

Introduction to GIS using Quantum GIS 1.8.0-Lisboa

Introduction

The purpose of this tutorial is to introduce you to the use of all Quantum GIS (QGIS) functions. Each lesson is designed to instruct you in one or more of these functions. If you are unfamiliar with geographic information systems (GIS), one resource you can review is the Guide to Geographic Information Systems (www.gis.com).

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Adding layers

The purpose of Lesson 1 is to demonstrate how to add layers to QGIS. What you will learn in this lesson will be useful if you are running QGIS for the first time, or if you need to create a new database.

1. Go to MassGIS (<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cen2000towns.html>) to download the US Census (2000) town layer as polygons. Also download (<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cen2000hydro.html>). Run the .exe file to unzip both sets of data.
2. Start Quantum GIS by going to Start > All Programs > Quantum GIS Lisboa > Quantum GIS Desktop (1.8.0).
3. Click on the Add Vector Layer button (), click Browse, and navigate to the folder where you stored the data. Add the two shapefiles you just downloaded (.shp).

Note: you may use the Ctrl or Shift keys to select more than one theme at a time. The Ctrl key allows you to select specific individual themes; the Shift key allows you to highlight a range of themes.

4. Download a USGS color ortho image (aerial photograph) from MassGIS for the MIT campus and Back Bay part of Boston (<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/colororthos2008.html>). Click download, then use Method 2 for 30 cm imagery (this will download an image with 30 cm x 30 cm resolution). Download tile 23429005.zip and extract the data into your working folder.

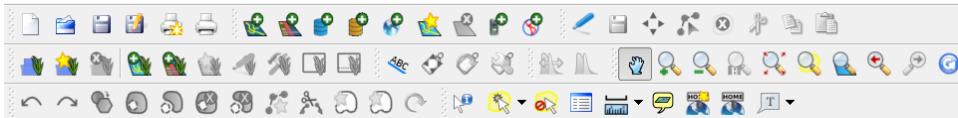
- Click on the Add Raster Layer button () and navigate to the folder where you stored the data. Click 23429005.sid then click Open.

Note: When searching for data, make sure "Files of type" is selected as "All files (*,*)" so all data files will appear.

- Turn the three layers on and off by checking the small box to the left of the name of each layer in the Map Legend. If you still cannot see the image, right click the layer name and go to Zoom to Layer Extent.
- Change the order of the layers on the map. The order that layers are listed in the Table of Contents dictates the order that they draw on the map. Click the layer names then drag to make the order 1) Census2000hydro_poly, 2) 23429005, and 3) Census2000towns_poly.
- Save your QGIS project file. In the File menu click Save Project As. Choose a name and save it to the directory with the data you downloaded.

QGIS allows users to save a record of the layers that have been added to a map display, along with the map display. This allows users to recover a map display including the layers in the map, symbolization, visibility, units of measurement, and other display settings. We recommend saving frequently with any GIS software.

The toolbar



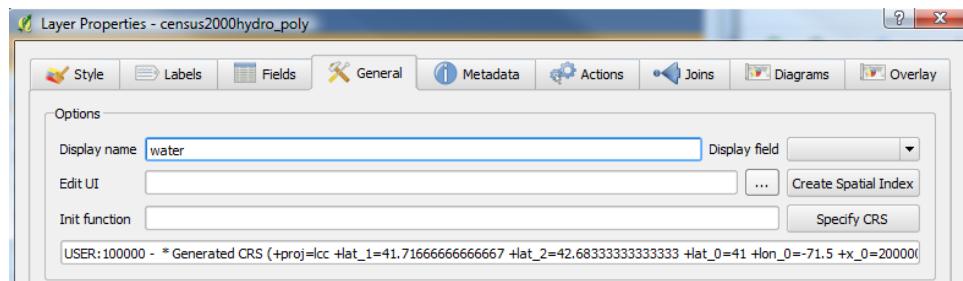
- Look at the QGIS Toolbar. Move your mouse over each tool icon. Notice that the software will indicate the name of each tool.
- Click on the Zoom In button (). You will notice that your cursor turns into a magnifying glass with a plus sign (+) inside the glass. Click your left mouse button over the map and continue to hold the button down. As you do, drag the mouse in any direction. You will notice that a white box appears on the map and increases or decreases in size depending on how you move your mouse. If you release the left mouse button the *Map View* will zoom to the new "map extents" (i.e., min x, max x, min y, and max y) represented by the window you created with the tool. Notice also that theme will zoom in to a larger-scale (i.e. more detailed map). Using this tool, you can click anywhere on the theme in the *Map View* and drag a box in any direction.
- Click on the Zoom Out button (). The cursor will turn into a magnifying glass with a minus sign (-) inside the glass. Move the magnifying glass over the zoomed in theme on your map view. Click your left mouse button one time. You will notice that the theme will "zoom out" to a smaller-scale (i.e., less detailed map). If you continue to click the left mouse button, the map will continue to get smaller.
- Zoom Full () will zoom to the full extent of all the layers in the map.
- Pan () drags the Map View in any direction.

