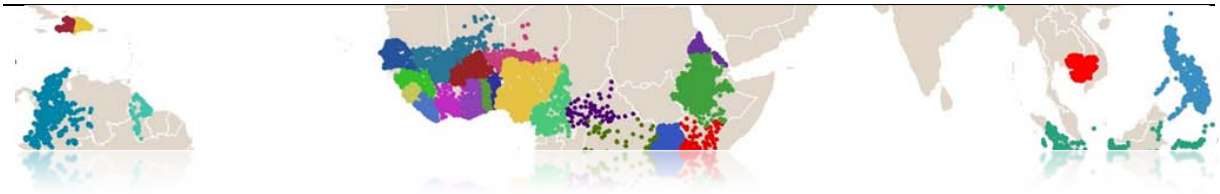
East Africa Regional Health and HIV Data Mapping Workshop using QGIS



Nairobi, Kenya

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MEASURE DHS and the Regional Centre for Mapping of Resources for Development

USAID
FROM THE AMERICAN PEOPLE

PEPFAR
U.S. President's Emergency Plan for AIDS Relief

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Excel Exercise: 1

Excel Data Cleaning

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Excel Exercise 1: Excel Data Cleaning

Summary: Microsoft Excel can be used to perform data cleaning procedures. Data cleaning is essential before using the data for mapping and analysis. Often, what looks best in reports and on paper is not the best for data verification, analysis, or maps. We will clean an example data file using a variety of Excel tools and formulas.

Objectives:

- Format data into a standard Excel table.
- Learn how to use basic Excel functions, e.g. Text to Columns, Find and Replace
- Learn how to use basic Excel formulas, e.g. TRIM, CLEAN, LEFT, RIGHT, CONCATENATE
- Learn how to filter and sort data in Excel.

Section 1: Open, explore, format, and save

We will open the Excel workbook to examine likely issues. Remove extraneous rows and columns. Adjust the column names so that each column has only one cell in row 1 which will serve as the column name. Save the file with a new name.

1. Copy the Training_Workshop folder from the USB flash drive to your desktop

2. From your desktop, open the Excel file
\\ Training_Workshop\05_Data\01_Excel\MEASURE_surveys.xlsx

3. Save a copy by clicking File and Save As or clicking the Office Button (the round button in the upper left corner) and selecting Save As. Save the file to \\Training_Workshop\06_Participant_Work and name the file *MEASURE_Surveys_Cleaned*.

4. Delete Rows 1-3 and Column A by right clicking in the row number and column header and selecting Delete.

5. Select row 1 by left clicking in the row number and highlighting the row.

6. Click the arrow next to Merge and Center in the Home menu. Select *Unmerge Cells* from the drop down list.

7. Move the cells H2, I2, and J2 (SurveyData, GPSData, Biomarkers) from Row 2 to Row 1.

8. Click OK to replace the contents of the destination cells.

9. Delete Row 2. Each column should have one cell in Row 1 with the column name.

   NOTE: Clean data consists of one row per record and a single column name. Extra rows and columns create problems for sorting, filtering, and pivoting. These tables may look nice when printed or viewed by a human but a computer will not understand data in this format.

10. Click Save.

Section 2: Convert text to columns

The Text to Columns tool can split one column into several using a delimiter, i.e. comma, semicolon, tab, etc. This tool will also store the data with the proper format. For example, numbers stored as text will be converted to numbers. In this example, the country name and year(s) of the survey are stored in one column (Country/Year) and years are numbers stored as text. Numbers stored as text will restrict the ability to sort and filter properly but will not affect mathematical formulas.

1. Insert a new column to the right of column A by right clicking on the column heading of Type (Column B) and selecting Insert.

2. Select the entire Country/Year column by left clicking the header.

3. Click the *Text to Columns* tool in the Data Ribbon Tab.

4. Select *Delimited* in the first window in the Convert Text to Columns Wizard.

5. Click Next.

6. Check *Comma* and uncheck *Tab* in the Delimeter window.

7. Click Next.

8. Select *General* under Column data format in the third window.

9. Click Finish.

10. If you receive a warning "Do you want to replace the contents of the destination cells?" click Ok.

11. Enter new column names – "Country" for Column A and "Year" for Column B.

    NOTE: Text to Columns can also convert data stored in one format into another format. For example, numbers could be stored as text. Examine Columns C and D (Type and CC/SurveyCode. You may see the green arrow in the upper left corner of each cell. Clicking on one of these green arrows should give you a warning message of "Number Stored as Text".

12. Click Save.

Section 3: LEFT and RIGHT Formulas

Sometimes one column will contain multiple pieces of information. For the purposes of sorting or filtering, you may need these pieces of data in separate, distinct columns. The LEFT and RIGHT formulas allow you to extract these data systematically. In this example, the survey code is combined with the year of the survey. You will separate the information and create a new column for the survey code.

1. Insert a new blank column by right clicking on CC/SurveyCode (Column D) and selecting Insert.

2. In D2 type the formula *=RIGHT(E2,3)*

   NOTE: Within the parentheses, the first variable specifies the cell that will be shortened. The second variable is the number of characters from the right. In this case, we are extracting the first three characters starting on the right from CC/SurveyCode. These three characters make up the Survey Code.

3. Fill this formula down the entire column either by dragging the bottom right corner of D2 or double clicking on the bottom right corner once the cursor becomes a black cross.

4. Name Column D *SurveyCode*.

5. Delete the entire CC/SurveyCode column.

   NOTE: What happened? You should see a "#REF!" error in the new column. This is because the formula was referencing the column you deleted. To fix this, you must copy and paste the formula results using Paste Special.

6. Click Undo or press ctrl+z. The CC/SurveyCode column should now reappear.

7. Right click in the column D heading and select Copy.

8. Right click on the column D heading and select Paste Special.

9. Select *Values* to paste the results of the formula and click OK.

10. Insert a new column to the left of CC/SurveyCode.

11. In E2 type the formula *=LEFT(F2,2)*

    NOTE: Within the parentheses, the first variable specifies the cell that will be shortened. The second variable is the number of characters from the left. In this case, we are extracting the two characters starting on the left from CC/SurveyCode. These two characters make up the Country Code.

12. Fill this formula down the entire column either by dragging the bottom right corner of E2 or double clicking on the bottom right corner once the cursor becomes a black cross.

13. Right click in the new column heading and select Copy.

14. In the same column, right click on the column heading and select Paste Special.

15. Select Values to paste the results of the formula and click OK.

16. Enter a name for this new column in E1 as CtryCode.

17. Delete the CC/SurveyCode column.

18. Click Save.

Section 4: Find and Replace

Spreadsheets often contain data that are not necessary. An easy way to remove extraneous information is through find and replace. In this example, we will remove the suffix "Survey" from the Status column.

1. Left click on the *Status* column header to select the entire column.

2. Click on the Find and Select button in the Home menu and select *Replace...*

3. Enter *Survey* in the *Find what:* box.

4. Leave the *Replace with:* box blank and click Replace All.

   NOTE: By leaving the replace with box empty we are essentially deleting the word Survey from the column as well as the trailing space.

5. Close the Find and Replace window and examine the Status column now. What do you see?

6. Click Save.

Section 5: CLEAN and TRIM Formulas

If data is copied from another source, like Word, there could be special, non-printable characters like bullets (•). The CLEAN formula removes these characters leaving only printable characters. Trailing, leading or extra spaces cause problems when sorting data or when matching on an entire cell's content. The TRIM formula removes these spaces leaving a single space between words.

1. Insert a new, blank column to the right of Type.

2. In D2 type the formula =*CLEAN(C2).*

3. Fill this formula down the entire column either by dragging the bottom right corner of D2 or double clicking on the bottom right corner once the cursor becomes a black cross.

   NOTE: If there are extra spaces, they will remain. The TRIM formula will remove them.

4. Right click in the D column heading and select Copy.

5. In the same column, right click on the column heading and select Paste Special.

6. Select Values to paste the results of the formula.

7. Delete the *Type* column.

8. Enter *Type* as the name for the new column in C1.

9. Insert a new, blank column to the right of Column A.

10. In B2 type the formula =*TRIM(A2)*

11. Fill this formula down the entire column either by dragging the bottom right corner of B2 or double clicking on the bottom right corner once the cursor becomes a black cross.

12. Right click in the new column heading and select Copy.

13. In the same column, right click on the column heading and select Paste Special.

14. Select Values to paste the results of the formula.

15. Now, rename Column B as Country and delete column A.

16. Click Save.

Section 6: Concatenate Using Ampersand (&)

We can create a unique survey ID by combining Country Code, Survey Code, and Year using the ampersand (&) in a formula. The formula = *CONCATENATE* serves a similar function but each cell reference is separated with a comma (,) instead of the ampersand (&).

1. Insert a new, blank column to the right of CtryCode.

2. In F2 type the formula =*E2&"-"&D2&"-"&B2*

   NOTE: The ampersand (&) separates cell references that will be combined in the new cell. Insert text by using quotes (") before and after the text. In this example we are combining cells E2, D2, and B2 and inserting a dash (-) between each.

3. Fill this formula down the entire column either by dragging the bottom right corner of F2 or double clicking on the bottom right corner once the cursor becomes a black cross.

4. Name the new column *SurveyID.*

5. Click Save.

Section 7: Comparing Using Formulas

Comparing data within your file is a useful way to examine the quality of the data. For example, the newly created SurveyID should match the RecordID from the original data. If they don't match, this could indicate a problem with the data or with our data cleaning process. The formula *=[CELL REFERENCE 1]=[CELL REFERENCE 2]* checks for an exact match between two difference cells.

1. Insert a new, blank column to the right of RecordID.

2. In K2, type *=F2=J2.*

3. Fill this formula down the entire column either by dragging the bottom right corner of R2 or double clicking on the bottom right corner once the cursor becomes a black cross.

4. Name the new column "RecordID Match".

5. Look down RecordID Match. Do they all display TRUE? Can you spot the difference?

   NOTE: There is a space in front of the Country Code for the BU-DHS-2010 RecordID.

6. Select the Burundi BU-DHS-2010 Record ID cell and delete the extra space in front of the country code.

7. The text in the corresponding RecordID Match column should change to TRUE once the additional space has been deleted.

8. Delete the columns RecordID and RecordID Match.

9. Click Save.

Section 8: Filter and Sort

Once the obvious errors have been cleaned, we can begin to dig deeper and examine the internal consistencies of the data. This will help us spot other errors that may not be visible on the first look. For this, we will use the filter and sort functions. The data must be properly formatted for these functions to produce usable results.

1. Select Columns A-L by left clicking Column A's header and while holding the mouse buttons, select to the right until you get to Column L.

2. Click Filter in the Data Menu.

   NOTE: You can also click the Filter icon on the Home ribbon in Excel 2007 or press ctrl+shift+L.

3. Try to sort Fieldwork column from smallest to largest by clicking on the grey down arrow in the column name and select the option "Sort Smallest to Largest." What happened?

   NOTE: This option is not available (the only available options are sort A to Z or sort Z to A) because these numbers are stored as text. This is why we used Text to Columns to change the Year column from text to numbers.

4. Sort the Country column from A to Z by clicking on the grey down arrow in the column name and select the first option *Sort A to Z.*

Now all of the surveys are sorted alphabetically by country. Next you will filter the SurveyCode column to check the codes against the Type column.

5. Click on the grey down arrow in the SurveyCode column name.

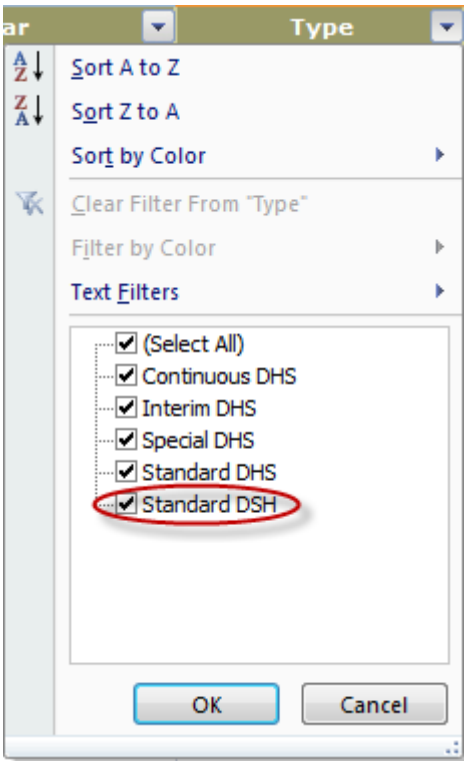
6. Uncheck the *Select All* box.

7. All of the boxes should now be unchecked. Click on the box next to *DHS* to recheck it.

8. Click OK.

9. Now you should only see different types of DHS surveys. Click on the grey down arrow in the Type column to verify that all of the records are a type of DHS survey. Do you notice anything wrong?

You should see all DHS survey types, but the last entry on the list is misspelled.



10. Uncheck the *Select All* box.

11. Recheck the misspelled *Standard DSH* box.

12. Click OK.

13. Correct the spelling of this record to *Standard DHS.*

14. Click the *Clear* button in the Sort & Filter section of the Data tab to clear the filters and show all of the survey records.

15. Click Save.

EXERCISE END

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Excel Exercise: 2 Excel Pivot Tables

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Excel Exercise 2: Excel Pivot Tables

A pivot table is one way to summarize data. It allows us to add together data for similar groups. For example, you may have survey data but you would like to see the country totals. Similarly, you may have multiple rows per survey code but you would like to see the data at the code level. In this example we will aggregate survey records for each country.

Objectives:

- Construct a pivot table with the MEASURE survey data
- Create summary tables of these data by a variety of categories

Section 1: Create a Basic Pivot Table

We are using the data we cleaned in the previous exercise.

1. Open the Excel file \\Training_Workshop\06_Participant_Work\MEASURE_Surveys_Cleaned.xls

2. Select the data by clicking on the upper left, un-numbered, un-lettered square.

3. Select PivotTable in the Insert menu.

4. Choose to place the PivotTable in a New Worksheet.

   NOTE: This will create a new tab with the Pivot Table. The table will reference data in the original worksheet so that any changes to the original data will be reflected in the Pivot Table. If the table was already calculated, you will have to click Refresh in the PivotTable Tools, Data menu or press Alt+F5.

5. Click OK.

The view will automatically switch to the new sheet with the pivot table. On the right side of the page will be the *PivotTable Field List* that will allow you to customize your pivot table.

6. In the *PivotTable Field List*, click and drag the Country field to the Row Labels box.

7. Drag the SurveyCode field to the Values box.

   NOTE: You should see a table like this. Notice that the data are aggregated as a sum. There are other options but this seems to be best choice for these data.

	A	B
1		
2		
3	**Row Labels**	**Count of SurveyCode**
4	Afghanistan	1
5	Albania	1
6	Angola	3
7	Armenia	3
8	Azerbaijan	1
9	Bangladesh	8
10	Benin	4
11	Bolivia	5
12	Botswana	1
13	Brazil	3
14	Burkina Faso	4
15	Burundi	2

Section 2: Create an Advanced Pivot Table

Continue with the same data and create more complex tables.

1. Drag the SurveyCode field to the Column Labels box.

   NOTE: You should see a table like this. Each row is one country and each column is one survey code.

	A	B	C	D	E	F	G
1							
2							
3	**Count of SurveyCode**	**Column Labels**					
4	**Row Labels**	**AIS**	**DHS**	**MIS**	**OTH**	**SPA**	**Grand Total**
5	Afghanistan				1		1
6	Albania		1				1
7	Angola	1		2			3
8	Armenia		3				3
9	Azerbaijan		1				1
10	Bangladesh		6		1	1	8
11	Benin		4				4
12	Bolivia		5				5

2. Drag the field Year to the Row Labels. Be sure to place the field below Country in the Row Labels box.

   NOTE: You should see a table like this. Now each survey is grouped by country in the rows and the survey code is displayed in each cell by year.

	A	B	C	D	E	F	G
1							
2							
3	**Count of SurveyCode**	**Column Labels**					
4	**Row Labels**	**AIS**	**DHS**	**MIS**	**OTH**	**SPA**	**Grand Total**
5	**Afghanistan**				**1**		**1**
6	2010				1		1
7	**Albania**		**1**				**1**
8	2008		1				1
9	**Angola**	**1**		**2**			**3**
10	2006			1			1
11	2010	1					1
12	2011			1			1
13	**Armenia**		**3**				**3**
14	2000		1				1
15	2005		1				1
16	2010		1				1
17	**Azerbaijan**		**1**				**1**
18	2006		1				1

Section 3: Change the Data Aggregation

Now you will change the aggregation and the view of the data by switching the columns and other boxes. Continue with the same data to explore the options for Pivot Tables.

1. Remove all the fields from the PivotTable by un-checking the box next to their name in the "Choose fields to add to report: box".

2. Drag the Status field to the Column Labels box.

3. Drag the field SurveyCode to the Row Labels box.

4. Drag the field SurveyCode to the Values box.

   NOTE: You should see a table like this. Each row is one survey category and the columns are the counts for the number of ongoing and completed surveys within each survey category.

	A	B	C	D
1				
2				
3	**Count of CtryCode**	**Column Labels**		
4	**Row Labels**	**Completed**	**Ongoing**	**Grand Total**
5	AIS	8	3	11
6	DHS	222	29	251
7	MIS	8	3	11
8	OTH	20	3	23
9	SPA	15		15
10	**Grand Total**	**273**	**38**	**311**

5. Add the Country field to the Row Labels box. Make sure that the SurveyCode field is above the Country field.

   NOTE: The table now lists the countries in which each survey category have been conducted, and the column labels indicate whether the surveys have been completed or are still ongoing.

	A	B	C	D
1				
2				
3	**Count of SurveyCode**	**Column Labels**		
4	**Row Labels**	**Completed**	**Ongoing**	**Grand Total**
5	**AIS**	**8**	**3**	**11**
6	Angola		1	1
7	Congo (Brazzaville)	1		1
8	Cote d'Ivoire	1		1
9	Guyana	1		1
10	Mozambique	1		1
11	Tanzania	2	1	3
12	Uganda	1	1	2
13	Vietnam	1		1
14	**DHS**	**222**	**29**	**251**
15	Albania	1		1
16	Armenia	2	1	3
17	Azerbaijan	1		1
18	Bangladesh	5	1	6
19	Benin	3	1	4
20	Bolivia	5		5
21	Botswana	1		1
22	Brazil	3		3
23	Burkina Faso	3	1	4

6. Save a new version of the file by clicking Save As…

7. Name the file MEASURE_Surveys_Pivot and save it in \\Training_Workshop\06_Participant_Work.

8. Close Excel.

EXERCISE END

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Excel Exercise: 3

Excel Crosswalk Tables

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Excel Exercise 3: Excel Crosswalk Tables

Summary: Crosswalk tables are used to bring together different data files that have data at the same level of aggregation (for example country) but do not use the same numeric codes or the same spelling.

Objectives:

- Explore your data file to make crosswalk table.
- Use the Excel VLOOKUP formula to match files
- Check your match
- Prepare a final crosswalk table

Section 1: Explore data file

In this step we will explore the data file that was prepared for this exercise.

1. Open the Excel file \\Training_Workshop\05_Data\01_Excel\Country_Match.xlsx

2. Look at the data in each worksheet "GIS_data," "Survey_Totals," and "CountryCodes"

    a. What kind of data is in each worksheet?
    b. Do the country codes in each worksheet match those in the other worksheets?

3. Click *Save As…* and save the file to \\Training_Workshop\06_Participant_Work naming it *Country_match_2012.*

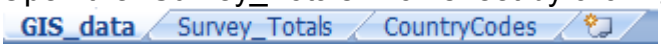
    NOTE: We save the file before working on it so that in case we have any problems we can always return to the original data.

    NOTE: For this exercise we are considering the "GIS_data" worksheet as the CORRECT codes for these data.

Section 2: Use VLOOKUP to match data

VLOOKUP is used to connect two worksheets within the same workbook.

1. Open the "Survey_Totals" worksheet by clicking the tab.



2. Insert a new column to the right of the Country column.

3. In B1, enter *DHS_CC*.

4. In cell B2, enter =*VLOOKUP(A2,CountryCodes!A:F,3,FALSE)*

5. Hit ENTER on your keyboard.

   NOTE: VLOOKUP default format is
   =VLOOKUP(lookup_value, table array, col_index_num, [range_look_up]
   - Lookup_value is the cell reference that contains the information you are looking up.
   - Table array is the place where the information you are matching to is located, make sure the first column of the table array is the "lookup_value"
   - col_index_num is the column number (starting with the lookup_value/first column) that you want returned to your table
   - range_look_up, enter FALSE or 0 to indicate that you want the match to be made exactly letter for letter/number for number

6. Click B2, then move the mouse to the bottom right corner, when the mouse changes to a small "+" double click.

   NOTE: This will fill in the formula down to the bottom of your table (as long there are no cells to the immediate left that contain no data).

7. Scroll through your table. Look at the column with the match information.
   - Does this look correct?
   - Are there any countries where the lookup value is "#N/A"?

8. Select the first row of the worksheet by left-clicking on the number 1.

9. Click the filter button in the Data tab.

10. Click on the grey arrow in the DHS_CC column and uncheck Select All, and then recheck #N/A.

This filters the results and shows there are 6 countries that did not match.

	A	B	C	D	E	F	G	H
1	Country	DHS_CC	AIS	DHS	MIS	OTH	SPA	SurveyTot
17	CAR	#N/A		1				1
22	Democratic Republic of the Congo	#N/A		2				2
23	Cote d'Ivoire	#N/A	1	3				4
43	Kyrgyz Republic	#N/A		2				2
44	Lao People's Democratic Republic	#N/A				1		1
68	Sao Tome and Principe	#N/A		1				1

11. Examine the "#N/A" rows that did not match.

12. Look at cell A23 (Cote d'Ivoire) in the Survey_Totals worksheet, and then look at cell A42 (Côte d'Ivoire) in the CountryCodes worksheet.

    NOTE: This is an example of why making a match on a name is difficult, since slight difference in spelling, accents, or spaces can make the match invalid.

13. Find the name equivalent in the CountryCodes sheet for each non-matched country and copy the DHS_CC for that country and insert it into the DHS_CC column in the Survey_Totals sheet.

    NOTE: Your results should look like this.

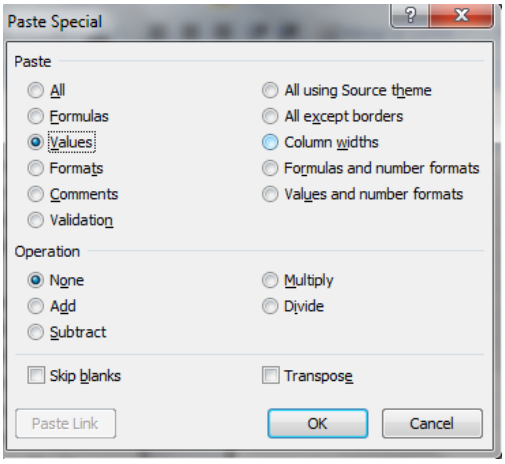
	A	B	C	D	E	F	G	H
1	Country	DHS_CC	AIS	DHS	MIS	OTH	SPA	SurveyTot
17	CAR	CF		1				1
22	Democratic Republic of the Congo	CD		2				2
23	Cote d'Ivoire	CI	1	3				4
43	Kyrgyz Republic	KY		2				2
44	Lao People's Democratic Republic	LA				1		1
68	Sao Tome and Principe	ST		1				1

14. Clear your filters by clicking on the *Filter* button in the Data tab.

15. In the “Survey_Totals” worksheet, copy the “DHS_CC” column.

16. Right click B1, select “Paste Special”.

17. Select “Values", then OK. (See example below).



NOTE: Using Paste Special “Values” for a VLOOKUP column removes the VLOOKUP formula and keeps only the results.

Section 3: Use VLOOKUP to see other table information

In Section 2 you made the link by DHS country code between the Survey_Totals and CountryCodes, data. Now we will add the GIS_data country code to the Survey_Totals file by linking on the DHS country code.

1. In the Survey_Totals sheet, insert a column to the right of DHS_CC

2. In the Survey_Totals sheet, enter *CC* in C1

3. In cell C2, enter =*VLOOKUP(B2,GIS_data!A:D,2,FALSE)*

   NOTE: This is similar to the code we entered in Section 2. However, the function will return data from the GIS_data worksheet instead of the CountryCodes worksheet.

4. Click C2, then move the mouse to the bottom right corner, when the mouse changes to a small "+" double click or click and drag down to the bottom of the table.

5. Examine the CC column. All of the countries should have properly matched.

6. Copy the CC column.

7. Click C1, right click and "Paste Special" selecting "Values".

Optional Steps

1. Add the FIPS_CC code from the CountryCodes worksheet to the Survey_Totals worksheet.

2. Add the GIS_data Region information to the Survey_Totals worksheet.

EXERCISE END

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QGIS Exercise: 0 Installing QGIS and Plugins

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 0: Installing QGIS & Plugins

In this exercise you will learn how to install QGIS and add plugins to expand the functionality of the software. The instructions will vary depending on your operating system.

Section 1: Download and Install QGIS

If you are using Windows Vista or Windows 7, you will need to right click and select ***Run as Administrator***. If you do not use this method, the software will install but not run correctly. If you are using an older version of Windows XP and do not have the C++ Runtime Engine, the software will not operate correctly. Download the latest package and install this prior to installing QGIS. If you have an earlier version of QGIS installed on your computer, you will need to uninstall it.

1. Open the Training_Workshop folder.
2. Install QGIS using the QGIS-OSGeo4W-1.8.0-1-Setup.exe file.

   OR

1. Use a web browser and navigate to http://www.qgis.org.
2. Click download and select the current version. For Windows users, choose 1 Windows - 1.1 Standalone Installer (recommended for new users)

   NOTE: Since this is open-source software, changes are constantly being made to the code. This manual was created using version 1.8.0 Lisboa. Icons and menus may be different in other versions.

3. Once the download is complete, install using the *.exe file.

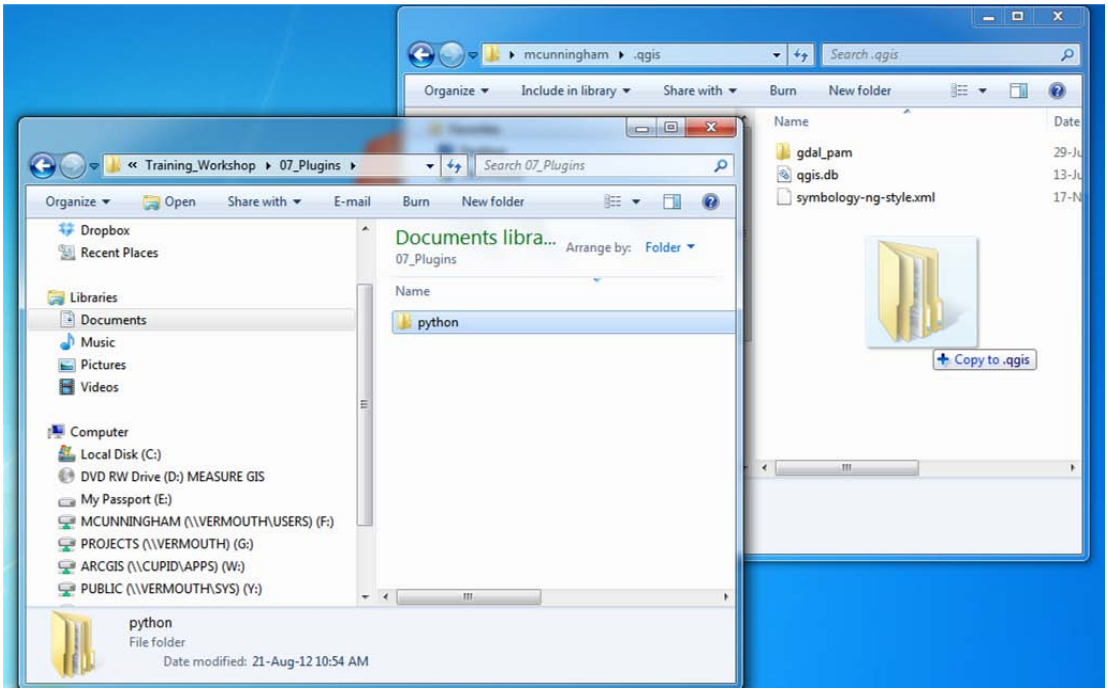
Section 2: Install Plugins Off-line

Plugins add functionality to the basic installation of QGIS. These tools are written by members of the open source community. Some are highly complex while others are basic, meant to accomplish one specific task. You can install as many or as few as needed. You can download the Plugins online via the “Fetch Python Plugins” option (See Appendix) or you can install them from the training folder.

1. We have pre-downloaded several commonly used plugins which you can install off-line. Open the 07_Plugins folder in the Training Folder. In a separate window, browse to the .qgis folder located at C:\Users\YourUserName\.qgis.

2. Copy the python folder from the Training_Workshop/07_Plugins folder to the .qgis folder.

   NOTE: If you have installed plugins, this will replace them.

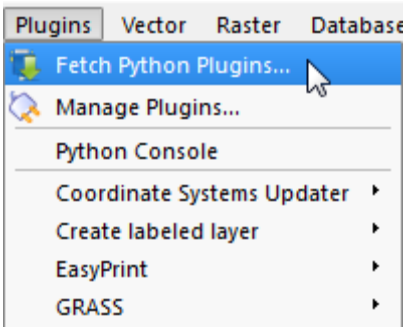


Let's open QGIS and look at the plugins we've installed.

3. If you have a shortcut for QGIS  on your desktop, double click it to start *QGIS.* Otherwise, click *Start* > *Programs* > *Quantum GIS Lisboa* > *Quantum GIS Desktop(1.8.0).*

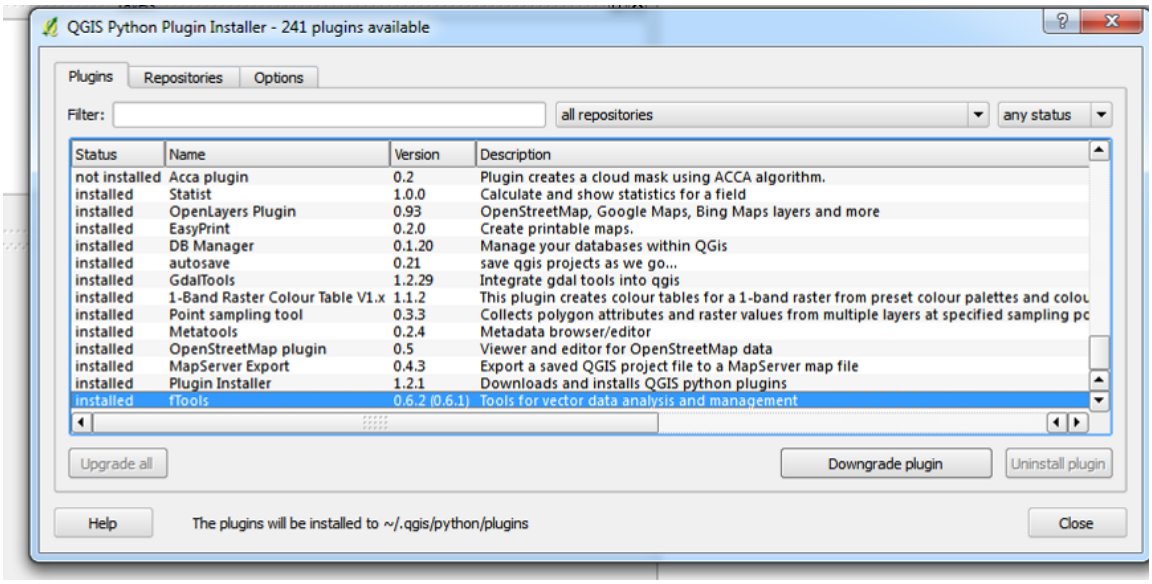
   NOTE: Make sure that you open Quantum GIS Desktop, not the similarly titled Quantum GIS Browser**.**

4. Click *Plugin* > *Fetch Python Plugins…*



   NOTE: You must be connected to a stable internet connection to download more plugins.

5. The *QGIS Python Plugin Installer* window will appear. Your window may show fewer plugins than the image below. Read through the descriptions of the plugins which are installed.



6. You should have the following plugins:

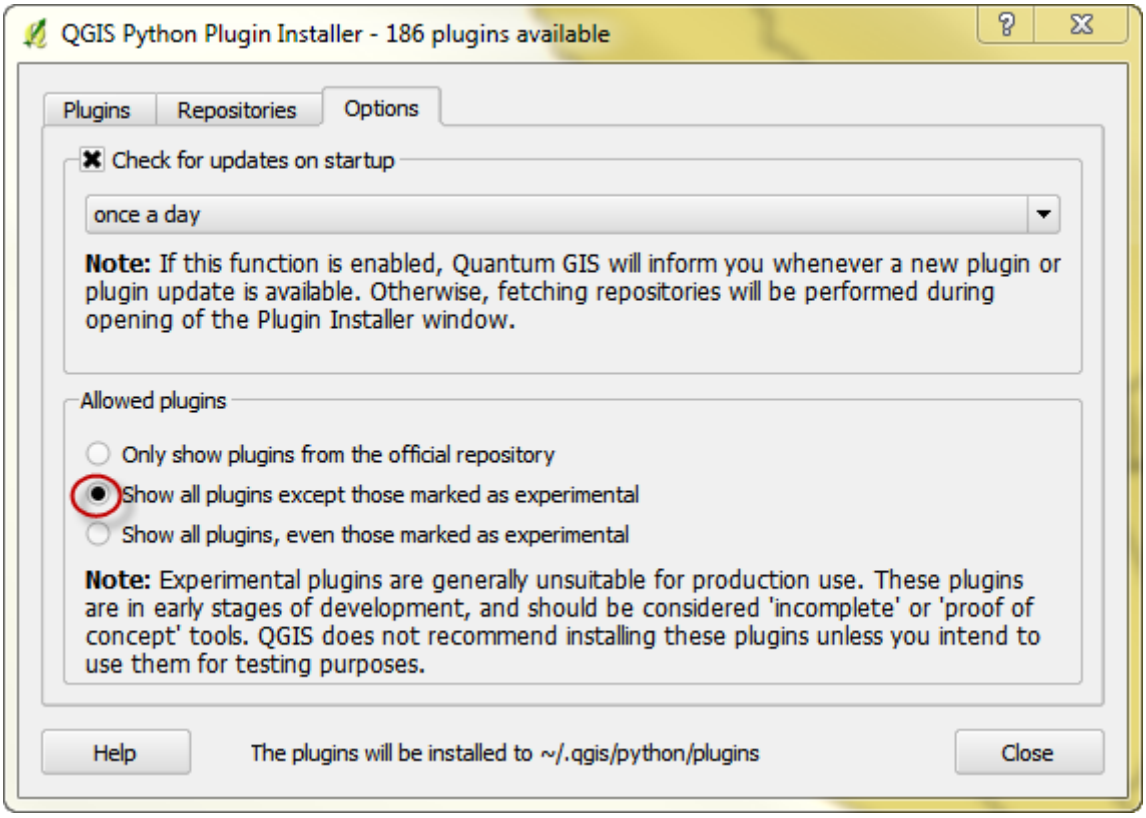
   - 1-Band Raster Colour Table V1.x[1]
   - EasyPrint
   - Metatools
   - Point sampling tool
   - Statist
   - ZonalStats
   - Open Layers Plugin
   - AutoSave
   - fTools.

7. Click the *Options* tab.

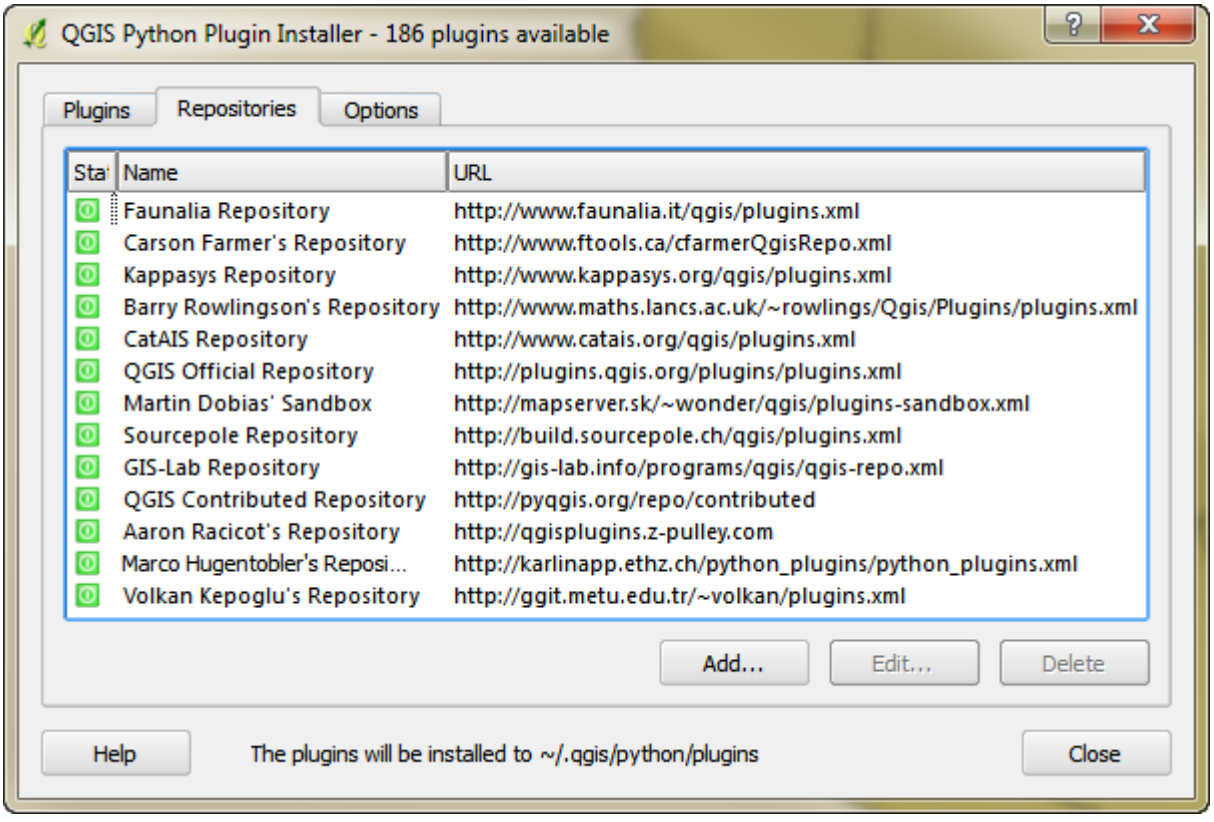
8. Select the radio button next to *Show all plugins except those marked as experimental.*

   NOTE: The standard default repository is the 'official QGIS' server. Changing the default option will allow you to view and install additional plugins from different sources.

[1] From the bcccoltbl1 tools plugin folder



9. If you have an internet connection, you can use the *Repository* tab to add additional sources of plugins. See the appendix for detailed instructions.

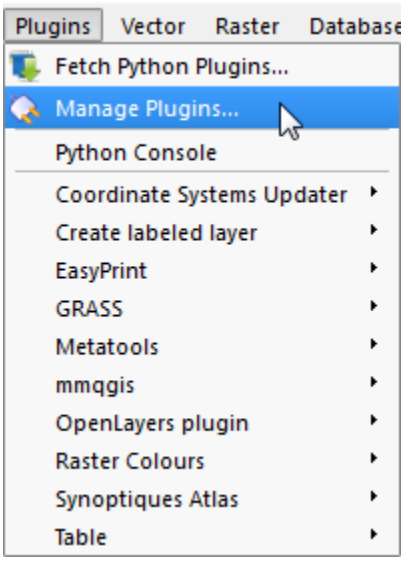


10. Click *Close.*

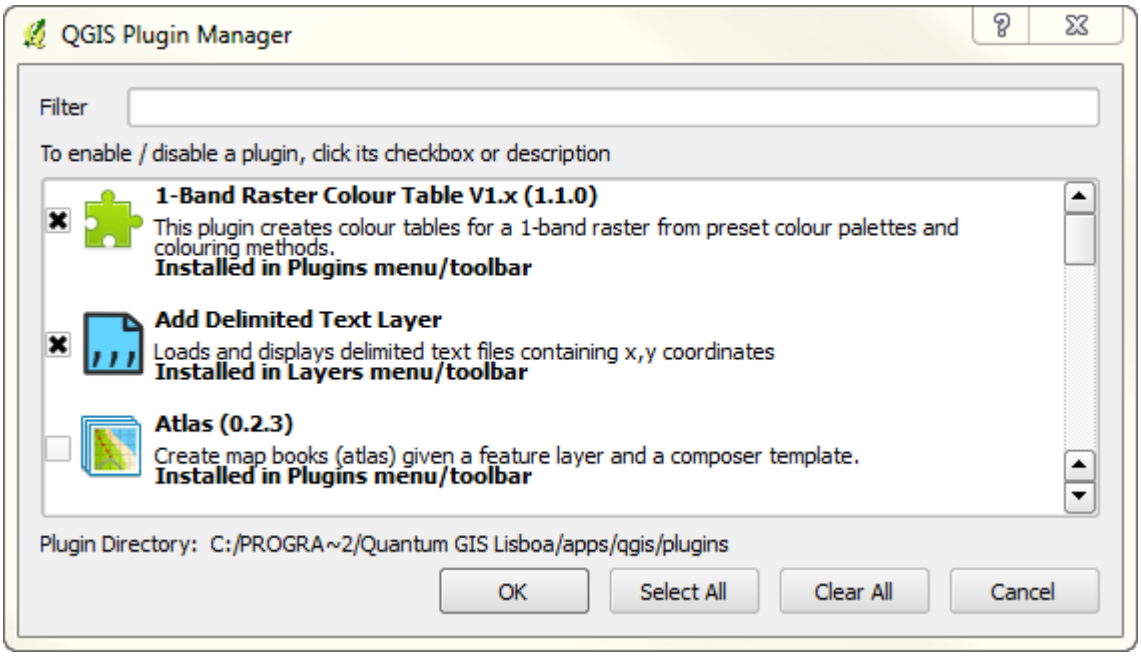
11. Restart QGIS Desktop.

Section 3: Add Plugins

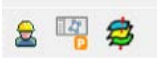
1. Click *Plugins* > *Manage Plugins…*



2. Within this dialog box you can add the installed plugins to QGIS.



3. Select the check box next to the following plugins:
    - 1-Band Raster Colour Table V1.x
    - Add Delimited Text Layer
    - Easy Print
    - GPS Tools
    - Metatools
    - Open Layers Plugin
    - Point Sampling Tool
    - Statist
    - ZonalStats
    - fTools plugins
    - Any additional plugins you wish to add and click *OK.*

4. You should now see several plugins as buttons on the *Plugins Toolbar* at the bottom left of the screen. These plugins may also be found in the Plugins menu. 

    NOTE: Your *Plugin Toolbar* buttons will vary depending on which are installed. Hover with the mouse over each button to display the text description. If you experience problems after installing a plugin, uninstall it.

    NOTE: Some of the Plugins add themselves under other toolbars: For example, Statist shows up on the Vector toolbar  and ZonalStats shows up on the Raster toolbar 

Exercise End

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

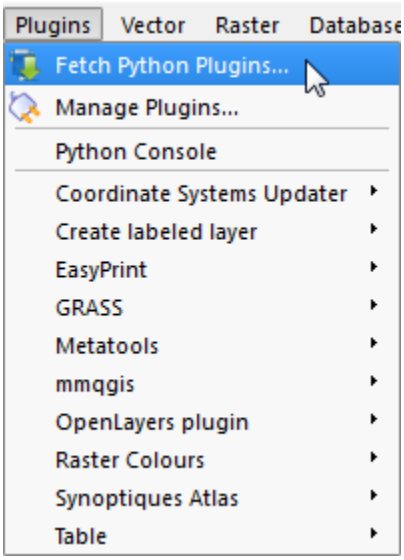
Appendix 0: Install Plugins online

Plugins add functionality to the basic installation of QGIS. These tools are written by members of the open source community. Some are highly complex while others are basic, meant to accomplish one specific task. You can install as many or as few as needed.

1. If you have a shortcut for QGIS  on your desktop, double click it to start *QGIS.* Otherwise, click *Start* > *Programs* > *Quantum GIS Lisboa* > *Quantum GIS Desktop(1.8.0).*

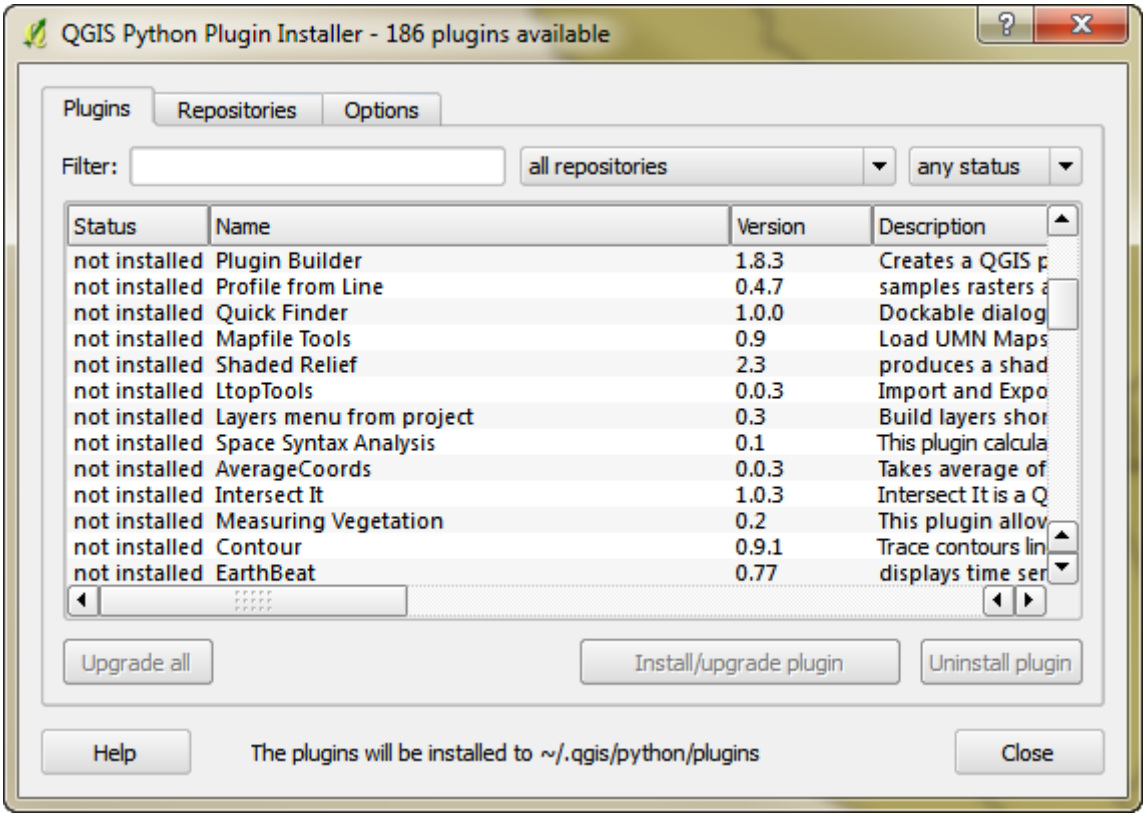
   NOTE: Make sure that you open Quantum GIS Desktop, not the similarly titled Quantum GIS Browser**.**

2. Click *Plugin* > *Fetch Python Plugins…*



   NOTE: You must be connected to a stable internet connection. The plugins are installed through the web.

