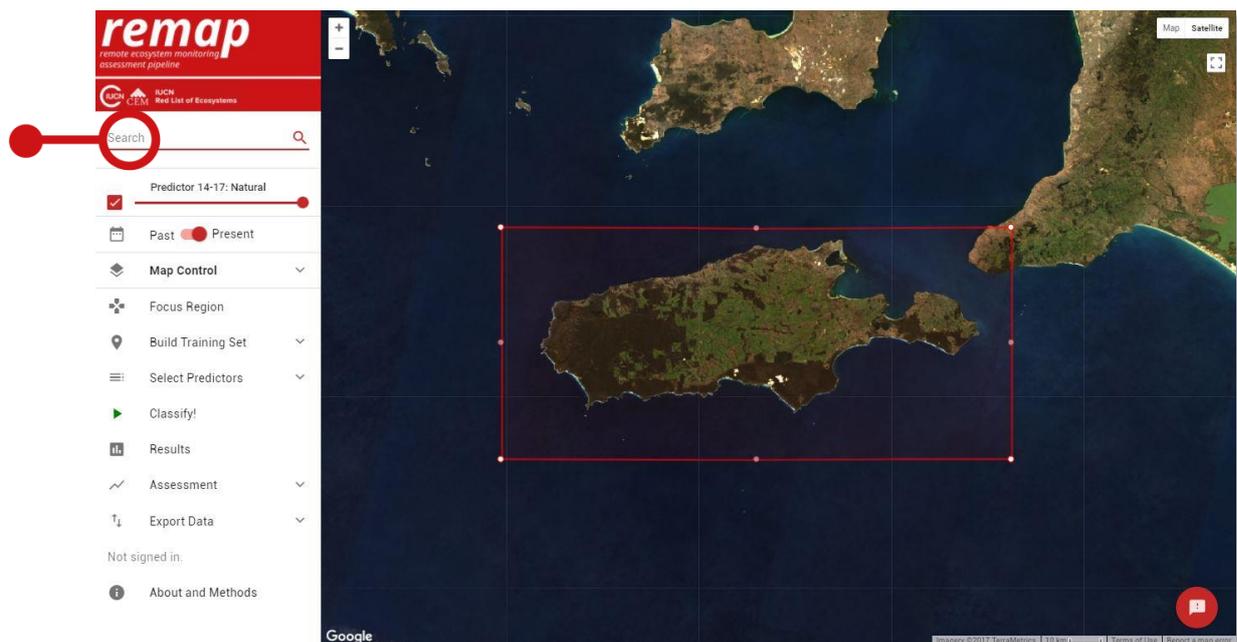


This tutorial is aimed at getting you started with making maps in Remap (<https://remap-app.org>). In this tutorial we are going to develop a simple classification of mangroves in northern Australia. Before getting started with the tutorial, read the user guide to become familiar with the Remap interface. For more information, see the user guide, read our paper, and explore the Remap website.

Location search

Search for the Gulf of Carpentaria in the remap search bar:

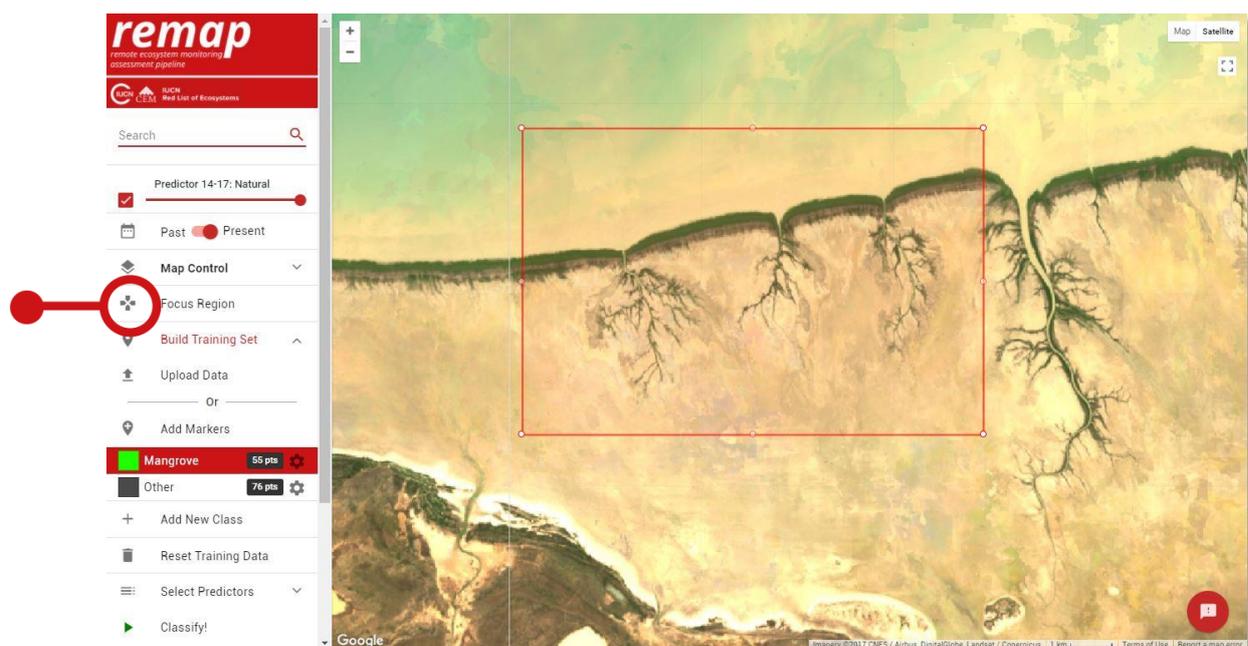


Focus region

Focus region defines the boundary of your analysis and limits the size of the computation required by the Google Earth Engine.

1. Zoom to centre the region you want to work on.
2. Click **Focus Region** to define the boundary of the analysis.
3. If you like, change the shape of the focal region by modifying the polygon boundaries using the vertices on the bounding box.

Use focus region to define the boundary of your analysis.

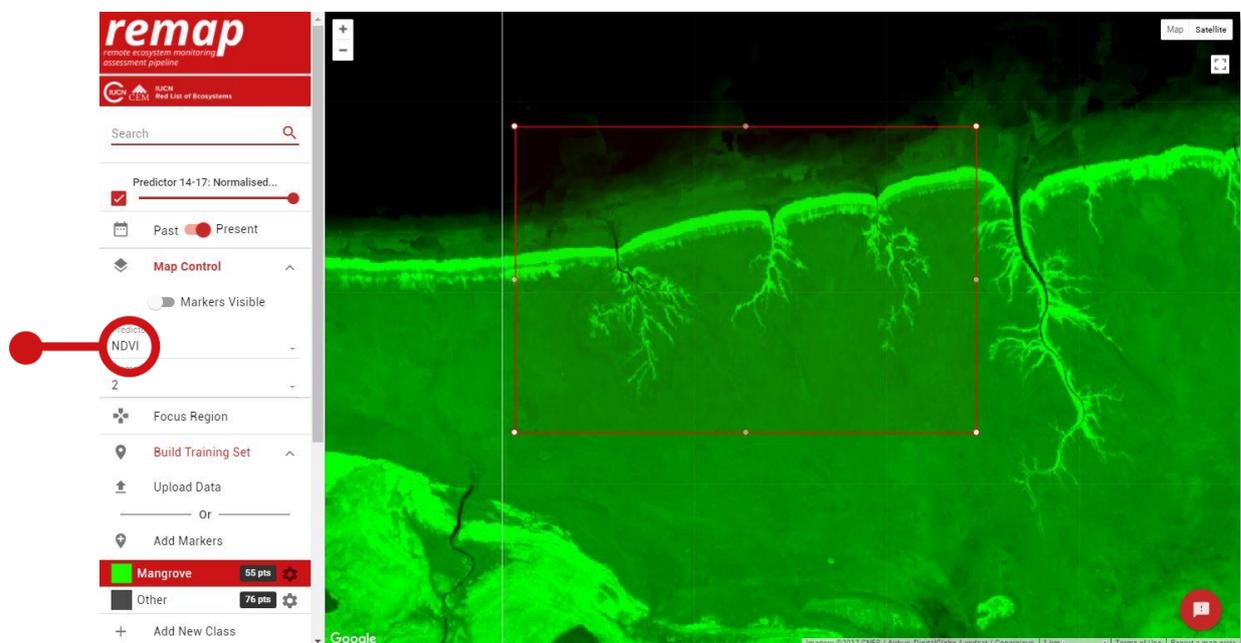


Map control

Map Control allows you to visualise different base layers (predictors), toggle marker points on and off and change the way colours of the base layers are rendered.

1. Use **Map Control** to explore the different predictor layers that are used in the analysis.
2. The Normalized Differenced Vegetation Index (NDVI) is an index that is quickly produced from satellite data. It is particularly useful for identifying live green vegetation, and is therefore a useful predictor for many ecosystem map classifications.
3. View the NDVI for this region by selecting it with the **Predictors** menu in the **Map Control**.
4. Explore the different predictors available for use in remap and read more about them on the **Methods** section of the website.

