- **Feedback button**

Feedbacks can be sent to Google using this button when there is no feedback given to you upon sending a bug report, request or suggestion.

- **Task manager**

This contains long-running queries.

- **Console output**

This displays script, text, objects or charts from your script when you print.

- **Inspect locations, pixel values, objects on the map**

This allows you to query on your map interactively such as showing location and layer value.

- **Layer manager**

This adjusts visibility and order of how the layers are displayed on the map.

- **Geometry Tools**

This allows adding geometry layers in the map such as points, placemarks, line and shapes.

- **Zoom**

This adjusts the view extent of the map being displayed on the screen.

Exploring Google Earth Engine Code Editor Elements

First that we will explore is the *Script Manager*. Under the Scripts, you can see the *Examples* section where the different ready-made scripts for downloading NDVI using MODIS and Landsat imageries can be found.

Let's now start exploring the code editor by following the steps below:

1. Click on the *Examples* section located under the Script.
2. From the *Examples* section, click on *Datasets*.
3. Under the *Datasets* section, click on MODIS_MOD09GA_006_NDVI. After selecting the specific dataset, the code editor section on the right side of your screen will be filled with its scripts for downloading images.

Figure 81

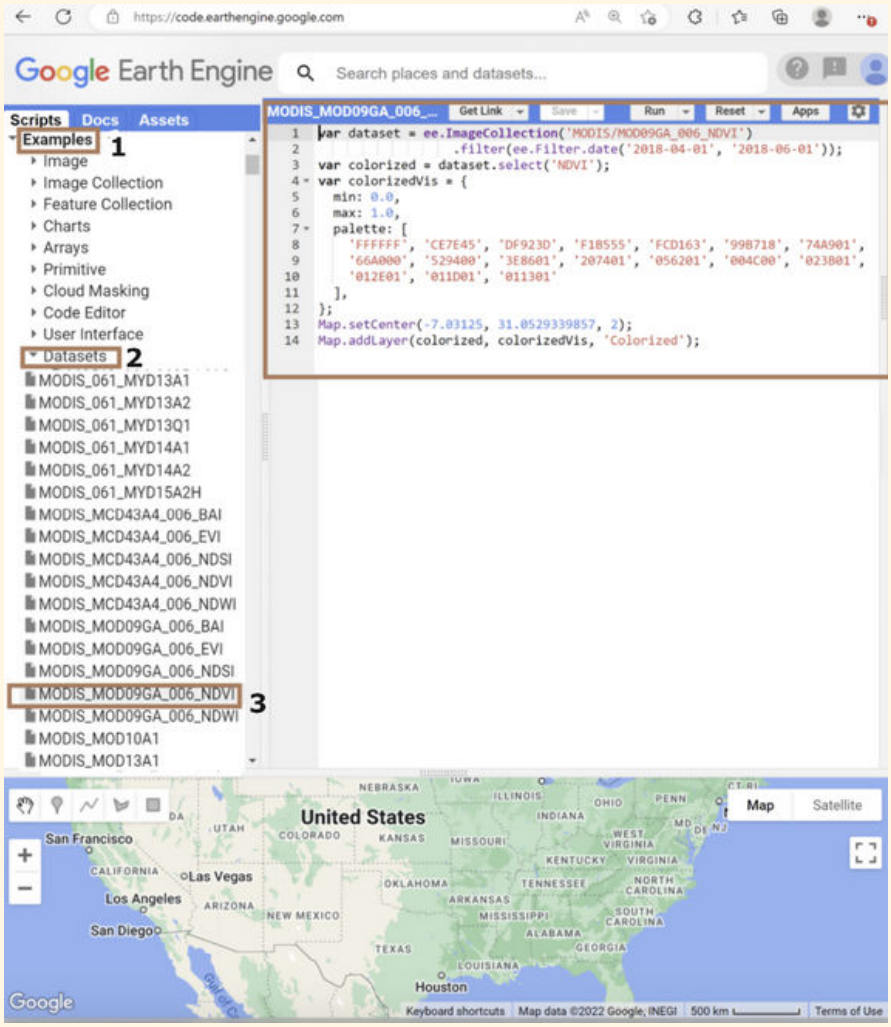

Figure 81. GEE Script Manager

4. *Datasets* can also be accessed on the data catalog by typing on the search bar the data that you are looking for. For our exercise you can try searching for MODIS_MOD09GA_006_NDVI and see if you can have the same result as the previous one.

Figure 82

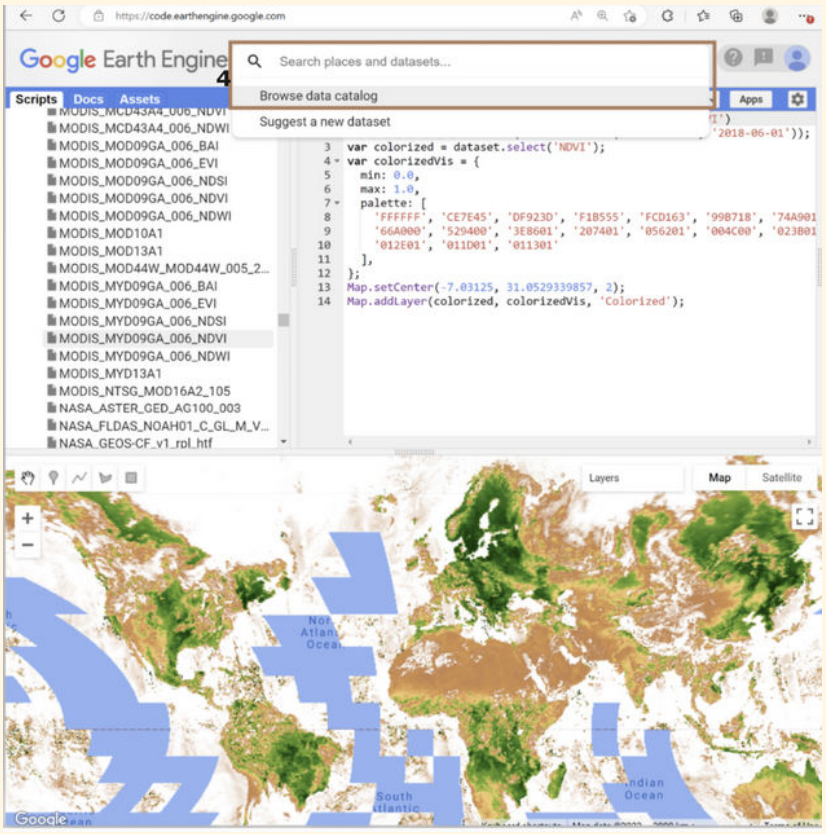

Figure 82. Accessing Datasets using Search Bar in GEE

5. Now, click the *Run* button to initialize the scripts for MODIS_MOD09GA_006_NDVI.

Examine the scripts. Each line in the script represents a function on what and how the satellite image is viewed on the map. Notice that the world's NDVI is loaded and the scripts listed can be configured depending on the data requirement, i.e. collection date and AOI.

Figure 83

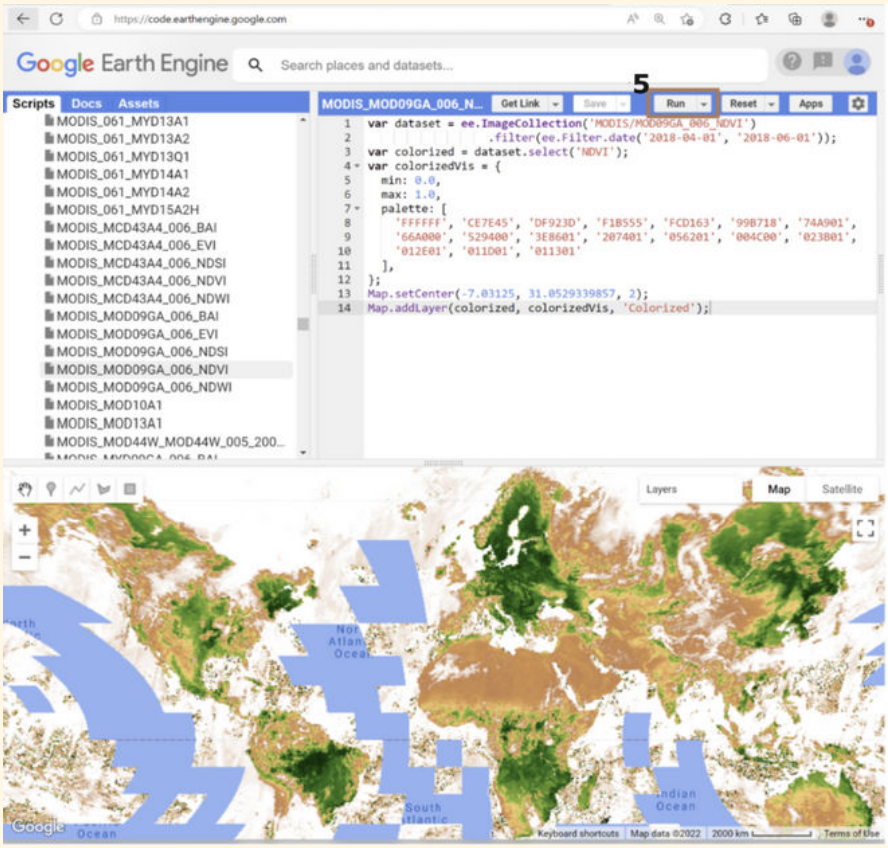

Figure 83. Initializing the Script in GEE

6. [Filtering the Dates] The second line of the script shows the date of the image shown on the map. To filter the dates, edit the second line of the script by typing in your preferred imagery date [6a] then click *Run* [6b].

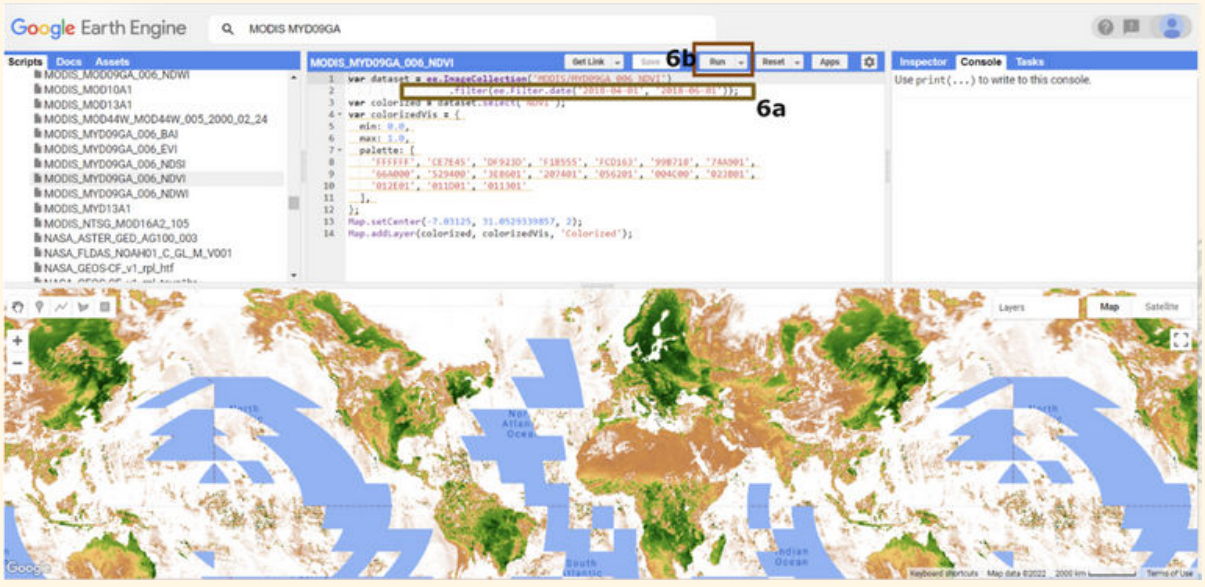

Figure 84. Filtering the Dates in GEE

7. [Setting the map center] You may change the map center so while exploring, we do not have to pan our AOI every time we run our script when we change the/filter the date. In our case let's set the map center to Palawan. Go to the Inspector tab [7]. Locate in the map where your area of interest is (e.g Palawan) by panning on the map then clicking on the area [8]. After you have clicked your area of interest, check the *Inspector tab* and copy the coordinates [9]. Replace the coordinates on line 13 of the script by pasting the coordinates from the *Inspector tab* [10]. You can try changing the date again before you click *Run* [11].

