

## Getting started with qGIS

Quantum GIS, or qGIS, is free open-access software for mapping and geospatial analysis. Most of you will be using qGIS to analyze the landscape around each frog and toad survey site (some of you will be using other GIS software that your instructor has expertise with). You may find qGIS a little intimidating at first, mostly because it has a lot of features. However, once you get used to the basics of importing and working with GIS data, you will likely find qGIS no more difficult than other menu-driven software packages. Hopefully you'll also find it pretty fun to play with the maps. We'll be using the 1.8 version of qGIS as the new 2.0 does not yet have fully functional add-ons and because we're not entirely sure of the bugs associated with this release.

The first step is to download qGIS 1.8 software. For windows machines, installation is usually straightforward.

1) You should be able to download from this link: [QGIS-OSGeo4W-1.8.0-2-Setup.exe](http://qgis.org/downloads/QGIS-OSGeo4W-1.8.0-2-Setup.exe)

If not, you can pull the 1.8 version from this site: <http://qgis.org/downloads/>

2) For mac, the best website to use currently seems to be:

<https://www.macupdate.com/app/mac/25428/quantum-gis>

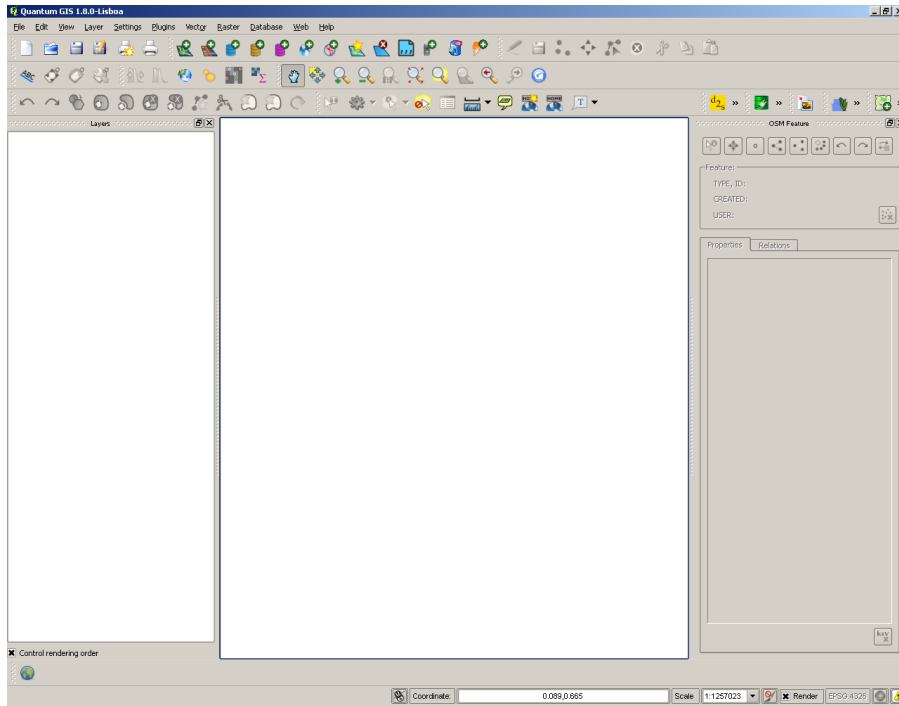
Make sure to click on the "Download" tab underneath where it says Quantum GIS, not the "Download Now" at the top, or any other pop-ups for that matter. You will also need to install the "GDAL complete frameworks package" and the "GSL framework" under Requirements.

On many macs, you may need to change your privacy settings to allow the software to install. To do this (courtesy of Haiyang Cui at Washington & Lee University)

1. Go to System Preferences, and click Security & Privacy
2. At the bottom left corner is a lock icon. Click on it and enter your computer password to unlock
3. Now you can see the lock is open, select "Anywhere" below "Allow apps downloaded from: "
4. Install the GDAL and GSL frameworks.
5. Install qGIS > Download and install QGIS 8. You're done!
6. Find the software in the application folder or move it to the dock if you're a frequent user
7. For security purposes, you might want to go back to System Preferences, and change "Anywhere" back to "Mac App Store and identified developers" in Security & Privacy. Then click on the lock again to lock in your selection.

For either Windows or Mac OS, *you do not need to install the sample datasets (North Carolina, South Dakota, and Alaska), and in fact, you can save a bunch of installation time by not installing the sample data.*

Once you've installed the software, you can open qGIS by clicking on the Quantum GIS Desktop icon (or the qGIS.exe file within the apps\qGIS\bin folder). The opening screen should look like this:



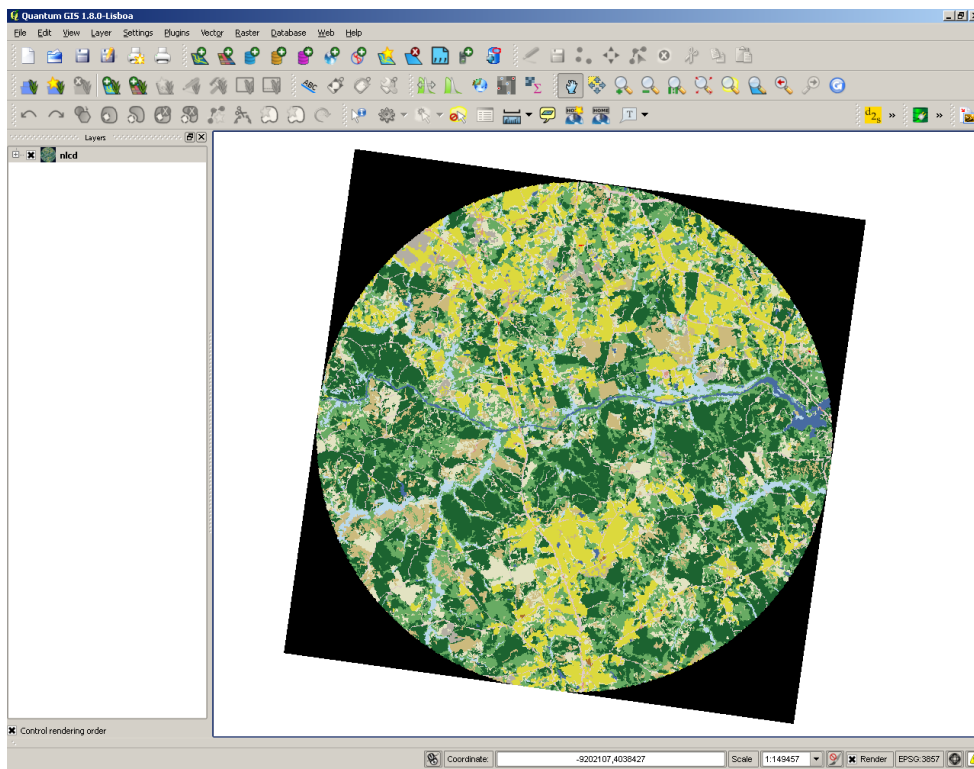
Across the top is the main menu. You can perform most actions from here, or alternatively from the three rows of icons below the menu. Don't worry about the large number of icons – we'll only be using a few of these in our analysis. The large window in the middle will show the working map. The window on the left will show a list of the different datasets (or "layers") that you are working with.

