

Estimation of area for REDD+ using stratified sampling design: application with SEPAL tools

Webinar GOFC-GOLD, 2017/06/06

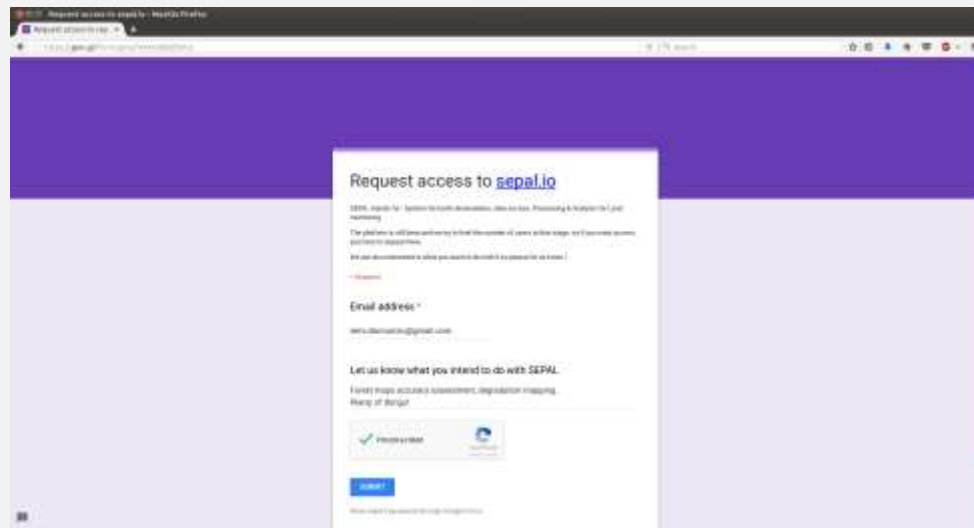
remi.dannunzio@fao.org



Request access to SEPAL

SEPAL stands for : System for Earth observations, data access, Processing & Analysis for Land monitoring.

The platform is still beta and we try to limit the number of users at that stage



The screenshot shows a Google Form titled "Request access to sepal.io". The form is displayed on a purple background. The text on the form includes: "SEPAL, stands for : System for Earth observations, data access, Processing & Analysis for Land monitoring.", "The platform is still beta and we try to limit the number of users at that stage, we therefore require you to request access.", "Email address *", "Let us know what you intend to do with SEPAL.", "I intend to use SEPAL for: (check all that apply) Forest mapping, Land use/cover mapping, Policy development, Other (specify):", and a "Submit" button.

If you want access, you have to request [in this Google Survey](https://goo.gl/forms/9cz2BGCch32H331y1)