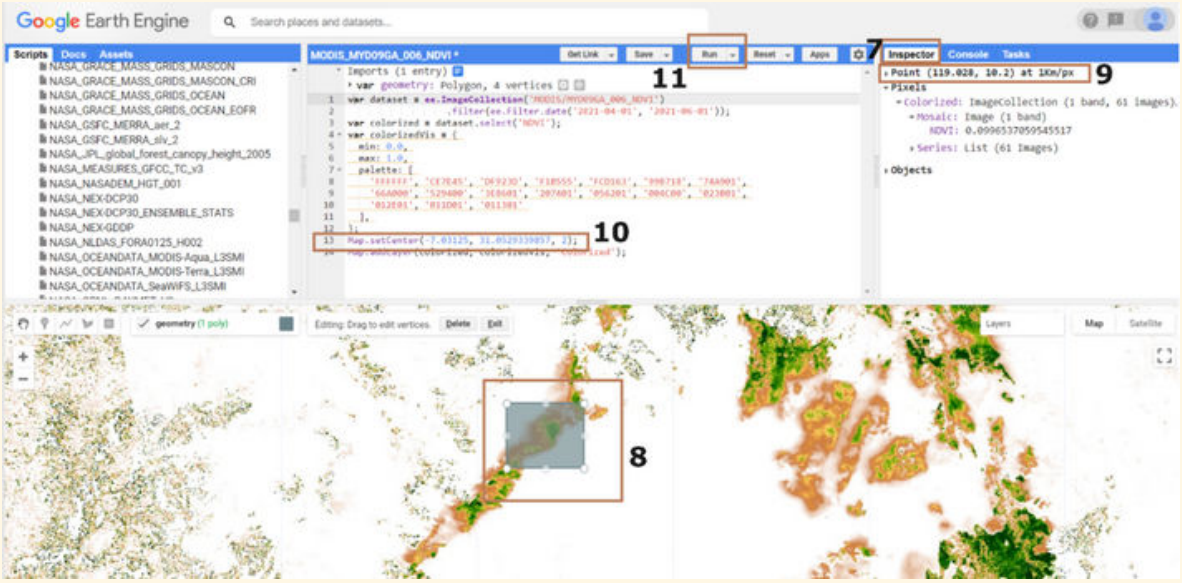

Figure 85. Setting the Map Center in GEE

You can now see the NDVI map display on the area of interest, Palawan. You can zoom in and out on the AOI so you have a better view of the area for assessment.

Downloading Imagery using AOI in GEE

In case you already found the "perfect" NDVI scene, and you only want to download the extent of your AOI, we can also do it by creating a bounding polygon on the map window.

1. On the map window, select the geometry button on the map window.
2. Select your AOI on the map by drawing a rectangle over it. You may edit your AOI by dragging its vertices.
3. After selecting your AOI, change the 'geometry' to ' aoi' on the script (above row 1);
4. Add the script below on the code editor script window for downloading;

```
Export.image.toDrive(
{image: dataset.mean(),
description: 'file name',
fileNamePrefix: 'file name',
region: aoi,
Scale:10,
crs:'EPSG:32650'
})
```

5. Click *Run*

Your image will be downloaded to your Google Drive based on the email that you used to create your Google Earth Engine account. Imageries can take up large storage space on your drive so make sure you have enough storage space left in your drive to avoid errors when downloading. This is also the reason why it is important that you only select your specific area of interest for downloading.

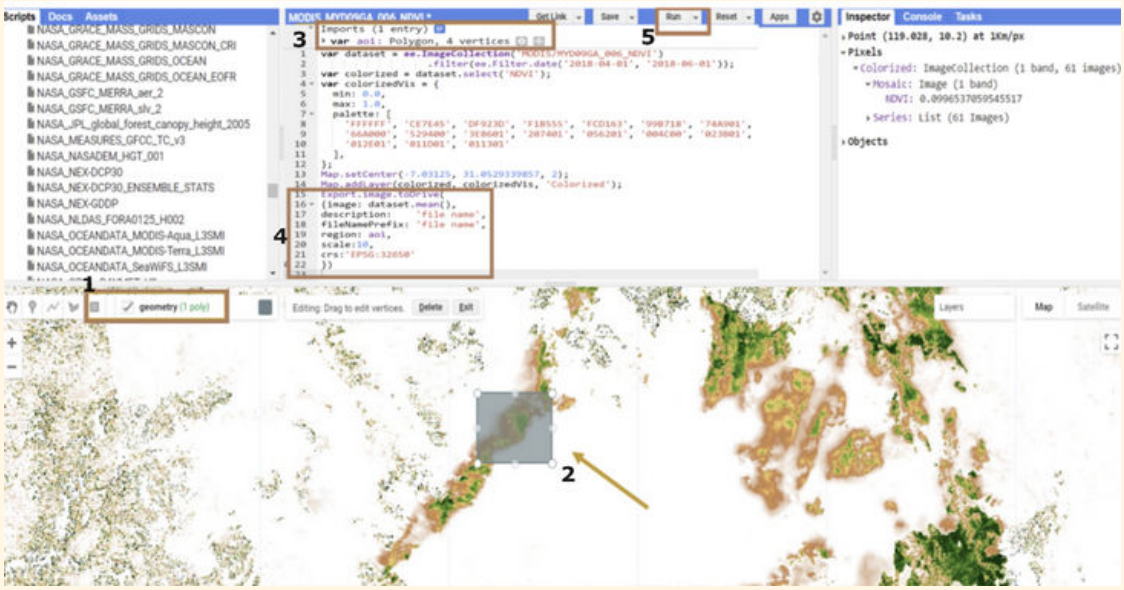

Figure 86. Downloading Imagery using AOI in GEE

Note: To optimize the download time for satellite imageries, make sure you define your AOI by adding a geometry defining the boundaries of your AOI. The downloading script on step 4 is the downloading script for Google Earth Engine. It is advisable that you have a copy of this in your notepad for easier access when downloading imageries.

Loading and Downloading Landsat 8 NDVI from Sample Script

Now do the same process on loading and downloading imagery while using the Landsat 8 NDVI from the sample script.
The following are the steps in selecting the dataset for downloading:

1. From the Example scripts, choose the Landsat 8 Collection 1, 8 day NDVI (LANDSAT_LC08_C01_T1_8DAY_NDVI). The script will be loaded on the code editor.
2. You will notice that the center of the map is in the US continent. To change the map center, drag the map window to the desired location (i.e. Palawan), then click the Inspector Tab, point the pointer in the middle of the desired location.
3. On the Inspector tab on the rightmost panel copy the coordinates of the point be where you put the pointer
4. Copy the coordinates and change the coordinates in row 13 of the code editor.
5. Click Run

To download the imagery follow the 5 steps listed in *Downloading Imagery using AOI in GEE*.

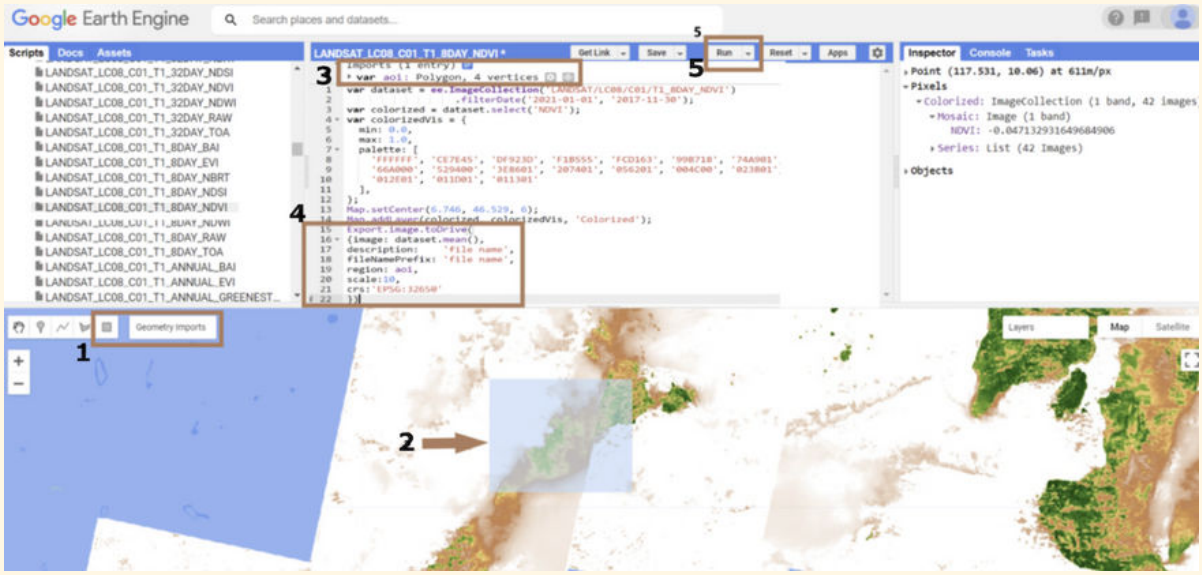

Figure 87. Loading Landsat 8 NDVI from Sample Script

On the image of the map shown above, there are apparent cloud cover in the AOI. Try adjusting the filter dates and running the script to obtain less cloud cover in the AOI.

Using the Sentinel Data Collection of GEE

In cases where both NDVI images from MODIS and Landsat have apparent cloud cover, another method that can be used is to download from the Sentinel 2 image collection and use a script to get a cloud-free mosaic.

The Sentinel Collections are a constellation of satellites developed by the European Space Agency (ESA) to operationalize the Copernicus program including all-weather radar images. In the next activity we will download high resolution imagery using the Sentinel 2 data (ESA) via Google Earth Engine.

The Sentinel data collections include Sentinel-1 Synthetic Aperture Radar and Sentinel-2 Multispectral Bands (Figure X.x). Sentinel-2 samples 13 spectral bands: visible and Near-Infrared (NIR) at 10 meters, red edge and SWIR at 20 meters, and atmospheric bands at 60 meters spatial resolution. It provides data suitable for assessing state and change of vegetation, soil, and water cover. Sentinel 3 is used for monitoring the ocean and the land surface; while Sentinel-5 is used for measuring atmospheric concentrations of ozone, methane, formaldehyde, aerosol, carbon monoxide, nitrogen oxide, and sulfur dioxide, as well as cloud characteristics at a spatial resolution of 0.01 arc degrees. There are also other ready-made datasets which might suit your needs such as *Dynamic World*, and *ESA WorldCover*. *Sentinel-2 Cloud Probability* and *Global Map of Oil Palm Plantations* are other collections that can be used as a script to get cloud-masked or cloud-free Sentinel image mosaics.

You may access the Sentinel collections through the link below:
https://developers.google.com/earth-engine/datasets/catalog/sentinel/ .

- **Searching for Cloud-free Images of Sentinel-2 by Creating a Cloud-free Image Mosaic**

Aside from the GEE data catalogue, we can search for cloud-free images of Sentinel-2 by creating a cloud-free image mosaic. Meaning we select a range of months in a year, say, 2022, which the GEE algorithm will be able to put together pixels without clouds and then form a mosaic of these. To do this, follow the steps provided below:

1. On the left panel go to the scripts tab and scroll down until you reach the "Datasets".
2. Inside the Datasets, look for a "ready-made script" called "Copernicus_S2_Cloud Probability" and click it.

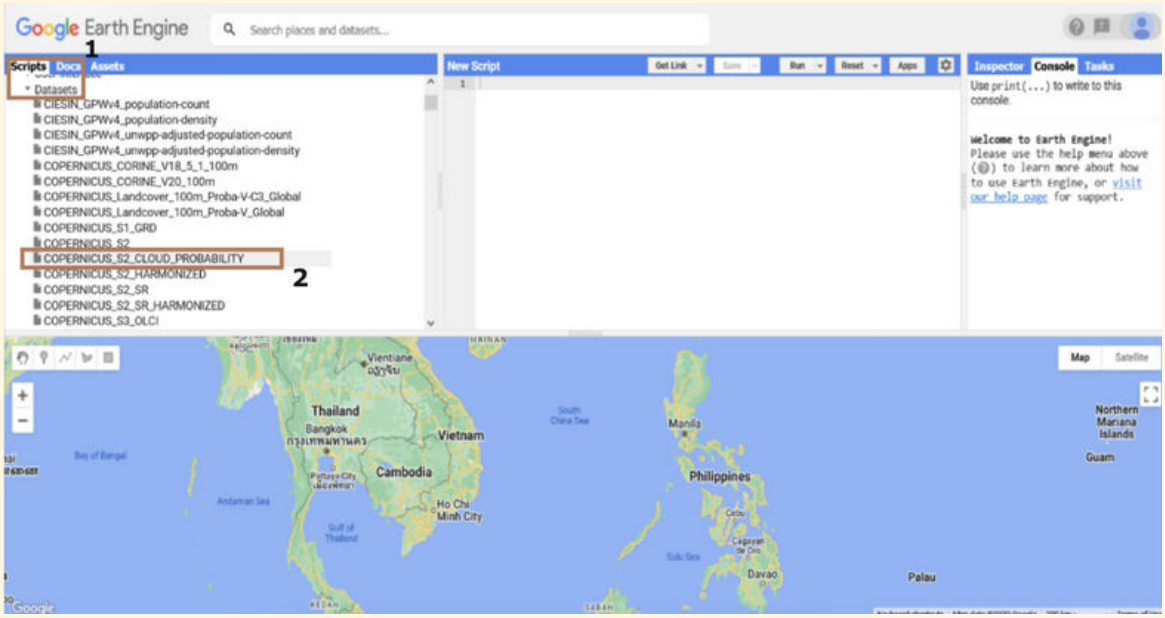

Figure 88. Accessing Sentinel 2 Dataset in GEE

Explore the different lines of the scripts for Copernicus_S2_Cloud Probability and what these represent. On the image shown below the magenta box represents the name of the 'data collection' in the GEE data catalogue. The blue box shows the inclusive dates for the wanted image data for your area. For this activity, change the inclusive dates to 2022-10-01 to 2022-10-17. The green box points to coordinates of the study area you want to work on. The red box shows the coordinates on which to center on your display. However, these ones you need to edit so this will show our area of interest. The orange box above directs you to a probability value set at 65%. Increasing or lowering this value will either limit your access to image data, since lower values will be too strict with cloud presence.

