Protocol for data collection and processing from Satellite imagery using Google Earth Engine

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Rationale

Satellite imagery offer an appropriate solution for monitoring pastures. Google Earth Engine (GEE) is a platform that is simplifying the aforementioned.

A comprehensive guide to GGE can be found in the link below:

- https://developers.google.com/earth-engine

GEE provides in a single portal a petabyte-scale archive of publicly available remotely sensed imagery and other data. The full catalog can be found in the link below:

- https://developers.google.com/earth-engine/datasets/

Among the catalog, the satellite family of Sentinel provides systematic coverage of the earth roughly every 10 days. Dense time-series of Sentinel data are freely available. There is a number of indicators related to plant productivity and health that can be derived from remotely sensed information. Among them, the Normalized Difference Vegetation Index (NDVI) is probably the most widely used.

The following was with the aim to introduce the capabilities of GEE as a platform, a simplified workflow (code included) to calculate NDVI.

This guide is not meant to be an exhaustive introduction to GEE. However, it was conceived to be as simple and straightforward as possible, no coding nedded. This is because the main barrier of adoption to any new technology is the slow learning curve at the beginning of its use.
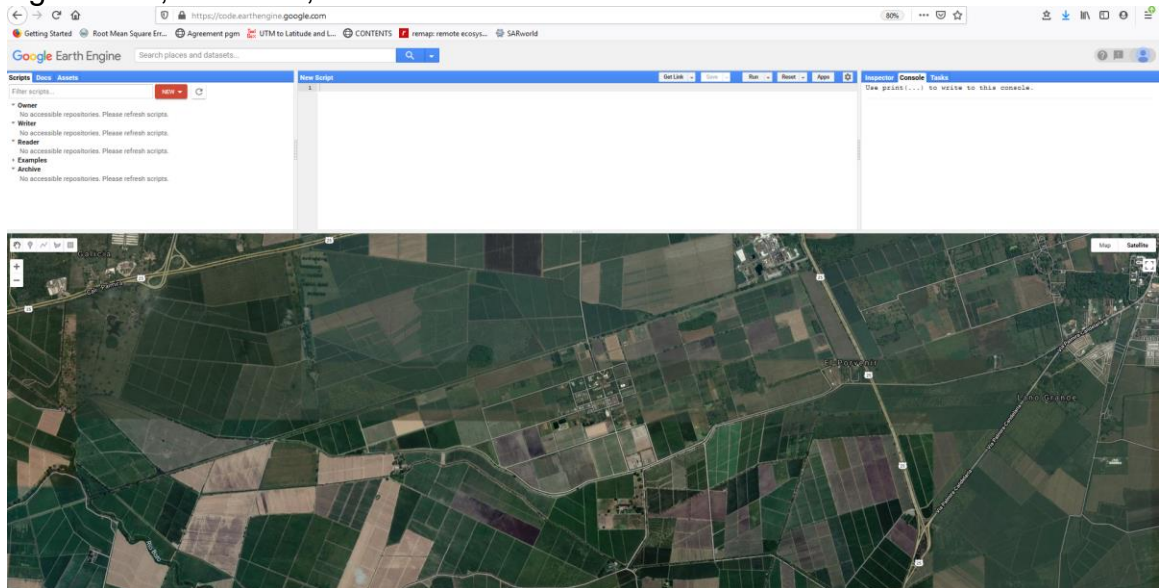
STEPS