- If you want more screen real estate, you can turn the Table of Contents on or off. Choose View > Panels and click Layers. For now, leave the Layers checkbox enabled.

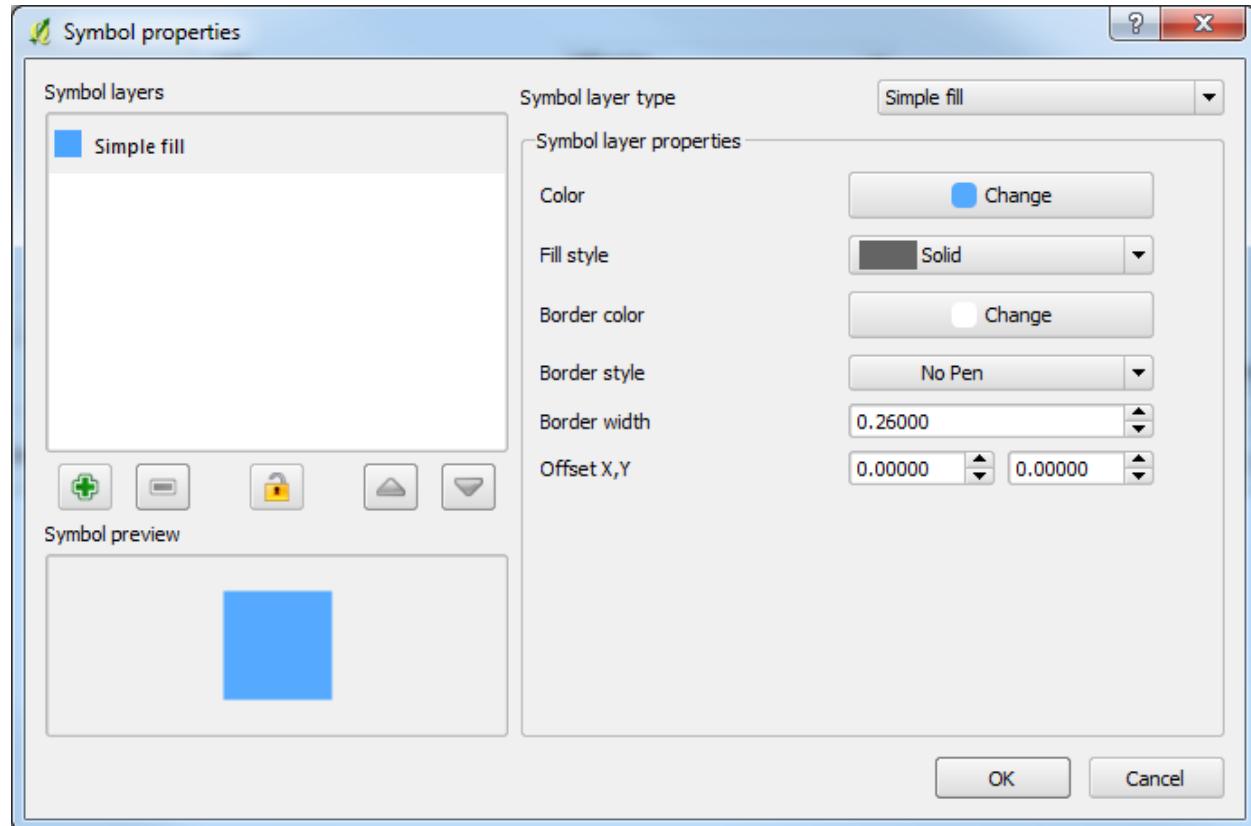
Changing names of layers, layer colors, and labeling

