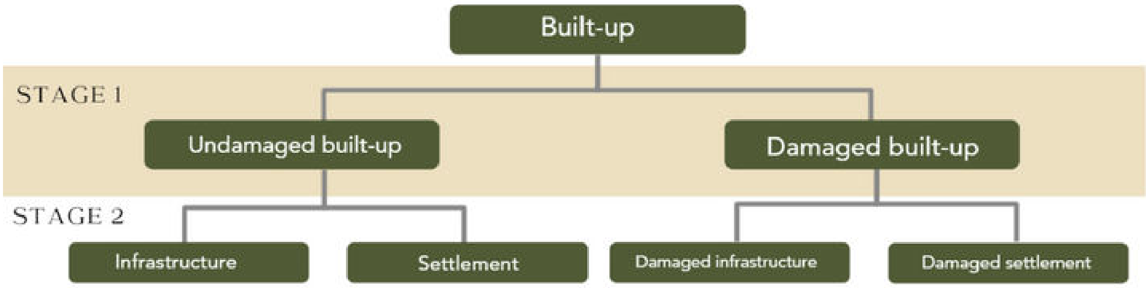

Figure 46. Settlement Classes for Stage 1 and Stage 2 of Green Assessment.

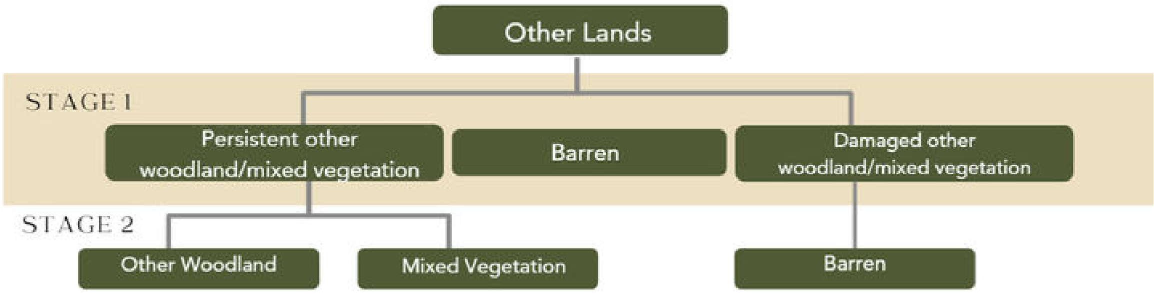

Figure 47. Other Lands classes for Stage 1 and Stage 2 of Green Assessment.

Lesson 5
Basic Theory and Concepts of Remote Sensing

Duration	Purpose of Learning
60 minutes	• To learn about the fundamental theory and concepts of remote sensing as applied for implementing land cover mapping

Requirements:

- Lecture with powerpoint presentations

Rapid Mapping to Supplement Rapid Appraisal Action

Rapid mapping is a critical step in the Stage 1 of Green Assessment to promptly generate maps providing spatial information where the possible sites of major changes have occurred in the landscape due to an extreme event such as the typhoon, or an exceptional event such as illegal cutting. Because of the wide area of the havoc, it is next to impossible to map them on foot or too expensive to do extensive aerial surveys. Hence, the idea of using satellite imagery has emerged for rapid mapping.

To execute this rapid mapping, it is important to have a strong foundation in understanding the basic theory and concepts behind the remote sensing technology.

Principles of Remote Sensing

Remote sensing is the acquisition of information about an object or phenomenon through sensors which allows data acquisition without making physical contact with the object. Airplanes, satellites and Unmanned Aerial Vehicles (UAVs) are some of the devices that have specialized platforms that carry sensors that are able to capture these information through aerial images. The major remote sensing technologies and their typical altitudes are shown in Figure 48.

Figure 48

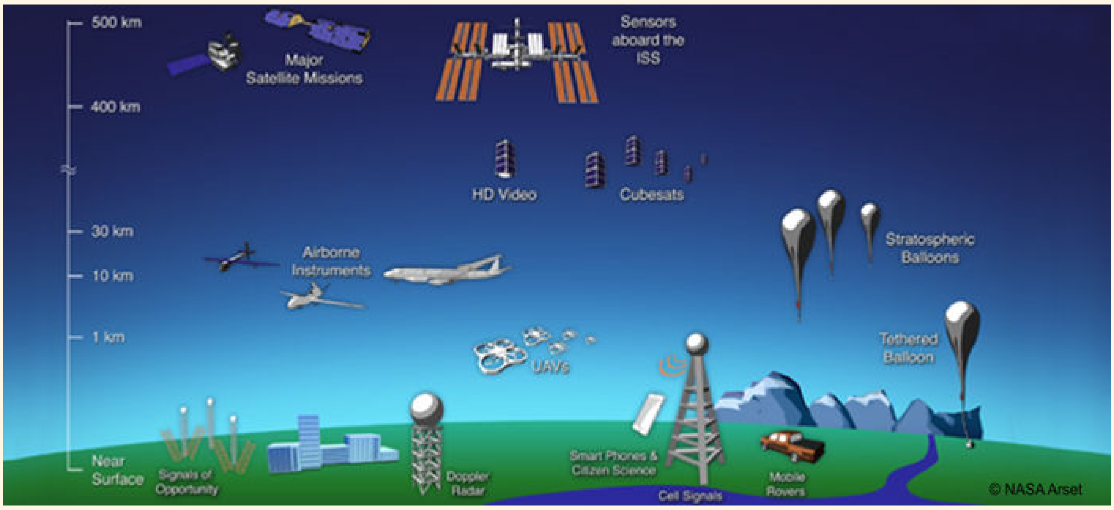

Figure 48. Remote Sensing Technologies

Since different types of sensors have their own advantages and disadvantages (Figure 49), in terms of the quality and information that the aerial images provide, it is vital that all the provided factors are accounted for to obtain the most appropriate dataset. For example, satellites capture data at a global scale while RPAs are better fit for flying small areas. Further, airplanes and helicopters go in between.

Figure 49. Advantages and Disadvantages of Different Types of Sensors

Components of Remote Sensing

When the radiation from the Sun reaches the surface of the Earth, some of the energy at specific wavelengths is absorbed and the rest of the energy is reflected back by the surface material (Figure 50). A detector or satellite sensor then measures the electromagnetic (EM) radiation that is reflected back from the Earth's surface materials. This results in spectral signature which is the reflectance of radiation from one type of surface material, such as soil, varies over the range of wavelengths in the EM spectrum. (Sanderson, 2003)

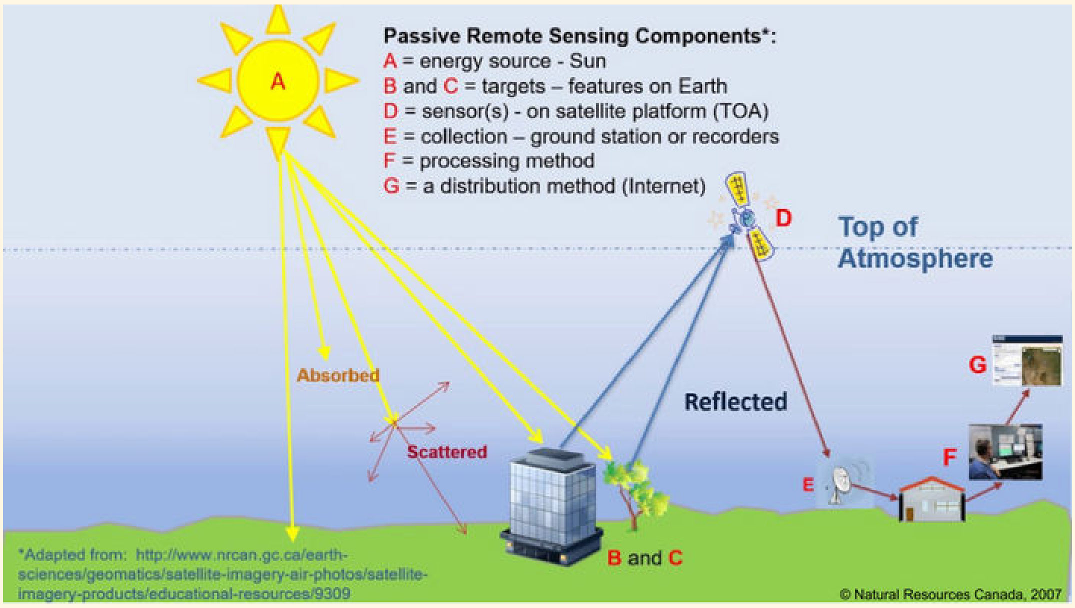

Figure 50. Passive Remote Sensing Components

- ### Electromagnetic Spectrum

There are different types of light that will interact with the target object and may pass the environment in different ways. Electromagnetic Spectrum (EM) in particular refers to this range of wavelengths of light as shown on Figure 51.

The colorful part in the middle of the EM is the only part that can be seen by the naked eye. However, the satellite sensors are designed to be able to detect many wavelengths along the spectrum, such as the microwave and *infrared light*.

The surface and atmospheric conditions affect the intensity of reflected and emitted radiation back to space. Thus, information about surface and atmospheric conditions can be found in the satellite measurements. For example, healthy green vegetation absorbs blue and red wavelengths and reflects green and infrared wavelengths, in this case that would be its spectral signature.

Continue

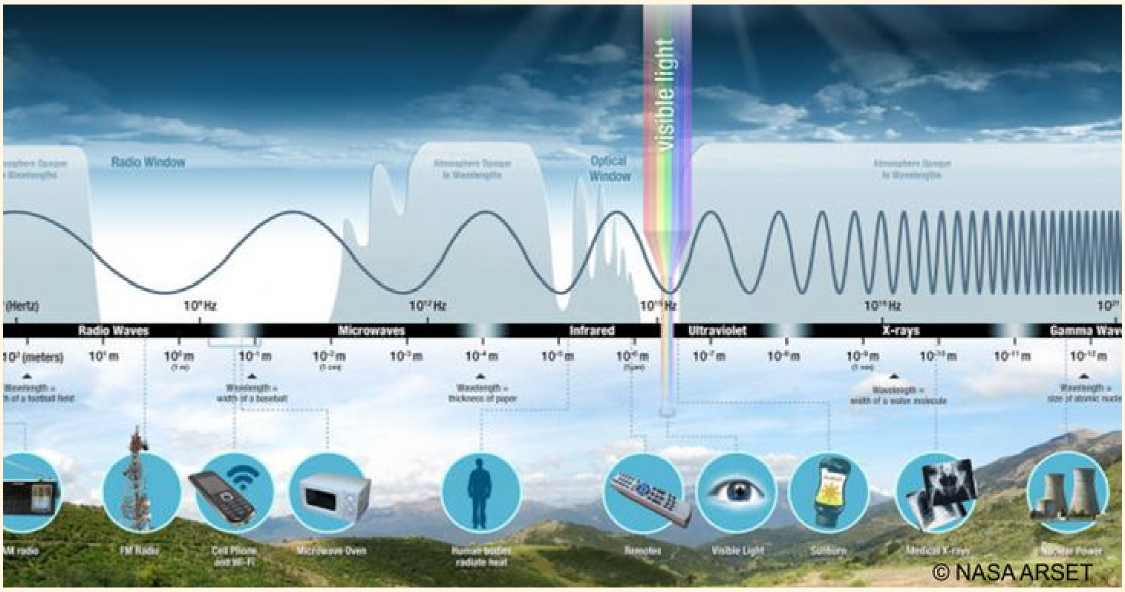

Figure 51. Electromagnetic Spectrum

The spectral signature shows how an object interacts with light of different wavelengths. The known spectral signatures of an object can be compared to the signatures measured in collected images to determine the type of object.