Use map control to visualise the Normalized Differenced Vegetation Index (NDVI) for a study region:

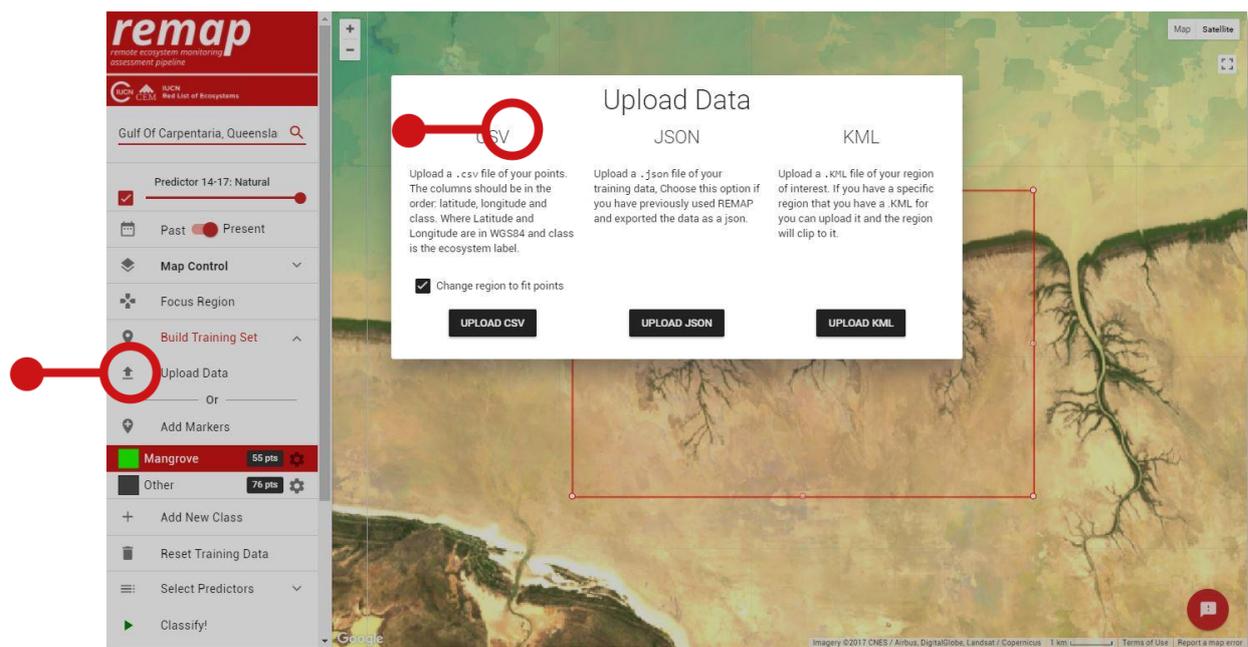


Build training set

To make a map in Remap, we need to teach a machine learning classifier called a Random Forest about the map classes we want to distinguish. These classes are normally ecosystem types, land cover types or land uses. In our case, we will produce a map with 'Mangrove' and 'Other', since we are only interested in the distribution of mangroves.

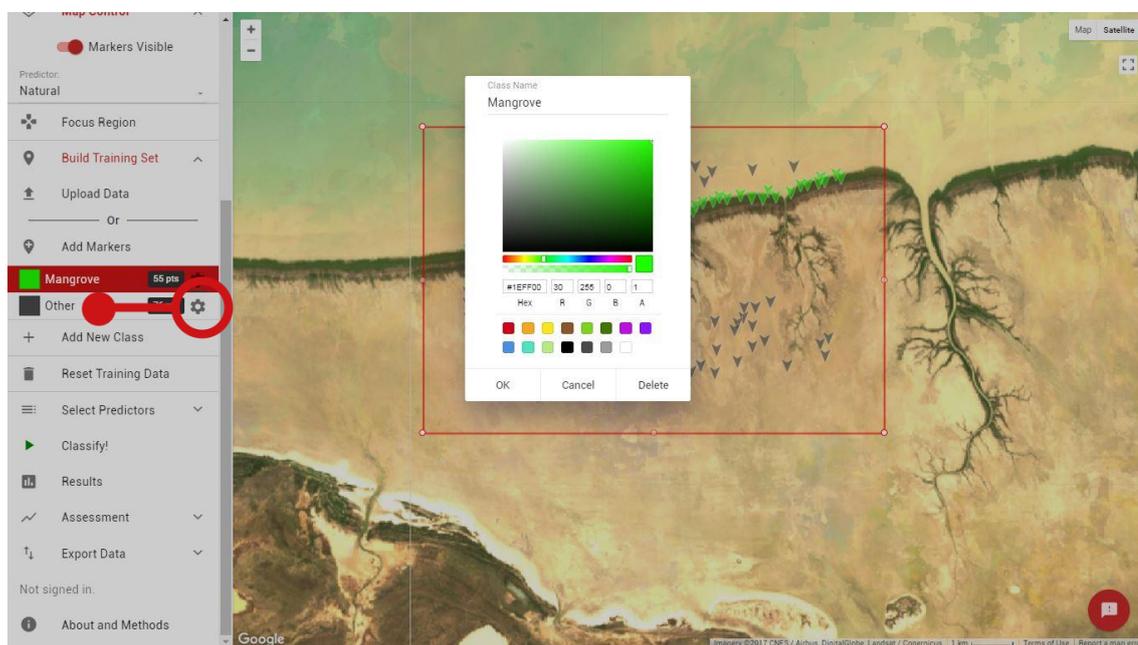
Data upload (.csv)

1. We upload our training data file (.csv) via the **Build Training Set, Data Upload** function.
2. Select **Upload CSV** and navigate to the file (remap_carpentaria_training_set.csv)



3. Remap will automatically move to the region where these data occur. Note the class labels are also imported.
4. Use the **gear** icon adjacent to each label to change their colour, name, or delete individual map classes.