1. Open an Google account
   The google account is required to access GEE

2. Go to https://earthengine.google.com/ or go to https://code.earthengine.google.com/
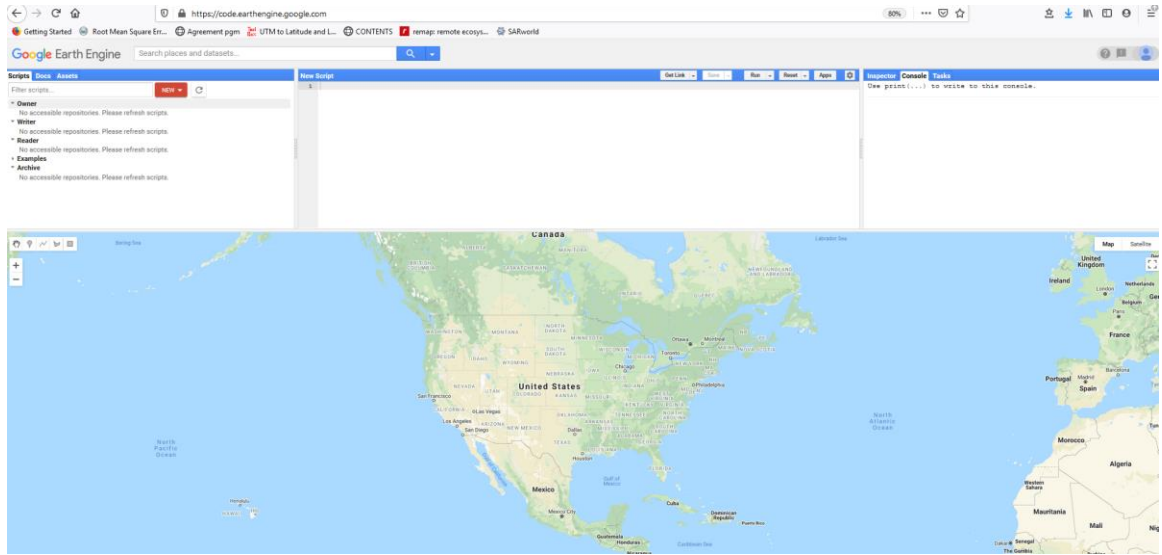
3. Navigate the map and locate a place where you want to perform analyses
   In the below example, we selected the International Center for Tropical
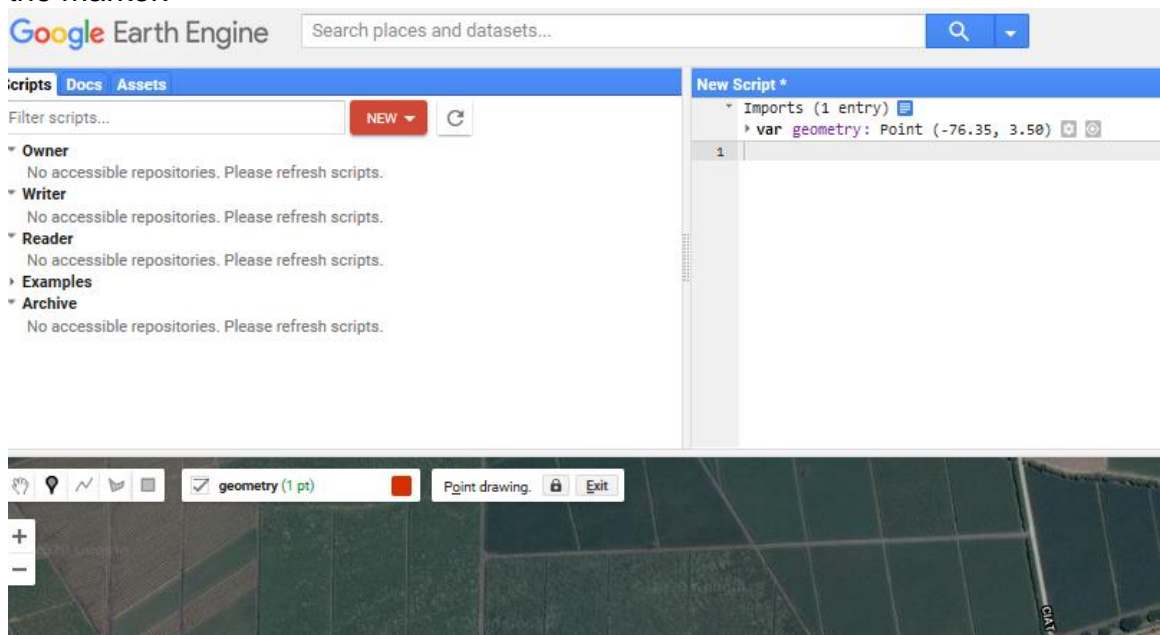   Agriculture, near Cali, Colombia