Continue

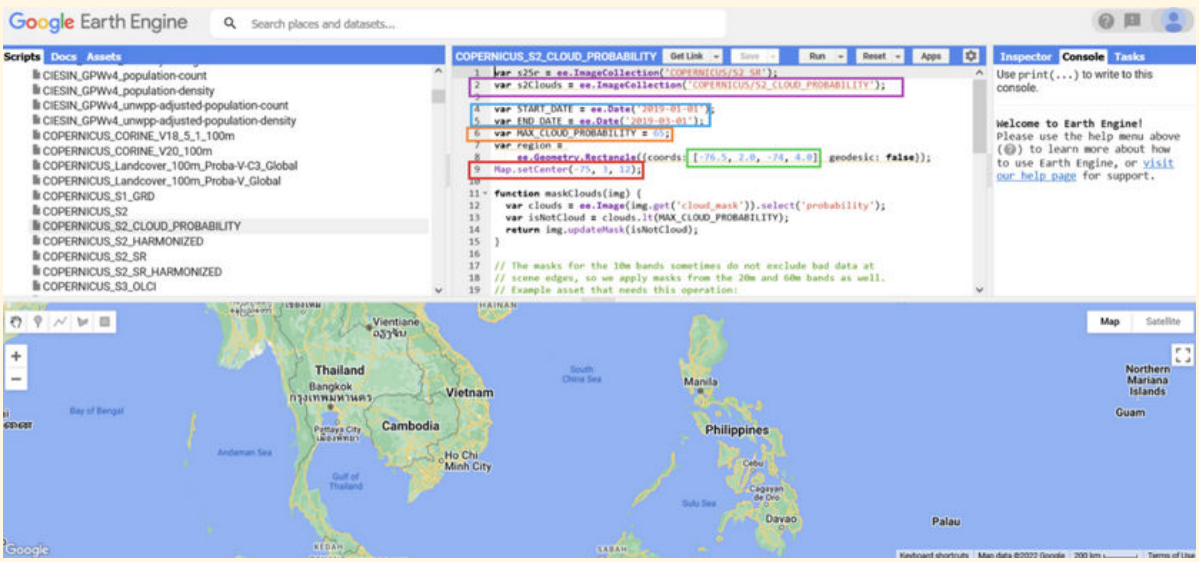

Figure 89. Examining the scripts of Sentinel 2 in the Code Editor

- **Delineating the bounding region as AOI**

1. Click on the Draw a rectangle icon located on the upper left side of the map
2. Delineate your boundary on the map by drawing a rectangle to your AOI. You may edit the vertices should you wish to edit your boundaries.
3. After defining the boundaries, click on the dropdown arrow at the top of the first line of the script to show what is inside the *var geometry* and then rename it as "aoi".
4. After renaming, you will notice on the upper left of the map area that "geometry" is also renamed to "aoi". Click the "exit" button to accept the AOI.

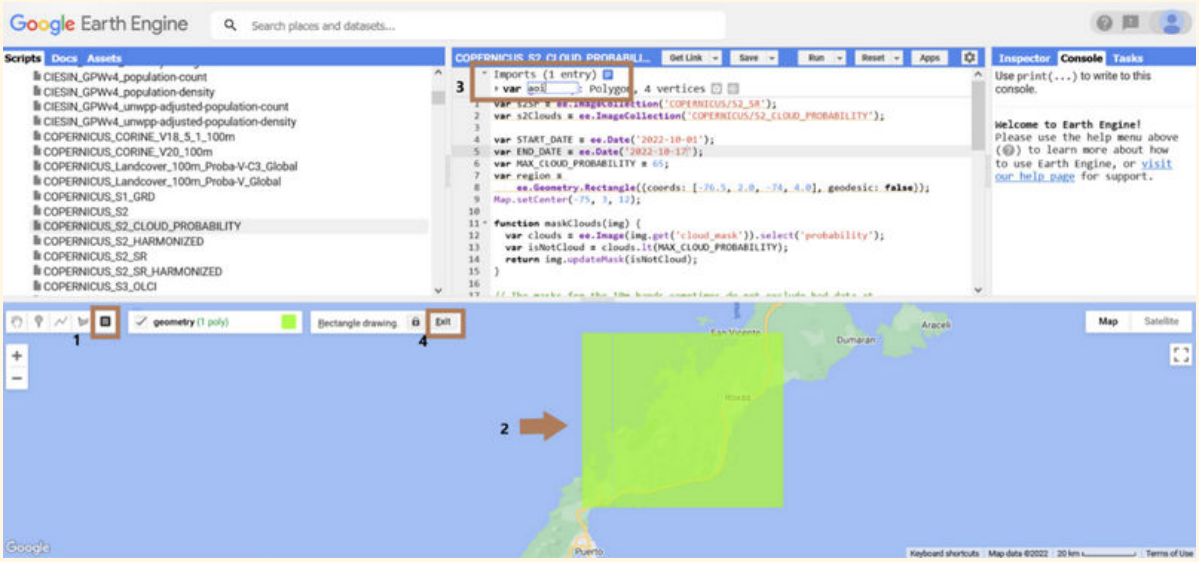

Figure 90. Delineating the bounding region as AOI

- **Trying out the dates to get a good mosaic**

Edit the date and input the whole month of September 2022 to October 17, 2022 and click *Run*.

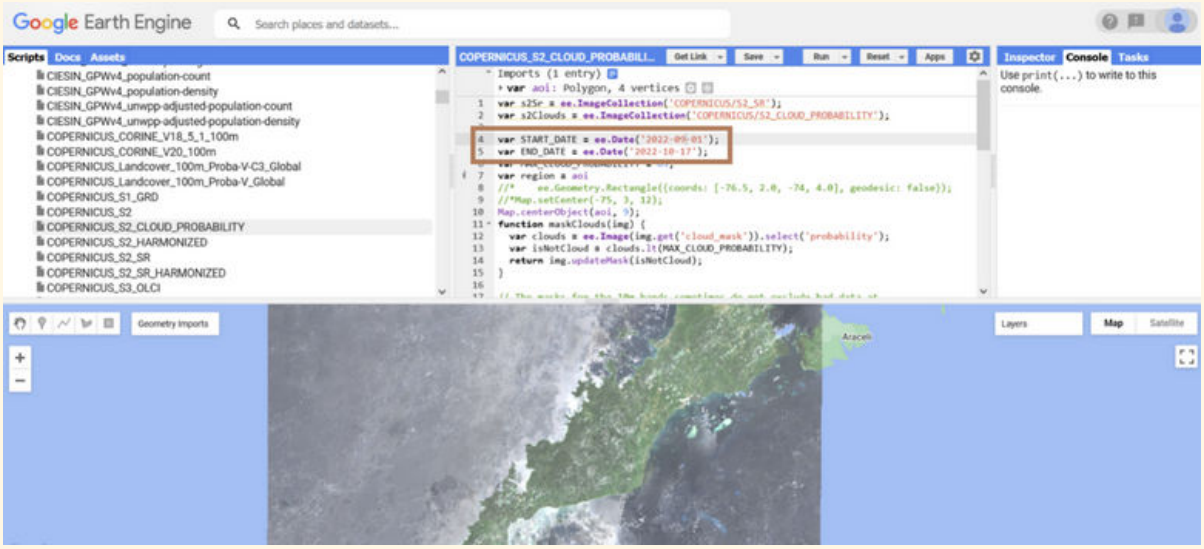

Figure 91. Trying the September to October 2022 Date Range of the Image in GEE

Trying out from January 2022 right after the aftermath of Typhoon Odette. We could get a better image, but remember to remove the clouds we had to use several satellite images to create a cloud-free image–and it might be that there has been change over the time period. However, for lack of better image this might do for our future land cover mapping. Or you can still explore other Satellite Data Catalogue.

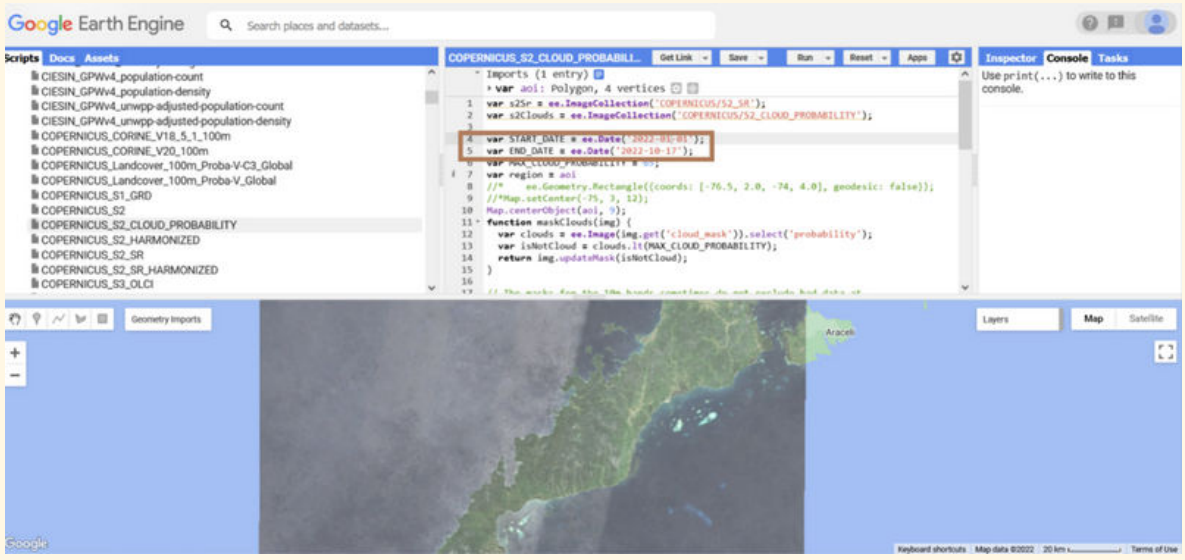

Figure 92. Trying the January to October 2022 Date Range of the Image in GEE

- **Inspecting the legend at the lower right panel**

In the legend, you can tick on or off the output. It says Sentinel 2 at Surface Reflectance and is masked at 65% cloud probability. You can play with this probability by increasing it to see if you can get faster, with a shorter time period, a cloud-free mosaic. Notice the band numbers with B4, as the blue wavelength, B3 the green and B2 as the blue. These represent the natural colors that are visible to the naked eye so you can see them in their natural look.

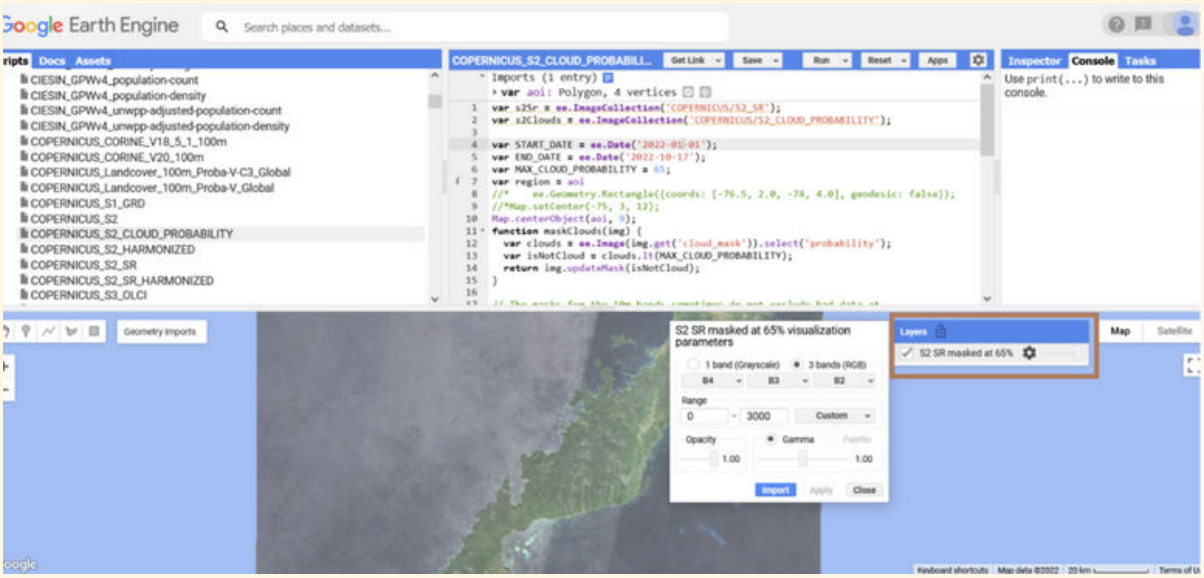

Figure 93. Legend in GEE

Set the band numbers B8 (NIR) for the red, B4 (red) for the blue and then B2 (green) for the blue. These bands are most commonly used to assess plant density and health, as plants reflect near infrared and green light, while absorbing red. Since they reflect more near infrared than green, plant-covered land appears deep red. Denser plant growth is darker red. Cities and exposed ground are gray or tan, and water appears blue or black.

