6

Drawing Your Own Area of Interest

Quick Links To Sections

Objectives:

1. Create your own shapefiles in QGIS.

2. Learn about cloud filtering options in A$\rho\rho$EEARS.

3. Access and download land surface data from ECOSTRESS of the highest and lowest temperatures in 2022 for your hometown, favorite place you have lived, or somewhere you wish to move in the future.
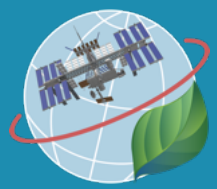
Motivation For Today's Tutorial : Temperature Competition

For this and the next tutorial, our goal is to increase the skills you have in your toolkit when working with the occasionally annoying quirks associated with satellite remote sensing data. Ultimately, we will have an in class competition to see who had the hottest and coldest hometown temperatures, but for now let's talk about one of the main tools we use everyday in GIS work, vector files.

6.1 AREA OF INTEREST DATA TYPES FOR AρρEEARS

For your first data download from AρρEEARS we provided you with a polygon shapefile that designated the area of interest (AOI) of Death Valley National Park, see (Tutorial #3: Accessing Remote Sensing Data With AρρEEARS). Today you will draw your own polygon and learn about the data formats that AρρEEARS accepts as AOI inputs. As you can see from the screenshot below, AρρEEARS needs a *vector polygon* to know where to pull ECOSTRESS satellite data for. Before we go any further we need to discuss the differences between two data types we use daily in geographic information systems (GIS) work, vector and raster data.
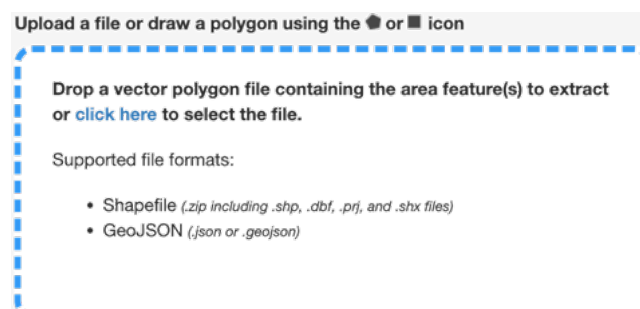
Vector vs Raster Data
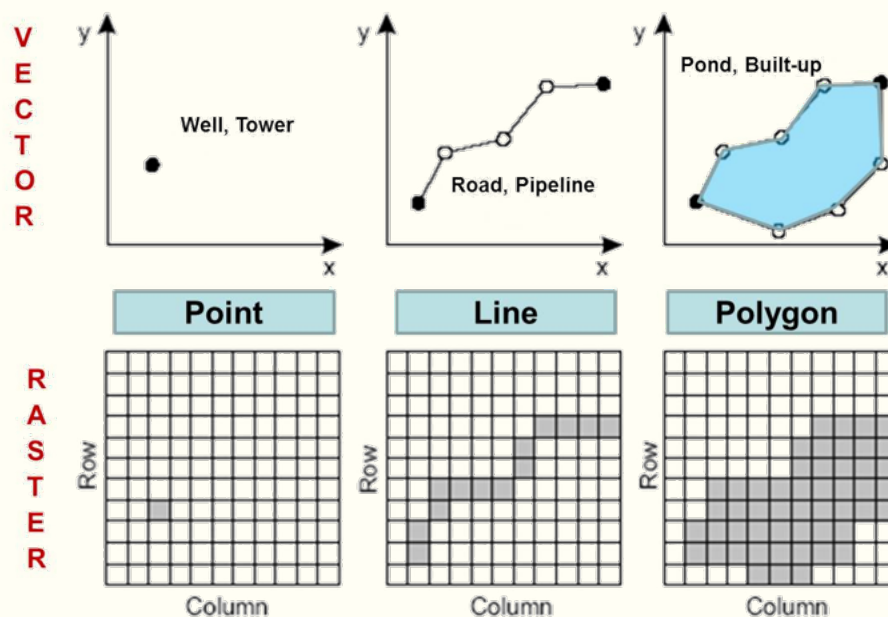
Both vector and raster data provide different ways to represent real world features within the GIS environment. A feature is anything you can see on the landscape: houses, roads, trees, rivers, etc.

