



Reference Documentation

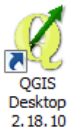
QGIS guide for national data visualization

Viviana Zalles and Peter Potapov

Global Land Analysis and Discovery Lab
University of Maryland
Department of Geographical Sciences
4321 Hartwick Rd, Suite 400
College Park, MD 20740
United States

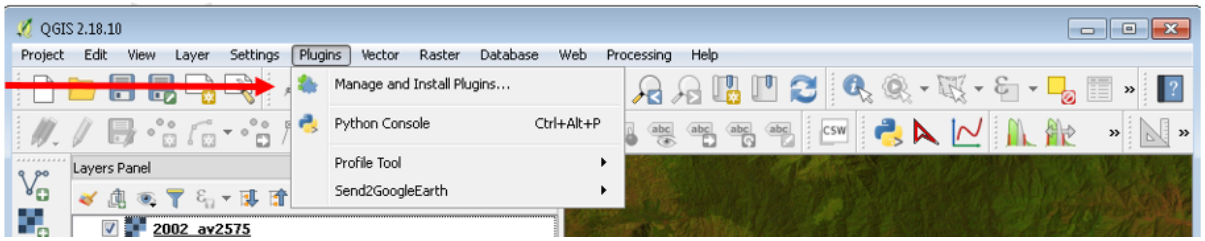
Installation and setup

QGIS is an open source software that allows user to view and modify vector and raster geographical data. The software is already installed on the lab computers. To start data analysis on your own computer, make sure QGIS is installed. The installer can be downloaded from the following link:
http://www.qgis.org/en/site/forusers/download.html

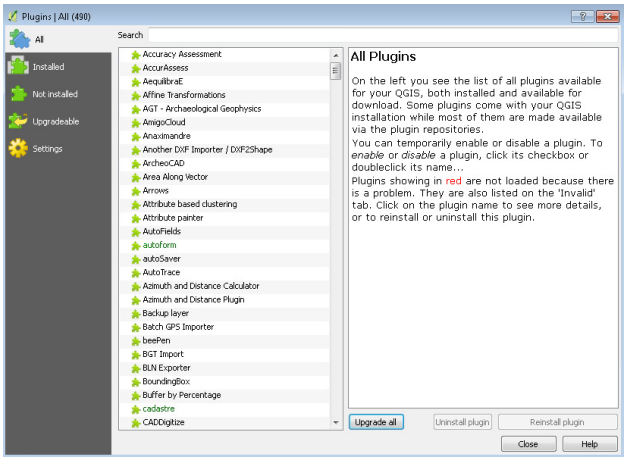


After installation, open QGIS Desktop using its shortcut. Use plugin manager ("Menu/Plugins/Manage and Install Plugins.../") to add useful tools. Specifically, the following exercise will require "OpenLayers Plugin" and "Send2GE" plugins to be installed. You can search and install missing plugins using plugin manager.

To install a plugin, click on "Plugins" → "Manage and install plugins".



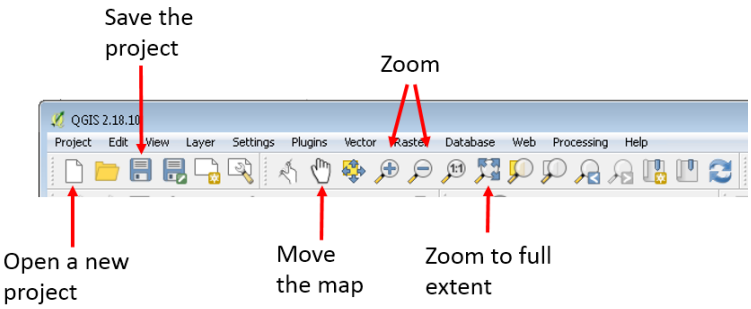
The following window will appear:



In the search bar, type "OpenLayers" and then click on "Install plugin." Next, type "Send2GE" and click on "Install plugin" again.