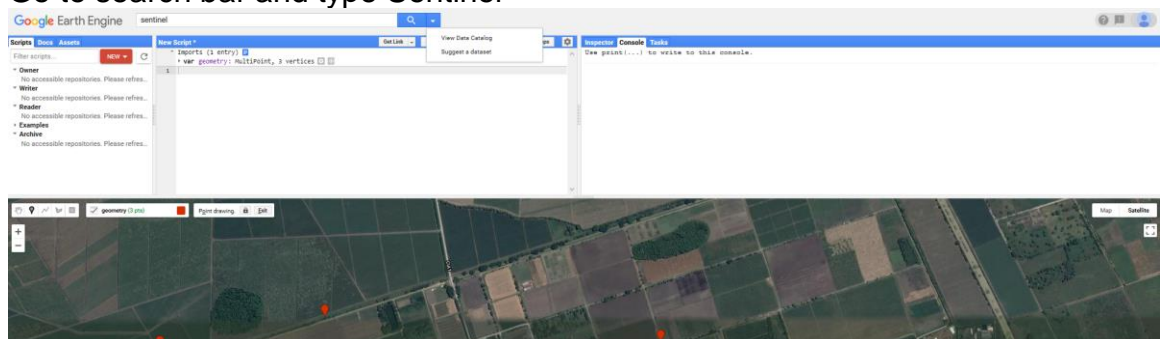4. Go to the map, and click the marker icon

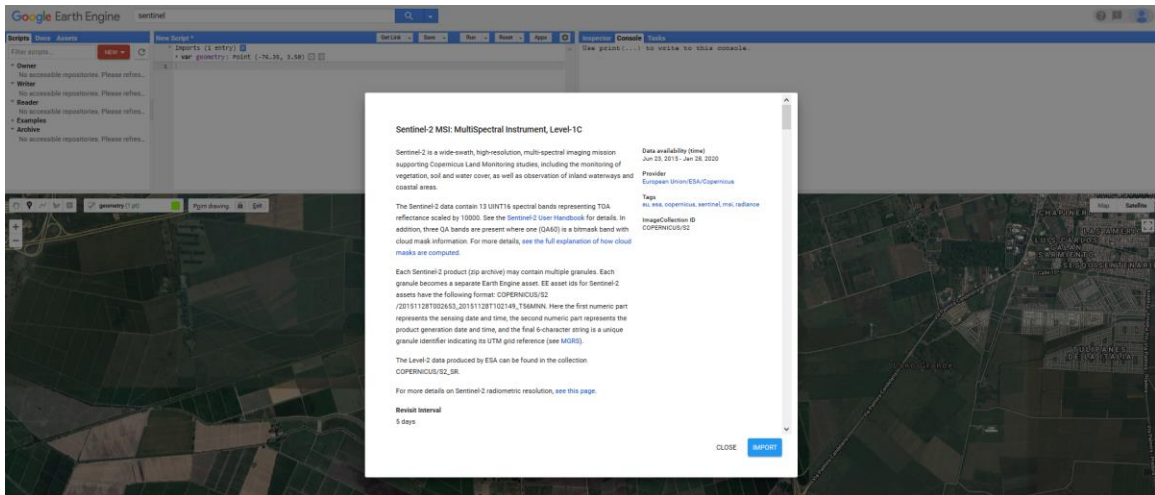5. Place the marker where you want to perform the analyses

6. Once the icon is placed, in the window **NEW SCRIPT** will appear coordinates of the marker:
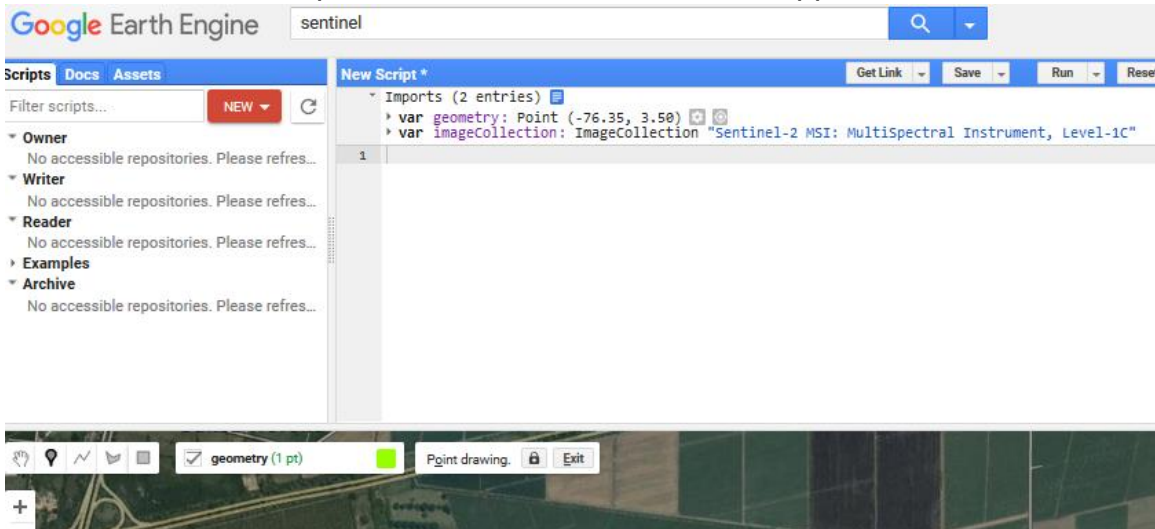