We will be working with four datasets – one that contains the randomly-chosen stop within each NAAMP route, one from a national database of roads (TIGER), one from the National Wetlands Inventory (NWI) that shows the location of wetland habitats, and one from the National Landcover Database (NLCD2006) that shows land use across the United States. The first three of these are all considered "vector data" – that is, data that are based on objects defined by their coordinates on a plane. The NAAMP stops data are simple points, the roads data are lines (which are defined by points), and the wetland data are polygons (lines that form a two-dimensional object). In contrast, the landcover dataset is "raster data" – basically just a picture with different colors to indicate different kinds of land use. In this case, each pixel of the image corresponds to a 30m by 30m square.

Easiest to see with an example. Go to the data site (<http://mirrors.nceas.ucsb.edu/trn/>) and type in the user name and password given to you by your instructor. Then, click on the folder for 2014. Download the folder for the first route: 270408, a site near the Savannah River in Georgia. First, you'll need to extract the data files from the zip. To do this, save the zip folder to your computer. Then find the zip folder, right click, and choose "extract." Once you have done this, you are ready to import the data files into qGIS.

Note the contents in each folder. First, there is a csv/excel file that contains the frog and toad data for that stop (see protocol for summarizing frog and toad call data). Then there's a folder numbered "270408" that contains all the map data. Files in this folder include a set of files called "naamp stop" that contain the necessary info on the location of that NAAMP stop, a set of files called "nwi" containing the national wetlands inventory data and a set of TIGER files that cover the roads. There's also a file called "nlcd.tif" which contains the raster (image data) for landcover and a set of files for "naamp-buffer" which you won't use.

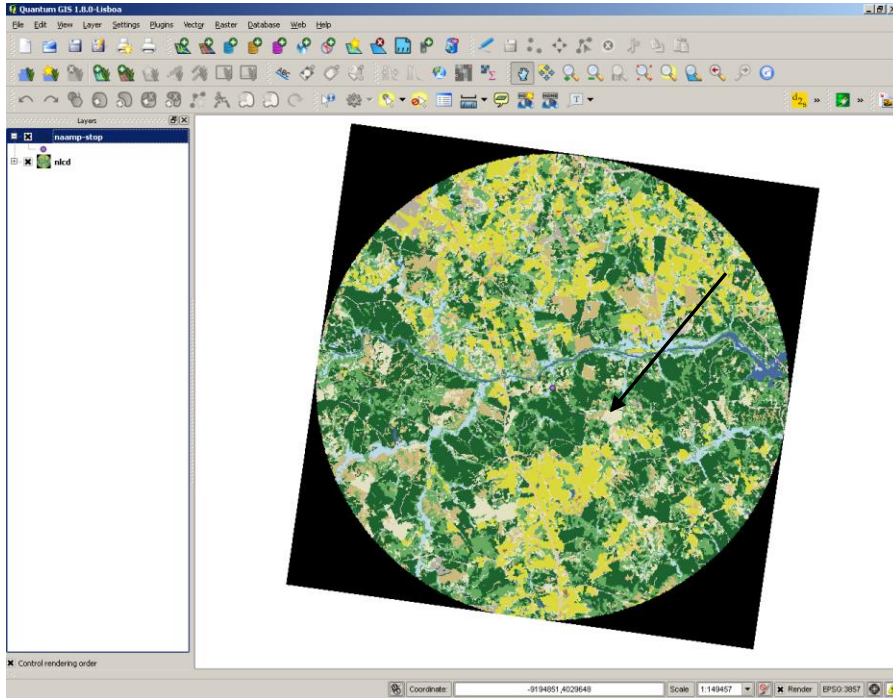
It doesn't actually matter which of the GIS data files you open first, but we'll start with the nlcd raster. To open this, go to "Layer" in the top menu and click "Add Raster Layer". Browse to where you saved the nlcd folder and click on "nlcd.tif". When it opens, it should look something like the image on the following page. Pretty!



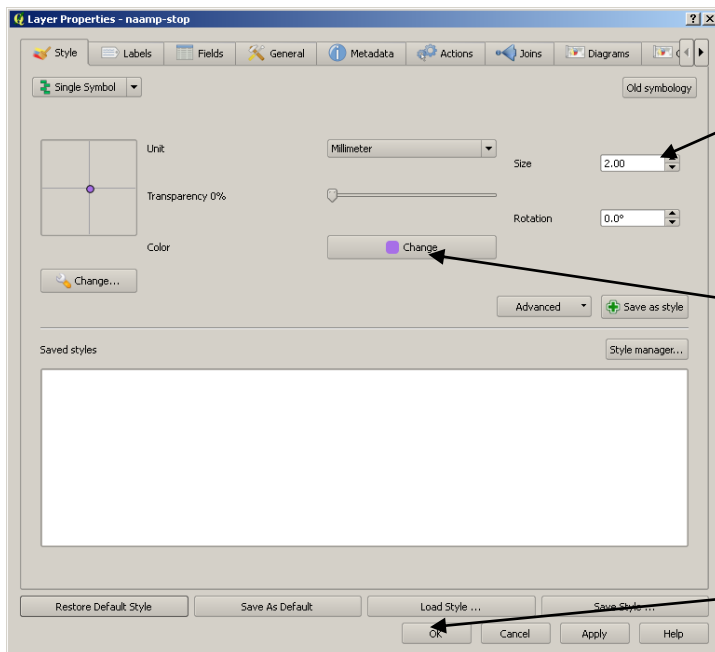
What are you looking at here? To keep the databases down to manageable size, we've gone ahead and trimmed the landcover data to cover a circular section of land that extends at least 11 km out from the relevant NAAMP stop. FYI the full landcover database is something like 18 GB!