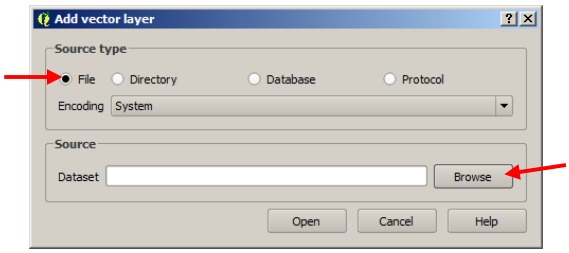
First steps

Whenever we begin a new project in QGIS, it is a good idea to start by saving the project in case the program crashes. When you save a project in QGIS you are simply saving the connections to the files that are loaded in the project. This means that the QGIS project will not load properly if these files have been deleted or relocated on the computer. To save a project, click on "Project" → "Save as" and save it in the desired folder with the desired name. The following image shows a few frequently used toolbar icons:

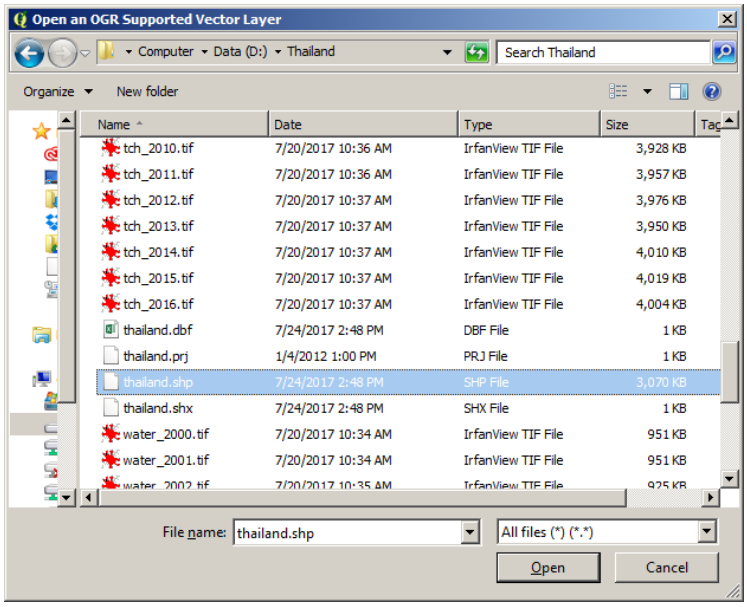


Loading vector data in QGIS

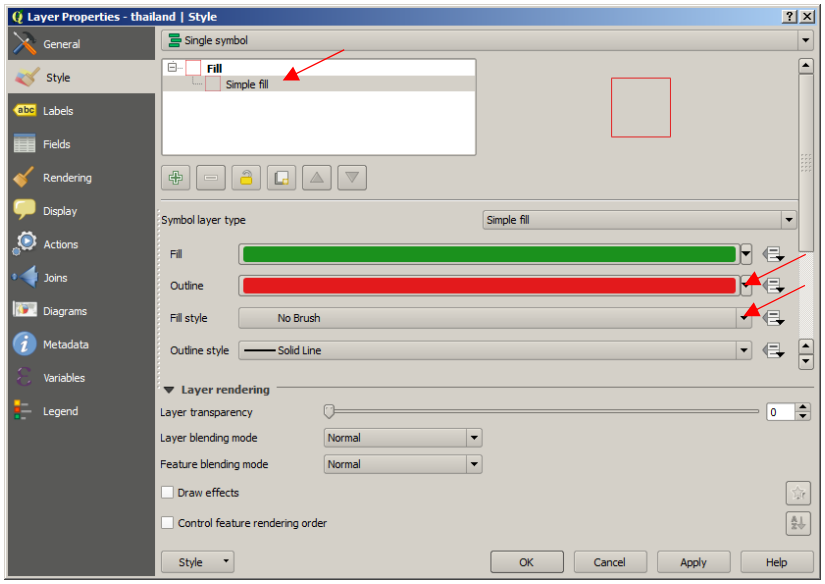
To load vector data (like ESRI Shapefile) click on [Add Vector Layer]  toolbar button. This will bring up a new window from which you can check radio button File "ON" and click on [Browse].



Select a ".shp" file in the file browser window and click on [Open]. You can also drag the file into the project window from a system file browser.



Right-click on the dataset name in the Layers Panel and select "Properties". In the "Style" dialog window, select "Simple fill option. Select "No Brush" for "Fill style", and change the color of the "Outline". Click on [OK] to close the dialog window.



GLAD Raster data

For this training, we provide you a subset of the national data:

http://glad.geog.umd.edu/Potapov/SERVIR_Mekong/Regional_workshop_August_2017/National_data/

Complete national dataset may be obtained from SERVIR Mekong data distribution interface. The following datasets are provided:

Annual Landsat data composites (YEAR_Landsat.tif)

To create these composites, we begin by aggregating all cloud-free observations that exist for each pixel for a given year. Then, for each spectral band, we ordered the values of the observations from highest to lowest. Finally, we average all values between the 25th and 75th percentile. We do this to eliminate extreme values that are not representative of the land cover for the entire year. The composites use Landsat 7 band #5 (short wave infrared), #4 (near infrared), and bands #3 (red). These correspond to bands #6, #5, and #4 of Landsat 8 OLI sensor.