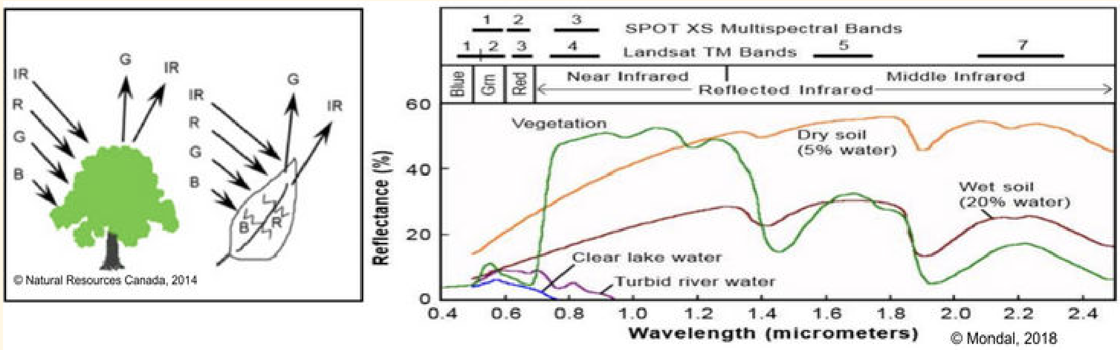

Figure 52. Spectral Signature

- ### Types of Remote Sensing Sensors

There are two main types of remote sensing sensors such as passive and active sensors. *Active sensors* provide their own energy source for illumination such as Radar sensors and Lidar sensors. An active sensor sensor like that from radar transmits microwave radiation toward the ground and measures the echoes. Depending on the moisture content of the surfaces, the reflected signal will be radiated back differently from each surface. On the other hand, passive sensors or optical sensors measure energy that is naturally available such as solar radiation and also radiation. Examples would be Sentinel to Landsat.

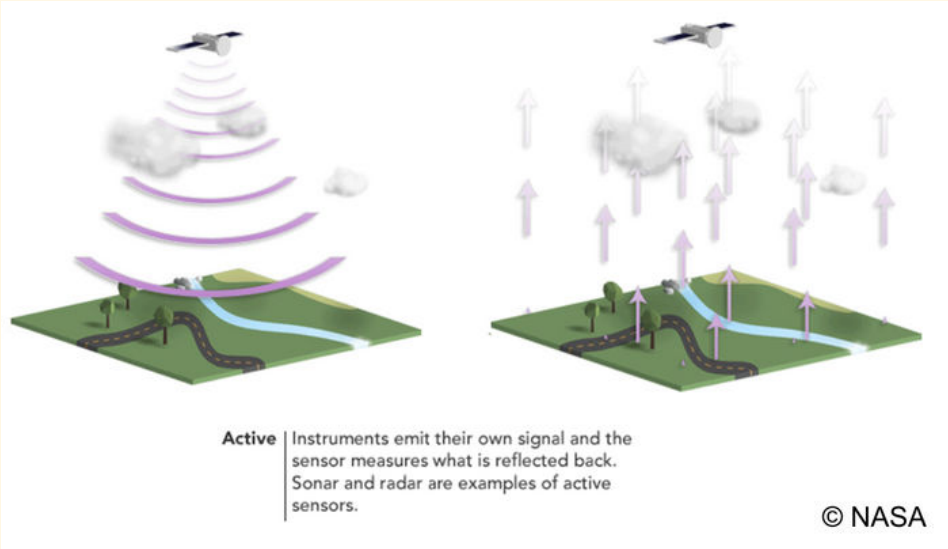

Figure 53. Active Sensor

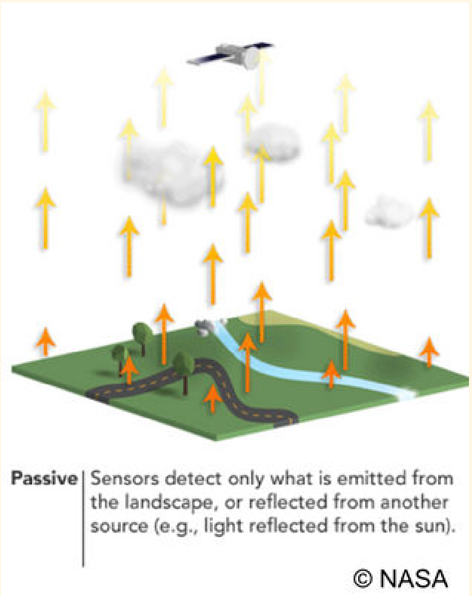

Figure 54. Passive Sensor

- ## Resolution Types

Resolution in remote sensing refers to the quality and useability of data that is collected. The data collected by each satellite sensor can be described in terms of spatial, temporal, spectral and temporal resolution.

Spatial Resolution

In this case, the first type is spatial resolution. It refers to the pixel size of a satellite image covering the earth's surface. The smaller the pixels the higher the resolution resulting in a clearer scene. However, there is a tradeoff between spatial resolution and spatial extent. As the spatial resolution increases,there is less area coverage by a pixel (NASA, n.d).

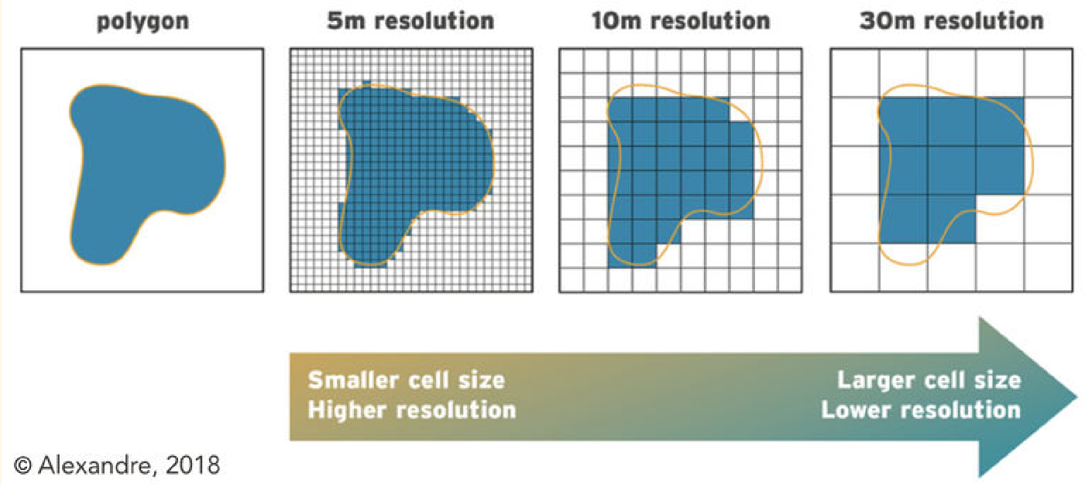

Figure 55. Spatial Resolution

Temporal Resolution

On the other hand, temporal resolution refers to the frequency at which images are recorded in a specific place. Recurrently capturing of images results in finer temporal resolution. The table 4 shows the spatial and temporal resolution of the commonly used satellite platforms.

Unfortunately, there is often a trade-off in resolution quality. High spatial resolution tends to be accompanied by low temporal resolution and vice-versa. This is because images with higher spatial resolution have a smaller viewing area.

Satellite	Spatial Resolution	Temporal Resolution
Landsat 8	300m	16 days
MODIS (Terra + Aqua)	250m, 500m, 1000m	1 to 2 days
VIIRS	375-m	12 hours
AVHRR	1100m	<1 day
Sentinel-2	10m, 20m, 60m	5 days
Ikonos	0.8m, 3.2m	<3 days
SPOT-7	1.5m, 6m	As low as 1 day

Table 4. Satellite Platforms used in Spatial and Temporal Resolutions

Satellites with high temporal resolution capture data within approximately less than 24 hours to three days. Medium temporal resolution capture data within four to sixteen days while those that capture data in a span of more than 16 days are considered low temporal resolution.

Spectral Resolution

The third type of resolution is the *spectral resolution*, which specifies the distribution of the bands over the spectrum. Since objects reflect, transmit and absorb invisible light differently, objects exhibit different band combinations. The images displayed by these objects could be panchromatic, multispectral and hyperspectral.

A monochromatic image consists of only one band. This is usually displayed as a grayscale image. Multispectral sensors typically provide less than 15 bands, while hyperspectral sensors can provide more than 100 spectral bands (Figure 56).

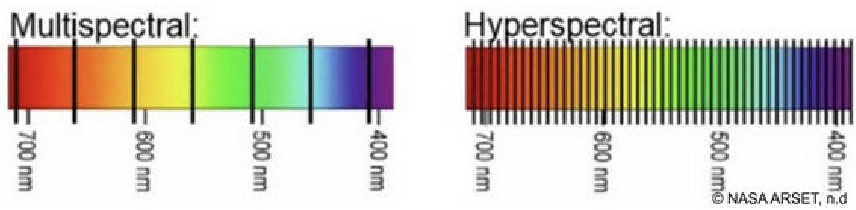

Figure 56. Multispectral and Hyperspectral Band

Radiometric Resolution

The last resolution type is the *radiometric resolution* which corresponds to the sensitivity of a sensor or its ability to measure and to enable distinction within the same spectral bands of differences in the electromagnetic energy reflected by the elements of the ground surfaces. It is usually quantified as a number and expressed in a bit. The higher the radiometric resolution the better is the quality of data. The bits are expressed as a part to a number starting from zero. Landsat 9 (14-bit quantization) is an improvement from Landsat 8 (12-bits) to include higher radiometric resolution for OLI-2. Sensors with this higher radiometric resolution can detect more subtle differences, especially, over darker areas such as water or dense forests (U.S. Geological Survey (usgs.gov), 2022).

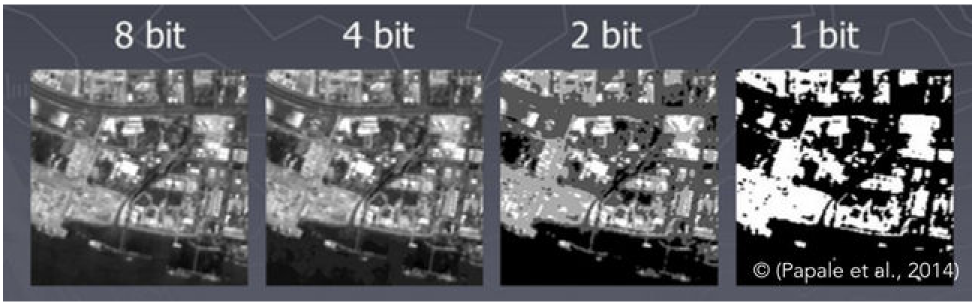

Figure 57. Radiometric Resolution

Lesson 6

Land Cover and Change Detection Due to an Exceptional or Extreme Event using the Electromagnetic Spectrum

Duration	Purpose of Learning
15 minutes	• To learn how multispectral satellites detect electromagnetic spectrum from exceptional or extreme events as an introduction to the concept of the Normalized Difference Vegetation index

Requirements:

- Lecture with powerpoint presentations

Detecting Change due to an Exceptional or Extreme Event using the Electromagnetic Spectrum

Defoliation and depletion in leaf area are among the substantial impacts of typhoons on vegetation exemplified by forests or trees (Abbas et al., 2020). In other parts of the country where no typhoon has crossed them, possible loss of leaf area or biomass might occur due to rampant unregulated harvesting of timber. In both these situations, there is either opening or clearing of the canopy, which can directly impact the fauna and flora living understory, especially for shade-loving species (Wang et al., 2008).

