University of Gothenburg
Department of Earth Sciences

Exercise 1 – Getting started with QGIS

The aim of this exercise is for you to get familiar with QGIS and learn how to add geographical data layers into the program. You will also learn how to change the appearance of a layer, handle labels and make selections from certain parts of a layer.

Assignment: Hand in a print screen of your final classification. I.e. an image showing your map and layer window (see example on the last page). You will learn to make a proper map layout later on, in Exercise 3. Paste your image into a Word-document, save it as a **PDF** and hand in the **PDF-file** on Canvas.

1. Download your data

At first you should create a folder where the data is to be stored. Be advised to not use å,ä,ö or blank space somewhere in the map structure since it can cause problems in the usage of certain tools. An example for folder name is *Exercise_1_FirstName_Lastname*. Download the zip files with data from Canvas and unzip the data in your folder. Check so that all the data is unzipped. A majority of the data is in a format known as shape. Shape-format is a vector-format consisting of either points, lines or polygons (surfaces). Some of the data is in raster-format and will be used in the following exercises. You can learn more about the different file formats, especially vector and raster, used in GIS by reading the course literature "Geografisk Informationsbehandling" (or one of the suggested GIS textbooks in English). To open a shape file in QGIS three files are needed – one .shp, one .shx and one .dbf. Shape files contain a layer of GIS-data. A layer is assembled GIS-data of the same kind, for example land use polygons, roads (lines) or cities (points).

In this exercise you will initially learn to create a new project in QGIS. You will also learn how to collect data for a project and view it in the right order.

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2. Create a new project

Start QGIS Desktop. The view of an empty project is shown in the image below and the highlighting makes it easier for you to navigate in the different tools and windows of QGIS.
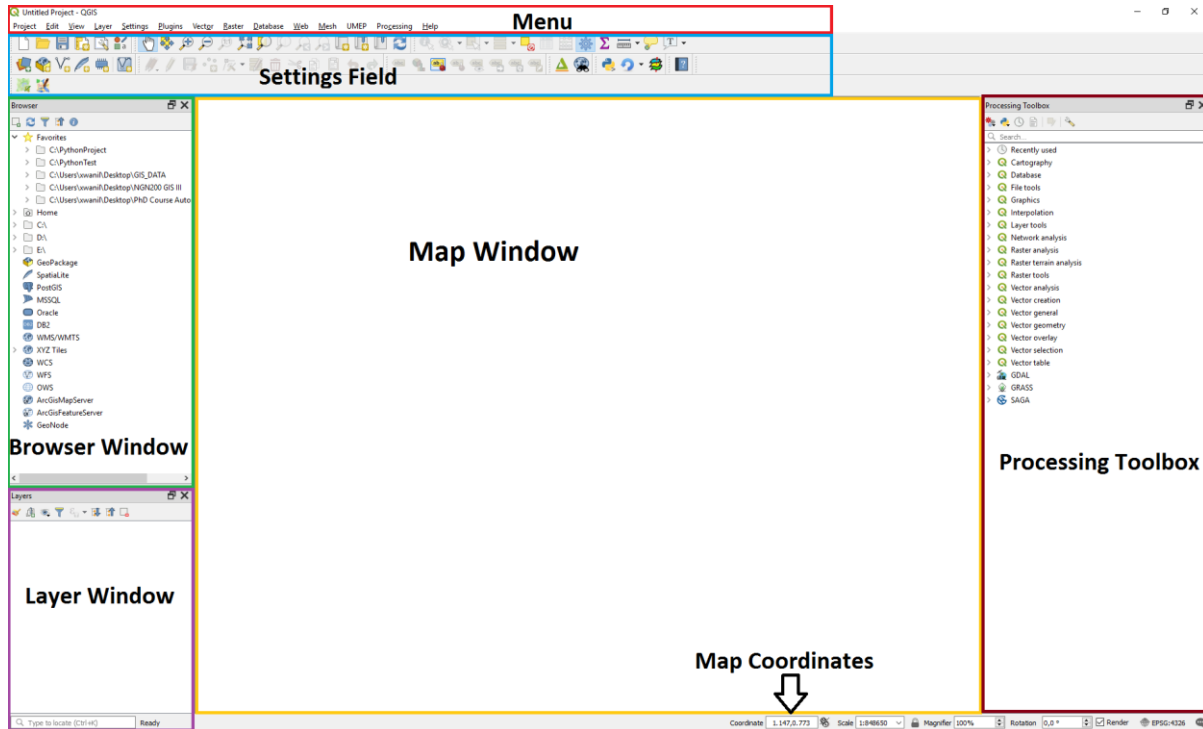
To start a new project you can also choose **Project → New** in the menu strip. If you want to change language you can do this by open settings in the menu strip and then click options. A new window appears where you choose **General**. Check the box **Override system locale** and choose the preferred language. The program needs to be restarted before the new settings apply. Since you follow the instructions in English, we suggest that you set the language to English.

3. Adjust the properties for your project

To open the settings shown below press **Project → Project Properties** in the menu. Under the tab **General** a project title can be adjusted and the canvas unit be changed. In this course we will mainly be using meters.
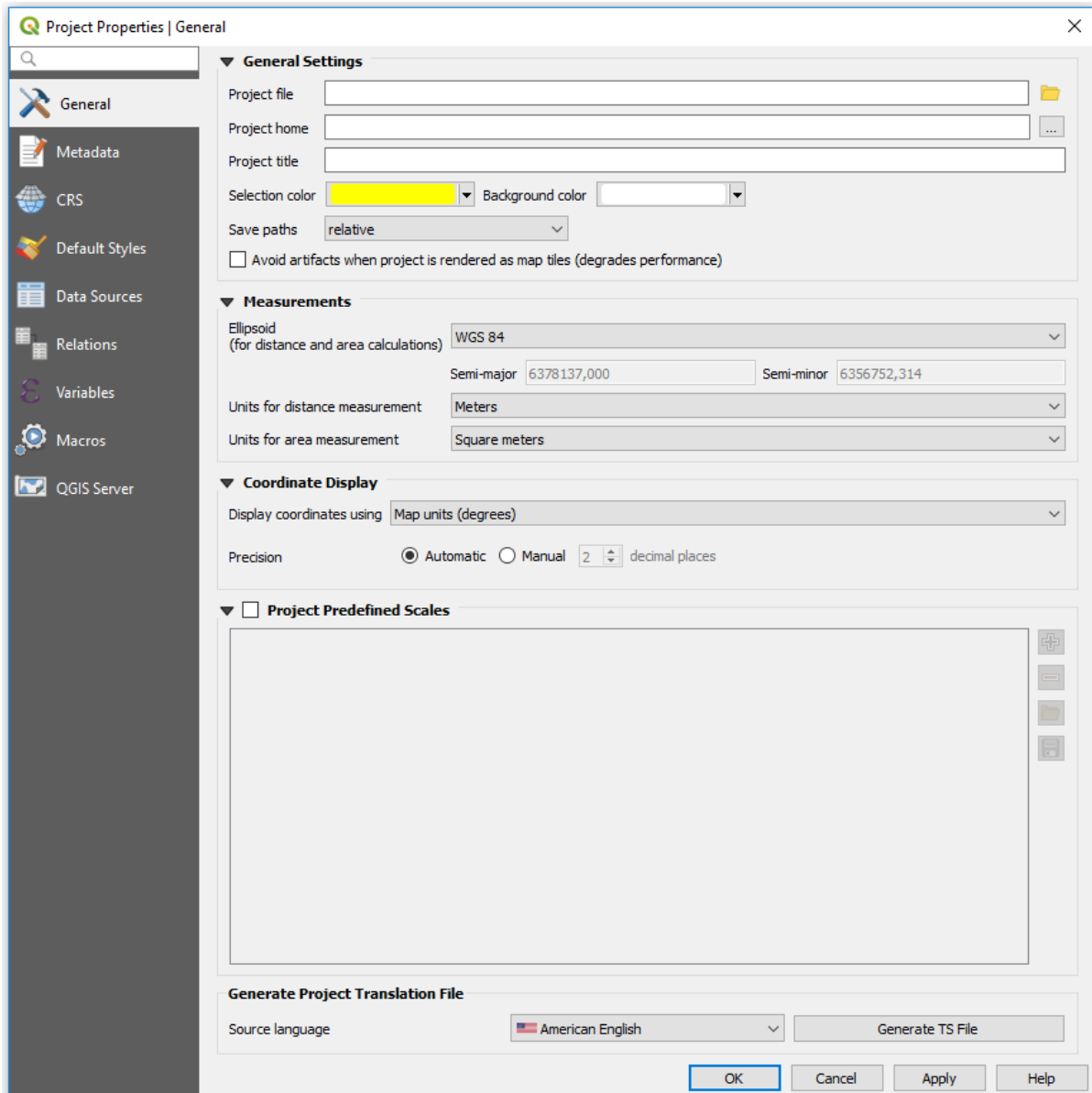
No settings need to be adjusted. We move on with the exercise.