Annual tree canopy cover (tcc_YEAR.tif)

Percent tree canopy cover within a Landsat pixel modelled using regression tree model. Values represent tree canopy cover, 0-100%

Annual tree canopy height (tch_YEAR.tif)

Average tree canopy height in meters modelled using GLAS lidar data, Landsat annual data, and regression tree model. Values are in the range between 0 and 26 meters.

Annual water duration (water_YEAR.tif)

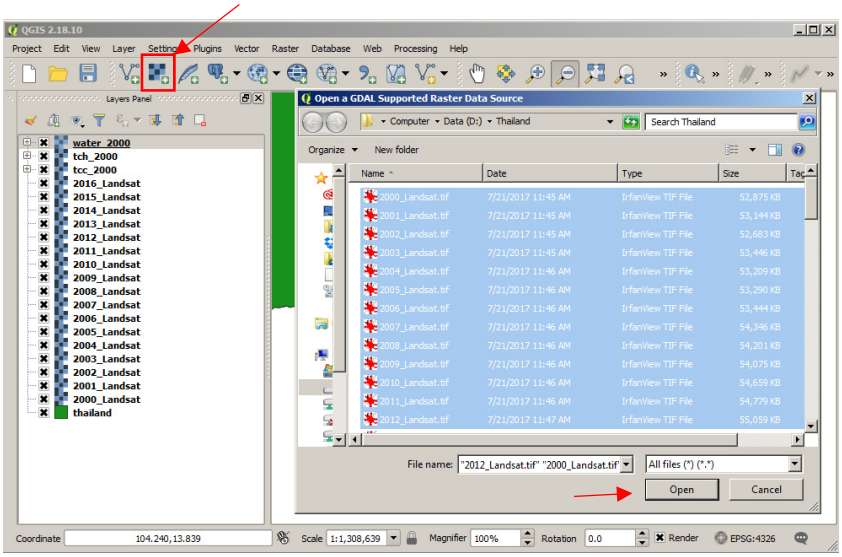
The fraction of the annual cloud-free observations when surface water was detected. The water duration reflects the fraction of the year where a particular surface area was flooded.

Tree cover loss detection (loss_date.tif)

This dataset shows areas where the tree cover loss was detected using the GLAD change detection method. The value represents the earliest date of change detection: 1 – 2001, 2 – 2002, …, 16 – 2016. Repeated changes are not recorded in this layer.

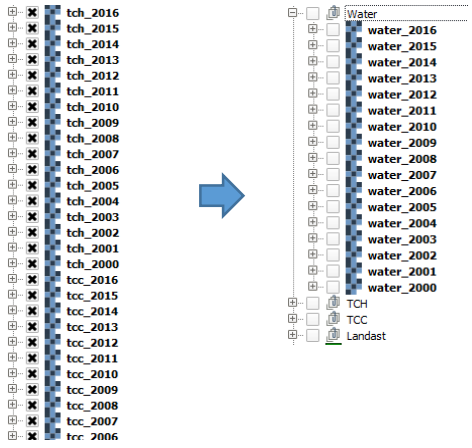
Loading raster data in QGIS

To load raster data click on [Add Raster Layer]  toolbar button. This will open the file browser window. Select all raster files (*.tif) and load them by clicking on [Open]. You can also drag files into the project window from a system file browser.