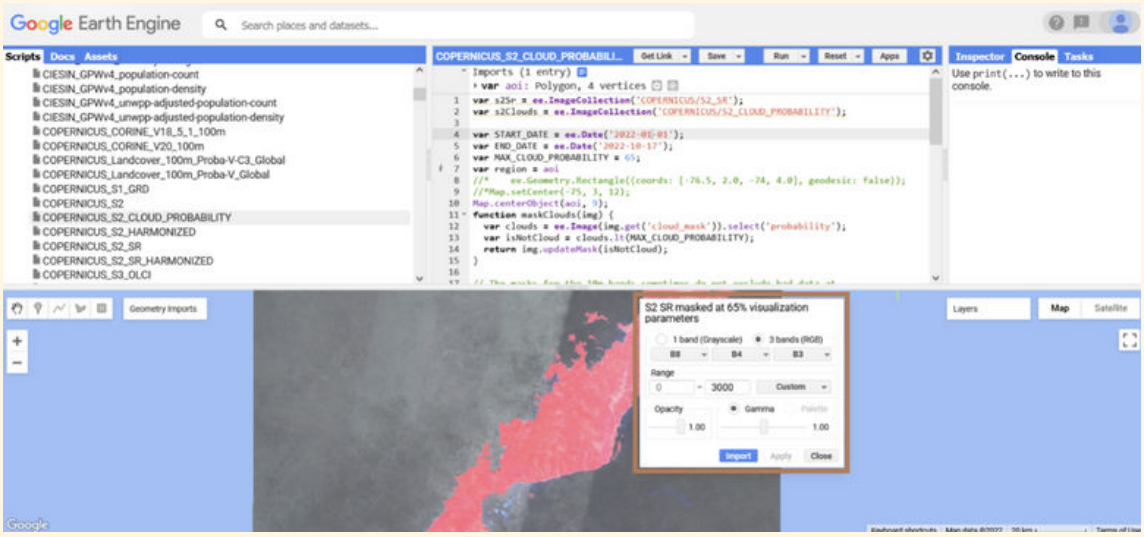

Figure 94. Assigning Band Parameters for Sentinel 2 Dataset

Explore the images using different date ranges and try looking for a cloud free image in your AOI until you reach the latest date. The images below are some examples of Landsat images of Palawan with their filter dates.

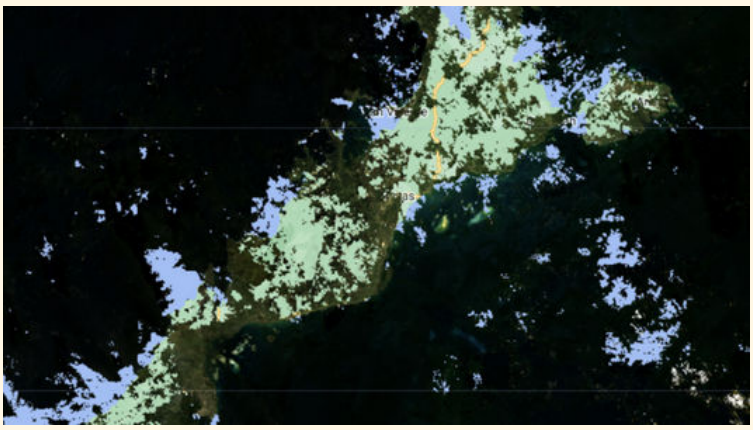

Figure 95. January to March 2022 Landsat 8 Image

Figure 96. January to June 2022 Landsat Image

Figure 97. January to October 2022 Landsat Image

If you found your cloud-free satellite image in your AOI, you can download it by adding the downloading script in the code editor. The script and the process of downloading is the same process with downloading Landsat 8 NDVI images discussed previously. Run your script and check the task tab to check the download status of your image in your Google Drive.

- **Planet & NICFI**

One of the websites that was discussed earlier where we can download satellite images is Planet. The free data portion can be alternatively accessed using the Google Earth Engine by searching for the Planet data catalogue by encoding the term "planet" on the search bar of GEE. Scroll down on the suggested results list and select the "Planet & NiCFI Basemaps for Tropical Forest Monitoring- Tropical Asia''.

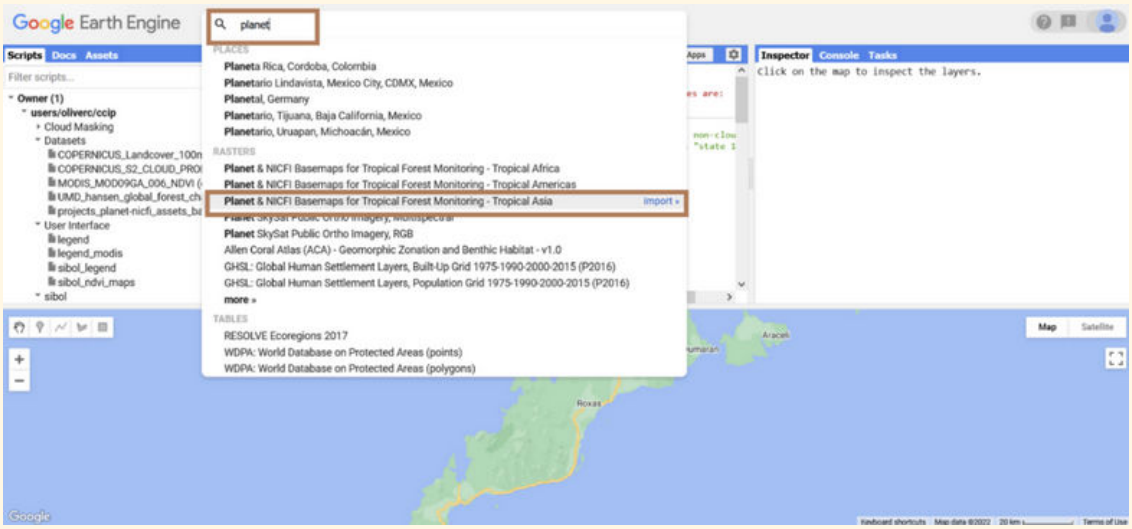

Figure 98. Accessing Planet & NICFI Data Catalogue from the Search Bar in GEE

Selecting the "*Planet with Tropical Asia*" keyword brings you to an instructional panel, which will tell you how to access. You will need to create a Planet account first before you can totally access the satellite database through the NICFI facility. Please read through the instructions, especially, on the uses. As a warning, these datasets cannot be used for commercial purposes. Right click on the 'sign up instructions here' button so that you open another tab, which will not remove your current panel.

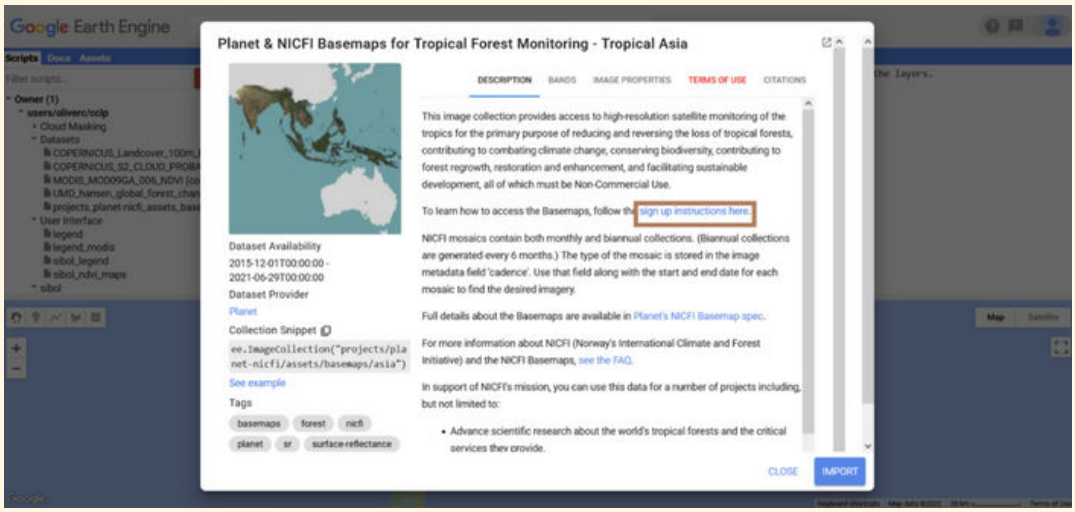

Figure 99. Access to Sign Up Page for Planet & NICFI from GEE

- **Accessing Planet NICFI Basemaps**

Here are the sign-up and access to GEE instructions provided on the Planet website.

Without an Existing Planet NICFI account

To access the NICFI Basemaps in GEE without an existing PLANET NICFI account, follow the steps below:

1. Sign up and accept the terms at, NICFI Satellite Data Program.
2. When you have created and logged in to a NICFI Planet account, access Basemaps in GEE by navigating to Account Settings.
3. In the Access NICFI Data in Google Earth Engine section, click Add to Earth Engine.
4. In the EE Image Collection dialog, enter the email associated with your GEE account.

Note:

- The email associated with your GEE account might differ from the email used for your Planet account.
- Each user is only permitted to register one email to the NICFI program. If you edit your account (email, collections, and so on) GEE access might be revoked from the previously registered email.

With an Existing Planet NICFI Account

If you already have an existing Planet NICFI account but it is still not connected to your GEE account just log in to your Planet account and go to your Account Settings and follow the instructions below:

1. Click on *My Settings*
2. On the lower right corner of your screen click *Edit Access*
3. On the Access NICFI Data in Google Earth Engine Window that prompts, tick on *Tropical Asia*
4. Enter your GEE email on the bar. Even though you used different emails on your GEE and Planet accounts this will still work.
5. Lastly, click the *Connect to Earth* Engine button.

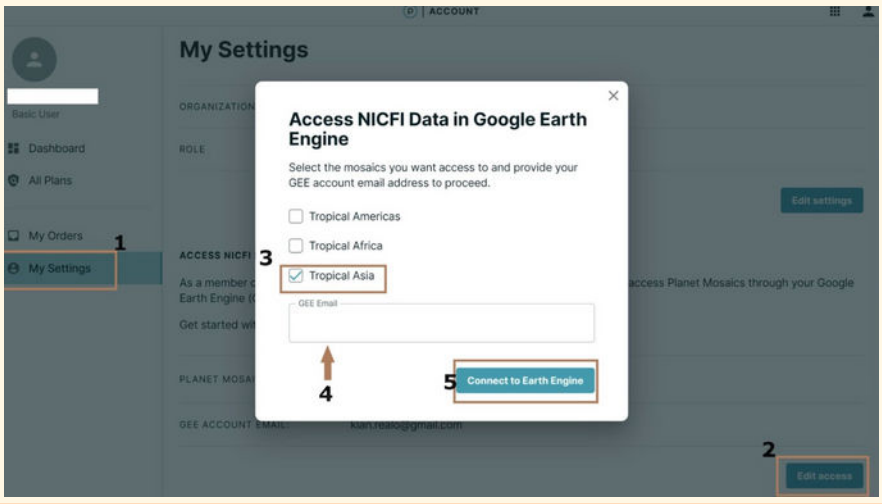

Figure 100. Connecting to a NICFI Data Mosaic in GEE

- **Loading the Planet NICFI map of the AOI to GEE:**

However, if you already have an existing Planet NICFI account that is linked to your GEE, there is no need for you to sign up. To load the map shown on the figure below, follow these steps:

1. You can directly go over your Scripts--> Examples -->Datasets--> projects_planet-nicfi_assets_basemaps_asia . After connecting your Planet NICFI account to your GEE, load the projects_planet-nicfi_assets_basemaps_asia to the code editor then make sure to center your map to your target site (i.e Puerto Princesa). The steps in editing the map center is the same process as those provided for the MODIS Dataset.
2. To center on the target site of Puerto Princesa Underground River, you can manually pan the map in GEE or you can copy the coordinates from the Inspector section on the figure below.
3. Copy the current coordinates from the Inspector section and replace those inside of line 6 and change the zoom level to 10.
4. Set the date of the mosaic. Note that to get a pre-Odette image it has to be before December 2021, say November 2021, because it is a one whole month mosaic. The inclusive dates used on the loaded map below is between June 2021 and December 1, 2021. Incidentally, Typhoon Odette happened on December 17, 2021.
5. Hit the Run button and you get an almost cloud-free mosaic.

You can play around the dates to see which ones will have totally no clouds. If you do not want to second guess, you can log in into the Planet Website and choose from their catalogue. The only problem when downloading from those sites is that the images are split into scenes, and you need to put them together.

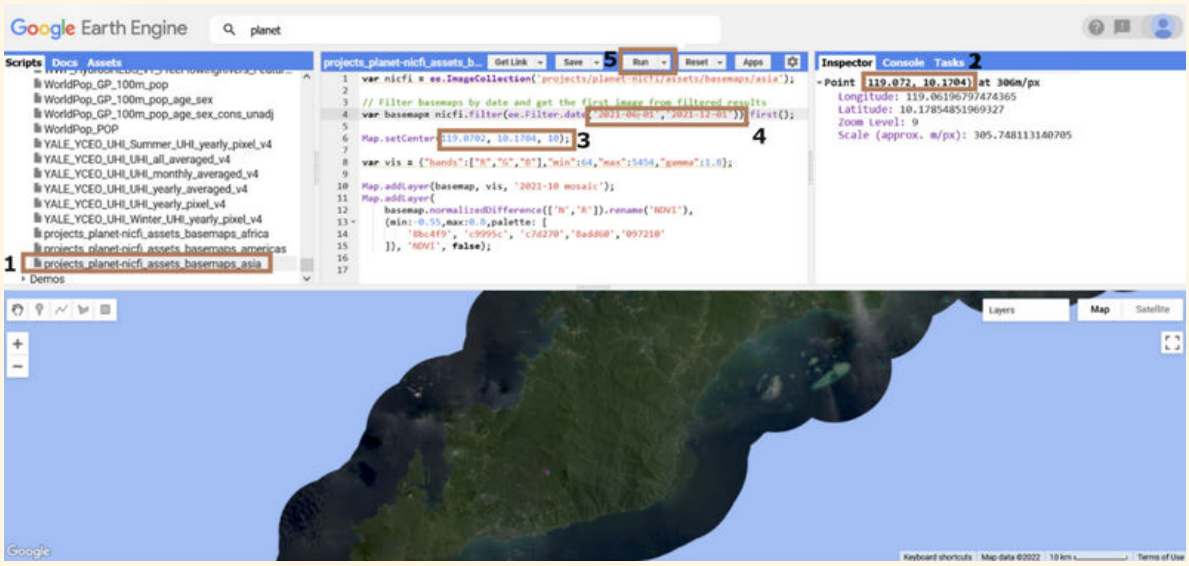

Figure 101. Loading Planet NICFI Dataset in GEE

- **Displaying NDVI through Planet Script in GEE**

The NDVI can also be directly displayed through the Planet script.