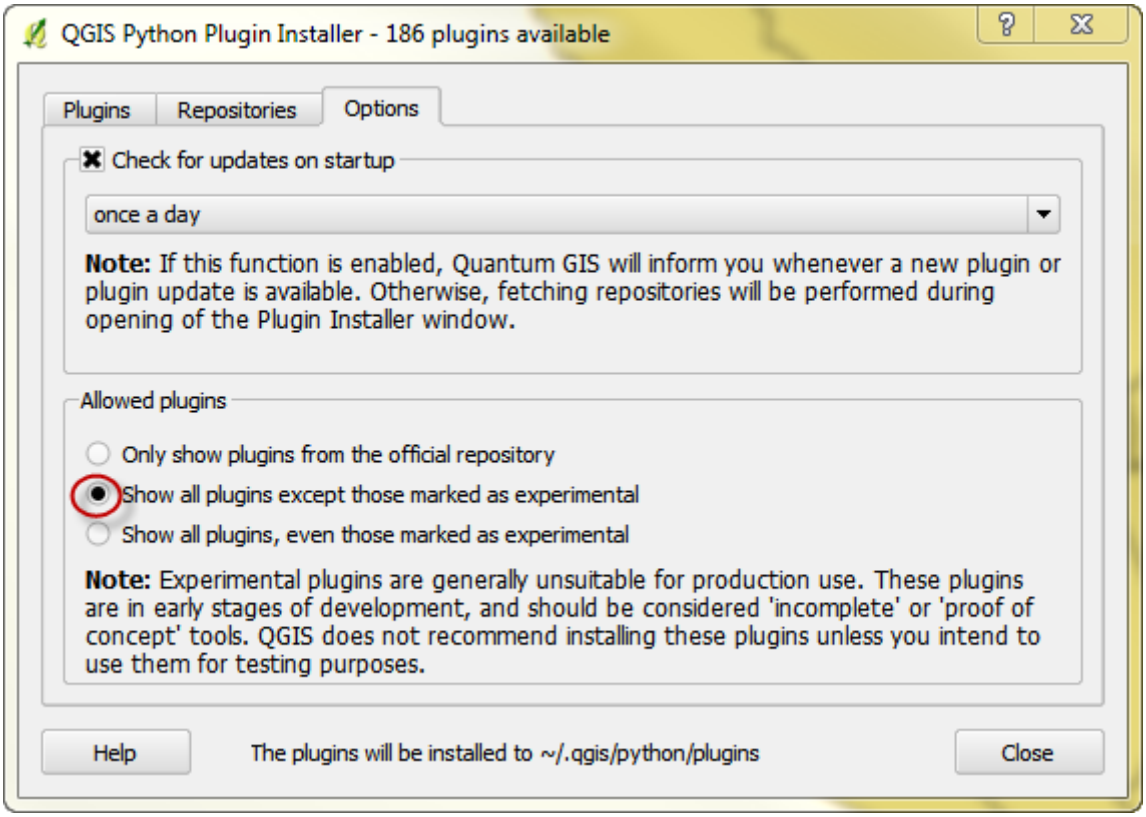
3. The *QGIS Python Plugin Installer* window will appear once the connection to the internet is verified. Your window may show less plugins than the image below.



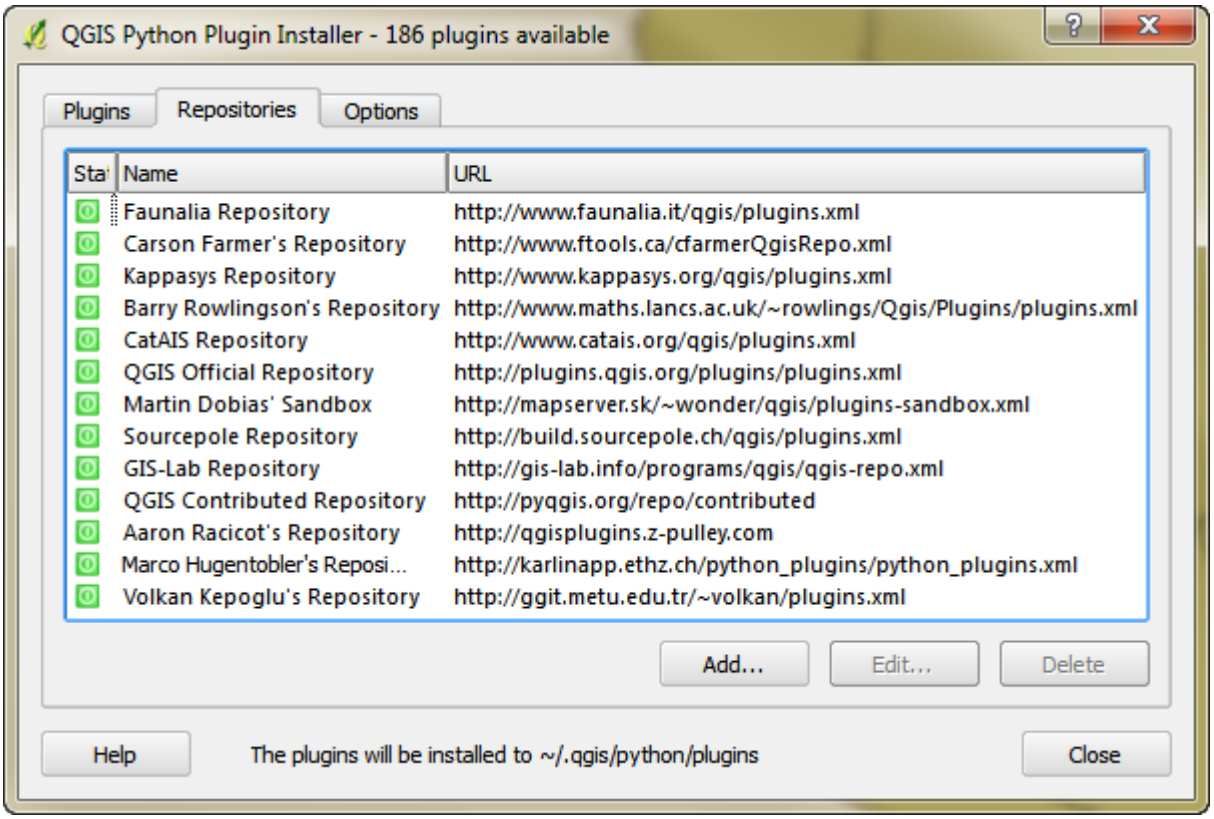
4. Click the *Options* tab.

5. Select the radio button next to *Show all plugins except those marked as experimental.*

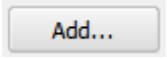
   NOTE: The standard default repository is the 'official QGIS' server. Changing the default option will allow you to view and install additional plugins from different sources.



6. Click the *Repository* tab to view or add additional sources of plugins.



NOTE: If you know the URL of a specific repository not listed you can add it using the *Add…* button and entering the name and URL from the above image. URLs to some repositories are provided in the PluginsTracker.xls file

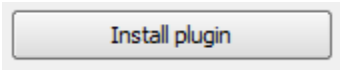
NOTE: Click the Add 

button if you do not see the Sourcepole Repository listed.
1. Enter *Sourcepole Repository* for the Name.
2. Enter http://build.sourcepole.ch/qgis/plugins.xml for the URL.
3. Make sure the box next to *Enabled* is checked.
4. Click *OK.*

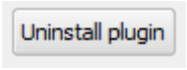
7. Click the *Plugins* tab.

8. Read through the *Description* and select the plugins you wish to install by clicking it. Selected plugins will appear bold.

9. To install a specific plugin, select the plugin and click *Install plugin*.



10. To uninstall a plugin, select the plugin and click *Uninstall plugin*.



11. Install at least the following plugins:

    - 1-Band Raster Colour Table V1.x
    - EasyPrint
    - Metatools
    - Point sampling tool
    - Statist
    - ZonalStats
    - Open Layers Plugin

12. Click *Close.*

13. Restart QGIS Desktop.

14. Click *Plugin* > *Fetch Python Plugins…*

15. In the *Python Plugin Installer* window, verify that the plugins you just installed say *installed* under the Status section.

16. Return to Section 3 in the Plugins Exercise to Add in the plugins you have installed.

Appendix 1: Download and Install QGIS in Mac OSX

The install files provided were designed the Lion or Snow Leopard OS.

1. The training Dropbox/CD/MacOS contains QGIS 1.8.0-2 installation files – QGIS-1.8.0-2.dmg

2. Copy the training folder to your computer and open the dmg file.

3. Install QGIS.

OR

1. Use a web browser and navigate to http://www.qgis.org.

2. Click download and select the current version. For Mac users, choose 3.1 Release. This will require you to go to the KyngChaos Qgis download page.[2]

   NOTE: Since this is open-source software, changes are constantly being made to the code. This manual was created using version 1.8.0 Lisboa. Icons and menus may be different in other versions.

3. Once the download is complete, install.

The Mac OSX version of QGIS requires the installation of several additional components in order to run properly. Currently, the **required** components include:

- GDAL Complete 1.9 framework package[3]
- GSL framework[4]

Two **optional** components include:

- GRASS 6.4.2[5]
- Python Modules for plugins

The installation files for these can also be found in the CD/MacOS folder, or on the KyngChaos Qgis download page.The GRASS application should be installed after the GDAL and GSL frameworks.

Specific python modules may be required for plug-ins to work properly. We suggest installing the *pysal and scipy* python modules. Plug-ins provide extra functionality and some advanced analysis tools.

Instructions on installing plugins while off-line can be found in the QGIS Exercise:0 Installing QGIS and Plugins instructions, while those for installing plugins while online can be found in the Appendix: **Install Plugins online**.

[2] http://www.kyngchaos.com/software/qgis
[3] http://www.kyngchaos.com/files/software/frameworks/GDAL_Complete-1.9.dmg
[4] http://www.kyngchaos.com/files/software/frameworks/GSL_Framework-1.15-2.dmg
[5] http://www.kyngchaos.com/files/software/grass/GRASS-6.4.2-5-Snow.dmg

QGIS Exercise: 1

Exploring QGIS

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 1: Exploring QGIS

This exercise will introduce you to QGIS and some of the basic functions of the program. By the end of this exercise you should be able to:

- Open a current QGIS file
- Set up the layout of your QGIS file
- Zoom, move, and navigate a map
- Turn layers on and off

Section 1: Start QGIS

1. If you have a shortcut for QGIS  on your desktop, double click it to start *QGIS.* Otherwise, click *Start* > *Programs* > *Quantum GIS Lisboa* > *Quantum GIS Desktop(1.8.0).*

   NOTE: Make sure that you open Quantum GIS Desktop, not the similarly titled Quantum GIS Browser**.**

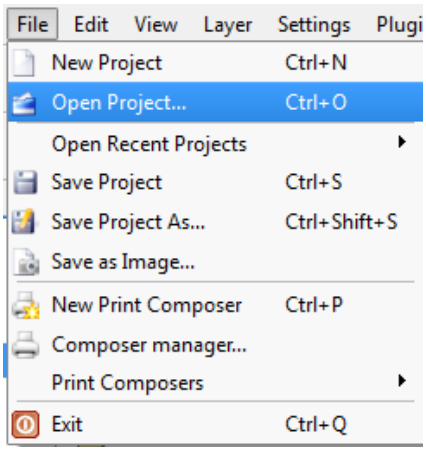
You are now looking at the interface of the QGIS application.

Whenever you work in QGIS Desktop, you are working with a map document. This document can contain various layers, which are populated by spatial datasets. A QGIS map document has a ***.qgs** file extension.

Section 2: Open a .qgs file

A map document was created for this exercise. You will use this file to examine some of the features of QGIS.

1. Click *File* > *Open Project…*

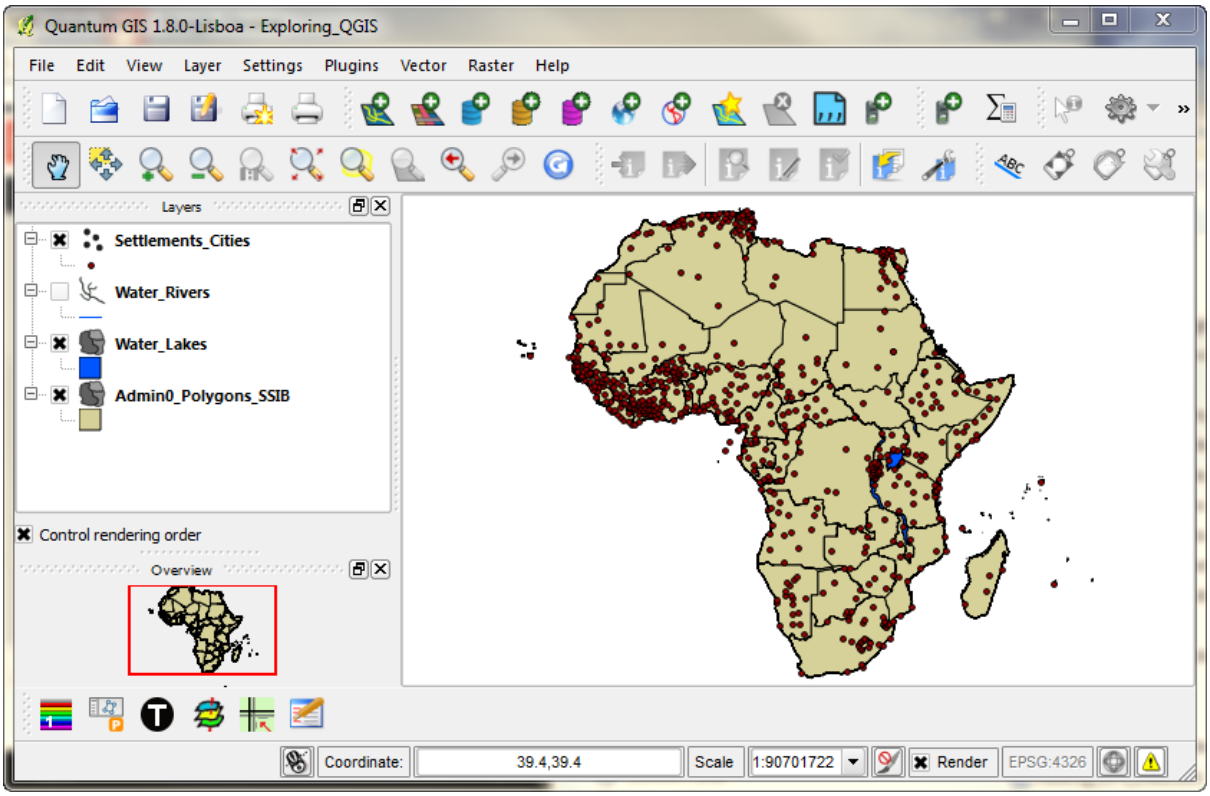


2. Navigate to the *Training _Workshop\04_Exercises\Project_files* folder and locate *Exploring_QGIS.qgs*

3. Double click *Exploring_QGIS.qgs* to open and display the map.

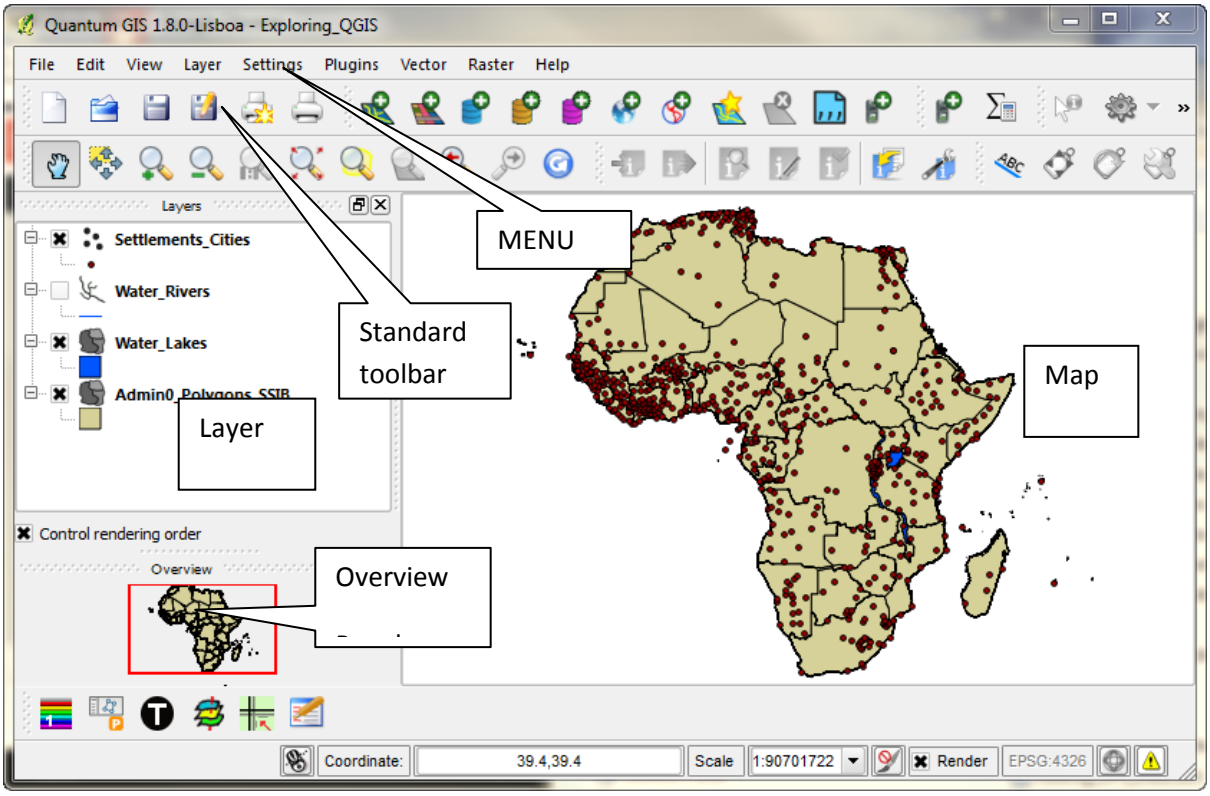
When the *Exploring_QGIS.qgs* opens, you will see an image depicting Africa with the location of various countries. It should look similar to the image below.

> **NOTE**: Your screen might show this in a different size and with the toolbars in different locations. If you are using a different version of QGIS, you might see a warning about project compatibility.

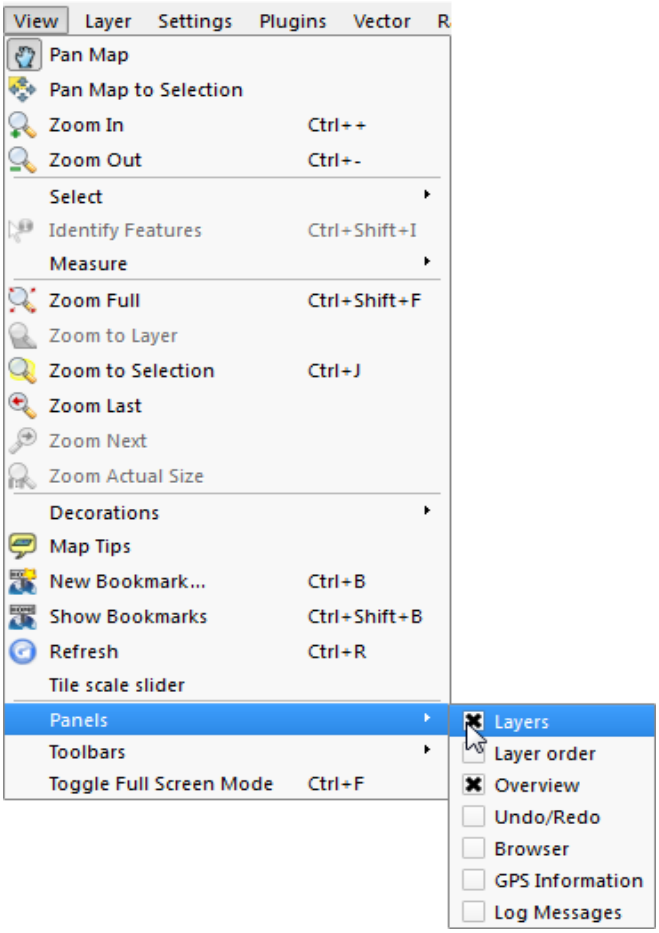


Section 3: Setting up your QGIS layout

The next image shows the individual pieces of the user interface in QGIS. Your QGIS window may look different depending on your settings. This section will teach you how to adjust your layout settings.



1. Click *View* > *Panels* in the menu.



2. Uncheck the box next to *Layers.*

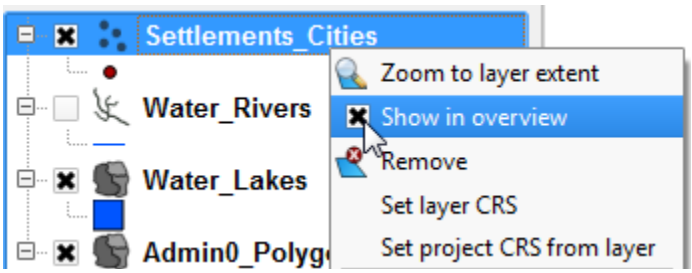
3. Click *View* > *Panels* in the menu.

4. Uncheck the box next to Overview.

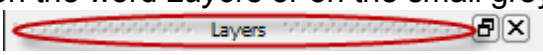
What does your QGIS window look like now?

5. Turn the *Layers* and *Overview* on by checking the boxes in the *View* > *Panels* menu.

6. Right click on the Settlements_Cities layer and check the box next to *Show in overview* to the add the layer to the *Overview panel.*

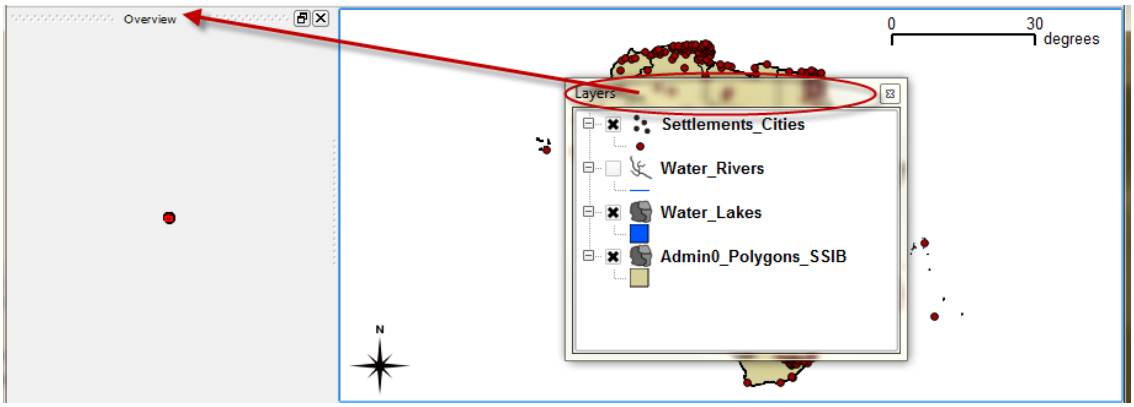


QGIS allows you to dock panels on the side of your screen so you have easy access to them. Now you will practice docking and undocking the Layer Panel.

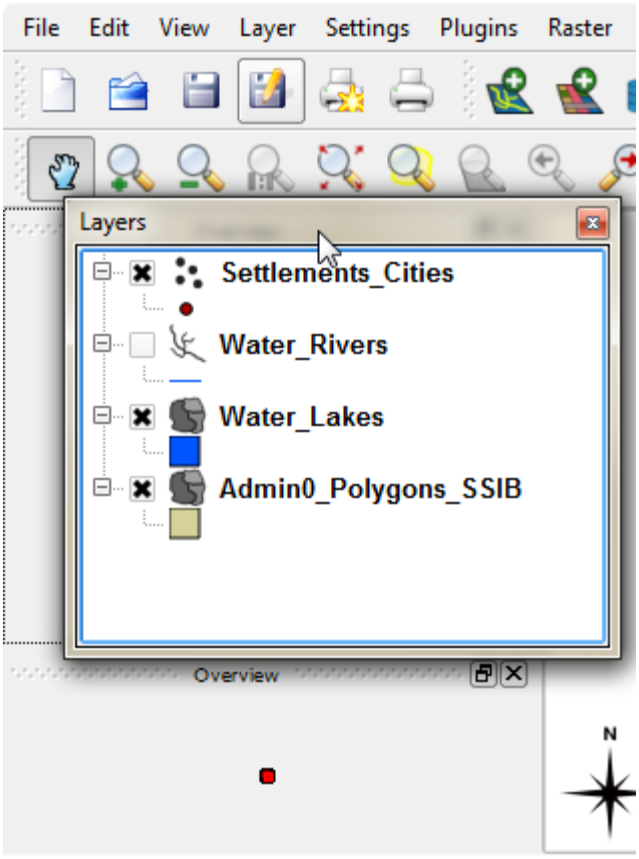
7. Click on the word *Layers* or on the small grey dots at the top of the Layer panel 

and drag the panel to the middle of your screen to undock it.

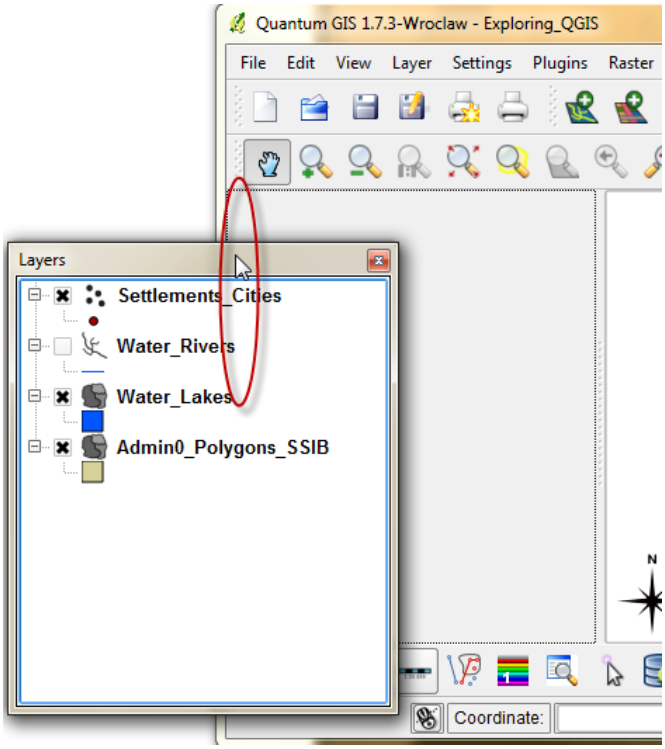
8. Redock the Layer panel by clicking on the top of the Layers panel and dragging the top of the Layers panel to the top of the overview panel.



9. Release your mouse button when you see the Overview Panel move down the screen and the grey dots appear indicating where the layers panel will dock, as in this image.



NOTE: If you want to dock the Layer Panel when there are no other panels open, click on the top of the Layer panel window and drag it to the left wall of your map area, or double-click on the top of the panel window. When the grey dotted outline appears, indicating where the layer panel will dock, you may release the mouse button.



Section 4: Introduction to the standard toolbar

The previous section showed you how to adjust your QGIS layout. In this section, you will zoom in and out, move, and navigate the map using the standard toolbar.

1. Click the *Zoom In* button on the standard toolbar.

   NOTE: The tool that is currently selected will appear with a different color background on the toolbar. After you select the *Zoom In* mode it should look like this .

2. Position the magnifying glass pointer to the upper left of a country of your choice.

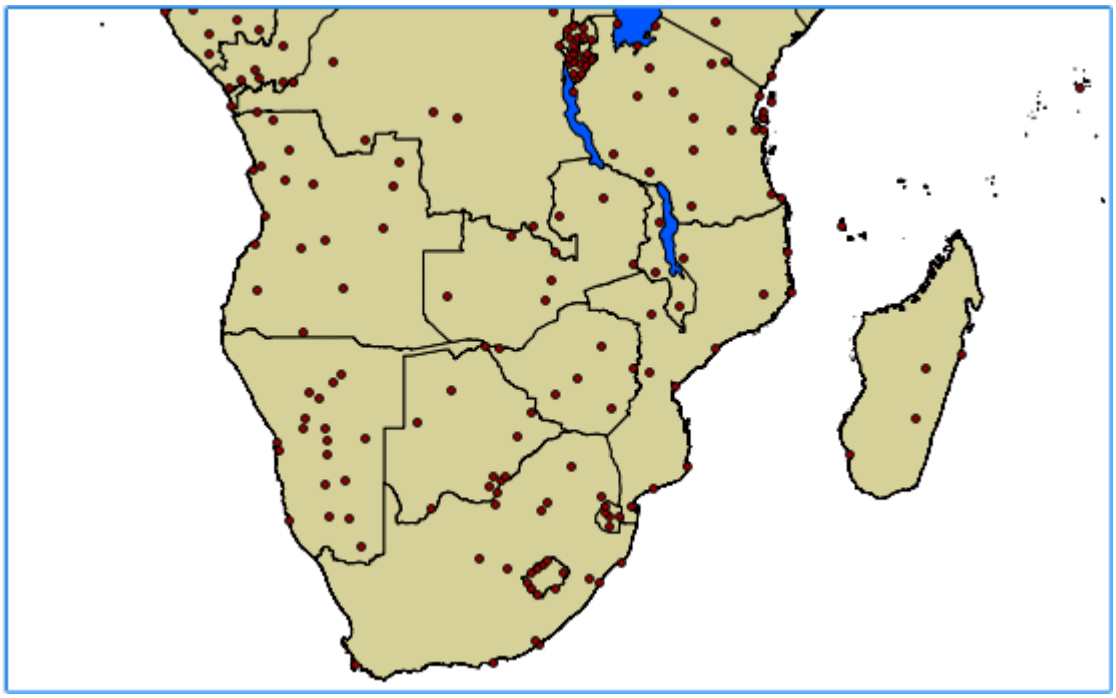
3. Click and hold the left mouse button while dragging your mouse to the bottom right of the country of your choice, making a square around the two points.

4. Release the mouse.

Now you will see a closer view of the county you chose.

5. To return to the previous view click the *Zoom Last* button. This will take you back to the previous zoom level that shows all of Africa.

6. Again, use the same tool to zoom in on Southern Africa. You should now see Southern Africa in the center of the map.



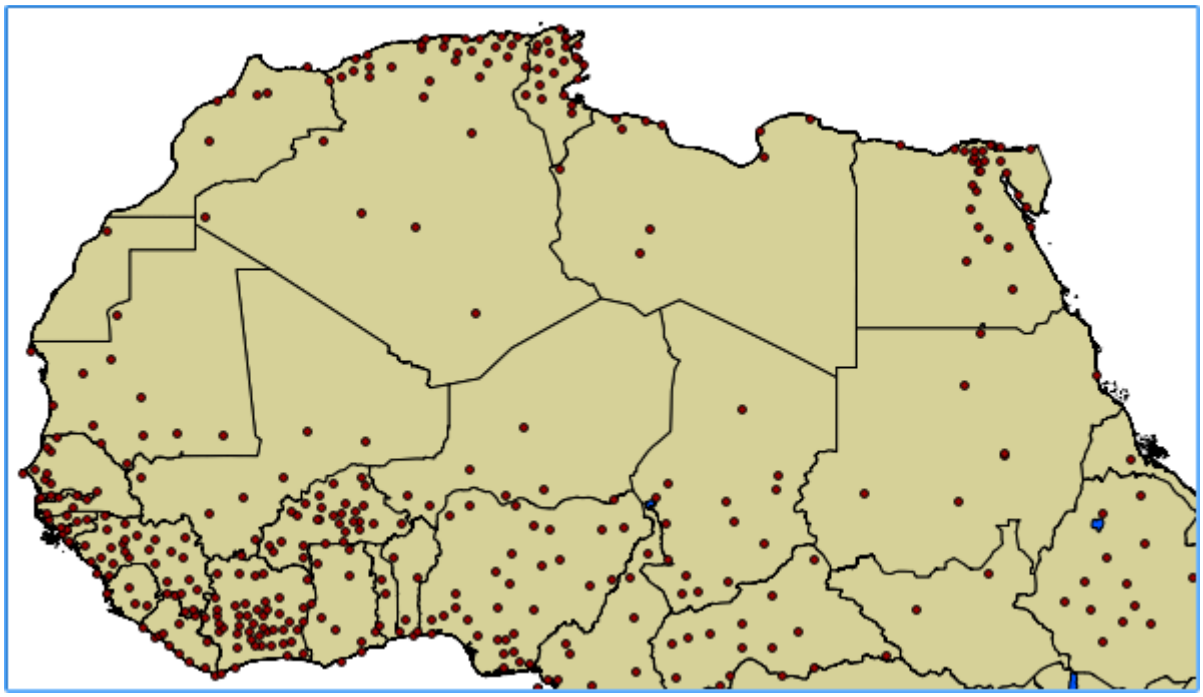
7. Click the *Pan Map* button on the standard toolbar.

8. Move the cursor hand to the top of your map area.

9. Click and hold the left mouse button while moving the map so that the top half of Africa is centered on your map.

10. Release the mouse button.

You will see that the map has been repositioned. You should now see Northern Africa in the Center of the map.



11. To return to the whole view of Africa, click the *Zoom Full*  button.

NOTE: The button *Zoom Full*  button and the *Zoom to Layer*  button in this example would give us very similar results. However, this will not always be the case. The *Zoom to Layer* button will redraw the map zooming to whichever layer is highlighted in the *Layer Panel*.

Section 5: Introduction to the layer panel

The previous section showed you how to zoom in and out, move, and navigate your map. In this section you will learn to turn a layer on or off using the *Layer Panel*.

NOTE: The *Layer Panel* is also called the *Table of Contents (TOC).*

The *Layer Panel* in QGIS shows you the layers of data that are available to be shown on your map. Think of layers as pieces of data that can be added one on top of the other and displayed together.
In the *Layer Panel* there currently 4 names: *Settlements_Cities, Water_Rivers, Water_Lakes, Admin0_Polygons_SSIB*. Notice that there is a check mark next to the *Settlements_Cities, Water_Lakes,* and *Admin0_Polygons_SSIB* layers.

1. In the *Layer Panel*, uncheck the *Settlements_Cities* check box.

The red dots on the map that show world cities will disappear.

2. In the *Layer Panel*, check the *Water_Rivers* check box.

Now you will see blue lines on your map that show rivers.

3. In the Layer Panel check the *Settlements_Cities* check box so that the cities are shown again.

4. Click the *Settlements_Cities* name so that it is highlighted in blue.

5. Click and hold the left mouse button while moving that layer to the bottom of the *Layer Panel* below the other layers.

Now, the order of the layers from top to bottom is: *Water_Rivers, Water_Lakes, Admin0_Polygons_SSIB, Settlements_Cities*.

6. Most of the dots disappear except for those on small islands and those next to the ocean.

7. Click the *Settlements_Cities* so that it is highlighted in blue.

8. Click on the Settlements_Cities name and move that layer to the top of the panel above the other layers.

Now, the order of the layers is: *Settlements_Cities, Water_Rivers, Water_Lakes, Admin0_Polygons_SSIB.*

> **NOTE:** When organizing layers in your map, think about ordering it with the smallest size or area on top.

Optional steps:

Try to perform some of the following steps while exploring the functionality of QGIS.

1. Turn on and off the Rivers and Lakes layer in the panel.
2. Move *Water _Lakes* to the bottom of the layers panel. Then move it back above *Admin0_Polygons_SSIB.*
3. Zoom the map so that you see a country of your choice in detail.

4. Change the color of *Admin0_Polygons_SSIB* to green.
5. Select a bordering country and zoom to the selected feature.
6. Pan the map back to your own country.
7. Zoom to the capital city and create a new *Bookmark*. *Zoom to Full Extent* and then zoom to the Capital City *Bookmark.*
8. Add a layer to the *Overview Panel*.

Exit QGIS without saving.

EXERCISE END

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

QGIS Exercise: 2

Adding Vector Data

This curriculum was designed as part of a joint collaboration between
MEASURE DHS and MEASURE Evaluation

QGIS Exercise 2: Adding vector data

In this exercise you will learn how to:

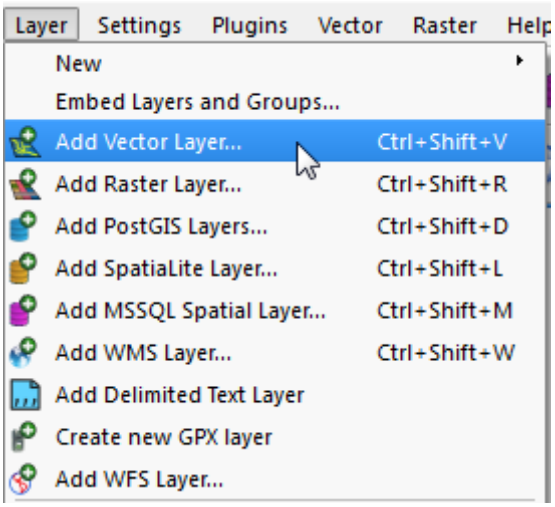
- Add vector files to your map
- Adjust the properties of layers
- Modify symbology
- Add and modify labels

Section 1: Start QGIS and add vector data

You will add a layer, consisting of vector polygon features.

1. Start QGIS Desktop.

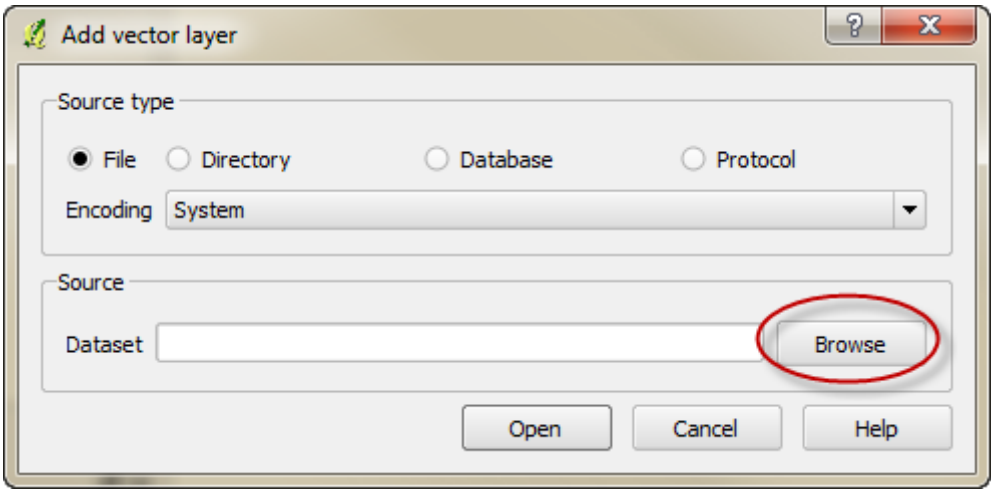
2. Open the *Layer* menu on the top of the screen.



3. Click *Add Vector Layer…* 

4. Select the Source Type as *File.*

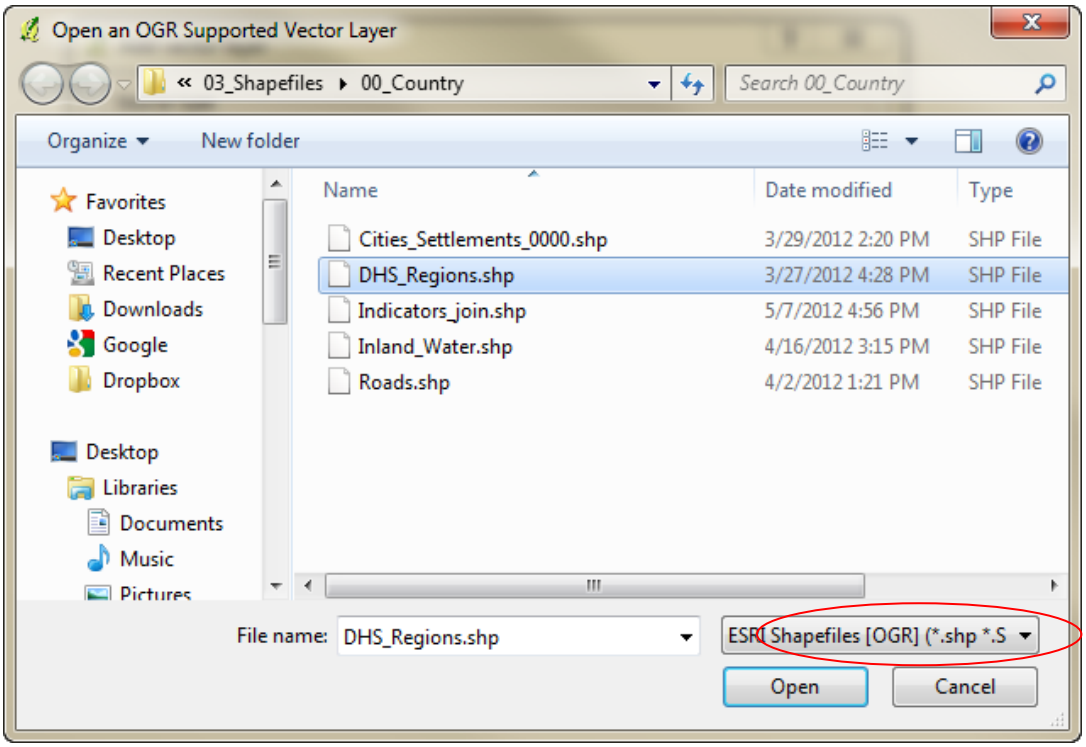
5. Click *Browse.*



NOTE: The dialog will open to the last place from which you added data in QGIS.

6. Navigate to the training folder *\\Training_Workshop\05_Data\03_Shapefiles\00_Country.*

7. Click on the file named *DHS_Regions.shp.*



NOTE: Make sure that your file type reads ESRI Shapefiles [OGR] (*.shp)

8. Click Open in the "OGR Supported Vector Layer" dialog.

9. Click Open on the "Add vector layer" dialog.

10. There are three ways to add vector layers in QQIS Desktop.
    a. Using the menu option *Layer > Add vector layer…*
    b. Using the *Add vector layer*  tool from the toolbar.
    c. Using *Ctrl+Shift+V.*

NOTE: In all of these methods the same dialog will open and the procedure for selecting which data you will add is the same as described above.

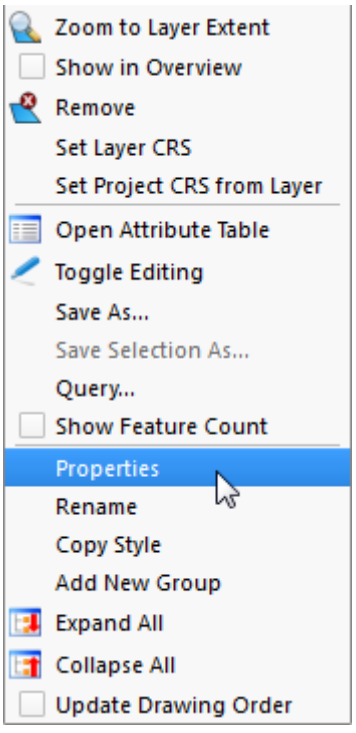
11. Add the following vector layer: *\\Training_Workshop\05_Data\03_Shapefiles\00_Country\Cities_Settlements_0000.shp*

NOTE: Your map should look similar to this:

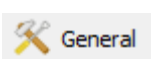
Section 2: Change a layer name

When a layer is added, QGIS assigns it a layer name. Sometimes this name is not very descriptive because it inherits the dataset or the feature class name. You can rename the layer at any time. Now, you will change the names of the layers that you added.

1. In the *Layer Panel*, right click (on the text) for the *DHS_Regions* layer.

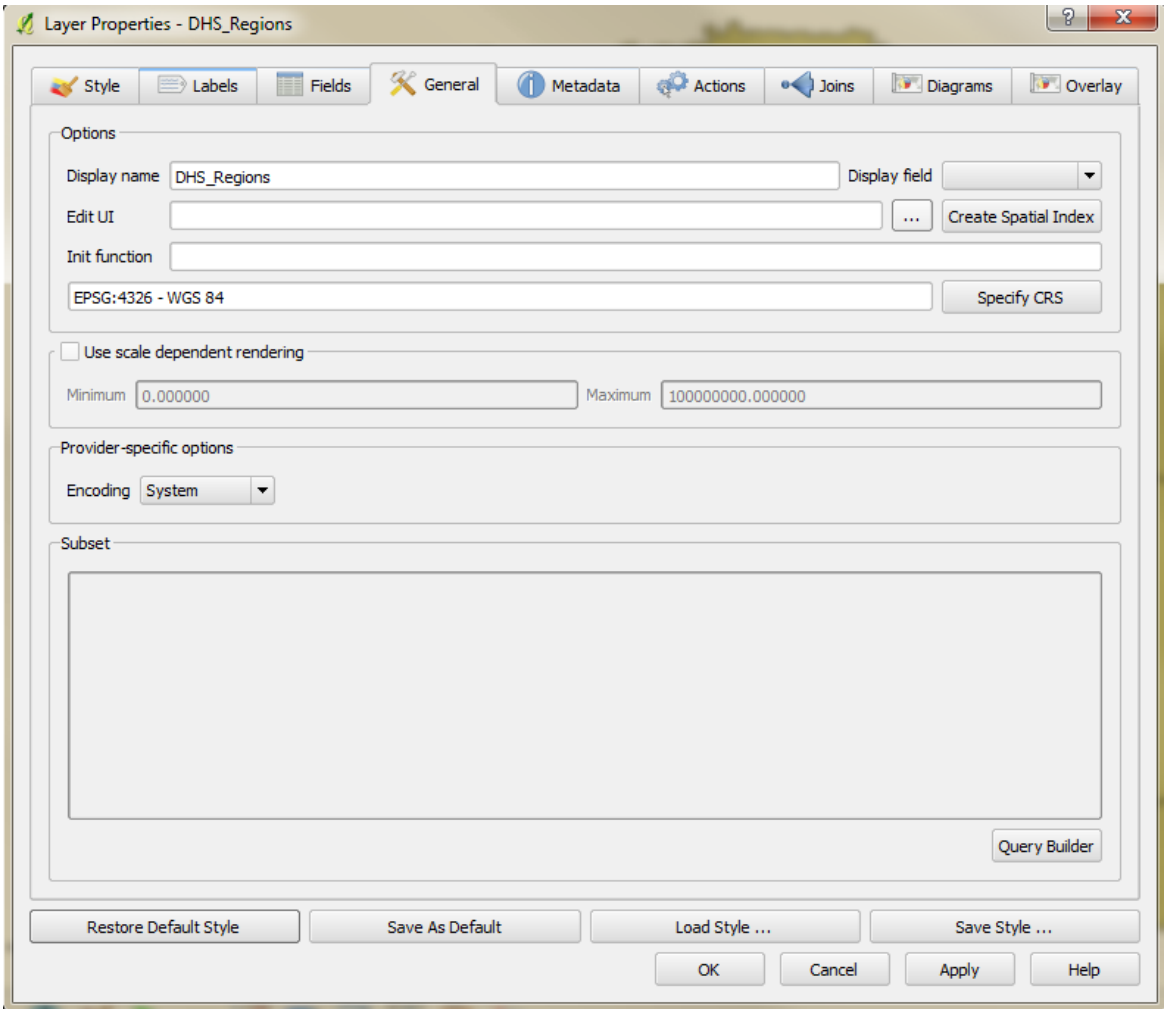


2. Click *Properties* to display the *Layer Properties* dialog.

3. Click the *General* symbol 

tab near the top of the dialog box.