7. Go to search bar and type Sentinel

8. Select Sentinel-2MSI: MultiSpectral Instrument, Level 1-C and from the pop-up window select import

9. In the window **NEW SCRIPT**, information of the selected sensor, in this case Sentinel-2 MSI: Multispectral Instrument, level 1-C will appear

10. In the new script window, go to var imagecollection and change it to a different name, such as **Sentinel**
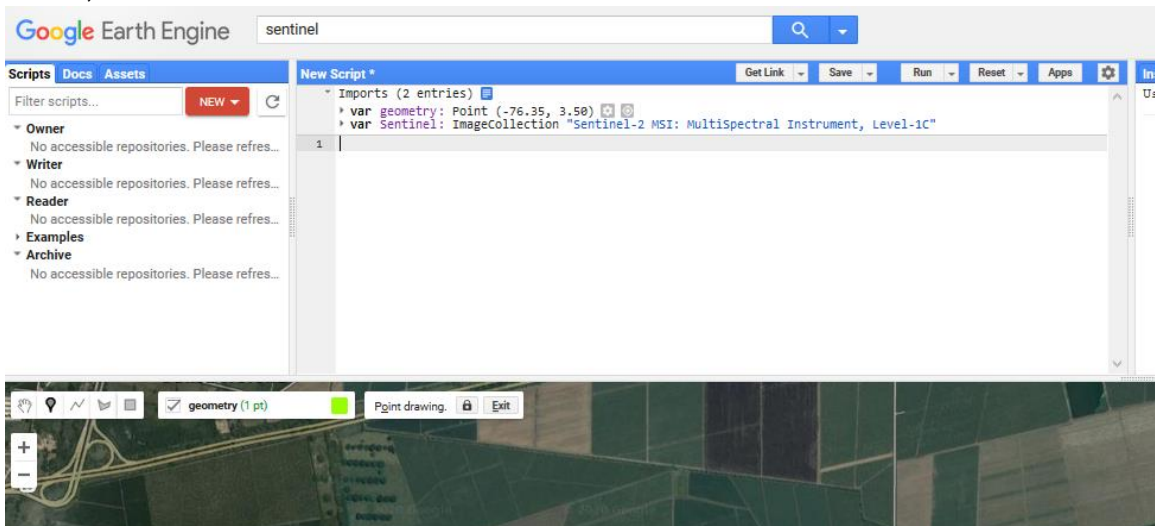
11. In the new script window, is now needed to know a bit of java programming. Fortunately there are lot of repositories were contributors upload their expertise, and share their knowledge.
Copy and paste the following lines and paste them in the new script window.

```
var image = ee.Image(Sentinel
.filterDate("2017-07-01", "2017-10-30")
.filterBounds(geometry)
.sort("CLOUD_COVERAGE_ASSESSMENT")
.first());
print("A Sentinel-2 scene:", image);
```