These defoliation, leaf area reduction, loss of timber or clearing of standing trees can be detected from afar using an instrument orbiting in space above our Earth, which we call a satellite. Hence, exemplifying the principle behind using the bands of the electromagnetic spectrum to detect the change in the forested habitat cover due to an exceptional event such as unregulated tree cutting or an extreme event such as extra strong winds.

Electromagnetic Spectrum in Normalized Difference Vegetation Index (NDVI)

Science has shown that if we take the ratio of the difference between the RED band and the Near InfraRed (NIR) band to their sum, we can have an index that enables us to distinguish vegetation types from the rest of the surface features of our Earth in a rapid fashion. In remote sensing, this is popularly known as the Normalized Difference Vegetation Index or NDVI.

Figure 51 shows the visible spectrum and its corresponding colors with pure wavelengths. Red light has the lowest frequencies and longest wavelengths. On the other hand, the range value of wavelength for the Near Infrared Light (NIR) goes beyond the value of the visible light. Those in the highest frequency values of NIR can still be detected in some photographs. The quantitative range of their wavelengths are shown below:

RED band: 620 - 750 nm (visible light)
NIR band: 750 - 900 nm (infrared)
Both of these range values should be taken into account to obtain the NDVI.

Lesson 7

Normalized Difference Vegetation Index for Rapid Mapping in Green Assessment Stage 1

Duration	Purpose of Learning
15 minutes	• To learn about NDVI range of values in determining possible land cover categories for rapid mapping in Stage 1 Green Assessment

Requirements:

- Lecture with powerpoint presentations

NDVI for Rapid Mapping

Normalized Difference Vegetation Index (NDVI) is the most commonly used vegetation index in remote sensing. Its values range from -1 to +1. Negative values represent the absence of vegetation (e.g., water bodies), while values closer to 1 corresponds to the presence of (low to high) vegetation (GIS Geography, 2021). The formula below is used to compute the NDVI using NIR and RED values:

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

NDVI Values for Possible Land Cover Categories

The following land cover categories and NDVI range of values are compiled from different literature and field work. These categories are still subject for ground-truthing validation during the Stage 2 of Green Assessment. Accordingly, these land cover categories can be translated into the six classes of land cover according to the global standards such as the Intergovernmental Panel on Climate Change (IPCC).

Continue

Table 5. NDVI Values for Possible Land Cover Categories

Possible land cover categories	NDVI range of values
Dense forests	Greater than 0.8
Moderately dense forests	0.74 to 0.8
Mixed vegetation or less dense forests	0.52 to 0.73
Cropland, grassland or non-forest vegetation	0.34 to 0.51
Inactive cropland, settlement infrastructure or barren land	Less than 0.34

Source: Abbas et al. (2020); Zhang et al. (2016); Ya'acob et al. (2014).

Continue

Exercise 2: Sourcing of Notable Free Satellite Image

Duration	Purpose of Learning
2 hours	• To familiarize with the different free satellite imagery sources • To download satellite images for rapid assessment

Requirements:

- QGIS (latest most stable version)
- Laptop
- *Lesson 8: Sourcing of Notably Free Satellite Images from USAID's* Manual on *Geospatial Training on Green Assessment for Ecosystems Disaster Mapping*
- Stable internet connection
- Google Earth Engine account (Google Mail account)
- USGS Account
- ESA Copernicus Account
- Planet Account
- Shapefile of the AOI extent

Expected Output:

- Pre-event and post-event satellite images of AOI with little to no cloud cover

---

About this Exercise

In this exercise, participants are guided to explore different online free satellite imagery sources. They are also asked to download from different free online portals available cloud-free or less cloud cover of pre-event and post-event satellite images for their chosen AOI in preparation for the rapid assessment.

Instructions

1. Create accounts for Google Earth Engine (ensure you have a Google Mail Account), USGS, ESA Copernicus and Planet Account.
2. Refer to Lesson 8: Sourcing of Notably Free Satellite Images for the detailed walkthrough of downloading satellite images from different online sources.

Lesson 8
Sourcing of Notably Free Satellite Image

Duration	Purpose of Learning
2 hours	• To familiarize with the different free satellite imagery sources • To download satellite images for rapid assessment

Requirements:

- Lecture with powerpoint presentations

Computing for the NDVI values will demand the use of data where we can collect bands of the electromagnetic spectrum. This type of band data will come from mainly multispectral optical satellites with passive receivers.

Where to source satellite data?

These data can be sourced out from online satellite imagery repositories free of charge. The most popular of these sources are the USGS/NASA website for Landsat data and ESA Copernicus Open Access Hub for Sentinel data. Planet website and Google Earth Engine are alternative data catalogs. There are also other websites where there are available satellite images, but most of these are on a commercial basis. There might be an instance where you cannot get cloud-free images that you will be forced to purchase. However, here we will show how to access free satellite images using NASA and Copernicus websites.

There are different ways where you can source notable free satellite images such as:

- Conventional procedure of accessing the USGS-NASA website to download free satellite imagery of 30-m resolution. Other sites are also available like the European Space Agency Sentinel imagery with 10-m resolution. Other sources are also available, but for a price ranging from US $2,000 and above. It will be cheaper for archived images.

- State-of-the art method of using Google Earth Engine to select, pre-process satellite images, masking out clouds and cloud shadows, and image band stacking in one step using GEE scripts.

Satellite Image Downloading using USGS/NASA Website

NASA's Earth Explorer is "an online search, discovery, and ordering tool of satellite, aircraft, and other remote sensing inventories through interactive and textual-based query capabilities" (USGS.gov, 2022) The figure below shows how the Earth Explorer interface looks like to access the US satellite platforms. All the figures showing extracts of the Earth Explorer Interface have been captured in this manual for ease of explaining the steps and transferring knowledge. We acknowledge the adoption of these interface forms from the USGS-NASA website [URL: earthexplorer.usgs.gov]

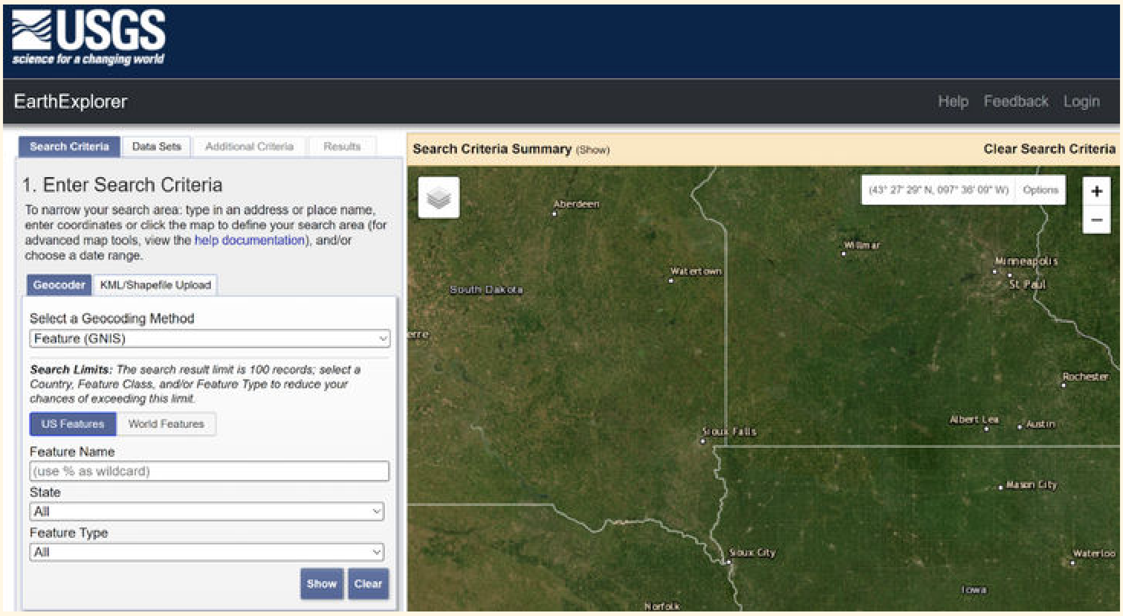

Figure 58. Earth Explorer Interface

Steps to Navigate through the USGS Earth Explorer Website:

a. In the "Enter Search Criteria" section of Earth Explorer you can define the area of interest based on different criteria that you will access the dataset. By default, the Search Limits for features is on US Features but you can switch the option to World Features [1] should you wish to access dataset based on features outside of the United States. There are multiple ways in which the area of interest can be defined:

1. Polygon using known feature:

Type in an address or place name in the *Feature Name* [2]. The search results can still be filtered out according to *Country, Feature Class* and *Feature Type* [3]. Once you are satisfied with your search query, the results can be shown by clicking Show [4]. Select one from the list of results by clicking the feature name of the result[5].

Continue

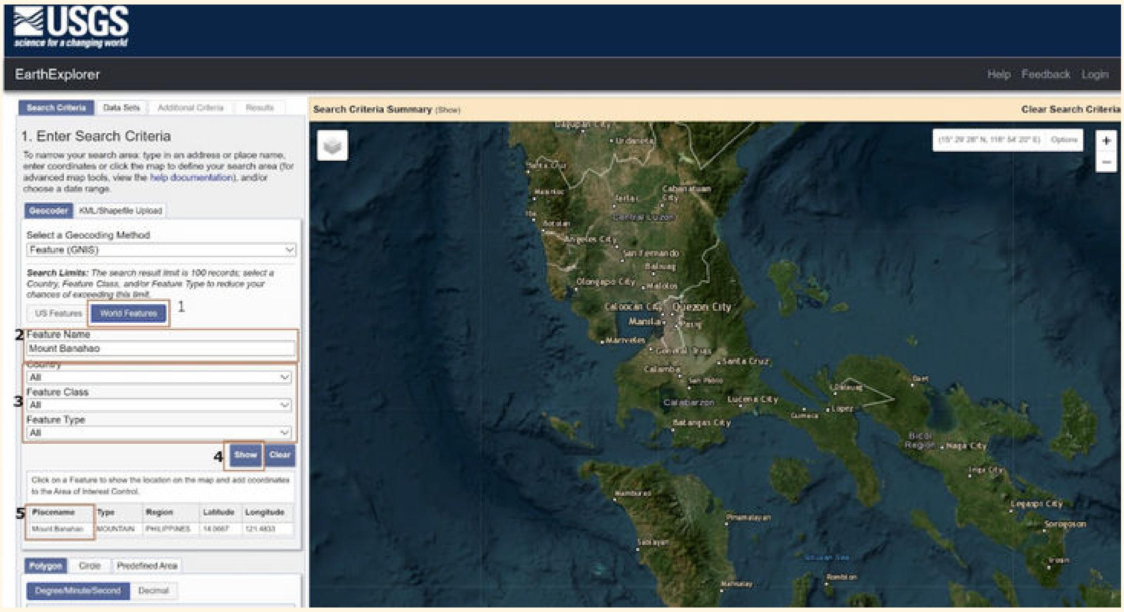

Figure 59. Searching for Known Feature/ Place in Earth Explorer

The coordinates of the searched feature will automatically be shown in the Degree/Minute/Second of the bounding Polygon section [6] and the feature will have a marker shown on the map[7].