Save the project **Project → Save.**

Routinely save the project and occasionally under a different name – you never know what will happen. Remember to not use å,ä,ö – and blank space in the File name.

4. Add data

At the beginning of the course we will mainly be using vector data, raster will also be used but in a later stage of the course. To open a vector layer, you open up **Layer** in the main menu and choose **Add layer** and then **Add vector layer.** You can also click directly on **Add Vector Layer** on the side panel furthest to the left. If you cannot see it, right click on the empty gray space in the Settings field and add the **Manage Layers Toolbar**.

This window appears:
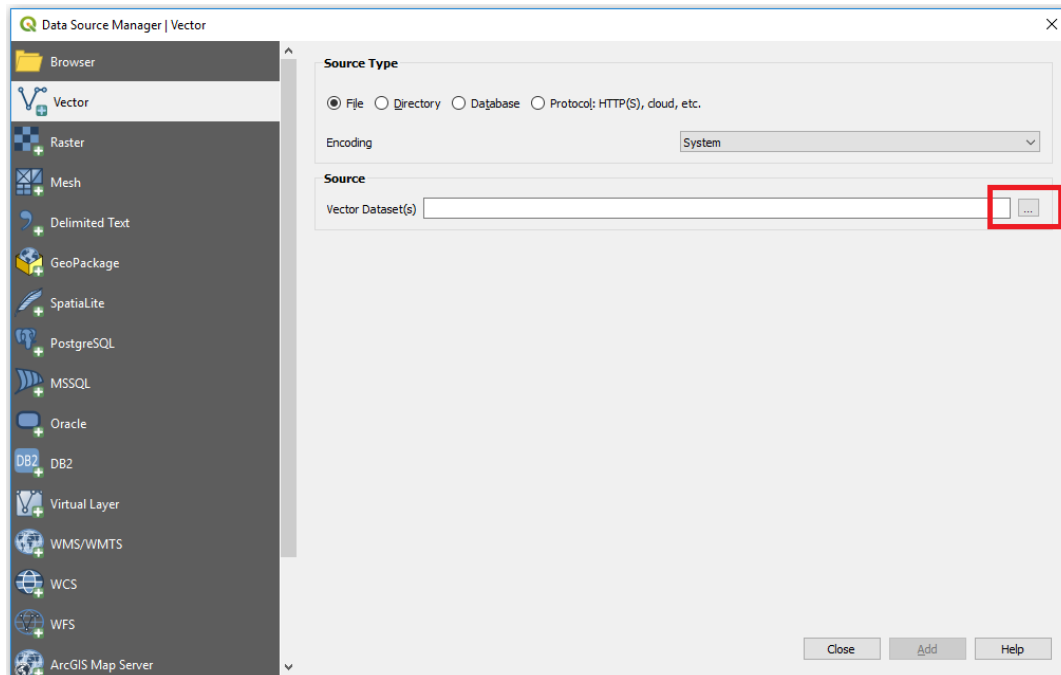
Set the **Source type** to **File**

Under **Source** click button in the red box and find the folder where you extracted the data files.
QGIS handles different standards for how the characters are rendered. Each time when you import shapefiles (in each exercise) set the following encoding to be able to show the Swedish letters åäö:

For Windows users: Encoding should be set to **System**.

For Mac users: Encoding should be set to: **ISO 8859-1**.

Find and open the following shape files (If they are not in the same folder you add every layer separately).

a.   my_14.shp   (land use)
b.   my_64_3_10.shp (land use)
c.   va_14.shp   (roads)
d.   vl_64_3_10.shp (roads)

These are your shape files, which are layers consisting of points, lines or surfaces (polygons).

The two first files are polygon layers (shown by the box symbol   next to the layer

name)

viewing the land use. The last two files are line layers (shown by the symbol ☑ ▭ next to the layer name) viewing roads.

The data you just added all have the coordinate system SWEREF99 TM (EPSG:3006). Make sure that the box next to each layer is checked.