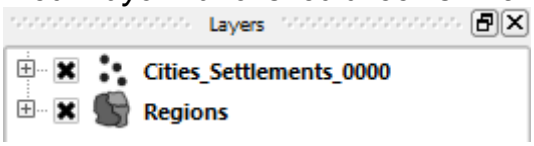
You should see the following dialog.



4. For *Display name*, type: Regions.

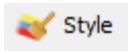
5. Click *OK*.

NOTE: Your *Layer Panel* should look similar to this:



Section 3: Symbolize spatial data

The *Regions* layer appears in a single color by default. You may want to display the Regions in different colors.

1. In the *Layer Panel*, double-click the Regions layer to open its *Properties* dialog.
2. Click the Style tab 

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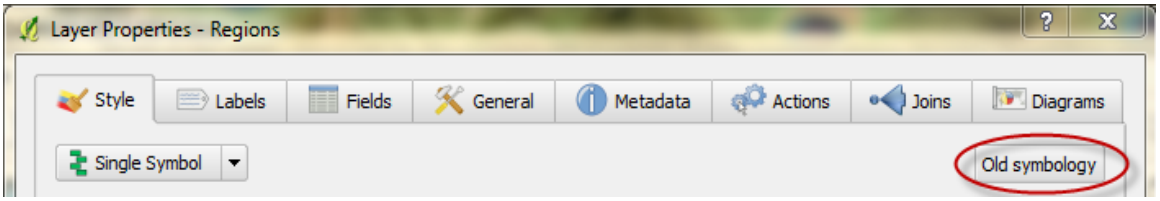
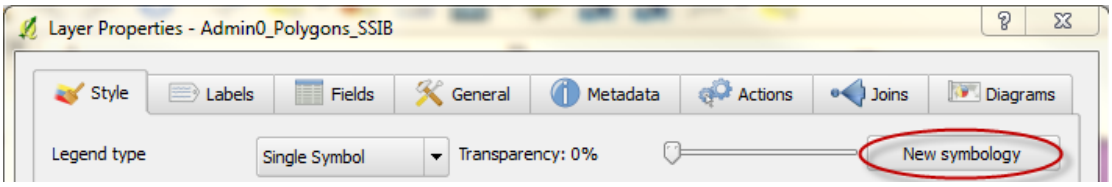
   NOTE: In previous versions of QGIS it was called Symbology.

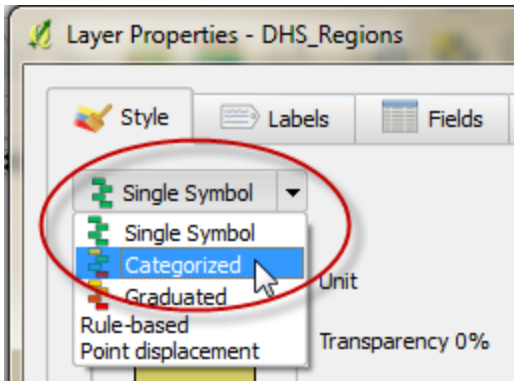
3. Make sure the button near the top right of your screen says *Old Symbology.*



NOTE: If you screen looks like the image below, then click on the *New Symbology* button. Clicking on *New Symbology* will change it to the newer version of QGIS symbology. You will receive a prompt asking if you wish to use the new symbology implementation for this layer. Click *Yes.*



4. Select *Categorized* from the drop down menu below the Style tab.

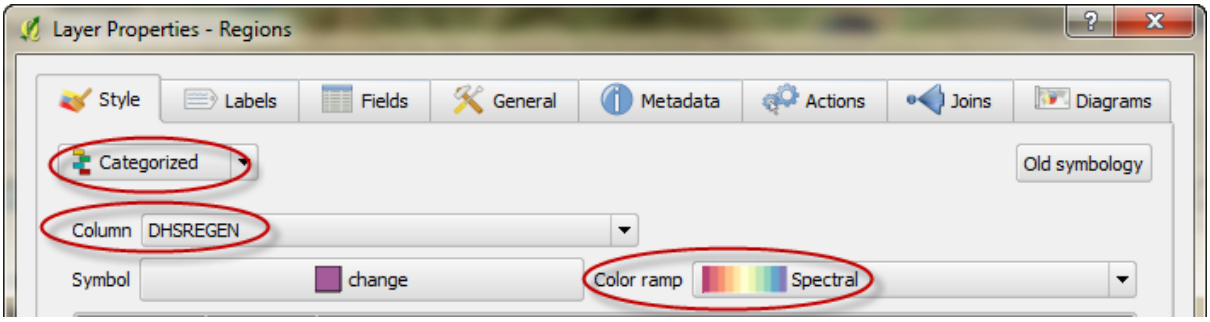


NOTE: If using a previous version of QGIS, select *Unique Value* in the drop down menu next to *Legend type.*

5. In the new screen that appears within the dialog, select DHSREGEN for the *Column.*

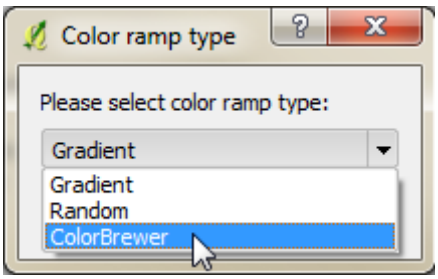
NOTE: If using a previous version of QGIS, *Column* is called *Classification field.*

6. Click on the *Color ramp* drop down menu.



7. Select *New color ramp…*

8. Select *ColorBrewer* for the Color ramp type.



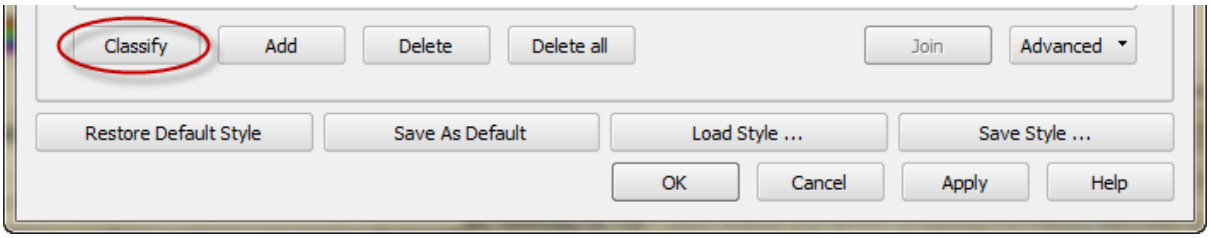
9. Select the Spectral Scheme name.

10. Select 10 for the number of colors.

11. Call the new color ramp *Spectral*.

12. Click OK.

13. Click *Classify.*

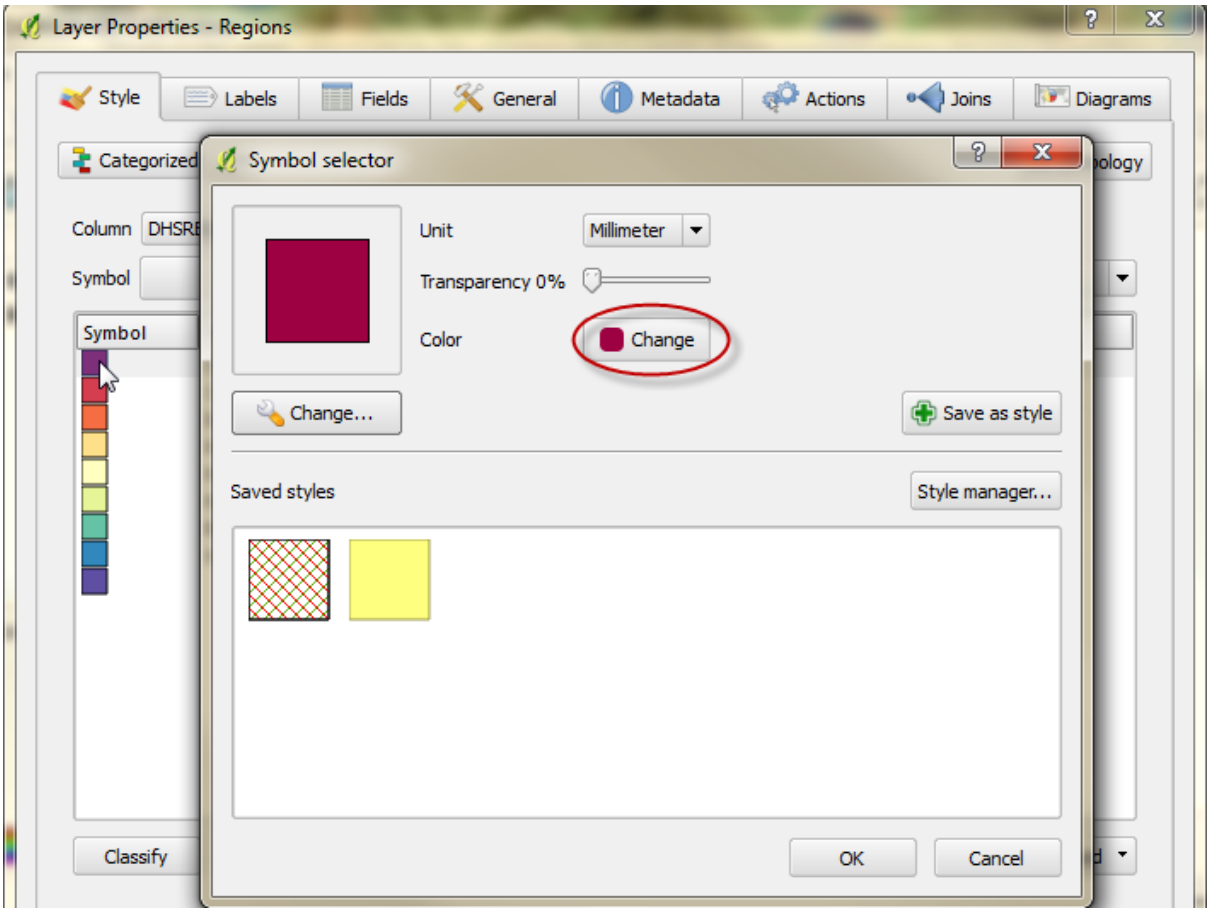


14. All the Regions will appear in the window, with an assigned color.

15. Double click on the first Region symbol in the list.

16. In the *Symbol selector* window that appears, you will be able to change the color for the highlighted region by clicking the *Change* button in the middle of the window.

    NOTE: If using a previous version of QGIS, click on the first Region name in the list. In the right side of the dialogue window, you will be able to change the color for the highlighted region. Click on the colored box in the Fill Options area.



17. Select a new color.

18. Click OK to close the color selection.

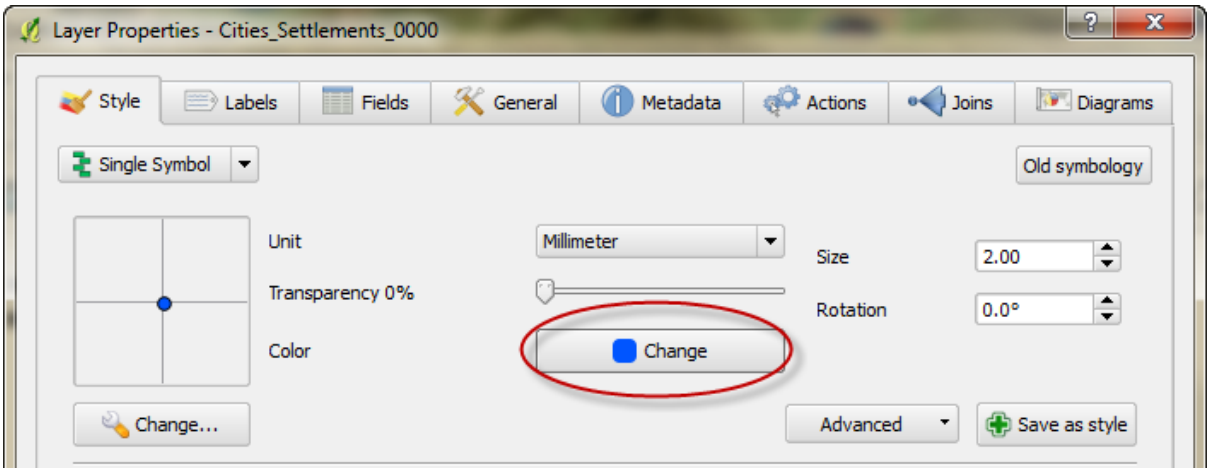
19. Click OK to close the *Layer Properties* dialog.

Next, you will change the symbol for the Cities.

20. Double-click the Cities_Settlements_0000 layer in the *Layer Panel* to open its *Layer Properties* dialog.

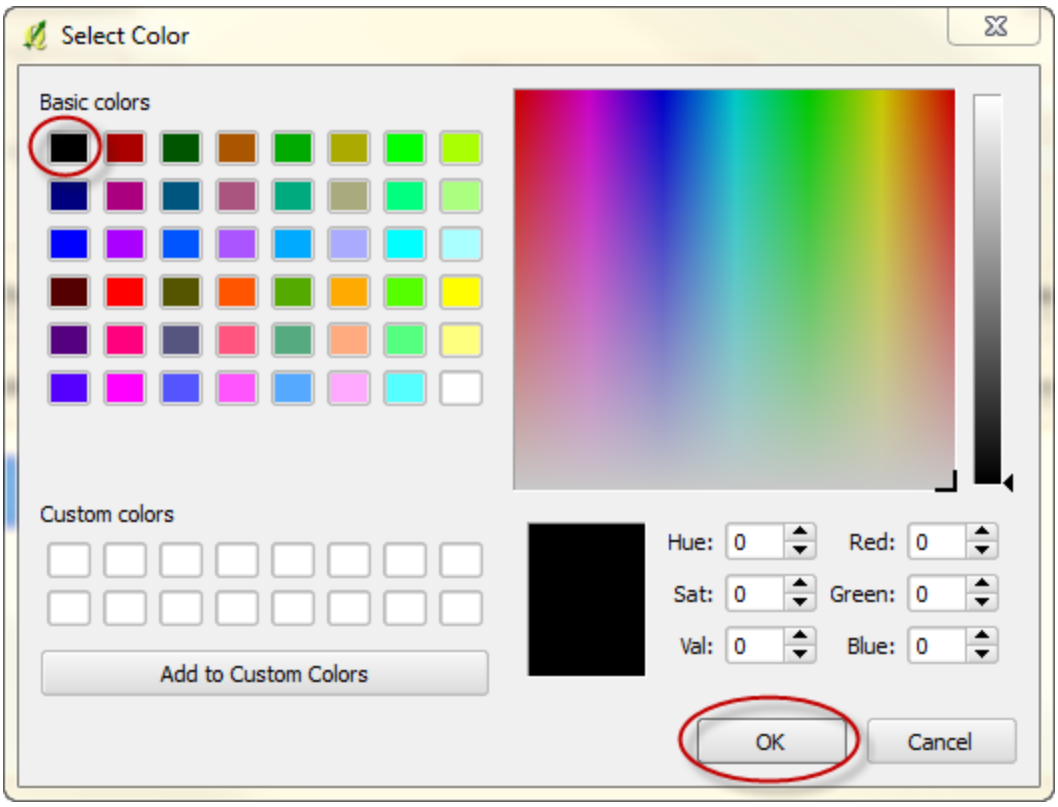
21. Click the *Style* tab.

22. Click the *Change* button in the middle of the window.



NOTE: If you are using a previous version of QGIS, you will change the symbol Scroll down (using the scroll on the far right of the dialog) until you see *Fill options*.

23. Click on the black box under the *Basic colors* options.



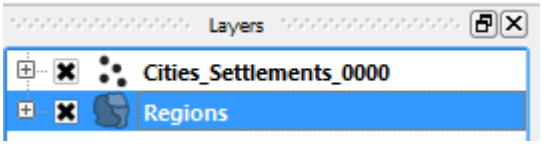
24. Click OK to close the color selection.

25. Click OK to close the *Layer Properties* dialog.

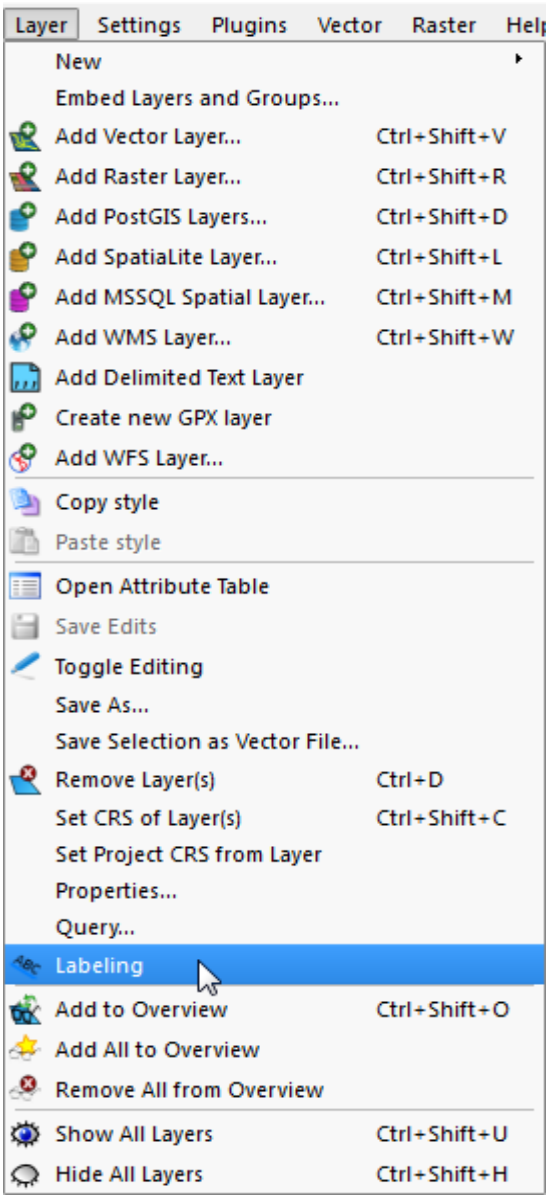
Section 4: Label features

A map is incomplete without some labeled features. Placing names on your map is an important communication task. Map readers should be able to find names quickly or they will not use your map. Now, you will place the name of the Regions on the map.

1. Select the Regions Layer in the *Layers* box by clicking once on it so it is highlighted blue.

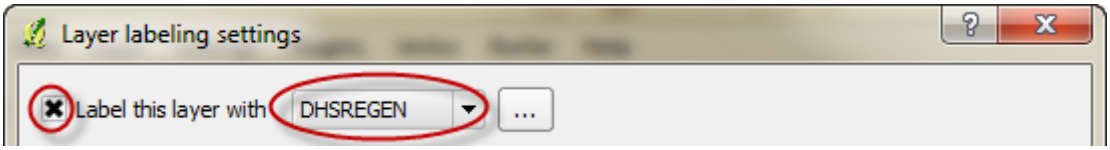


2. Click the *Layer* menu > *Labeling* to open the *Layer labeling settings* dialog.

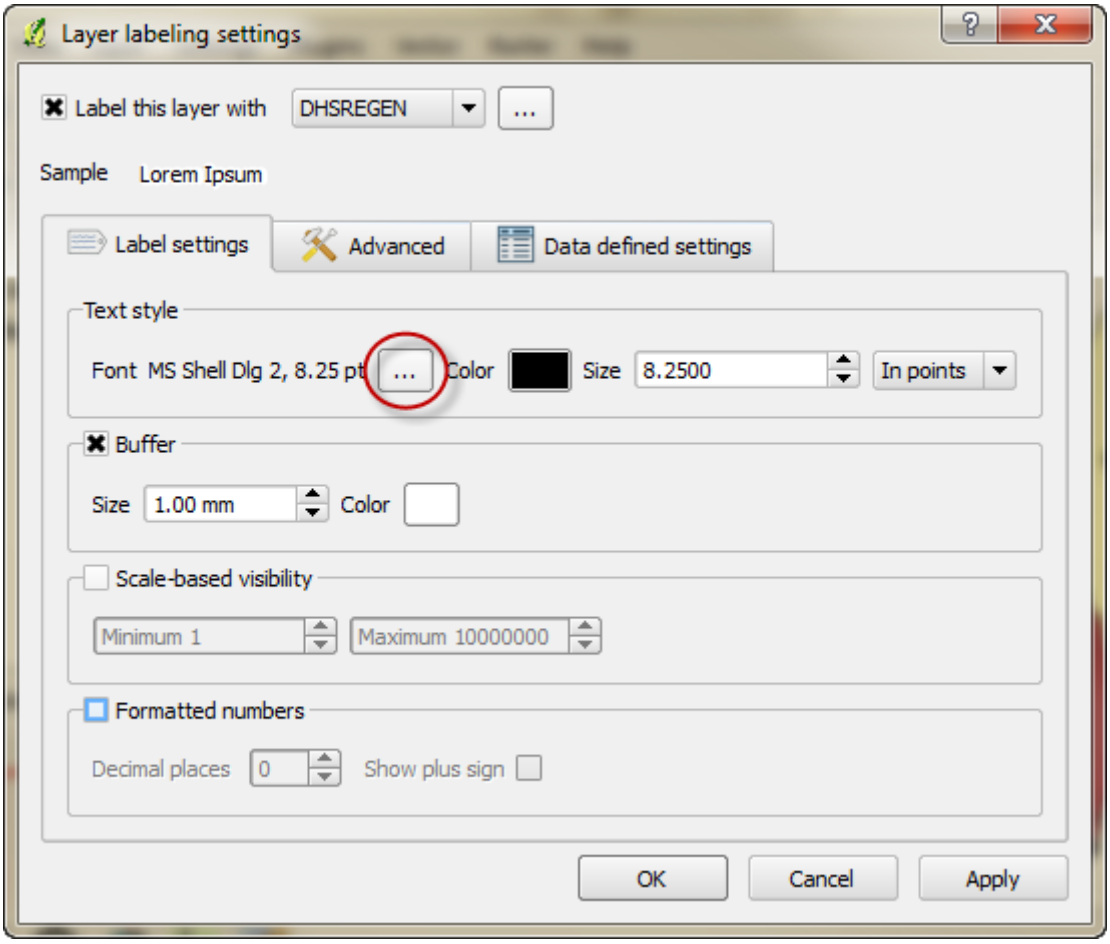


3. Check the *Label this layer* box to label Regions.

4. Select *DHSREGEN* from the *Label this layer with* drop down menu located in the top.



5. Click the button with three dots in the Text Style section of the *Label settings* tab.



6. Select *MS Serif, Bold, 10 (size)* from the *Select Font* window.

7. Click OK.

8. Click *Color and* select *black.*

9. Click OK to close the color selection.

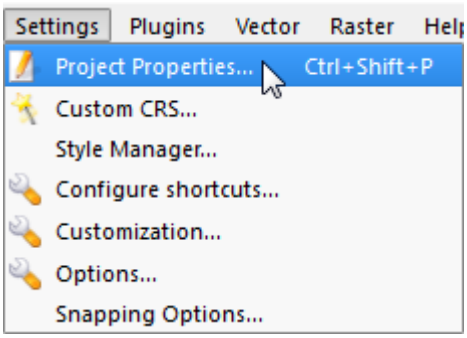
10. Click OK to close the *Layer labeling settings* dialog.

    NOTE: Your map should look something like this. The colors will be different.

Section 5: Save your map document

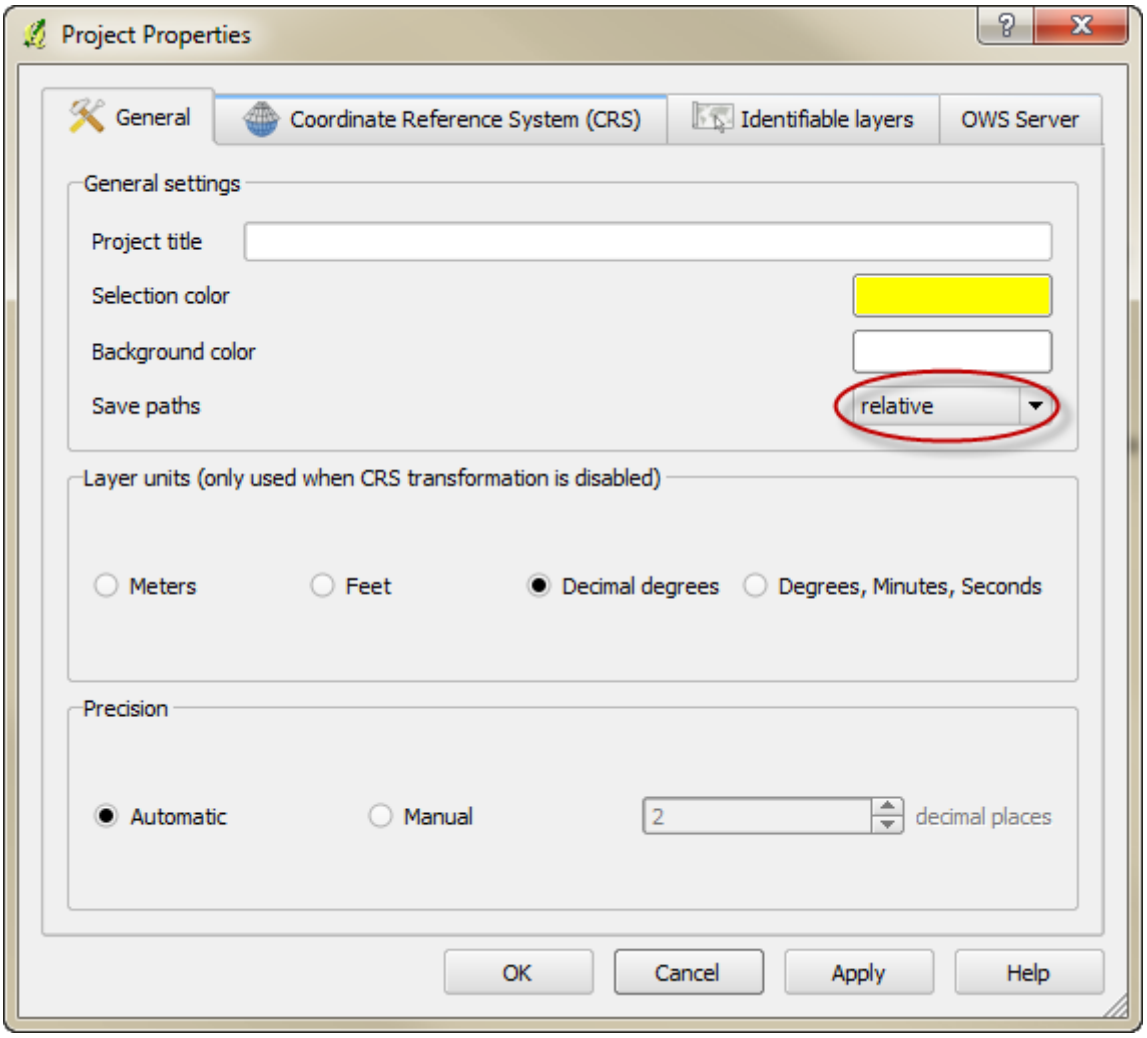
You will save your map document for future use. You can save your file with absolute or relative paths. This refers to how the QGIS file will remember where the data corresponding to each layer is located. Absolute path means that QGIS will always look in the same file location (exact location on the computer for the data while relative path means that QGIS will look for the data to be in the same place in relation to the QGIS file (such as in the same folder or 2 folders away in a folder called 02_Data.) Relative paths are in general better if you might move your folders and or share your *.QGS files with a colleague.

1. Click *Settings* > *Project Properties*.



2. Open the *General* tab.

3. Change *Save paths* to *relative* under *General settings*.



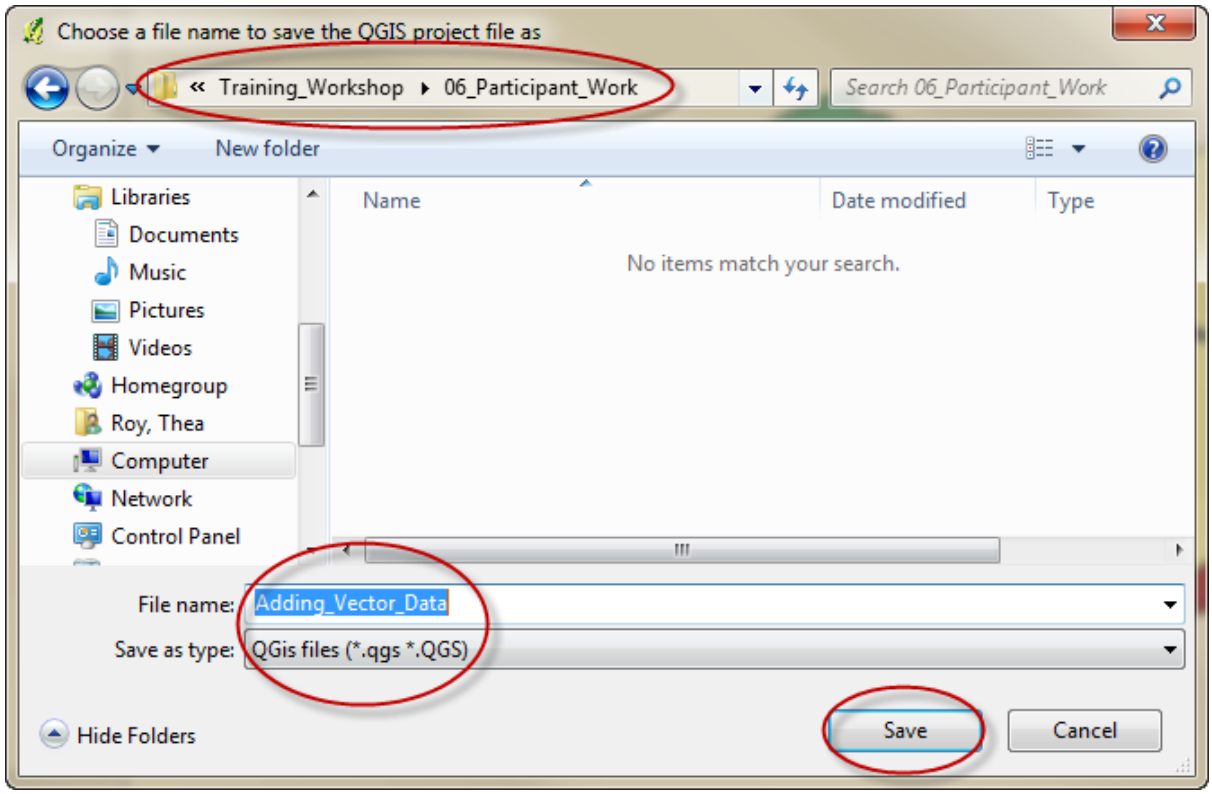
4. Click ok to close the dialog.

5. Click *File* > *Save Project as...*

6. Save the file in \\Training_Workshop\06_Participant_Work.

7. Name the file *Adding_Vector_Data*.

8. For *Save as type*, confirm *QGIS Project File (*.qgs).*



9. Click *Save.*

Optional steps:

1. Add the road layer to the map.
2. Change the road color to a different color.
3. Change the road line width.
4. Symbolize the road layer according to the road type.

EXERCISE END

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

QGIS Exercise: 3

Joining data

This curriculum was designed as part of a joint collaboration between
MEASURE DHS and MEASURE Evaluation

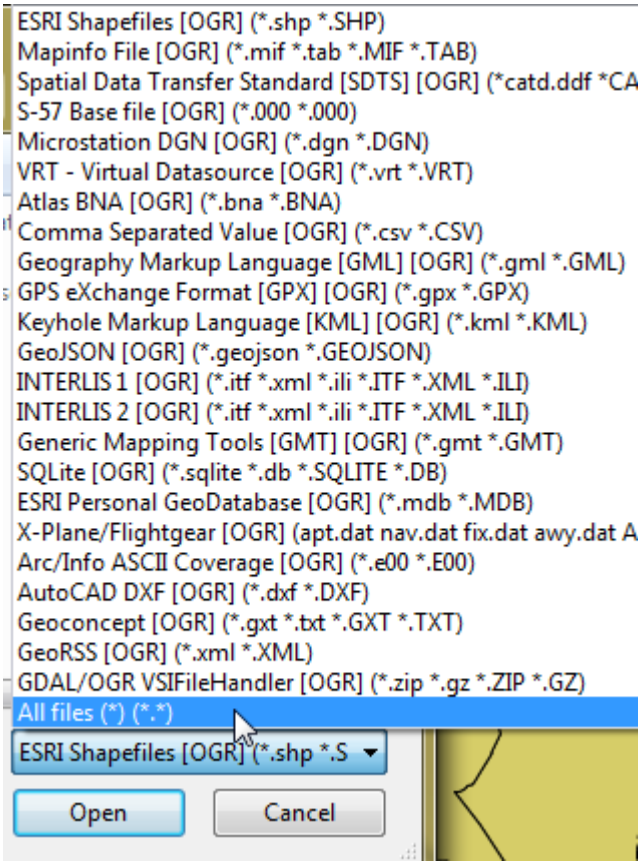
QGIS Exercise 3: Joining data

In this exercise you will learn how to join data from an excel table to spatial data in QGIS. Since the shapefile contains multiple, unique records, the data to be linked must be in the same form. For example, numbers joined to numbers or text joined to text. If a text field name is used for linking, the spelling in the two files must be exactly the same.

Section 1: Join attributes

The DHS_Regions layer only contains the regional names and geographic information. You will join the Region_Data file to the DHS Regions layer in order to display the indicator data contained in the excel file.

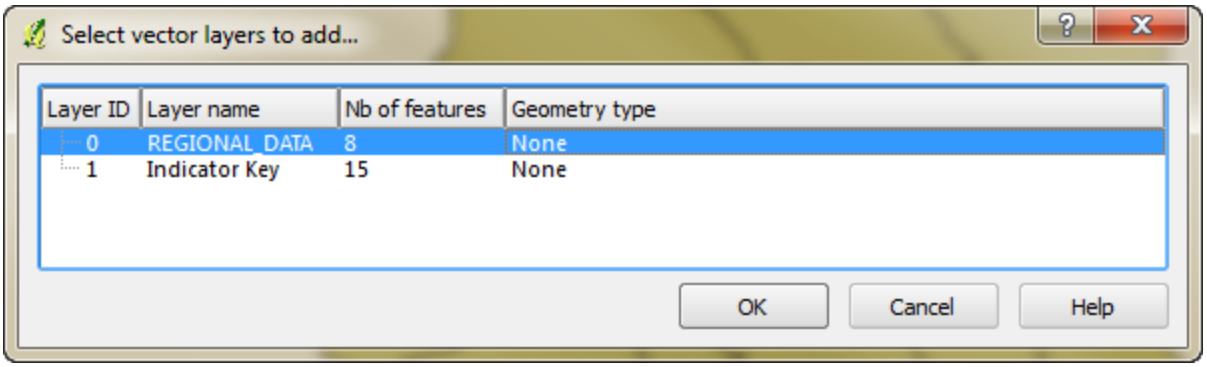
1. Launch the QGIS Desktop application.
2. Click *File* > *Open.*
3. Navigate to *\\Training_Workshop\04_Exercises\Project_files\Joining_Data.qgs.*
4. Click the *Add Vector Layer*  button from the toolbar.
5. Click the browse button.
6. Select *All file (*) (*,*)* from the file type menu on the bottom right.



7. Navigate to \\Training_Workshop\05_Data\01_Excel\00_Country\Indicators.xls

8. Click *Open.*

9. Select the REGIONAL_DATA layer from the *Select vector layers to add…* window.



10. Click OK.

11. Right click on the *REGIONAL_DATA* layer and select *Open attribute table*.

12. Explore the attribute table.

    NOTE: Open the file \\Training_Workshop\05_Data\01_Excel\Indicators.xls and click on the Indicator Key tab for descriptions of each of the indicators in the REGIONAL DATA layer.

13. Right click the *DHS_Regions* layer in the *Layer Panel* and select *Properties.*

14. Click the *Joins* tab in the *Layer Properties* window.

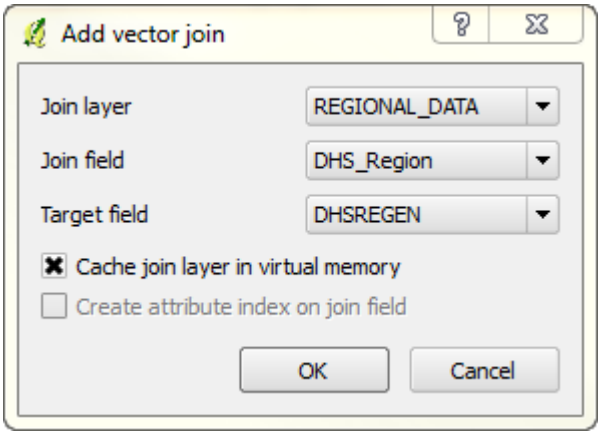
15. Click the plus  button.

16. Set *Join layer* to REGIONAL_DATA.

17. Set *Join field* to DHS_Region.

18. Set *Target field* to DHSREGEN.

Your *Add Vector Join* window should look like this example.



19. Click OK.

20. Click OK to close the *Layer Properties* window.

21. Right click on the *DHS_Regions* layer and select *Open attribute table*.

22. Scroll to the right to see the newly joined data.

You should see the data for select variables joined to the appropriate region. You can now map these data or send this file to colleagues.

> **NOTE**: If the attribute table does not contain the data for the variables you just attempted to join, go back to the .xls file to ensure that the Join field is spelled exactly the same as the target join field from the shapefile. If there are any differences in spelling, accents, hyphens, or one field contains extra spaces, the attribute join will not work for that record.

The joined data is currently being stored in virtual memory. To save the join permanently, you must export it as a new layer.

23. Right click on the *DHS_Regions* layer and select *Save as...*

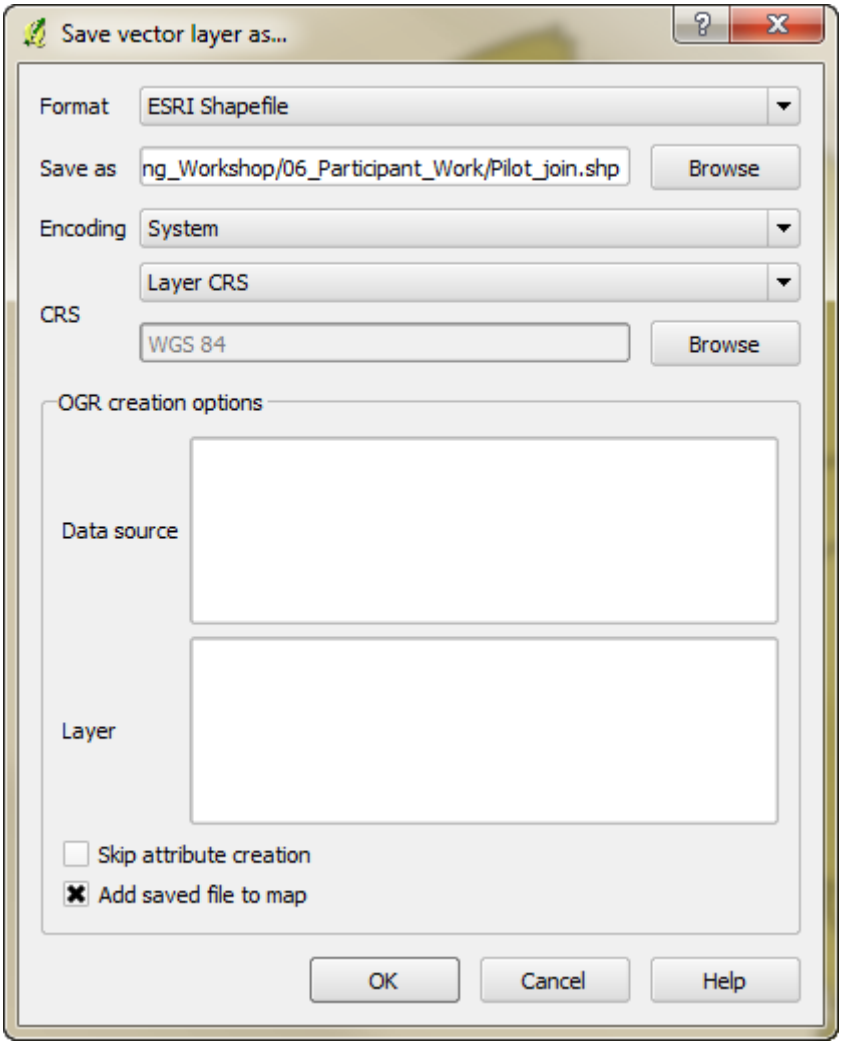
24. Click *Browse* for *Save as,* navigate to *Training_Workshop\06_Participant_Work* and name the shapefile *Pilot_join*

25. Click *Save.*

26. Select *Layer CRS* for *CRS*.

27. Check the box next to *Add saved file to map.*

The resulting window should look like this:



28. Click *OK.*

Section 2: Join attributes by location

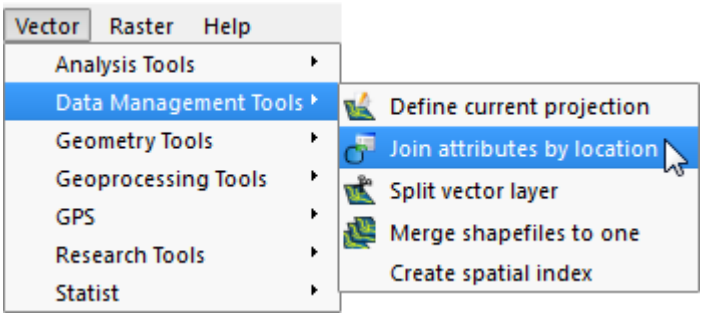
Now we will join the Cities data to the Regions based on location. Although the Cities data already indicate to which Province they belong, this task will function as a data check.

1. Click *Layer > Add Vector Layer…*

2. Browse to //Training_Workshop/05_Data/03_Shapefiles/00_Country/ Cities_Settlements_0000

3. Click *Open.*

4. Click *Vector > Data Management Tools> Join attributes by location*.



5. Set *Target vector layer* field to Cities_Settlements_0000.

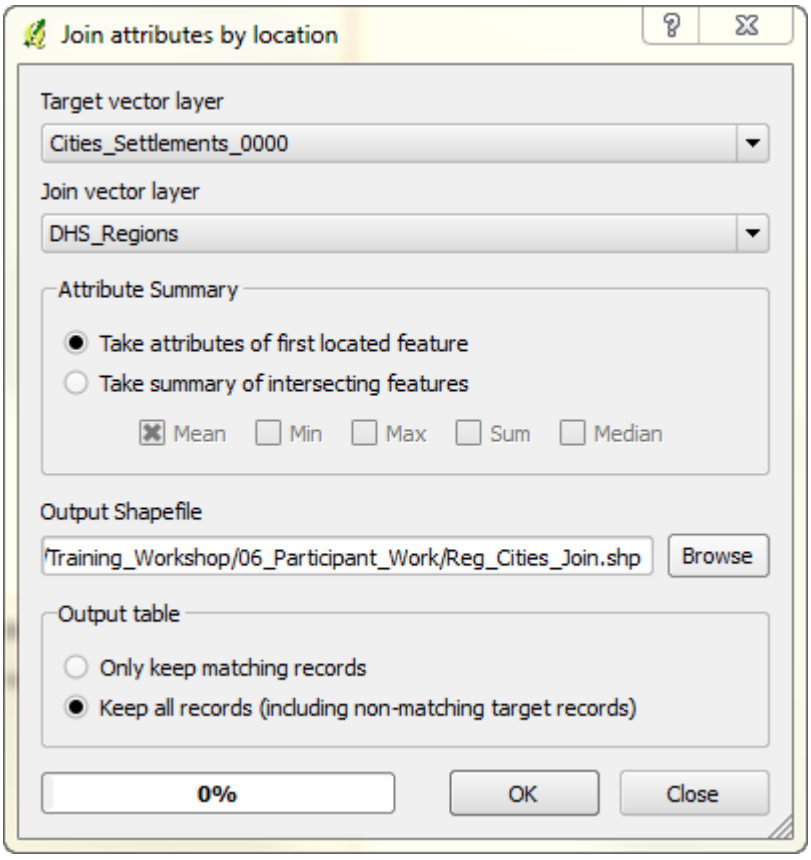
6. Set J*oin vector layer* to DHS_Regions.

7. Set *Attribute Summary* to *Take attributes of first located features.*

8. Set the *Output Shapefile* folder to *Training_Workshop\06_Participant_Work* and name the shapefile *Reg_Cities_Join.*

9. Set *Output Table* to *Keep all records (including non-matching target records).*

   NOTE: The resulting window should look like this.



10. Click *OK.*

11. In the pop-up box, click *Yes* to '*Would you like to add the new layer to the TOC?'*

12. Then *click Close.*

13. Right click on the *Reg_Cities_Join* layer, select *Open attribute table*.

You should now see the Regional attribute information for each City as new fields.

Optional steps:

Below is output from STATcompiler.com for the Kenya 2008-09 DHS:

Country	Survey	Sub-national	Place of delivery: Health facility (Births in three years preceding the survey)
Kenya	2008-09 DHS	Region: Nairobi	90.3
Kenya	2008-09 DHS	Region: Central	74.6
Kenya	2008-09 DHS	Region: Coast	46.9
Kenya	2008-09 DHS	Region: Eastern	43.6
Kenya	2008-09 DHS	Region: Nyanza	43.6
Kenya	2008-09 DHS	Region: Rift Valley	32.7
Kenya	2008-09 DHS	Region: Western	28.4
Kenya	2008-09 DHS	Region: North Eastern	18.7

1. Copy the table to excel.

2. Clean the table to prepare the data for joining in QGIS.

   HINT: Make sure the region names match the spelling of the region names in the shapefile within QGIS.

   HINT: Shorten the name of the indicator to 10 characters or less.

3. Join the attributes from the .xls file to the DHS_Regions shapefile.

4. Check the join to verify that the indicator values for all regions joined properly.

EXERCISE END

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

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QGIS Exercise: 4

Displaying Data

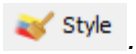
This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 4: Displaying data

In this exercise you will learn how to categorize data to make a thematic or chloropleth map. A thematic map is a useful way to show data for multiple areas at one time. This data can be related i.e. nominal or unrelated i.e. ordinal.