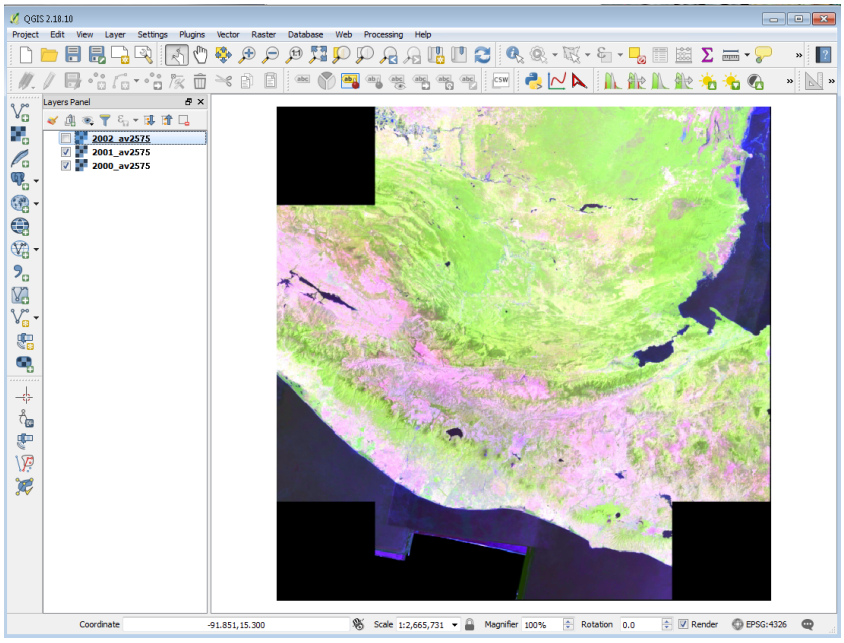
When you have several files open at once, you will notice that the files appear on the left-hand panel called “Layers Panel”. The first file on the list is the one that is visualized first. We can change the visualization order by dragging the file name to the desired position. You can also “turn off” any of the layers by unchecking the box next to the file name.

If all raster data is loaded correctly, it should be arranged in the “Layers Panel” by type and year (from early to late). If it is not arranged, you can shift the image position to keep layer sin order. To simplify visualization, we recommend grouping layers by type. To create a group, select all layers of the same type (i.e. “water”) and select option “Group Selected” from the right-click menu. See figure below that shows “Layers Panel” before and after layers grouping:



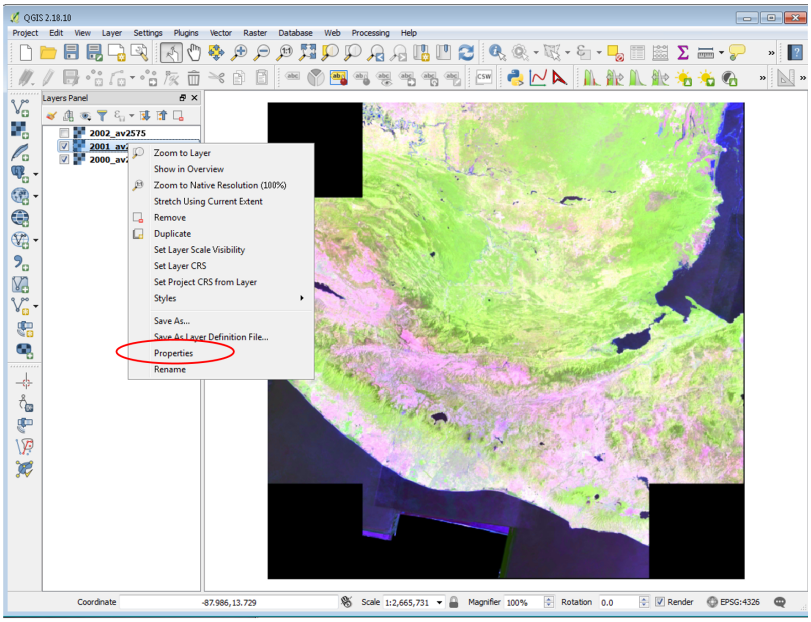
Multi-band raster data visualization

Once you have opened one of the files, you will see an image similar to this:

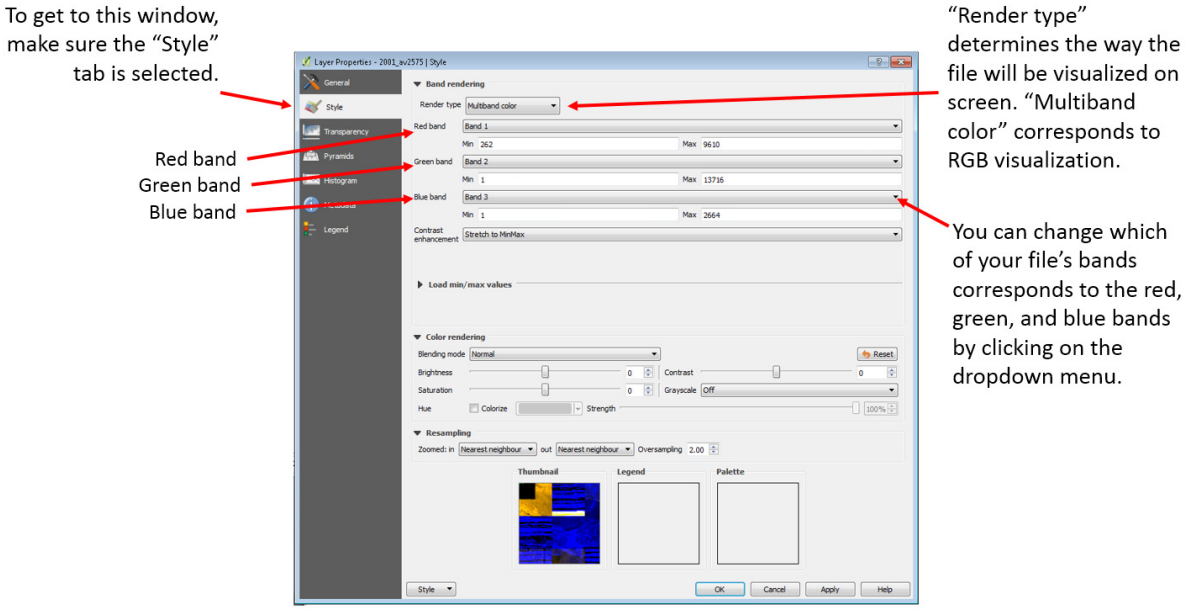


The image we observe is in a 5-4-3 RGB combination (this is equivalent to 6-5-4 in Landsat 8). This means that we have loaded the short wave infrared band (SWIR I) in the red band, the near infrared band in the green band, and the red band in the blue band. This color combination is useful for highlighting different types of vegetation.

To change the way the data are visualized, right click on the file name in the panel on the left and select “Properties”:



The following window will appear:



In this case, the composites we are using only have three bands. These bands correspond to the following Landsat bands:

Band 1 – Shortwave infrared (band 5 in Landsat 7, band 6 in Landsat 8)

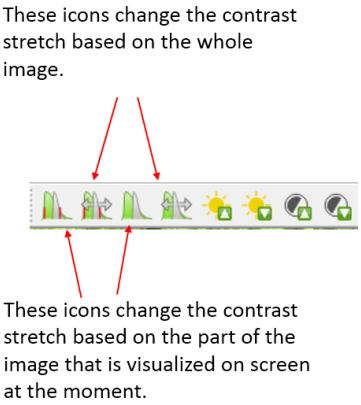
Band 2 – Near infrared (band 4 in Landsat 7, band 5 in Landsat 8)

Band 3 – Red (band 3 in Landsat 7, band 4 in Landsat 8)

Image histogram enhancement

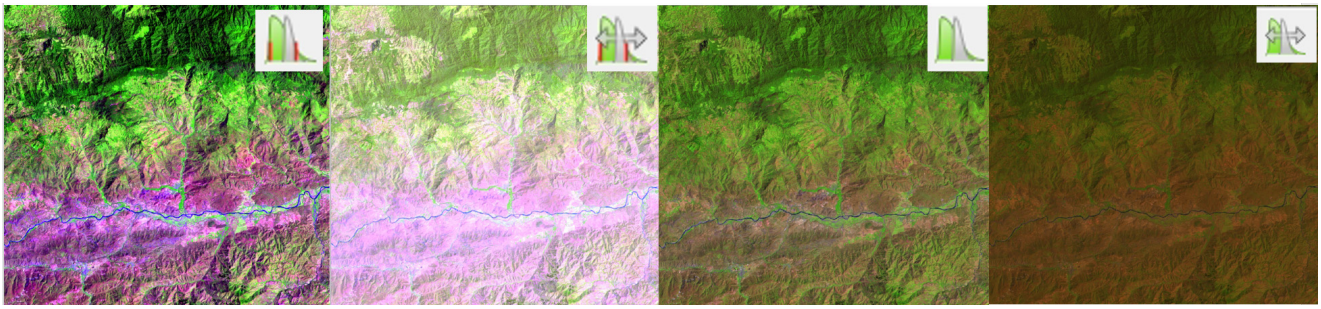
When we visualize raster data, we can apply an image stretch in order to improve the contrast and aid image interpretation. Sometimes, the images we want to visualize have values within a smaller range than we can use (QGIS can visualize values from 0 to 255). In these cases, using an image stretch extends the values of our image so that they fit within the 0 to 255 range, which improves contrast. Every time we load a new image, we change band combinations, or we zoom in and out of the image, we should make sure that we are using an appropriate stretch.