As far as land use goes, different categories of land use are coded with different colors, and the guide to the color codes is found here: [http://www.mrlc.gov/nlcd06\\_leg.php](http://www.mrlc.gov/nlcd06_leg.php). So, in this route we have mostly evergreen (e.g. pine) forest (dark green), deciduous forest (lighter green) and pasture (yellow). There's also some rivers (blue) that you can clearly see, though we'll use the NWI layer for all wetlands since the NWI data have been ground-truthed more extensively.

Now let's see where the NAAMP stop is. At the top menu, hit Layer and then Add Vector Layer. Then hit browse and point to the data folder for this route. In here is the shapefile (.shp) that contains the stop location, i.e. "naamp-stop.shp." When you click on that, it will get added to the map.



Usually it's a good idea to make the stop more visible (the black arrow is just to show you where the stop is). To change what the point looks like, right click on the name of the layer at the top left window and click on "properties." The window that pops up will look like this:

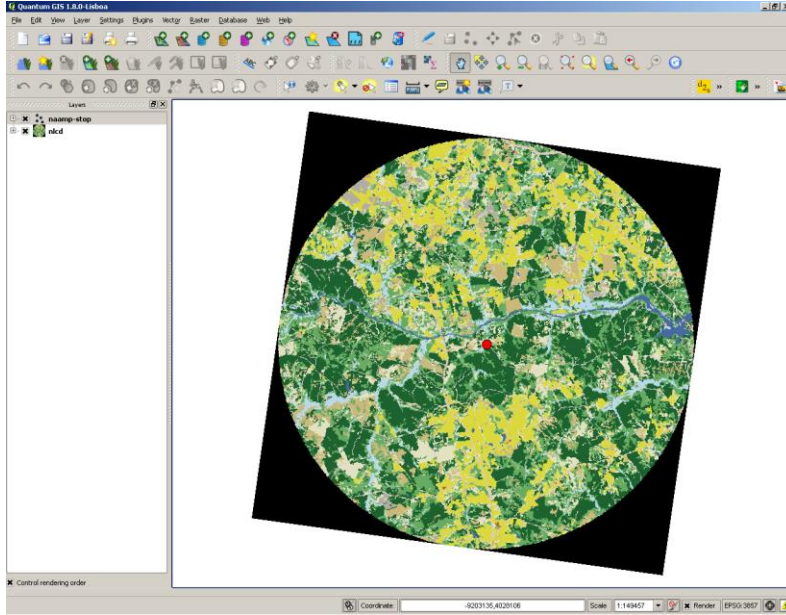


Symbol size

Symbol color

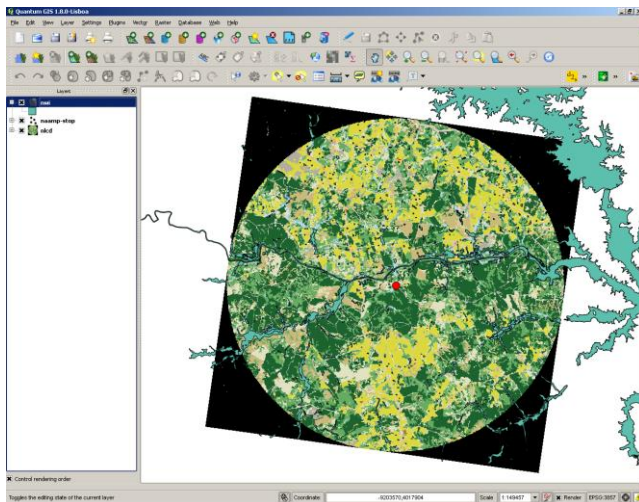
OK

If you click on the Change button with the purple symbol next to it, you can change the color of the circle. For this one, I might suggest red (of course, what will be most visible will depend on which kinds of land use are most common). I might also change the size from 2.00 to 4.00. Then click OK at the bottom (or Apply). The result should look like this:



Much easier to see. At this point, if you haven't already, you should probably save your project using File then Save Project or Save Project As. In general, I try to save every time I add a layer so that if I get in trouble (or qGIS crashes), I can just close and re-open from where I was before.

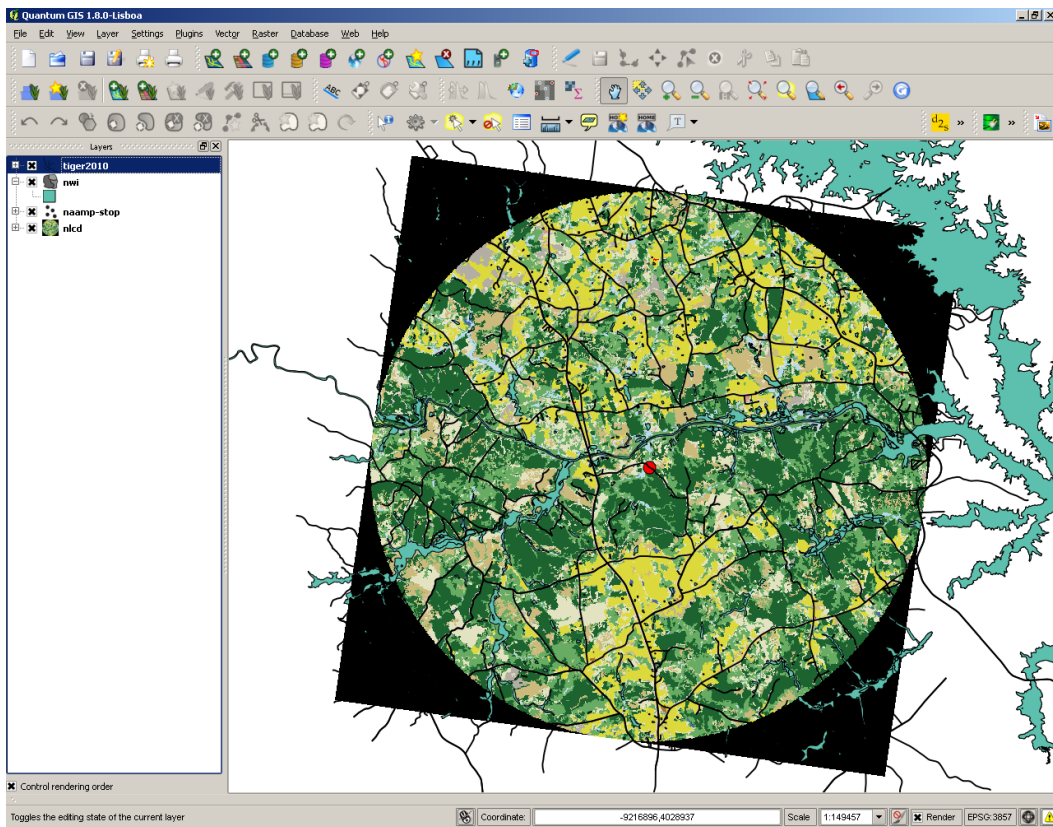
Next, we can add the wetlands layer. Go to Layer than Add Vector Layer and Browse to the nwi shapefile for this route (nwi.shp). In this case, the aquatic habitats pop up in a blue color, but if they don't, you can change them to blue by right clicking on the layer then going to "properties" and then changing the color. Either way, the result should look something like this:



If you look closely, you'll notice that the nwi wetlands layer does not match up exactly with the water in the NLCD file. The contours of the river are the same, but NLCD identifies some wetlands in the upper (northern) sections of the map that are not on the NWI layer. Which is right? The landcover data are based on satellite images, whereas the wetlands inventory data have been ground-truthed – that is, actual humans have gone walking around to check to see what's there. Humans can make mistakes of course, and they can miss seasonal wetlands (but so can satellite images taken at the wrong time of year). Either way, we'll always use the nwi data for wetlands to ensure consistency. Oh, and don't forget to save your progress after adding this layer!

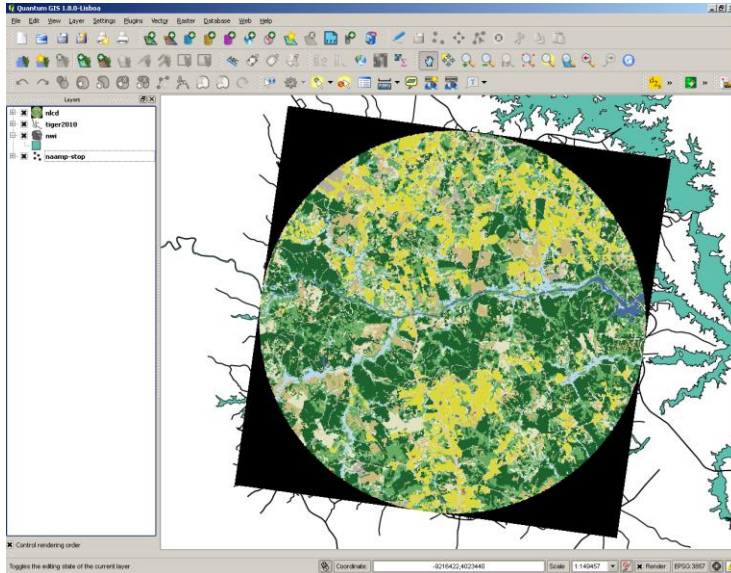
OK now let's add the roads layer. Click Layer then Add Vector Layer then browse to the tiger2010.shp file. I typically use the properties tab to change the color of roads to black and up the width from 0.26 to 0.40 or 0.50.

Here's the result:



**NOW THAT YOU HAVE ALL FOUR LAYERS THAT YOU'LL NEED, TIME FOR SOME IMPORTANT POINTS THAT YOU'LL DEFINITELY NEED LATER ON:**

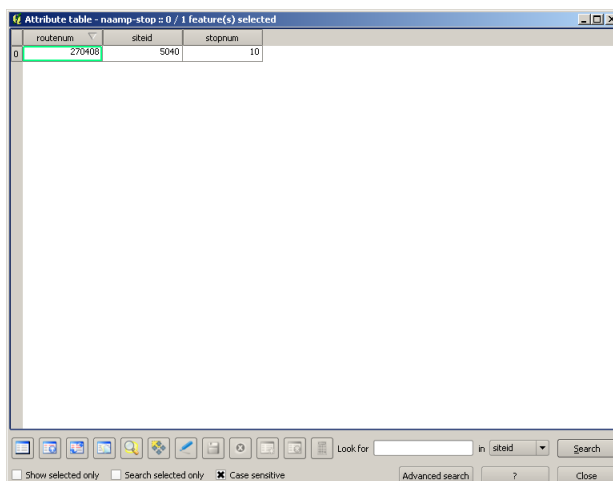
1) It doesn't matter in what order you import the four layers. You can import them in whatever order you want and then switch the order of the layers using the layer window at the left. Whichever layer is on top on the list (here, the tiger2010 roads layer) appears on top on the map. Just highlight the layers and drag and drop them in order to change their order in the list. For example, you could move the nlcd raster layer to the top, which would look like this:



That's not very helpful of course since you can no longer see the naamp stop, the wetlands, or the roads.

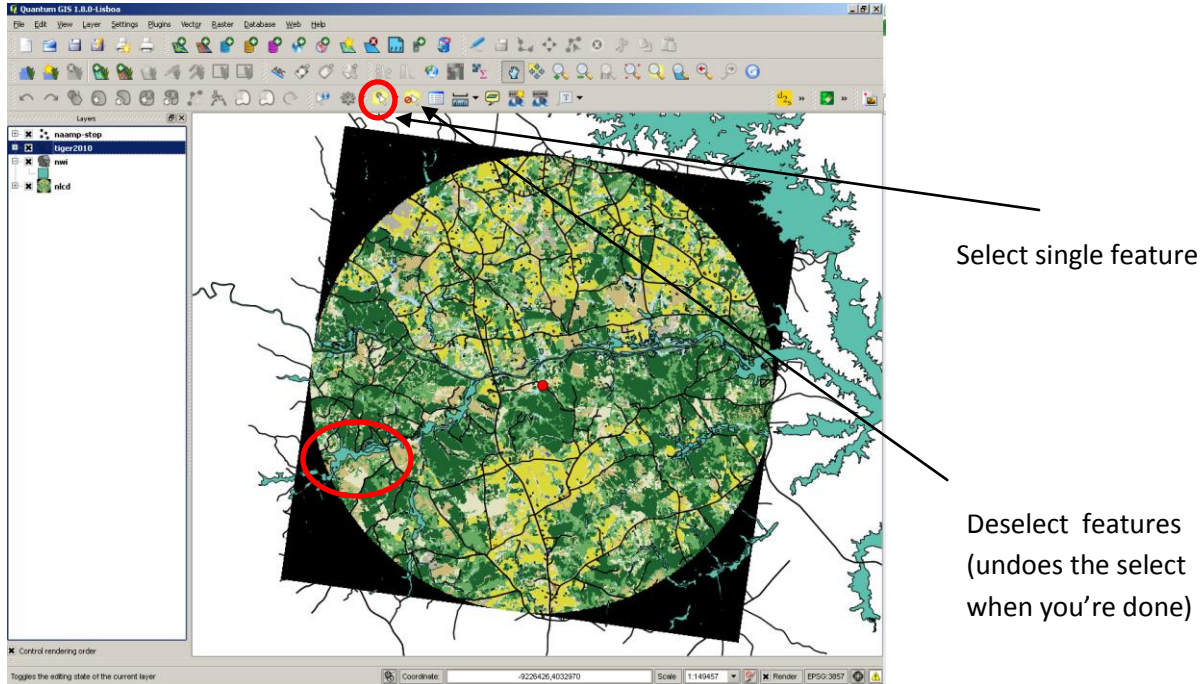
Typically, I keep the naamp stop on top (since I always want to know where that is), then the roads second from the top (those are thin and won't obscure much), then the wetlands, and finally the landcover data on bottom.