Section 1: Classify with Graduated Renderer

The Indicator_join layer appears in a single color by default. You will categorize the variables with one color using a method called graduated renderer.

1. Open QGIS Desktop
2. Click *File > Open project*
3. Browse to \\Training_Workshop\04_Exercises\Project_files\ Displaying_Data.qgs.
4. Click *Open.*
5. In the *Layers Panel*, right-click the Indicators_join layer to open its *Layer Properties* dialog box
6. Click the *Style* tab 

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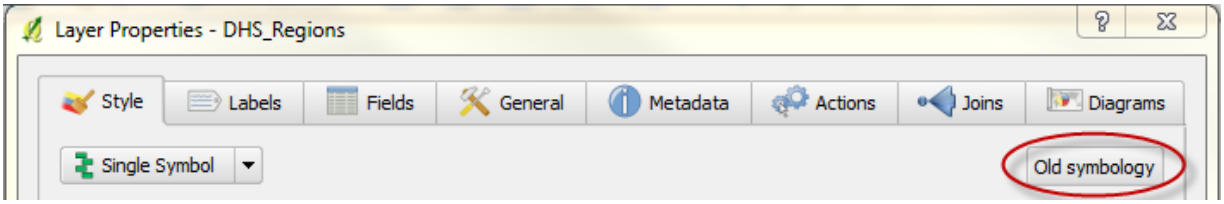
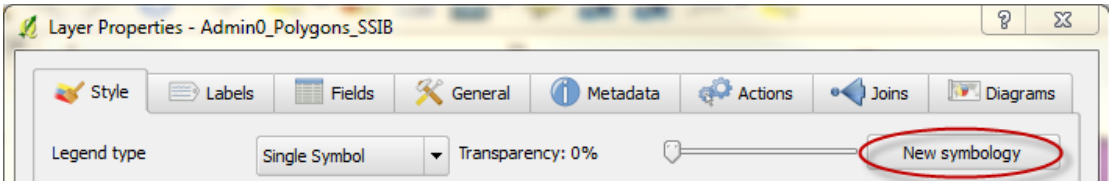
   NOTE: In previous versions of QGIS it was called Symbology.

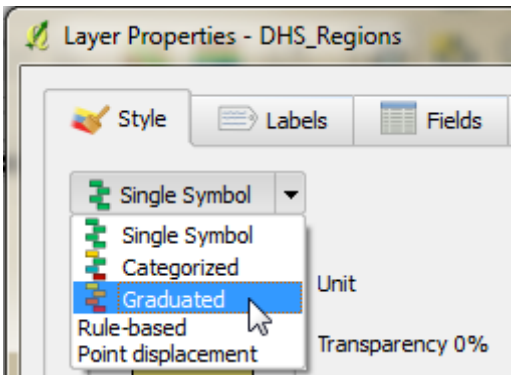
7. Make sure the button near the top right of your screen says *Old Symbology.*



NOTE: If you screen looks like the image below, then click on the *New Symbology* button. Clicking on *New Symbology* will change it to the newer version of QGIS symbology. You will receive a prompt asking if you wish to use the new symbology implementation for this layer. Click *Yes.*

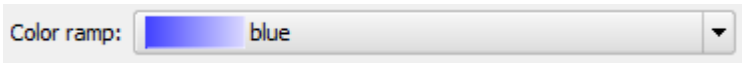


8. Select Graduated from the drop down menu directly below the *Style* tab.



9. Select HIV_Preval for the *Column.*

10. Select the blue(s) color ramp.



11. Select 3 classes.

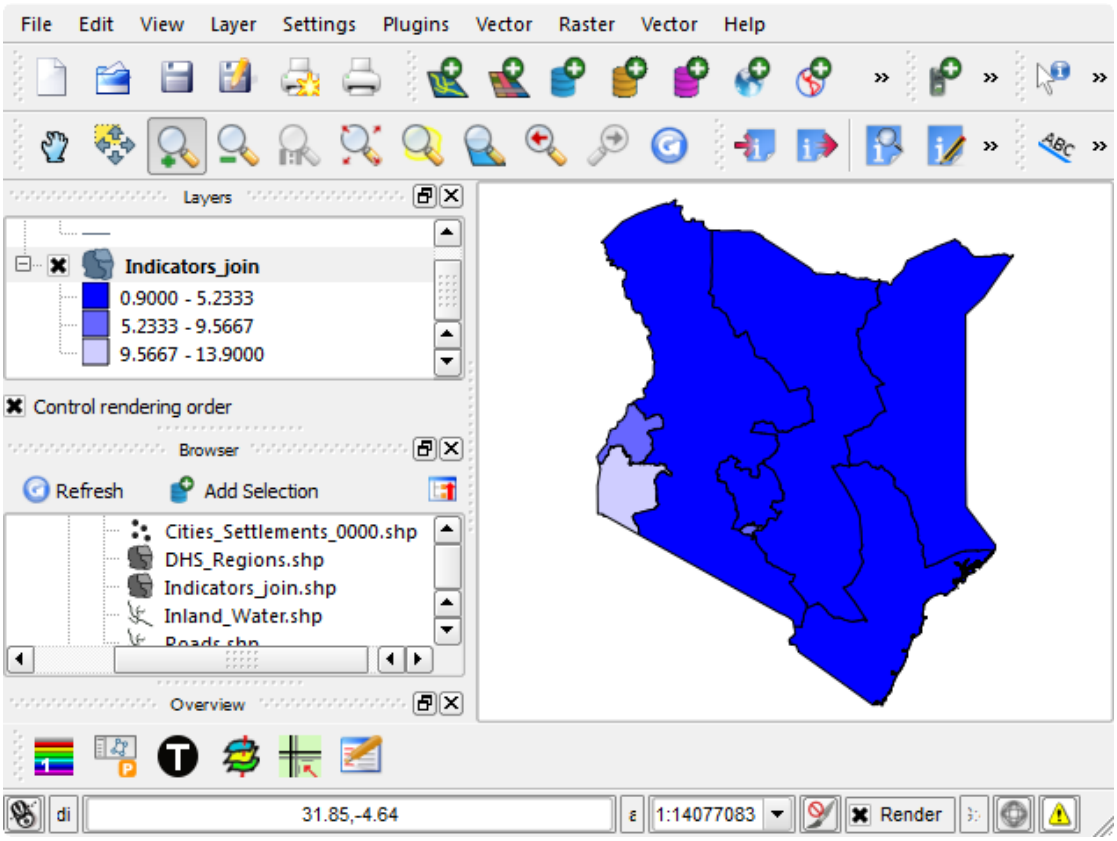
NOTE: By default the *Mode* is set to Equal Interval.

12. Click *Classify.*

13. Click *Apply*.

14. Move the *Layer Properties* dialog box over to see the changes on the map.

The country is now various shades of blue calculated by grouping the HIV Prevalence variable into three classes. Each class is now listed in the *Layer Panel* with the color and label.



Now you will change the classification scheme for the data to Quantile.

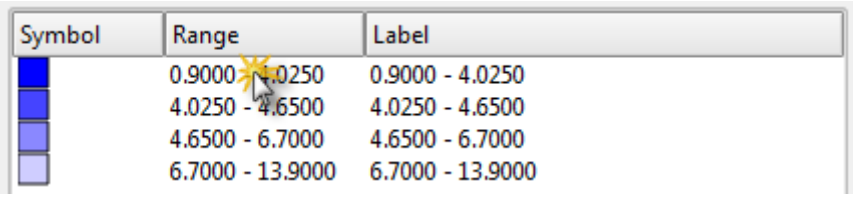
15. In the *Layer Properties Symbology* panel, change the *Mode* to Quantile

16. Change the number in the *Classes* box to 4, this will change the number of categories from 3 to 4.

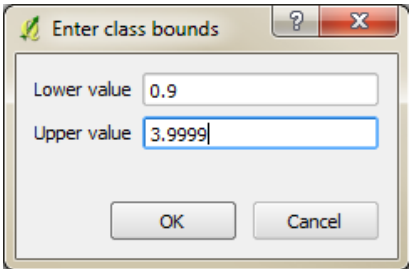
17. Click *Classify.*

18. Click Apply and move the *Layer Properties* dialog box to see the changes on the map

19. The range and label of the classification may need to be adjusted to make it user friendly. Double click on the Range values you want to adjust.



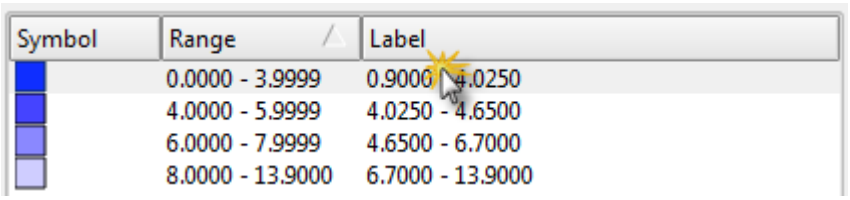
20. Then set the lower and upper values of the range. **NOTE:** Make sure you do not to have either overlaying ranges or gaps in the range.

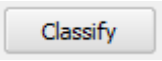


For Example:

Class	Correct	Incorrect	Issues
1	0 – 10	0 - 10	
2	10.1 – 15	9 -15	Overlap
3	15.1 – 20	15.1 - 20	
4	20.1 – 25	21- 25	Gap

21. Double click on the label value you want to adjust and change it to match the range.



NOTE: If you make a mistake and want to return to the original classification then click 

22. Click Apply.

23. Move the *Layer Properties* dialog box over to see the changes on the map and the legend.

24. Click Ok.

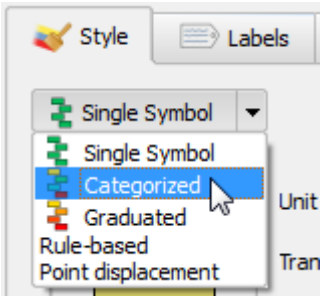
Section 2: Classify with Categorized Renderer

You will now categorize the variables with multiple colors using a method called categorized renderer.

1. Check the box next to the *Roads* layer to turn it on.

2. Open the *Layer Properties Style* panel for *Roads.*

3. Change the drop down menu directly below the *Style* tab to *Categorized.*



4. Select RTT_DESCRI for *Column.*
5. Select *New color ramp…* from the Color ramp drop down menu.
6. Select ColorBrewer in the *Color ramp type* window.
7. Click *OK.*
8. In the *ColorBrewer ramp* window, select *Spectral* for the Scheme name.
9. Select 5 for colors.
10. Click *OK.*
11. Enter *Spectral Ramp* for the color ramp name.
12. Click *OK.*
13. Click *Classify.*
14. Click *Apply* and move over the *Layer Properties* dialog box to see the changes on the map.

What do you see? Which Roads are similarly colored? How might this method be useful and what attribute data is necessary?

Optional steps:
Try to perform the following steps while exploring symbologies.

1. Select a different attribute and classify using *Graduated Symbol*.
   a. Create your own custom category breaks.
   b. Are all Provinces displayed? Why did you choose those break values?

2. Classify another Indicator code of your choice
   a. *Graduated Symbol*, *Equal Interval*, and 5 *Classes*
   b. Change the number of classes to 3
   c. What would be a better way to display this data?

3. Classify any variable using New Symbology, Graduated Renderer, 20 Classes.
   a. What happened? Why do you think this is?

Exercise End

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

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QGIS Exercise: 5

Coordinate Systems

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 5: Coordinate Systems

This exercise will teach you the fundamentals of Coordinate Systems within QGIS. In this exercise you will learn:

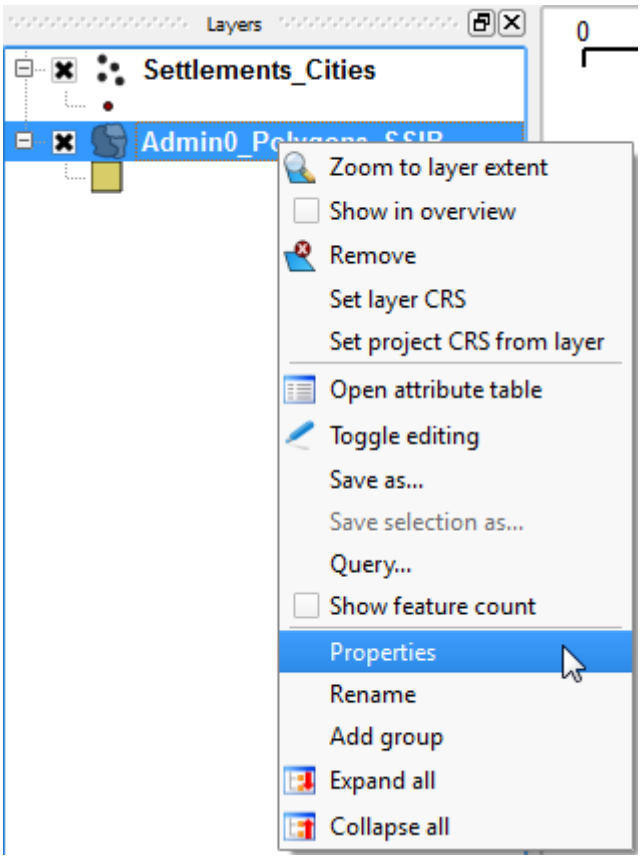
- How to determine the coordinate system of a layer
- How the projection of your map affects distance measurements
- How to add a custom projection to QGIS
- How to choose the best Projected Coordinate System for your map

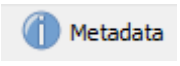
Section 1: Determining the Coordinate Reference System (CRS) of a layer

1. Open the folder \\Training_Workshop\04_Exercise_Templates\Project_files.

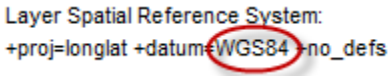
2. Double click on the QGIS file called Coordinate_Systems.qgs.

3. Right-click on the *Admin0_Polygons_SSIB* layer and select *Properties.*

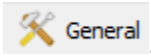


4. Click on the *Metadata* tab 

5. Look to the bottom of the window for information on the CRS listed under *Layer Spatial Reference System.* The coordinate system of the layer is circled in red below. It shows that the layer is in the WGS84 coordinate reference system.

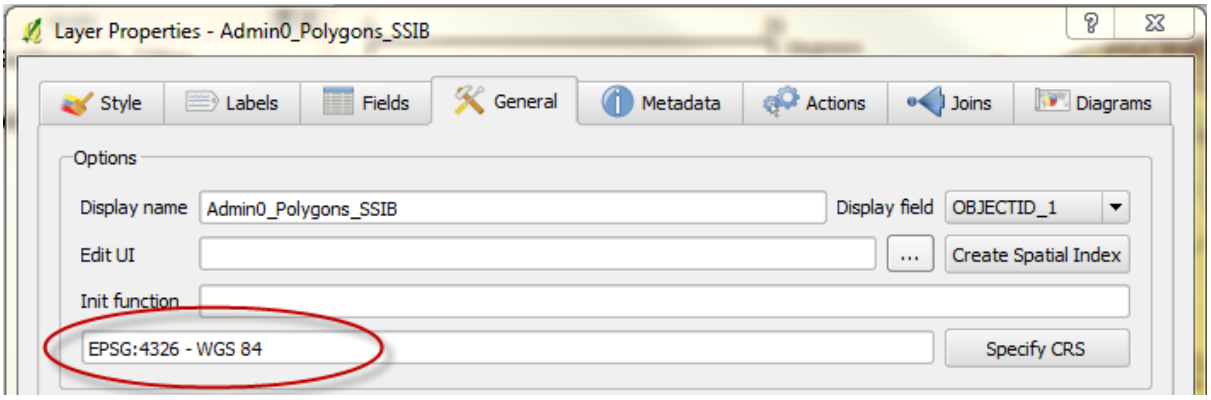


Now you will use a different method to look at the CRS information for the layer.

6. Click on the *General* tab 

.

The coordinate system of the layer is circled in red below. It shows that the layer is in the WGS84 coordinate reference system.



7. Click the *Specify CRS* button to view more information about the coordinate system.

When the *Coordinate Reference System Selector* window opens, the WGS 84 row is highlighted.

8. Scroll all the way to the top to determine which type of coordinate system WGS 84 is. You see that WGS84 falls under the Geographic Coordinate Systems classification.

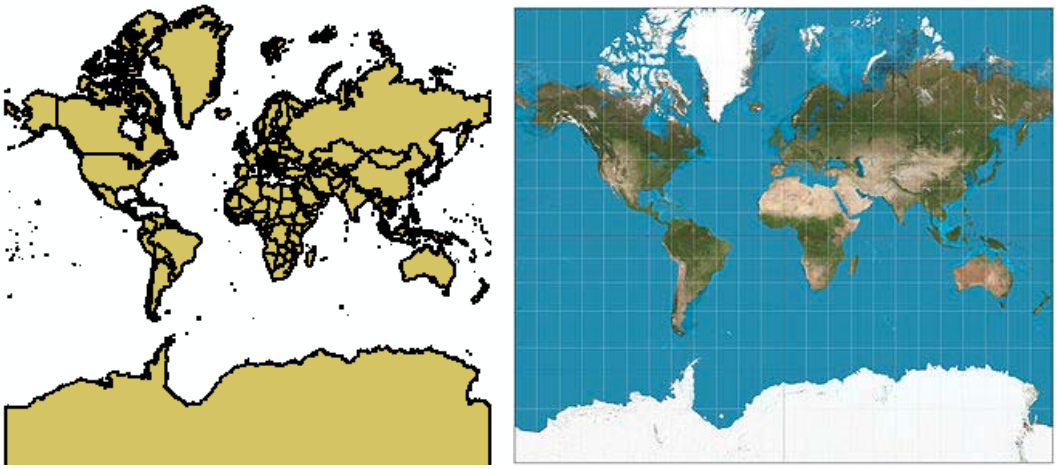
   NOTE: If the Coordinate reference system of a layer is a Geographic Coordinate System the units of the layer will be in either decimal degrees or degrees, minutes, seconds. There will be only 1-3 digits to the left of the decimal point.

   NOTE: If the Coordinate reference system of a layer is a Projected Coordinate System the units of the layer will be in either meters or feet. There will be 6-8 digits to the left of the decimal point.

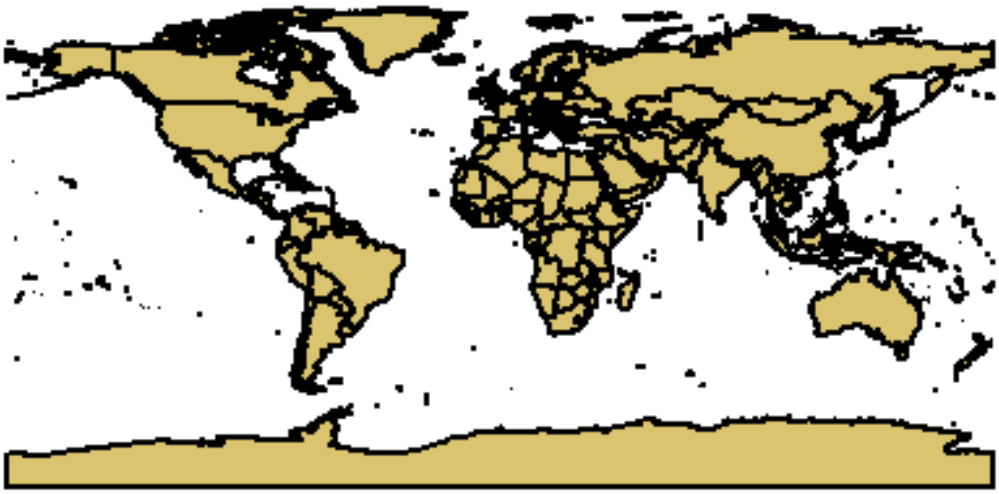
Section 2: A projection's affect on distance measurements

A Projected Coordinate System transforms the earth's surface to a two dimensional grid with units of either meters or feet. Because the earth is not actually a flat grid, no projection is a completely accurate representation. There are many different map projections that are designed to preserve either shape, distance, area of land, or a combination of these.

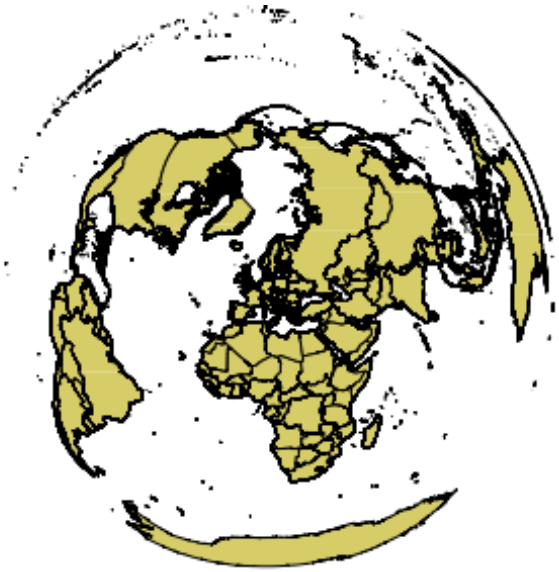
Google Mercator is an example of a Projection that preserves **shape** by ensuring that all latitude and longitude lines cross each other at 90 degree angles:



Lambert Plate Carree Equidistant Cylindrical is an example of a Projection that preserves **distance**:



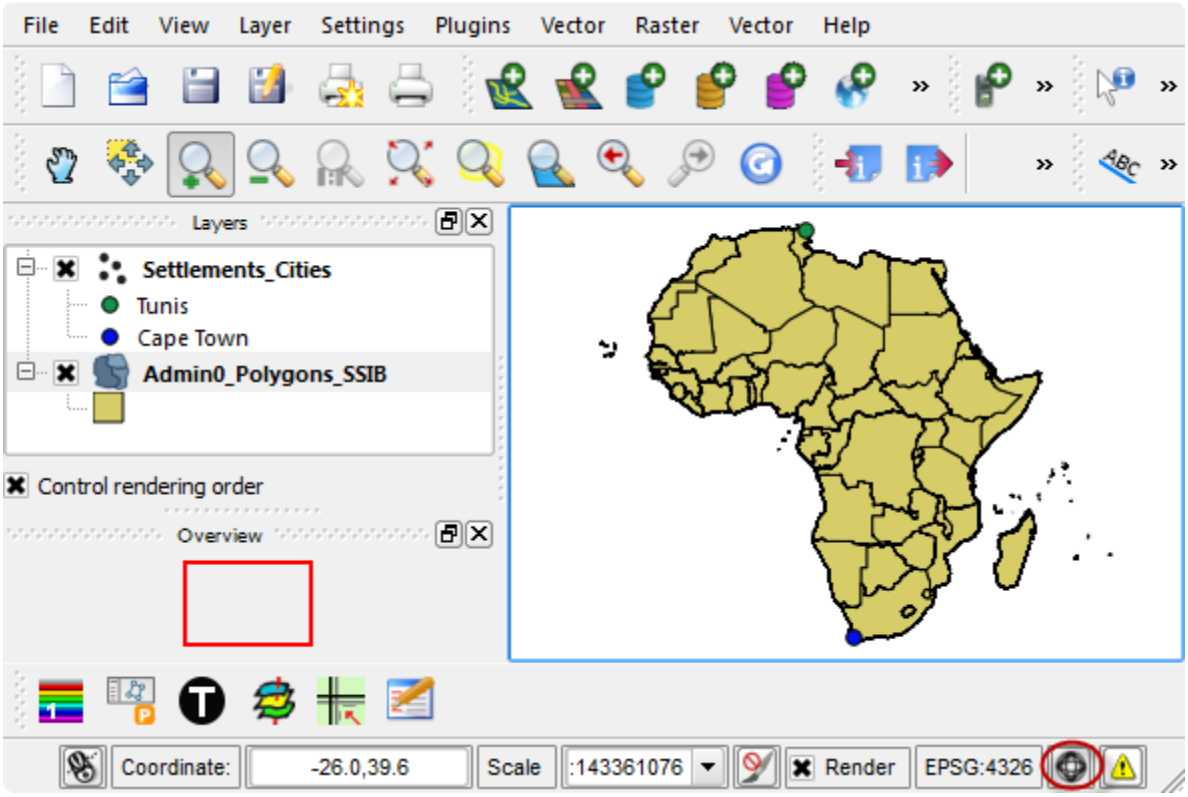
Lambert Azimuthal Equal Area is an example of a Projection that preserves **area**:

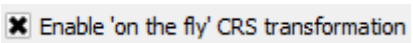


Robinson is an example of a Projection that is a **compromise** to preserve as much shape, distance, and area as possible:

To observe the differences in projections, you will measure the distance between two cities using different projections and compare the results. Tunis, Tunisia and Cape Town, South Africa are shown as green and blue points on your map. In order for you to measure the distance in units of meters, a projected coordinate system that uses meters for units must be used. The Google Mercator projection, which will be used for this exercise, is one example of a projection that uses meters.

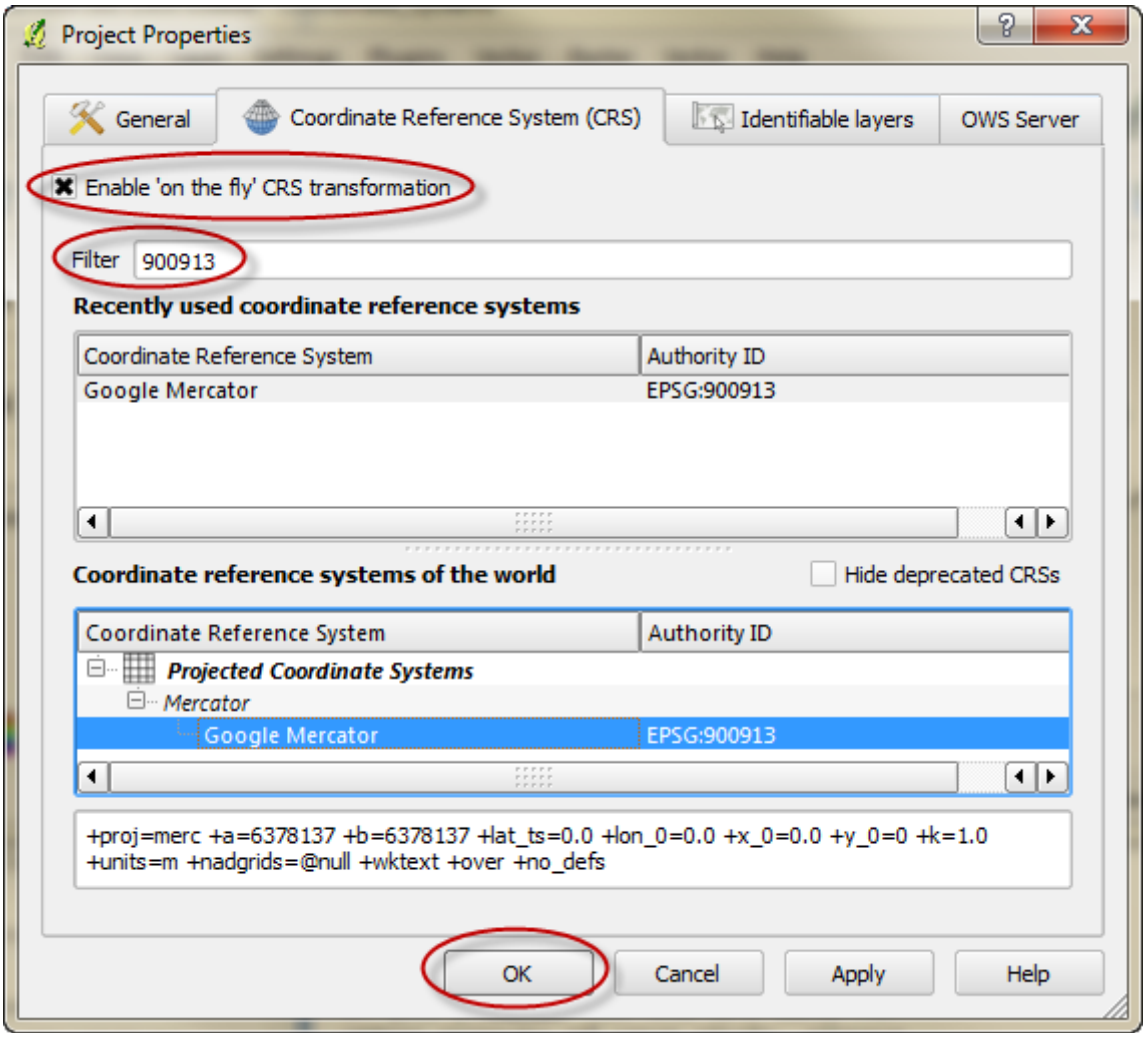
1. Click on the *CRS Status* button at the bottom right corner of your QGIS window.



2. Check the box 

to allow your layers in the WGS 84 CRS to be automatically transformed and mapped in the new projection you will select for your map document.

3. Type *900913* into the *Filter* section.



4. Click on the Google Mercator Projected Coordinate System to select it.

5. Click OK.

6. Right click on the Admin0_Polygons_SSIB layer.

7. Select *Zoom to layer extent.*

Now that a projection has been set, you will measure the distance between two points.

8. Click the *Measure Line* button  .

9. Click on the map.

10. Uncheck the  box in the *Measure* window that opens

NOTE: Unchecking the ellipsoidal box means that the distances using the measure tool will be calculated based upon the projection. If the box is checked, the distances will be calculated based upon the WGS 84 ellipsoid. The box should only be unchecked for this exercise, which is to demonstrate the variation in distances calculated from projections.

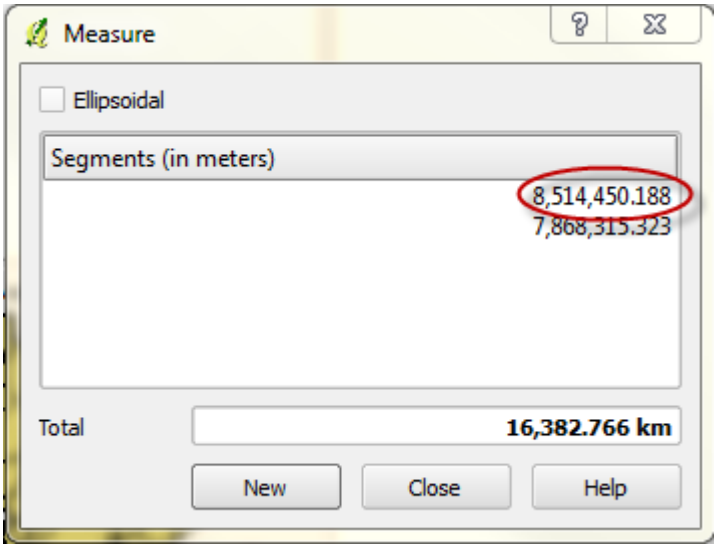
11. Click the *New* button in the *Measure* window to begin a new measurement segment.

12. Move the cursor directly over Tunis (the green point) and click once.

13. Move the cursor over Cape Town (the blue point) and click once.

14. The distance in meters between the two cities will display as the first segment in the *Measure* window.

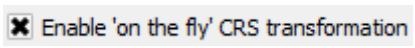
NOTE: It is ok if your distance is slightly different from this example.



15. Record the distance and label it Google Mercator.

16. Close the *Measure* window.

17. Click on the *CRS Status* button at the bottom of your QGIS window.

18. Make sure the  box is checked.

19. Type *3035* into the *Filter* section.

20. Select the Lambert Azimuthal Equal Area > ETRS89 / ETRS-LAEA Projected Coordinate System.

21. Click OK.

22. Right click on the Admin0_Polygons_SSIB layer.

23. Select *Zoom to layer extent.*

Now that a different projection has been set, you will measure the distance between the same two points as a comparison.

24. Click the *Measure Line* button  .

25. Move the cursor directly over Tunis (the green point) and click once.

26. Move the cursor over Cape Town (the blue point) and click once.

27. The distance in meters between the two cities will display as the first segment in the *Measure* window.

28. Record the distance and label it Lambert Azimuthal Equal Area.

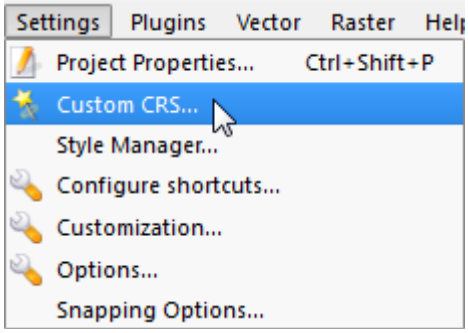
29. Close the *Measure* window.

30. Calculate the difference for the distance between the two cities under the Google Mercator and the Lambert Azimuthal Equal Area projections.

Section 3: Adding a custom projection to QGIS

QGIS contains many different options for CRS settings. However, there are not any compromise projections available, which are the most popular projections to use when creating a map of a continent or the entire world. This section will teach you how to add the Robinson compromise projection and save it in your QGIS settings for use in the future. Refer back to Section 2 for an explanation of the Robinson and other compromise projections.

1. Select *Custom CRS* from the Settings menu

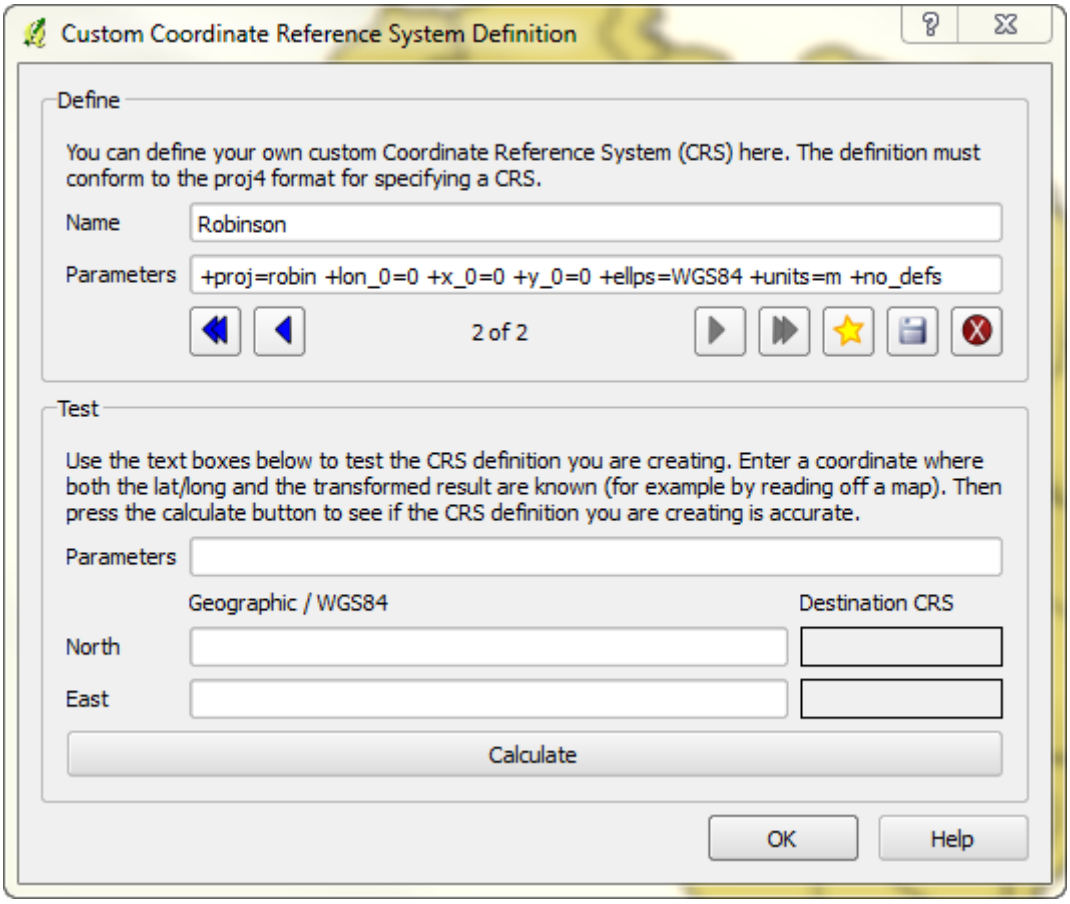


2. Click the star  button to add a new empty entry

3. Name the CRS *Robinson*

4. Type or copy and paste: +proj=robin +lon_0=0 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_defs into the *Parameters* box

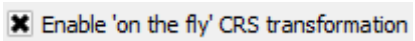
Your *Custom Coordinate Reference System Definition* window should look like this example.



5. Click the save button to save the projection to your CRS library

6. Click OK.

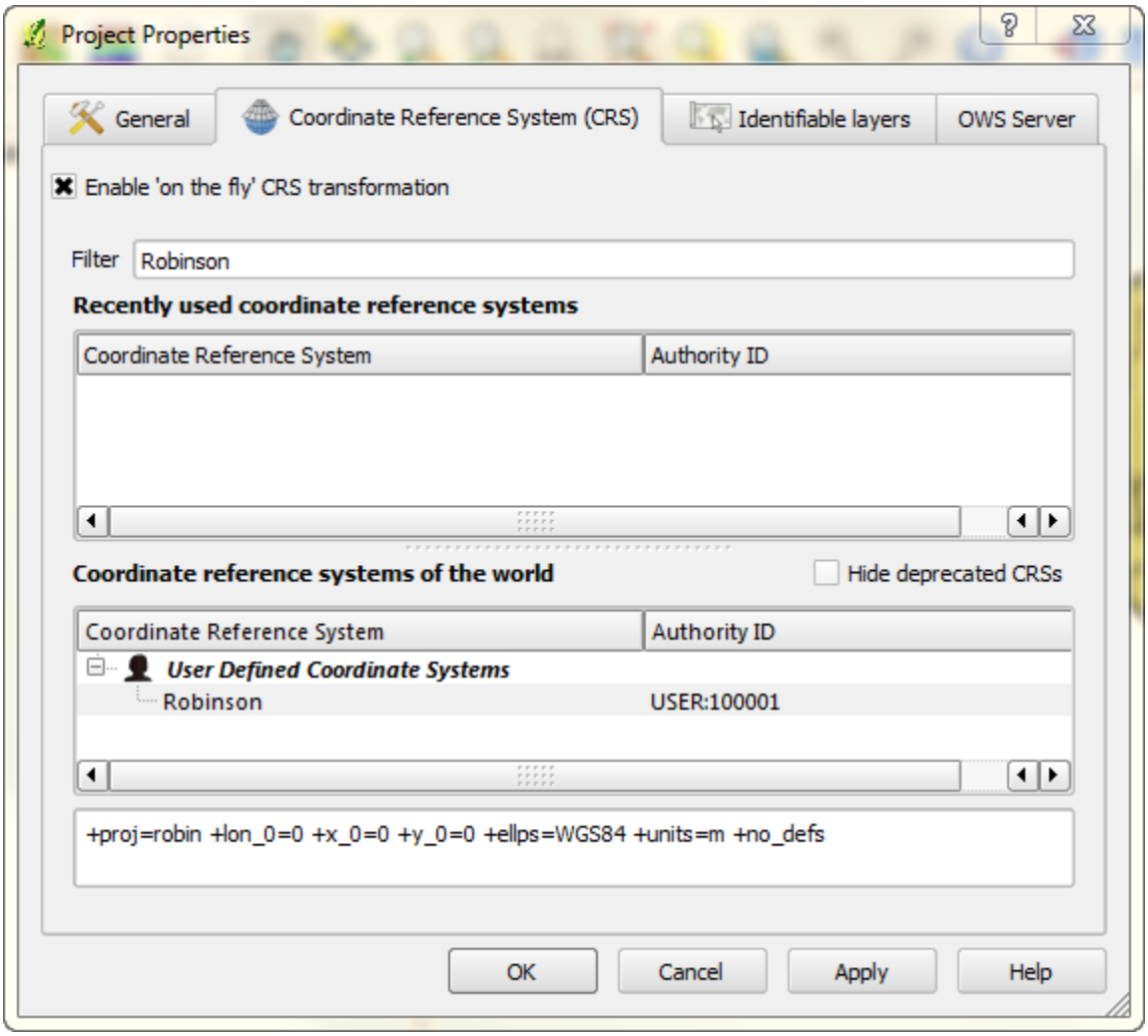
7. Click on the *CRS Status* button at the bottom right corner of your QGIS window 

8. Make sure the 

box is checked

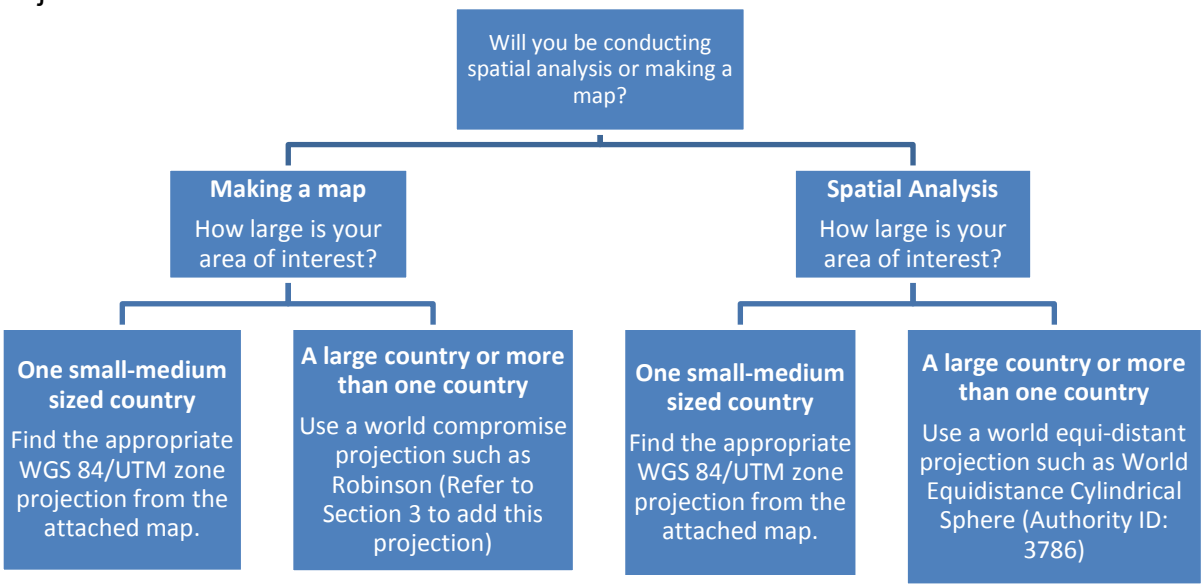
9. Type *Robinson* into the filter box

The Robinson projection you added should appear under the *User Defined Coordinate Systems* section. Note that the Authority ID will automatically be assigned based upon the order in which you add new custom CRSs.



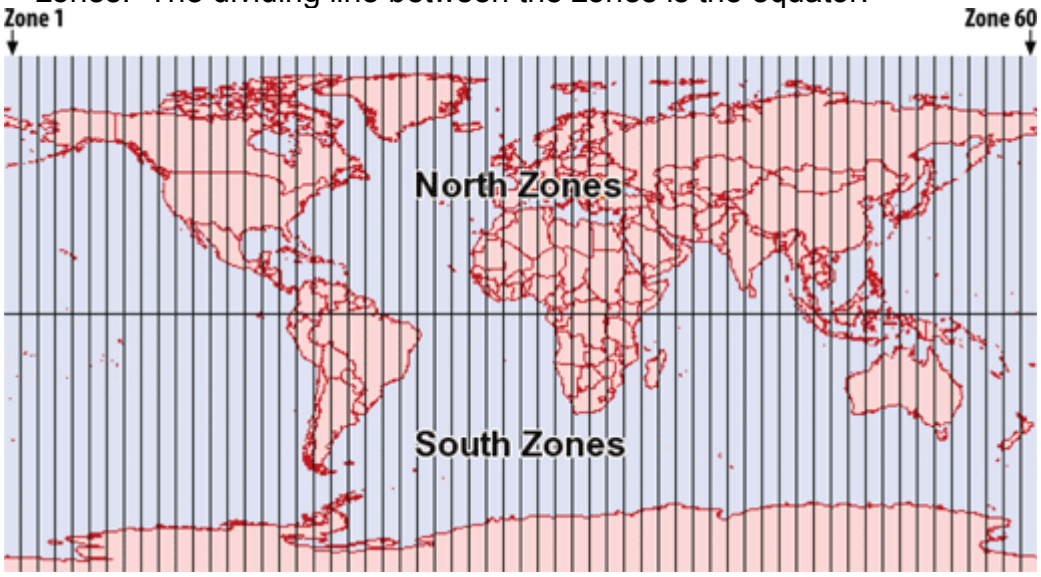
Section 4: Choosing the proper projection

Section 2 showed the difference in distances across projections. That variation makes it important to choose the proper projection for your analysis. This section provides a flow chart to help you select the best projected coordinate system for your project.



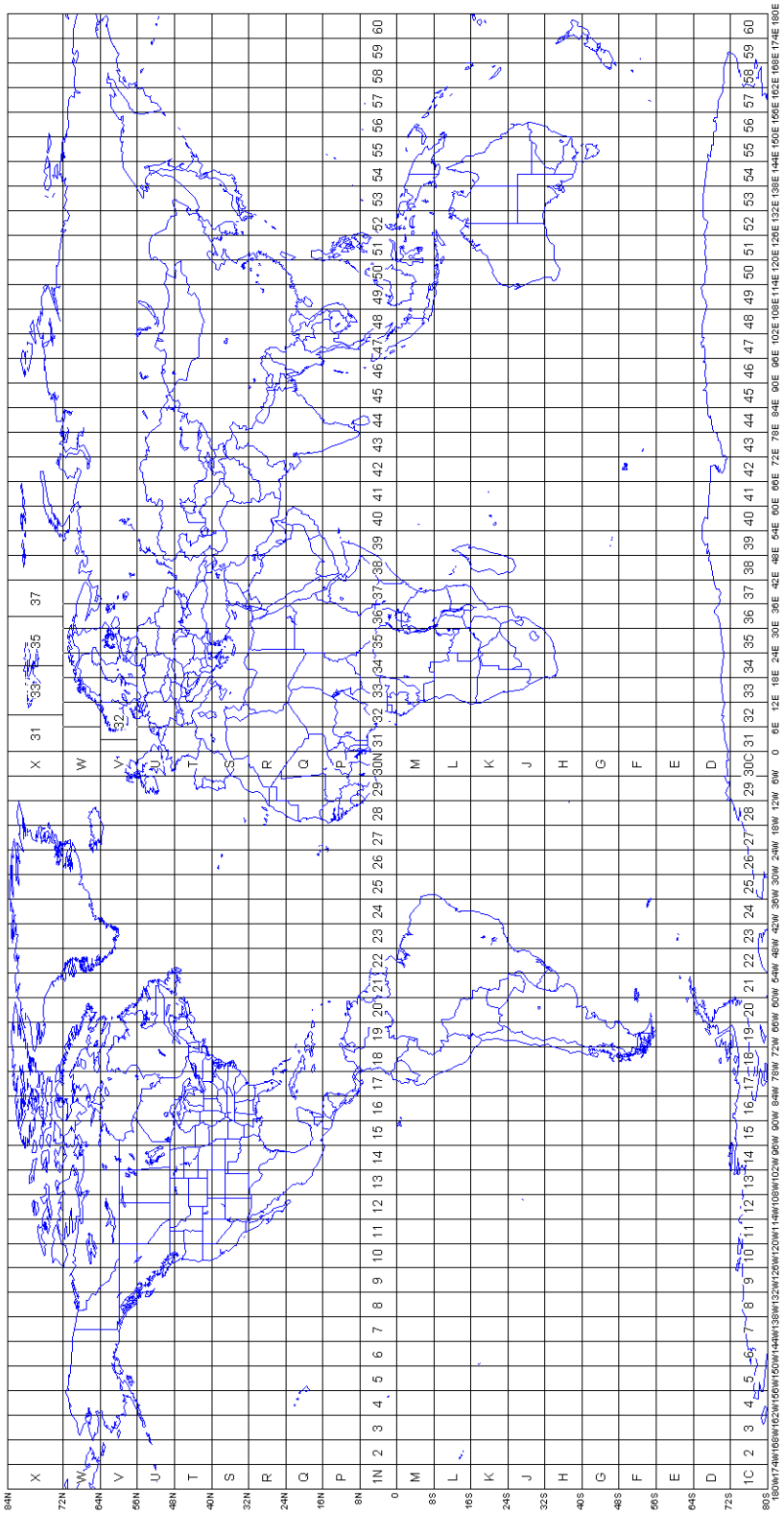
If you have gone through the flow chart and it tells you to select a WGS 84 / UTM zone, follow the steps below.