To apply a stretch, first make sure you have the necessary toolbar. To do this, go to "View" in the main toolbar, then select "Toolbars" and "Raster toolbar". Make sure the box next to "Raster toolbar" is selected. If it is, the following icons should appear in your toolbar:



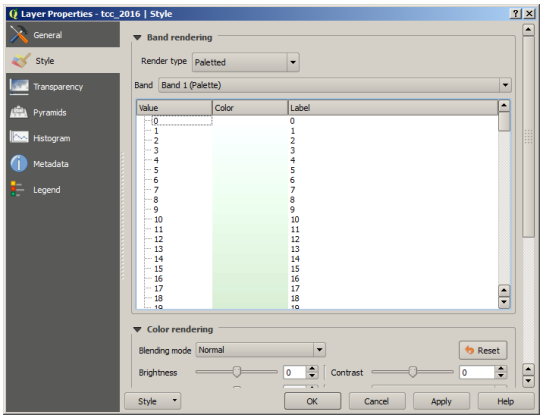
The first four icons change the image stretch and the last four increase and decrease the brightness and contrast of the image.

The image colors change significantly depending on the image stretch. The next four images show how an image changes when we apply each of the stretch options:



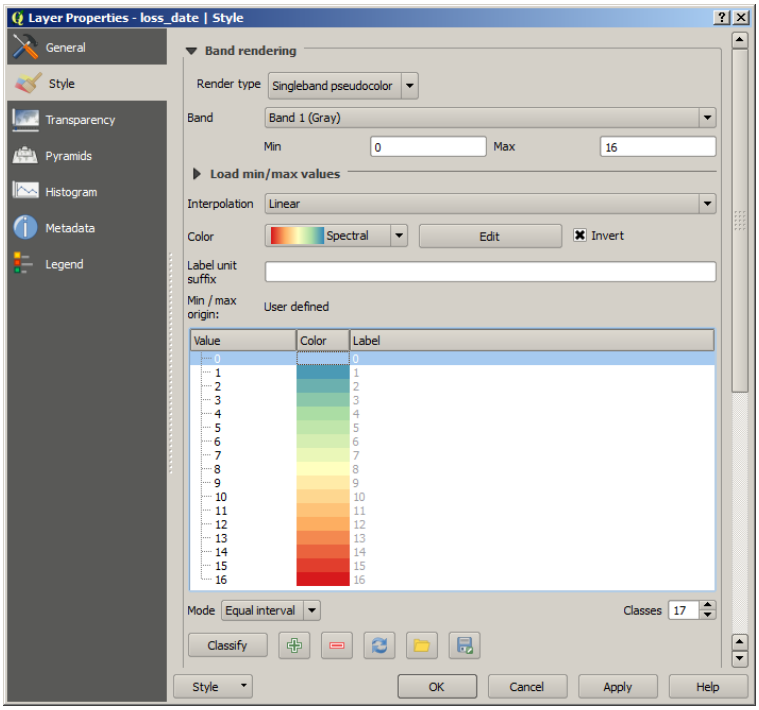
Single-band raster data visualization

All GLAD products except Landsat data composites represent single-band raster layers. The annual product layers has color palette included in the data file. When such file is opened in QGIS, the palette is loaded automatically. To see the palette, right-click on the dataset name in the “Layers Panel” and select “Properties”. See palette options in the “Style” dialog window.

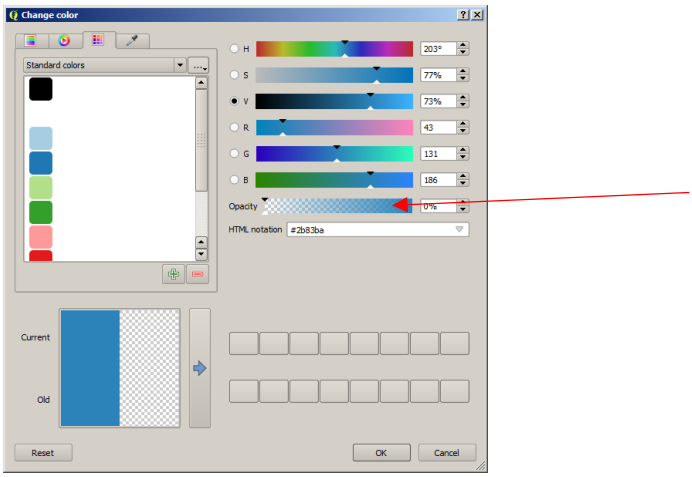


You may modify the transparency of certain values or the entire image using the “Transparency” tab.