1. Click on the legend box on the upper right side of the GEE map area.
2. On the dropdown option that appears, tick the checkbox beside NDVI

Note: For the Planet data, so far it has four bands: red, blue, green and NIR, but their commercial version has more than 4, which might include shortwave infrared, usually useful for marine or coastal mapping.

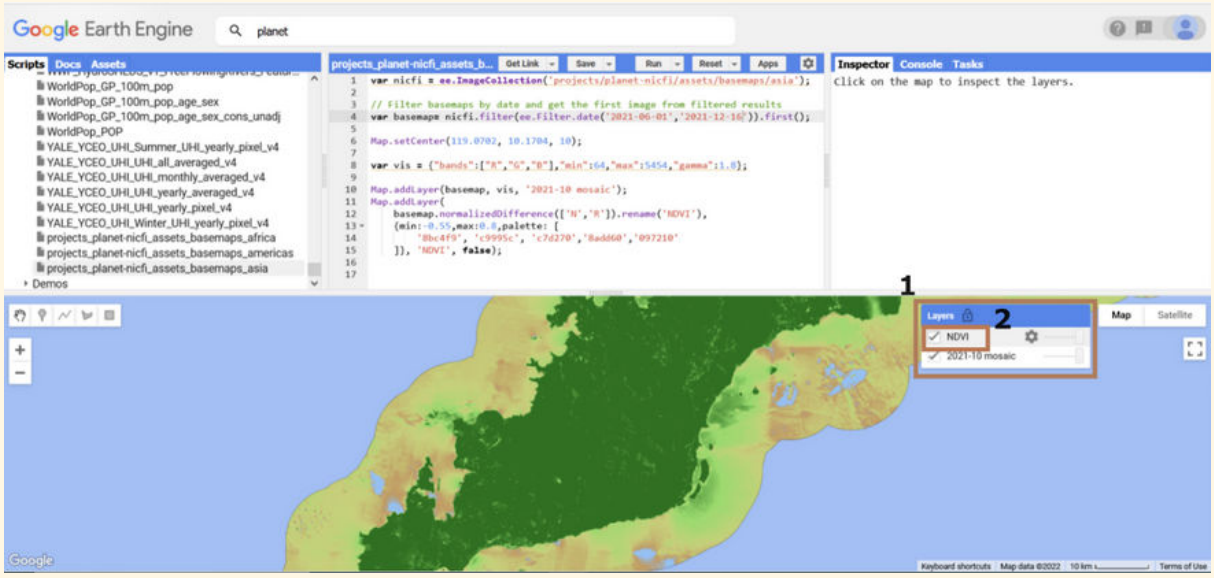

Figure 102. Displaying NDVI of the Planet Dataset in GEE

- **Downloading the Selected Cloud-free Images**

1. Define the AOI of your downloading extent by adding a geometry. Follows steps 1-3 in "*Downloading Imagery* using AOI in GEE"
2. Copy the downloading script for GEE indicated in "*Downloading Imagery* using AOI in GEE" and paste it after the last line of your current *Code Editor*.
3. Remember to assign the variable 'basemap' to the image parameter.
4. When ready you can hit "*Run*' on the *Code Editor*.
5. Then go over the Task section on the right panel of GEE and click *Run*.The dialogue box for downloading of the image inside the AOI will appear. Ensure that the appropriate projections are indicated.

Continue

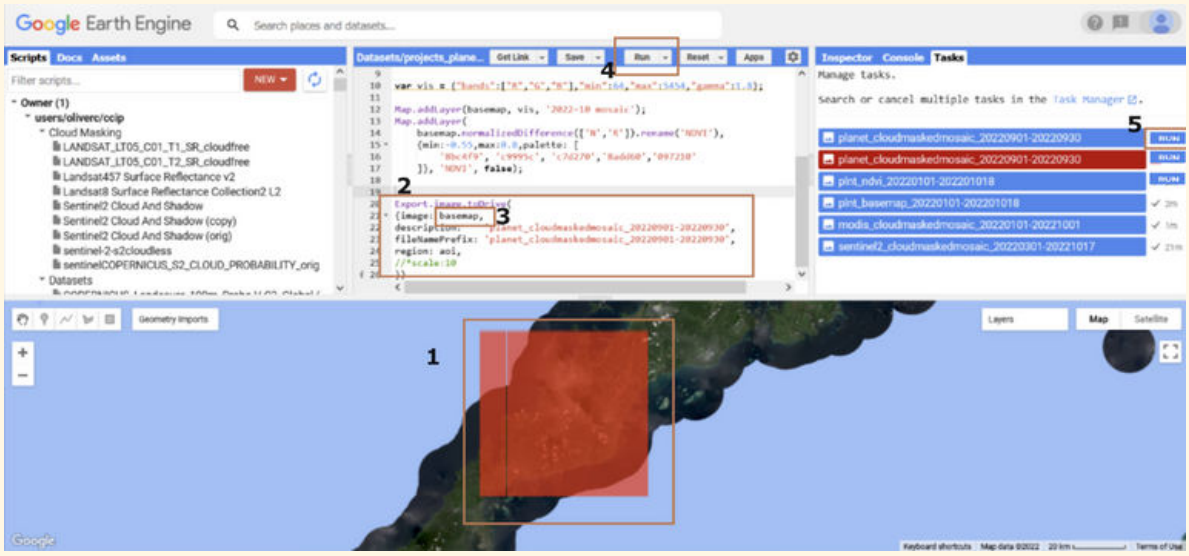

Figure 103. Downloading Planet *Dataset* in GEE

Activity 3

Exercise 3: Processing of Satellite Images

Duration	Purpose of Learning
1 hour	• To learn about different band combinations using QGIS • To compare satellite images of different imagery dates using image stacking

Requirements:

- QGIS (latest most stable version)
- Laptop/Desktop
- *Lesson 9: Processing of Satellite Images on Geospatial Training on Green Assessment for Ecosystems Disaster Mapping*
- Downloaded Sentinel 2 Images for pre-event and post-event date ranges
- Semi- Automatic Classification Plugin

Expected Output:

- One merged band raster for pre-event Sentinel 2 image with true color symbology
- One merged band raster for post-event Sentinel 2 image with true color symbology
- Extracted relevant raster bands of pre-event and post-event Sentinel 2 images for NDVI

About this Exercise

This exercise focuses on the merging of the downloaded satellite images using QGIS and how these can be represented as *infrared* color or true color using different raster band colors. This activity also aims to extract only the necessary bands for NDVI for a more efficient processing. There are three methods for raster band extraction that can be used for this activity such as a *semi-automatic classification* plugin, raster calculator and rearrange band tool in QGIS.

Instructions

1. Load in the QGIS project all the Sentinel 2 images for pre-event and post events that you have downloaded from the previous activity.There can be multiple images (.tiff) within your AOI.
2. Refer to *Lesson 9: Processing of Satellite Images* for a detailed guide on merging satellite images, using different raster band combinations and extracting raster bands.

Lesson 9
Processing of Satellite Images

Duration	Purpose of Learning
1 hour	• To learn about different band combinations using QGIS • To compare satellite images of different imagery dates using image stacking

Requirements:

- Lecture with powerpoint presentation, on-the fly demonstration of image downloading and hands-on activity

The satellite images downloaded from the Google Earth Engine and other alternative sources can be processed using QGIS for further analysis. The processing of satellite images in QGIS include the following: merging images; extracting raster bands using the SCP plugin; extracting raster bands using raster calculator; extracting raster bands using rearrange band tool and calculating NDVI in the raster calculator.

Merging of Images in QGIS

Sentinel 2 images may result in one or more images (.tiff) after downloading. In this case, we merge the downloaded images so it will be easy to explore/process the satellite image.

1. Load your Sentinel images in QGIS.

You may use either of the three ways in adding your raster layer such as: from the (a) data source manager toolbar; (b) layers from the menu bar; or (c) drag and drop from your layers folder. Follow the numbers shown on the figures below to load your images.

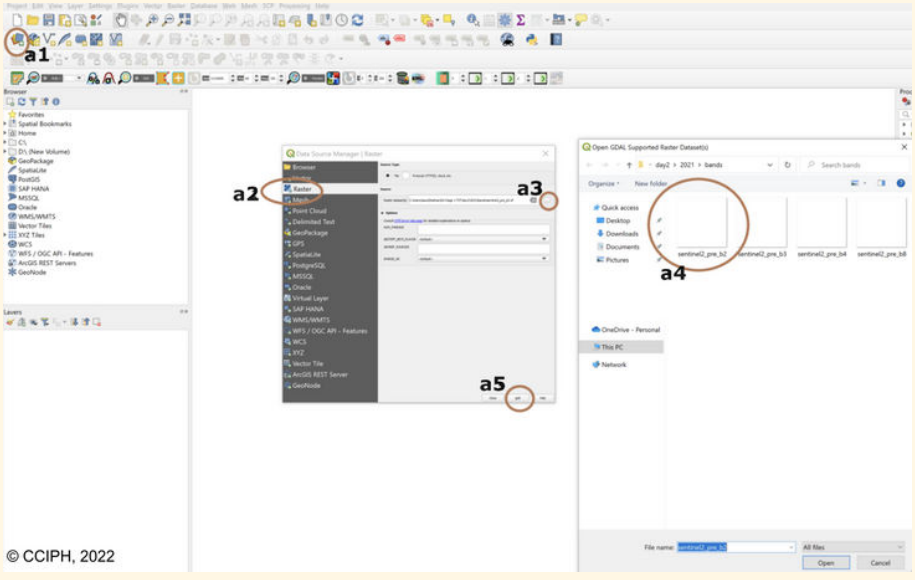

Figure 104. Loading Raster from the Data Source Manager

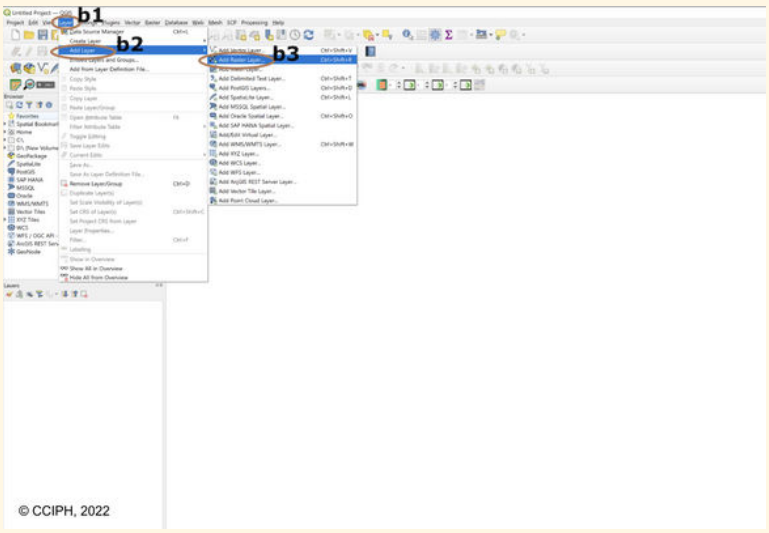

Figure 105. Loading Raster from the Menu Bar

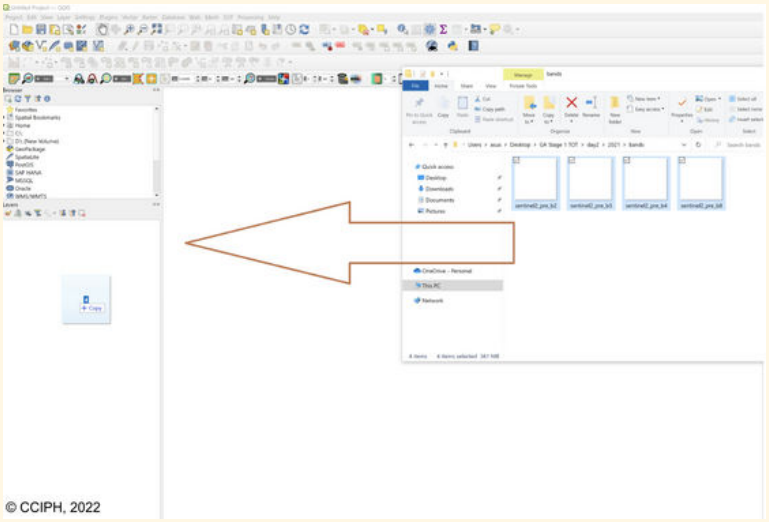

Figure 106. Loading Raster through Drag and Drop from the Layers Folder

2. In the Menu Bar click on Raster —> Miscellaneous —> Merge.

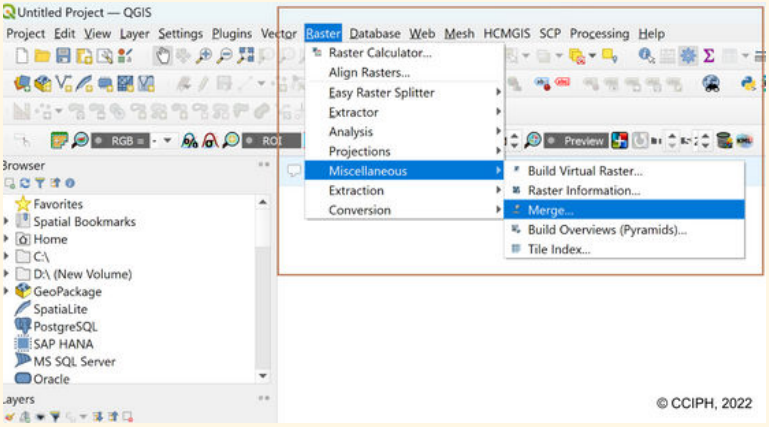

Figure 107. Loading Merge Tool from the Menu Bar

3. In the *Merge Window* click on the encircled button below and select all the satellite images that you want to merge by clicking on the checkbox beside the raster layer name then click *Ok*.