2) For each of the vector layers (stops, roads, and wetlands), you can view an attribute table that contains all the information about the layer. Just highlight a layer on the left window and right click. Open Attribute Table appears about a third of the way down. For the naamp layer, the attribute table shows the route number, the siteid, the stop number. FYI the attribute table is contained in the .dbf file in each data folder and can be opened by Excel or other spreadsheet software.

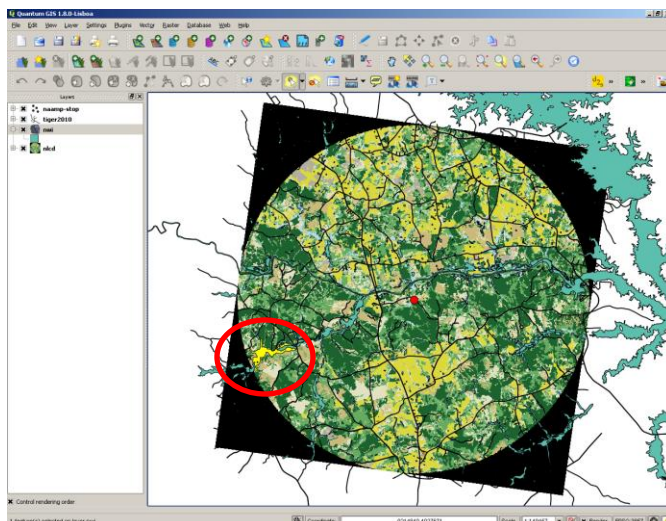


The attribute table for the roads layer contains information such as state, county, road name, and an MTFCC code that tells what type of road it is. The table for the wetlands data contains the area and wetland type for each individual wetland. Open each of these just to check them out – we’ll be using the information in the attribute tables later on.

3) You can select individual features within vector data (e.g. wetlands, roads) in addition to entire layers. For example, if you have the nwi wetland layer highlighted, you can then click on the icon for Select Single Feature (circled in red the icon menu below).



Then use the Select Single Feature icon to select the wetland section at the southeast border of the circular region (also circled). It should turn yellow to show that it has been selected (can't see it well below but the red circle shows the location).



Since this layer is made up of polygons, rivers and wetlands in old river beds are indicated by sets of connected polygons that capture the shape of the river. Typically, ponds and lakes will be represented by one (or at most a very few) polygons. But, what you see as a single wetland is often broken up into several on the nwi layer.

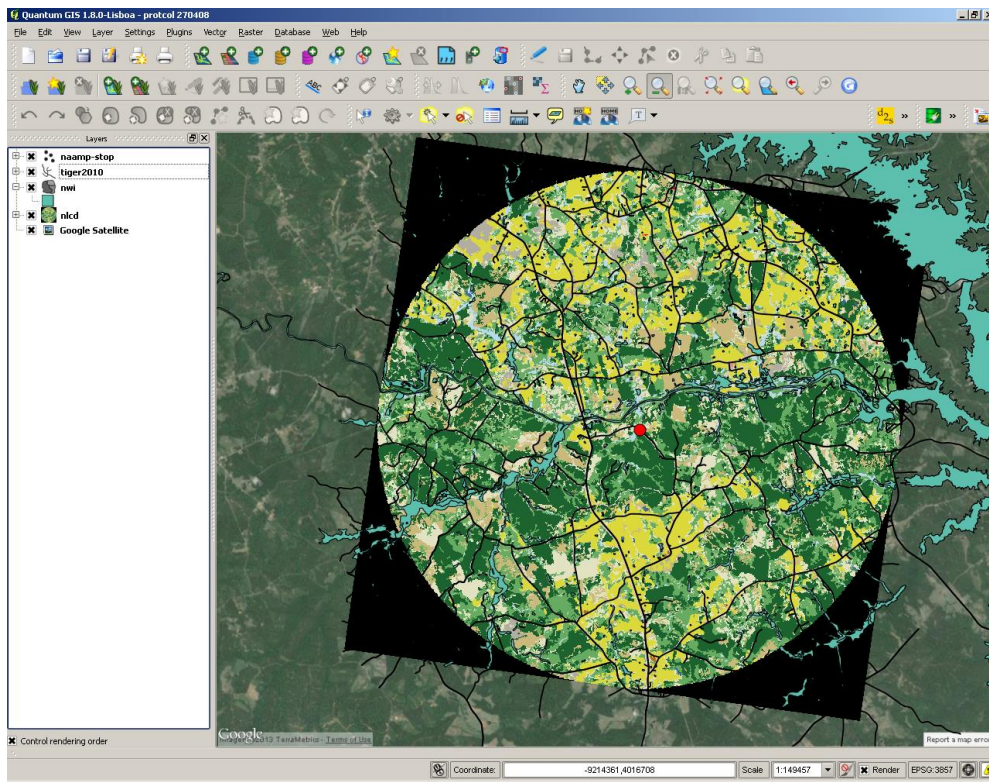
Now click on the attribute table for the nwi layer and scroll down until you see a highlighted row (should be row 218). This is the selected wetland. You'll see from the attribute table that the highlighted wetland is classified as a Freshwater Forested/Scrub Wetland and that the area is 301.6 acres. So, for any vector layer, you can find out about any feature on the map by selecting that feature and then opening the corresponding attribute table. When you're done, you can deselect the feature with the button just to the right of the "select single feature" button – it says "Deselect features from all layers."

4. You've probably figured this out on your own, but you can zoom in and out using the magnifying glass icons in the middle of the icon menu. Just click on the Zoom In (+) or Zoom Out (-) icon on the screen. For example if you zoom in on any of the sections of the map, you'll probably notice a lot of small wetlands that you probably didn't notice on the broader-scale map.

5) Sometimes it's useful to see the actual landscape, rather than the GIS representation of the landscape. You can actually add a Google satellite image (as in Google Maps) as a layer to your map. Then you can toggle back and forth between the actual image and the GIS map.