For the Tree cover loss date layer, the palette should be set up. Right-click on the layer name (“loss_date”) to open “Layer Properties”. In the “Style” tab select “Render type” as “Singleband pseudocolor”. Set Min and Max values to 0 and 16, respectively. Use “Invert” to rotate color palette. Select “Equal intervals”, and set up 17 classes.

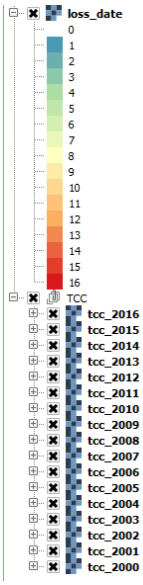


To make value “0” transparent, click on it and change its opacity using the slider.



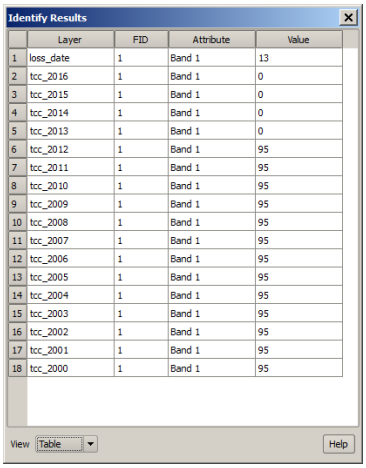
Analyzing temporal profiles

QGIS has a number of tools to analyze temporal profiles. We will use the simplest tool that allows us to see the values in a table format. To start using the tool, arrange layers as follows:



We will use “loss date” to navigate, and will check the tree canopy cover temporal profiles for areas with different change dates.

Using the information tool , click on the map. Select “Top down” Mode and “Table” View. The table shows the change in tree cover (values for layers tcc_2000 – tcc_2016) and the date of the detected change event (13 -> 2013).

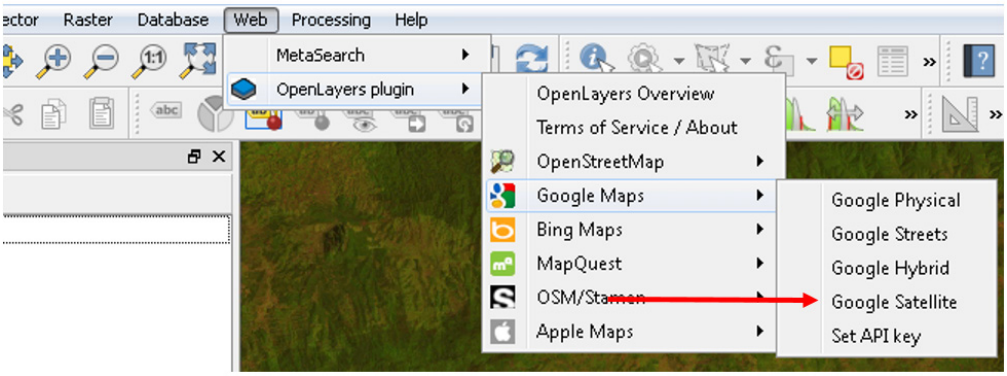


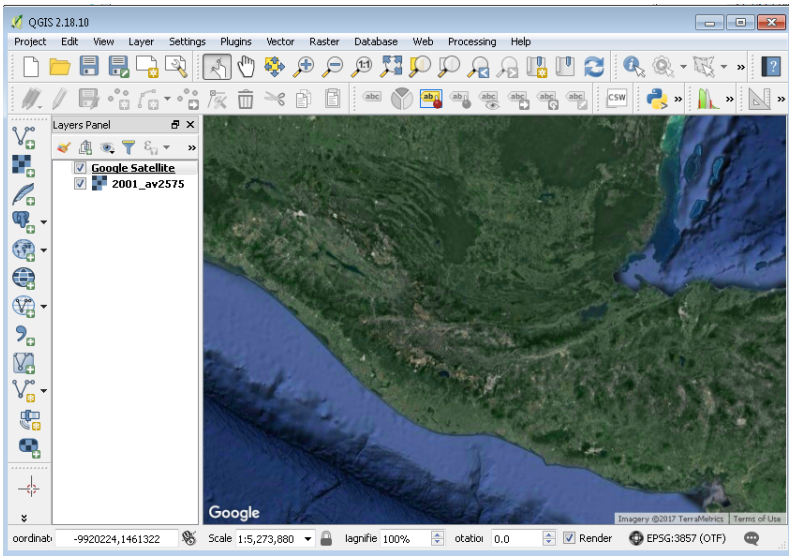
Try using this tool with other time-series data (tree cover height and water)

Linking QGIS and Google Earth high resolution image data

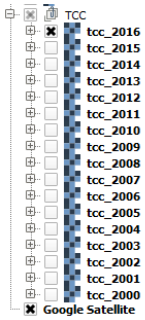
QGIS has a number plugins that add additional functionalities. We will use two plugins that allow using the Google Earth more easily in order to help image interpretation: OpenLayers Plugin and Send2GE.