The layer properties dialog box enables one to change a variety of display properties for each layer, including symbology and labeling. There are two ways you can get to the layer properties dialog box: 1) right click the layer name then click properties, or 2) click the icon just below the layer name.

- Under the General tab, change the display name of census2000hydro_poly to “water”



- Change the layer from filled to a blue outline with no fill (Style tab, Change button with the wrench). Press OK when you are done.



Within the Style tab, note that it is possible to “Set a Color as Transparent” by sliding the Transparency button over to a specific percentage. By doing this the color will be transparent and will allow features on the layer over which the transparent theme lies to be seen. Press OK when you are done modifying the style.

QGIS provides the capability to label feature themes based on a user-specified text field from the layers database.

3. Right click on the census2000towns_poly layer and click properties to display the layer properties menu. Click on the Labels tab. Put a checkmark in the box to Display Labels. Use the TOWN column for the Field containing label. Click OK and zoom out until your map looks something like this:



Making a layer active and exploring the data

An active layer is one whose attribute information is available to the user and one on which the user can perform some operation. For example, a user can identify attributes of the layer or change its symbology. An active layer appears to be highlighted; all you have to do is click on the layer in the Table of Contents.

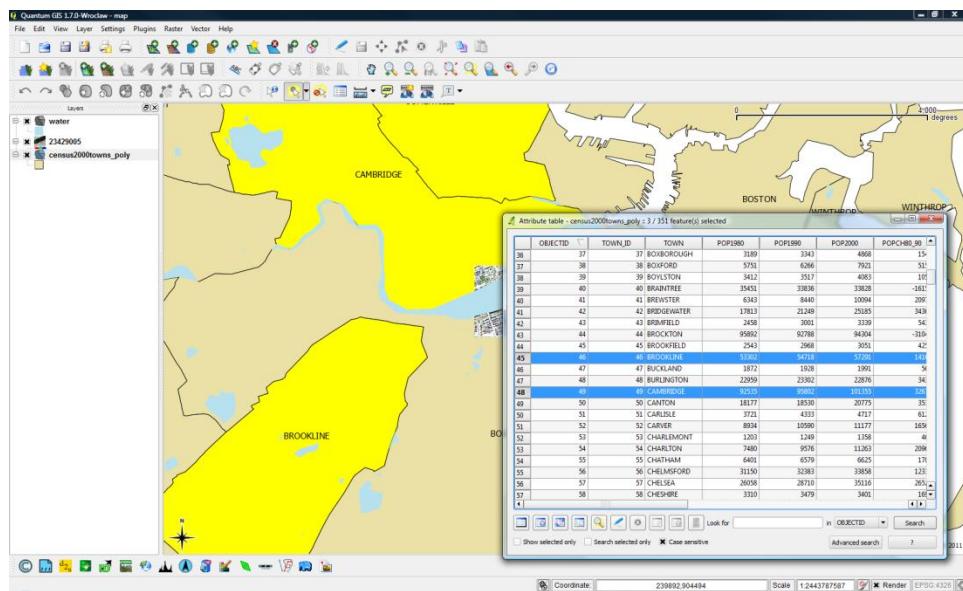
The Identify tool () is used to quickly retrieve attribute information for a feature on a map. In order to use this tool for a specific map layer, the layer that contains the information must be made active, then the features of the layer on the map can be clicked to obtain information about each feature. One of the benefits of GIS is that, in addition to being able to display a map of a layer, one can also display attributes about a layer that are stored in a database.

First select the census2000towns_poly layer, then click the Open Attribute Table button (). Notice that there is a row for each town and columns with data such as town name, population values, and population change. More descriptive information about this data can be found in the metadata that was downloaded with the file and on the MassGIS website (<http://www.mass.gov/anf/research-and-tech/it>

serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/cen2000towns.html) where you downloaded the data.