Vector Data: (File Formats: Shapefile, GeoJSON, Geopackage)

- A vector feature has its shape represented using geometry. The geometry is made up of one or more interconnected vertices. A vertex describes a position in space using an X, Y and optionally Z axis.

- When a feature's geometry consists of only a single vertex, it is referred to as a **point** feature.

- Where the geometry consists of two or more vertices and the first and last vertex are not equal, a **line** feature is formed.

- Where three or more vertices are present, and the last vertex is equal to the first, an enclosed **polygon** feature is formed

- Vector features have attributes, which is additional text or numerical data linked to the features that describe something of interest, perhaps wildfire burn severity.

Raster Data: (File format: GeoTIFF)

- While vector features use geometry (points, polylines and polygons) to represent the real world, raster data takes a different approach.

- Rasters are made up of a matrix of cells (also called pixels), each containing a value that represents the conditions for the area covered by that cell.

- Every raster has cells of a fixed size that determine its spatial resolution.
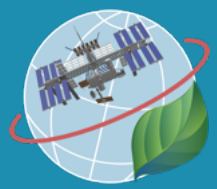
The raster approach is best for situations where your data is continuous and varies across space, such as the greenness of grasses in a prairie field or population density in Los Angeles county. The vector approach is better for features that can be represented by points, lines, or polygons, such as trees, hiking trails, or school district boundaries.

NOTE: You can convert between raster and vector file types, but you should have a good reason why you would want to do this. For example, if you had vector polygons of wildfires by year and wanted to make a continuous map of burn frequency, you could convert the vectors to rasters to easily add them together. We will revisit raster calculations in a later tutorial.

6.2 CREATING A SHAPEFILE IN QGIS

Today, you are going to learn how to create your own polygon vector file in QGIS. We are also going to introduce you to another plugin that can make working with latitude and longitude data in QGIS easier. Let's install Lat Lon Tools.

