Exercise 04b
Advanced Shapefile Editing
Assigned Feb. 9, 2018
Due Feb. 16, 2018

For the exercise this week I'll just give you the "overview" instructions rather than keystroke-by-keystroke ones. But email or stop by my office if you do have questions. In particular, let me know by mid-Friday morning if you have had difficulties, so I can decide how to arrange the class time. We'll try to primarily discuss new principles and techniques.

As discussed in class, make a new **`exercise_4b`** folder which is a copy of all the material from exercise_04. Within that, change the name of the **`qgs`** project file from **`exercise_04.qgs`** to **`exercise_04b.qgs`**, then start QGIS and open that project.

The tools we will be using will be located in the menu under **`Vector/Geoprocessing Tools`**, **`Vector/Geometry Tools`**, or **`Vector/Data Management Tools`**. I won't give explicit instructions about zooming and changing layer display properties, but use the techniques we have learned to keep the new layers yo create visible in reasonable ways. Turn off or remove the display of no longer needed layers once you have replaced them by somethings "better".

1) Open the gps_track_polygon layer for editing, and delete or move vertices to clean up the NW corner. Modify its attribute table to it just contains an **`id`** and a **`year_added`** column like that in the original Laramie **`land_additions`** shapefile and enter 1957 as the year. (I've just chosen this to make setting a reasonable display style easier.)

1B) For the following steps to work the CRS for the different shape files needs to be the same. While QGIS itself can perform on-the-fly projection to convert different layers to a common CRS the vector processing tools are not that automatic.

When you created **`land_additions`** its CRS defaulted to the Project CRS which was in effect at the time. And that in turn defaulted to the CRS of the first layer you loaded into QGIS. So if that was one of the GPS tracks, the project and shapefile CGS will be using **`EPSG:4326 - WGS84`** which is just latitude, longitude in the WGS84 datum. However if the first layer you loaded was the Laramie Map (or the updated laramie_map CRS we manually entered) that those might be the project and **`land_additions`** layer CRS. You <u>can</u> set the project CRS explicitly using the **`Settings / Project / CRS`** menu but that won't change the existing layer CRS.

To check if your **`land_additions`** layer is in **`EPSG:4326 - WGS84`** right click on it in the **`layers`** panel then select **`Properties`** then the **`General`** tab and see if it says **`EPSG:4326 - WGS84.`** If that IS the layer CRS you can skip to step 2. If not, we need to create a new version with that CRS. You can't simply change the existing CRS. That would simply

change the way the coordinates saved in the shapefile are interpreted – it wouldn't change the coordinate numbers themselves. If you do need to convert the file back out of this **Properties** dialog and once again right click on `land_additions` in the `layer` panel. This time select Save As. In the dialog window which appears use the CRS dropdown box to select `EPSG:4326 – WGS84`. Browse to select a new shapefile name in the `exercise_06` project directory, say `land_additions_wgs84`. Finally click **OK** to create the new shapefile. You'll then need to adjust the **Style** properties for this layer as you did for the original land_additions. In the following steps use this new layer rather than the original `land_additions`.

2) Use **Vector\Geoprocessing Tools\Difference** to subtract the `gps_track_polygon` layer from `land_additions`. Rather than allowing the system to save the output to a default "memory" layer, tell it to save it to the file `laramie_difference`. QGIS will probably still label the layer just `Difference` in the layers window. In previous versions of QGIS you had to select just one layer or polygon from the `land_additions` file but in the current version 2.18, it subtracts the `gps_track_polygon` from each input layer or polygon.

3) Use `Vector\Data Management Tools\ Merge Vector Layers` to one to combine the above `Difference` layer and the `gps_track_polygon` a new layer. Clicking on the . . . after the `Layers to merge` entry box lets you select the layers to merge. Once again, rather than letting the output go to a default memory layer, tell it to save the output in a file called `all_land_additions`. (It may get labeled `Merged` in the layer panel. If so you can right-click and rename it.)

4) You should now have a map showing all the additions, with the central campus treated as a separate one. If you haven't already, adjust the Style properties to create a good display, then save a jpg image of this for inclusion in your report.

5). Next we want to create a single shape which includes all of Laramie -- or at least all of the area in `all_land_additions`. You might think the "Union" command is the right tool to use, but unfortunately not everything is that logical. First, make sure that the `Advanced Digitizing` toolbar is visible. It may not be. In the menu go to either `View / Toolbars` or `Settings / Toolbars` (its location varies on different systems) and click to add a checkmark to make `Advanced Digitizing` visible if it isn't already. Next, in the layers panel right click on `all_land_additions`, save it as a new shapefile called `all_laramie`, and if that isn't done automatically, add that to the canvas. Next, toggle on editing for that shapefile and select all the layers in it. Click the `Merge Selected Features` tool. (The icon will show two blobs with stitches between them.) This will bring up a dialog asking how to merge the various lines of the attribute table. For now that isn't critical -- experiment with various options or just click `OK`. Finally, toggle off editing to save the result.

6) Now back to the vector tools. Suppose you need to create a shape which includes Laramie and a 0.5 km buffer around it. Use the **Vector/Geoprocessing/Fixed Distance Buffer** tool, with **all_laramie** as the source file. Note that since all distances are (for the moment) specified in degrees, we'll need to specify the buffer size in degrees. The conversion I gave you last week wasn't quite right, as I was assuming it used degrees of latitude, but it apparently is using degrees of longitude -- which are a slightly smaller linear distance at our 41°N latitude. We'll explore these and other projection effects later, but for now just use a conversion of 84 km/degree, so specify a buffer of 0.5 km = 0.006 degrees. Leave the other values at their default (although you can experiment with them) and save the resulting shape to **laramie_buffer**.

7) To be able to see both Laramie and the buffer, in the layer panel, drag the buffer layer down so it appears underneath the **all_laramie** layer. The order in the panel controls which shape is shown "on top" on the canvas. Finally, click on the **Measuring** (ruler) tool in the toolbar and experiment finding distances from the edge of **all_laramie** to the edge of the buffer. As a sanity check, also measure the length of the map's scale bar. The tool lets you select the units used for reporting results.

8) Create a reasonable display showing the map, **all_laramie**, and **laramie_buffer**, and save this as a jpg image.

9) Try experimenting with some of the other vector functions, like **dissolve** or **symmetric difference**. Try experimenting with some of the other **advanced digitizing** tools, such as **split feature**.

9) Save the project file. Zip all this into an **exercise_04b_lastname_firstname.zip** file and submit it next Friday.