Click on the Select Feature tool (, and select several of the polygons representing Massachusetts towns. Holding the Ctrl key will allow you to select more than one feature.

When a record is selected on the map or in the table it changes color so it is distinguishable from the non-selected records. Also notice a set of helpful tools in the bottom of the attribute table dialog box which offer options such as move selection to the top, invert selection, show selected only, or search selected only.



Using the query builder

The query builder tool enables you to find all map features that meet a certain criterion or criteria. For example, suppose you were working with a map of the United States and wanted to find all cities with a population of 1 million people or greater. The following is an outline of how to use the Query Builder tool:

1. Right click the layer for which you want to find map features, and select Open Attribute Table.
2. In right hand corner click the Advanced search button. The Build Query dialogue box will appear.
3. From the Fields Menu, choose the desired field by double clicking it.
4. Choose the appropriate mathematical operation for your query.
5. Click Test and search results box will appear and show how many matching features that meet the criterion will be displayed. Click OK
6. Click OK again to run the query.
7. Click Clear to clear any previous queries.

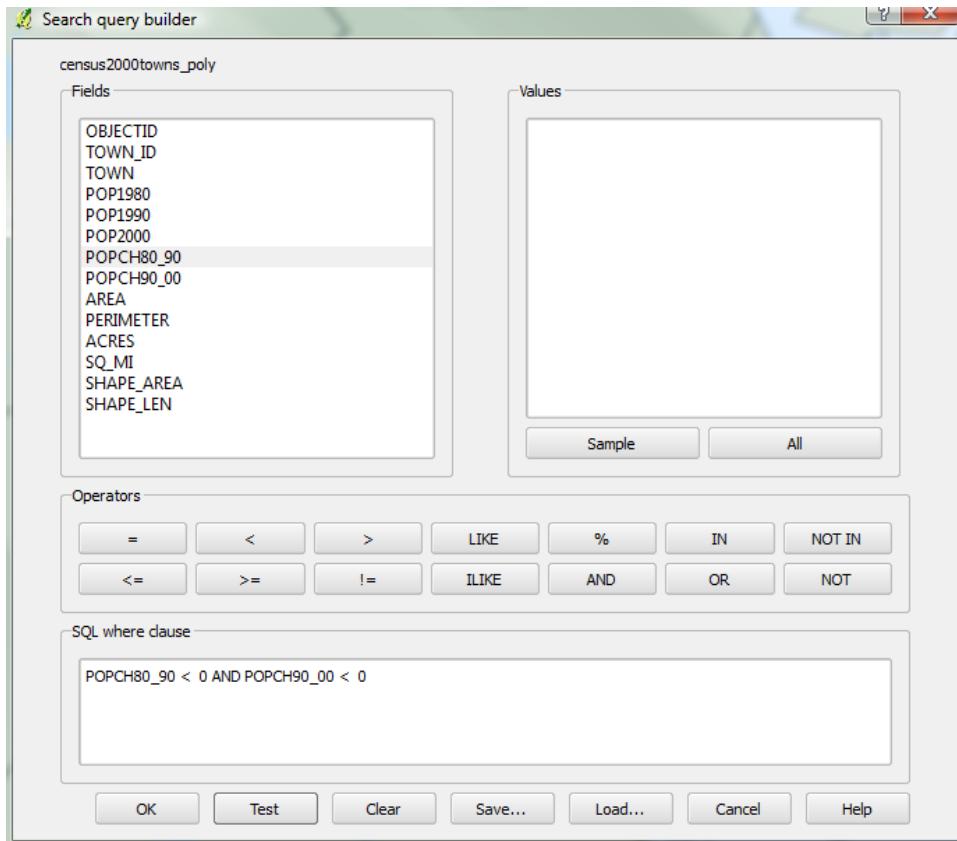
Build the following query using the census2000towns_poly layer:

POPCH80_90 < 0

Click Test and note there are 63 matching features (i.e. 63 towns with a shrinking population between the 1980 and 1990 census). Expand the query to:

POPCH80_90 < 0 AND POPCH90_00 < 0

Click Test and note there are 21 matching features (i.e. 21 towns with both decades of shrinking population between 1980 and 2000). Click OK



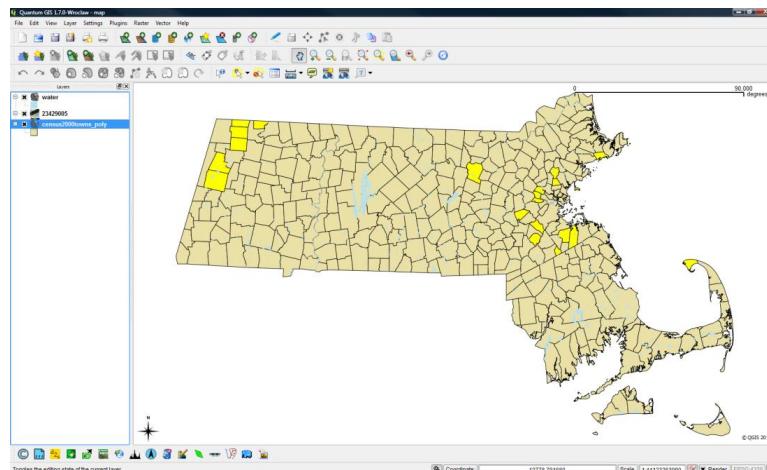
Click Show selected only (at the bottom of the attribute table) to easily distinguish which towns have been shrinking.

Attribute table - census2000towns_poly : 21 / 351 feature(s) selected

	OBJECTID	TOWN_ID	TOWN	POP1980	POP1990	POP2000	POPCH80_90	POPCH90_00	AR
1	236	236	PITTSFIELD	50340	48622	45793	-1718	-2829	109598
2	40	40	BRAINTREE	35451	33836	33828	-1615	-8	372564
5	10	10	ARLINGTON	45640	44630	42389	-1010	-2241	142749
6	178	178	MELROSE	29123	28150	27134	-973	-1016	123026
7	125	125	HARVARD	13174	12329	5981	-845	-6348	698472
11	4	4	ADAMS	10181	9445	8809	-736	-636	594062
13	26	26	BELMONT	25400	24720	24194	-680	-526	121893
15	73	73	DEDHAM	24399	23782	23464	-617	-318	275682
16	209	209	NORTH ADAMS	17387	16797	14681	-590	-2116	532643
26	305	305	WAKEFIELD	25112	24825	24804	-287	-21	204872
27	18	18	AVON	4843	4558	4443	-285	-115	118421
33	220	220	NORWOOD	28918	28700	28587	-218	-113	273189
34	336	336	WEYMOUTH	54273	54063	53988	-210	-75	461244
36	314	314	WATERTOWN	33430	33284	32986	-146	-298	107811
37	148	148	LANESBORO...	3171	3032	2990	-139	-42	770106
44	196	196	NAHANT	3922	3828	3632	-94	-196	322282
48	166	166	MANCHESTER	5354	5286	5228	-68	-58	203354
51	317	317	WELLESLEY	26658	26615	26604	-43	-11	271621
54	190	190	MONROE	148	115	93	-33	-22	279129
57	63	63	CLARKSBURG	1756	1745	1686	-11	-59	3324
62	242	242	PROVINCETO...	3562	3561	3431	-1	-130	255158

Look For: in Search Show selected only Search selected only Case sensitive Advanced search ?