6.2.1 Installing the *Lat Lon Tools* Plugin

1. Open QGIS and start a new project by selecting the *Project* menu → then *New*.

2. To install the Lat Lon Tools plugin, click on the *Plugins* drop down menu and select *Manage and Install Plugins*.

3. In the next window, make sure *All* is selected in the first window pane and search for *Lat Lon Tools*.

4. Click *Install Plugin*, wait for the installation to complete, then close the plugin window.
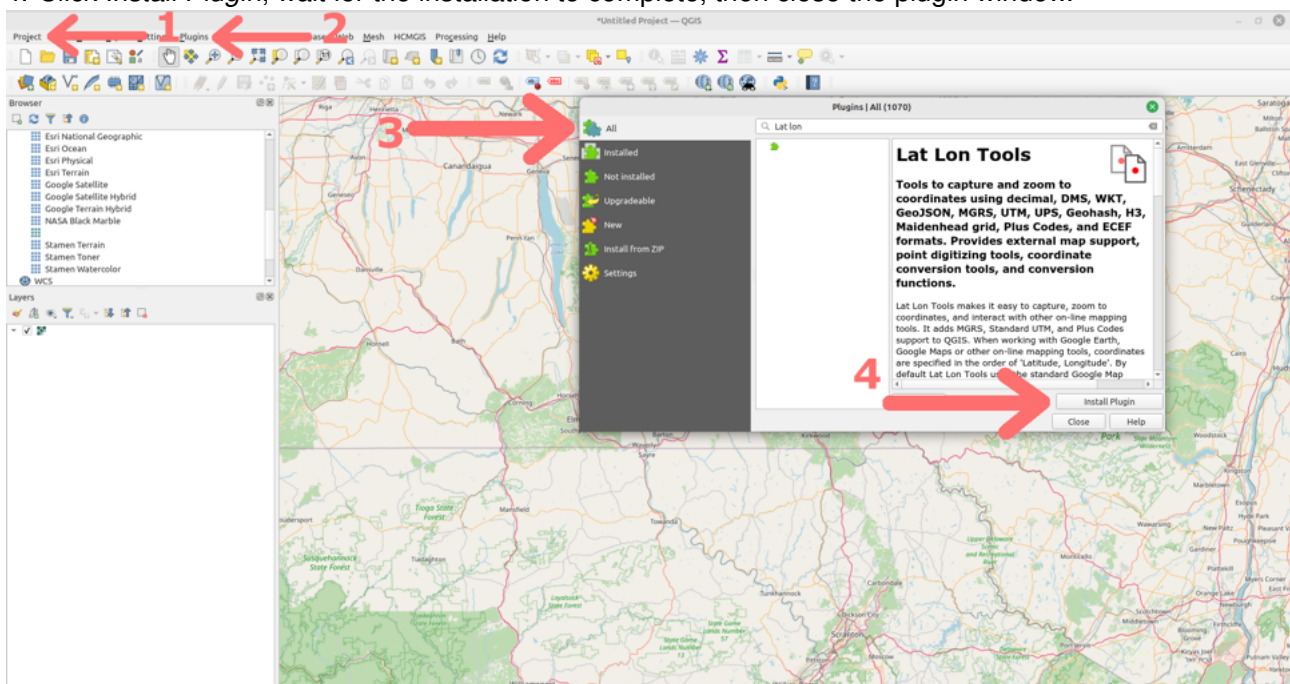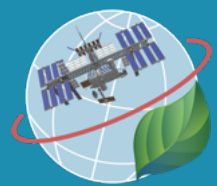
6.2.2   Adding an Open Street Basemap Layer
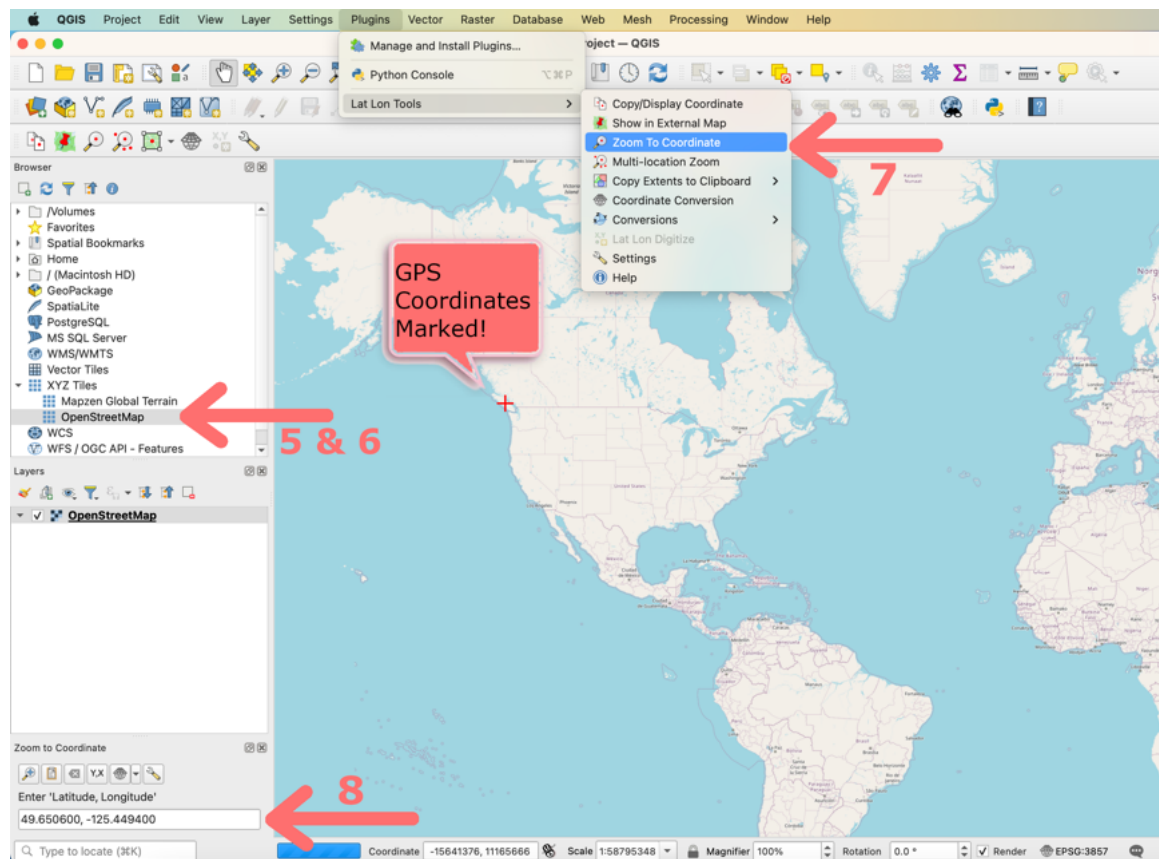
5. In the browser window, expand your options by clicking on the small arrow next to *XYZ Tiles*.