Change the colour and name of a class in remap using the gear icon:



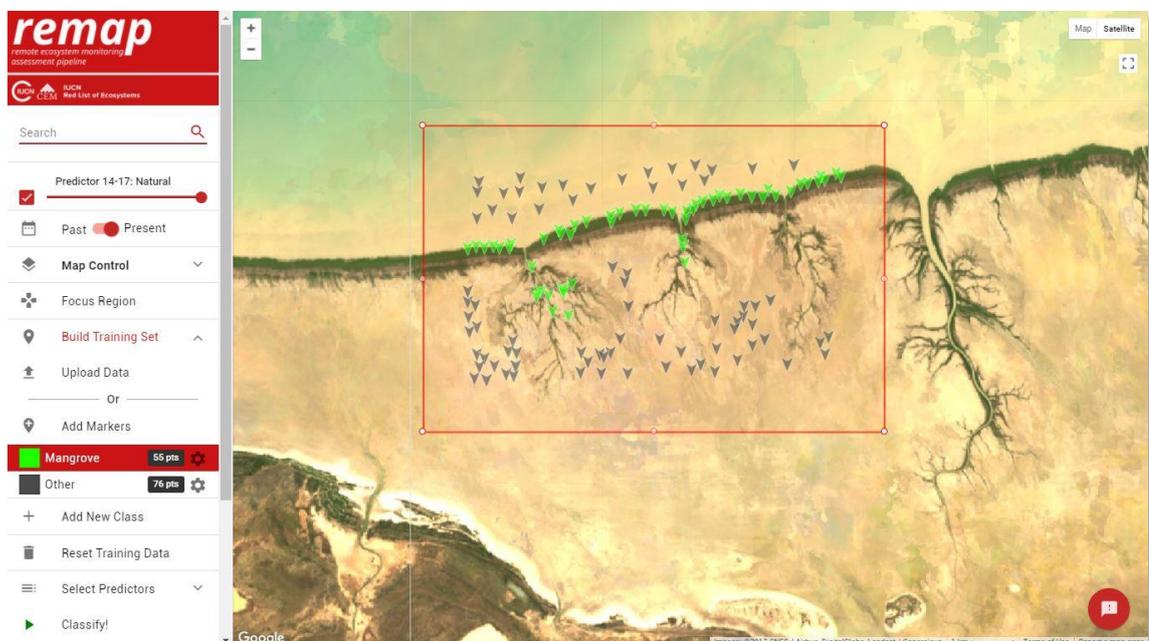
Notes:

- Although remap has no lower limit to the number of training points in a training set, we recommend having a large number of points (>50) for each class to minimise the classification error rate.
- Remap will allow users to run the classification with any amount of training data. However, if an attempt is made with <20 training points in any class remap will warn the user that this will probably result in a poor classification.

Build training set (interactive)

Remap can also be trained interactively by identifying locations on the map that correspond to each class you want to map. Use the **Add Markers** and **Add New Class** functions to interactively train remap.

1. Use **Add New Class** to add all of the classes you want remap to map.
2. Modify the class name or colour, or delete the class, using the **gear icon** located next to each class label.
3. When you are ready to identify locations on the map that correspond to each map class, select the class by clicking on it and use the **Add Markers** tool to add points to your map where that class is located.
4. Here we have added 55 points for the mangrove class and 76 points that correspond with other.
5. Continue to add markers for each class until a full training set for all classes is achieved. The more accurate you are at this stage the better your map will be.