The above lines (in red) are requesting GEE the following:
- Recall images
- Filter the images based on a particular date or dates there is interest in
- Filter images that are free of clouds
- Show the images on the browser/map
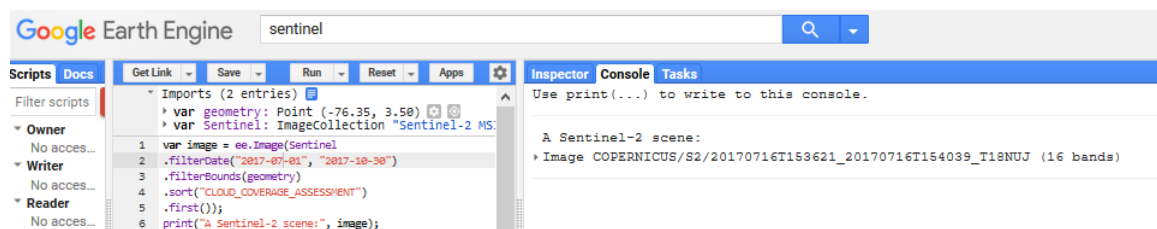
In the console menu, the date that is free of clouds will appear as:

```
Image COPERNICUS/S2/20190706T153612_20151224T154031_T18NUJ (16 bands)
```

The image available with the less clouds in it, and for this range of the selected period, is July 6th, 2017
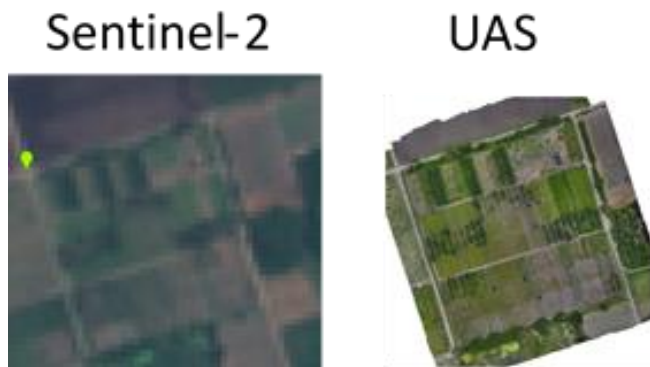
12. Once, a cloudless image is available, visualization of the images is desired
For that, copy and paste the following:

```
var trueColour = {
    bands: ["B4", "B3", "B2"],
    min: 0,
    max: 3000
    };
Map.addLayer(image, trueColour, "True-colour image");
```
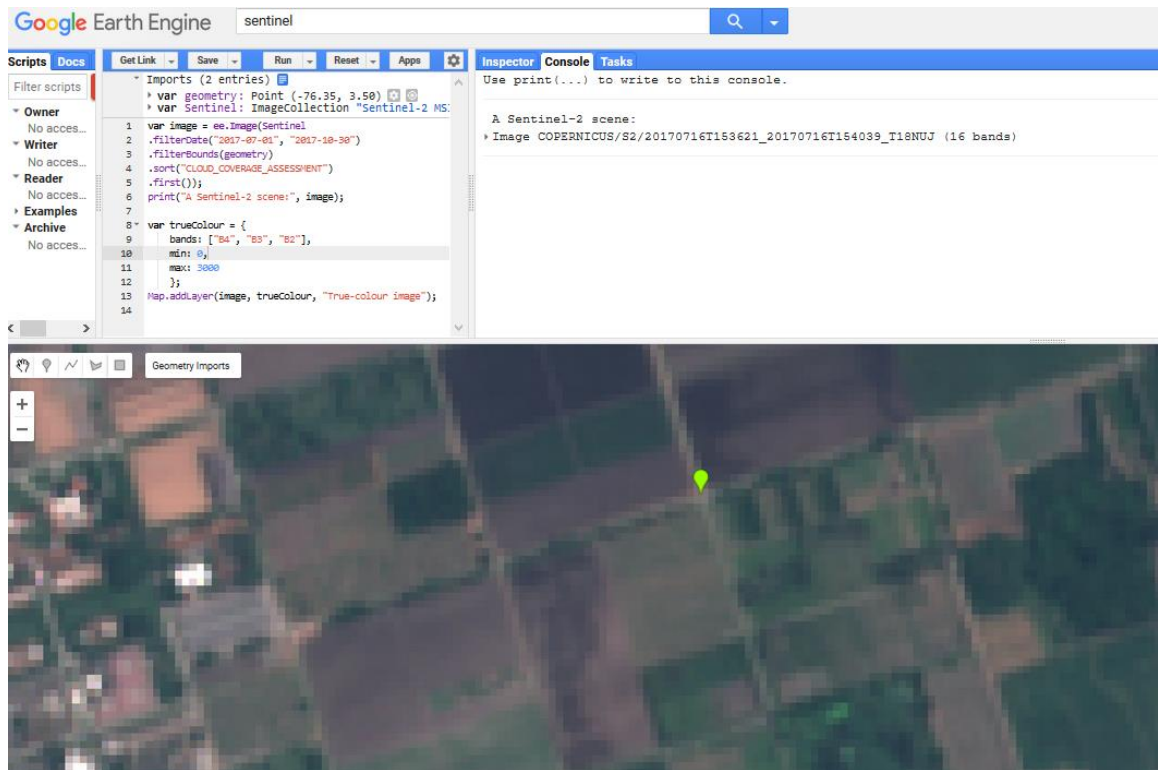
For comparisons, see the images bellow collected from Sentinel-2 using GEE (June 6th, 2017) and a drone (UAS, on june 5th, 2017)