6. Double click on Open Street Map to load in a basic open source map. You will notice that we just added a layer to the layer window below.

6.2.3   Finding GPS Coordinates with *Lat Lon Tools*

Let's say you were interested in requesting and downloading ECOSTRESS land surface temperature (LST) data for Vancouver Island. You need to tell A$\rho\rho$EEARS where Vancouver Island is located, then request and download the data before you can make a map of the results. The first step is to find the island on the basemap we just added.

7. Open up the Lat Lon Tools window by selecting the *Plugins* menu → *Lat Lon Tools* → *Zoom To Coordinate*.

8. Enter in the following GPS coordinates (formatted as latitude, longitude) : 49.650600, -125.449400. Note that if you are not sure of a location's latitude and longitude, you can navigate to that location in Google Maps and right click on the location to display the coordinates.

9. The Lat Lon Tools plugin has found the GPS coordinates for Vancouver Island and marked them with a "+" on the map.

6.2.4 Drawing a Shapefile
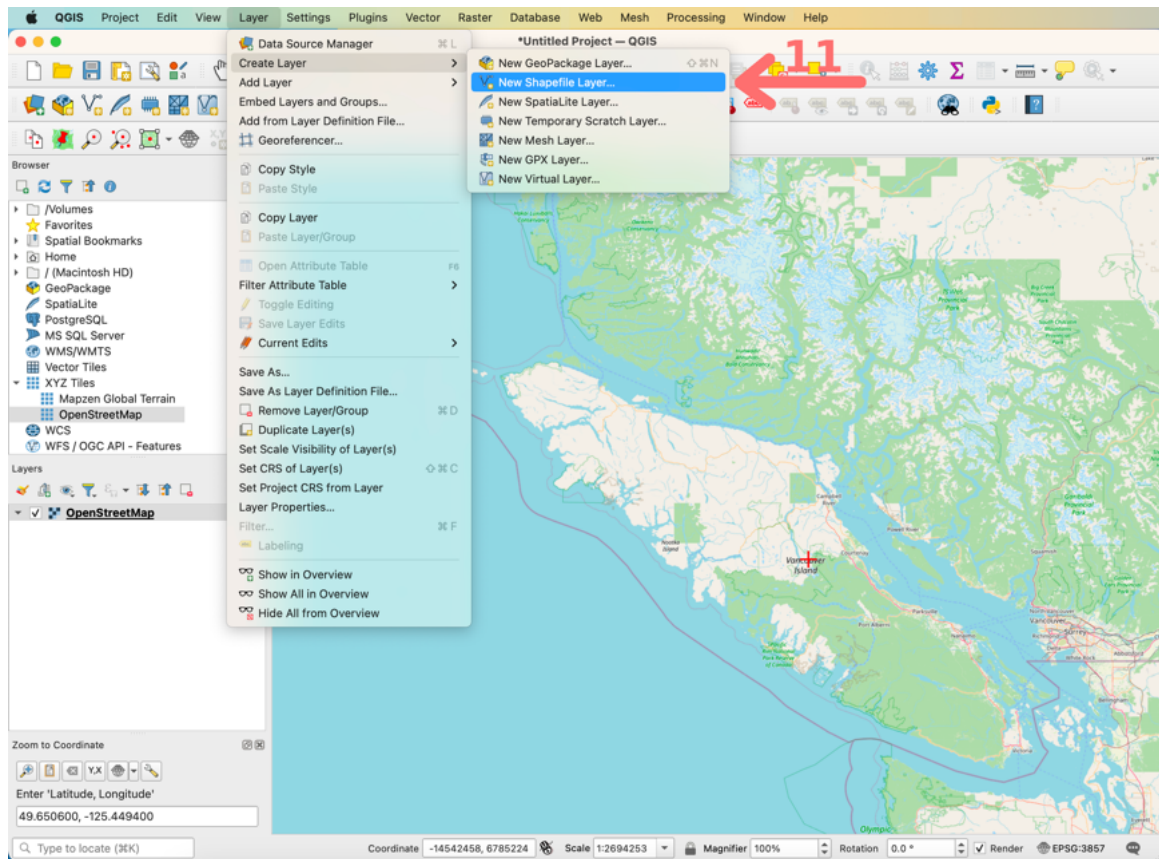
Next, we want to draw a polygon (i.e., a line that forms the perimeter of the area of interest) that encompasses Vancouver Island, so that we can pull the request and download the data from A$\rho\rho$EEARS.