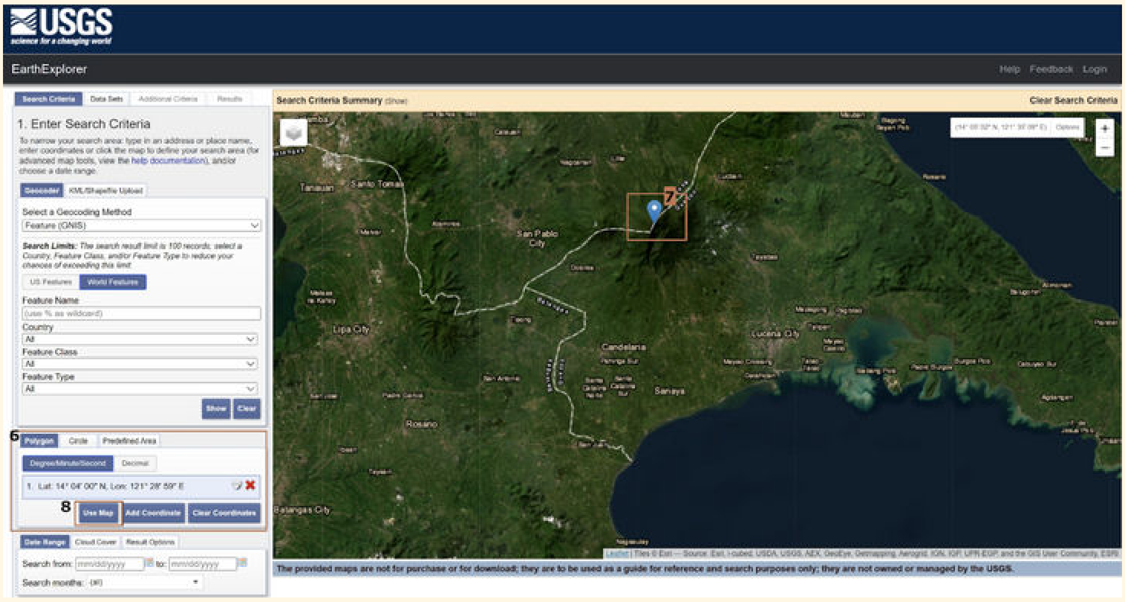

Figure 60. Coordinates of Known Feature/Place Displayed in Polygon Section

Continue

To use the extent shown in the map area as the extent of the satellite images that you will look into, just click Use Map [8]. This will automatically select the whole map extent for download as signified by the red polygon displayed in the map [9]. The coordinates of the edges' extent will also be automatically shown in the coordinates list [10].

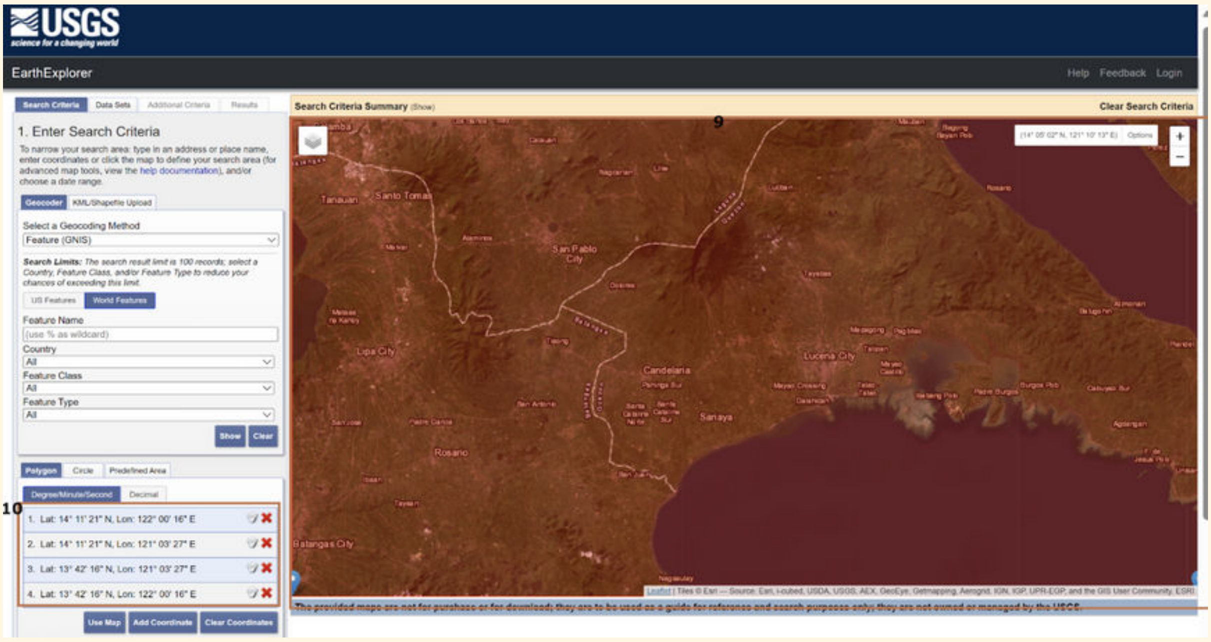

Figure 61. Coordinates List of the Edges of the Bounding Layer

2. Polygon with known coordinates:

Another way to define the area of interest is by adding the coordinates of the edges of your bounding polygon. Click *Add Coordinates* [11] under the polygon panel. The *Add New Coordinates* window will automatically prompt where the coordinates must manually be encoded [12]. After encoding the coordinates, click *Add* [13]. The coordinates will automatically be added in the coordinates list of the bounding polygon. Repeat 11-13 for other coordinate values. Click *Use Map* [14] after encoding all the coordinates of the bounding polygon. The same red bounding polygon will be displayed in the map area.

Continue

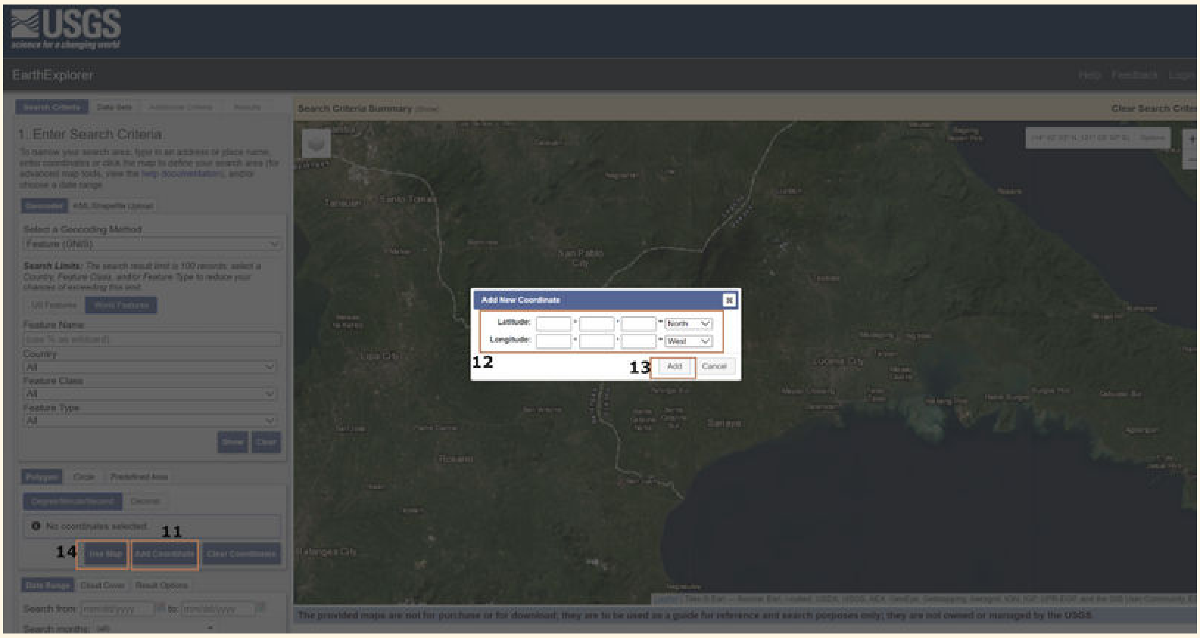

Figure 62. Adding Known Coordinates to Define AOI Extent

3. Circle with known feature:

Aside from bounding polygons, the area of interest can also be defined using a circle. Should you have an already known feature for a feature, follow numbers 1-5. From the default *Polygon* panel, switch to *Circle* panel [15]. The searched feature/place's coordinates will automatically appear in the *Center Latitude* and *Center Longitude* in decimal format [16]. The extent of the circle can be adjusted by providing a numerical value for the radius which you can choose from meters, kilometers or miles from the dropdown option as the unit of measurement [17]. After determining the radius, click Apply [18]. The determined extent will automatically be shown in the map area.

4. Circle with known coordinates:

If the coordinates are already known, switch to *Circle* panel [15] and manually input the decimal coordinate values of the center point [16] together with the necessary radius extent [17]. After defining all the values, click *Apply* [18].

Continue

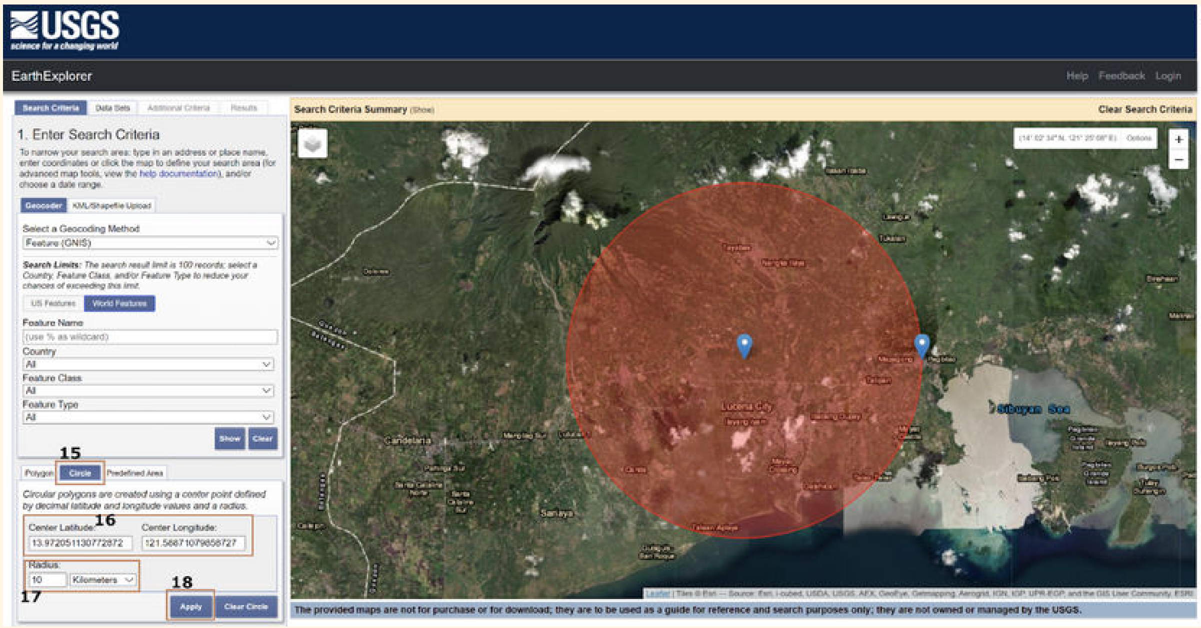

Figure 63. Defining the AOI Extent using Circular Bounds

Note: The *Predefined Area* option for choosing extents is only applicable for areas in the United States.