To do this, you first need to enable OpenLayers. At the top menu, click Plugins, then "Fetch Python Plugins". Scroll down to the OpenLayers plug in, click on it, and click "Install."

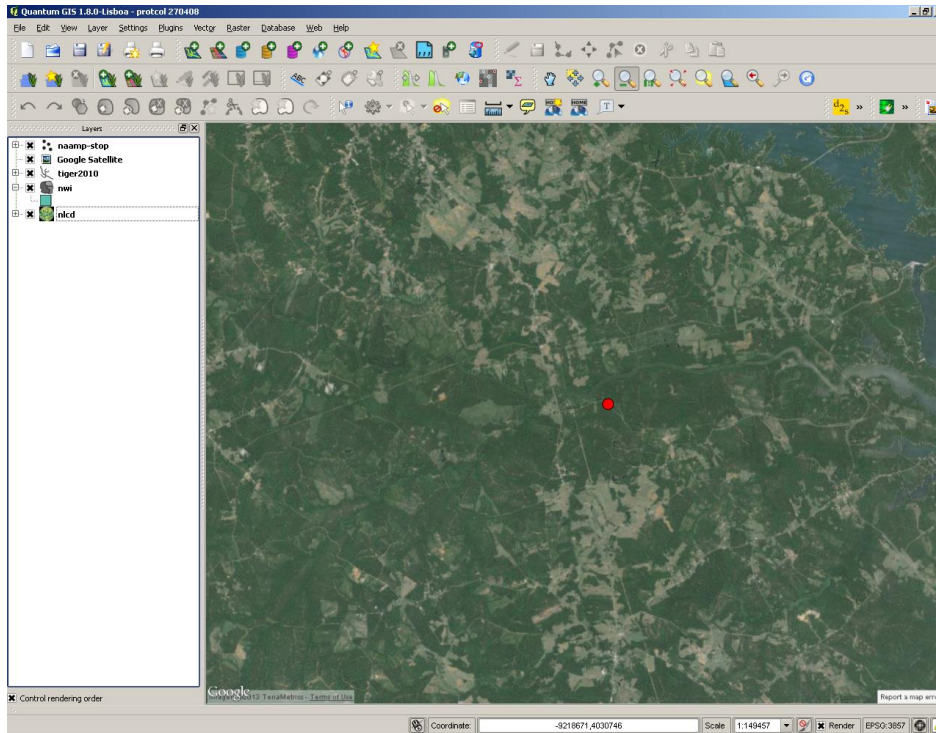
Now when you click again on the Plugins menu, a new option appears for OpenLayers plugin. Follow this menu to "Add Google Satellite layer." If you add it to the bottom of the Layer window, the result should look like this:



**NOTE:**

*Occasionally, I've been getting errors where adding a Google satellite layer crashes qGIS. If this happens, just open qGIS again (you won't lose anything if you've been good about saving your projects) and just don't add the satellite layer for that stop. Satellite imagery is optional – it's not required for any of the calculations.*

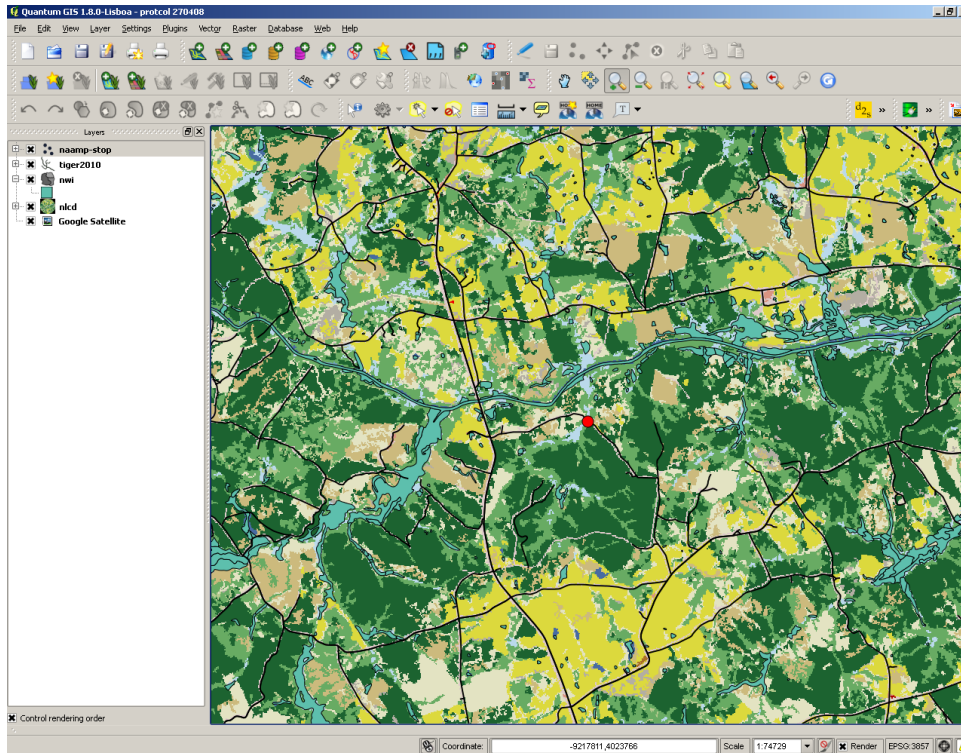
By dragging the Google Satellite layer up to higher on the label list, you can effectively switch back and forth between the satellite image and the landcover raster as the background. If you drag the "Google Satellite" layer tab, up above the nlcd layer, you can see the stop represented on the satellite image:



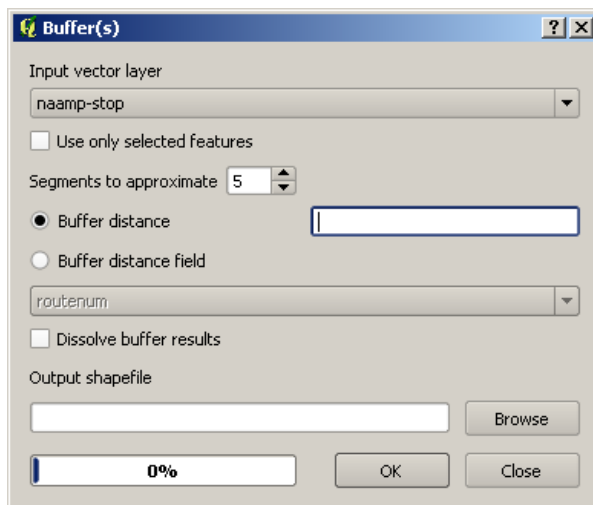
Looking at a satellite image of your site should help you better visualize the landscape that frogs and toads are living in and moving through. This should help you think more clearly about the colored pixels, lines, and polygons that you'll be working with within qGIS. Similarly, seeing the landscape may help you think of additional questions we should be asking in this project.