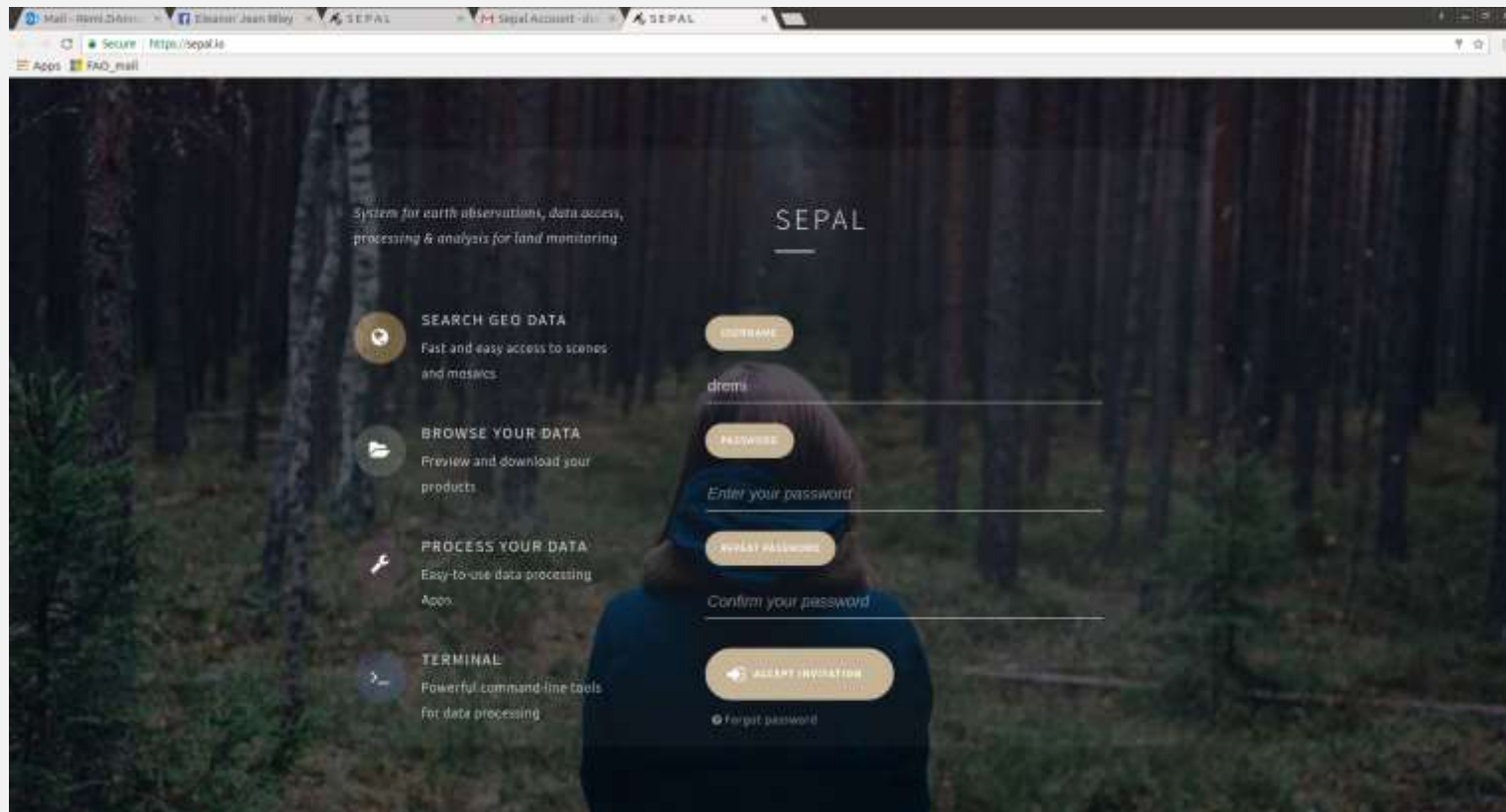
(<https://goo.gl/forms/9cz2BGCch32H331y1>)

You will then receive an email with a link to activate your access.

Remember to check in your **SPAMS**, it might be there.