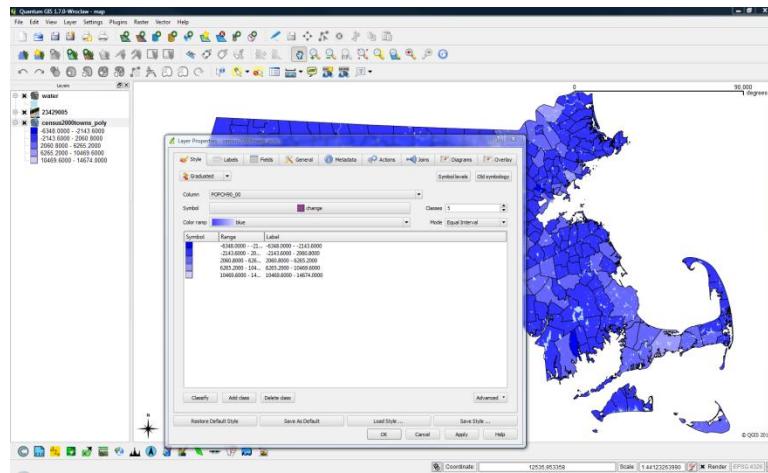
Look at the map to see the selected features and visualize the areas with shrinking towns. Make sure Labels are turned off at the full extent. After you've completed this step, you can clear the selected features  (this button is to the right of the Select single feature button).



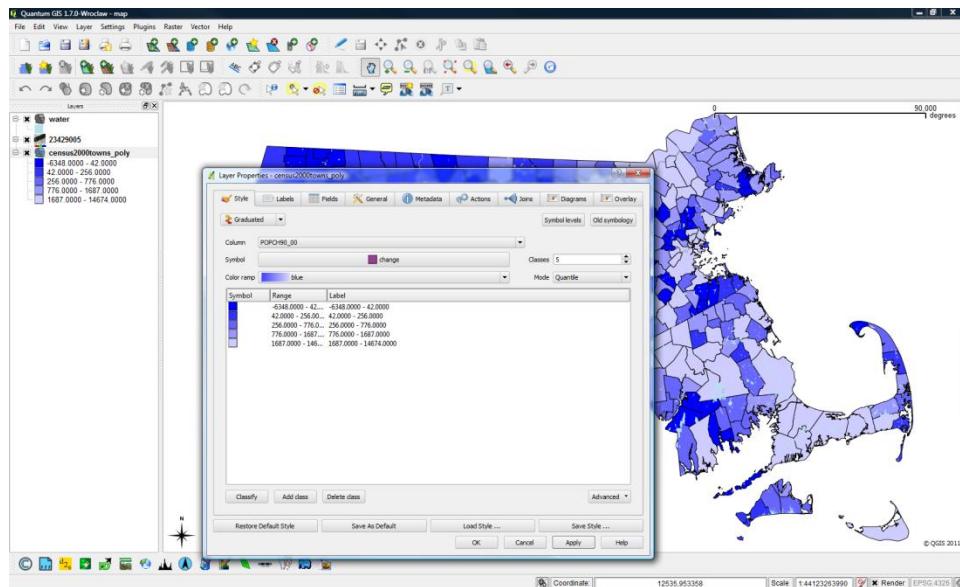
Changing layer properties, symbolizing data, and creating/editing data

There are four symbology renderers in the Legend Type drop down box that allows you to choose between the symbolization options: Single Symbol, Graduated Symbol, Continuous Color, and Unique Value. Use graduated symbol to look at the population change between the 1990 and 2000 census in the state of Massachusetts by town.

1. Right click and open the layer properties dialog box for census2000towns_poly, and go to the Style tab.
2. Change the style to Graduated in the drop-down menu in the top left.
3. Select POPCH90_00 as the column.
4. Choose Equal Interval as the mode (an equal number of features/rows from the specified field and a color will be assigned to each class) with five classes (or “breaks”). Click classify and apply.