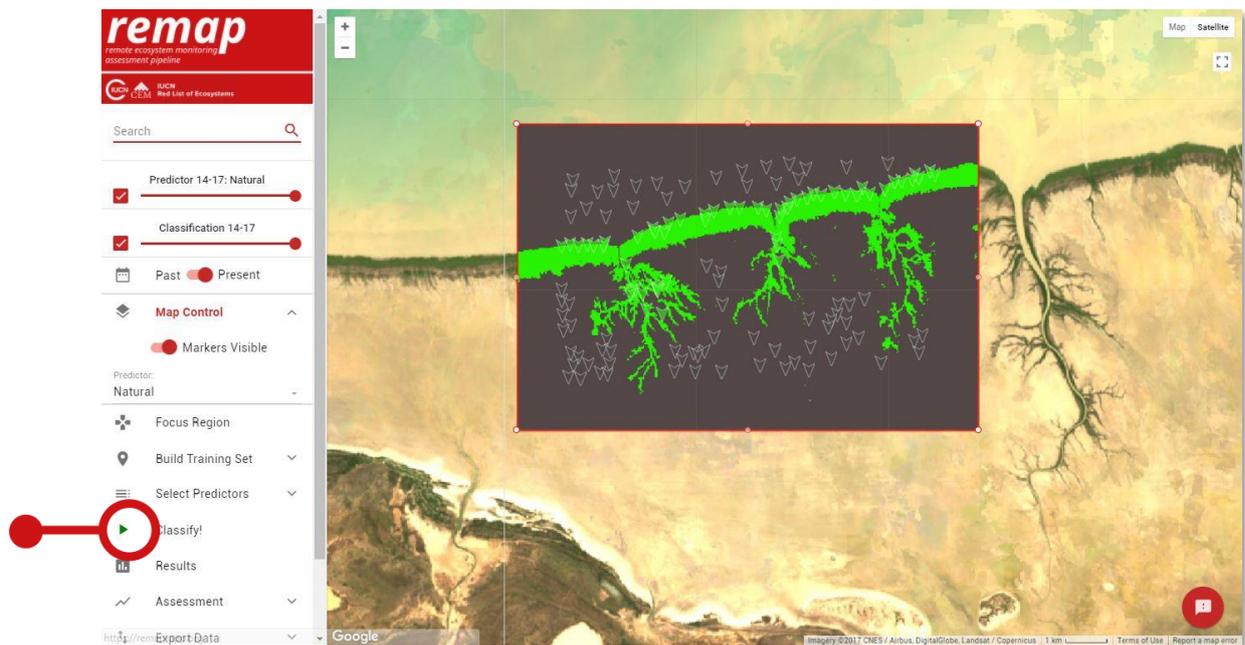


Classify

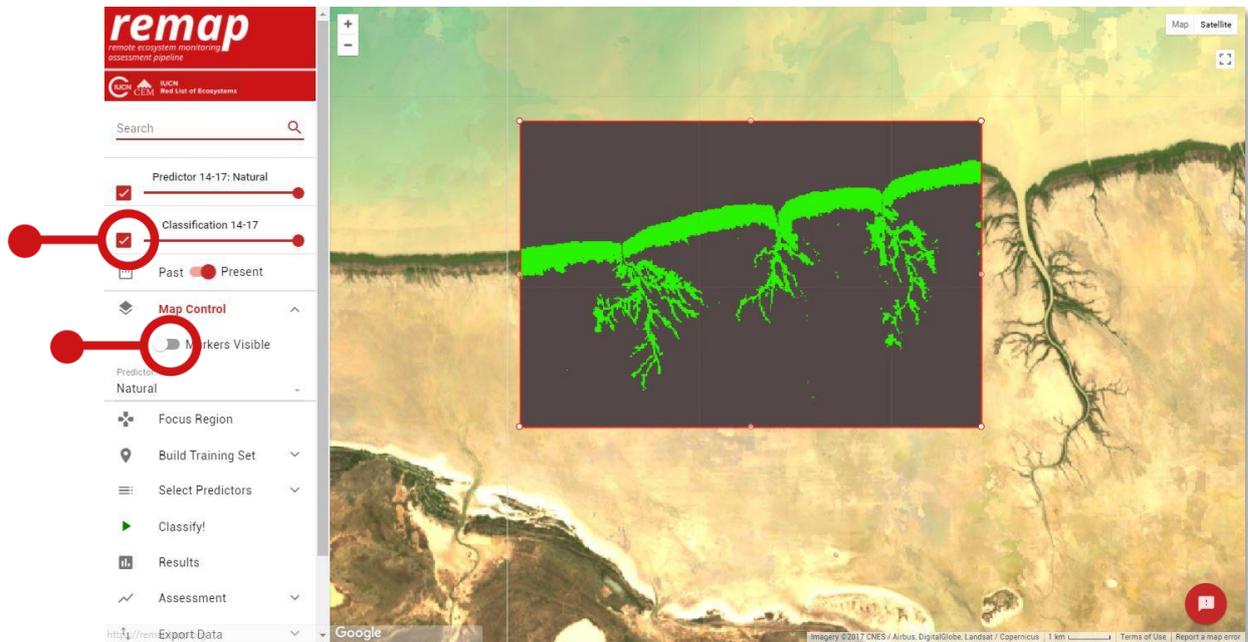
Now that we have a comprehensive and accurate training set, we are ready to get the Google Earth Engine to classify our data.

1. Click **Classify** to run the classification.
2. As this is a computationally intensive operation that is farmed out to several processors by the Google Earth Engine, this step can often take some time.
3. When it is complete the wheel will disappear and the classified map is returned.
4. If no map is returned within a few minutes click **Classify** to try to run the classification again.

When clicking *Classify*, remap implements the classification on the Google Earth Engine and returns a classified map to the browser:



5. Use the map control to hide the training set, and the transparency slider to compare the classified map to the underlying data.