When all the layers have been added, your QGIS-window should look something like this, but the colors will probably be different.
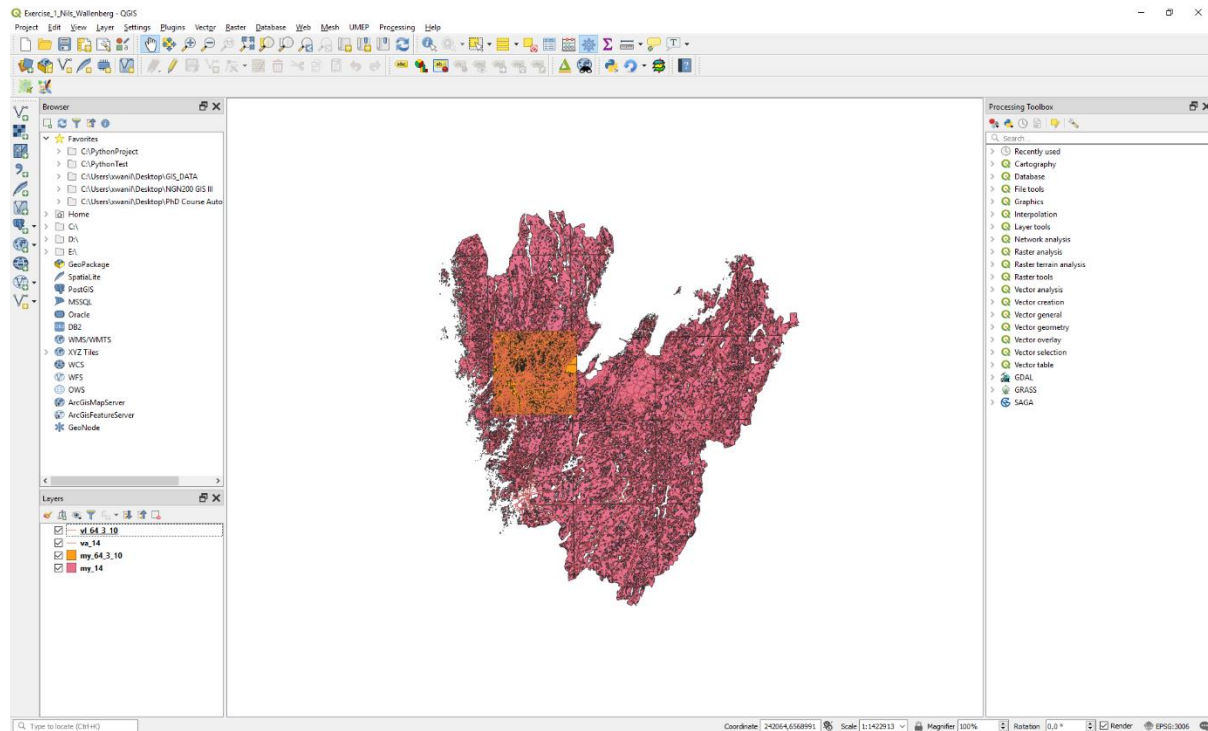
5. Handling your layers
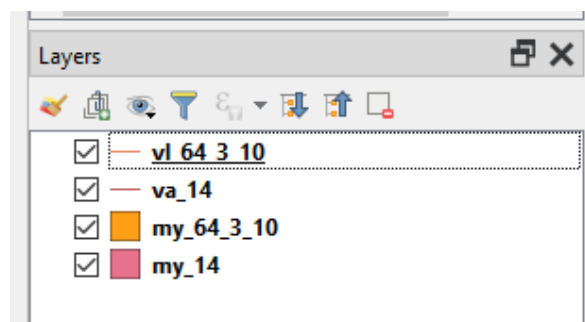
All layers with a checked box are visible in the map window. By only having the layers that you use for the moment visible, your work becomes more efficient. You can change the order of the layers. The layer at the top in the layer window is also at the top in the map window. Highlight a layer by left clicking on its name. To move it you hold down the left mouse button and drag it too where you want it. Simply release the button to finalize the change. You can also highlight and move several layers simultaneously by holding down the shift button (↑). Do not forget to save your project!

Be advised that it is important to differentiate between project-file and data. A project-file contains only links to the data and the settings (colors, layer management etc.) you have chosen for the layers included in the project. It is these settings that are saved when you save your project. Without a link to data files, a project file will be empty. In a later stage we will learn how to change and save layers separately.

Now you will learn to change the appearance of a layers. You will learn how to handle labels and some basic SQL and get familiar with the information tool.

6. Choose layout

How the layers are viewed can be changed in the **Layer properties.** The **Layer Properties** are shown in separate window which is opened either by double clicking the layer or right clicking the layer and choosing Properties. The appearance of the layer is changed under the tab **Symbology**.

Enter the properties for the layer my_64_3_10 and click **Symbology**. Choose **Categorized** in the dropdown menu marked in red on the picture below. Then choose **Column: KATEGORI** and let the **symbol** remain as it is. **Color ramp** should remain as **Random Colors**.

Click **Classify** and the results should be something like this:
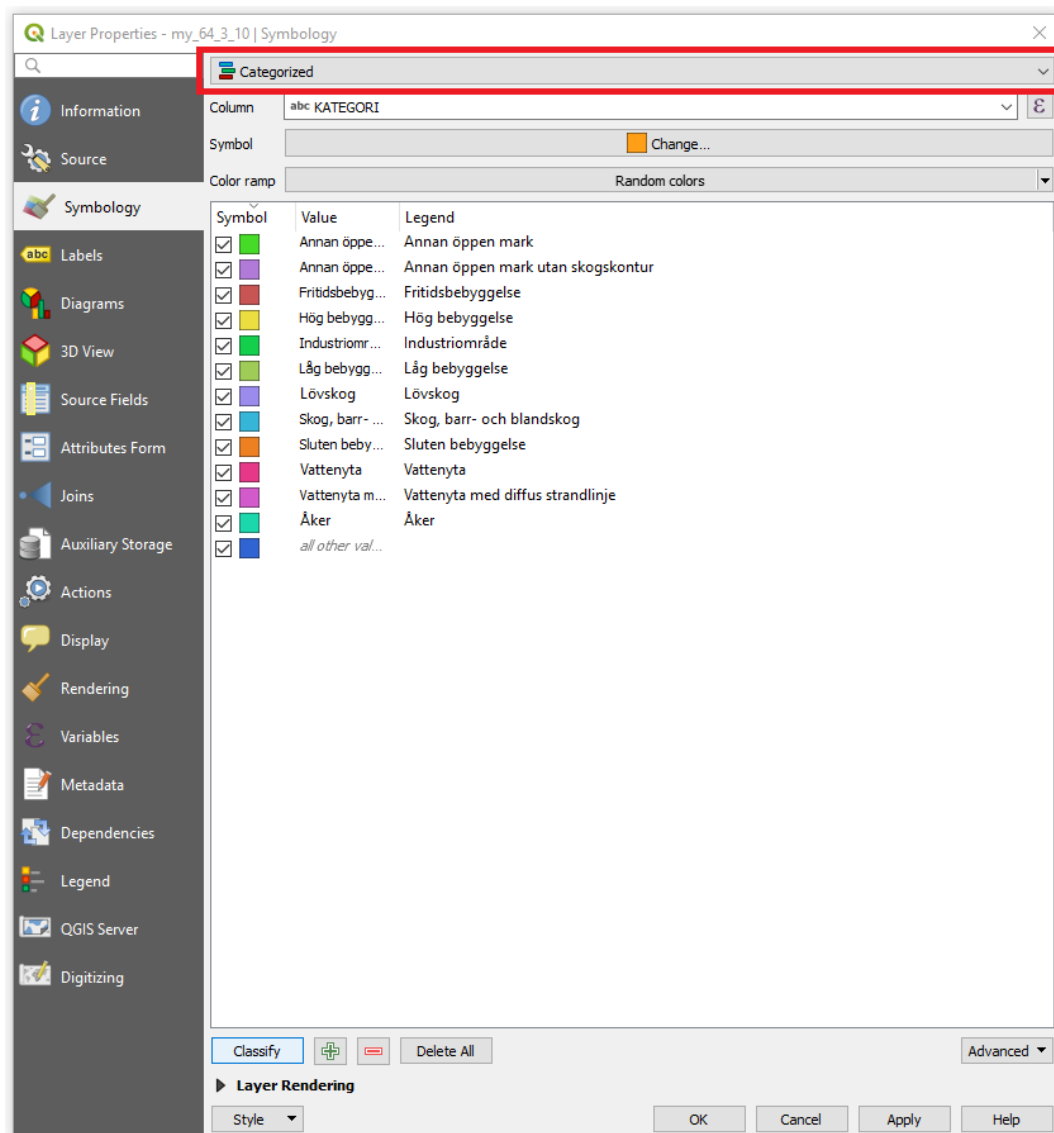
Click **OK**

Zoom in on my_64_3_10, either by right clicking the layer and choosing **Zoom to layer**, or by clicking the magnifier and dragging a square covering the area you want zoom in on (left click, hold in the mouse button and drag out a square).