The **OpenLayers** plugin allows us to visualize Google Earth data within QGIS. A Google Earth data layer is added to the panel on the left in the same way as our other raster layers. To turn on the Google Earth layer, click on “Web” → “OpenLayers plugin”→ “Google Maps” → “Google Satellite”.

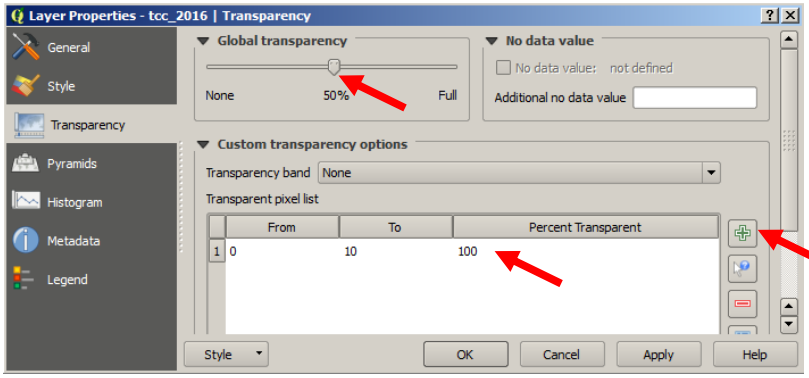




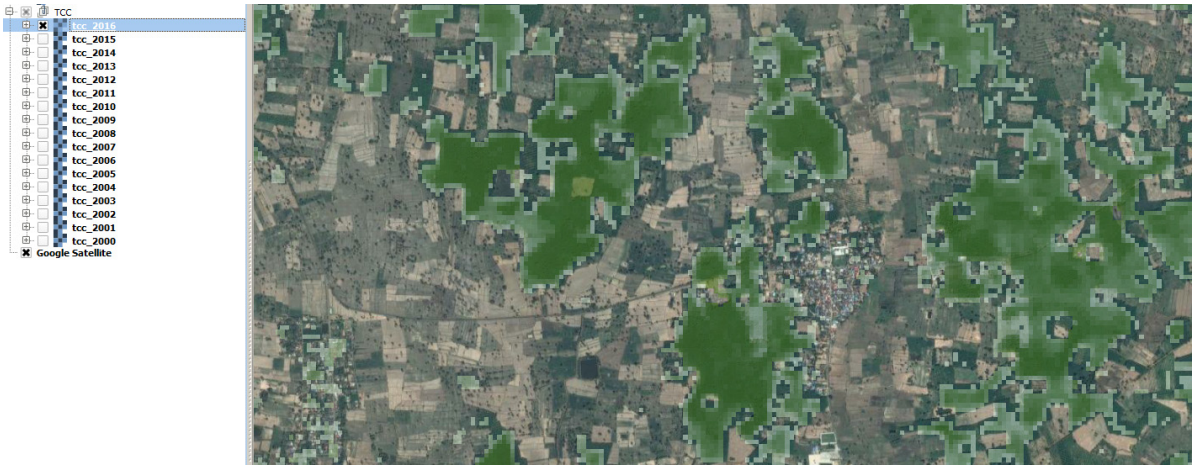
To overlay the national product with Google Erath, first add the “Google Satellite” layer as shown above and place it on the bottom of the layers in the “Layers Panel”. Switch OFF all other layers and layers groups, but switch ON the tree canopy cover for the year 2016:



Right-click on the ”tcc_2016” layer to open it properties. Open tab “Transparency” and set layer transparence to 50%. Than add to the “Custom transparency options” one line and set values 0-10 with the 100% transparency:



Navigate through the image to see if the canopy cover in the product sufficiently accurately represents the tree cover observable on the high-resolution images.



The next plugin is called "**Send2GE**", which stands for "Send to Google Earth". This plugin lets us click on any point within our image to see that location on the Google Earth software window. Once you have installed the plugin, the following icon should appear in the toolbar: 

Click on this icon, and then click on any spot in the image. Google Earth will automatically start and will center on the selected spot. Google Earth must be installed on your computer in order for this plugin to work.