5. Change the mode from Equal Interval to Quantiles, then classify and apply.



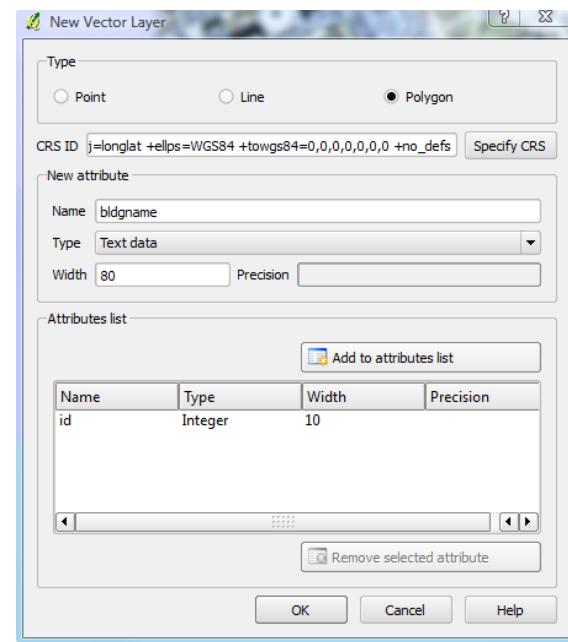
Notice the map looks totally different. Small changes can be very influential in people's interpretations of maps. A graduated classification produces a choropleth map, which is one of the most common forms of maps used today. The word choropleth derives from two Greek root words, “choros” meaning place, and “plethos” meaning value. A choropleth, or place value map, displays each area on the map by shading or coloring the areas based on their values. In particular, the values are grouped according to a classification system, and then a shade or color is applied to each value based on grouping of values.

Shades or colors are usually graduated from light to dark with dark meaning more of the value and light meaning less of the value.

Creating new GIS data

We will create polygons to represent buildings by tracing (“digitizing”) from the aerial photograph.

1. Zoom in close on layer 23429005, until you can clearly make out individual buildings.
2. Click the New Shapefile Layer button (). Make the type polygon and add a text attribute for building names abbreviated as bldgname. Make sure to click Add to attributes list.
3. Press OK. Save the new file as buildings.shp to your working directory.
4. Click the toggle editing button ().
5. Click the Add Feature button ().
6. Left click on 3 corners of the building then right click on the last to close the polygon. You will be prompted to fill out the attribute table for your new polygon, so enter a name for the building.
7. Click the save edits button () to save your new building. Toggle out of edit mode by clicking the toggle editing button.



Map units, scale, and coordinates

The purpose of this lesson is to familiarize you with how to set map units, how to determine map scale for the map shown in the Map View, and how to determine coordinate values for features shown in the Map View.

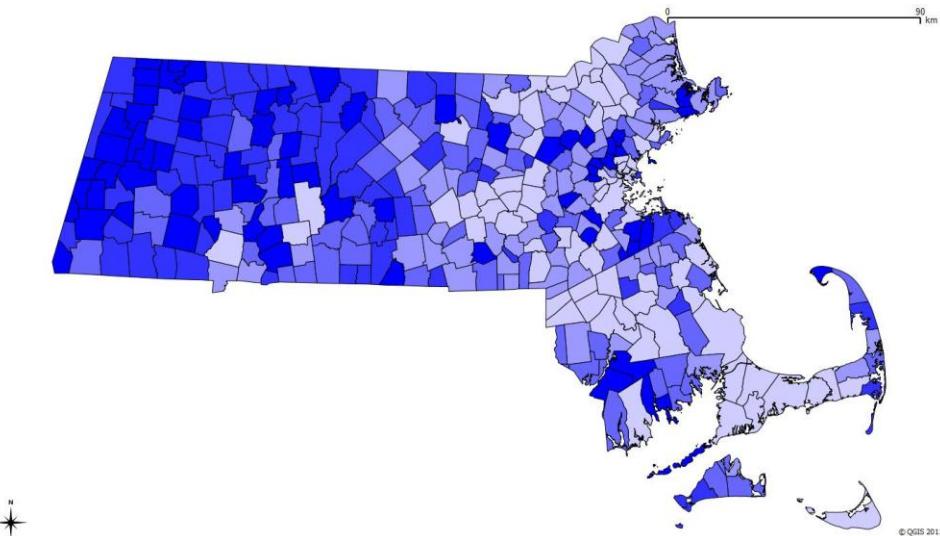
1. Look down at the bottom of the screen at the Status Bar. There are two things shown. One displays an X/Y coordinate, and the other shows the scale. The map units must be set in order for the scale of the map in the Map View to be indicated.
2. To see what the map units are, or to set them, click Settings > Options > Map tools tab. Notice the map units are set to meters for these files.
3. Click Settings > Project Properties > General Tab and make sure the layer units are set to “Meters”, and click OK.