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Your map window should now look sort of like this:
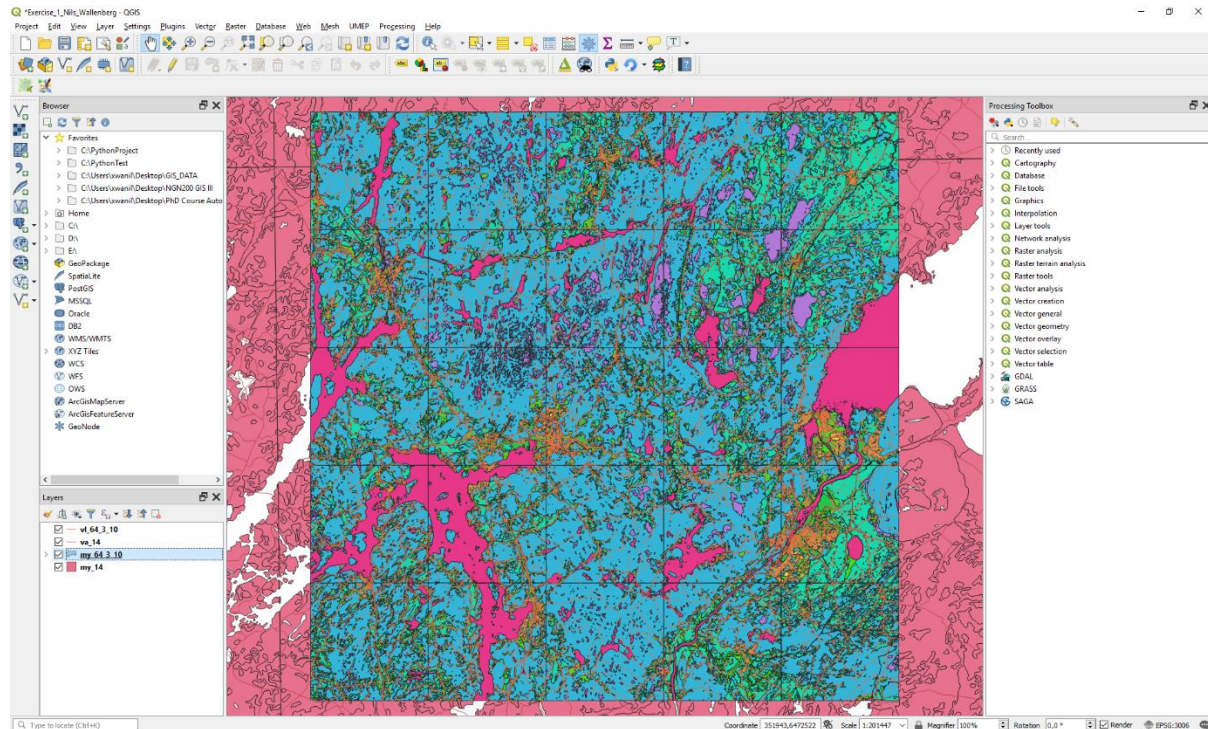
Try to change the color settings, for example Gradient color ramp or **ColorBrewer**, by first removing all classes and then choosing the new color setting and clicking **Classify**. Think about which color settings would be most suitable for different types of data (e.g. land use, population density, GDP growth/decrease, elevation about the sea level).

7. Change the Layout

To give the different categories of land use an appearance that is closer to reality and thereby easier to interpret (water is blue and forests are green etc.) enter the **Properties** and the tab **Symbology** for the layer my_64_3_10. Double-click the colored square next to *vattenyta*. Click the square **Simple fill** and set **Fill** and **Stroke** to blue. Click **OK** on both windows and the water surfaces in the layer my_64_3_10 should now be viewed as blue. You have probably noticed that there is a grid in the layers you use which makes the map harder to interpret. If you give the fill color and the stroke color the same color, this grid will be removed. Tip: Sometimes it can be difficult to find a color which will look good on a map. Then you can use **standard colors**. As a rule of thumb, colors in your map should slightly unsaturated. This is pleasing to the eye and makes the map easier to read.

Follow the same procedure for the other land uses; Change forests into different shades of green, settlements into shades of purple/pink, fields to yellow and open land to a light color (e.g. gray, yellow or green). Remember that the shades shall be distinguished from each other. Change the stroke color to have the same color as its fill color to remove the grid in the map. Distinct borders can make the map harder to interpret. However, sometimes borders can be a good feature to mark important or not so numerous categories (e.g. national parks).

You can find some inspiration from Google Maps, or other maps to, get a feeling of which colors you can use for the map to look good.

To change how the category is named in the layer window rename the same tab in properties (**Symbology**). Double-click the square next to Vattenyta, in the column **Legend** and write "Water". You can also change the legend of the other categories into fitting descriptions.
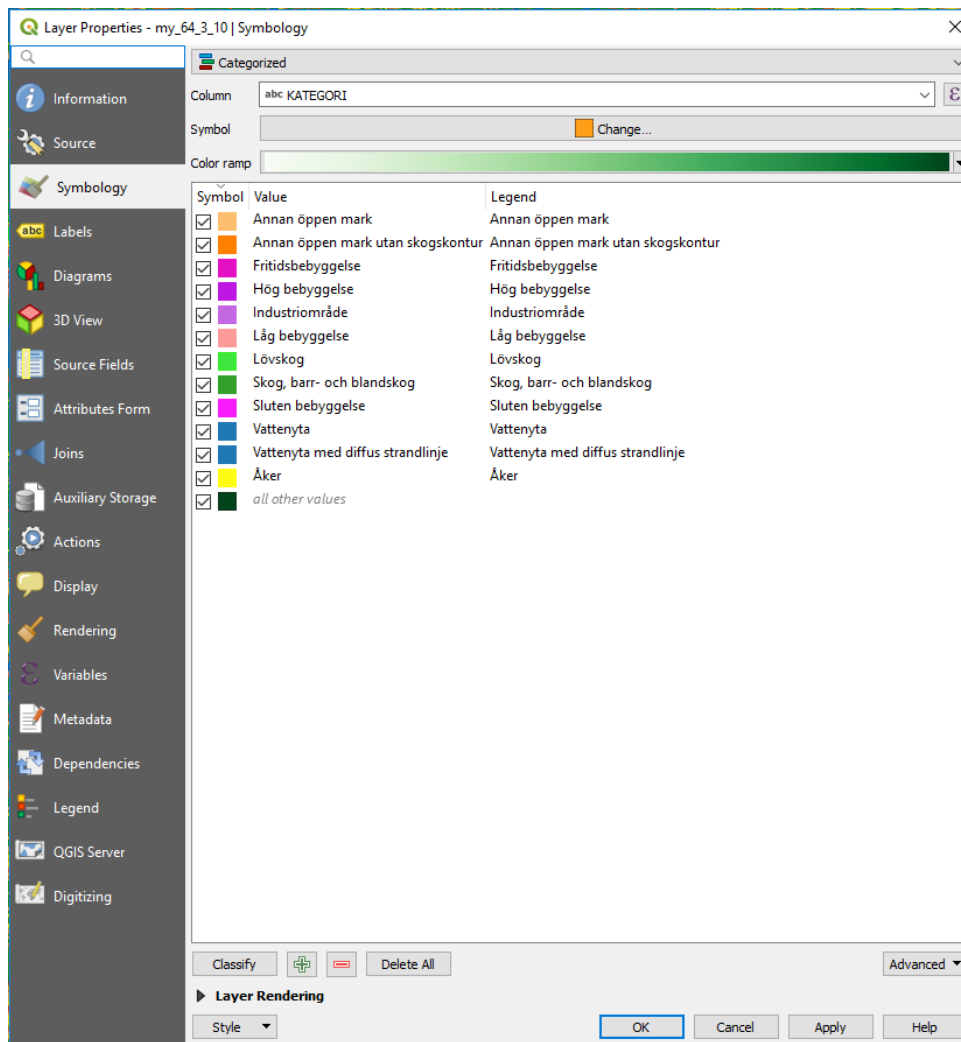
When you're ready, click **OK**

8. Zoom

There are several different symbols for changing the scale in QGIS.