1. Determine whether your area of interest falls into the northern or southern zones. The dividing line between the zones is the equator.



2. Determine the zone number for your area of interest from the image below.

   NOTE: You may also use an interactive map to zoom in to your area of interest and see which UTM zone to use. The map is available online at: http://whatutmzoneamiin.blogspot.com/p/map.html.



EXERCISE END

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QGIS Exercise: 6

Map Layout

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 6: Map layout

In this exercise you will learn how to use the QGIS Print Composer, add map elements to the map to make it more useful, and export the map. Map elements include a legend, a map title, a scale bar, dates for the data and map, the name of the author, and other textual disclosures or pertinent information.

> **NOTE:** This exercise is about how you add the different map elements and manipulate their characteristics. This does not imply, however, that you should have all these elements in every map you make. The map objectives and individual map specifications at your organization or supplied by your client will dictate what map elements are important to include in each map.

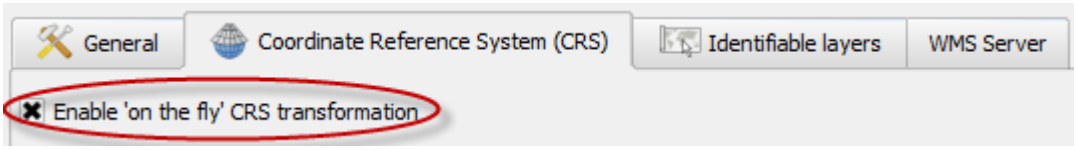
Section 1: Start QGIS and set the map projection

First, launch the QGIS application (if not already open).

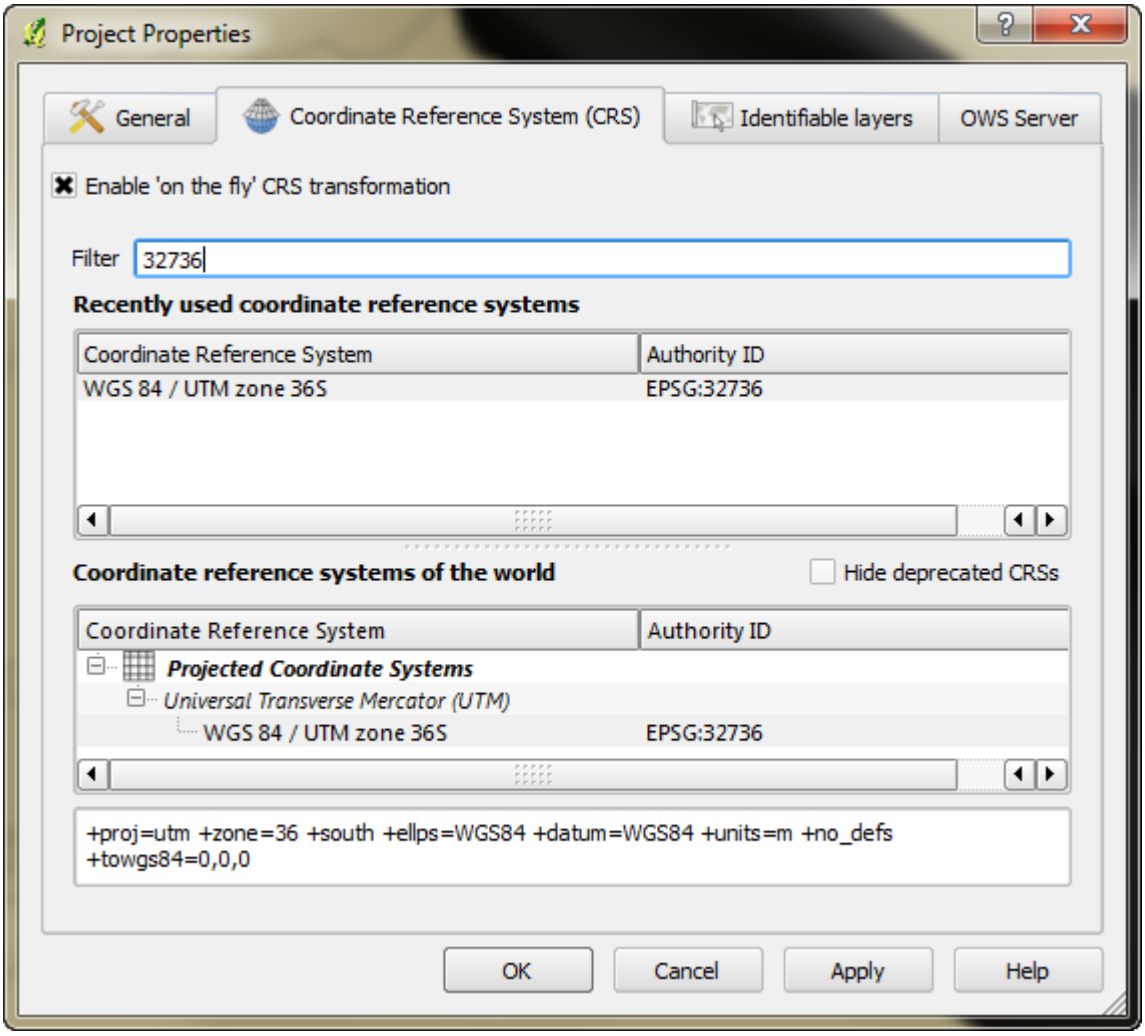
1. Click *File* > *Open.*
2. Navigate to *\\Training_Workshop\04_Exercises\Project_files.*
3. Double click *Map_Layout.qgs* to open the map.

The Map_Layout project file is currently in the WGS84 Geographic Coordinate System, which means the units are in decimal degrees. To make sure that your map displays units that are easier to understand (such as meters or kilometers,) you must change the map to a Projected Coordinate System. The recommended projection for Kenya is WGS84/UTM zone 37S.

4. In main Map Window Click on *Settings* > *Project Properties*.
5. Click on the *Coordinate Reference System (CRS)* tab.
6. Check the box next to Enable 'on the fly' CRS transformation



7. Type “32737” into the filter box **OR** scroll down to the Coordinate Reference System called “WGS84/ UTM zone 37S” and select it by clicking on it.



8. Click OK

9. In main map Window select the DHS_Regions layer

10. Click on Zoom To Selected 

Section 2: Start a new print composer session

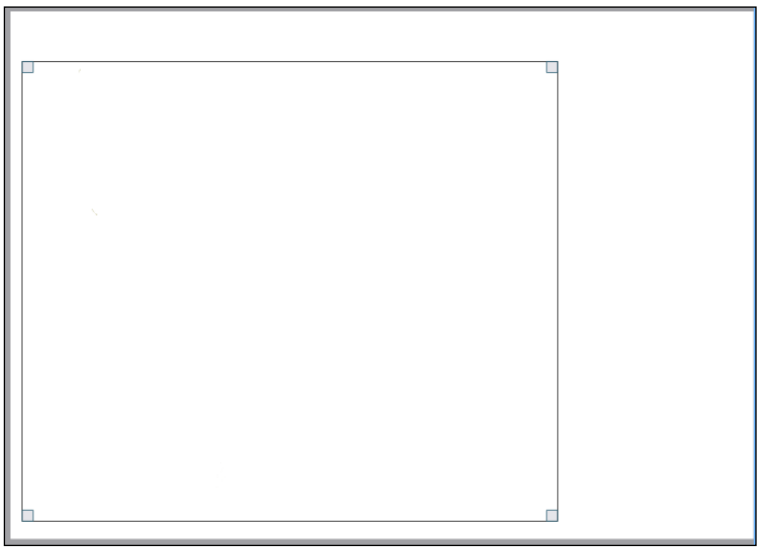
Print composer is the interface in QGIS for creating a map layout for export or print.

1. Click the *Print Composer*  button

2. Click the *Add new map*  button

3. Now, in order to add the map, hover the mouse over the top left corner of the white page. Click and hold the left mouse button and move the mouse right and down to create a square on the white page. Release the mouse button.

The placement of your map object should look similar to this.



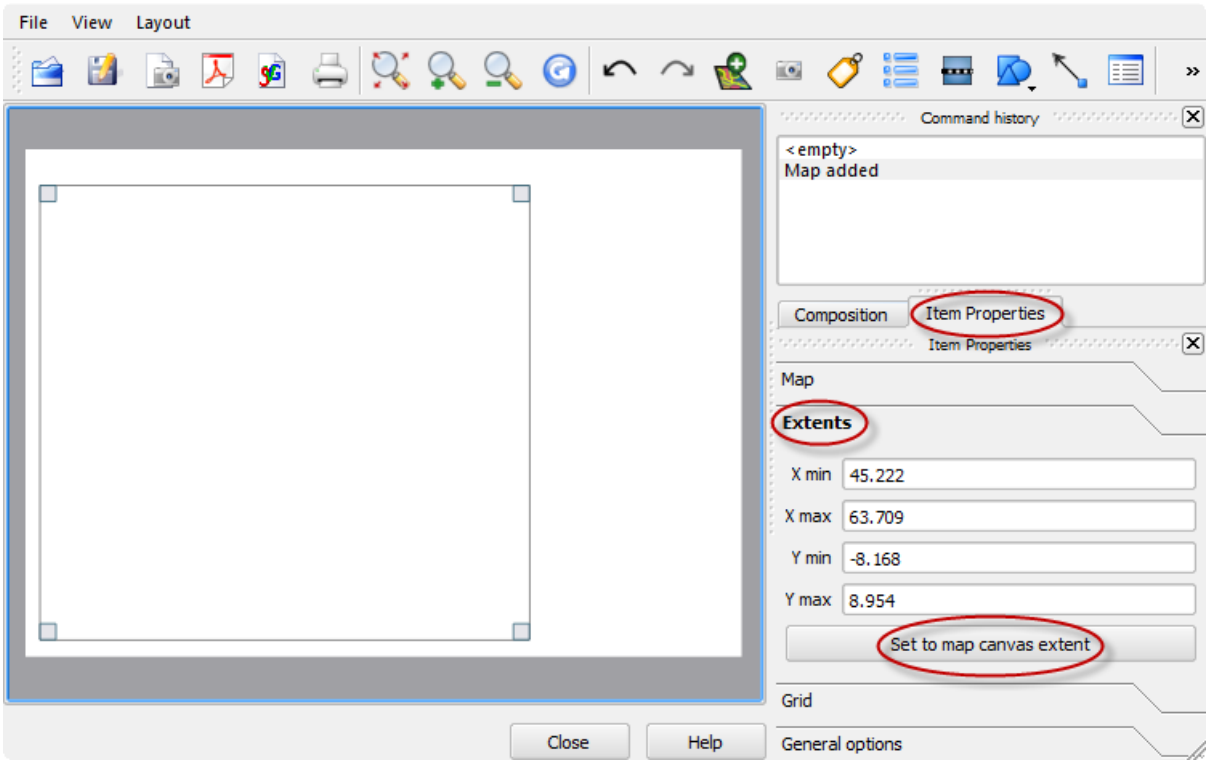
4. You should see the same data from the map display. This is what will be exported.

5. Select the map by clicking in the map. In the corners you will see little light blue squares that it indicates the object (map) is selected.

6. If the scale of the map is not as desired then click on the *Item Properties* tab on the right sidebar.

7. Click on *Extents* in the *Item* tab.

8. Click on *Set to map canvas extent*. This will adjust the viewing area of your map object to best show the layer of interest, which is the DHS regions in this case.



9. To center the map on the country of interest, select the Move item content button  . Move the mouse to the map, click and hold the left mouse button and drag the country of interest to the center.

10. You may close the Command history panel if you wish by clicking on the  at the top right hand corner of the panel.

Section 3: Save a template of your map

It is a good idea to save your work frequently when working the in the *Composer* window.

1. In the *Composer* window, go to the File menu and select *Save as template.*

2. Navigate to \\Training_Workshop\06_Participant _Work and name the file Map_Layout.

3. Click *Save.*

4. Repeat this save process throughout the exercise to make sure you do not lose your work.

It is easy to accidentally close your *Composer* window, so we will practice how to reopen your saved template.

5. Click the *Close* button on the bottom of the *Composer* window.

6. Click the *Print Composer*  button.

7. Click *File > Load from template* OR the *Load from template*  button to open your saved template.

8. Browse to \\Training_Workshop\06_Participant _Work\Map_Layout.qpt

9. Click *Open*

Section 4: Add a title and citation

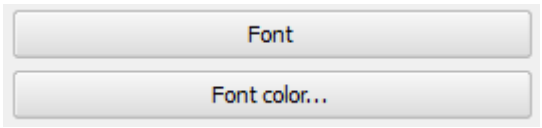
1. Use the *Add new label*  button to create a descriptive title.

2. Click on the top of the page to insert a label.

3. Select the *Item Properties* tab then the *Label* tab in the box on the right side of the screen.

4. Enter a title (e.g. Percentage of Males age 15 – 49 Who Have Ever Been Tested for HIV and Received the Results) in the *Label* box.

5. Set the *Font* and *Font color…* using the buttons under the *Item* menu.



NOTE: As the title of your map, it is important to make sure that the font size is large enough for others to read easily. Setting the font style to bold is another way to make the title easier to read.

6. Click on the *General options* tab.

7. Un-check the box under *General options – Show frame* to remove the frame from around the title.

8. Adjust the size of the title box but dragging the corners of the box until all the text is visible.

9. Click the *Add new label* button  .

10. Click on the empty space on right side of the map layout.

11. In the *Item* tab, click on the *Label* tab and type a citation for the data values in the map. For example: “Data are from the Kenya 2008-09 Demographic and Health Survey Final Report authored by the Kenya National Bureau of Statistics, Nairobi, Kenya and MEASURE DHS, ICF International, Calverton, Maryland, USA.”

12. Resize the box so all of the text is visible.

13. Save your map template.

Section 5: Add a legend

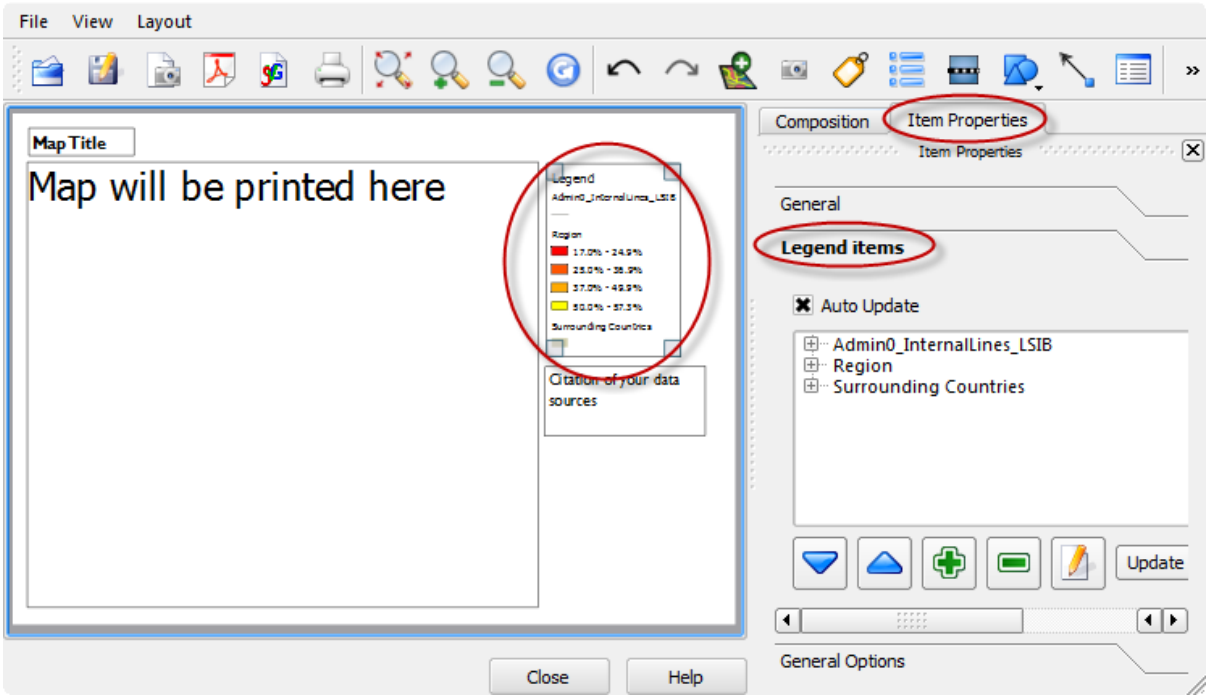
1. Add a legend by selecting the *Add new vector legend* button.

2. Click on the top-right of the page to insert the legend.

3. Select the legend by clicking on it so the blue squares in the corners appear.

4. Click on the *Item Properties* tab on the ride side of the window.

5. Click on the *Legend items* tab.



6. Order the items by selecting the layer in the *Legend items* box and clicking on the up and down arrows.

7. Remove the Admin0_InternalLines_LSIB layer from the Legend by selecting the layer so it is highlighted blue, then clicking the minus button .

8. Edit the layer name for the Regions layer by selecting the layer, then clicking the *Edit* button . Name the layer *Percent by region.*

9. Save your map template.

Section 6: Add a scale bar

1. Add a scale bar by selecting the *Add new scalebar* button.

2. Click on the map where you want your scale bar to be placed.

3. Select the *Item Properties* tab on the right side of the window.

4. Select the *Scale Bar* section.

The *Segment Size* number is the number of units (meters in this case) that each section of the scale bar is equal to. The *Segment size (map units)* will automatically set itself to the scale and units of the map. The default segment size always starts with the number one. For this map, the default segment size is too small, so you will change the first number from 1 to 2.

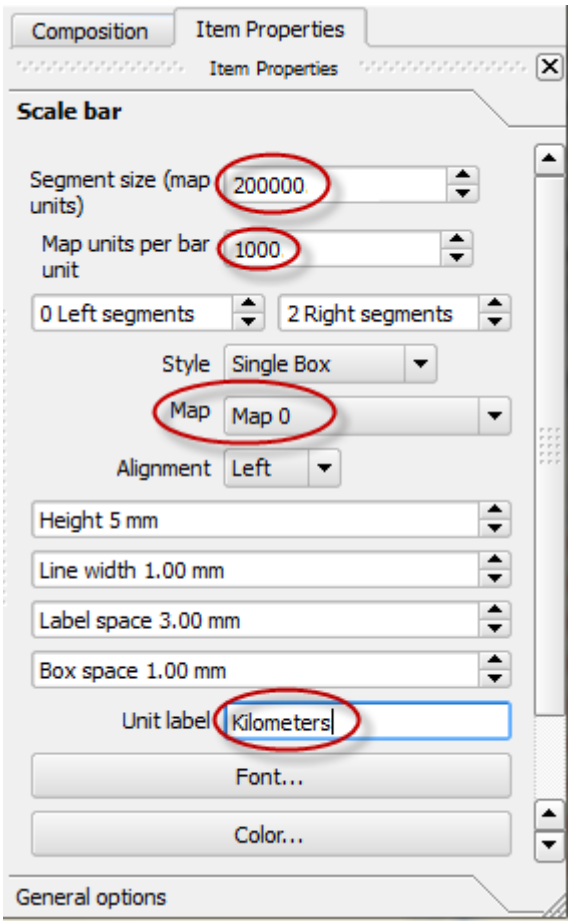
5. Set the *Segment size* to 200000.

   NOTE: This sets each section of your scale bar equal to 200,000 meters.

6. Adjust the *Map units per bar unit* to 1000. This converts the units of the scale bar from meters to kilometers. (1000 meters per kilometer)

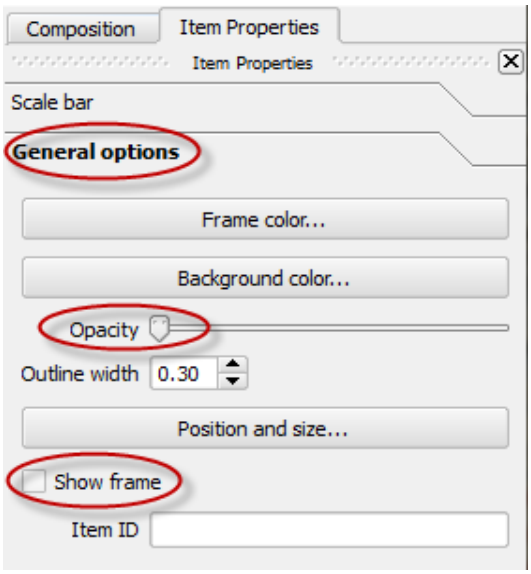
7. Make sure that Map 0 is selected under the Map section. This links your scale bar to the first (primary) map you added to your Layout.

8. Enter the *Unit label* as *Kilometers.*



9. Adjust the box around the scale bar by dragging the corners to fit the size of the bar.

10. Under *General options,* change the *Opacity* to clear by dragging the slider all the way to the left. This will make the box around the scale bar see through.



11. Un-check *Show frame*.

12. Save your map template.

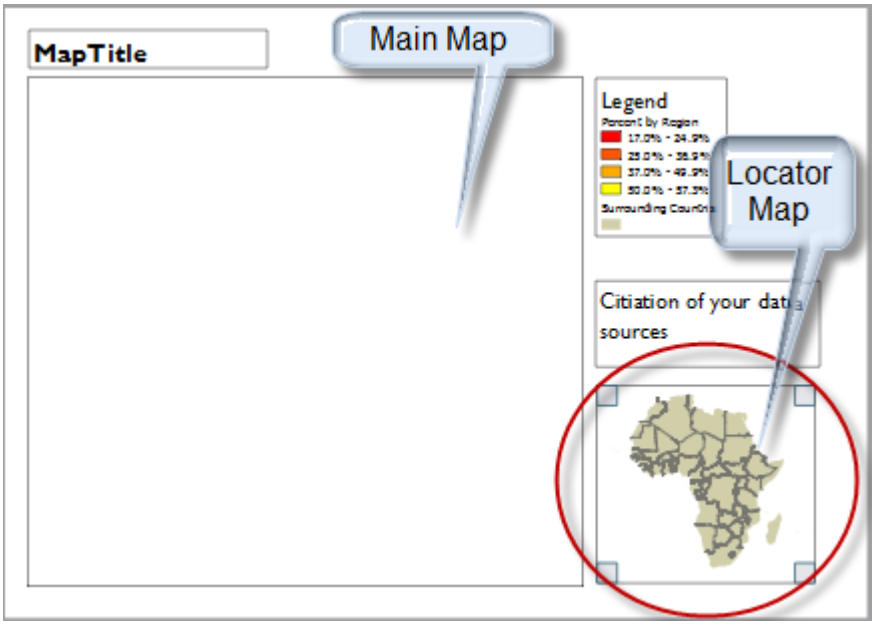
Section 7: Add a locator map

One way to provide context for a map is to include a locator map. The locator map is second map that shows the reader where the area of interest is located.

1. Click the *Add new map*  button.

2. Click and hold the left mouse button and drag the mouse to create a small map in the bottom right corner of the page. Release the mouse button.

The placement of your locator map should look similar to this, but with your own content.



3. Select the locator map, by clicking on the map. In the corners you will see little light blue squares that indicate the object (map) is selected.

4. Using the scroll button on your mouse, zoom out by scrolling down until you see all of Africa.

5. Select the Move item content button  .

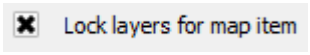
6. To center the map on Africa move the mouse to the map, click and hold the left mouse button and drag to center the map.

7. Click the Select/Move item button  .

8. Select the main map, by clicking on it. In the corners you will see little light blue squares that indicate the main map is selected.

9. Click on the *Item* tab.

10. Click on the *Map* section.

11. Check the box *Lock layers for map item.* 

    NOTE: This locks the layers of your main map so that the main map layout will not update if new layers are added to your project file.

12. Go back to the main QGIS window and click the *Add vector layer button* 
    .

13. Browse to and open the file \\Training_Workshop\05_Data\03_Shapefiles\00_Country\DHS_Regions.

14. Open the layer properties for the DHS_Regions file.

15. Change the fill color to black and click OK.

16. Click OK in the layer properties window.

17. Go back to your Composer window and click the *Refresh view* button  .

The country of interested should have turned black in the locator map only.

NOTE: If the DHS_Regions file was automatically added to your legend, select the legend, go to the Legend Items tab in the Item tab, select the DHS_regions layer, and click the minus button to remove it.

18. Save your map template.

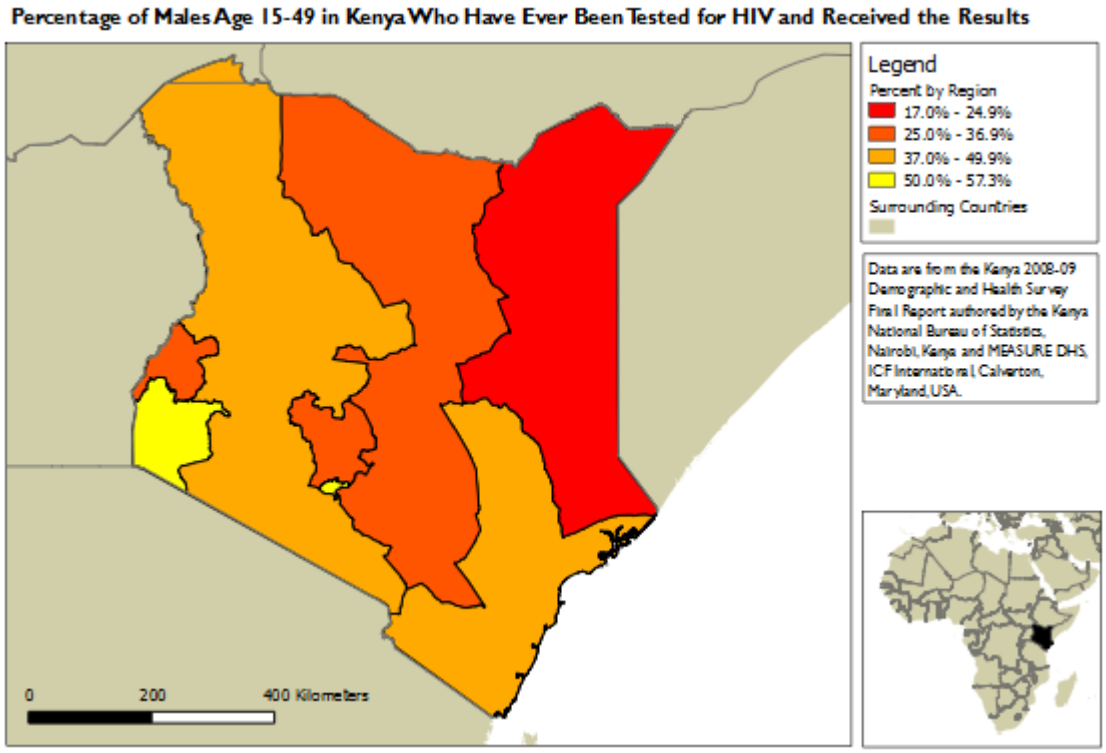
Section 8: Export as a PDF

1. Click the *Export as PDF*  button.

2. Give your map an appropriate file name and save it to \\Training_Workshop\06_Participant _Work.

3. Navigate to the newly created PDF and open the document.

Does the map look as you intended? Below is just one example of a possible output.



Section 9: Export as an image

1. Export the map as an image using the *Export as Image* .

2. Choose *JPEG* in *Save as type* and enter an appropriate location on your computer.

4. Give your map an appropriate file name and save it to \\Training_Workshop\06_Participant _Work.

3. Navigate to the newly created JPG and open the document.

Does the map look as you intended?

EXERCISE END

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

QGIS Exercise: 7

Querying data

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

QGIS Exercise 7: Querying data

In this exercise you will learn how to perform queries in QGIS including selections and structured query language (SQL) queries. A query is a useful way to better understand your data and to answer questions with your data.

Section 1: Use identify features tool

The *Identify Features*  button allows you to see attribute information about a feature in a layer.

1. Navigate to the *\\Training_Workshop\04_Exercises\Project_files* folder and locate *Querying_Data.qgs*

2. Double click *Querying_Data.qgs* to open and display the map.

3. Click on the *DHS_Regions* layer the *Layer Panel* to highlight it.

   NOTE: The *Identify Features* tool will always provide you with information from whichever layer is highlighted in the *Layer Panel.* Therefore, you must check to make sure that the layer of interest is highlighted.

4. On the toolbar select the *Identify Features*  button.

5. Click on a region on your map. A dialog box will open that lists all the attributes for that region.

6. Click on one of the Cities.

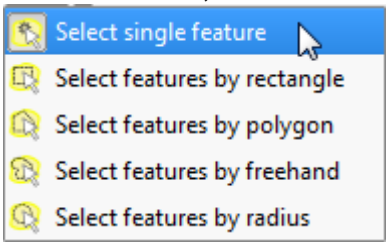
   NOTE: What happened? Did you get the attribute data for the region instead of for the City? Make sure that the Cities_Settlements_0000 layer is selected in the *Layer Panel*. Also, make sure that when you click, the mouse arrow is at the center of the City point on the map.

7. Close the *Identify Results* dialog box.

Section 2: Spatial selection

There are two ways to select features, spatially or by attribute. This section will show you how to select individual features or multiple features spatially.

1. On the toolbar, click the *Select single feature*  button.



2. Make sure that the *DHS_Regions* layer is highlighted in the *Layer Panel.*

   NOTE: The *Selection* tool will only select features from the highlighted in the *Layer Panel.* Therefore, you must check to make sure that the layer of interest is highlighted.

3. Click on a region on your map. The region will turn a different color (yellow or red are the common default settings).

4. Click on a different region.

   NOTE: What happened? The original region is no longer highlighted. The newly selected region should now be highlighted.

5. Click on a new region.

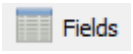
6. Hold the CTRL key and click on several other regions. Now several regions should be selected.

7. Click the *Deselect features from all layers*  button.

Section 3: Exploring attributes

Selecting by attribute requires some understanding of the data available in the attribute table and the way in which the data are represented.

1. Double click the *DHS_Regions* layer in the *Layer Panel.*

2. Click the *Fields* 

tab in the *Layer Properties* dialog box.

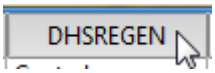
   NOTE: In the box, you will see the information about each attribute in the attribute table. These are descriptions of the attribute categories i.e. column names, type (String, Integer, or Real), length, and precession (number of decimal places).

3. Close the *Layer Properties* dialog box.

Make sure that the *DHS_Regions* layer is highlighted in the *Layer Panel.*

4. Click the *Open Attribute Table*  button on the toolbar.

   NOTE: You can also access this dialog box by right clicking the layer in the layer panel and clicking *Open Attributes Table* button. Or, you when the layer is selected in the *Layer Panel*, click the *Open Attributes Table*  button.

5. Click the DHSREGEN header 

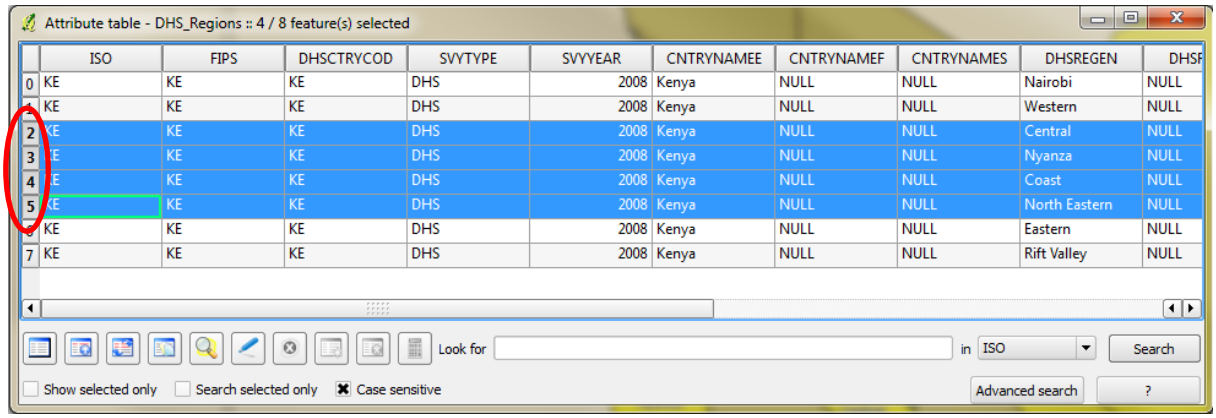
in the *Attribute table*.

   NOTE: This will reorder the rows so that they are in alphabetical order starting with A. If you click the header again it will reverse the sort order.

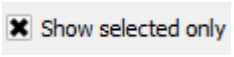
6. Click the Shape_Area header.

   NOTE: This will reorder the rows so that they are in numerical order from smallest to largest. If you click the header again it will reverse the sort order.

7. Select the rows Central, Nyanza, Coast, and North Eastern by clicking and holding the left mouse button as you drag it across the gray numbers on the far left of the table.



   NOTE: You can also select in the attribute table by clicking the first row and holding the SHIFT key then clicking the last row in a continuous selection. For a non-continuous selection, hold the CTRL key and click each row that you want to select. To unselect something in the table hold the CTRL key and click the row number.

8. Check the box for *Show selected only* 

(located in the bottom left of the dialog box).

   NOTE: What happened? You should see only the selected rows.

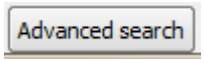
9. Uncheck the box for *Show selected only.*

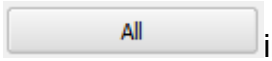
10. Explore the use of the other select tools in the attribute table (at bottom left of dialog).

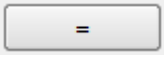
11. Close the dialog box by clicking on the X in the upper right corner.

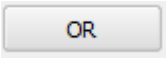
Section 4: Selection by attribute using advanced search

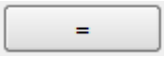
Advanced Search in QGIS allows you to select features using structured query language (SQL) with clause operators such as equal to and greater than. This is important for querying data and making new layers.

1. Open the *Attribute table* for the Cities_Settlements_0000 layer.
2. Click *Advanced search.* 

3. Double click *POP_CLASS* in the *Fields* box. That field will appear in the *SQL where clause* box.
4. Click 

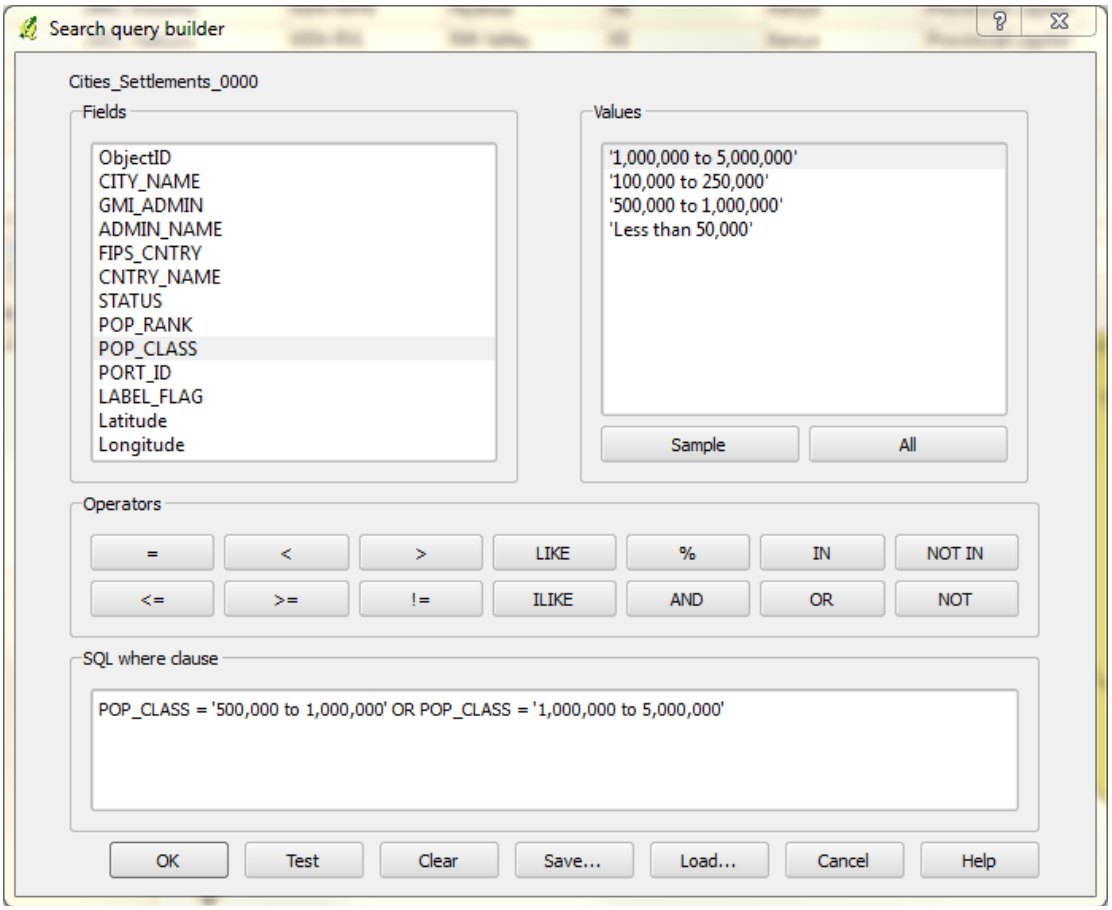
in the *Values area.* The names of all the population classifications appear in the values box.
5. Click the equal sign 

in the *Operators* area.
6. Double click '500,000 to 1,000,000' in the *Values* area.
7. In the *Operators* area, click the OR button. 

8. Double click *POP_CLASS* in the *Fields* box.
9. In the *Operators* area, click the equal sign. 

10. Double click ‘1,000,000 to 5,000,000' in the *Values* area.

The *Search Query Builder* window should look like the example below.



11. Click *Test.*

A dialog box should appear that tells you that two matching features were found.

12. Click *OK*.

13. Clear the *SQL where clause* box.

14. Enter the following in the *SQL where clause* box by typing or using the operators: *POP_RANK != 7*

15. Click *Test*.

16. Click OK in the *Search Results* dialog box.

17. Click OK in the *Search query builder* dialog box.

You will now see 4 cities highlighted in the *Attribute table*. The highlighted cities are those with a population rank that does not equal 7. The population rank of 7 corresponds to the population class of *Less than 50,000.* Therefore, the highlighted cities are those with a population of 50,000 or more.

18. Close the *Attribute table* using the X in the upper right corner.

    NOTE: How many cities are selected on the map? Where are they located?

19. Clear all selections using the *Deselect all features from layer*  button.

Section 5: Create a new layer from a selection

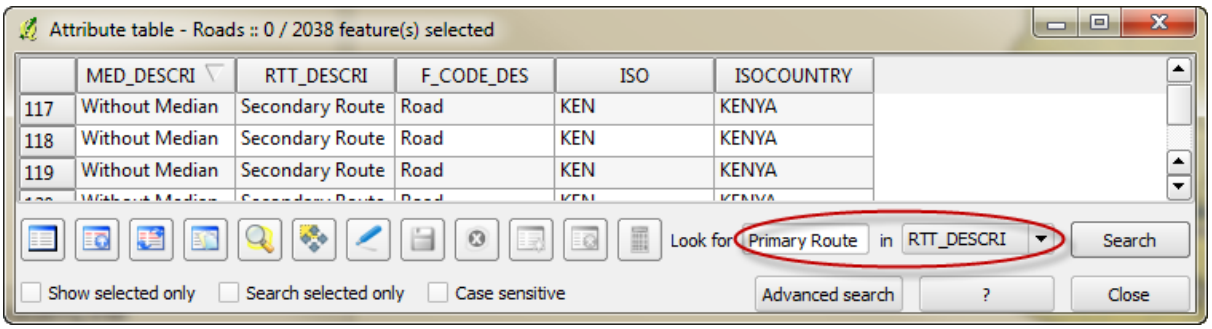
Sometimes you want to create a new layer with the information you have selected. This might be used for further querying or for display purposes.

1. Open the *Roads* layer's *Attribute table*.

2. Uncheck the box next to *Case sensitive.*

3. Type *Primary Route* in the bottom right corner in the *Look for* box.

4. In the *in* drop down menu, select RTT_DESCRI.



5. Click *Search.*

6. Click the *Show selected records only* box in the bottom right of the dialog. This will show the *Attribute table* with only the selected rows.

7. Close the *Attribute table* using the X in the upper right corner.

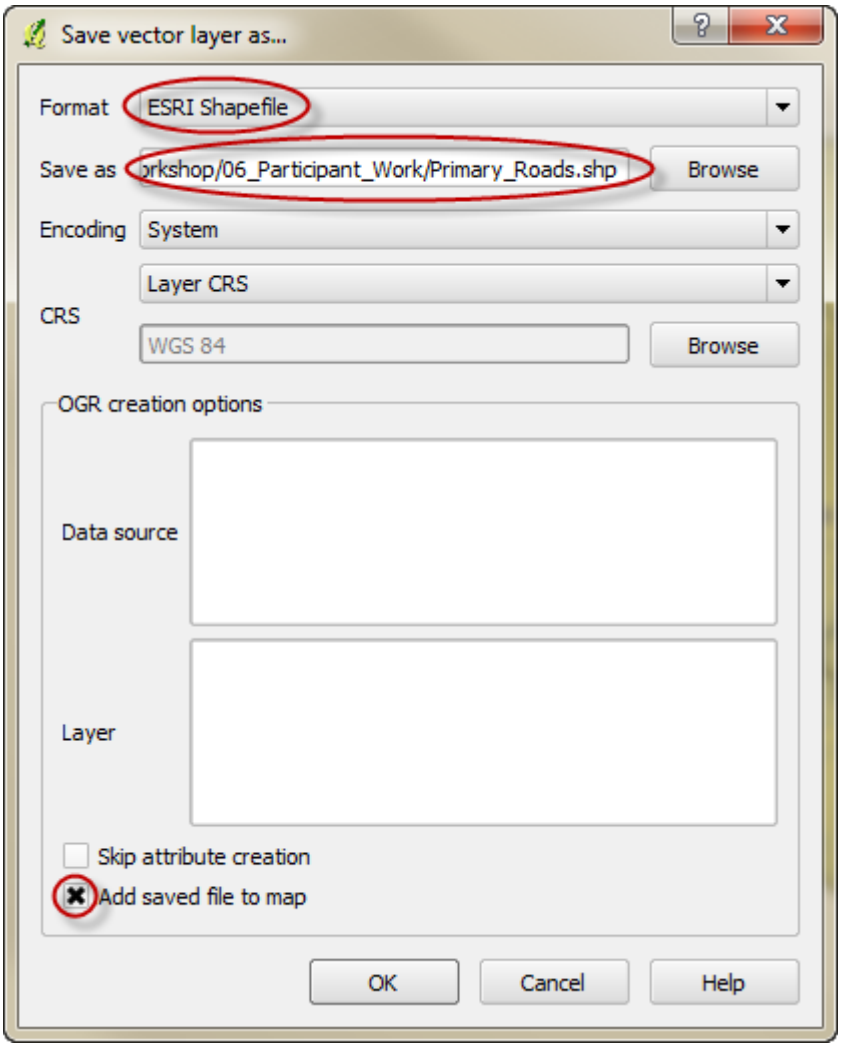
8. Click *Layer > Save Selection as Vector file...*

9. Make sure the Format is ESRI Shapefile.

10. Navigate to \\Training_Workshop\06_Participant_Work and name the file Primary_Roads.shp.

11. Check the box next to *Add saved file to map.*

The *Save vector layer as…* window should look like the example below.

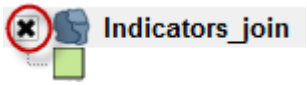


12. Click *OK*.

13. Click *OK*.

Section 6: Attribute calculation

The *Field calculator*  button allows you to make calculations in the *Attribute table* on a single column or using multiple columns.

1. Click the box next to *Indicators_join* to turn the layer on.
   

2. Open the attribute table for the *Indicators_join* layer.

3. Click the *Toggle editing mode*  button.

   WARNING: This activates the editing mode. You can change the attributes and geometry. You might want to save your layer as a new layer before performing any edits. Once you save your edits, you cannot go back to a previous version of the layer unless you have another copy of it saved.

4. Click the *Open field calculator*  button.

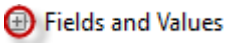
5. Type “Pop_Dens” in the *Output field name* box.

   NOTE: If the *Output field* options are grayed out, uncheck the box that says *Update existing field.* The *output field* area will now be active.