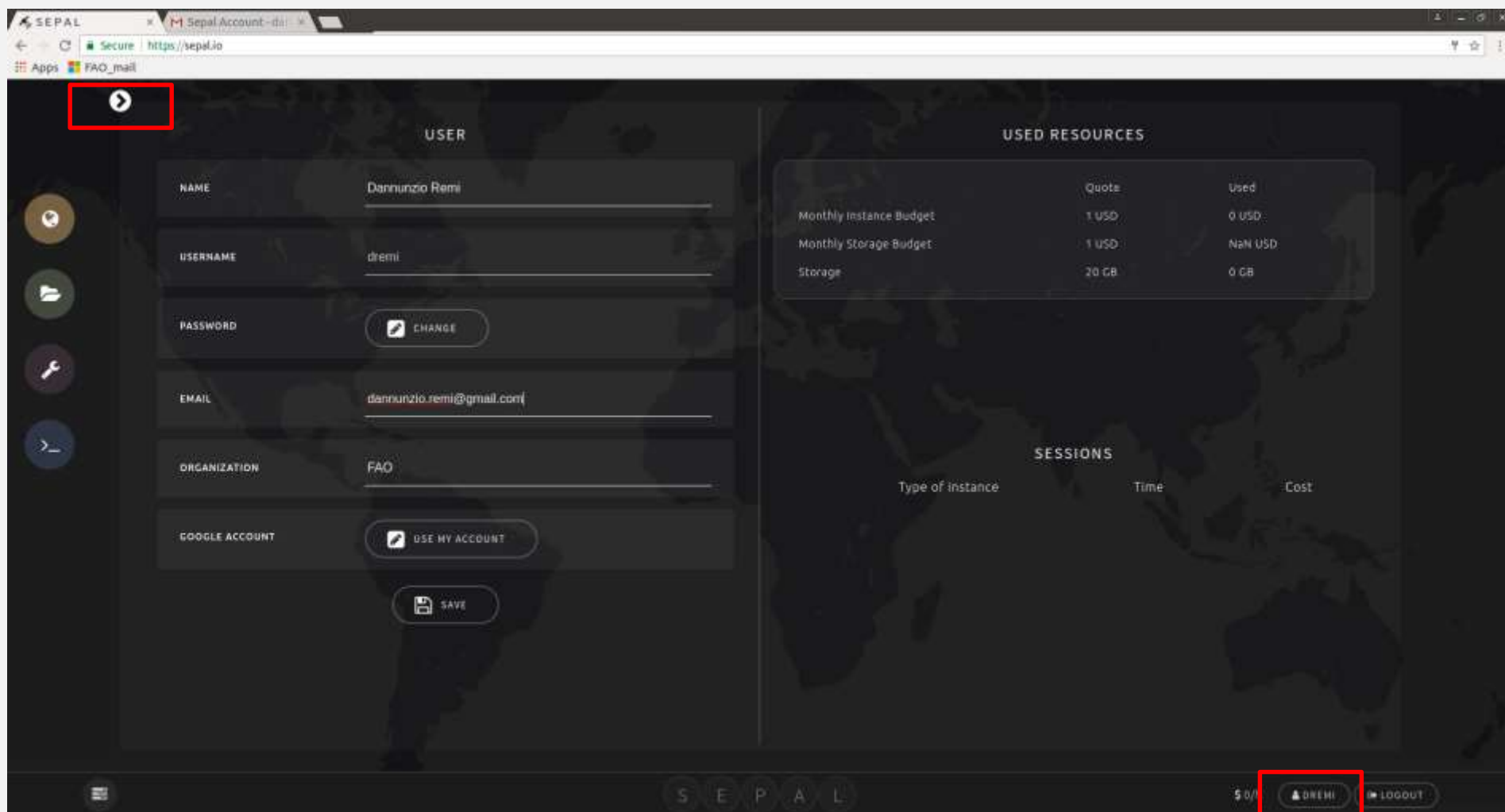
Setup your password in SEPAL

It needs at least one upper case, one lower case and one number.
The minimum size is 6 digits.



You can always reach the platform at <https://sepal.io>

Check your status, budget, parameters



The screenshot shows the SEPAL web application interface. The browser address bar displays 'https://sepal.io'. The interface is divided into two main sections: 'USER' and 'USED RESOURCES'.

USER Section:

- NAME:** Dannunzio Remi
- USERNAME:** dremi
- PASSWORD:** Includes a 'CHANGE' button.
- EMAIL:** dannunzio.remi@gmail.com
- ORGANIZATION:** FAO
- GOOGLE ACCOUNT:** Includes a 'USE MY ACCOUNT' button.
- A 'SAVE' button is located at the bottom of the user profile section.

USED RESOURCES Section:

	Quote	Used
Monthly Instance Budget	1 USD	0 USD
Monthly Storage Budget	1 USD	NaN USD
Storage	20 GB	0 GB

SESSIONS Section:

Type of instance	Time	Cost
------------------	------	------

Navigation and Footer:

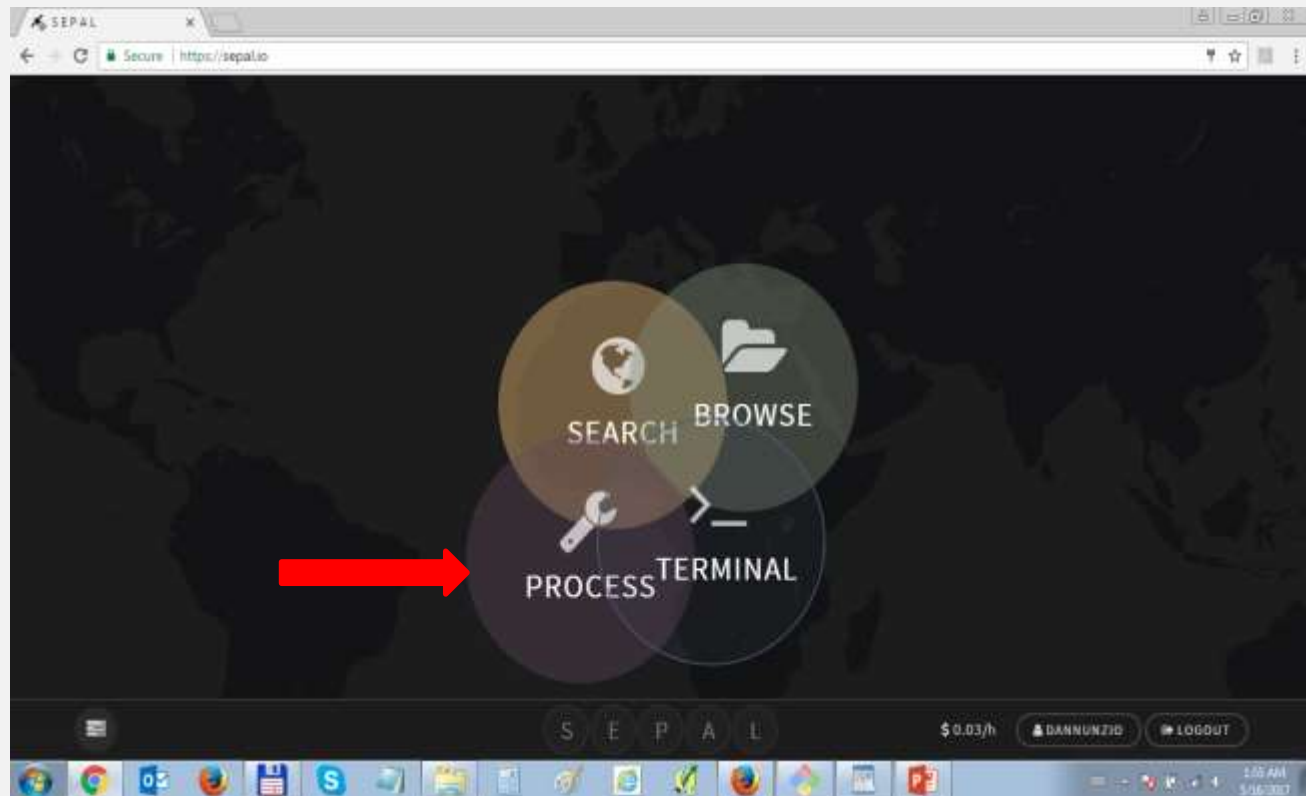
- A red box highlights a top-left navigation arrow.
- The footer contains the text 'S E P A L' and a red box around the 'dremi' user profile icon.
- A 'LOGOUT' button is visible in the bottom right corner.

Go back to main page (top left arrow)