Explore what the different symbols meaning by hovering over them with the mouse pointer. Use the functions to move around or zoom in and out of the areas of the map.

The scale of the map is shown below the map window. For the scale to work properly QGIS must know what type of units to use (km, miles etc.).

9. Identify feature tool and attribute data

A very useful function in the most GIS software's is the **Identify feature** tool. With it you can examine the attribute data connected to each object (point, line or polygon) in a GIS layer. For every single shape file the attribute data is saved in a .dbf-file with the same name as the shape file. The attribute data for my_14.shp is saved in my_14.dbf for example.

To activate the Identify feature tool, highlight the requested layer in the layer window and then click

on the symbol [image] in the tool field. The information you will get depends on what object you highlighted. The result can look like this:
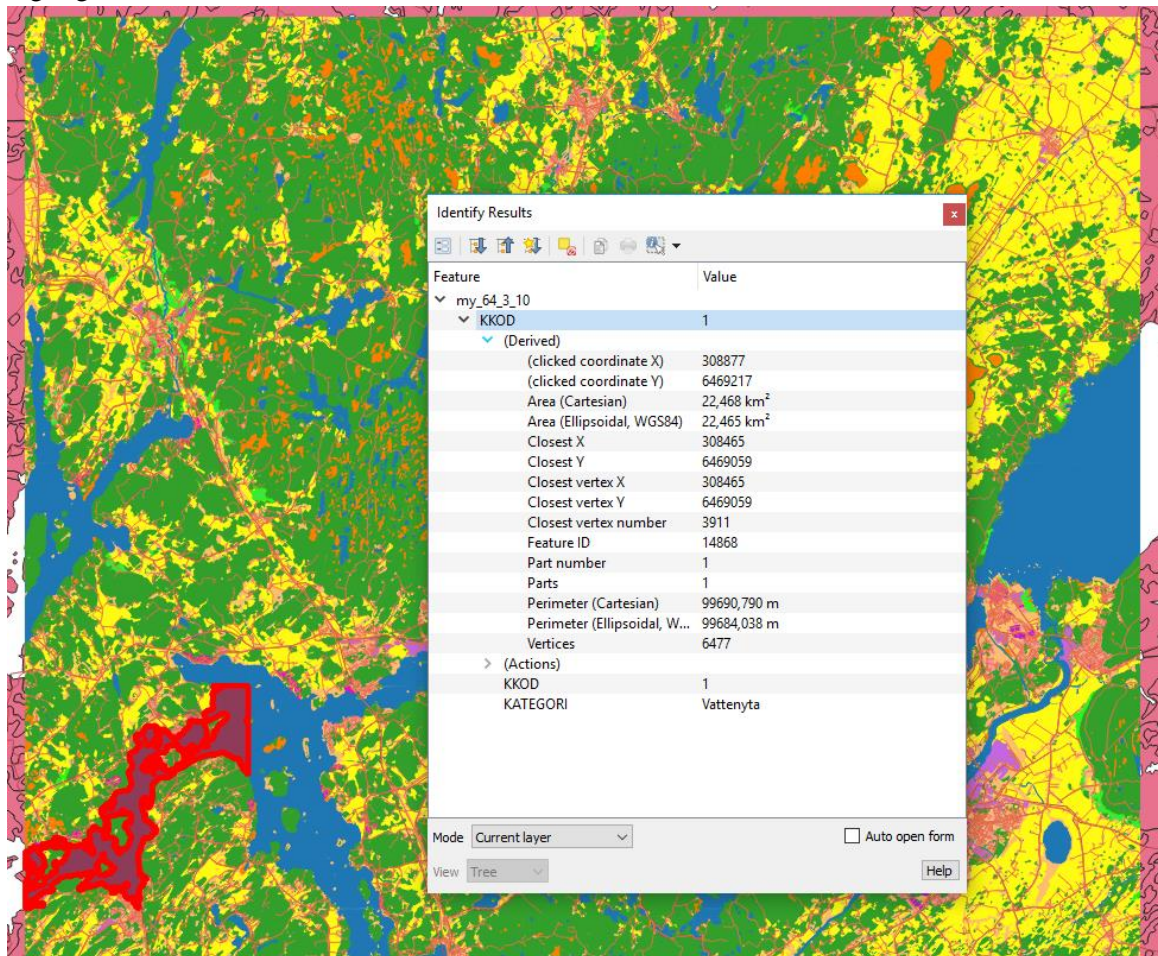
The information is about the area marked in red on the map. The object is located in the layer my_64_3_10, its area is 22,468 km², KATEGORI Vattenyta and KKOD is 1.

Sometimes several objects can be highlighted simultaneously and then information from several objects pop up. It is easier to avoid this when you zoom in.

Try the function out!

10. Scale for viewing

To decide at what scale (or scales) a layer (suggestively vl_64_3_10) is to be viewed you need to enter the properties of the layer. Under the tab **Rendering** check the box "**Scale dependent visibility**". Here you can also fill in the highest and lowest scale that the layer should be viewed in. This is a useful feature if you for example think it is unnecessary that all the small roads in the layer vl_64_3_10 is viewed when the map is zoomed out (i.e. small scale).