6. Change the *Output field type* to *Decimal number (real).*

7. Set the *Output field width to 10*.

8. Set the *Output field* Precision to 2.

9. Click the plus sign next to *Fields and Values*  under *Function List.*

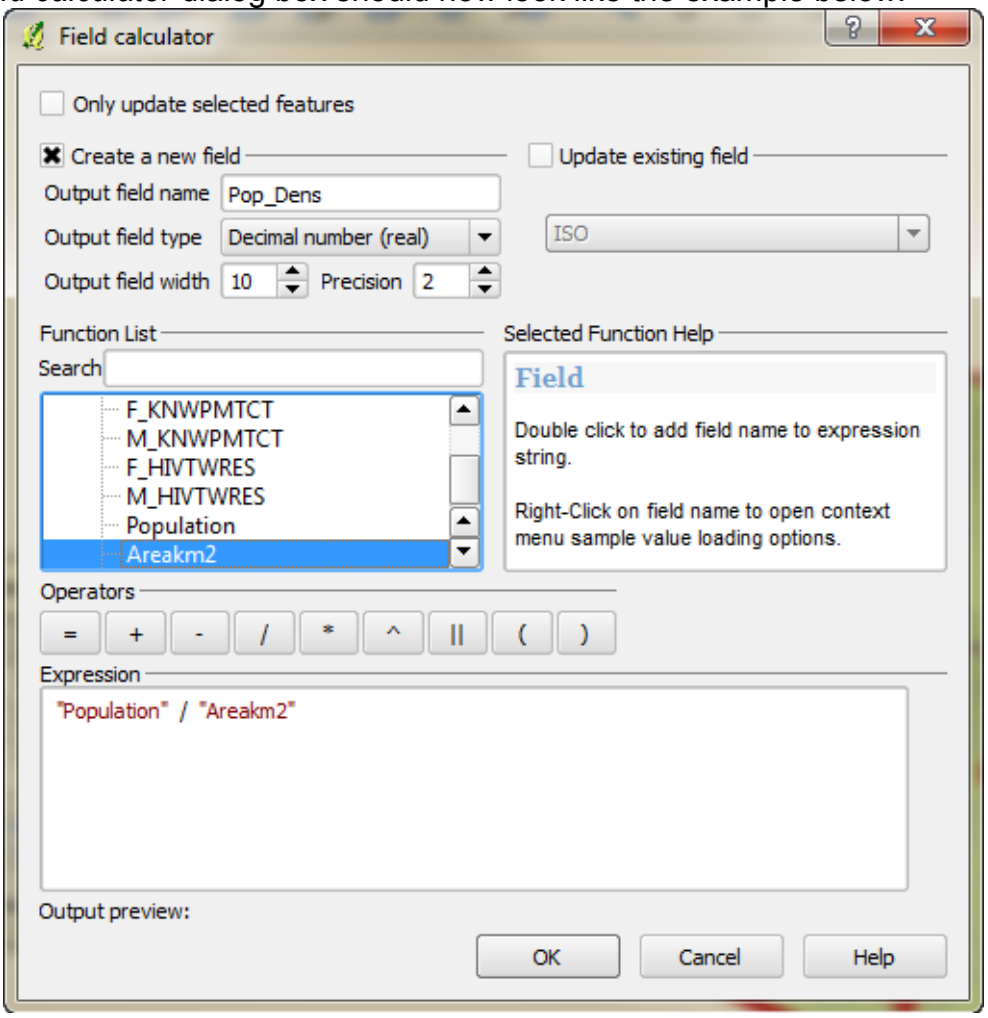
10. Scroll down to the *Population* field.

11. Double click the *Population* field. It will appear in the *Expression* box.

12. Type (or use the operator buttons) to add the division symbol in the *Field calculator expression* box

13. Double click the *Areakm2* field.

The *field calculator* dialog box should now look like the example below.



14. Click *OK.*

The new field will appear in the last column of the *Attribute table*.

NOTE: What is the value? What does this mean?

NOTE: If you make a mistake when creating a new column or calculating the attribute, you may delete the unwanted column(s) by clicking the Delete column  button. In the *Fields* tab, scroll down to the field you want to delete and click on it so it is highlighted blue. Click to select the field you would like to remove from the window that appears. Click *OK*.

NOTE: You must be in editing mode in order to delete columns.

15. Click on *Toggle editing mode*  button to exit the editing session.

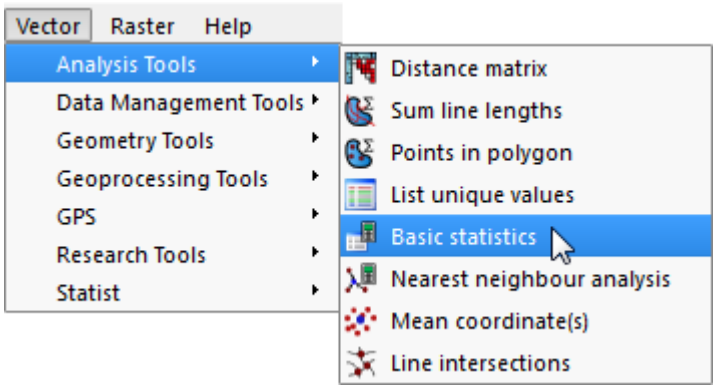
16. When prompted, click *Save.*

17. Close the *Attribute table* by clicking on the X in the upper right corner.

Section 7: Layer and selection summary statistics

Understanding the overall summary statistics of an attribute can assist in determining proper categorization of the data and better understanding of the data you are using.

1. Click *Vector > Analysis Tools > Basic statistics.*



2. Select *Indicators_join* in the *Input Vector Layer* field.

3. Select *Pop_Dens* in the *Target field*

4. Click *OK.*

   NOTE: The window will populate with the summary statistics for the number of people per square kilometer in each region.

5. Close the window using the X in the upper right corner.

6. Exit QGIS without saving.

Exercise End

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.

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QGIS Exercise: 8

Adding GPS data

This curriculum was designed as part of a joint collaboration between
MEASURE DHS and MEASURE Evaluation

QGIS Exercise 8: Adding GPS data

In this exercise you will learn how to create a point vector file from a GPS data entered as Latitude and Longitude decimal degrees in excel.

Section 1: Create a CSV file in Excel

Excel can save files in many formats including CSV files which are called a type of delimited files.

1. Open your excel file with GPS data \\Training_Workshop\05_Data\01_Excel\Settlements_Cities.xls

2. The file should contain a table with at least these columns: ObjectID, CITY_NAME, GMI_ADMIN, ADMIN_NAME, FIPS_CNTRY, CNTRY_NAME, STATUS, POP_RANK, POP_CLASS, Latitude, Longitude

3. Open the Save as… dialog

4. Navigate to \\Training_Workshop\06_Participant_Work

5. Select CSV Comma Delmited (*.csv) as the Save as type.

6. Name the file Settlements_Cities_ex

7. Click Save.

8. Click Yes in the window that appears to warn you that the file may contain features that are not compatible with CSV.

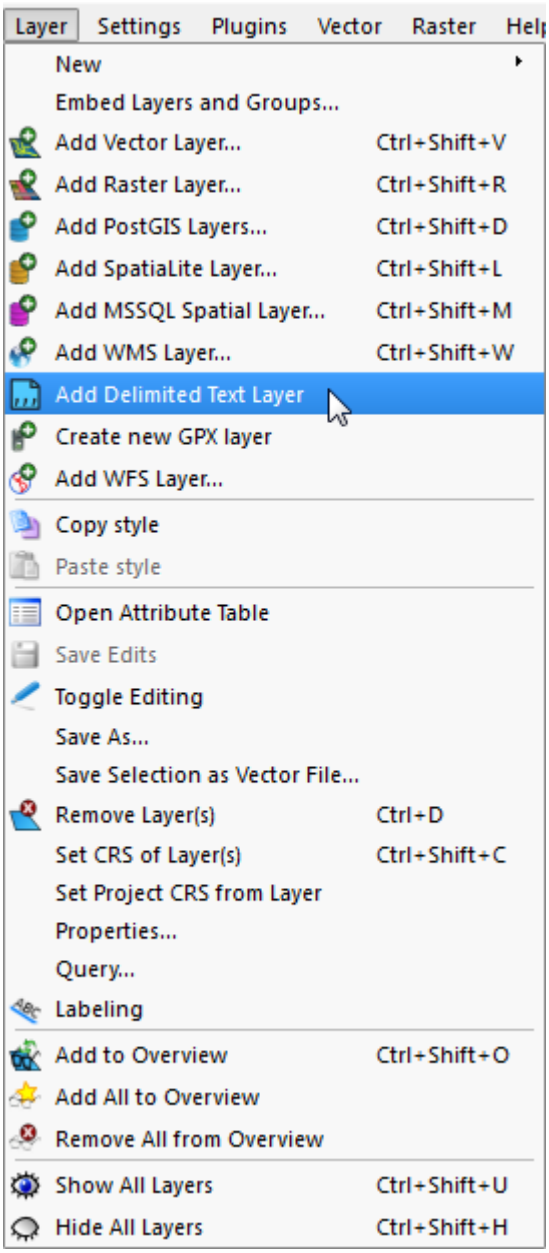
9. Close excel (you might need to click yes several time to do this as excel will confirm that you want to save and close a file in a different format).

Section 2: Add data to QGIS

Using a delimited file you can add your point data to QGIS using the *Delimited Text layer plugin.*

1. Start QGIS

2. Select Layer > Add Delimited Text Layer or click the Add Delimited Text Layer on the toolbar  (See note below if you don't see the plugin on your screen).

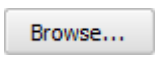


NOTE: If you don't see this tool in the menu you might need to add it. See exercise 0 for details of this process.

Here is the quick version:

1. Open Manage Plugins…
2. In the Filter box type *Delimited Text Layer*
3. Check the box next to the plugin called *Delimited Text Layer*, this will add the plugin.
4. Click Ok.
5. Now you should see the option in the menu as described above.

The Create a Layer from a Delmited Text file dialog will open

3. Click the button with three periods on it 

4. Navigate to \\ Training_Workshop\06_Participant_Work \Settlements_Cities_ex.csv

In some cases the rest of the dialog will automatically fill itself in or QGIS might tell you that you need to parse the data and the fields in the window will remain blank.

5. In the Layer name box TYPE: *Settlements_Cities_ex*

6. Select the *Selected Delimiter* s radio button.

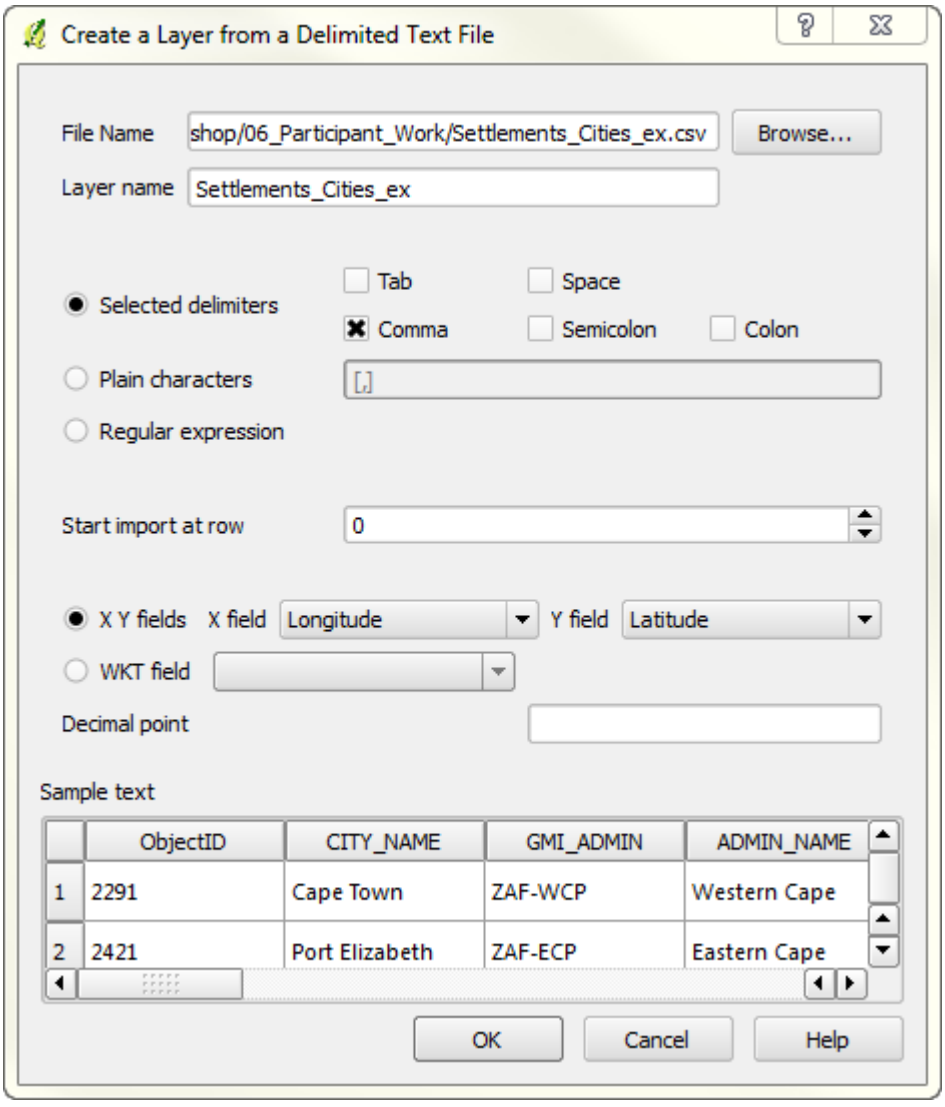
7. Check the box next to C*omma.*

8. Uncheck the box next to *Space.*

9. Set the *Start import at row* to zero (0).

10. Make sure that the X field says *Longitude* and the Y field *Latitude*

The window should look like the one below.

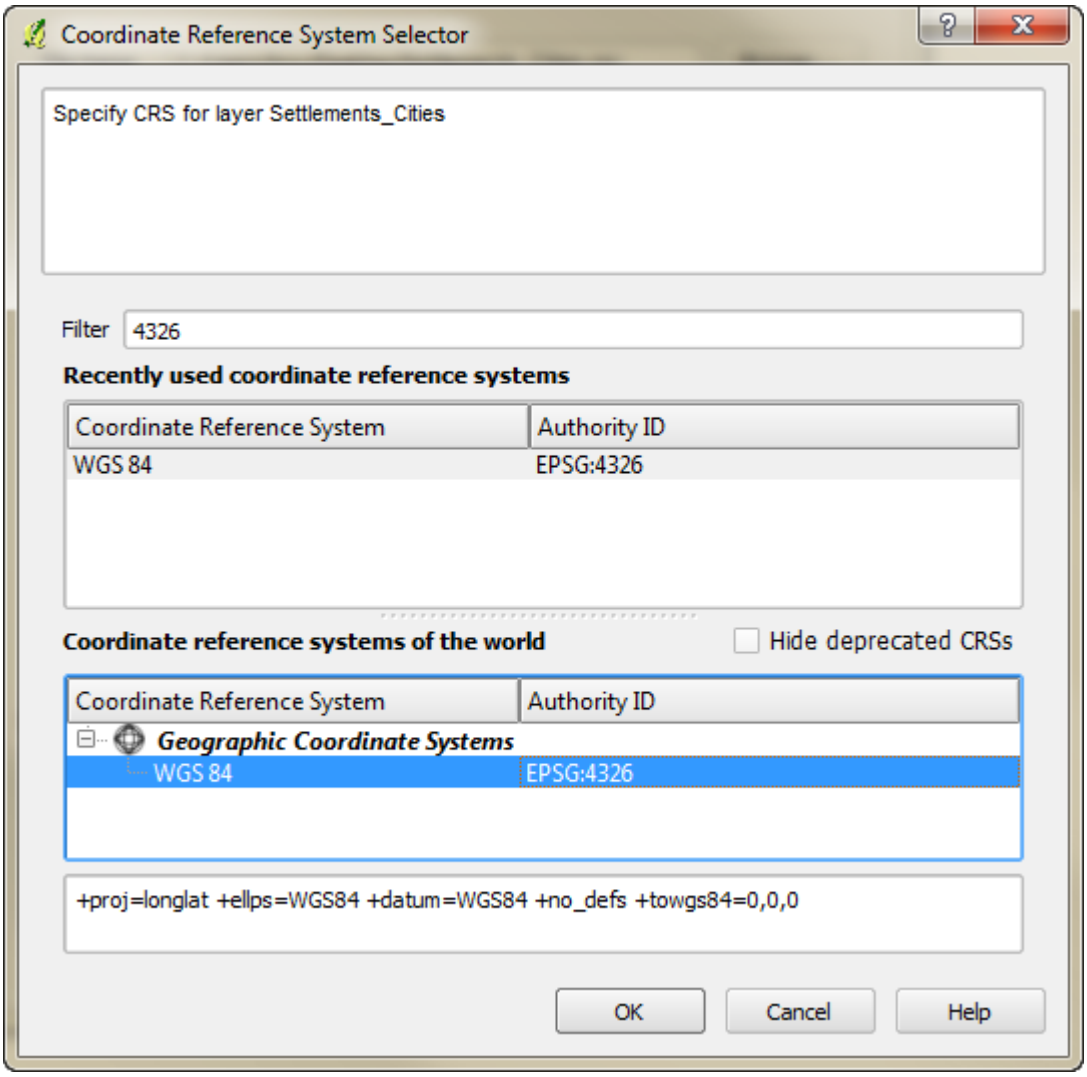


11. Click *Ok.*

The Coordinate Reference System Selector window may appear.

12. Select the *WGS 84* Coordinate Reference System using one of the following methods
    a. Scroll to the *WGS 84* Coordinate Reference System located in the Geographic Coordinate Systems category and click on it so it is highlighted in blue.
    b. *OR type 4326* in the Filter box and click the WGS 84 result.

The window should look similar to the one below.



13. Click *Ok.*

QGIS will automatically add the layer to your map.

14. Right click on the *Settlements_Cities_ex* in the Layer panel and select *Open Attribute Table.*

15. Check the attributes of the layer by looking through the Attribute table.

16. Close the Attribute table.

Section 3: Save new layer as Shapefile

When you add a delimited file to QGIS does not save the information. You need to create a shapefile to save the new layer you created from your delimited file.

1. Highlight the *Settlements_Cities_ex* layer in the Layer Panel.

2. In the layer menu select *Save as…*

3. Make sure that the Format is set to *ESRI Shapefile.*

4. Navigate to the \\Training_Workshop\06_Participant_Work.

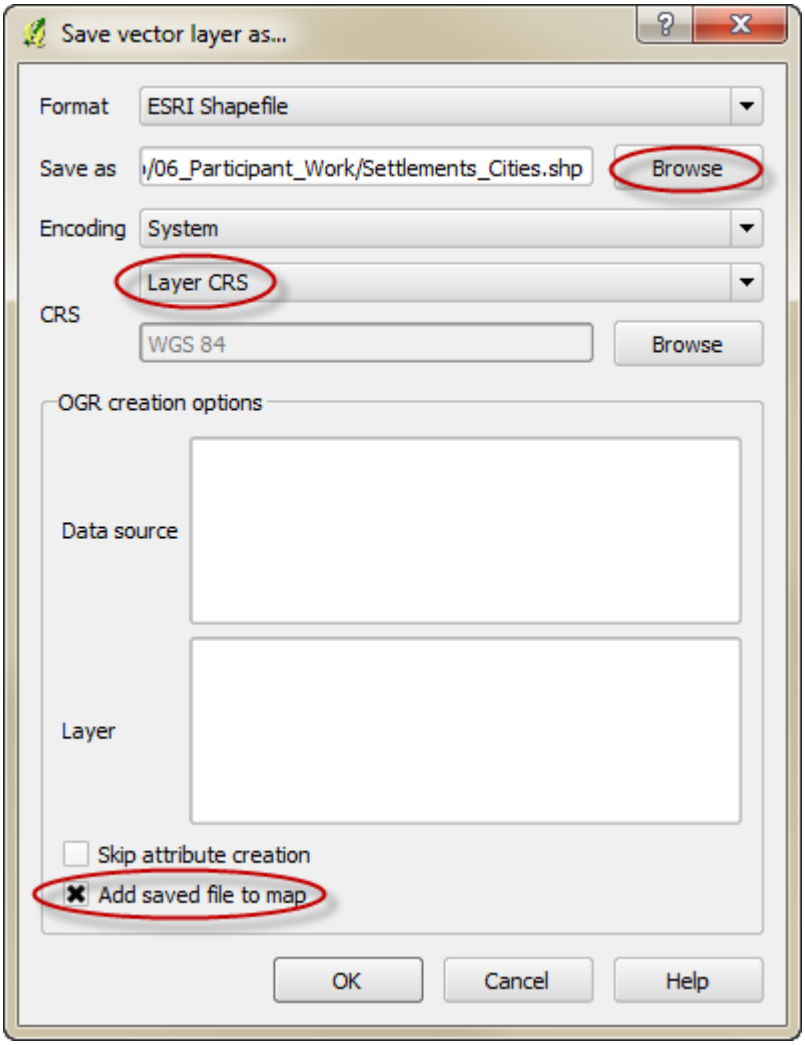
5. Name the file *Settlements_Cities* .

6. For CRS(Coordinate Reference System) make sure it is set Layer CRS, since you already defined WGS 84 as the CRS when you imported the GPS data.

   NOTE: Most common GPS format is WGS84 but verify this with the GPS unit or the data collection agency. Often this will already be in the GPS data file.

7. Check the box next to *Add saved file to map* to automatically add the newly created shapefile to your map document.

Your window should look like this example.



8. Click Ok.
9. Click Ok in the pop-up window that confirms that creation of your shapefile.
10. Exit QGIS without saving.

EXERCISE END

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QGIS Exercise: 9

Adding Raster Data

This curriculum was designed as part of a joint collaboration between
MEASURE DHS and MEASURE Evaluation

QGIS Exercise 8: Adding Raster Data

This exercise will teach you how to add and work with raster data in QGIS. In this exercise you will learn how to:

- Add a raster layer to QGIS
- Symbolize the raster layer
- Extract values from the raster layer

You will be working with a Digital Elevation Model (DEM) in this exercise. A DEM is a representation of the Earth's surface. Each pixel of the DEM provides the elevation value for that particular pixel area. Elevation values are computed from satellites equipped with specialized radar antennae.

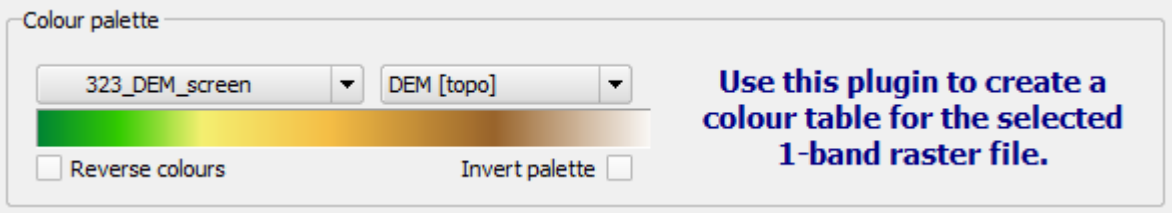
Section 1: Adding and symbolizing a raster layer

1. Start QGIS Desktop.
2. Click the *Add raster layer* icon  .
3. Browse to //Training_Workshop/05_Data/02_Raster /DEM.tif and click *Open.*
4. Click on the DEM layer in the Layer Panel to highlight it
5. Go to the *Raster* menu and select *Raster Colours > 1-Band Raster Colour Table V1.x*, **OR** click on the *1-Band Raster Colour Table* icon  from the toolbar.

   NOTE: If you don't see the *1-Band Raster Colour Table V1.x*. plugin in the menu you might need to add it. See exercise 0 for details of this process.

The 1-band raster color window will allow you to customize the symbolization of raster layers.

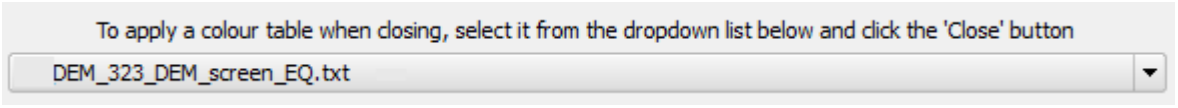
6. Click the drop down menu for *All palettes* and select *DEM [topo].* This will select all of the color palettes that have been specially designed for representing elevation.
7. Click the drop down menu for ****ColorBrewer Palette**** and select the color ramp that is green on the left, then yellow, then brown, and white on the right side. Once the proper color ramp has been selected, the name *323_DEM_screen* should appear in the drop down menu.



8. Click the *Create* 

button.

9. Select DEM_323_DEM_screen_EG.txt from the drop down menu at the bottom of the window.



10. Click *Close.*

Section 2: Extracting raster values to a point layer

This section will teach you to extract the value of the raster at the exact location of a point and add that value to the attribute table of the point layer.

1. Add the Cities_Settlements_0000 layer from \\Training_Workshop\05_Data\03_Shapefiles\00_Country

2. Select *Analyses* > *Point sampling tool* from the *Plugins* menu.

   NOTE: If you don't see the Point sampling tool in the menu you might need to add it. See exercise 0 for details of this process.

   Here is the quick version:
   1. Open Manage Plugins…
   2. In the Filter box type *Point Sampling*
   3. Check the box next to the plugin called *Point sampling tool*, this will add the plugin.
   4. Click Ok
   5. Now you should see the option in the menu as described above.

3. Select the *Cities_Settlements_0000* layer from the drop down menu for *Layer containing sampling points* under the *General* tab.

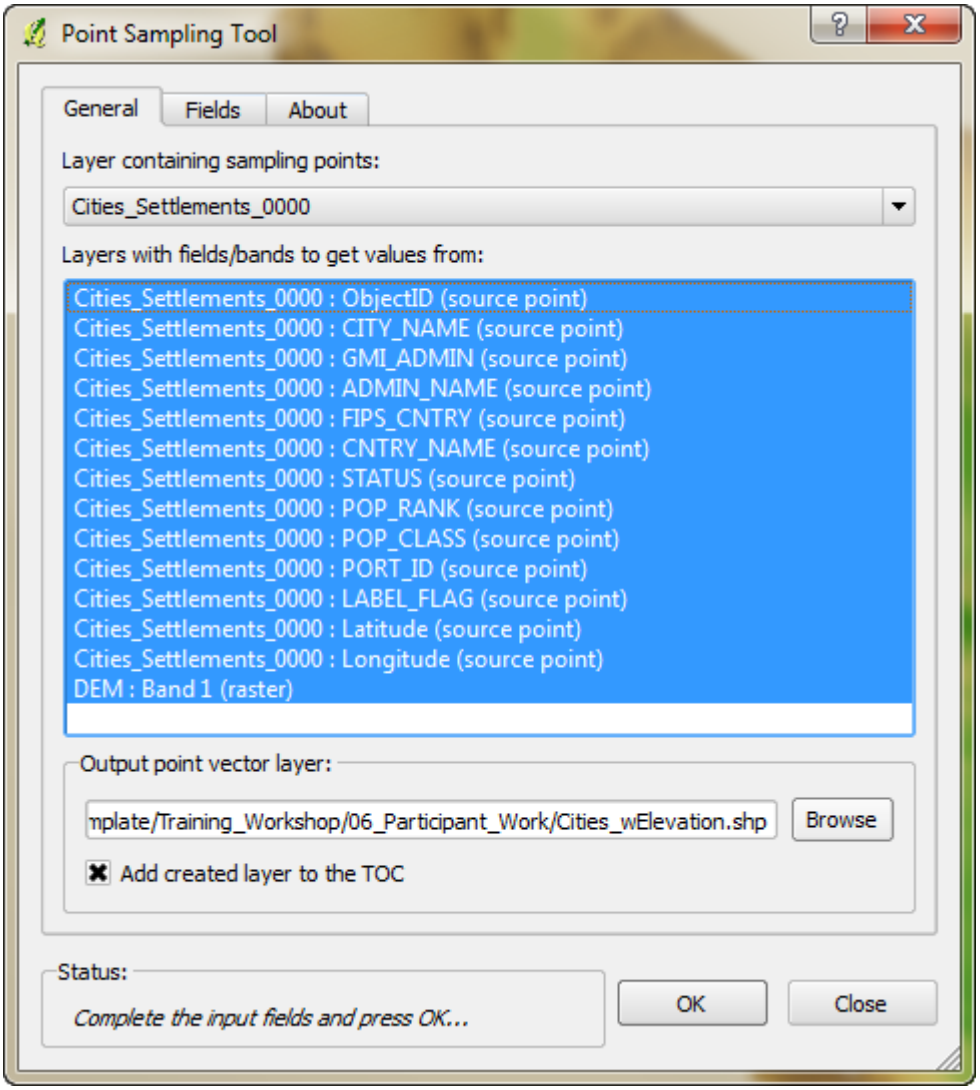
4. For *Layers with fields/bands to get values from,* select all fields that start with *Cities_Settlements_0000* and *DEM : Band 1 (raster).*

   NOTE: You must select all the fields from the layer containing the sampling points for the attribute data to from the original layer to be included in the new layer that will contain the extracted raster values.

5. For *Output vector layer,* browse to \\Training_Workshop\06_Participant_Work and name the file Cities_wElevation.shp

6. Check the box next to *Add created layer to the TOC.*

Your *Point Sampling Tool* window should now similar to this.



7. Click *OK.*

8. Close the *Point Sampling Tool* window.

9. Right click on the layer *Cities_wElevation* in the layer panel and select *Open attribute table.*

10. Scroll to the last field in the attribute table called *DEM* that contains the elevation (in meters) for each point location in the file.

EXERCISE END

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QGIS Exercise: 10

Adding Basemaps

This curriculum was designed as part of a joint collaboration between
MEASURE DHS and MEASURE Evaluation

QGIS Exercise 10: Adding basemaps

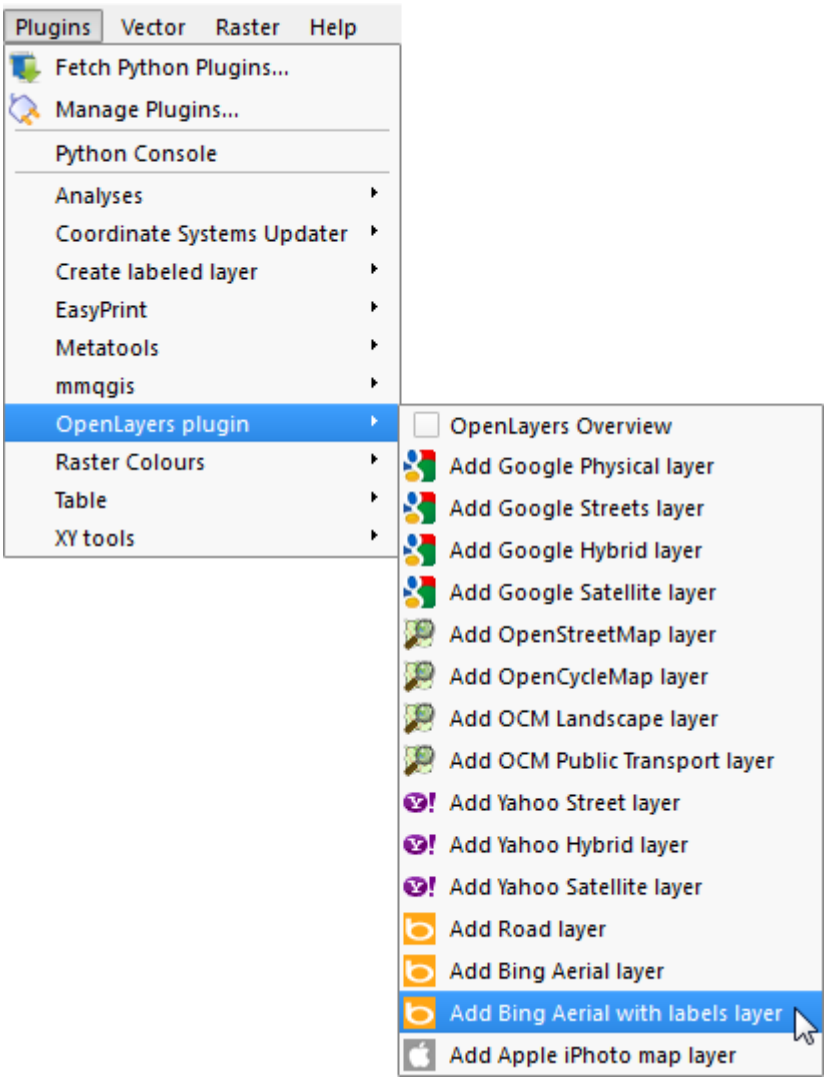
This exercise will teach you how to add aerial imagery to QGIS. When making a map, it is sometimes easier to use a pre-made base map. Depending on the map, you may use aerial imagery (with or without labels), a street map, or a hybrid of the two. In this exercise you will learn how to add aerial imagery base maps from Bing and open street maps.

Section 1: Adding vector data and a basemap

1. Open QGIS Desktop.

2. Add the DHS_Regions layer from \\Training_Workshop\06_Data\03_Shapefiles\00_Country

3. Select *Plugins* > *OpenLayers plugin* > *Add Bing Aerial layer with labels* from the *Plugins* menu.



NOTE: If you don't see the OpenLayers plugin in the menu you might need to add it. See exercise 0 for details of this process.

Here is the quick version:

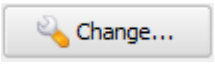
1. Open Manage Plugins…
2. In the Filter box type *OpenLayers*
3. Check the box next to the plugin called *OpenLayers plugin*, this will add the plugin.
4. Click Ok
5. Now you should see the option in the menu as described above.

The imagery may take a minute or two to load.

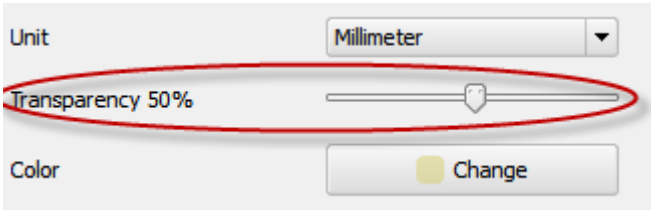
4. Once it has loaded left-click the *Bing Aerial* layer in the layer panel (also called table of contents) and hold the mouse button down while dragging the layer below the *DHS_Regions* layer.

You should now see the regions of the country over the aerial image.

NOTE: If you don't see the *DHS_Regions* layer, go to the Layers Panel (also known as the Table of Contents), left-click on the *DHS_Regions* layer and drag it to the top of the layer panel while holding the mouse button down.

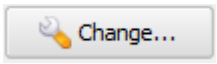
5. Right click on the *DHS_Regions* layer and select properties.
6. Click the *Style* tab.
7. Click the *Change* button on the left 

8. Select *No Brush* for the *Fill style*.
9. Select the color white for the *Border color*.
10. Click *OK.*
11. In the *Layer properties* window, adjust the *Transparency* slide to the right until the number says 50%.

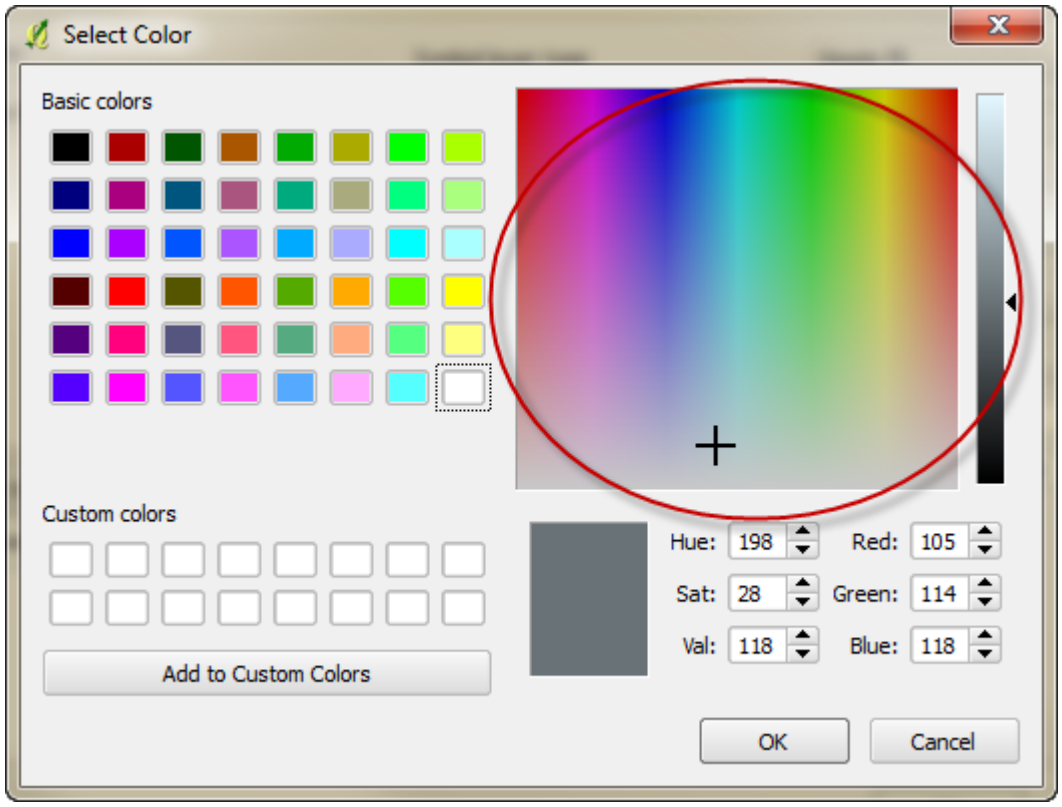


12. Click *OK.*
13. Zoom into regions at different levels and pan the map to explore the aerial imagery.

Section 2: Changing the basemap

1. Uncheck the box next to *Bing Aerial with labels* in the Layer Panel.
2. Select *Plugins* > *OpenLayers plugin* > *Add OpenStreetMap layer* from the *Plugins* menu.
3. Right click on the *DHS_Regions* layer and select properties.
4. Click the *Style* tab.
5. Click the *Change* button on the left 

6. Click the *Change* button for the *Border color.*
7. Select a dark gray color from the spectrum by clicking and adjusting the color.



8. Click *OK.*
9. Click *OK.*
10. Click *OK.*
11. If the DHS_Regions layer is not the first in the layer panel, then left-click on the layer and drag it to the top of the layer panel while holding the mouse button down.
12. Zoom into regions at different levels and pan the map to explore.

Do you notice any differences between the DHS_Regions layer and the basemaps?

In which cases do you think basemaps are useful?

EXERCISE END

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Supplemental QGIS Exercise

Buffering and Intersecting Data

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

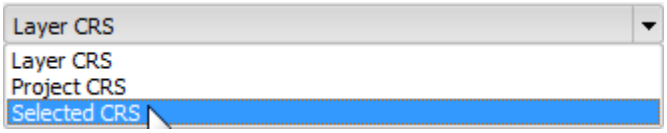
Supplemental QGIS Exercise: Buffering and Intersecting Data

In this exercise you will learn how to identify points that fall within a certain distance of a feature. This exercise will use the example of determining which towns are located close to a permanent/perennial river or lake. You will learn to buffer a shapefile using a specified distance, then perform an intersect of the buffered layer and the towns layer to determine which towns fall within the specified distance.

Section 1: Adding and re-projecting layers

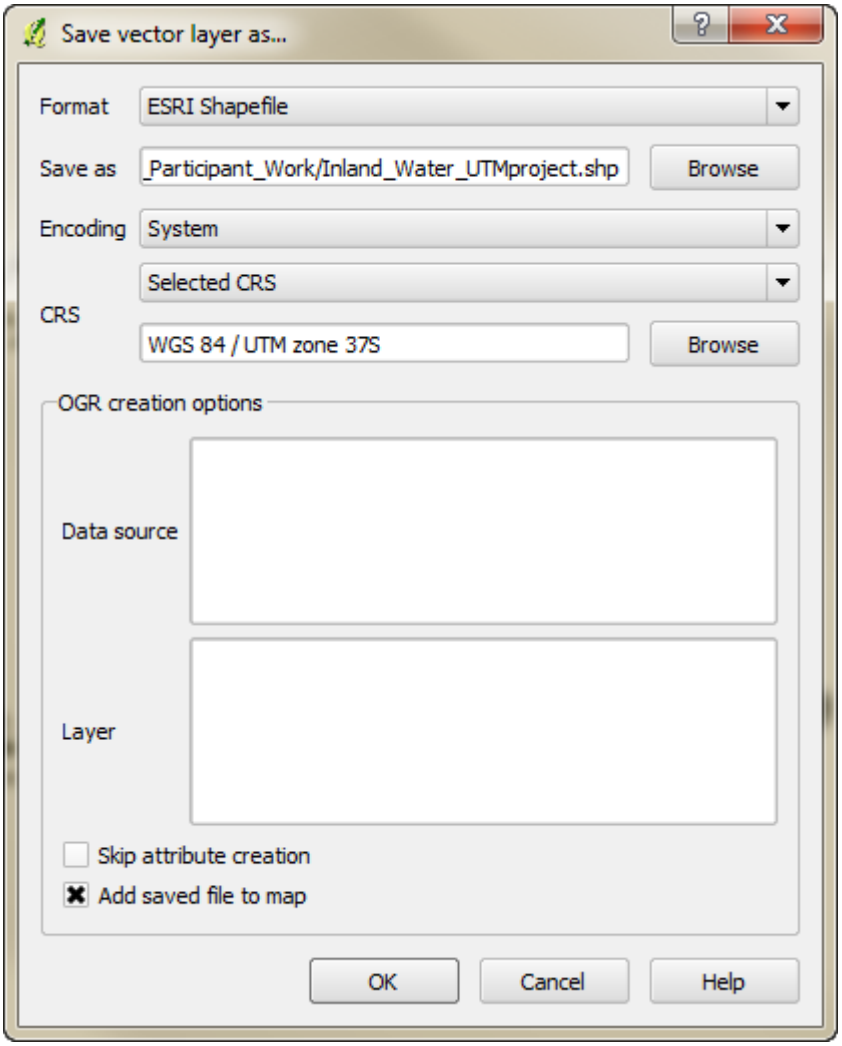
The Inland_Water shapfile is in the WGS 84 coordinate reference system, for which the units are decimal degrees. In order to buffer the layer using a distance in meters, the layer must be reprojected into a projected coordinate system with meters for units.

1. Open QGIS.
2. Add the vector layer Inland_Water from the data folder *Training_Workshop\06_Data\03_Shapefiles\00_Country\Inland_Water.shp.*
3. Right click on the Inland_Water layer and select *Save as...*
4. Select ERSI Shapefile for *Format.*
5. For *Save as,* browse to *Training_Workshop\06_Participant_Work*\ and type Inland_Water_UTMproject.shp for the file name.
6. Select *Selected CRS* from the CRS drop down menu.

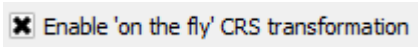


7. Click the *Browse* button to select the CRS.
8. Type *32737* into the *Filter* field of the *Coordinate Reference System Selector.*
9. Select WGS 84 / UTM zone 37S.
10. Click OK.
11. Check the box next to *Add saved file to map.*

Your window should now look like this.



12. Click OK in the *Save vector layer as…* window.
13. Go to the *Settings* menu and select *Project Properties*.
14. Check the box next to *Enable 'on the fly' CRS transformation.*



15. Click OK.
16. Turn off the original *Inland_Water* layer by un-checking the box next to it.
17. Click the *Zoom full* button  .

Section 2: Creating a buffer

You only want to buffer Perennial or Permanent water sources, so you must select them from the layer.

1. Right click the *Inland_Water_UTMproject* layer and select *Open attribute table.*

2. Click the *Advanced search* button on near the bottom right corner of the table.

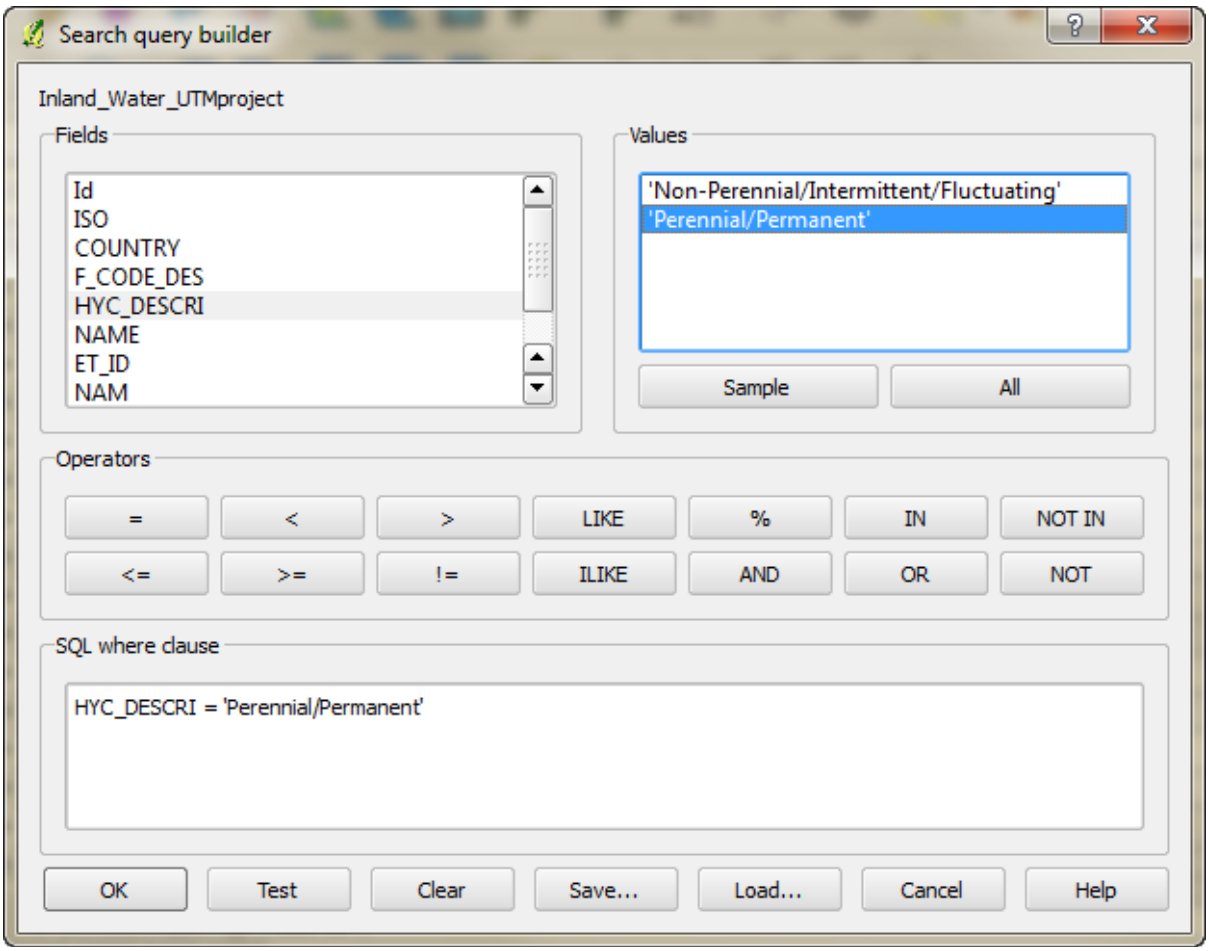
3. In the *Search query builder* window, double click the *HYC_DESCRI* field so it appears in the *SQL where clause* box.

4. In the *values* box, click the *All* button.

5. Click the equals sign in the *Operators* box.

6. Double click the *'Perennial/Permanent'* text within the *Values* box.

Your *Search query builder* window should now look like this:



7. Click *OK.*

All of the permanent river and lakes should now be highlighted.

8. Close the attribute table.

9. In the Vector menu, select *Geoprocessing Tools* > *Buffer(s).*

10. In the *Buffer(s)* window, choose *Inland_Water_UTMproject* for the Input vector layer.

11. Check the box for *Use only selected features.*

    NOTE: Using only selected features will apply the buffer to only the selected Perennial/Permanent inland water, rather than the entire layer.