Notes:

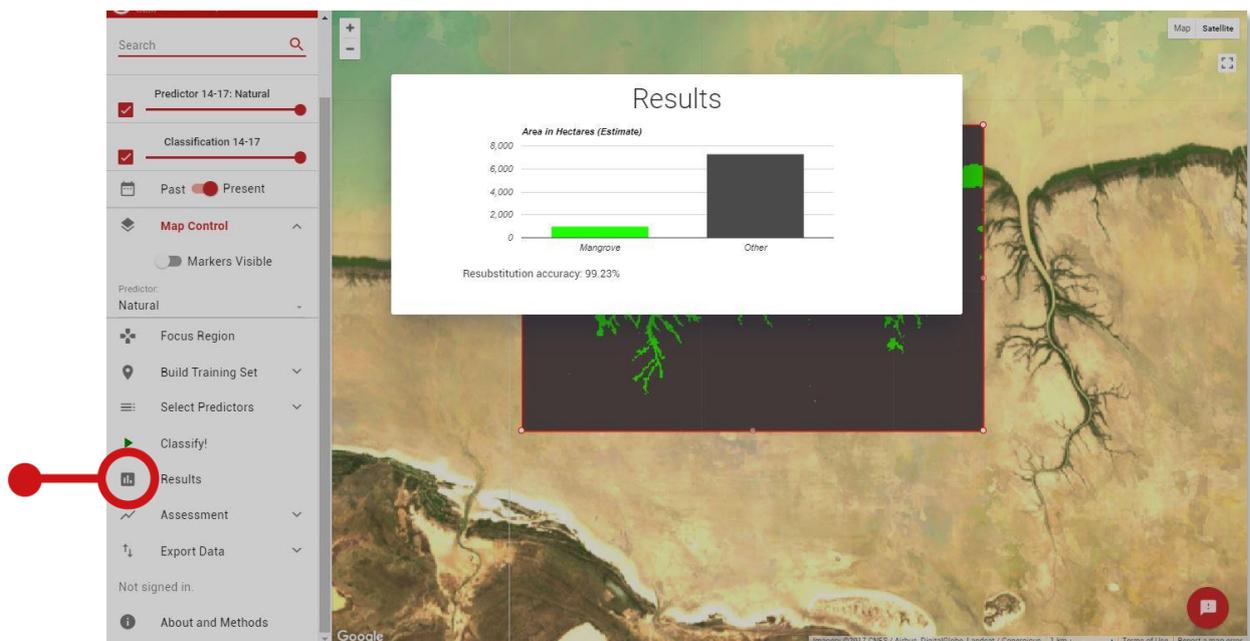
- Remap uses a best-of-class machine learning classifier to classify freely available Landsat data. This allows maps to be produced over time and the production of a wide-range of predictor layers that assist in the classification (including the NDVI, NDWI, NIR band). *Owing to licensing restrictions, it is not possible to implement a classification on the underlying Google Earth high-resolution imagery in both Remap or the Google Earth Engine.*
- Remap runs classifications in parallel using tiles (see Google Earth Engine). Sometimes the tiles may take some time to return and be compiled on the screen. Just wait, zoom in and zoom out and it will load completely with time.

Results

The **results** function allows you to assess the accuracy of your classified map.

1. Click Results and review the error rate of the classification. This figure is calculated by comparing the known class of each point against what the classifier ultimately maps it as.
2. In many cases, the error rate of the classification can be reduced by adding more training data, considering different map classes (e.g. splitting 'Other' into 'Salt pan' and 'Water') or selecting different predictors.
3. For difficult classifications, such as Peat or Seagrass, it will probably be necessary to run a custom classification that utilises specific predictor layers. In this case we recommend users learn the Google Earth Engine and develop their own remote sensing workflow.
4. Users can download the .csv file of these results by clicking on the download function.