Notice that the scale bar on your map is metric. Every GIS file has map units stored within it. If the software does not automatically read what they are, then one should check the metadata to find out what they are and set them manually in the QGIS project. If no map units are specified, an Incorrect Measure Results box pop-ups and tells you where to fix the coordinates.

Printing a map and saving as a graphics file

The purpose of this lesson is to demonstrate how to use QGIS to print basic maps in landscape format containing a theme list (legend), the map scale, a title, and a north arrow, as well as save a map as a .jpg, .qpt or a .pdf file.

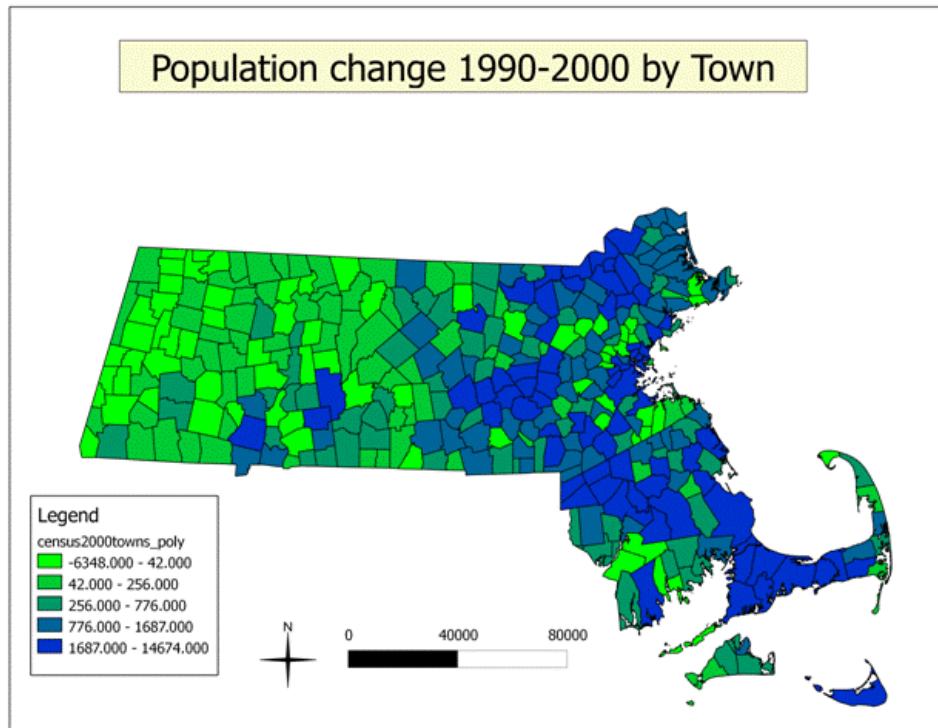
1. You can save the map as you see it as an image file. Click File > Save as Image



A dialog box will appear where you should specify the name of your file and save it with your other work. There are many formats to choose from. JPEG and PNG are widely supported formats that are easy to insert into text documents and presentations. Or you can create a more meaningful map by adding the components important for understanding it, such as a title, legend, scale bar, North arrow, data sources, date created, and any other notes. You can do all these things using Composer.

2. Click File > New Print Composer.
3. In the General tab (on the right) you can specify things like page size and orientation. Choose landscape in this case.
4. To add the QGIS map canvas, click on the Add new map from QGIS map canvas button (GIS icon) in the print composer toolbar, and drag a rectangle on the composer canvas with the left mouse button to add the map.
5. Click on the Label button (text icon), and click inside the map to insert a title. In the Item Properties Tab (on the right), type the name of your map, adjust the font, and the alignment. Towards the bottom of this dialog box is General options where you can also adjust the frame color, position and size.
6. Click on the Add Image button, (image icon) and draw a square. In the Item Tab in the Preview Box scroll down until you find a North Arrow and select it.
7. Press the Add new scalebar button (scale icon). As you draw your box the scale will appear. In the Item Tab you can adjust what type of scale you want.

8. You can also save a map as a graphics file (.jpg, .pdf, or .qpt). To do so, choose one of the following buttons: (.qpt, .jpg, and .pdf, respectively). An example of what your map could look like (without much work on its cartographic design) is below.



Have fun with QGIS!