Try it out to get a idea of how it works. For vl_64_3_10 let the maximum be 1:1 but fill in minimum to 1:300 000. This means that vl_64_3_10 only is viewed when the scale is zoomed in to 1:300 000 or more.
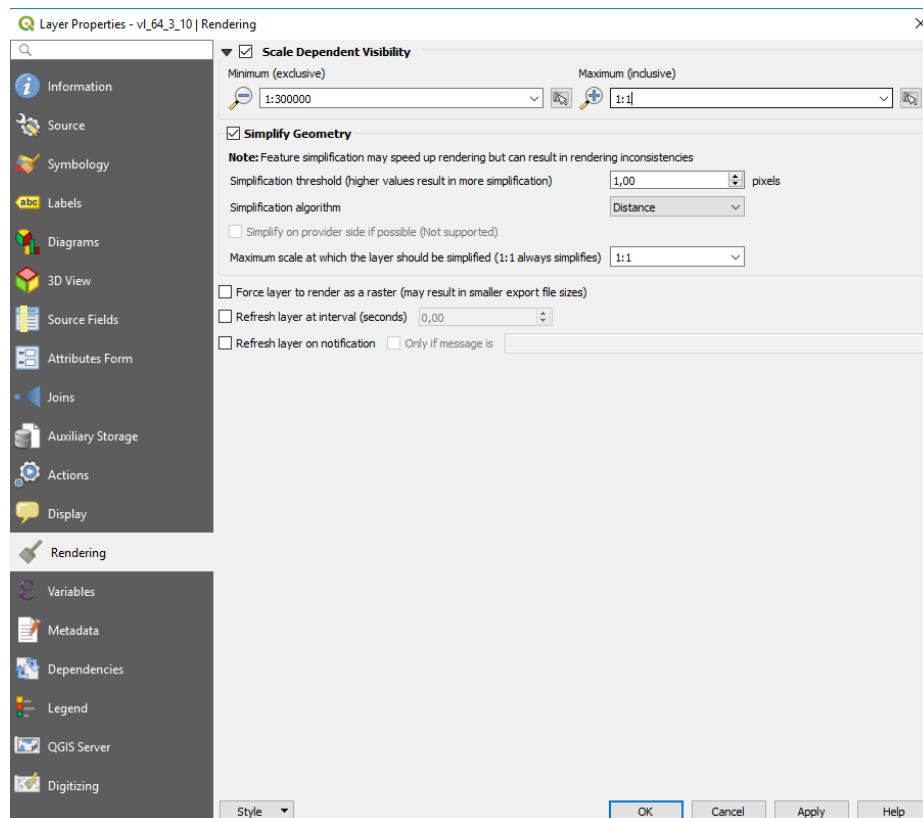
Click OK.

Zoom in and out on the map window and see if the layer no longer is visible after 1:300 000.

Small and large scale
Which scale is larger: **a)** 1: 1 000 or **b)** 1:500 000?
The correct answer is **a**. 1:1 000 is a large scale and 1:500 000 is a small scale. For many people this is misleading, since 500 000 is a much larger number than 1 000. But think of a scale as of a fraction. A scale 1:1 000 means that an object in the map is 1 000 times smaller than in real world (1/1000 of the real size), so the object is presented relatively large. 1/1 000 is a much larger number than 1/500 000, and so 1:1 000 is a larger scale than 1:500 000.
Why is it important? A large scale map shows many details which can be important while navigating in a city or a forest. However, we often do not need this many details, e.g. when we drive across the whole country. In such case we need a small scale map with fewer details, but giving a good overview of a large area.

11. Restriction by selection

Sometimes you just want to make certain information visible in a layer. You can then make a restricted selection based on the attribute data. To make a selection of only the *allmäna vägarna* (public roads) of class one be displayed from the layer vl_64_3_10. Make it the only visible layer by unchecking the other layers in the layer window and then zoom to layer.

Right-click vl_64_3_10 and choose **Open attribute table**. A table containing information of all the objects in the layer is opened (we will review the attribute table further in the next exercise). In this case you want to choose several categories at the same time. This is done by clicking the symbol **Select features using an expression** located in the toolbar above the table. A new window appears.

Under the category **Field and values** there are attributes that the selection can be based upon. For vl_64_3_10 it can be based on KKOD or KATEGORI. "Allmän väg klass 1" is listed under KATEGORI.

Write your selection by:
- Double-click KATEGORI
- Click =
- Click **all unique** under **load values**
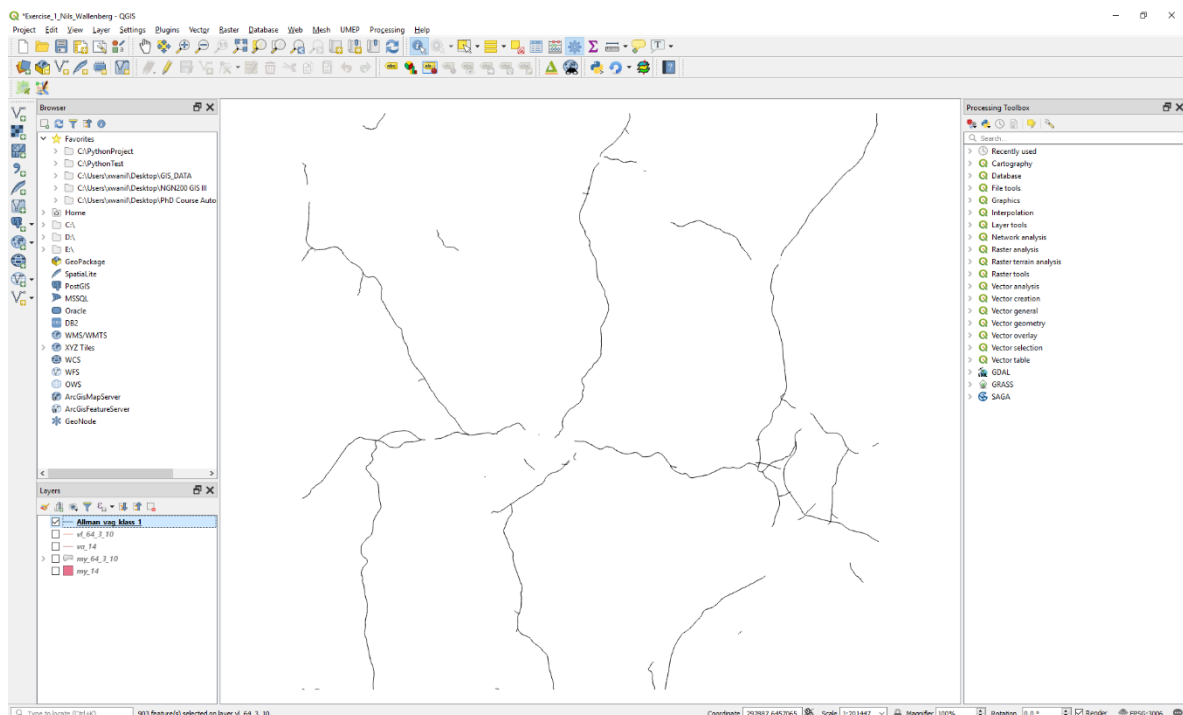- Double-click Allmän väg klass 1

The selection is then added in the **Expression** field. Then click **Select** to finalize the selection. Close the window and sort the table by clicking the table heading KATEGORI. Make sure that the rows with Allmän väg klass 1 are marked in the table. To add more than one category you will have open **Select features using an expression** again. Make the same selection as before but add the category *Allmän väg klass 1, i underfart* instead. To add the selection to the one you just did you have to use **Add to current selection**, as shown below.
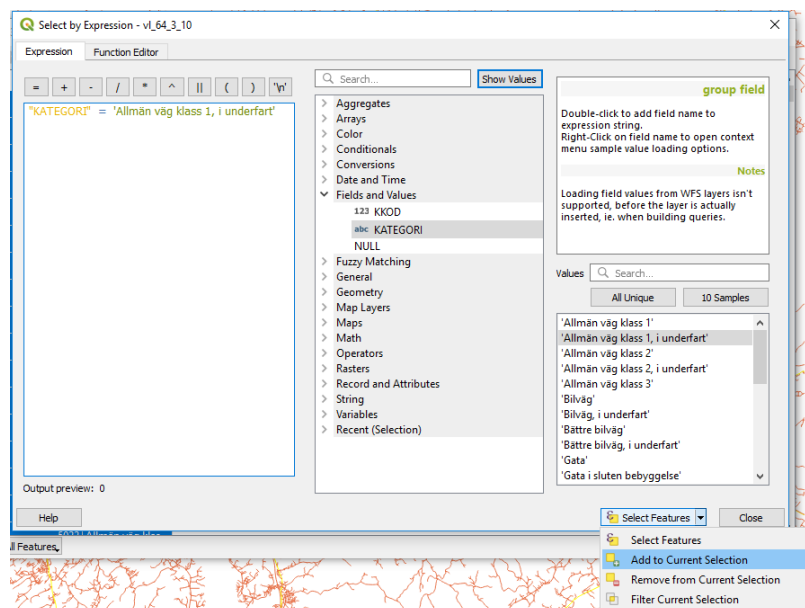
Close the window. If you have performed the selection correctly Allmän väg klass 1 including underfarter will be highlighted in the map. If so you can close down the attribute table as well. If not try the selection again.