6) One final technique you'll need is drawing "buffers" (really just circles) around the naamp stops. The landscape variables to be assessed examine the landscape within a range of scales around each stop. To measure these variables, you'll need to draw circles around each stop to delineate what's included and what's not included at each scale.

Let's start with start with a 1 km buffer to illustrate how this process works. Highlight the naamp stop layer. If you zoom in on this stop, your screen should look something like this:



Now, at the top menu, go to Vector, then Geoprocessing Tools, then Buffer. A pop-up window should appear:

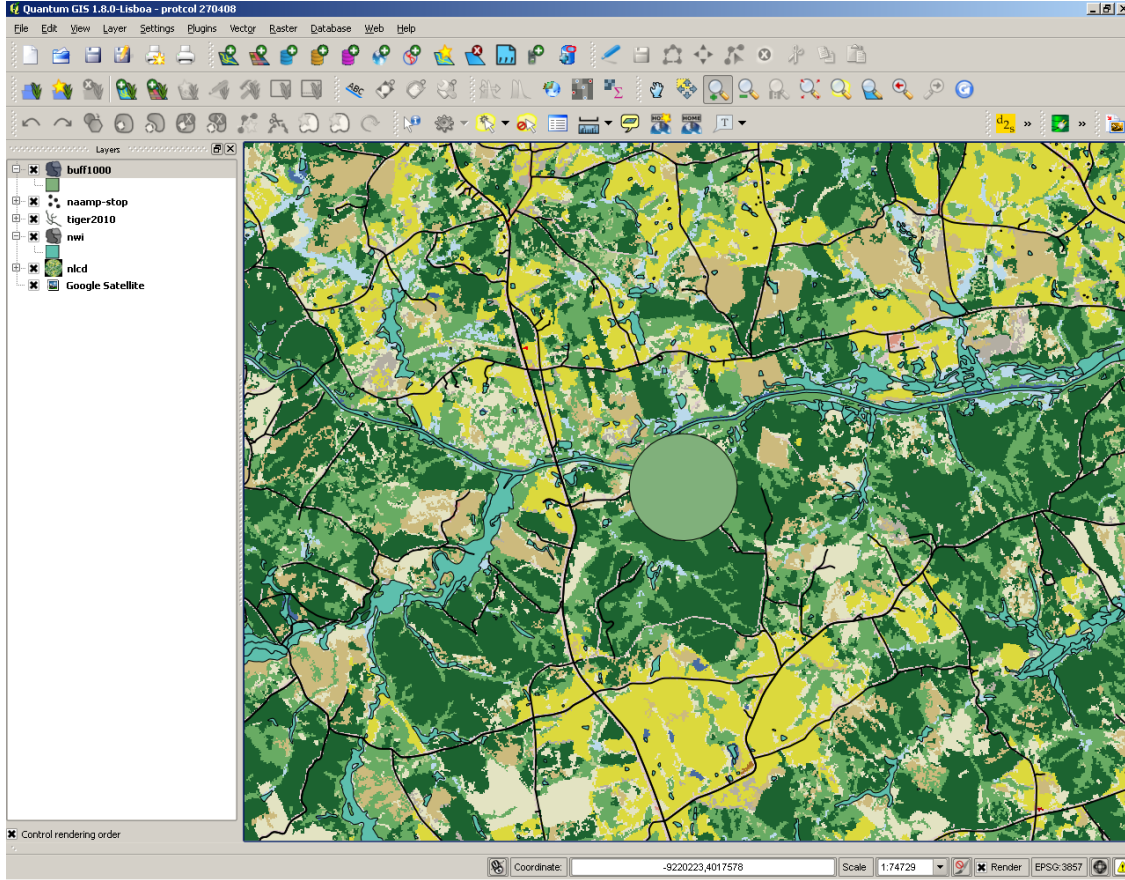


Make sure that you says “naamp-stop” under Input vector layer. If it doesn’t use the drop-down arrow next to this in order to change it to “naamp-stop.”

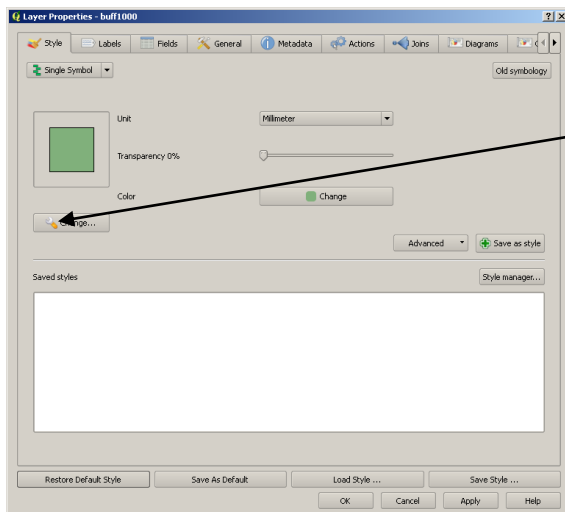
QGIS draws a circle based on segments. To get a better-looking circle, change “Segments to approximate” from 5 to 10. Under buffer distance, type in 1000 (for a 1000 m buffer). The buffer will be another data layer, so click on browse and tell qGIS where you want to put the file (usually, within the folder that contains the other files for this route). Then give it a name – I’d suggest something like “buff1000”. Click “Save” then “OK” on the Buffer popup window. Click Yes for saving the buffer layer to

the TOC (table of contents in the layer window). If you've done all this, you should get something like this:

Note the big blue green circle in the center (the color of your may be different)