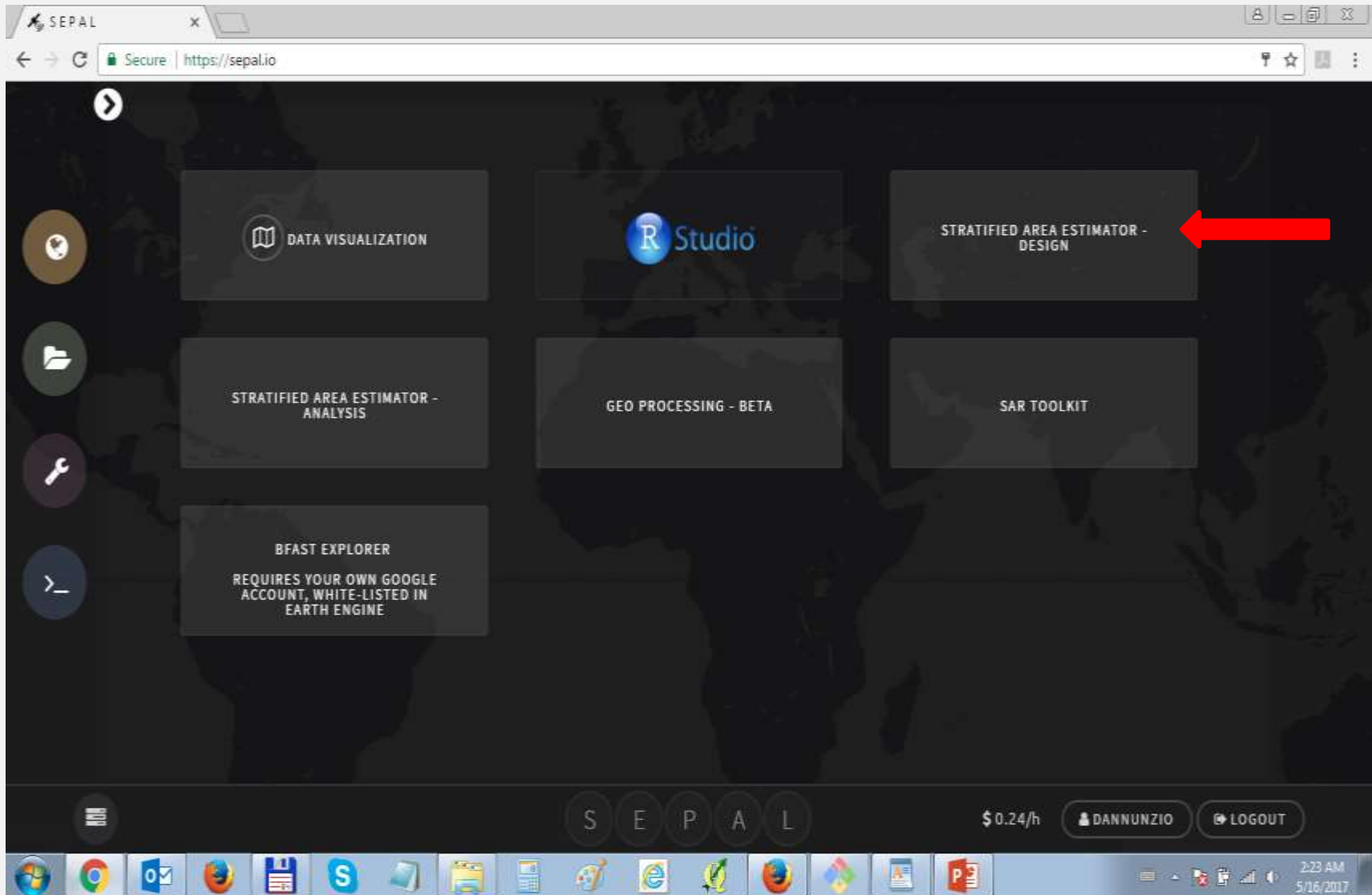
Start the PROCESS tab

There are four fields in SEPAL

- SEARCH for imagery and creating mosaics
- BROWSE through your personal folders and visualize your data
- TERMINAL to access all the command lines possibilities of the LINUX server
- PROCESS access pre-loaded tools and chains of processing



Select SAE – DESIGN tool



Introduction TAB: Select your language

Check the description tabs and the tool structure.
Steps need to be performed one after the other.

The screenshot displays the SEPAL Stratified estimator web application. On the left is a dark sidebar with navigation links: Introduction, Map input, Strata areas, Strata selection, Sampling size, Sample allocation, Source code, and Bug reports. The main content area has a green header with the title 'SEPAL Stratified estimator'. Below the header, there are three main sections: 'Language', 'Description', and 'Background'. The 'Language' section features a dropdown menu with 'English' selected and highlighted by a red box. The 'Description' section contains text about the tool's purpose and a link to the Open Foris support forum. The 'Background' section explains the tool's design and its use in area estimation. At the bottom, there is a 'How to use the tool?' section with a list of five steps. The footer includes logos for SEPAL, UN-REDD, and Open Foris, along with a disclaimer.

SEPAL Stratified estimator

Language

English

English

Français

Español

Description

This interactive tool creates stratified designs to estimate areas. The objective of this tool is to provide a simple user interface for generating a probability dataset with stratified random sampling. For support ask [Open Foris support forum](#)

Background

The aim of this stratified sampling design tool is to produce a sampling design that can be used for area estimates. The idea is to combine a map (used as a stratification of the landscape of interest) with a visual map interpretation of samples to produce an area estimation.

