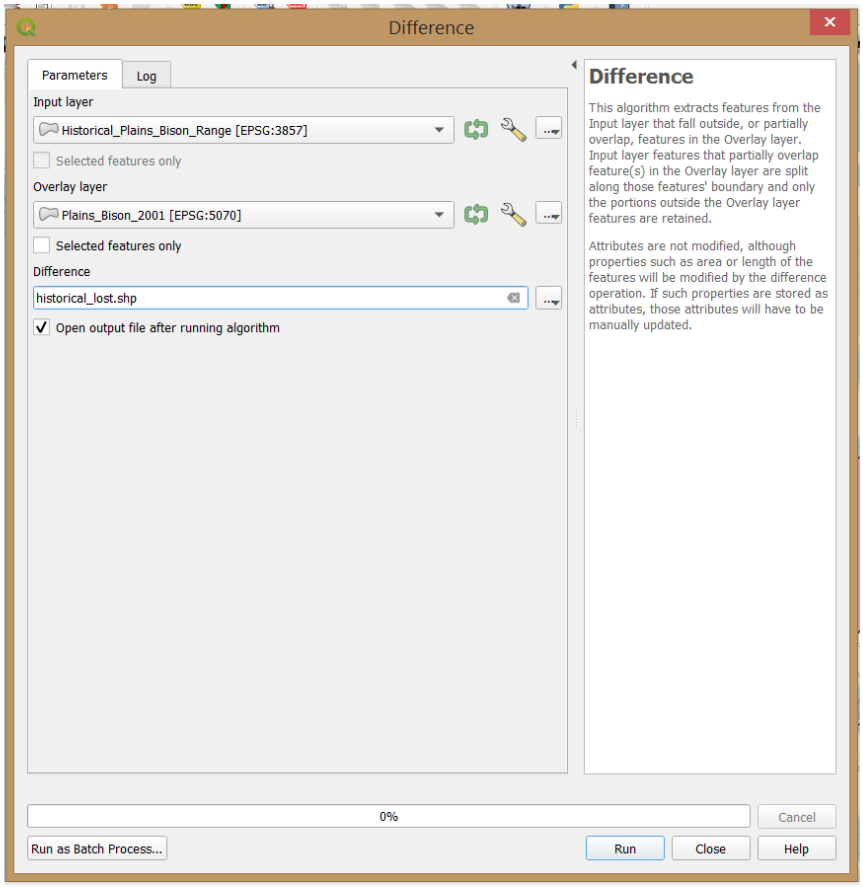
1. For this step we are looking at patch sizes of modern bison habitat. To do so we will be working in the attribute table. First we need to toggle edit mode which is the first option on the ribbon menu in the attribute table.
2. We are creating a new field for Area, using the field calculator (4th from right). Our new field is a decimal number (real). Within the menu we navigate to Geometry → $area. Double click on this line of code and click ok.



3. We now have values in a column called Area. But wait- what do these mean? What are the units! If we go to Properties → Information we can see that these are in meters, (area is in meters squared).
4. Finally we can answer our question! If we right click the top of the Area column, we can sort from smallest to largest. Without changing anything in the window that appears, click OK. We can then click on the row to show the patch that corresponds with these - where are the smallest and largest bison patches?

How much of the species range has been lost?

1. For this question we want to take the *Difference* (there is a Vector → Geoprocessing tool for this!) from the Historical range from the modern range.



2. We can then get the statistical summary from the toolbar second from the top. On the side a window will pop up and we can calculate the sum of the Shape_Area. Remember this is in meters squared.

How much of the modern range is outside of the historical range?

1. For this question, we want to calculate the patches outside of the historical range, by taking the opposite *Difference* (a hint!) as the last question!
2. We can get statistics and total area for this shape.