To better view your selection you will now create a new layer from the selection. Right-click vl_64_3_10 and in **Export** click **Save selected features as…** and place the file in an appropriate place (your GIS-folder). Name it "Allman_vag_klass_1" and make sure the box **Save only selected features** is checked. Click OK.

Open your new layer in the same way you did at the beginning of the exercise. Uncheck the other layers. Your new layer should look something like this:

Now uncheck the layer Allmän väg klass 1 to hide, alternatively remove it from the project by right clicking → **Remove**. This action will not delete the data file; only remove it from the project. If needed you could thereby add the layer again, if you know where it was saved. That is why it is important to save all the files in your exercise folder.

Check out the layer vl_64_3_10. As you can see some of the roads are yellow. These are the roads that are selected in the attribute table. To unselect these click the symbol **Unselect all** in the toolbar of the attribute table. It looks like this:

12. Adding Labels

Start by adding the layer tx_64_3_10. Enter the properties for the layer and click the tab **Labels**. You can either add a label to all the objects or to a selection of them.

We choice the first, and easier, option. Zoom in to the area between Uddevalla (a city close to the middle of my_64_3_10) and Vänersborg (to the west of Uddevalla, by the lake Vänern).
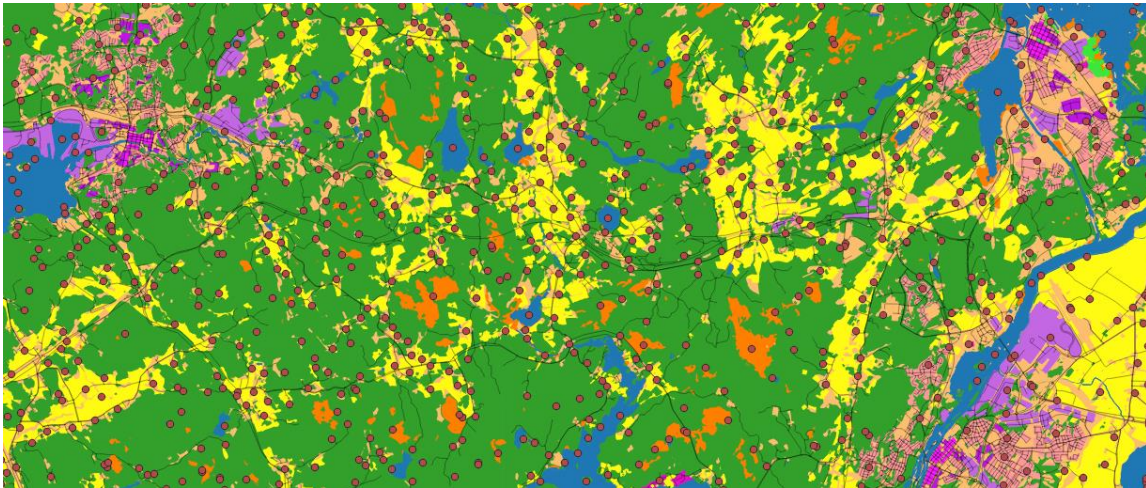
You will see a lot of points in the map. Every point represents a text. It could be the name of a city or village, a road number or the depth of a lake etc. For the text to be visible you check the box **Label this layer with** (still under the tab labels) and choose **TEXT** from the drop-down menu. You can also change the font size and placement of the labels. Under advanced further adjustments can be done. Try it out!

When you are done click **Apply** and then **OK**.
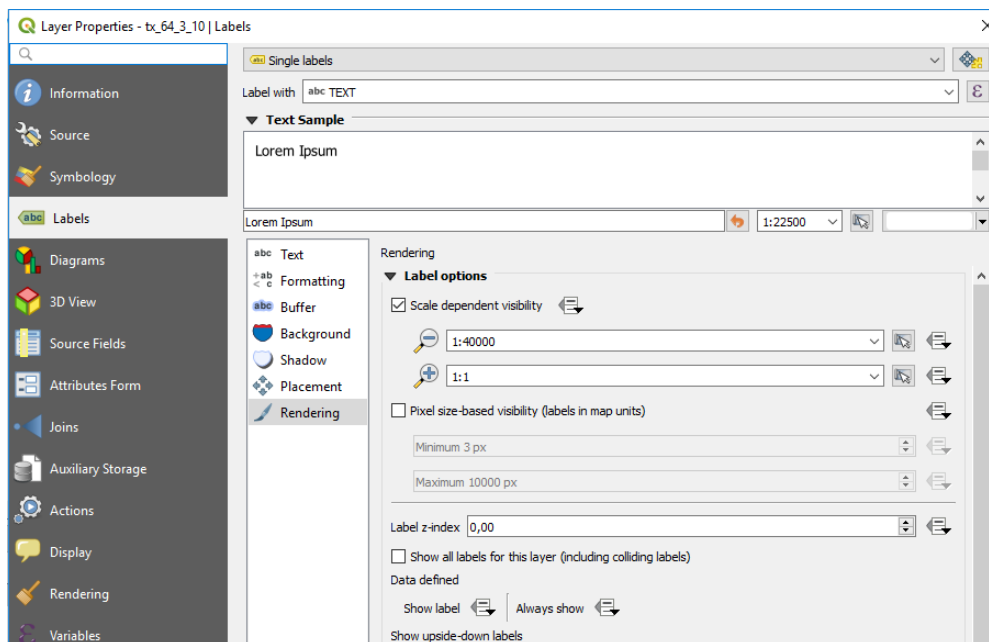
The text from all the points is now shown in the map. Since all this information makes the map harder to read in an out zoomed mode you can choose to only view the labels at certain scales. Choose **Rendering** (see picture above) and check the box **Scale-based visibility** and write 40 000 under minimum. Click OK. Now the labels are only shown when you are more zoomed in than scale 1:40 000. Try to zoom in and out to make sure it works properly.

These settings can also be accessed through the toolbar Labels.

To only view labels for certain categories of points, for example larger cities, in your layer (tx_64_3_10) open the layer properties and the tab Symbology. Instead of single labels choose **Rule-based** in the drop-down menu. Double-click in the area of the (no filter) column, marked in red on the picture below.