10. Zoom in to the GPS coordinates we entered and marked with a "$+$" on the basemap using the *zoom in* 🔍, *zoom out* 🔍, and *pan* 🖐 buttons in toolbar. If you are on a laptop, you could use the trackpad to do the same.

11. Next, we are going to create a new layer in the map by selecting the following menus: *Layer → Create Layer → New Shapefile Layer...*
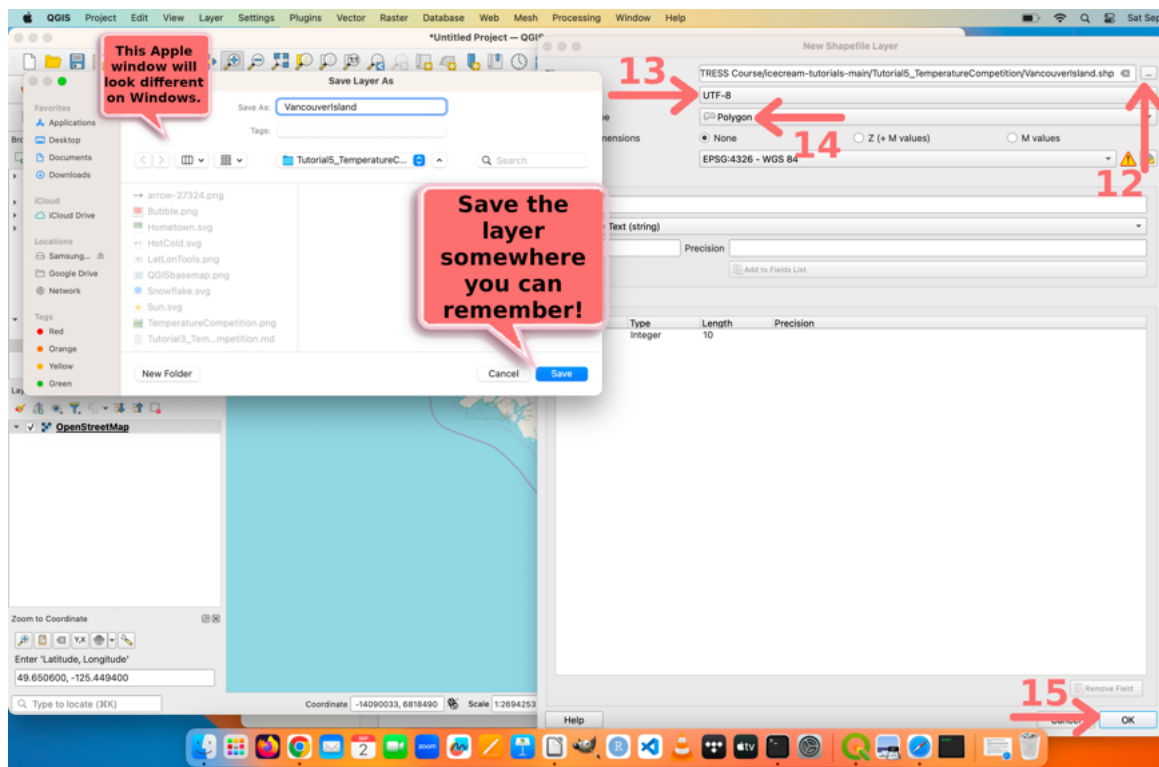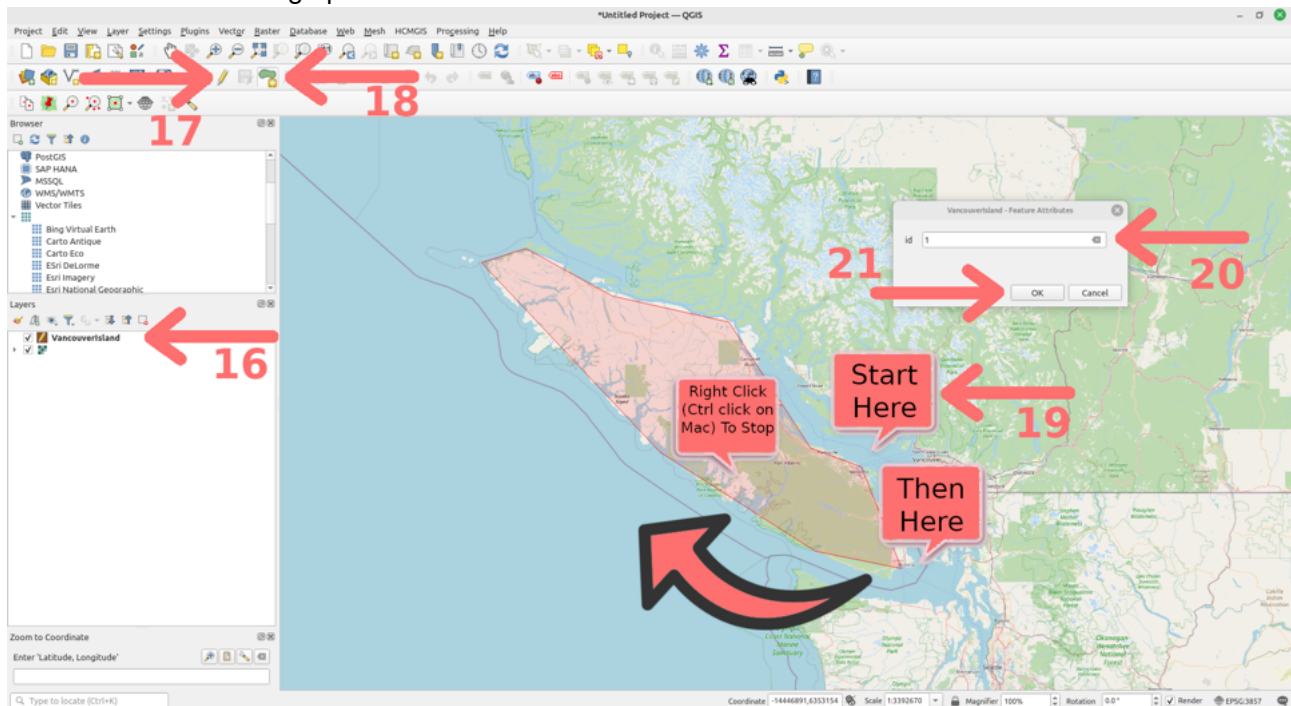
12. Select the "..." option next to the *Filename* input window. Navigate somewhere you can remember and save it with a worthy filename. "Vancouver Island Perimeter" seems appropriate.