Steps to Navigate through the USGS Earth Explorer Website

b. The *Date Range* and *Cloud Cover* can also be added as filter criteria to refine the search results of your dataset.

1. Date Range

The *Date Range* is located just below the coordinates section [19]. Set the Date Range by clicking on the calendar icon and selecting the start and end date of the target dataset [20].

2. Cloud Cover

The *Cloud Cover* section is located beside the *Date Range*. Just click on the *Cloud Cover* section [21] and adjust the slider for the cloud cover range to the percentage of cloud cover that you wish to be present in your downloaded satellite image [22]. It is ideal that there is little to no cloud cover present in the images; however, this slider may have to be adjusted if there is a limited dataset present in your area of interest with low cloud cover.

Continue

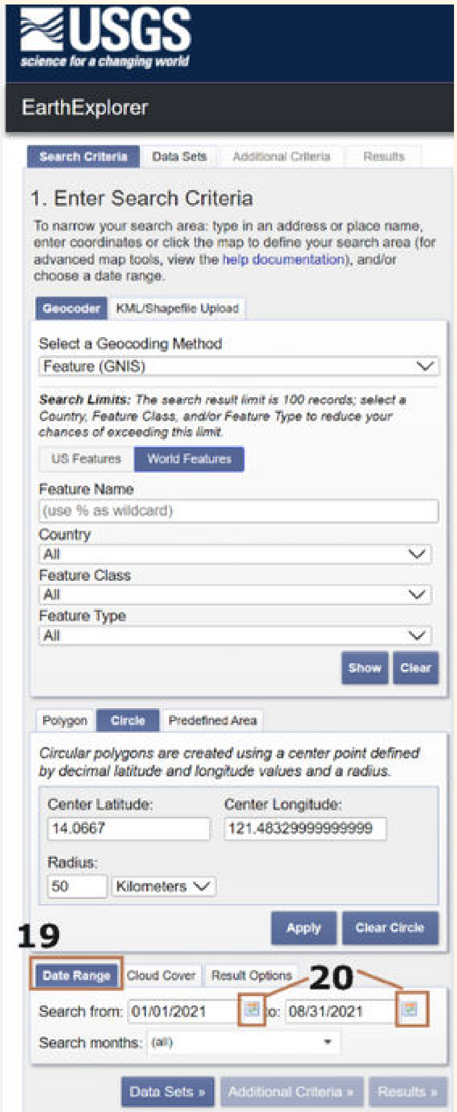

Figure 64. Date Range

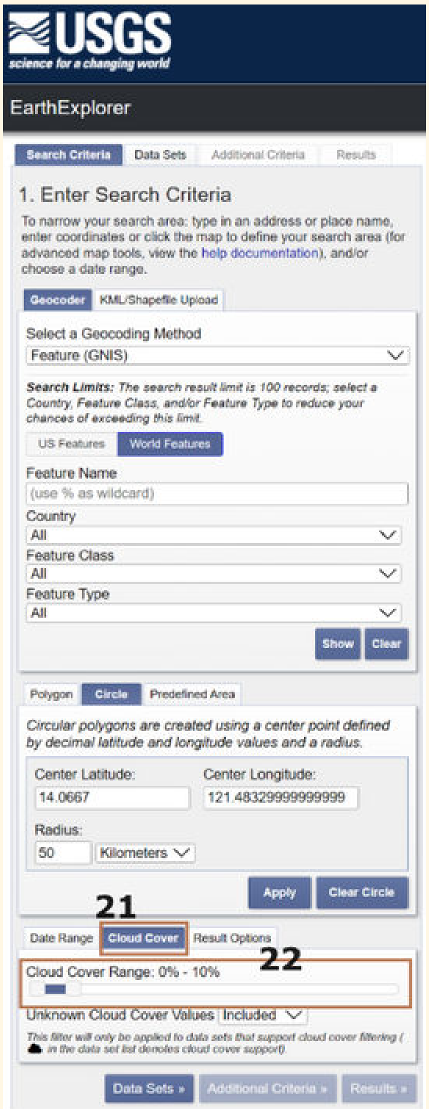

Figure 65. Cloud Cover

Steps to Navigate through the USGS Earth Explorer Website

c. After defining the extent of the area of interest and other criteria, the dataset for download can still be specified by checking on the data set filter options provided below. Click on the *Data Set* panel [23]. This panel will show the dataset that are available on the website. Tick the checkbox beside the dataset name that you wish to search [24]. After selecting the dataset, click on the *Additional criteria* [25].

Continue

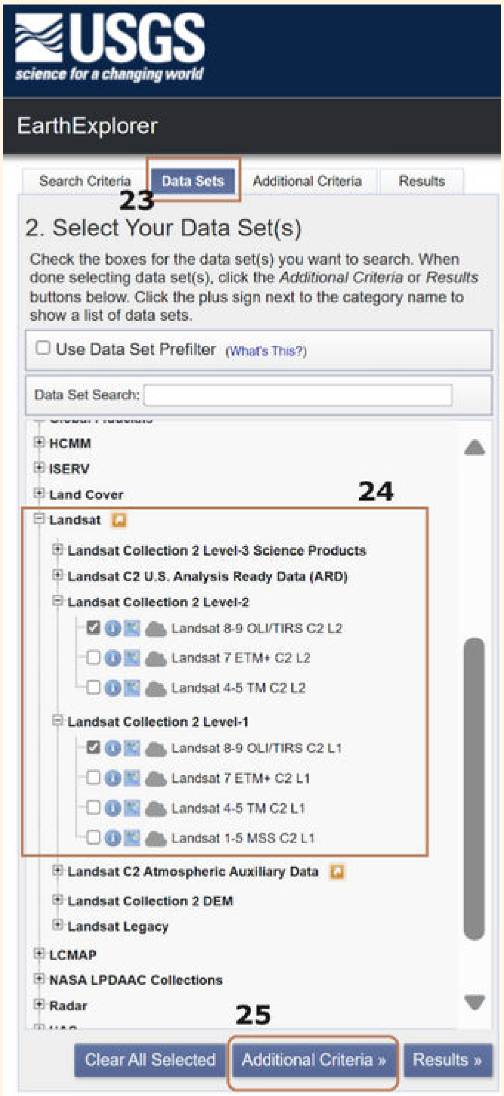

Figure 66. Selecting Data Set(s)

Steps to Navigate through the USGS Earth Explorer Website

d. In the *Additional Criteria* panel, other additional criteria for the chosen dataset can be defined in this section. Click on the specific criteria that you wish to set and define/specify its values. This panel is optional, if you do not have any additional criteria you can proceed on the *Result* button [26] .

Continue

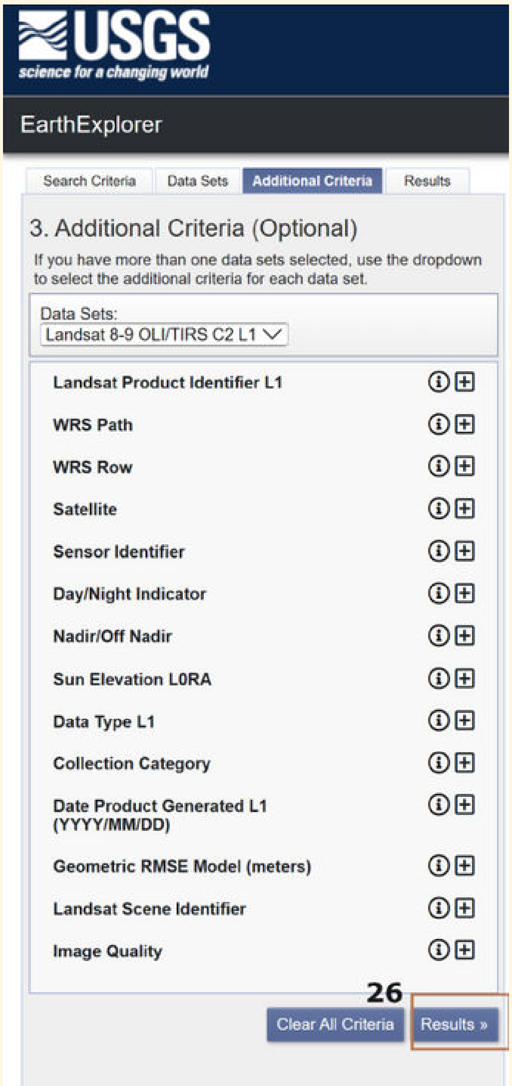

Figure 67. Additional Criteria

Steps to Navigate through the USGS Earth Explorer Website

e. The *Results panel* will display all the available dataset that correspond to your defined criteria. To preview the image in the search results, click on the image from the search results [27]. This will open a window showing a preview of the chosen dataset [28]. The same window also shows the dataset attribute and values [29].

Continue

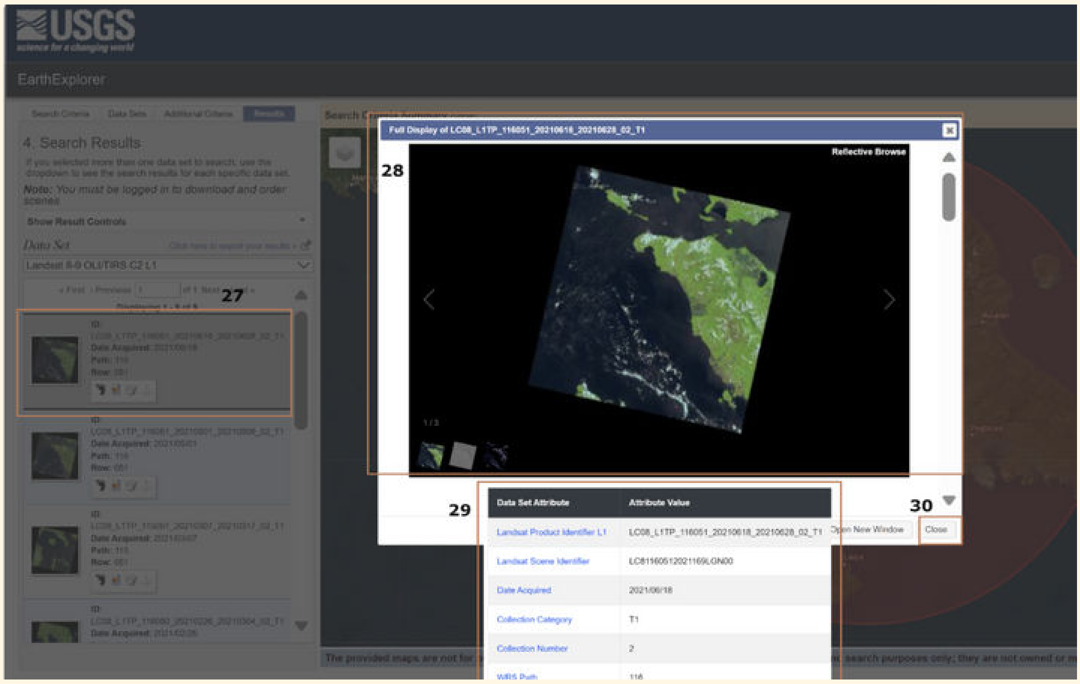

Figure 68. Results Preview

Steps to Navigate through the USGS Earth Explorer Website

f. To view the resulting datasets in your map area together with the bounding polygon of the area of interest, click on *Show Browse Overlay* icon from the search results [30].

g. If you have already selected the dataset that you want to download, click on the *Download button* [31] on your chosen dataset from the search results.