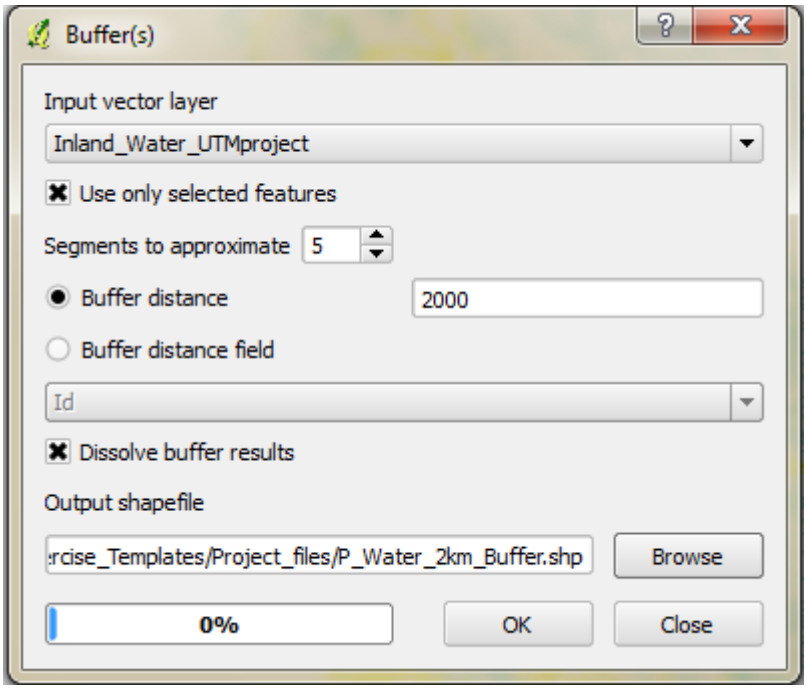
12. Select the radio button for *Buffer distance* and enter 2000 into the box. The units for the layer are in meters, so this is equal to 2 kilometers.

13. Check the box for *Dissolve buffer results.*

    NOTE: Dissolving buffer results will merge all the individual buffers of each river and lake into one single buffer.

14. Browse to \\Training_Workshop\05_Exercises\Project_files\ and name the file P_Water_2km_BufferUTM.

Your *Buffer(s)* window should look like this example.



15. Click *OK.*

    NOTE: The buffer tool make take several minutes to run. Do not click the *Cancel* button while the tool is running.

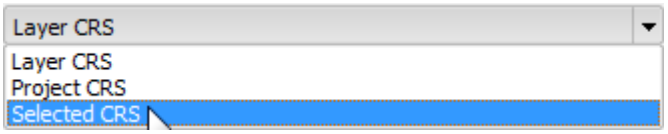
16. When the tool is done running, you will receive a prompt asking if you want to add the new layer to the TOC. Click *Yes.*

17. Close the *Buffer(s)* window.

Section 3: Re-projecting the buffer layer

Now that the buffer is complete, you must re-project your buffer layer into the WGS 84 coordinate reference system so that it matches the decimal degree units and coordinate reference system of the Settlements layer for the intersect.

1. Right click on the P_Water_2km_BufferUTM layer and select *Save as...*
2. Select ERSI Shapefile for *Format*.
3. For *Save as,* browse to *Training_Workshop\06_Participant_Work*\ and type P_Water_2km_Buffer for the file name.
4. Select *Selected CRS* from the CRS drop down menu.

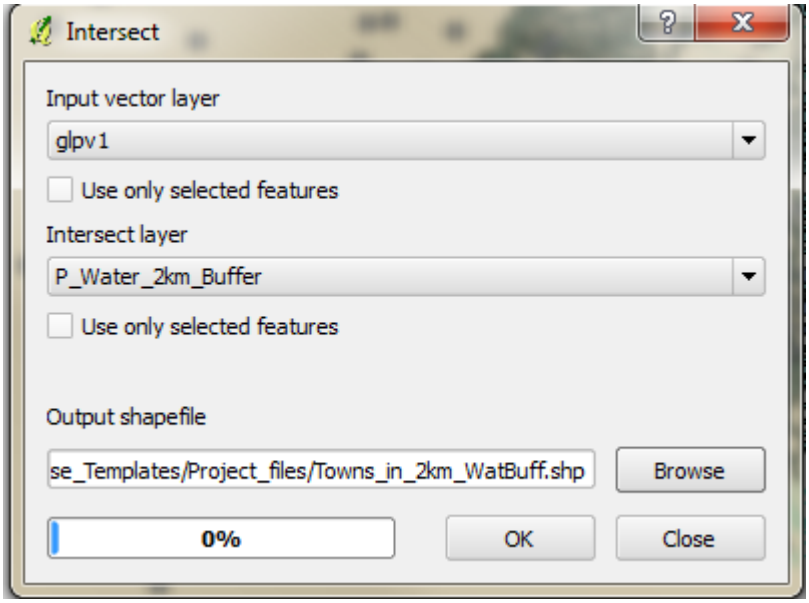


5. Click the *Browse* button to select the CRS.
6. Type *4326* into the *Filter* field of the *Coordinate Reference System Selector.*
7. Make sure the filter selected WGS 84.
8. Click OK.
9. Check the box next to *Add saved file to map.*
10. Click OK in the *Save vector layer as…* window.

Section 4: Creating an intersect

1. Add the vector layer glpv1 located at *Training_Workshop\06_Data\03_Shapefiles\01_World\gl_grumpv1_ppoints_shp\glpv1.shp*
2. In the Vector menu, select *Geoprocessing Tools > Intersect.*
3. In the *Intersect* window, select *glpv1* as the *Input vector layer.*
4. Select *P_Water_2km_Buffer* as the *Intersect layer.*
5. Browse to \\Training_Workshop\06_Participant_Work\ and name the file Towns_in_2km_WatBuff.shp

Your *Intersect* window should look like this example.



6. Click *OK.*

   NOTE: The intersect tool may take several minutes to run. Do not click the *Cancel* button while the tool is running.

7. When the tool is done running, you will receive a prompt asking if you want to add the new layer to the TOC. Click *Yes.*

8. Close the *Intersect* window.

9. Right click on the *Towns_in_2km_WatBuff* layer and select *Zoom to layer extent.*

The *Towns_in_2km_WatBuff* layer should display only the towns that are within 2 kilometers of a perennial or permanent river or lake.

Why is this information important, and how could it be used?

EXERCISE END

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Supplemental QGIS Exercise

Exploring Spatial Data

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Supplemental QGIS Exercise: Exploring Spatial Data

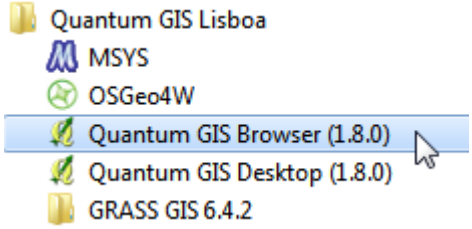
This exercise will introduce you to how to view the information and specifications about spatial data and how to download spatial data from the internet. In this exercise you will learn how to:

- Preview spatial data in QGIS Browser
- View metadata for a shapefile in an internet browser
- Download a shapefile from the internet
- Import the downloaded file to QGIS
- View metatada for a shapefile in QGIS

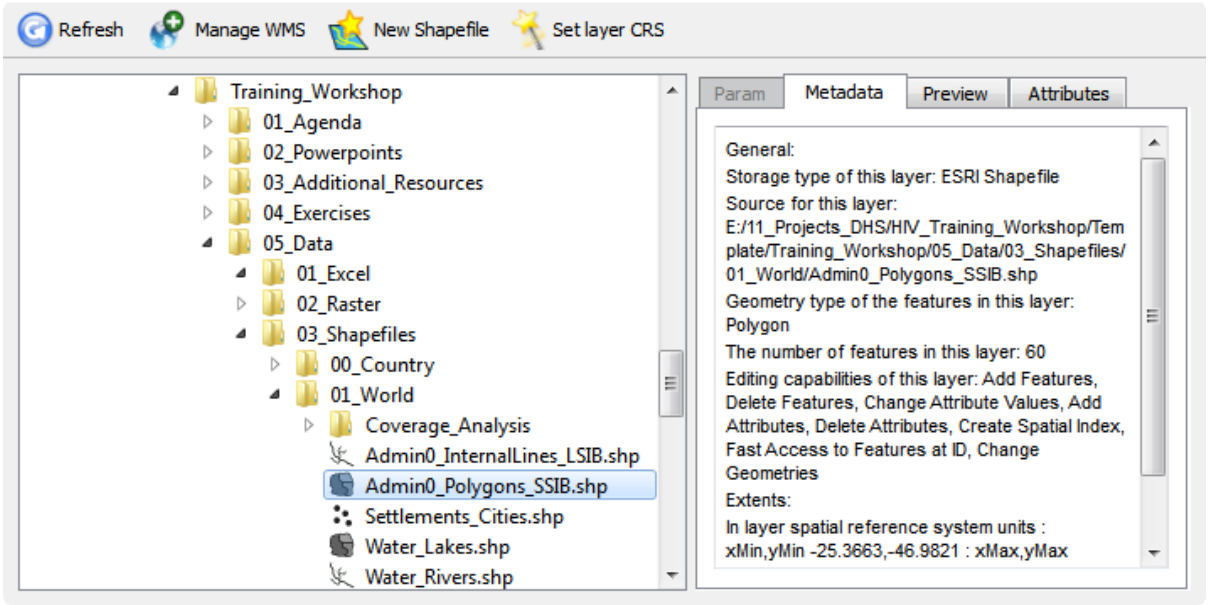
Section 1: Previewing spatial data in QGIS Browser

It is helpful to quickly glance at a preview of a shapefile or raster and its attributes without having to add it to a map document. QGIS Browser allows you to do so, and then directly drag and drop layers directly into QGIS Desktop.

1. Click *Start > Programs > Quantum GIS Lisboa > Quantum GIS Browser (1.8.0).*



2. Browse to \\Training_Workshop\05_Data\03_Shapefiles\01_World\Admin0_Polygons_SSIB.shp using the file tree on the left side of the Browser



3. Read through the information in the *Metadata* tab for the Admin0_Polygons_SSIB shapefile.

4. Click on the *Preview* tab to view a sample of the layer.

5. Click on the *Attributes* tab to view a preview of the attribute table for the layer.

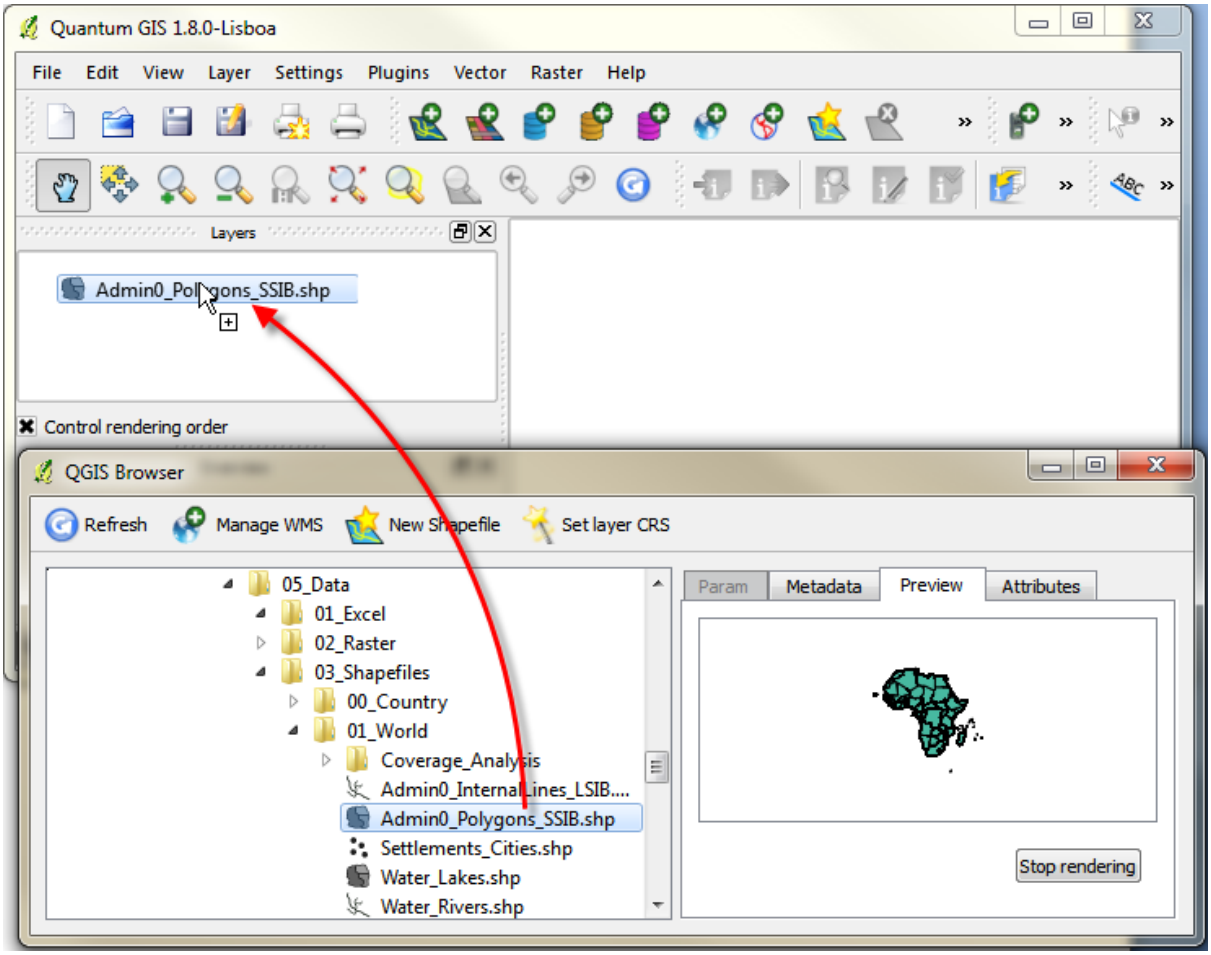
Now you will add Admin0_Polygons_SSIB shapefile to a map document from the QGIS Browser.

6. Click *Start* > *Programs* > *Quantum GIS Lisboa* > *Quantum GIS Desktop (1.8.0).*

7. Navigate back to the Admin0_Polygons_SSIB shapefile in QGIS Browser.

8. Left-click on the layer and hold down the mouse button.

9. Drag the layer from the QGIS Browser to the Layer Panel within your QGIS Desktop window.



10. Release the mouse button.

NOTE: The Admin0_Polygons_SSIB shapefile should now appear in your QGIS Desktop window. It will also still appear in the QGIS Browser window. Dragging a layer from the Browser to the Desktop window does not change the storage location of the shapefile, it simply adds the layer to a map document.

11. Close QGIS Desktop.

Section 2: Viewing metadata in an internet browser

Sometimes you would like to analyze or make a map for which you do not have all the necessary information. The internet is a good source for spatial data, but you must make sure you explore the information about files to make sure they contain the data you need, and so you know how to properly display them in QGIS.

1. Open your internet browser and navigate to http://sedac.ciesin.columbia.edu/data/set/grump-v1-settlement-points

2. Click on the *Metadata* tab.

You should see the information for the following sections:
   a. Identification
   b. Data Quality
   c. Spatial Data Organization
   d. Spatial Reference
   e. Entity and Attribute
   f. Distribution
   g. Metadata Reference

3. Read the key pieces of information
   a. Identification Information > Citation > Citation Information
   b. Identification Information > Description > Abstract
   c. Identification Information > Description > Purpose
   d. Identification Information > Use Constraints
   e. Spatial Data Organization Information > Direct Spatial Reference Method
   f. Spatial Reference Information > Horizontal Coordinate System Definition > Geodetic Model > Horizontal Datum Name

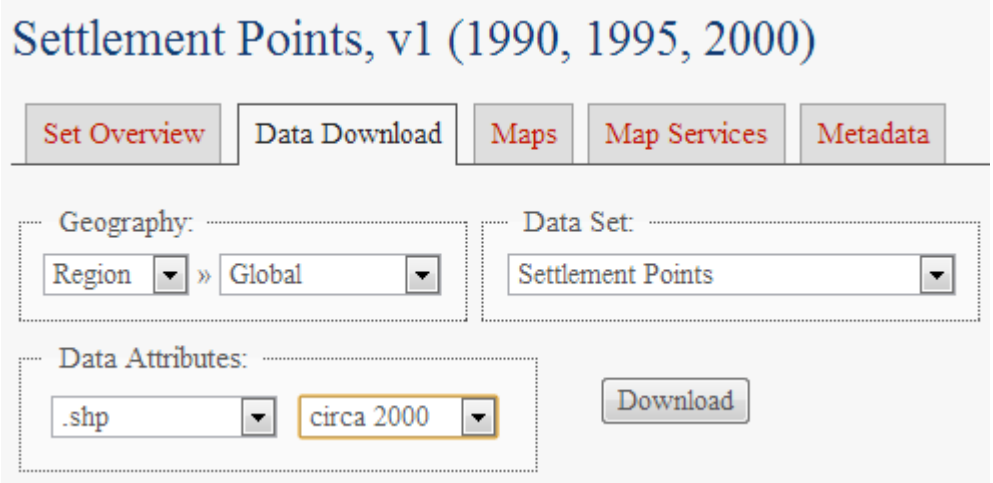
Section 3: Downloading a shapefile from the internet

1. Navigate back to http://sedac.ciesin.columbia.edu/data/set/grump-v1-settlement-points

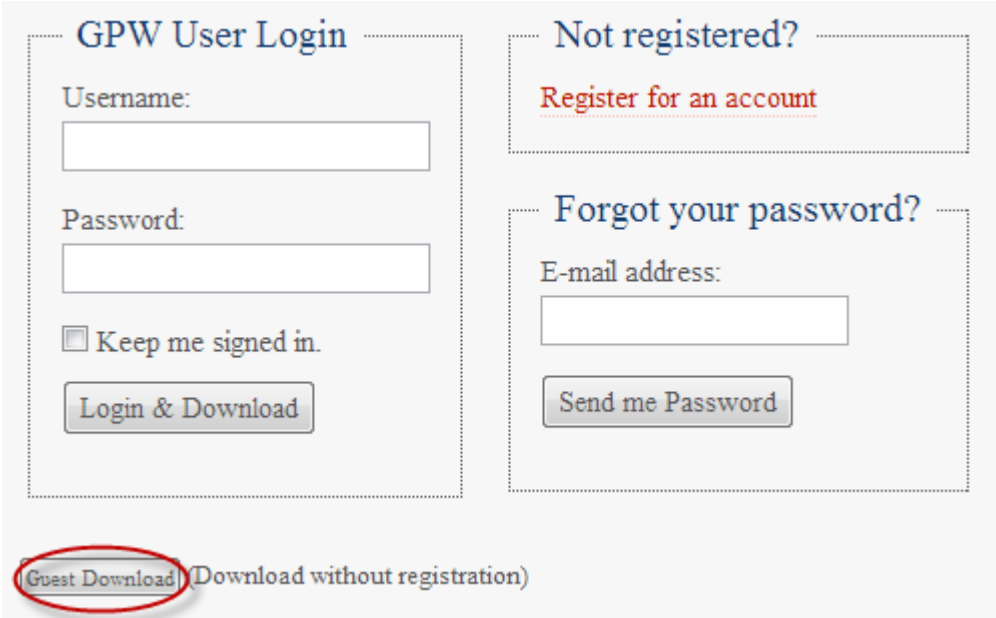
2. Click on the *Data Download* tab.

3. Select *Settlement Points* from the *Data Set* dropdown menu.
4. Select *.shp* from the *Data Attributes* dropdown menu.
5. Select *circa 2000* from the *Data Attributes* dropdown menu.

Your window should look like this image.



6. Click *Download.*
7. You will be taken to a login screen. You may either register, or click the *Guest Downloads* button under the login box.



The file will begin downloading to the default location on your computer.

Section 4: Importing downloaded data to QGIS

1. Go to the downloads folder located at C:\Users\username\Downloads and locate the file called *gl_grumpv1_ppoints_shp.zip*

2. Right click on the file and select *Extract All…*

3. Browse to \\Training_Workshop\06_Participant_Work

4. Click *Extract.*

5. If the folder does not automatically open with the extracted shapefile, navigate to \\Training_Workshop\06_Participant_Work\gl_grumpv1_ppoints_shp and open the document called *readme.txt*

ReadMe files are sometimes included when you download a shapefile, and contain helpful information that explains the data and the fields in the attribute table.

6. Read through the *readme.txt* file.

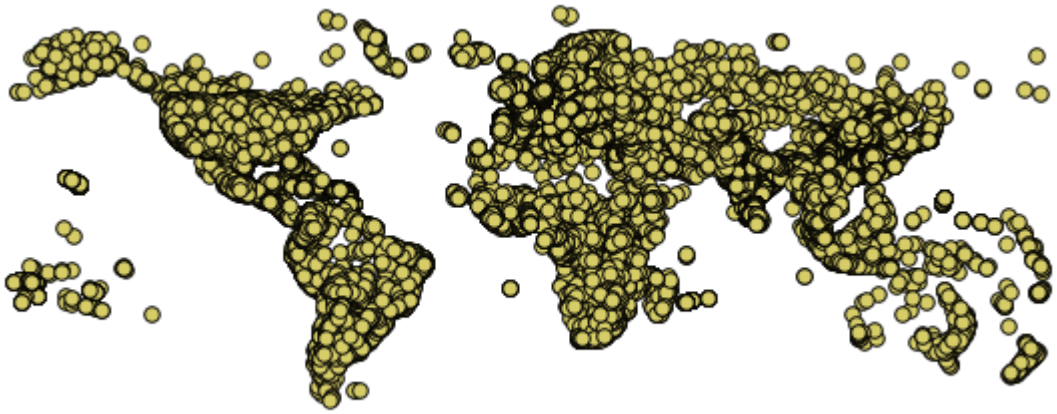
7. Open QGIS Deskstop.

8. Click the Add Vector Layer button  .

9. Browse to \\Training_Workshop\06_Participant_Work\gl_grumpv1_ppoints_shp

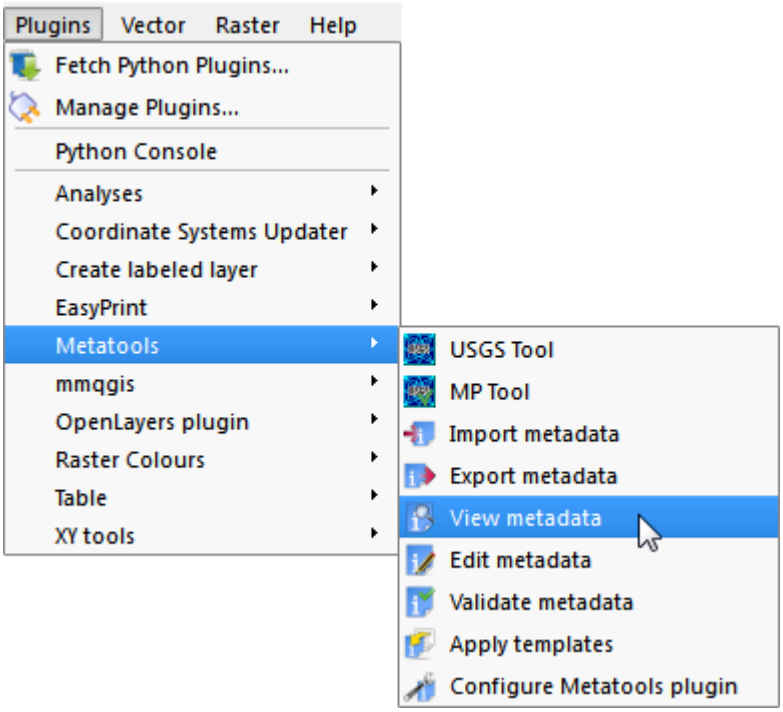
10. Click *Open.*

Your QGIS window should look similar to this image.



Section 5: Viewing metadata in QGIS

1. Select Metatools > View metadata from the Plugins menu.

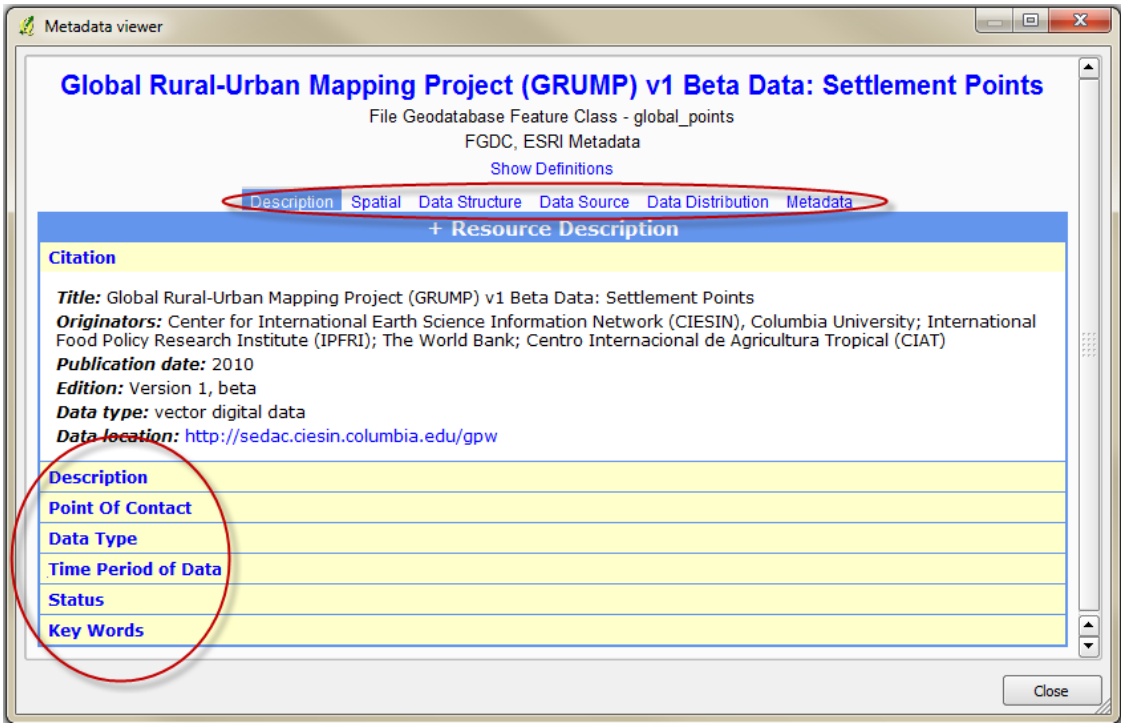


NOTE: If you don't see this plugin in the menu you might need to add it. See exercise 0 for details of this process.

Here is the quick version:

1. Open Manage Plugins…
2. In the Filter box type *Metatools*
3. Check the box next to the plugin called *Metatools*, this will add the plugin.
4. Click Ok
5. Now you should see the option in the menu as described above.

2. In the Metadata viewer window, explore the information in the tabs along the top as well as the sections under each tab.



EXERCISE END

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Supplemental QGIS Exercise

Creating Metadata

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Supplemental QGIS Exercise: Creating Metadata

This exercise will teach you how to create metadata in QGIS. In this exercise you will learn how to:

- Set a metadata standard
- Create and apply metadata templates
- Create metadata for a file
- View the metadata you created

Section 1: Set a metadata standard in QGIS

1. Open QGIS.

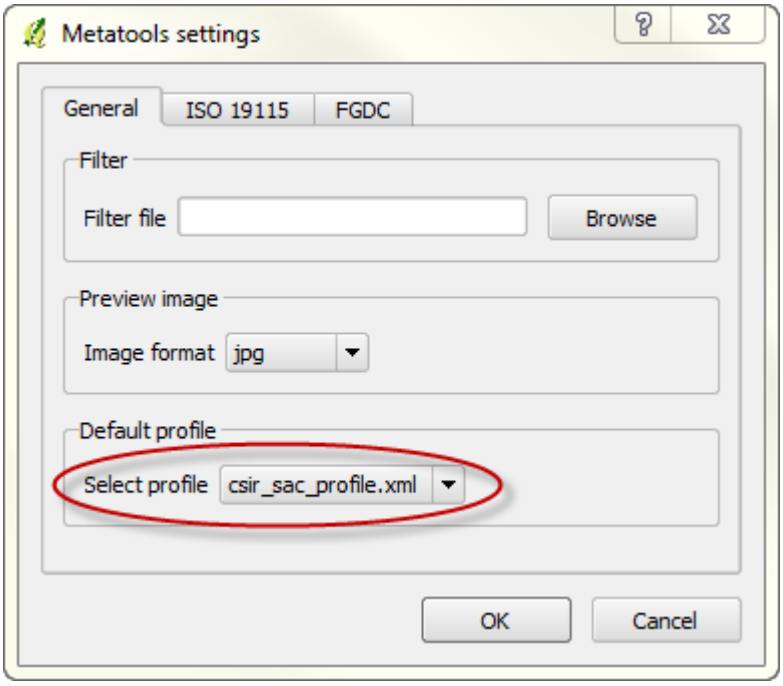
2. Add the vector layer \\Training_Workshop\05_Data\03_Shapefiles\00_Country\Indicators_join.shp

3. Right-click on the *Indicators_join* layer in the Layer Panel and select *Zoom to layer extent.*

4. In the Plugins menu, select *Metatools* > *Configure Metatools plugin*

5. Choose csir_sac_profile.xml from the drop down menu under the Default profile in the Metatools settings window > General tab.

   NOTE: There are many styles of metadata. The international standard and most widely used format is known as ISO 19115. The profile csir_sac_profile.xml follows the ISO 19115 standard.



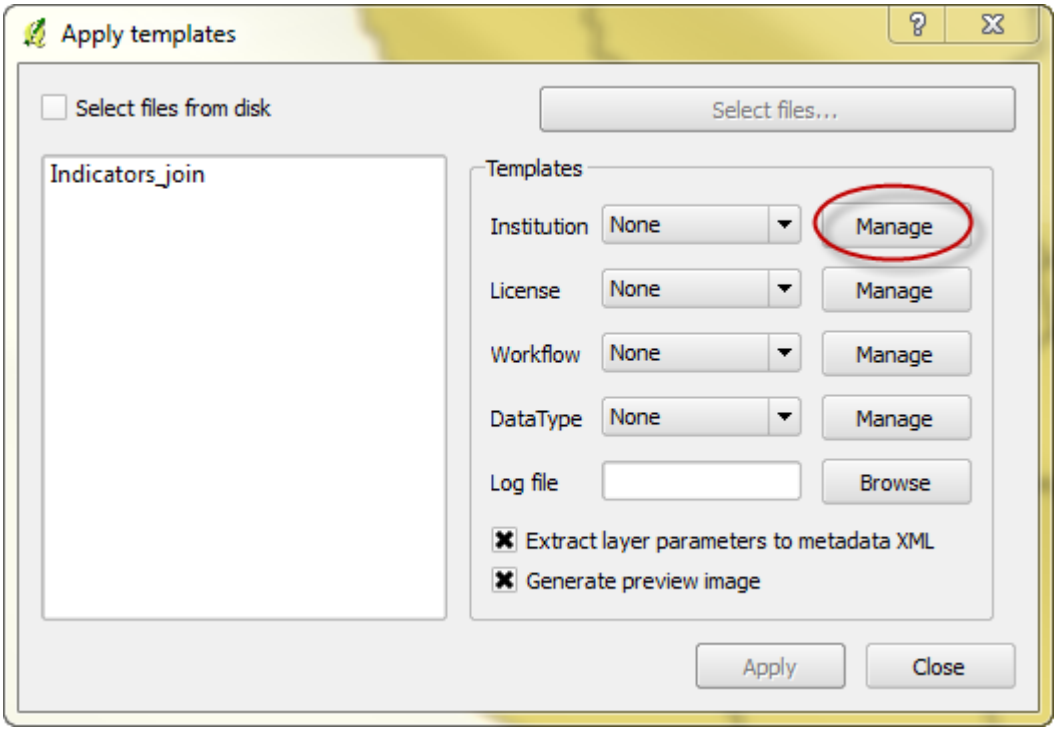
6. Click *OK*.

Section 2: Create and apply metadata templates in QGIS

Creating template information to apply to your metadata can save time since you only need to input some information once, and it can be applied to files in the future. For example, you may enter the institution and contact information once, and then apply it to all the layers you create while employed at that institution.

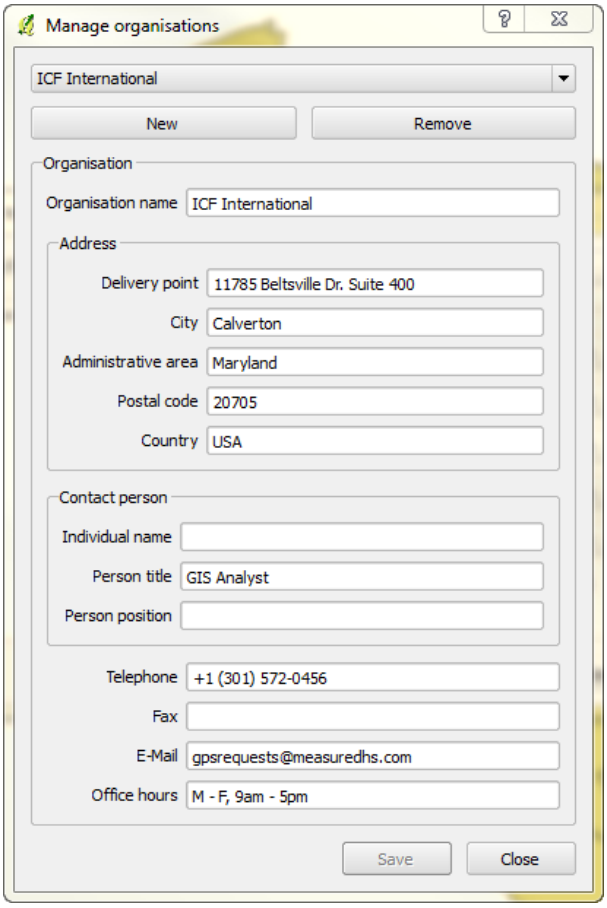
1. In the Plugins menu, select *Metatools* > *Apply templates*

2. Click the *Manage* button for the Institution in the Templates section.



3. Enter the appropriate information for your organization in the *Manage organizations* window that appears.

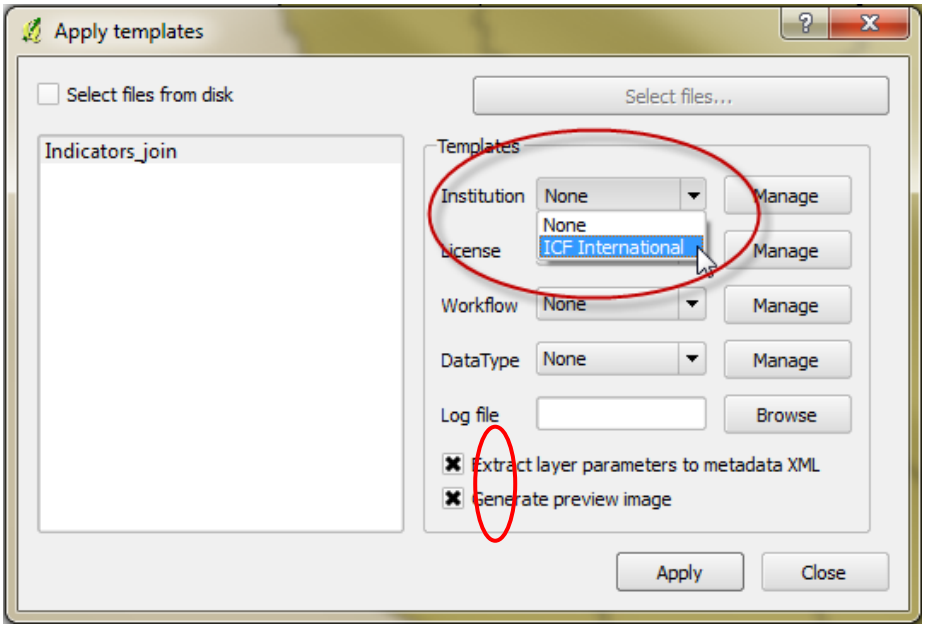
On the next page is an example of the information for ICF International.



4. Click *Save* once you have entered the information.

5. Click *Close.*

6. Select your organization name from the drop down menu next to *Institution* in the *Apply templates* window.



7. Check the boxes next to the options *Extract layer parameters to metadata XML* and *Generate preview image.*

   NOTE: Enabling the extraction of layer parameters to metadata xml will auto populate the metadata with certain layer specifications such as the data type and the spatial extent.

8. Click on the Indicators_join layer to select it.

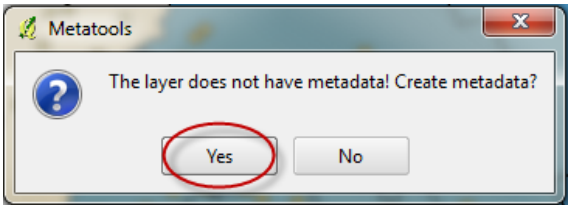
9. Click the *Apply* button.

10. Click the *Close* button.

Section 3: Create metadata in QGIS

1. Select *Metatools* > *Edit metadata* from the Plugins menu.

A window may appear warning you that the layer does not have metadata, and will ask if you want to create metadata.



2. Click *Yes.*

3. In the Metadata editor window, click on the plus sign to the left of the *MD_Metadata* under the Name column.

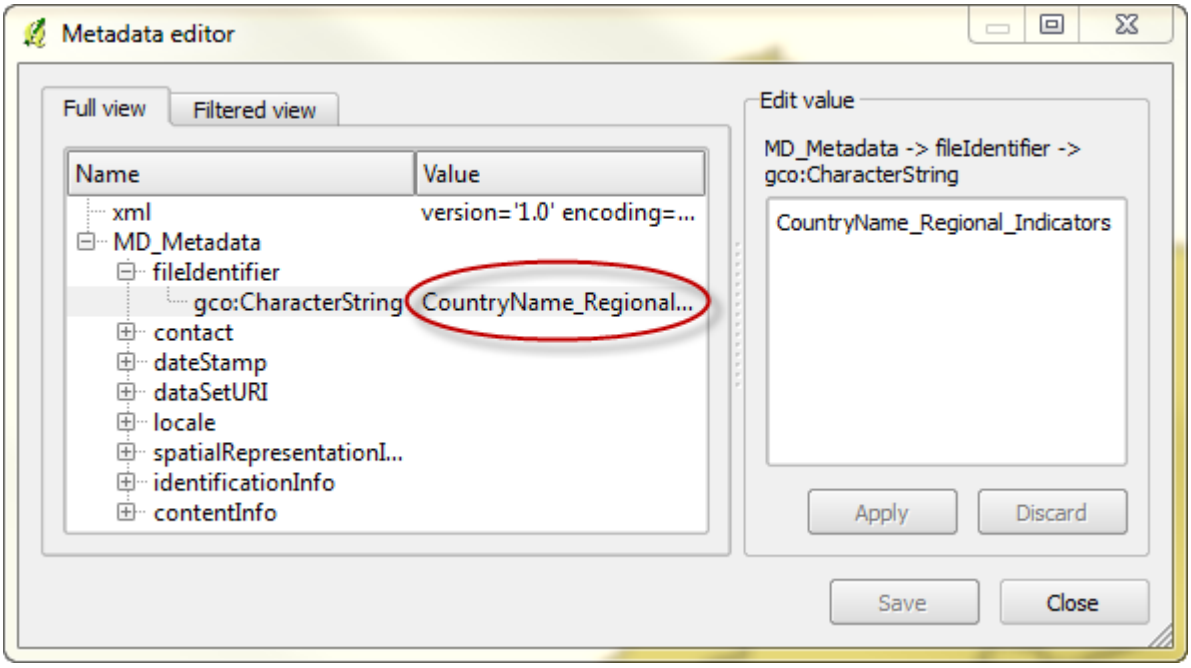
4. Click on the plus sign next to *fileIdentifier*

5. Click on the *gco:CharacterString* so that it is highlighted blue.

Within the *Edit value* window, it should say MD_Metadata -> fileIdentifier -> gco:CharacterString.

6. In the text box of the *Edit value* window, type an appropriate file identifier. For example: CountryName_Regional_Indicators.

7. Click the *Apply* button and the text you just typed will appear under the value column in the Full view tab



8. Click on the plus sign next to the *identificationInfo* field.

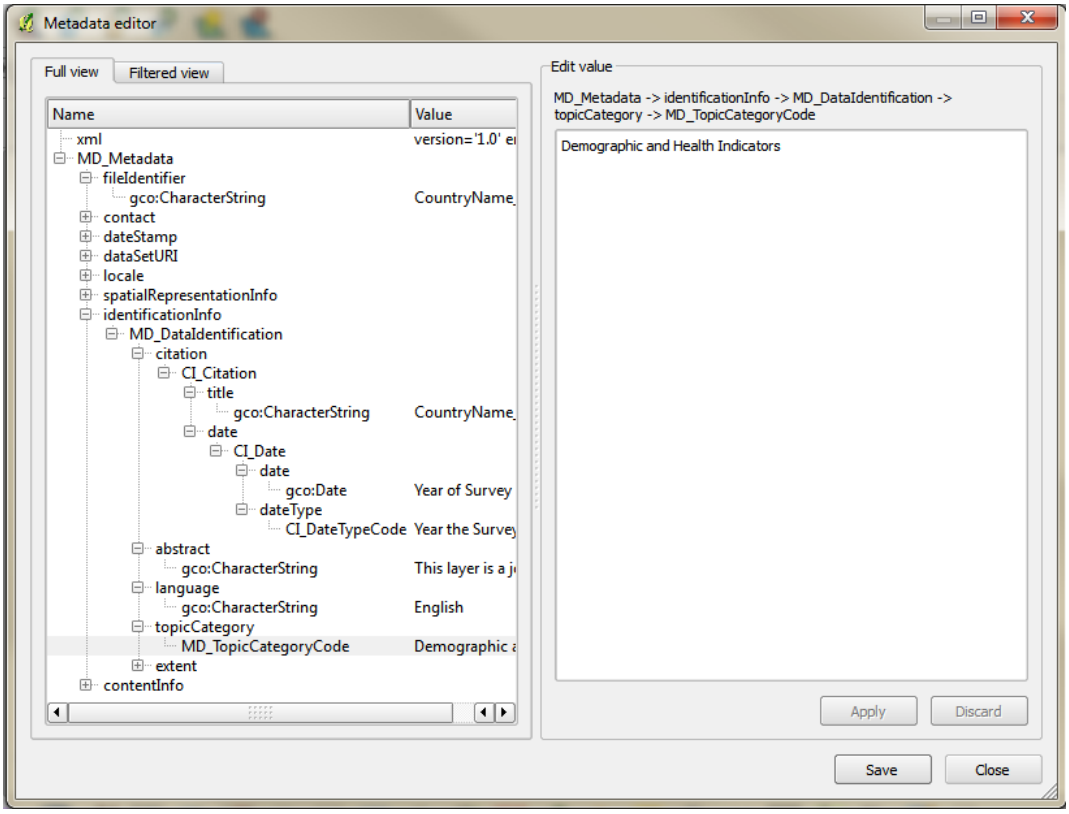
9. Click on the field *MD_DataIdentification* field that appears below.

10. Click the plus signs within the *MD_DataIdentification* field, until you reach the *gco:CharacterSring* level.

11. Fill in the appropriate information in the Edit Value section on the right for each field, making sure to click *Apply* after you enter the information for each field.

    NOTE: Ignore the extent field, which was already auto populated when you applied the template in Section 2.

Your window should look similar to the example below, but with your country's information in the value column.



12. Click the *Save* button.

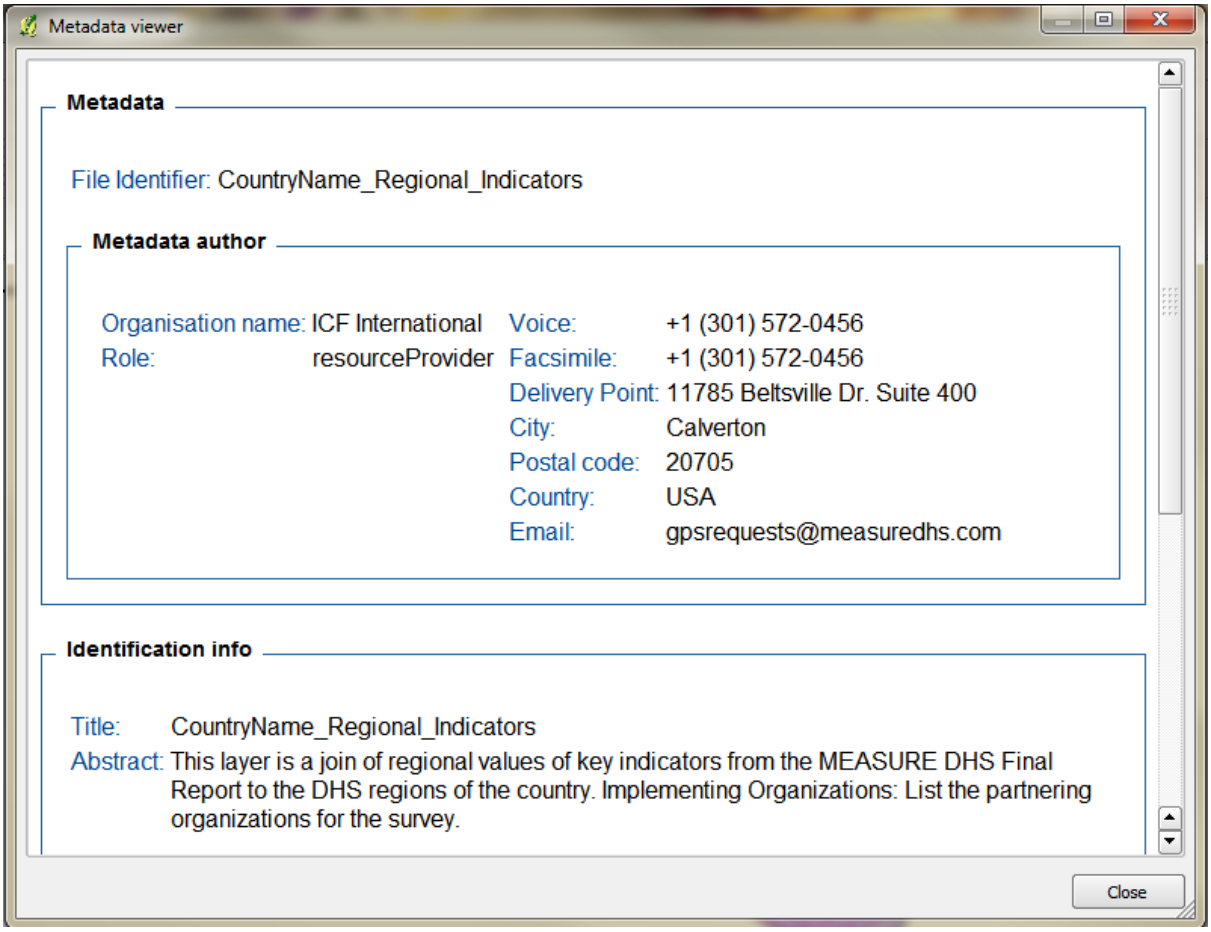
13. Repeat steps 10 and 11 for the *dateStamp* field.