13. To visualize NDVI, copy and paste the following:
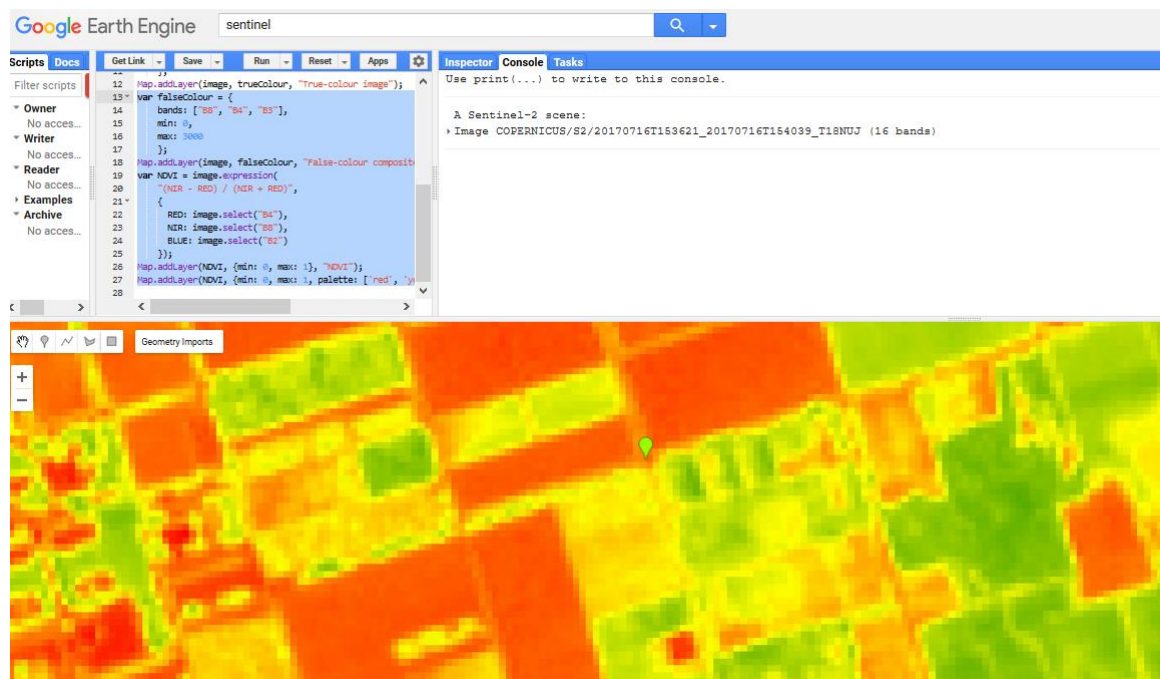
```
var falseColour = {
    bands: ["B8", "B4", "B3"],
    min: 0,
    max: 3000
    };
Map.addLayer(image, falseColour, "False-colour composite");
var NDVI = image.expression(
```

```
    "(NIR - RED) / (NIR + RED)",
    {
      RED: image.select("B4"),
      NIR: image.select("B8"),
      BLUE: image.select("B2")
    });
Map.addLayer(NDVI, {min: 0, max: 1}, "NDVI");
Map.addLayer(NDVI, {min: 0, max: 1, palette: ['red', 'yellow', 'green']}, "NDVI
colour");
```


Further analyses can be performed after exporting of data in GIS software such as
ArcGIS and QGIS.

Alliance