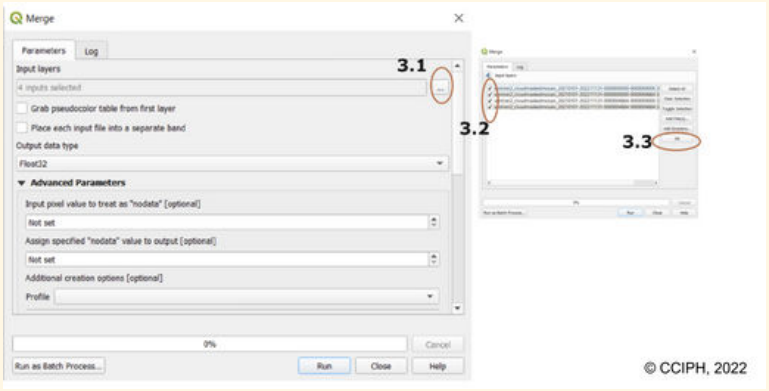

Figure 108. Selecting Raster Layers to Merge

4. Scroll down on the *Merge window* and click on the encircled button below to select the location and name of the output raster.

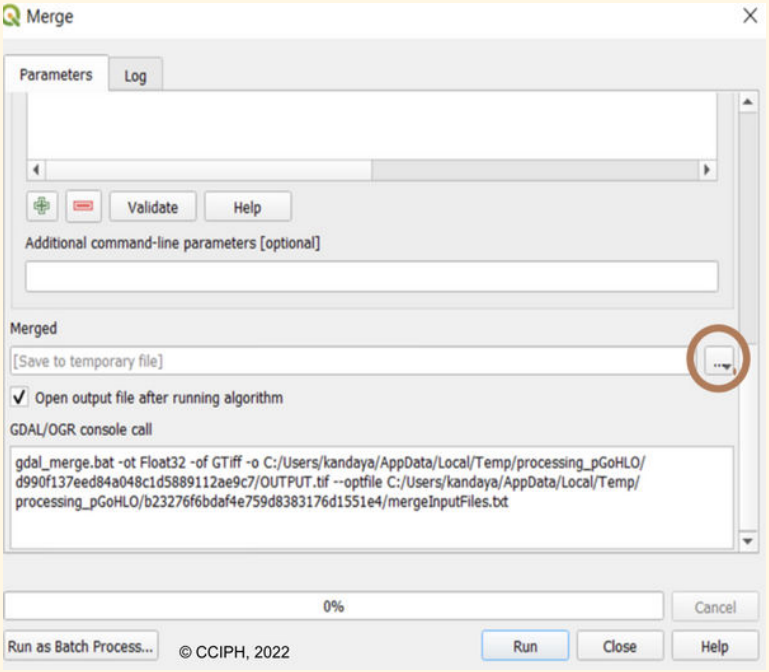

Figure 109. Setting the Raster Output Name and Location

5. After finalizing your output raster filename and location, you may now click *Run* to initialize the merging process.

Once you press the *Run* button, a new window will prompt showing the progress of the merging process. If it reaches 100% just click on its *Close* button and the *Close* button of the Merge window

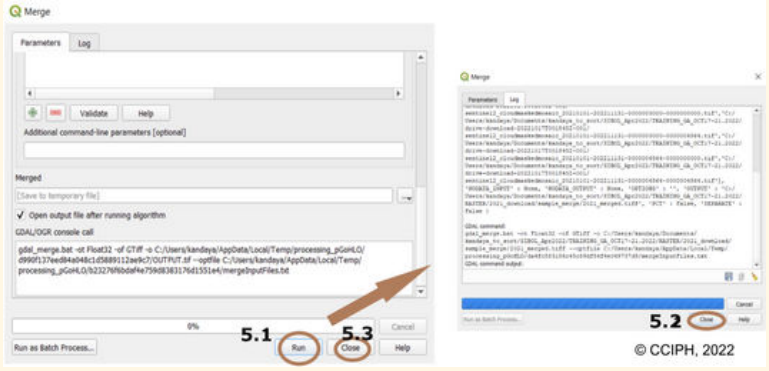

Figure 110. Initializing Merge

At last! You now have your own merged Sentinel 2 images.

Notice that from the previous four raster layers enabled to show the image on the map, only one merged raster layer is enabled yet the map shows the same raster image from the previously loaded four raster layers before merging.

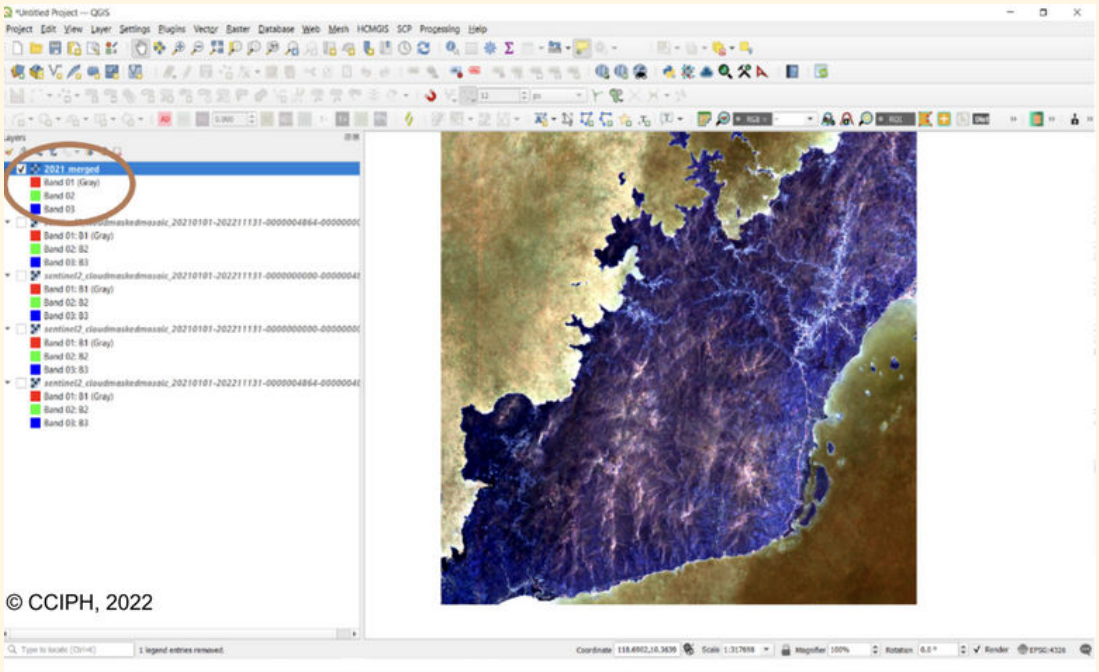

Figure 111. Merged Raster Layer Output

Sentinel Band Combinations

Before we proceed with testing different band combinations, let us first have a quick review on the different sentinel band combinations on the table below.

Table 7. Sentinel Band Combinations

Band	Resolution	Central Wavelength	Description
B1	60 m	443 nm	Ultra Blue (Coastal and Aerosol)
B2	10 m	490 nm	Blue
B3	10 m	560 nm	Green
B4	10 m	665 nm	Red

Band	Resolution	Central Wavelength	Description
B5	20 m	705 nm	Visible and Near Infrared (VNIR)
B6	20 m	740 nm	Visible and Near Infrared (VNIR)
B7	20 m	783 nm	Visible and Near Infrared (VNIR)
B8	10 m	842 nm	Visible and Near Infrared (VNIR)
B8a	20 m	865 nm	Visible and Near Infrared (VNIR)
B9	60 m	940 nm	Short Wave Infrared (SWIR)
B10	60 m	1375 nm	Short Wave Infrared (SWIR)
B11	20 m	1610 nm	Short Wave Infrared (SWIR)
B12	20 m	2190 nm	Short Wave Infrared (SWIR)

You may refer to this table when deciding on the sentinel band combination to use for the optimal visualization needed for your analysis. We will explore the different composites of the bands in this table using QGIS.

Observing the Different Raster Band Combinations

1. Now go to your merged layer in your *Layers Panel*. Right click on the merged layer and select Properties. On the Properties window click on *Symbology*. You will notice on this tab that the render type is in Multiband color and there are red, green and blue band visuals. By default the band combinations do not show the natural colors of the image.

Continue

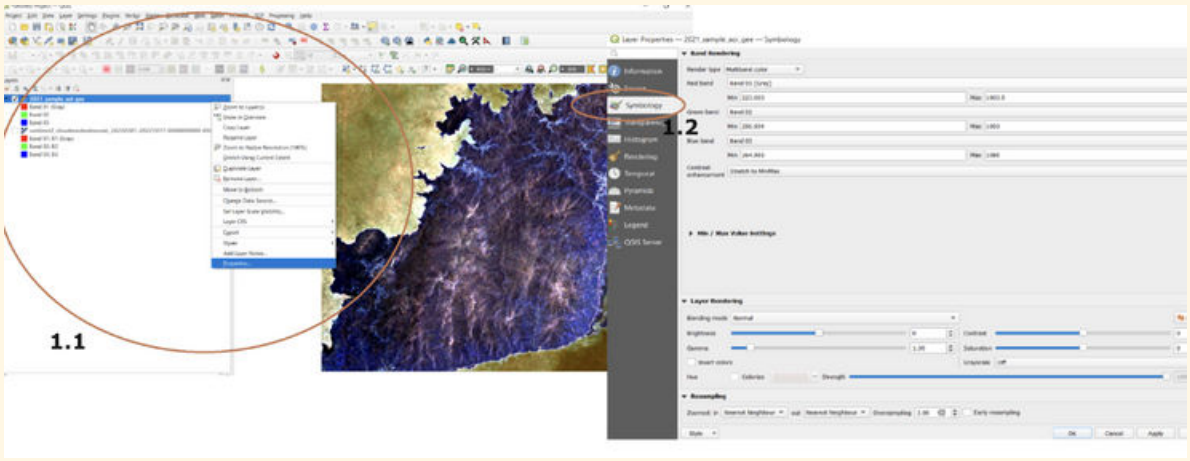

Figure 112. Symbol Properties of the Merged Sentinel Raster

2. In the *Layer Properties* window, click on *Symbology*. Since the default merged image does not show its natural/true colors, let's show the image's true color by changing the band colors based on the following:

Red band: Band 02
Green band: Band 03
Blue band: Band 04

Click *Ok*

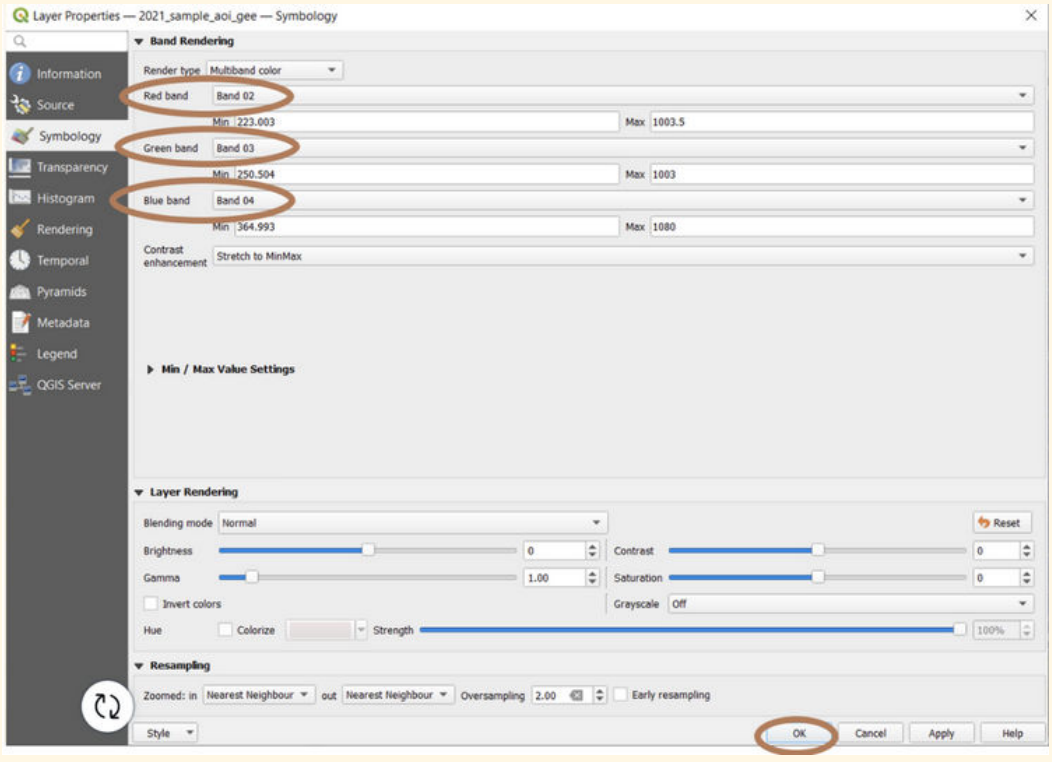

Figure 113. Sentinel Image True Color Band Combination

You can also try the Infrared band colors by changing the symbology into the following:

Red band: Band 08
Green band: Band 04
Blue band: Band 03

Click *Ok*

The images below show the different band colors of our Sentinel 2 image:

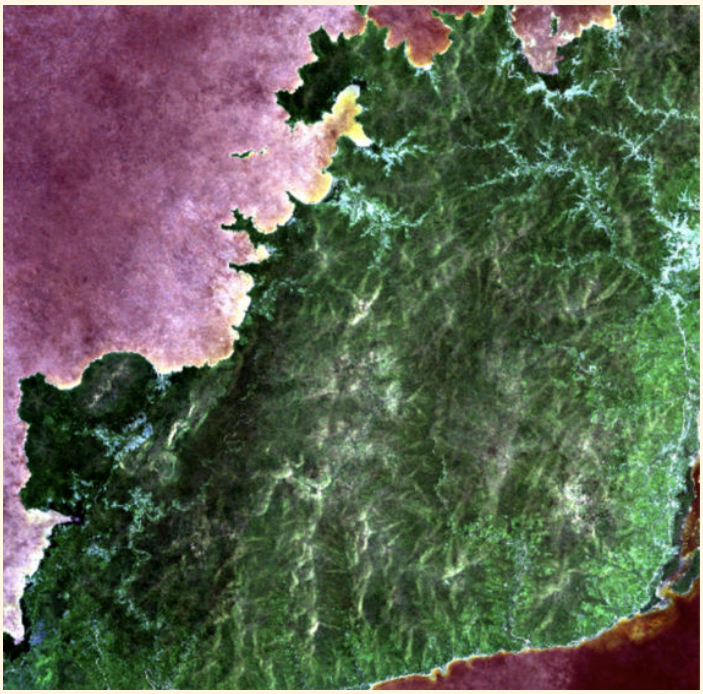

Figure 114. True Color of Palawan Sentinel 2 Image

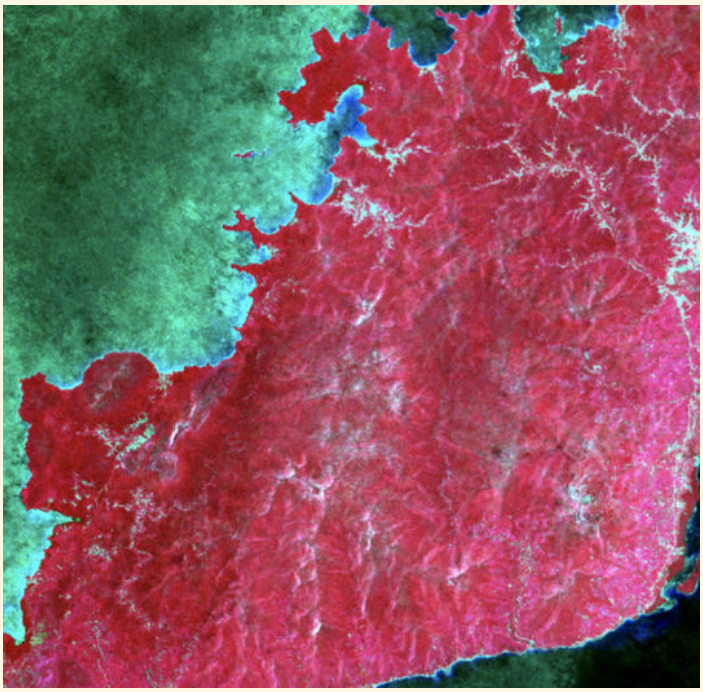

Figure 115. Infrared Color of Palawan Sentinel 2 Image

Extracting Raster Bands

Sometimes loading a satellite image with all the bands can be heavy on the QGIS software and takes time to load and process. Hence, we can extract the bands we will only use and process them. In this activity, we will extract the bands we will use for computing NDVI values in the AOI.

There are multiple ways to extract/split the raster bands:

Method 1: Using the Semi-automatic Classification Plugin
Method 2: Using the Raster calculator
Method 3: Rearrange band tool (in Processing Toolbox)

- **Method 1: Using the Semi-automatic Classification**

Plugin

1. Download and install the Semi-automatic Classification Plugin (SCP) by going to the Plugins in the menu bar then select the Manage and install plugins.

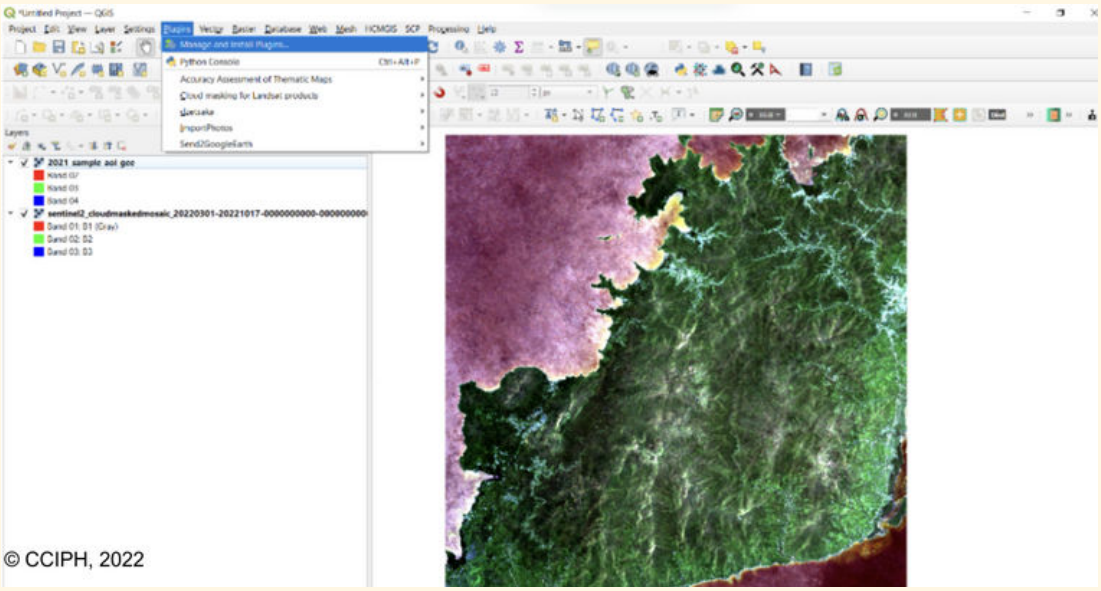

Figure 116. Accessing the Manage and Install Plugins in QGIS

2. On the *Plugins* window, search for "SCP" and select the "Semi-Automatic Classification Plugin" from the results. Click the *Install Plugin* button at the bottom of the window if you haven't installed the plugin then click Close. However, if you already have the SCP installed, the button at the bottom of the window will be *Reinstall plugin*.

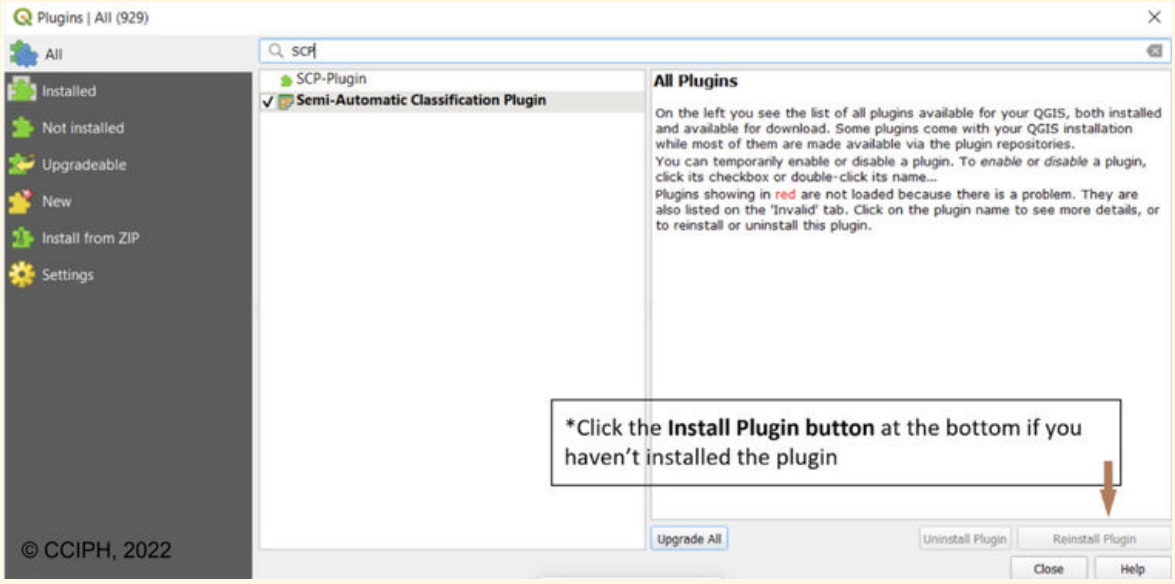

Figure 117. Installing the Semi-Automatic Classification Plugin in QGIS

If you have successfully installed the SCP, its icon will be available in the toolbar (Figure 118) of your QGIS general user interface.

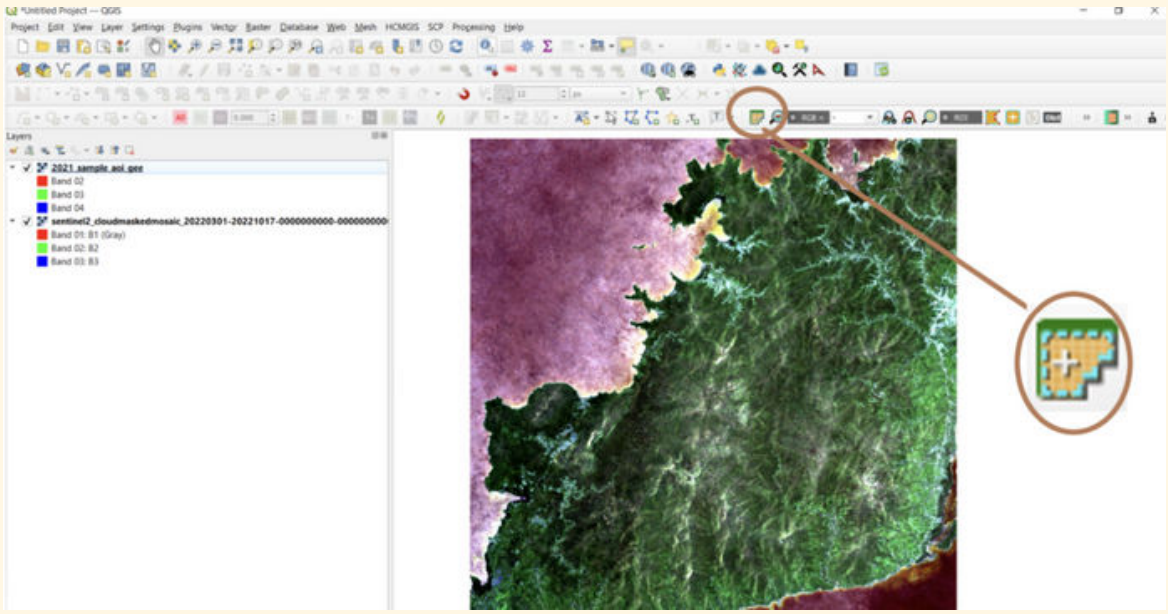

Figure 118. Semi-Automatic Classification Plugin in the QGIS Menu Bar

3. Click on the SCP icon to open the SCP window. From here you can find all the multiband images currently loaded to your QGIS project. If no layers are showing in this window, just click the Refresh button located near the dropdown list of the multiband image list.

From the drop-down list, select the multiband image that you wish to extract the bands from. After selecting the multiband image, all its containing bands will be listed on the table below.