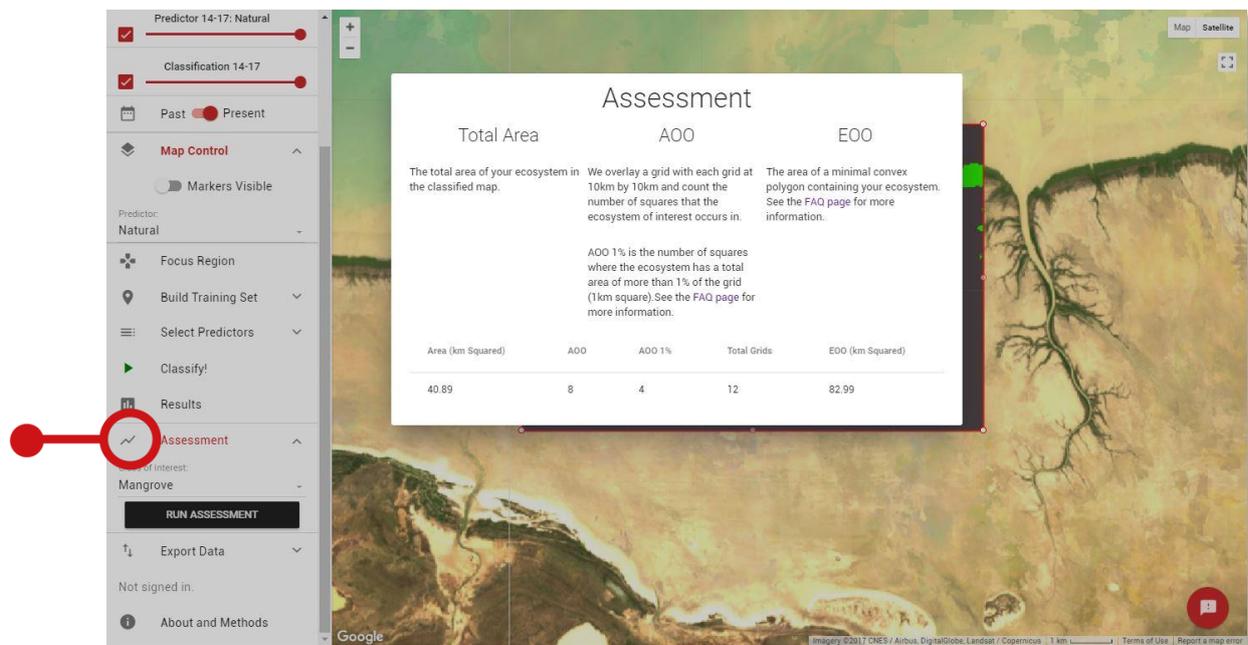
Remap reports the error rate of the classification and an estimate of the area per class:



The **assessment** tab in remap calculates the spatial metrics required for assessments under the IUCN Red List of Ecosystems (<https://iucnrle.org>).

1. Click the **assessment** tab and choose Mangrove to produce the range size metrics for the mangrove class.
2. This step can take some time while the Google Earth Engine generates a Minimum Convex Polygon for EOO and counts the number of 10 × 10 km grid cells to compute the AOO.
3. Again, if it doesn't run simply click the **assessment** tab a second time.

Remap assessments report total area (km²), the Area of Occupancy (AOO) and the Extent of Occurrence (EOO):



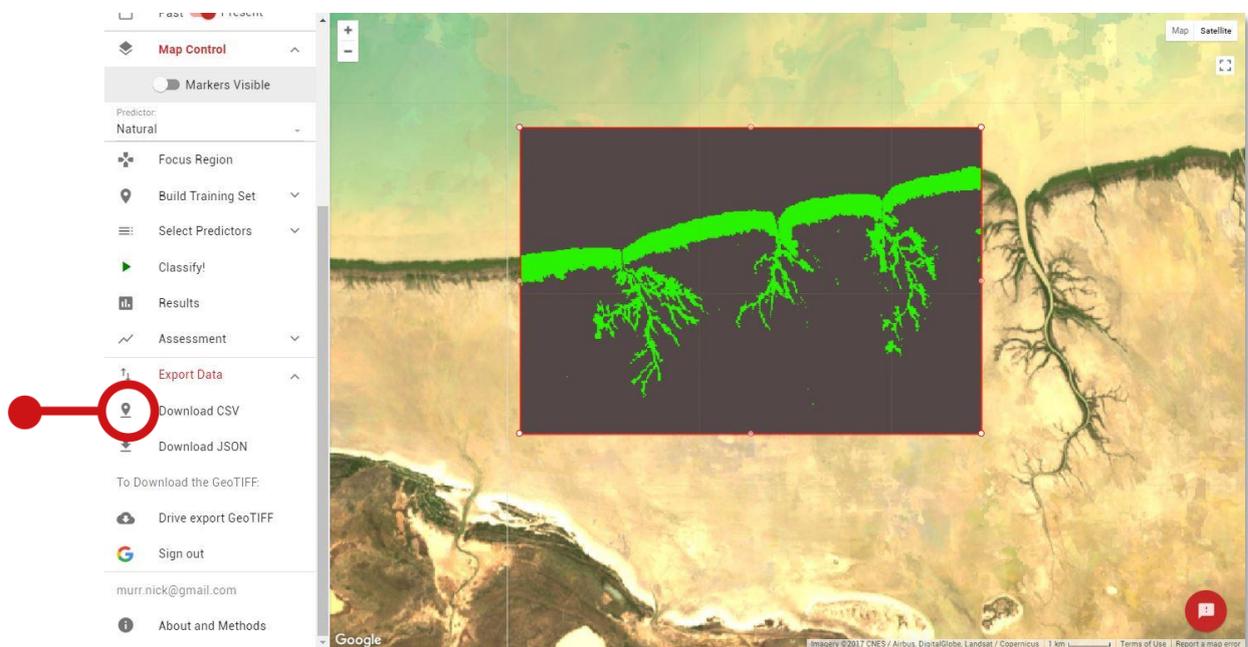
Notes:

- Remap may take some time to compute the results and assessment statistics. In some cases, it may reach the time-out applied to it by the Google Earth Engine. In this case, when no result loads, simply click the results or assessment tab a second time.