Reminder: To download the chosen dataset, make sure that you are logged in to your USGS account.

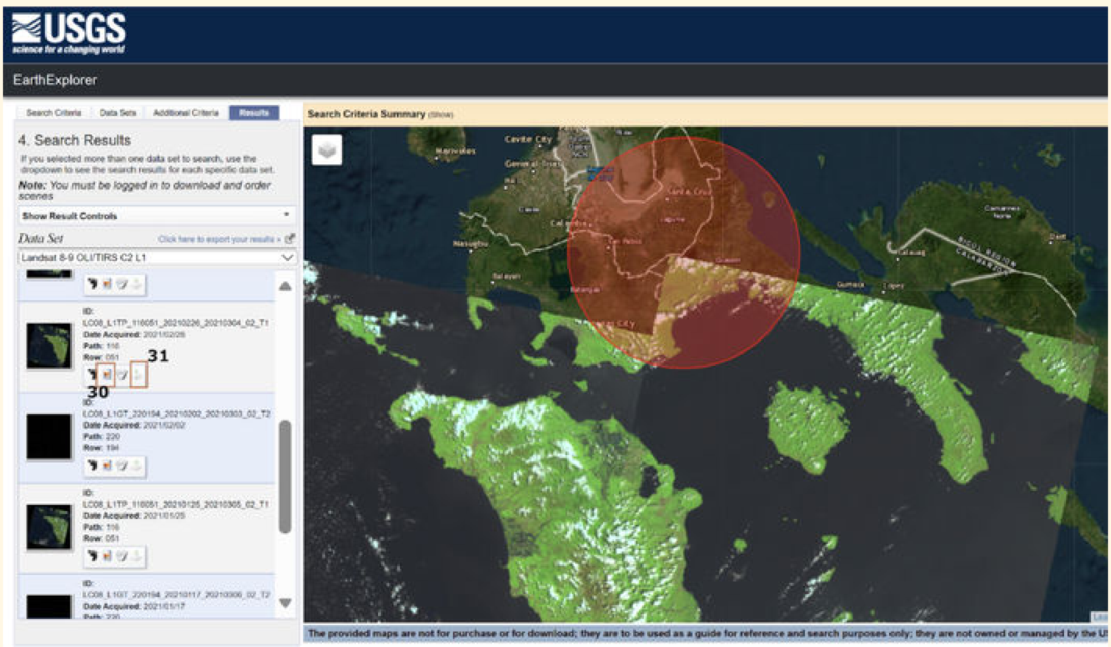

Figure 69. Show Browse Overlay and Download Dataset

Satellite Image Downloading using ESA Copernicus Open Access Hub for Sentinel Data

Copernicus Open Access Hub provides free and open access to all the datasets from Sentinel satellites from the European Space Agency (ESA). We acknowledge the adoption of these interface forms from the Copernicus Open Access. The steps for satellite image downloading using ESA Copernicus Open Access Hub for Sentinel Data are listed below:

a. To open the sentinel hub interface, go to https://scihub.copernicus.eu/. Then click on the Open Hub [1] button inside the box below.

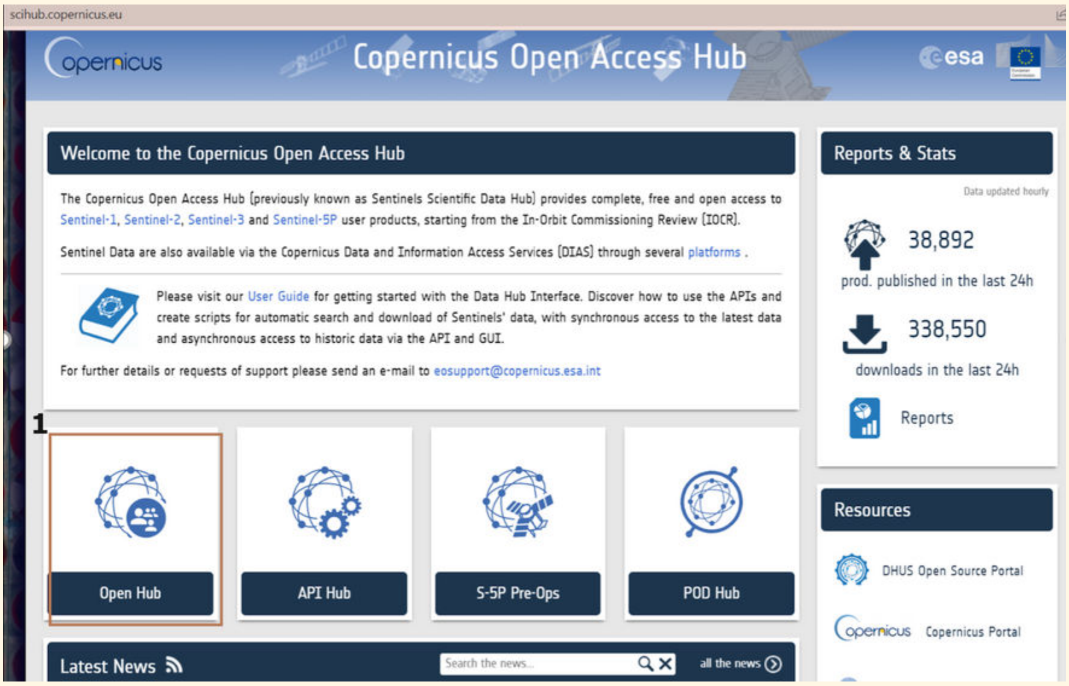

Figure 70. ESA Copernicus Open Hub

b. If you are already signed in, you can directly type on the search bar below for a search criterion [2] that you need and proceed to number 6.

If you are not yet signed in, it will prompt you with a log in notification window [3] shown on the image below. If you do not have any registered account, you may register to access free sentinel data by clicking on the Sign Up [4] button that will prompt.

Continue

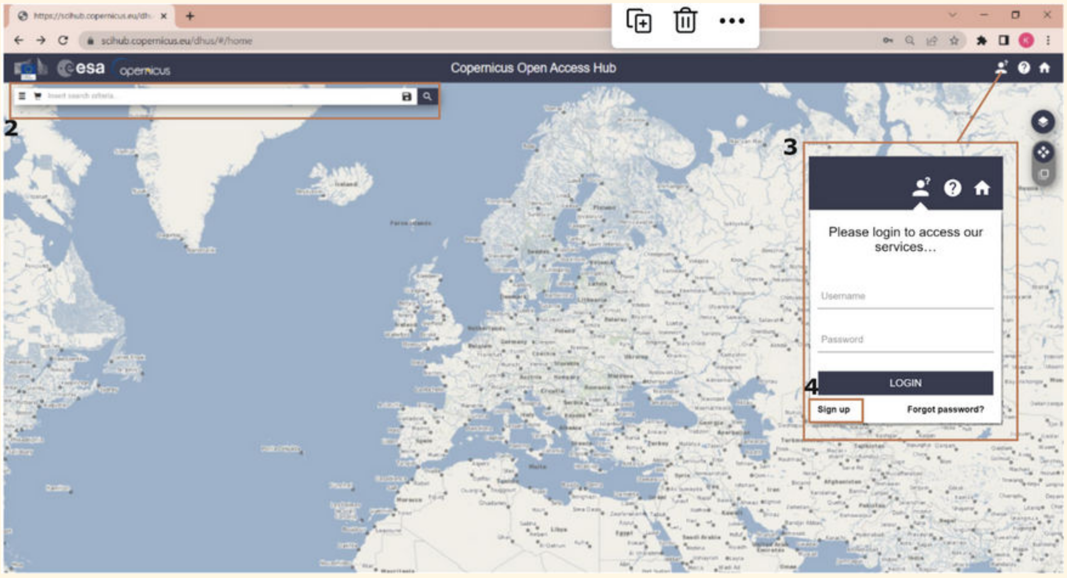

Figure 71. ESA Copernicus Sign In

c. After clicking the Sign up button, the Register New Account window will open. Once you have filled in all the required fields, click the *Register* button on the lower right side of your window[5].

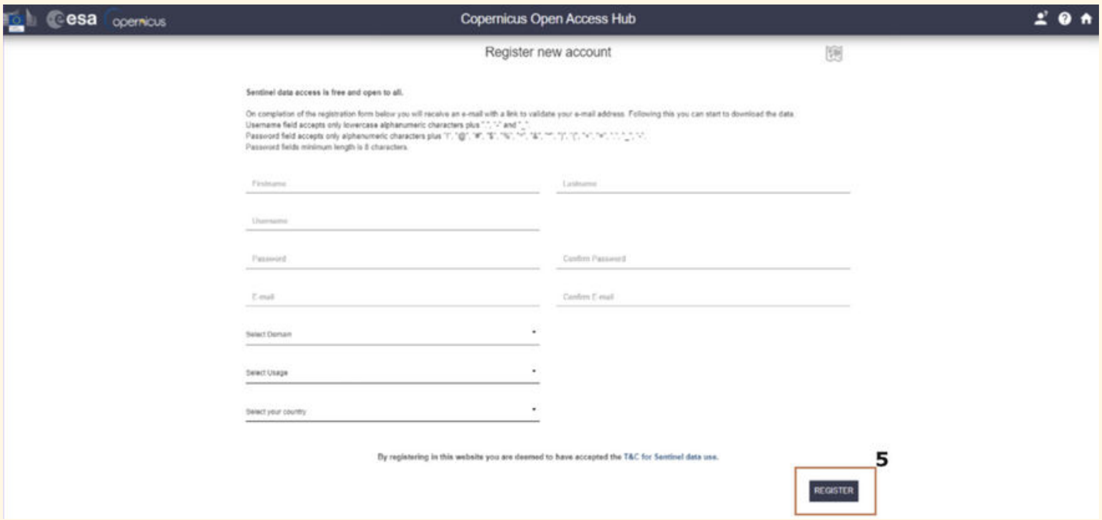

Figure 72. ESA Copernicus Sign Up

d. Once you have logged in to your account, the Copernicus interface will look like the image below. You may now proceed with your search queries on the search bar and input additional filters by clicking on the button to the left of the cart icon [6] to refine your search according to date and data type[7].