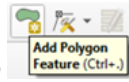13. Select *UTF-8* for *File encoding*.

14. Select *Polygon* for geometry type.

15. Leave the remaining options as their defaults and click *OK*.

16. Now, it is time to draw the polygon. First, make sure that your new "Vancouver Island" layer is highlighted in the *Layers* window.

17. Select the *Toggle Editing* ✏ button from the toolbar to start editing the layer.

18. Then select the *Add Polygon Feature* button to begin drawing your shapefile.

19. Draw a polygon that encompasses Vancouver Island. Don't worry too much about being perfect, getting the basic shape will do. Right click on Windows or Linux and Ctrl click on Mac to stop drawing when your shape is complete.

> **NOTE:** Drawing a polygon in QGIS is both straightforward and nuanced. You use successive clicks with your mouse to create your desired shape. Simple forms like squares or rectangles are easy achievable, while more complex designs take some practice to master. My recommended route is to start by clicking near Parksville then proceed clockwise around the island. See the screenshot above (step 19).

20. After you finish drawing, QGIS will prompt you for a feature ID. This is an arbitrary designation for our purposes today, so simply using the number 1 is my recommendation.

21. Click *OK*.

22. Select the *Toggle Editing* button from the toolbar to toggle off editing the layer. QGIS will prompt you to confirm saving the layer. Select *Yes*. QGIS has now saved a shapefile with your polygon.

What Are Shapefiles?

The shapefile format is one of the most commonly used vector file formats for geographic information. A shapefile dataset consists of several files. The following three are required:

.shp file containing the feature geometries

.dbf file containing the attributes in dBase format

.shx index file

Additionally, they can have:

.prj which contains projection information

.cpg plain text files that describes the encoding applied

.qix spatial index file containing zoom and pan information

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23. As you likely remember from earlier tutorials, the A$\rho\rho$EEARS interface we use to access ECOSTRESS data requires shapefiles to be combined in a zip file. Use the following instructions on the next page for your operating system to zip the shapefile data into one zip file.

Windows

1. Locate the Vancouver Island shapefile layer files that you saved in step 12 using your computer's *File Explorer* application .

2. Hold the *ctrl* button down and select the files with the .shp, .dbf, .shx, .prj, and .cpg extensions.

3. When they are all selected, release the *ctrl* button and right-click the highlighted files, select *Send to*, and then select *Compressed (zipped) folder*.

4. A new zipped file with the same name is created in the same location. To rename it right-click the .zip file, select *Rename*, and then type the new name. "VancouverIsland.zip" seems like a good choice.

5. This .zip shapefile dataset is now ready to be used in AρρEEARS.

Apple macOS

1. Locate the Vancouver Island shapefile layer files that you saved in step 12 using your computer's *Finder* application .

2. Hold the *command* button down and select the files with the .shp, .dbf, .shx, .prj, and .cpg extensions.

3. When they are all selected, release the *command* button and ctrl-click the highlighted files, select *Compress*, and then select *Compressed (zipped) folder*.

4. A new zipped folder with the name "Archive.zip" is created in the same location. To rename it, ctrl-click the folder, select *Rename*, and then type the new name. "VancouverIsland.zip" seems like a good choice.

5. This .zip shapefile dataset is now ready to be used in AρρEEARS.

In the next tutorial, we will use this shapefile to make an AρρEEARS request, so remember you where you save it.
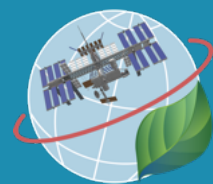
Map of the Week Assignments

1. Submit a map of Vancouver Island complete with the boundary of your shapefile outlined in the color of your choice, scalebars(s), north arrow(s), legend(s), title(s), and label(s).

2. Provide a one paragraph description of your map, including any struggles and successes you had drawing your first vector polygon.