Export data

Remap allows you to **export** the data used to develop your map:

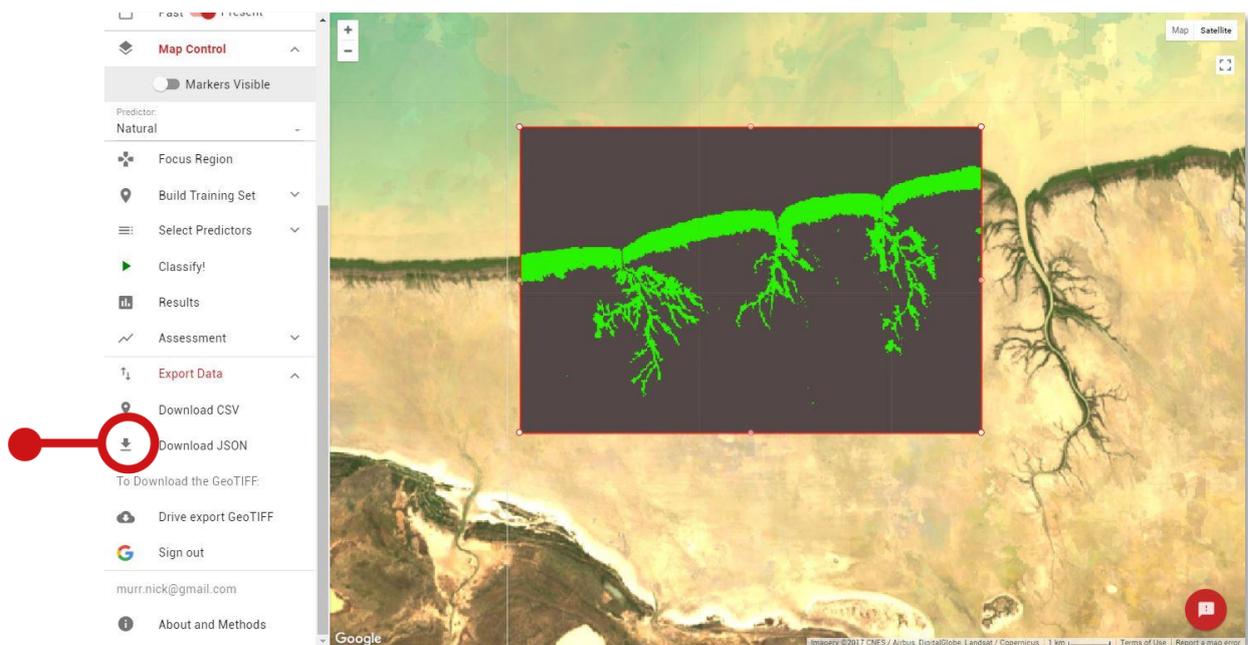
1. Download a .csv file of your training set to your local drive by clicking **Export Data, Download CSV**. This file can be opened in a text editor, Google Sheets or Excel to review your training set.
2. This dataset can be uploaded again via the **Build Training Set** tab at a later date to continue your classification



Save your workspace

Remap allows you to save your workspace to continue your work at a later date.

1. Use **Export Data** and **Download JSON** to download a remap 'workspace' file (.JSON).
2. The workspace file saves your training set, the focal region, map classes and class options such as colour.
3. This option is very useful if you want to return to working on your classification with minimal fuss. Simply upload the remap 'workspace' file (.JSON) can be uploaded again via the **Build Training Set, Data Upload** function, and Remap will return to where you left off.



Export map as GeoTIFF

Remap has two methods for downloading a spatially rectified GeoTIFF file for use in third party software such as R, ArcGIS and QGIS ([Direct Download](#)) and ([Drive export GeoTIFF](#)). To find out more about the GeoTIFF export function, refer to the Remap User Guide. If you have trouble with the export function, refer to the Frequently Asked Questions.

Feedback

Please provide feedback or get in touch with us by submitting a form that can be accessed by the feedback button.

Use the feedback button to provide feedback. Useful feedback allows us to further improve remap.



About remap

Remap was developed with funding from a Google Earth Engine Research Award with aim of increasing the utility of remote sensing for global environmental conservation. We thank the Google Earth Engine team for developing such a ground-breaking geospatial analysis tool.

If you use remap for any purpose, please acknowledge it by citing our paper and software:

Murray, N.J., Keith, D.A., Simpson, D., Wilshire, J.H. & Lucas, R.M. (2017) REMAP: An online remote sensing application for land cover classification and monitoring. *bioRxiv*. DOI: 10.1101/212464

Murray, N.J., Keith, D.A., Simpson, D., Wilshire, J.H., Lucas, R.M. (2017) REMAP: The remote sensing ecosystem monitoring and assessment pipeline. <https://remap-app.org>

The data used to prepare this tutorial are available at:

<https://figshare.com/s/7125654aded6d9235f08>