The window **Rule properties** is opened and here you decide which points that will be viewed in the map. This is done by creating a filter where only the points that coincides with a certain criterion is viewed. We want to add points with labels for urban centers with 10000 - 49999 inhabitants, and urban centers with 2000 - 9999 inhabitants.
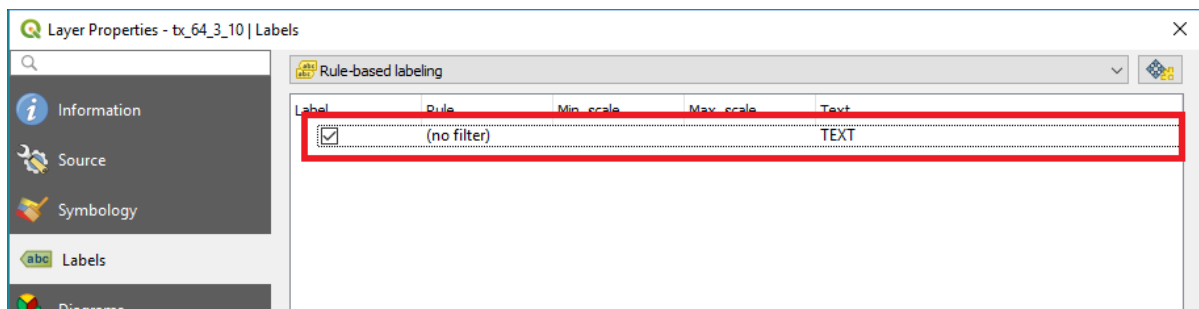
Press the ![epsilon button] button to open the **Expression string builder**. Here we will use a simple SQL (Structured Query Language) expression. SQL is a programming language used in databases. You can read more about it in the course literature. You should add the following expression in the Expression square.

"KATEGORI" = 'Tätort 2000-9999 inv.' OR "KATEGORI" = 'Tätort 10000-49999 inv.'

Either you can write it in yourself or you can use the functions list to click yourself to the right expression. OR and = are located under Operators and the categories can be found in the same way as you did in an earlier stage.
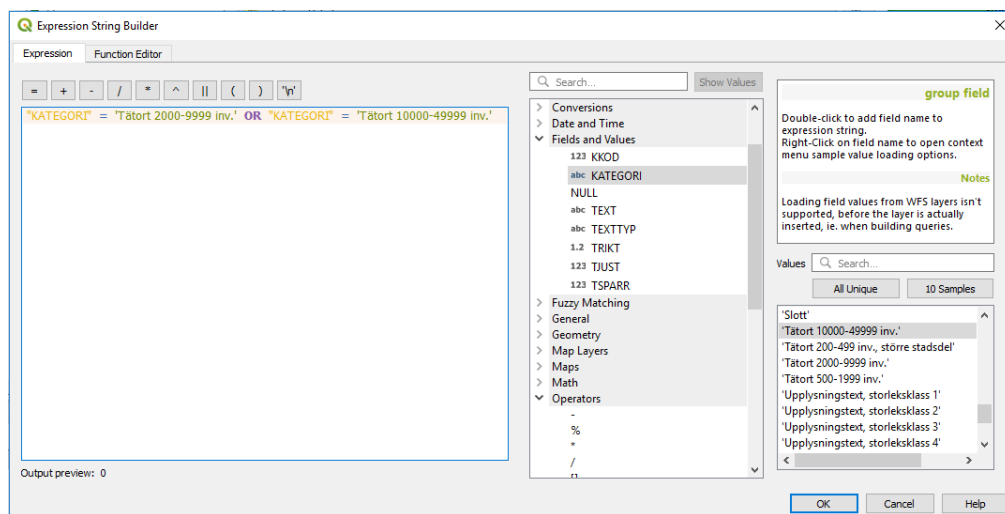
Click OK to close down the windows.

Increase the font size of the larger urban centers and make the points 100% transparent (opacity to 0%) under the tab **Symbology** in the Layer properties. The map should look something like this:
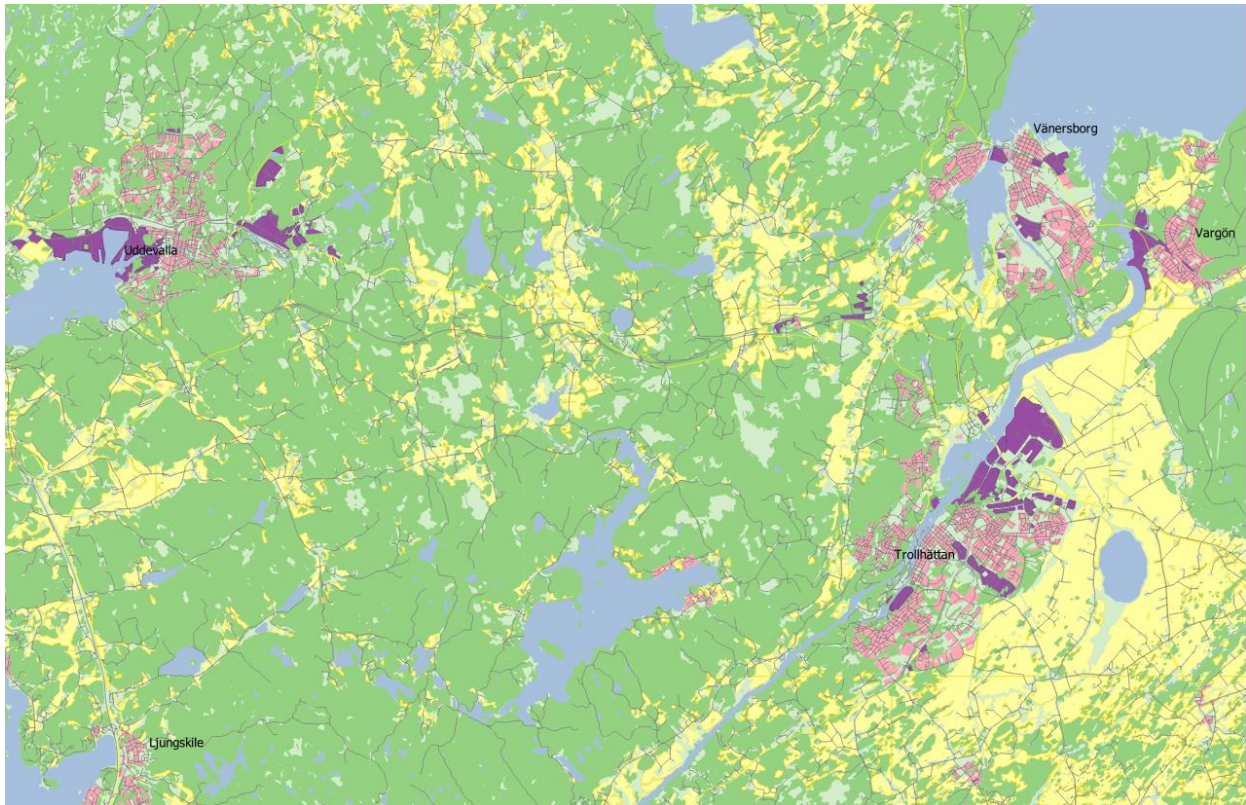
Remember that you could have made settings for scale-based visibility. To show the labels even when you zoomed out more than 1:40 000 the scale-based visibility needs to be changed or even unchecked.

This is the end of Exercise 1! Do not forget to hand in a print screen (zoomed in to layer tx_64_3_10 as in the picture above) as a PDF under the Exercise 1 Assignment on Canvas.