14. When you have entered and saved the information, click *Close.*

Section 4: View metadata in QGIS

1. Go to the Plugins menu and select *Metatools* > *View metadata* to view the information you just entered.

The metadata view window should look similar to this, but with your information.



EXERCISE END

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Supplemental QGIS Exercise

Advanced Labeling

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Supplemental QGIS Exercise: Advanced Labeling

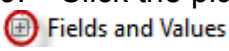
This exercise will teach you how to add complex labels to your map documents. In this exercise you will learn how to:

- Create a new multi-line label field
- Label your map with the new label field
- Manipulate the placement of your labels

Section 1: Creating a new multi-line label field

This section will show you how to create a label for each region that contains the region name, the percentage of females age 15-49 with no education, and the percentage of males age 15-49 with no education.

1. Open QGIS.
2. Add the vector layer Indicators_join.shp located in \\Training_Workshop\05_Data\03_Shapefiles\00_Country
3. Right click on the *Indicators_join* layer and select *Open Attribute Table.*
4. Click the  *Toggle editing mode* button OR type CTRL+E.
5. Click the  *Open field calculator* button OR type CTRL+I.
6. Enter *Label* for *Output field name.*
7. Change the dropdown menu to *Text (string)* for *Output field type.*
8. Change the *Output field width to 50.*
9. Click the plus sign next to the *Fields and Values* under the Function List.



10. Duble click the *DHSREGEN* field under the *Fields and Values* heading to insert it in the *Expression* box.
11. Click on the  button from the *Operators*.

    NOTE: The  operator combines multiple fields.

12. Type *'\nWomen: '*

    NOTE: Make sure to type a space between the colon and the apostrophe.

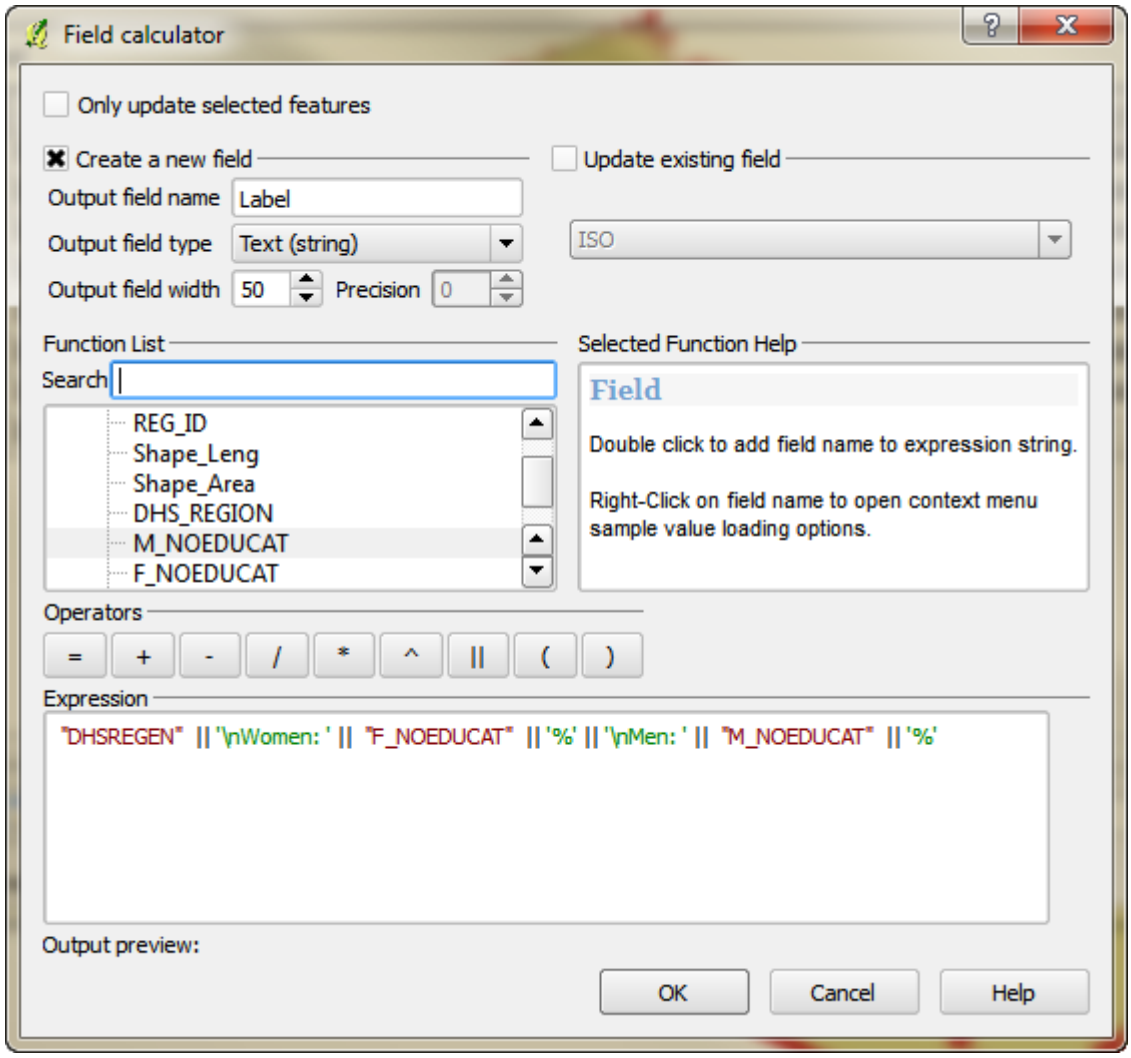
NOTE: The '\n' indicates a new line for the label. You may insert it wherever you would like a line break.

13. Click on the  button.
14. Double click F_NOEDUCAT in the *Fields* menu.
15. Click on the  button and type another space.
16. Type '%'.
17. Click on the  button from the *Operators*.
18. Type '\nMen: '

    NOTE: Make sure to type a space between the colon and the apostrophe.

19. Click on the  button.
20. Double click M_NOEDUCAT in the *Fields* menu.
21. Click on the  button.
22. Type '%'
23. Check your entire field calculator expression to make sure it now reads: DHSREGEN || '\nWomen: ' || F_NOEDUCAT || '%' || '\nMen: ' || M_NOEDUCAT || '%'

This is an example of what your field calculator window should look like.



24. Click OK.

25. If you receive an error message, check your Field calculator expression to make sure it is the same as in the above example. You may also try cutting and pasting the expression from step 23 into your field calculator expression window.

26. Open the attribute table for the Indicators_join layer and scroll to your newly created Label field. It should contain the region name on line one, followed by the percent of women with no education on the second line, and then the percentage of men with no education on line three.

27. Click on the *Toggle editing mode* button to exit the editing mode.

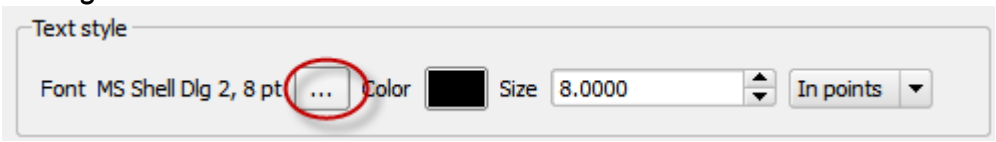
28. Click *Save* when the message appears asking if your want to save your edits.

Section 2: Label your map with multi-line field

Now that your labeling field has been generated, it is time to use it to label your map.

1. Go to the layer menu and select 

.
2. Check the box next to *Label this layer* in the *Layer labeling settings* window.
3. Select the field called Label from the *Label this layer with* drop-down menu.


4. Click on the button with three dots in the Text Style section of the *Label Settings* tab.


5. Set the *Font style* to Bold.
6. Click OK.
7. Click OK.

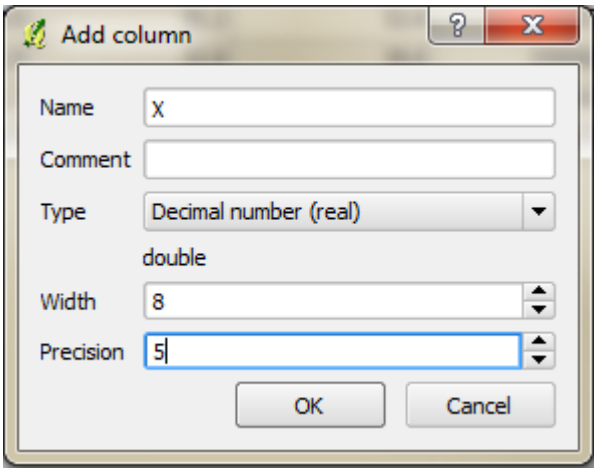
Section 3: Edit the placement of labels

For most maps, it is necessary to adjust the automatic placement of labels so they fit better with the features they are labeling.

1. Go to the layer menu and select  *Toggle editing.*

   NOTE: To edit label placement in QGIS, you must be in editing mode.
2. Open the attribute table for the Indicators_join layer.
3. Click the  *New column* button.
4. In the add column window, name the column *X.*
5. For the *Type,* select *Decimal number (real).*
6. Set the *Width* to 8 and the *Precision* to 5.

Your *Add column* window should now look like this.



7. Click OK.

8. Click the *New column* button.

9. In the add column window, name the column *Y.*

10. For the *Type,* select *Decimal number (real).*

11. Set the *Width* to 8 and the *Precision* to 5.

12. Click OK.

13. Go to the layer menu and select Labeling.

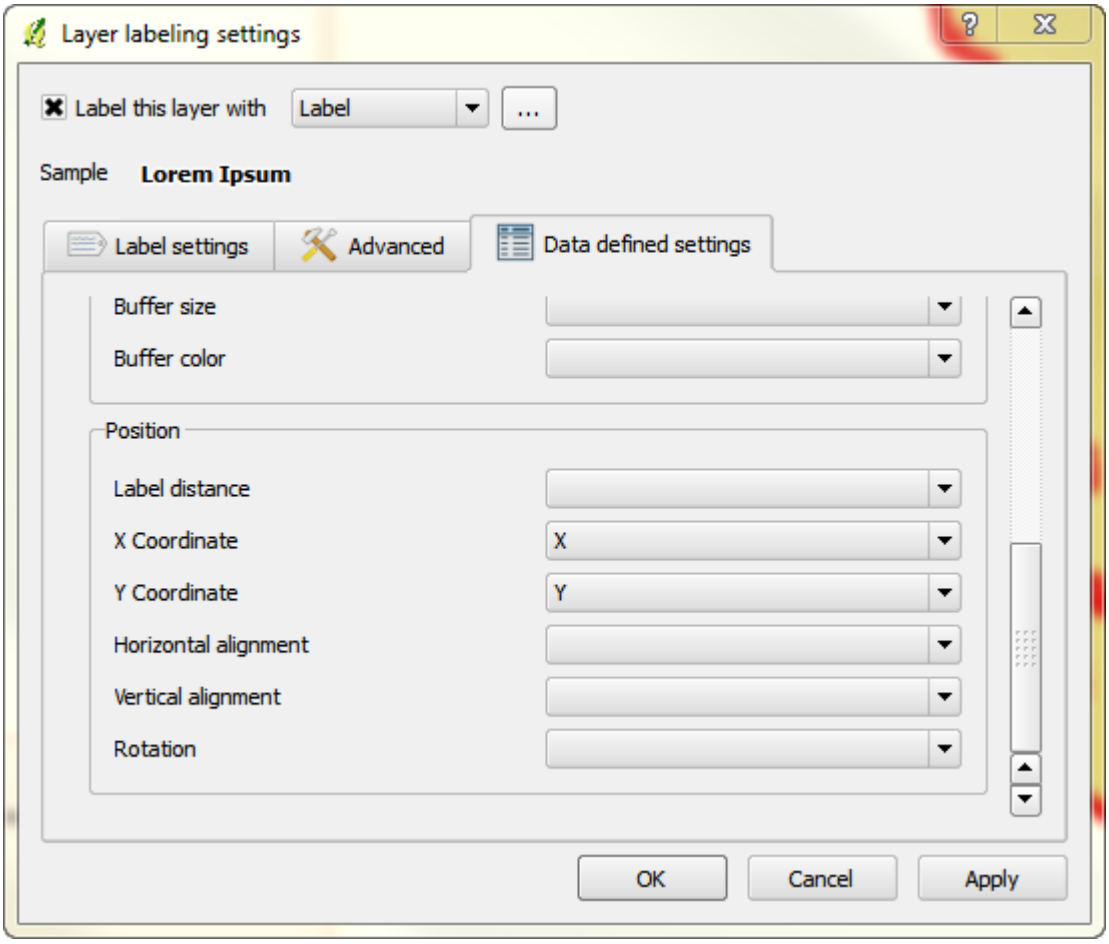
14. Click on the *Data defined settings* tab.

15. Scroll down to the *Position* box.

16. Choose the X field you just created from the drop down menu for the *X Coordinate*.

17. Choose the Y field you just created from the drop down menu for the *Y Coordinate*.

    NOTE: To edit label placement in QGIS, you must create new X and Y columns within the attribute table. The labeling plugin will automatically update the columns with the coordinates of the position where you decide to place your labels.



18. Click OK.

19. Click the  *Move label* button in the Label toolbar.

    NOTE: If you don't see the label toolbar, right click on an empty portion of your menu bar and check the box next to *Label.*

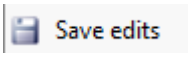
20. Move the cross hairs and hover over a label you wish to move.

21. Left-click and hold the button down. A green box will appear around the label.

22. Drag the label to where you would like it to be and then release the mouse button.

    NOTE: If you are unable to move your labels, check to make sure that the layer alias does not contain any special characters such as "à , é, ë.. etc." If it does, rename your layer without special characters.

23. Repeat steps 20 - 22 with the label for each region until you are satisfied with all the label placements.

24. Go to the layer menu and select 

.

25. Go to the layer menu and select  *Toggle editing* to exit editing mode.

26. Pan around your map. Do the labels move with the regions?

EXERCISE END

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Supplemental Exercise

Working with Google Earth

This curriculum was designed as part of a joint collaboration between MEASURE DHS and MEASURE Evaluation

Supplemental Exercise: Working with Google Earth

In this exercise you will begin by exploring the fundamentals of Google Earth. You will navigate the globe. In addition to learning how to save and print screen shots, you will learn how to create, edit, and share your own KML files, which are a type of text-based spatial data file which can be used by other mapping programs.

Section 1: Download Google Earth

1. Google Earth is available as a free download at http://www.google.com/earth/.

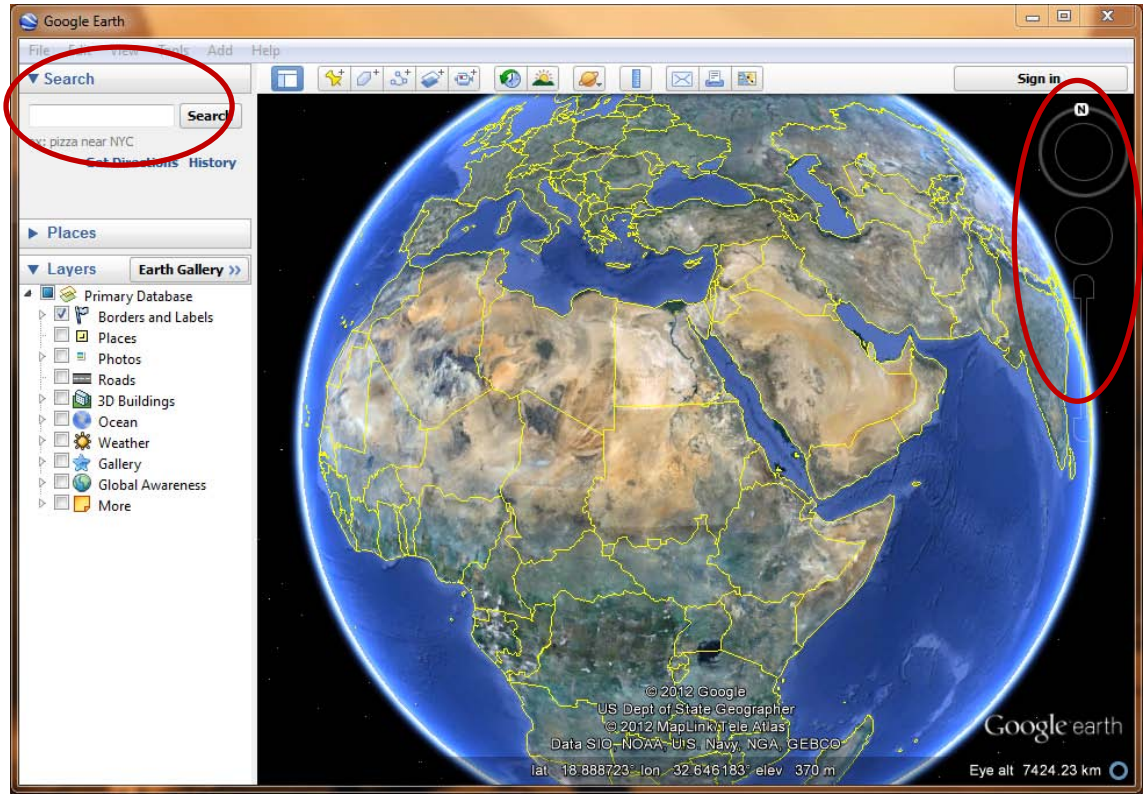
   NOTE: This exercise was created using version 6.2 of Google Earth. Icons and menus may be different in other versions.

2. Click the download button. 

3. Once the download is complete, install using the *.exe file.

Section 2: Open Google Earth and practice navigation

1. Double-click the icon for Google Earth on your screen. You should see the main view screen and menus:



2. Click and drag anywhere on the globe to rotate the globe's viewing area. To zoom in to a particular position, either double-click on it, or enter its name or its coordinates into the *Search* box, highlighted above (upper left).

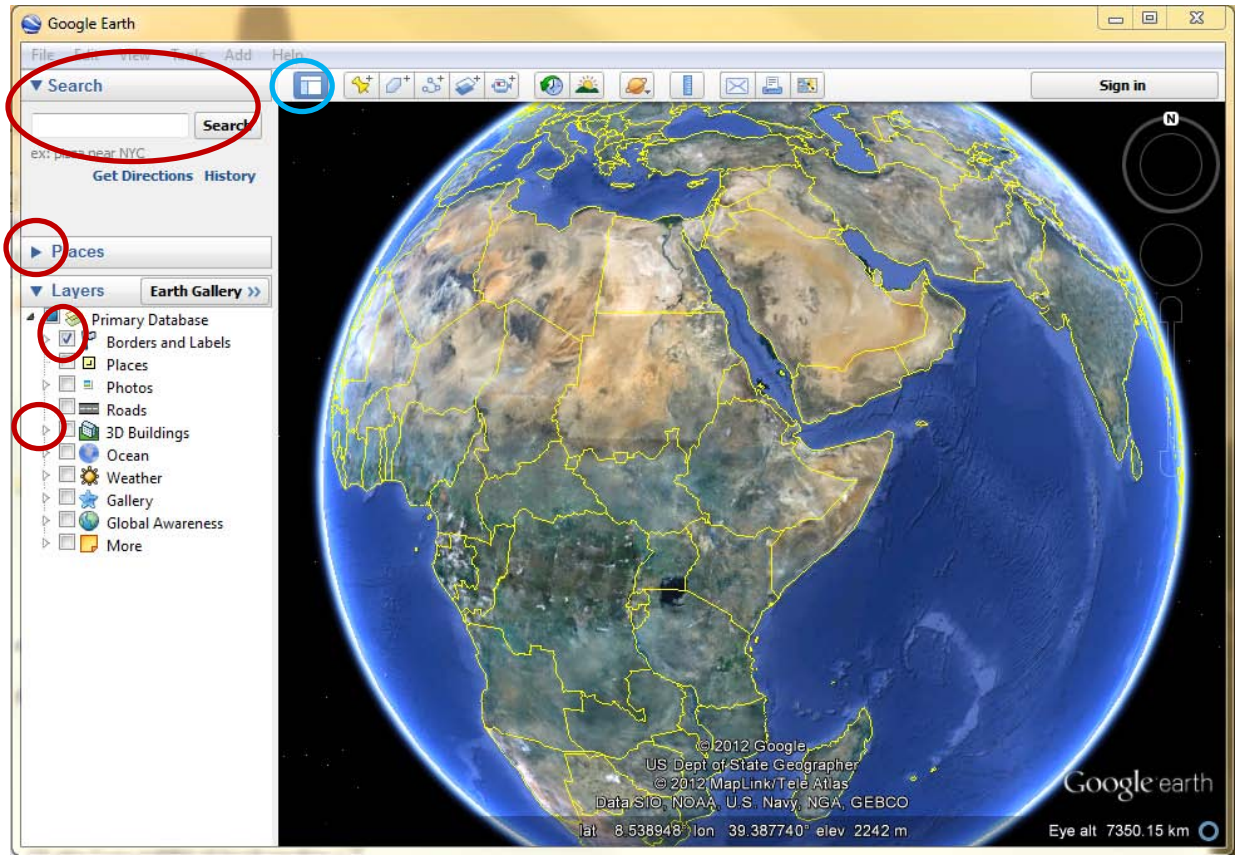
3. Practice using the Navigation controls (also highlighted above, upper right) to zoom in and out and change position.

NOTE: To orient the viewing area at any time so that North is toward the top of the screen and the viewing angle is straight downward, click the letter "R" on your keyboard or by clicking the "**N**" at the top of the navigation controls.

4. Turn the navigation controls on and off by choosing from the top menu View>Show Navigation>Always (or Automatic or Never).

5. Expand or collapse the Sidebar boxes on the left by clicking on the little triangles to the left of each of them: Search, Places, and Layers.

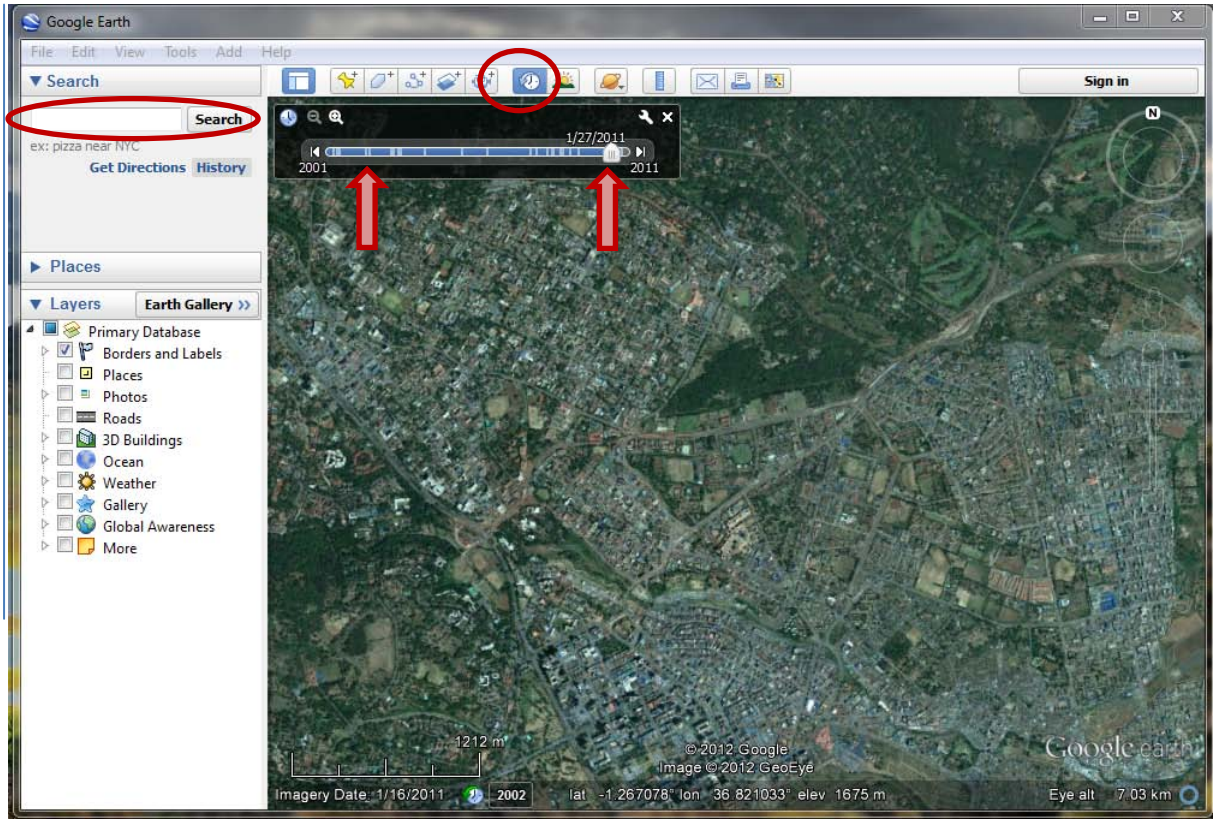
6. To fill the screen with the main view, click on the show/hide sidebar toggle button as highlighted blue below:



7. Turn on and off the streaming content available from Google Earth's Primary Database by clicking in the boxes to the left of the descriptions in the Layers sidebar. Clicking the " " sign will expand each layer into its sub-layers for more viewing control. (In the view above, only *Borders and Labels* has been displayed, as indicated by the yellow country borders in the viewing window.)

8. Zoom to your capital city by entering its name in the Search sidebar.

9. Examine historical satellite imagery by clicking on the “clock” icon along the top command bar (see below). Click on the bar which appears to select imagery from different dates. Do you see any changes over the course of time? Notice that some images taken at different times of the year or with different satellites may have variations in color, clarity and even cloud cover.



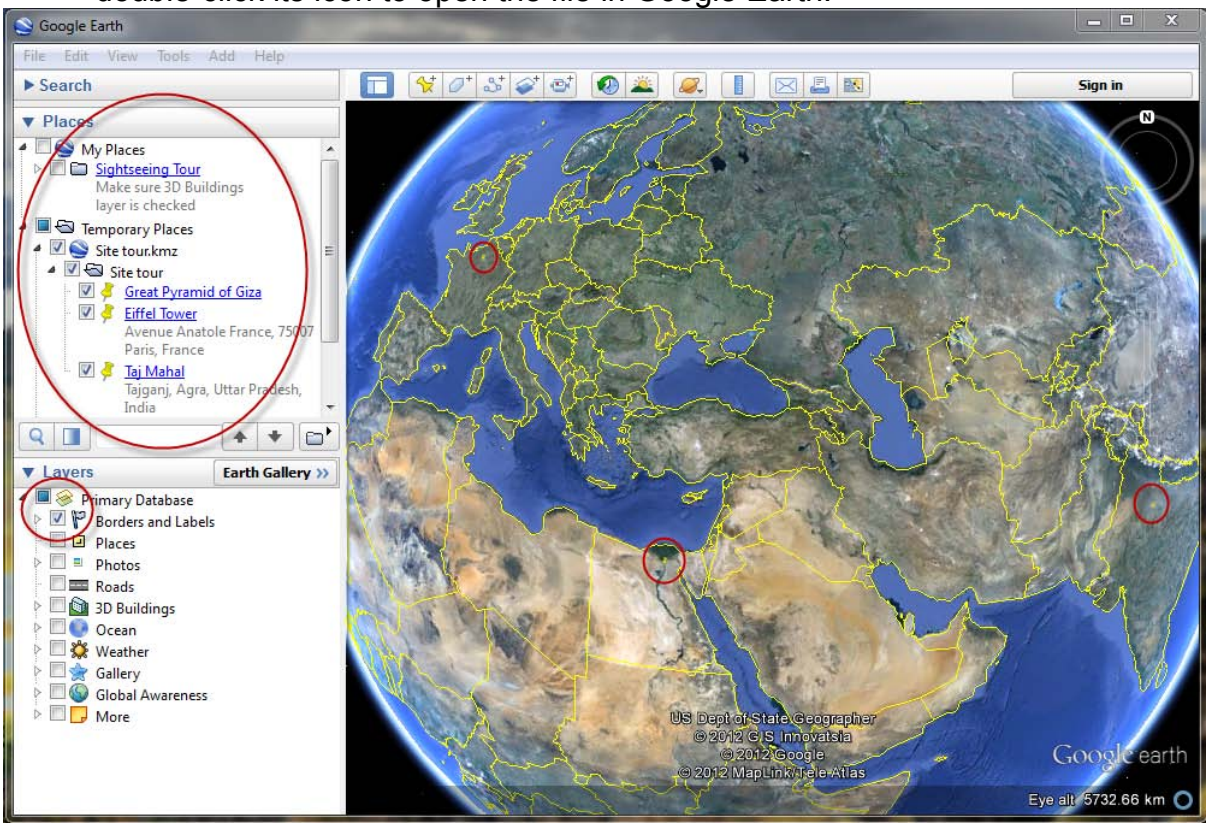
10. Close Google Earth to complete this portion of the tutorial.

Section 3: Opening a KMZ file in Google Earth

You are now ready to begin opening and creating KMZ files, a map file format which can be read by Google Earth and displayed on top of its imagery. KMZ files can contain lines, polygons, and points. KMZ is a compressed form of a KML file. A KML file can be read by Google Earth and some other GIS programs, and can also be edited in an XML editor.

> **NOTE:** KML/KMZ files use longitude and latitude (and, optionally, altitude) coordinates as defined by the World Geodetic System of 1984 (WGS 84). When using any mapping program or GPS unit it is important to note the coordinate system in use by any given map. Some GIS systems can read and convert dozens of different coordinate systems. It can be tricky to convert data accurately from one coordinate system to another. Points collected in a coordinate system other than WGS 84 will not necessarily line up with the imagery in Google Earth.

1. Browse to the file Site_tour.kmz at \\Training_Workshop\05_Data\03_Shapefiles\01_World on your computer and double-click its icon to open the file in Google Earth.



2. Your file will appear in the Places sidebar under “Temporary Places”.

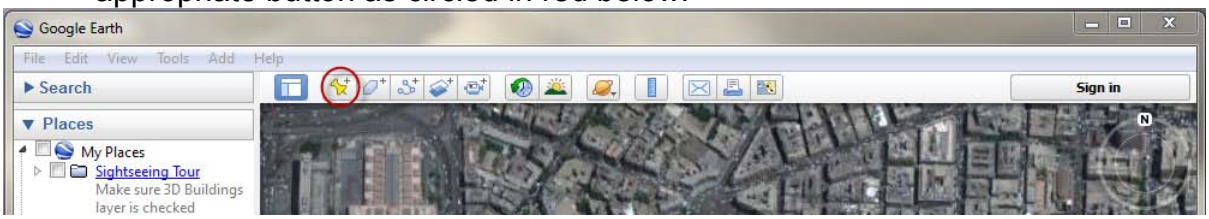
3. Click on the “▷” sign to display the list of the 3 point locations that are contained in the file. The globe image will also rotate and zoom automatically to include a view of everything contained in this file. The 3 points (displayed as yellow “pushpins”) have been circled above in red—zoom into each of them for a closer look using the navigator controls in the upper right. In the Layers sidebar, choose to display the “borders and labels” database layer for added visual reference by clicking the box to the left of its name. The borders are showing up here in yellow.

   NOTE: If you wish to save the KMZ file to “My Places”, Google Earth will then find and open this file each time you open Google Earth. If not, you will need to locate it on your own to open it. You will be asked, each time you close Google Earth, whether you would like to save the files in your *Temporary Places* folder in this manner. Not saving a KMZ file to *My Places* does **not** delete the file from your computer; it simply means you will need to find it on your own next time.

Section 4: Creating a KMZ file in Google Earth

1. Using the navigation controls, zoom into your home city and visually locate 5 places of interest (for example, hospitals, health facilities, schools, etc.).

2. Zoom into the first one and choose Add>Placemark, or simply click on the appropriate button as circled in red below.



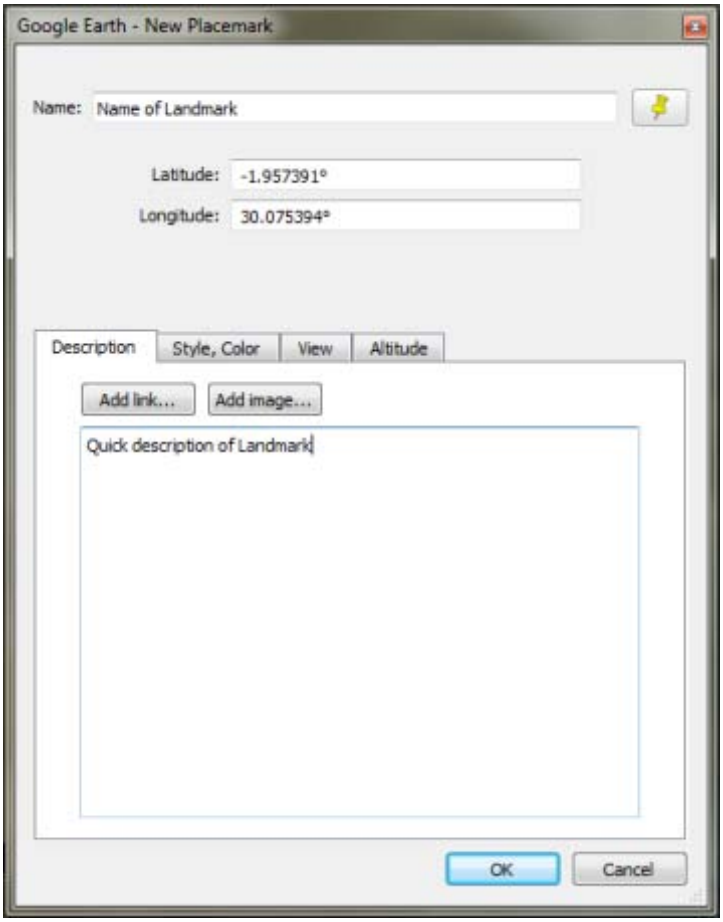
3. A new marker will be placed in the middle of the current view screen and a *Google Earth – New Placemark* window will open

4. In the *Name* box, enter the name of the placemark.

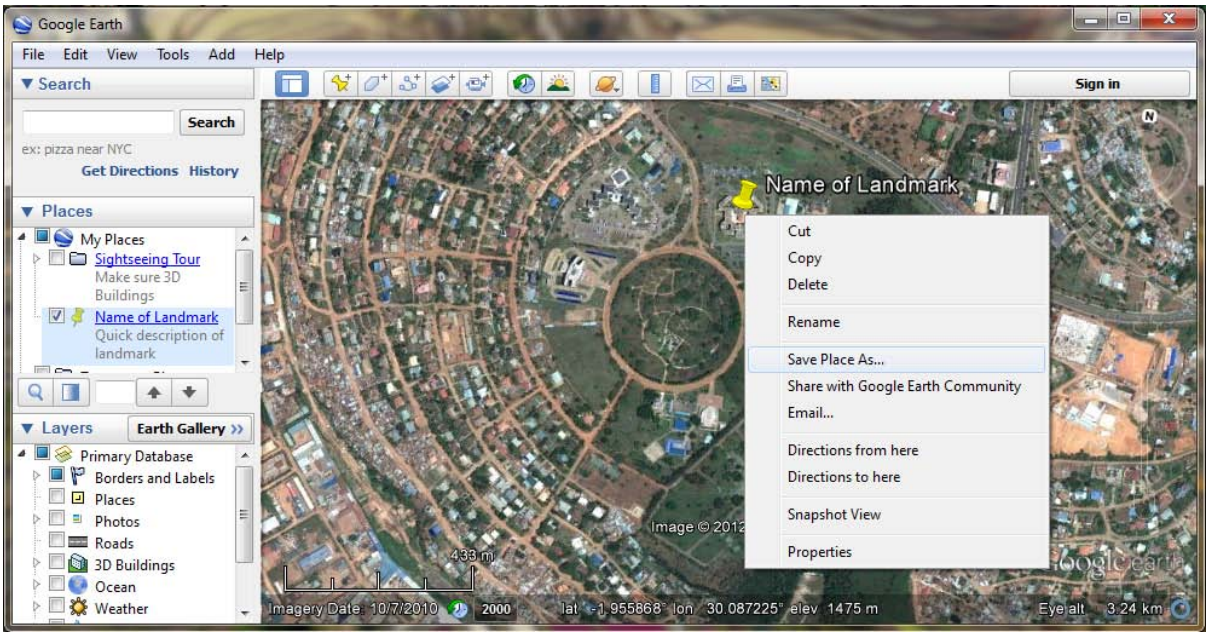
You will note that the latitude and longitude of the location you have chosen will appear in the dialog box as well. If you edit these, the marker will move to the new corresponding location.

5. In the *Description* tab, enter the name and description for the feature you have selected. This description will appear in a pop-up bubble whenever you left-click on the point in the future.

Your *Google Earth – New Placemark* window should look like this, but with the information of your placemark.



6. Choose OK to save the information. To save this point in a KML or KMZ file, right-click on it to see a pop-up menu, as below:



7. Now choose *Save Place As . . .* and browse to \\Training_Workshop\06_Participant_Work and name the file according to the title of the landmark.
8. **NOTE:** A further option under *Save as type* would be KML, which is simply an uncompressed and more easily editable version of a KMZ file.

9. After you have saved the placemark, close Google Earth.

Section 5: Adding new placemarks to existing KMZ files

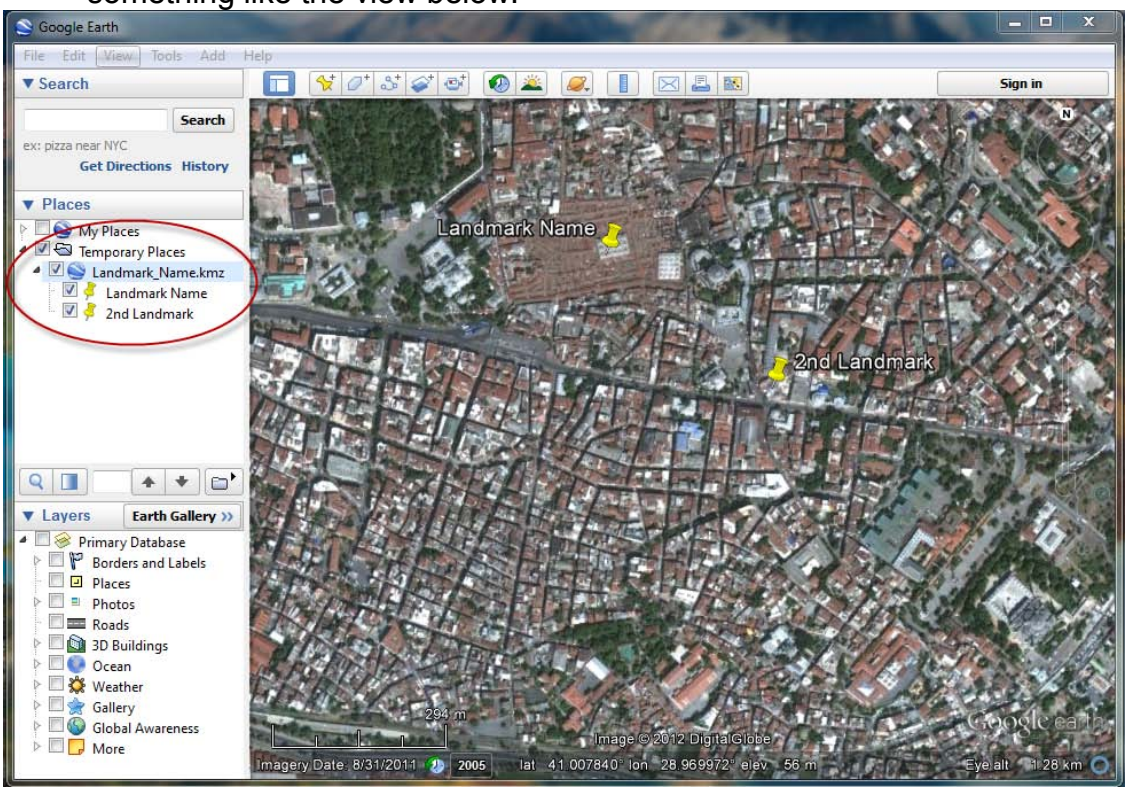
Next you will look at other points of interest in your home city.

1. Browse to \\Training_Workshop\06_Participant_Work and open the file placemark KMZ file that you just saved.

2. Say we want to save other locations of interest as other points within the same KMZ file. Locate and zoom to a second landmark within your city.

3. Select the KMZ landmark file that you created in the Places menu so that it is highlighted blue. This will ensure the next placemark you add will be added to the same file.

4. Click the *Add placemark* button (or choose it from the *Add* menu) and enter its information into the dialog box, then choose OK. You should see something like the view below:



There are now 2 points within the landmark name KMZ file you created.

5. Your original file name is no longer appropriate, as it now contains another location, so right-click its name and choose *Rename* from the pop-up menu. Type in the name of the city followed by the word *Landmarks* as a new KMZ file name.

6. Then right-click again and choose *Save Place As...*, browse to \\Training_Workshop\06_Participant_Work, make sure the file has your updated file name, and click *Save* to make sure all locations are now saved in the same KMZ file.

Section 6: Visually re-positioning or otherwise editing a placemark

1. Click the *Add placemark* button drag it to a random location in your Google Earth window, and click *OK.*

Now you need to move the placemark to the third landmark in your city. To edit the location of a placemark, you have two choices:

2. Right-click on the placemark, choose *Properties* from the pop-up menu, and type in new lat/long coordinates, or

3. Right-click on the placemark, choose properties, and observe that the placemark how has a flashing, highlighted "bull's eye" box around it (if necessary, move the *Edit Placemark* dialog box out of the way by dragging its title bar). While the placemark is highlighted in this manner, you can click on it and drag it to a new position on the background image.

4. While the Properties dialog is open, edit the description and name of the point to match the landmark.

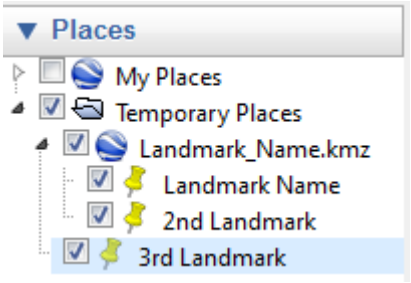
5. Choose *OK*.

6. No matter which method you have used to move the placemark, you need to right-click on the KMZ file name in the *Places* sidebar and choose *Save As...* to replace the old file with the new one.

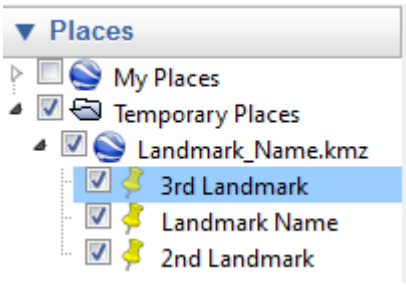
7. Browse to \\Training_Workshop\06_Participant_Work and keep the same name (which will result in an alert message telling you it already exists and you are replacing the original—choose "Yes" to do so.)

   NOTE: If you do not re-save your KMZ file after making edits or adding points, (or, alternatively, do not save any of your new points to "My Places"), then your information will be lost upon exiting Google Earth.

   NOTE: When you chose *Add Placemark*, make sure to note where the new point is being entered. In the illustration below, *3rd Landmark* was added to the Temporary Places folder and not to *Lankmark_Name.KMZ* (note the dotted line to the left of the names in the sidebar).



If you wanted this point to be part of the hospitals file, you could click on its name and drag it onto the name of your Landmark KMZ file. (See the result on the next page).

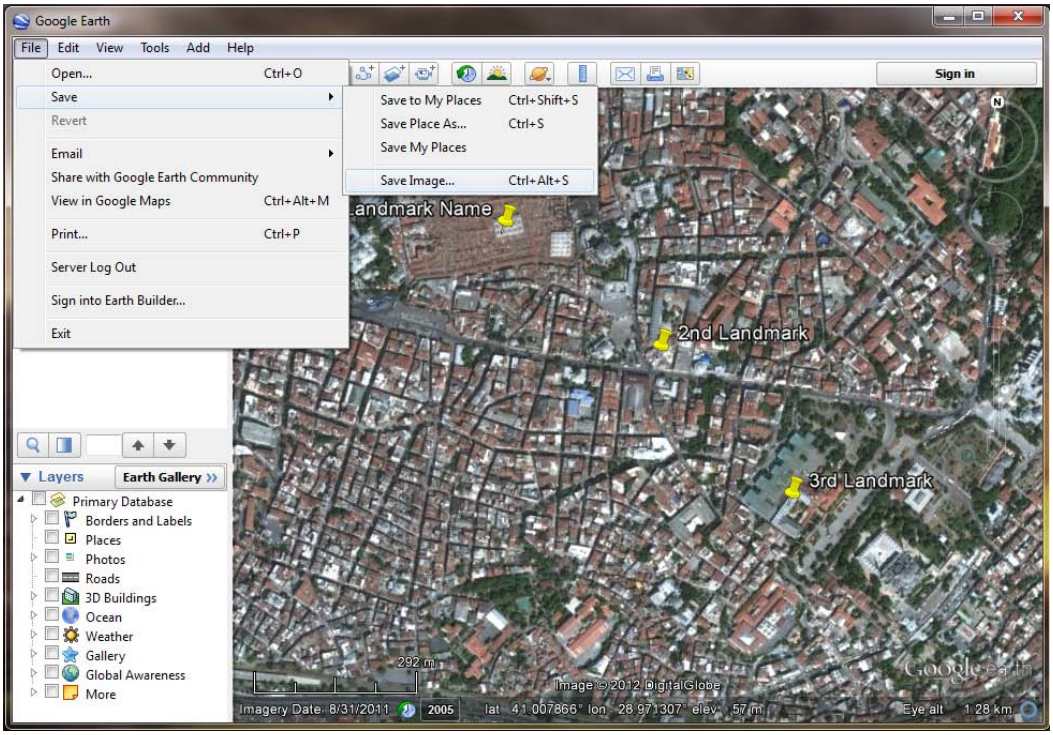


NOTE: If you right click on any of the names of the files in the Places sidebar and choose "Delete", you are not deleting the actual file. You are simply removing it from the Temporary Places (or My Places) location. This procedure is unique to Google Earth and may take some getting used to; you may want to try it for yourself until you feel comfortable manipulating your map files within the Places sidebar.

Section 7: Saving an image of the map for printing or sharing

In addition to saving your point file as a KML or KMZ, you may also want to save the background image as it displays in the Google Earth viewing window.

1. Choose *File>Save>Save image…*



2. Enter a file name in the dialog box which appears and save it in \\Training_Workshop\06_Participant_Work. This will save a JPG (photograph format) file to the indicated folder.

3. Navigate to your file and click on it to view the image.

This image can be printed or sent to others for viewing. Unlike the KML/KMZ file, this image will not require Google Earth to be installed on the recipient's machine in order for them to open it.

> **NOTE:** It is important to note that if you wish to manipulate your locations from within another mapping program, such as ArcGIS or QGIS, *you will need the KML file*. The JPG is simply a screenshot image and does *not* contain location data and is not tied in any way to the surface of the earth.

EXERCISE END

MEASURE DHS and MEASURE Evaluation are funded by the U.S. Agency for International Development (USAID). The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.