To define the extent of your image switch to area mode [8] then draw a polygon [9] on the area of the map that you wish to download. Then you may now proceed with your search by clicking on the Search button[10].

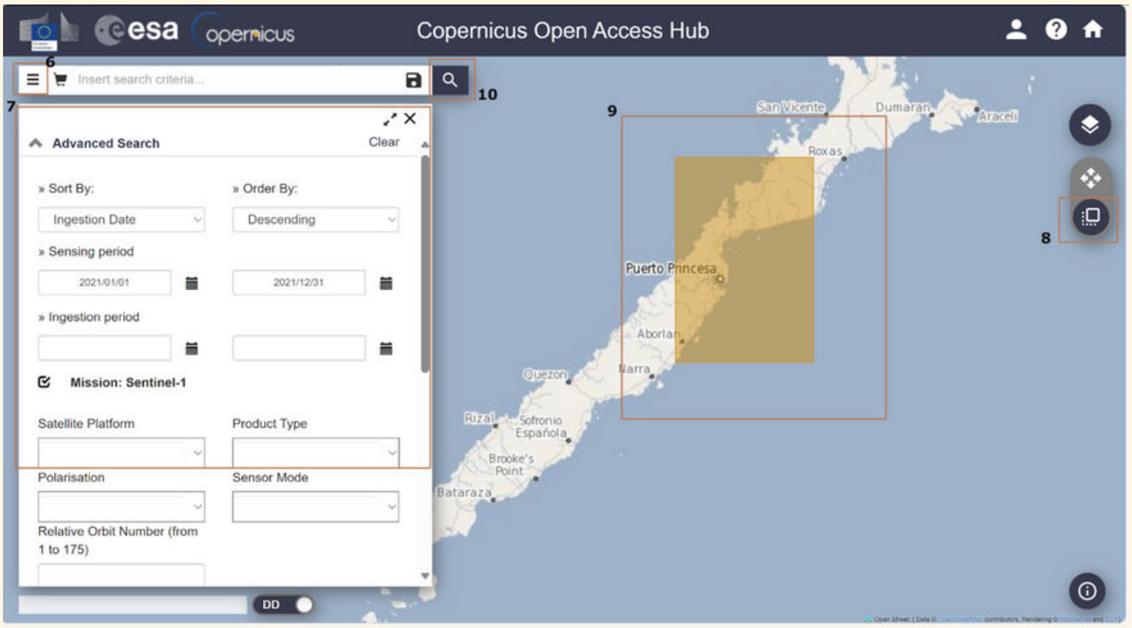

Figure 73. ESA Copernicus Defining the Extent and Adding Search Filters

e. All the resulting images that cover even a portion of the extent of the area of interest will appear in the search results. Once you have selected the image that you wish to download just click on the *Download product* button [11]. This will automatically initialize the download process of your image.

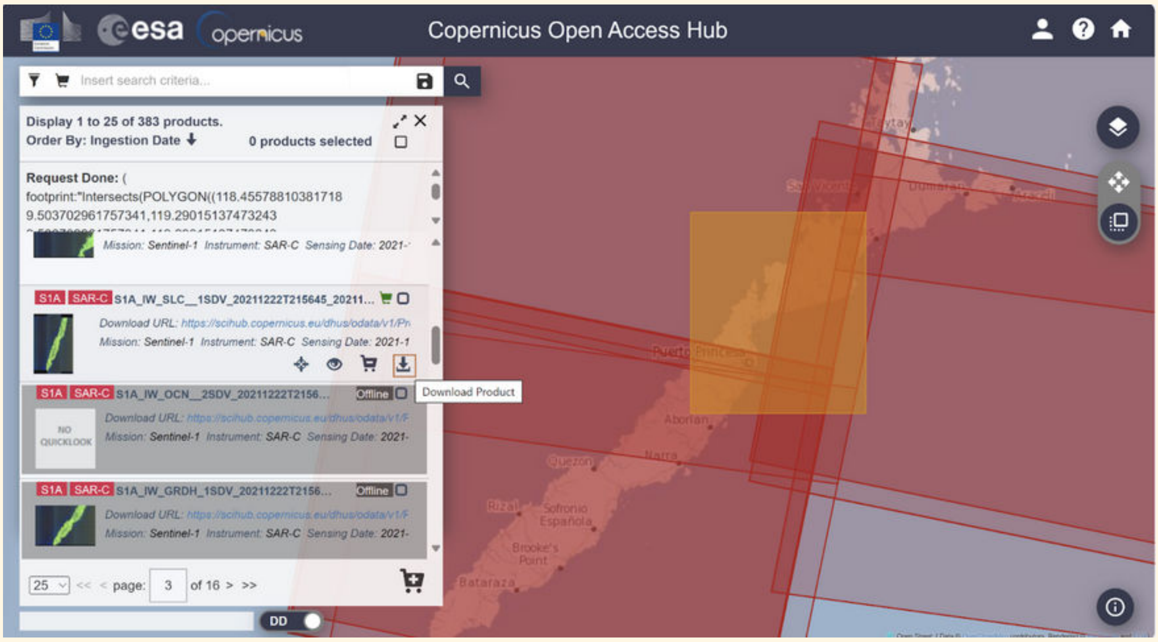

Figure 74. ESA Copernicus Download Product

Satellite Image Downloading using Planet Website

Another website where you can download satellite imagery is the Planet website. This is a website for searching in a data catalogue owned by commercial satellite providers. We acknowledge the adoption of these interface forms from the Planet website.
The image below shows the Planet website interface.

a. If you do not have any existing planet account, click on the Log in [1] button inside the brown box above to find the Log in/ Sign up button for the Planet Data catalogue.

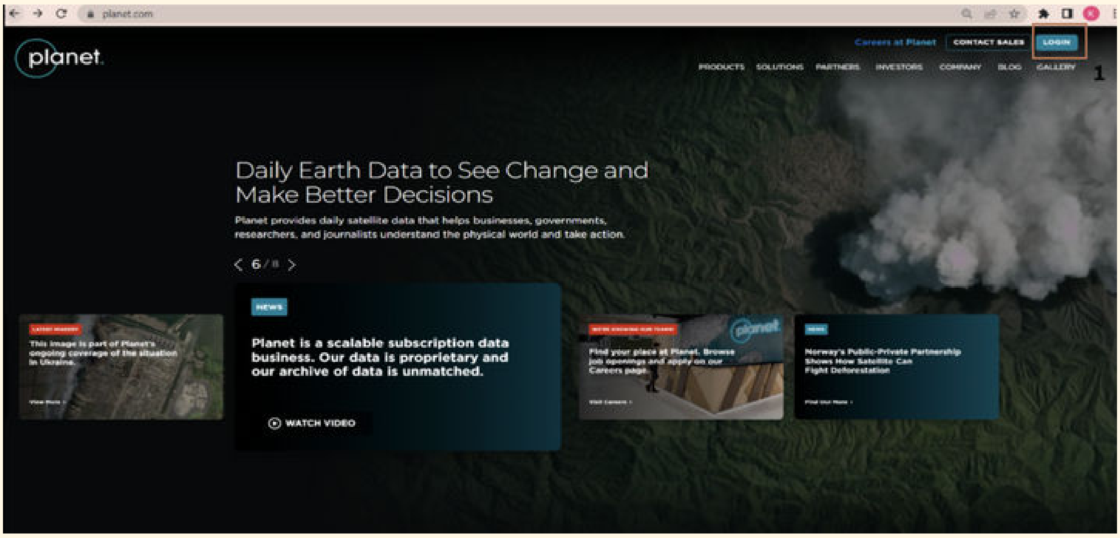

Figure 75. Planet Website Interface and Log in/ Sign Up Button

b. You may now explore the different functions and products of the Planet website upon registration by clicking on the applications menu button and choosing from the drop down list of applications available [2]. These applications include *Planet Explorer, Planet Stories, Basemaps Viewer, Tasking Dashboard and Developer Center.*

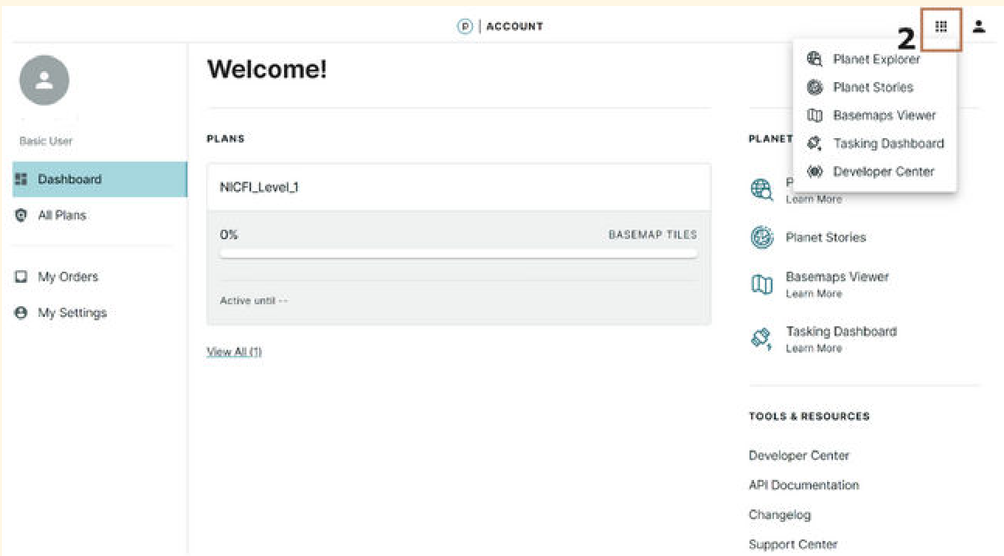

Figure 76. Planet Website Dashboard

c. For satellite image downloading, we will focus on *Planet Explorer*. To learn more about this, click on the *Planet Explorer* from the drop-down list on the applications menu shown previously. The highlighted panel on the left allows you to explore the different functions of *Planet Explorer*. Its user interface is shown below.