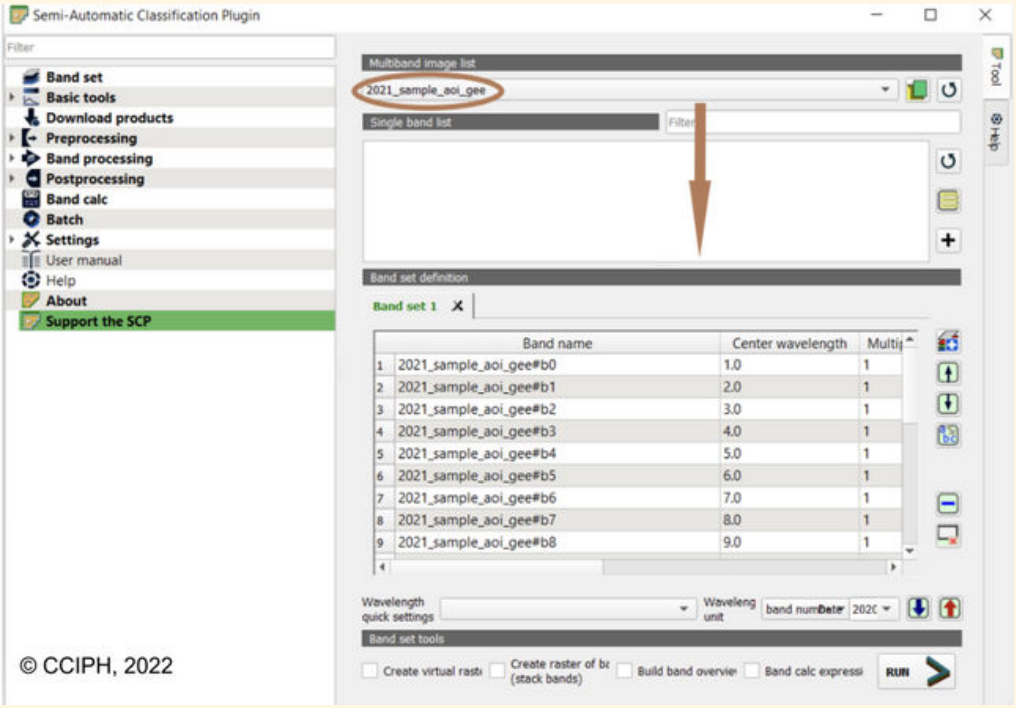

Figure 119. Semi-Automatic Classification Plugin Window

4. On the left side of the SCP Window, click on the Preprocessing dropdown arrow.
5. From the preprocessing options shown, select Split raster bands.
6. Click Run and save to your chosen folder to initialize the split raster bands function. Then all the split bands will automatically be loaded in QGIS.

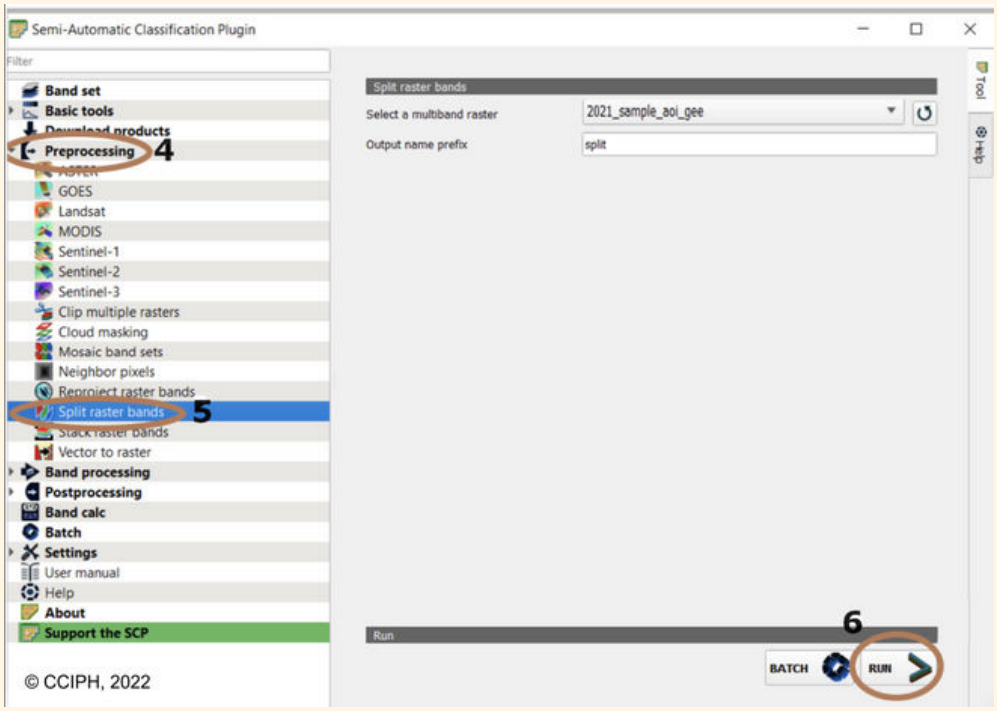

Figure 120. Split Raster using the Semi-Automatic Classification Plugin

- **Method 2: Using the Raster Calculator**

1. Open the raster calculator from the Raster menu bar or you may also search it from the Processing Toolbox.

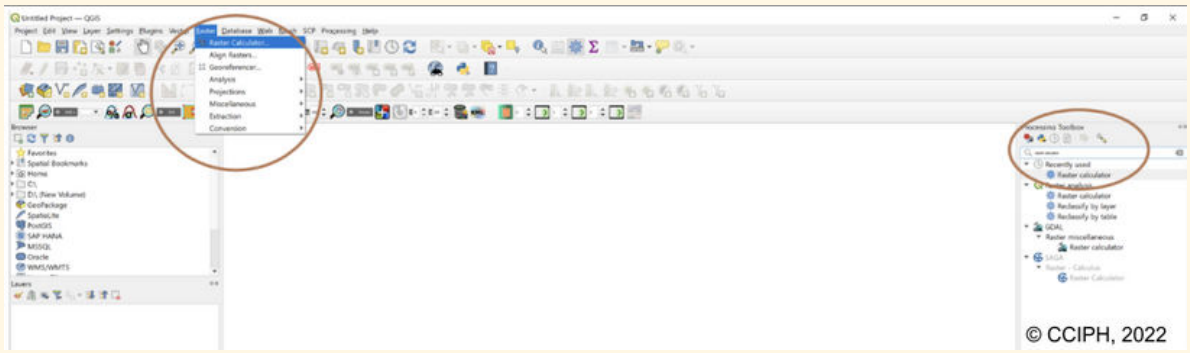

Figure 121. Accessing Raster Calculator from the Menu Bar and Processing Toolbox

2. Double click the raster band you want to extract/save
3. Check the *Raster Calculator Expression* if the band you selected was loaded
4. Check if the expression is Valid
5. Save file to selected folder
6. Press Ok to run the calculator

The extracted raster band will also be loaded in QGIS.

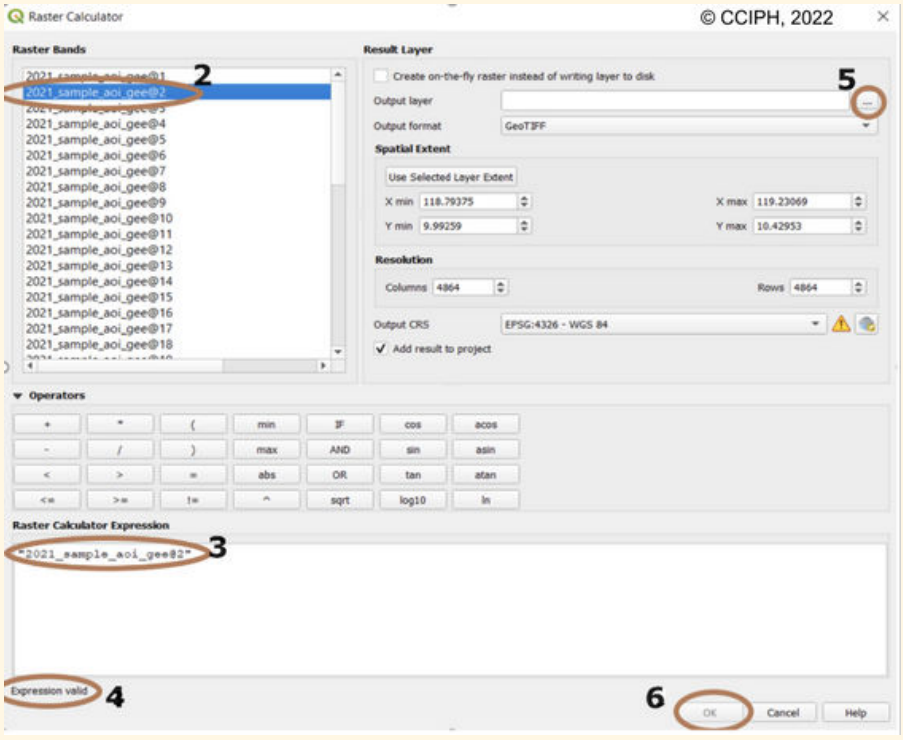

Figure 122. Extracting Raster Bands using Raster Calculator

- **Method 3: Using Rearrange Band Tool**

1. Using the *Processing Toolbox* search for "Rearrange bands"

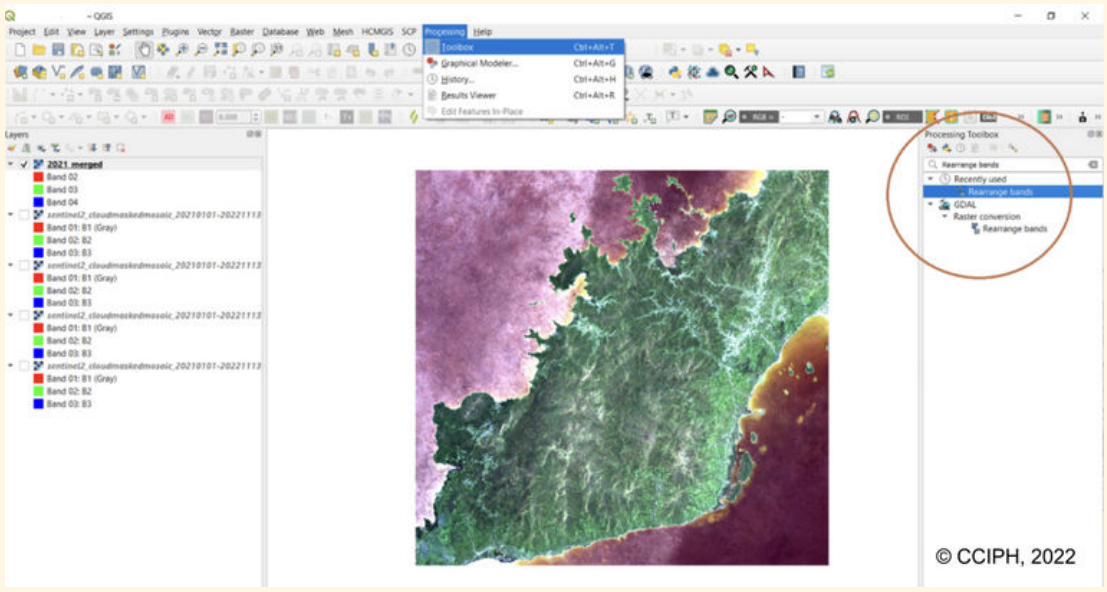

Figure 123. Accessing the Rearrange bands from the Processing Toolbox

2. In the rearrange bands window click the dropdown arrow to select for the input layer.
3. The bands for your input layer will now be included in the selected bands(s) option, click on the three dots beside the bands selected bar to open all the available bands in your chosen input layer.
4. This will prompt a new rearrange bands window, tick on the bands from the list that you will rearrange.
5. After selecting the bands, click Ok
6. Locate the output folder and set the output filename.

Click *Run*

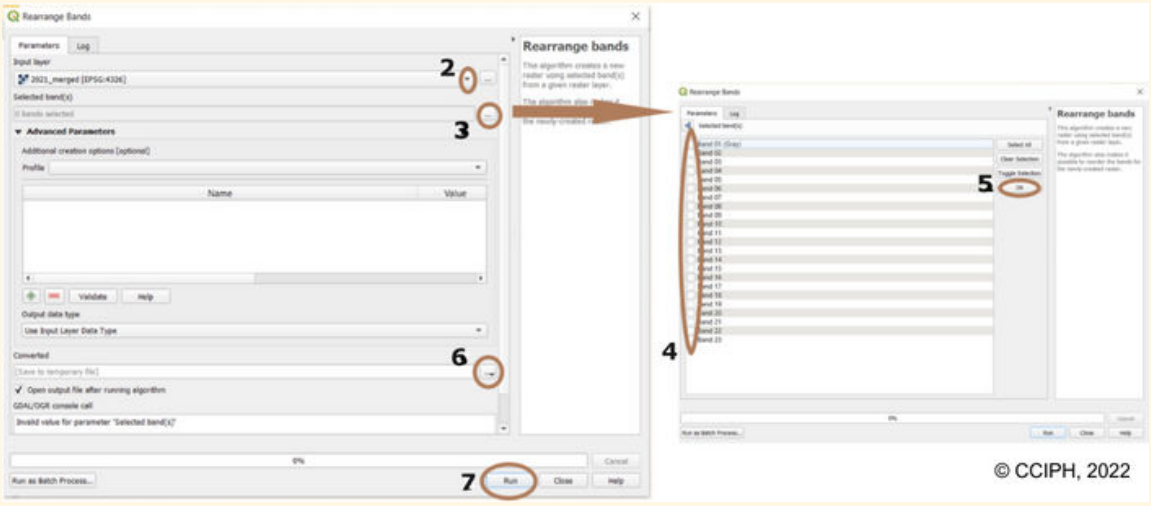

Figure 124. Extracting Raster Bands using Rearrange Band Tool