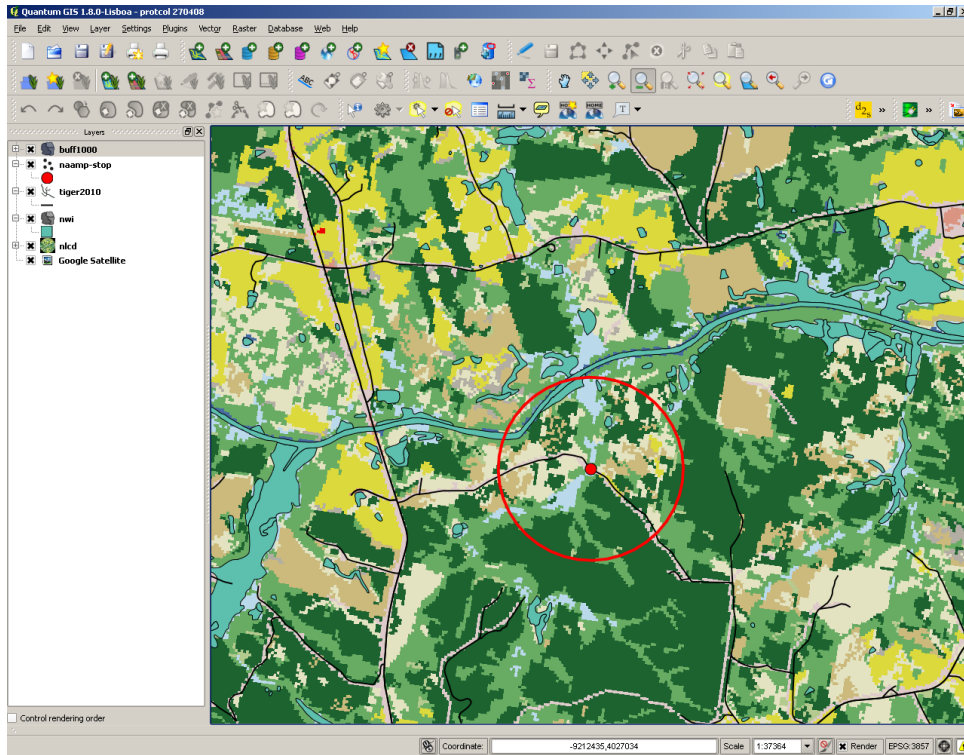


Not super helpful since you can no longer see what's inside the buffer. Highlight the buffer layer then right click to get to Properties.



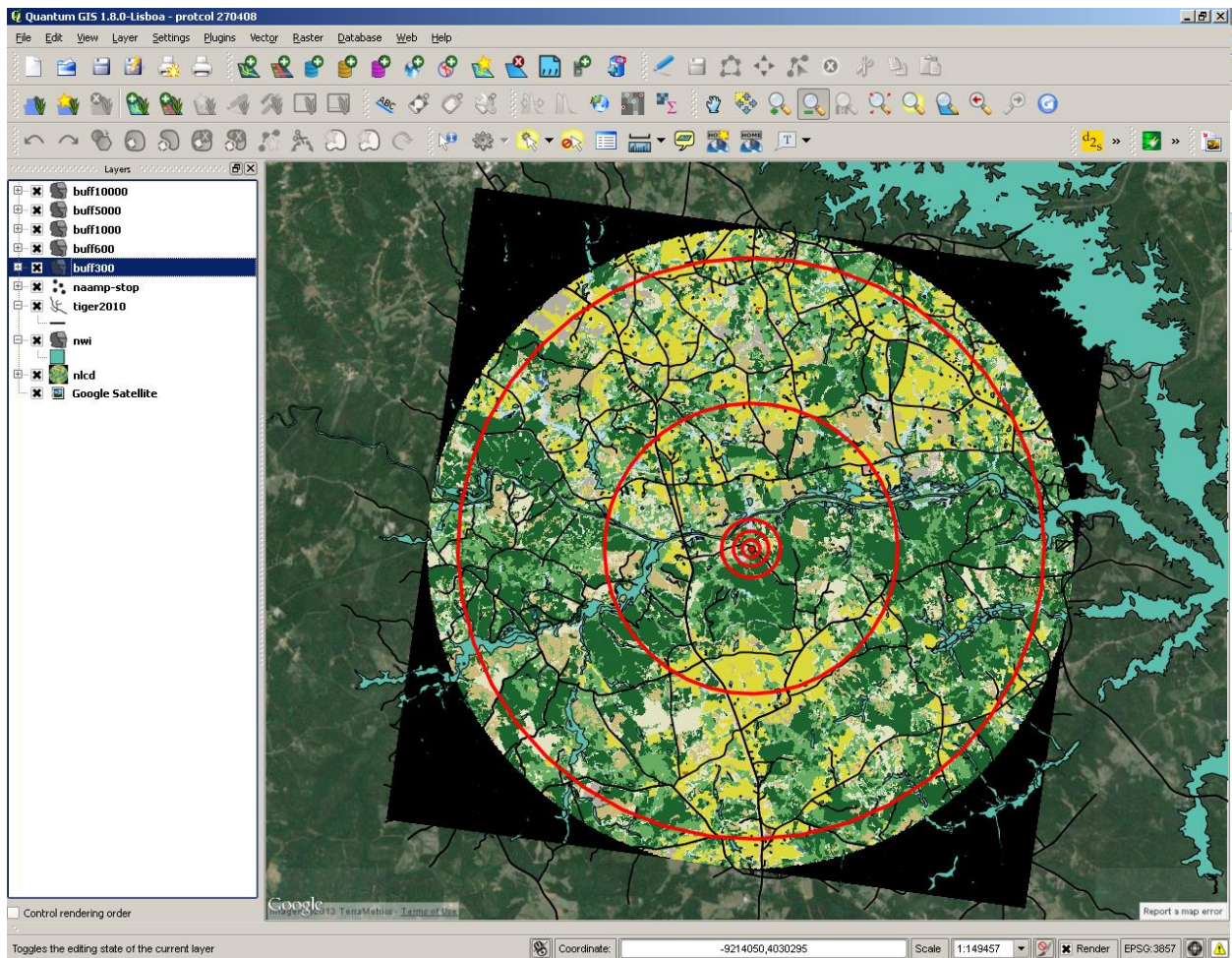
In the properties window, click on the icon of the wrench with "Change..." next to it.

You might change Fill Style to "No Brush", change the Border color to red (I use red here because nothing else right around the stop is red, otherwise I might just use black) and change the Border width to 1.00 to make the buffer more visible. Then zoom in one time and you should get a map that looks like this:



Now you can clearly see what's within 1000m of the site.

Now add some more buffers to the same map. Use the same set of steps as above to make buffers of 300 m, 600 m, 5000 m, and 10000 m. Make sure in the buffer creation window you have "naamp-stop" entered under "input vector layer" each time (if you have the naamp-stop layer highlighted in the layer window, it should come up automatically). You should be able to produce something that looks like this (see next page):



This particular landscape looks pretty similar across the different scales (i.e. buffer distances). But it's easy to imagine that you might have other landscapes where things like development or forest cover look really different 5 km away from a survey location versus 300 m away.

Anyway...

**Congratulations – these are all the basic skills you'll need to do the landscape calculations in qGIS.**

You're now ready to go on to the formal protocol for "Compiling and Recording Landscape Variables." But first, don't forget to save your project! We'll continue with this project as we work through the rest of the protocols.