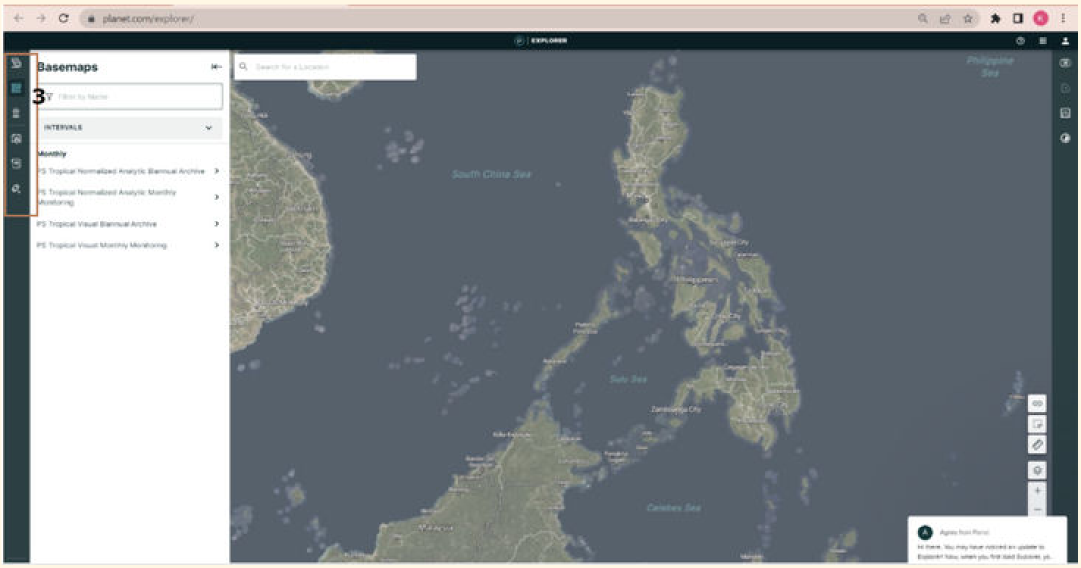

Figure 77. Planet Explorer Interface

d. To download an image from the *Planet Explorer* website, define the area of interest [4]. The area of interest can be defined by drawing a polygon, circle [5] or by importing any of the supported files such as shp, wkt, json, geojson, gpx, kml, dbf, shx, prj, zip, kmz [6].

e. After defining the area of interest, you may include additional filters to your search which can include the date range, imagery type and environmental conditions [7].

f. The search results will automatically be displayed after defining your filters [8]. You can click on your chosen image [9] to be displayed on the map [10].

g. If you have already chosen your image for download, click the *Add to order* button of your chosen image [11] then click the *Order Scenes* [12].

Continue

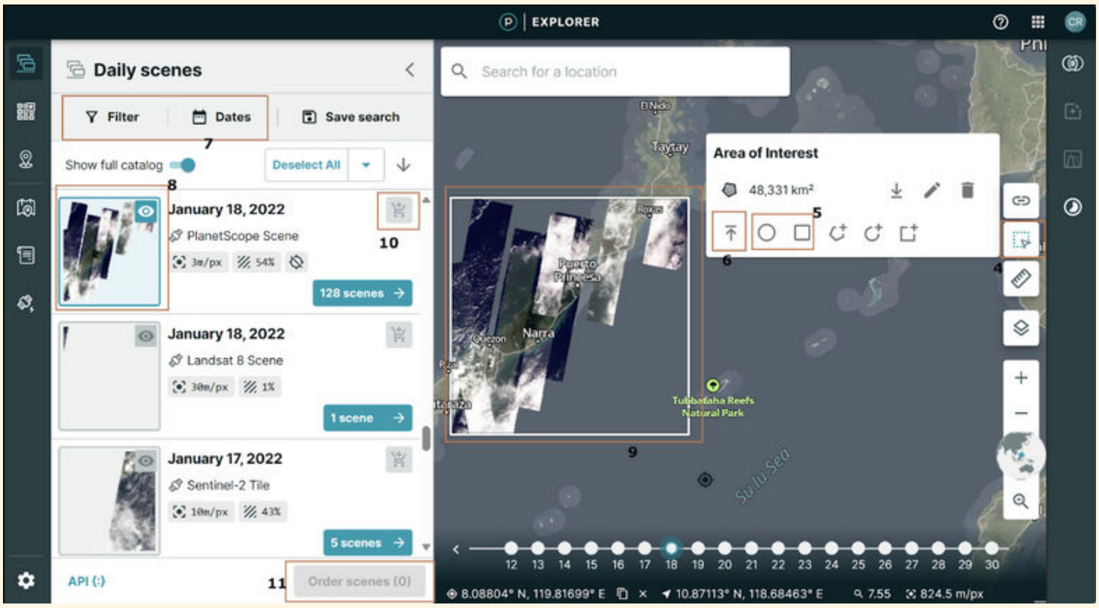

Figure 78. Planet Explorer Defining Area of Interest and Ordering Scenes

Google Earth Engine as a Data Source and Image Processor

Sources of satellite imageries are mainly from free-to-use satellite imagery repositories, most popular of which are from the USGS/NASA EarthExplorer (Landsat) and Europe's Copernicus Open Access Hub (Sentinel). These websites may have complex downloading procedures, but these can be simplified by using Google Earth Engine (GEE) for satellite image downloading.

Google Earth Engine is a cloud-based geospatial processing platform that connects multiple petabytes of publicly accessible imagery and a massive computational infrastructure with a web-based integrated development environment. The Google Earth Engine interface is shown below.

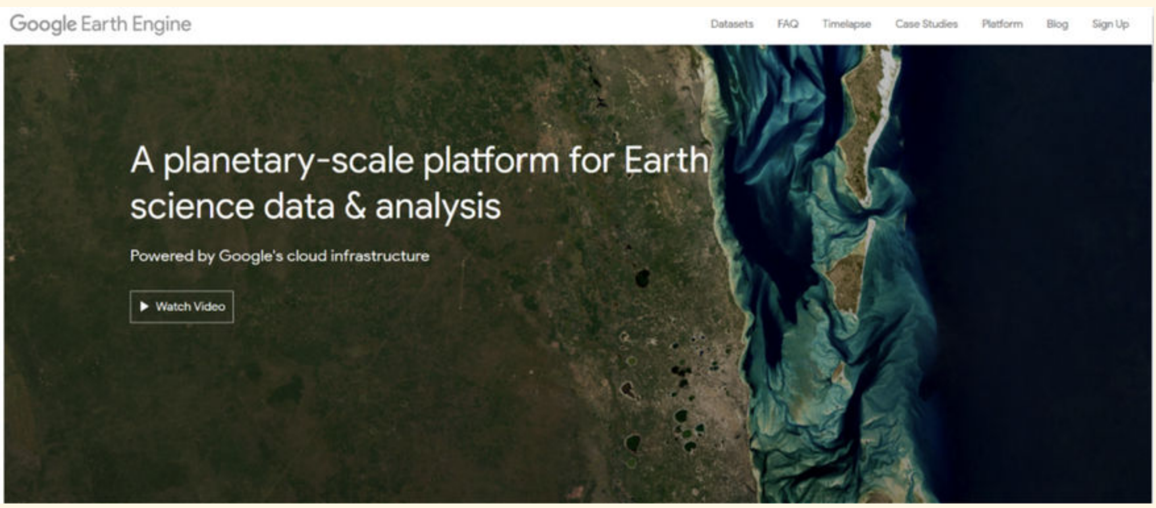

Figure 79. Google Earth Engine Interface

Using GEE has corresponding advantages and disadvantages as listed on the table below.

Table 6. Advantages and Disadvantages of using Google Earth Engine

Advantage	Disadvantage
You can directly process data without downloading to your local storage.	Programming skills required
You can have access to petabytes of data.	Dependent on internet connection
GEE has computing power and provides fast analyses.	Primary focused on raster-based imagery
Updates are frequently provided by users.	Lack of mature and detailed documentation

Source: (Earthblox, 2022)

Code Editor

Google Earth Engine has the *Code Editor* as the web-based platform where algorithms and scripts are logged making data visualization and processing with GEE easier. The figure below shows the sample interface of Google Earth Engine Code Editor if we have something in process in our code editor. This also shows the different elements and components available in the Code Editor.

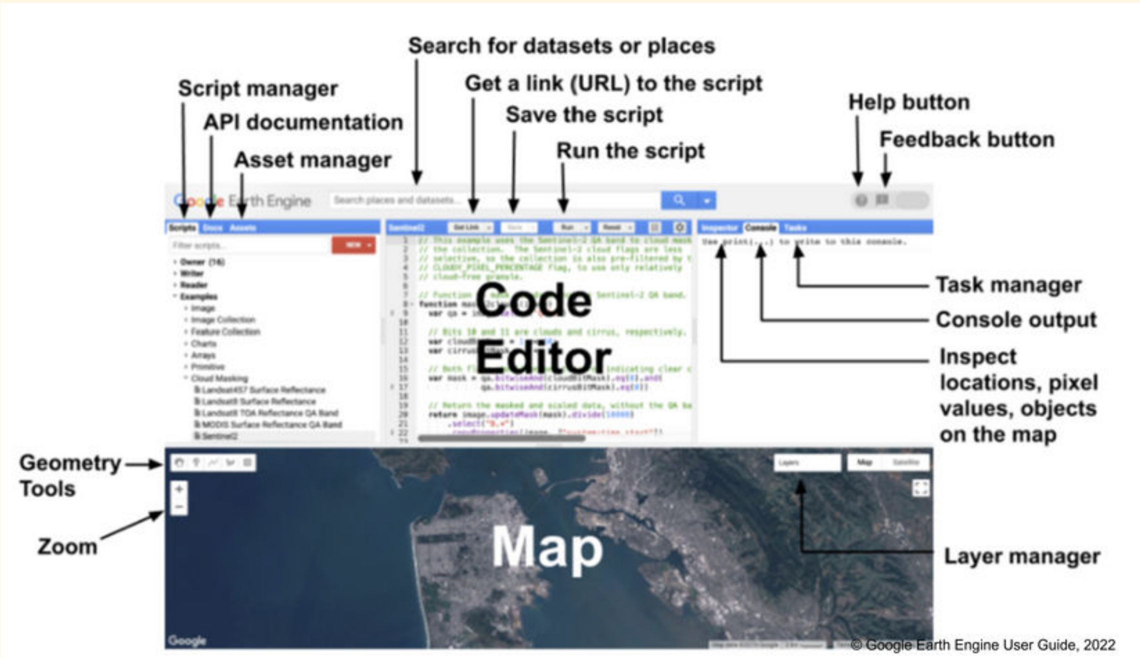

Figure 80. Google Earth Engine Code Editor Interface

The following are the GEE Code Editor Elements and functions as described from the Google Earth Engine User Guide:

- **Script Manager (Scripts tab)**

This tab lets you view and store your own scripts and example scripts in Git repositories hosted by Google. You may search through your scripts using the filter bar at the top of the Scripts tab.

The following sections are located within the Scripts tab:

1. Owner: This shows the personal repository of the scripts which is saved in the users/username/default. Only the owner has access to this folder unless they are shared with others.
2. Writer: This shows the repositories where access to view, add and modify has been given by the owner.
3. Reader: This shows the repositories where view access has been given by the owner. Editing of script is not allowed here.
4. Examples: This contains a special repository of ready-made scripts managed by Google.
5. Archive: This contains legacy repositories.

- **Map**

This displays the geographic region determined in the code editor.

- **API Documentation**

This contains the complete Javascript API documentation.

- **Asset Manager**

This is where own image assets are uploaded and managed in the Earth Engine.

- **Search for datasets or places**

This search tool allows finding datasets and places to use in the scripts.

- **Get a link (URL) to the script**

Once this is pressed, the code in the editor present will be represented by a unique link in the browser's address bar.

- **Save the script:**

This gives users an option to share a link that will always load the most recent saved version and is only accessible by the owner and others that are given access to its repository.

- **Run the script**

Once this is clicked, this submits an export task to the server.

- **Help button**

This shows the links to the Developer's Guide, other help forums, a guided tour of the Code Editor and a list of keyboard shortcuts for coding and displaying data on the map.