The concept is derived from map accuracy assessment principles; characterized frequency of errors (omission and commission) for each map class may be used to compute area estimates and also to estimate the uncertainties (confidence intervals) for the areas for each class.

How to use the tool ?

You have to go through all the steps in the left panel, in this order:

1. Select the map data which will be assessed. The required input is either vector (.shp supported) or raster (.tif supported)
2. Compute the areas of each strata
3. Select the expected accuracies of the strata
4. Compute the sampling size
5. Draw the sampling points and export as a Collect Earth file

Disclaimer **Reference and Documents**

FAO declines all responsibility for errors or deficiencies in the database or software or in the documentation accompanying it for program maintenance and upgrading as well as for any damage that may arise from them. FAO also declines any responsibility for updating the data and assumes no responsibility for errors and omissions in the data provided. Users are, however, kindly asked to report any errors or deficiencies in this product to FAO.

SEPAL
UN-REDD
Open Foris

Introduction TAB: reference documents

Access reference and background documents, the link will bring you directly there

SEPAL - Mozilla Firefox

Request access to sep... x SEPAL x +

https://sepal.io

90% Search

SEPAL Stratified estimator

Introduction

Map input

Strata areas

Strata selection

Sampling size

Sample allocation

Source code

Bug reports

Language

English

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Disclaimer

Reference and Documents

REDD Compass

Olofsson et al. (2014): Good practices for estimating area and assessing accuracy of land change

FAO NPMA paper N46: Map accuracy assessment and area estimation

STEP 1 Map input

1. Download the test dataset (note it is downloaded to your SEPAL workspace)
2. Select the map you just downloaded (INPUT/aa_data_test/aa_test_congo.tif)

The screenshot shows the SEPAL Stratified estimator web application. The interface is divided into a left sidebar, a main content area, and a right sidebar.

- Left Sidebar:** Contains navigation links: Introduction, **Map input** (highlighted with a red box), Strata areas, Strata selection, Sampling size, and Sample allocation.
- Main Content Area:**
 - Data type:** A section with instructions: "First choose the type of data used for the stratification - the map. The map can be in raster or vector format. The map area will be calculated in the next tab. The input map can represent a single time or multiple times change made from satellite images. It can also be any acquired from available map data of land cover or land use." Below this, the 'Input' field is highlighted with a red box and labeled with a red '2'. It shows 'Missing' and a 'Browse' button.
 - Download test data:** A section with a 'Download test dataset' button highlighted with a red box and labeled with a red '1'. Below the button, the file path is shown: "INPUT/aa_data_test/aa_test_congo.tif".
 - Output folder:** A section with the text: "All products of the random stratified sampling design will be stored here: areas of the map, sampling sizes, point file".
- Right Sidebar:** Contains a 'Manual selection' section with the text: "The map can be selected from the shapefile database or the CSV with the raster areas".

A 'Browse' dialog box is open in the foreground, showing the file explorer. The path 'aa_data_test' is selected in the left pane. In the right pane, the file 'aa_test_congo.tif' is highlighted. The dialog has 'Cancel' and 'Select' buttons at the bottom.

STEP 2 Strata areas

Display map by checking box

Generate the legend by clicking on the button: you can further EDIT the legend

SEPAL - Mozilla Firefox

Request access to sep - SEPAL

https://sepal.io

SEPAL Stratified estimator

Map input

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Area calculation

Map areas are calculated by counting the frequency of the pixels for each map class or by summing the areas of all the polygons. If using raster data the map area can be calculated using R or Open Foris Geospatial Toolkit (OFT). R is compatible with all systems and OFT is only compatible with Linux. Area calculations of large raster files using R will take some time.

☐ OFT

☒ R

Area calculation and legend generation

☒ Do you want to display the map?

Legend and Areas

The areas for each of the map categories need to be calculated in order to calculate the overall and stratified sample size. Make sure to click on the submit legend button to load the map area table. Click on area calculation and legend generation. Click on submit legend before continuing.

Legend labeling

The legend classes need to be specified and submitted. Please wait for the map values to appear. Then type the names of the classes and submit the legend. After submitting the legend the table with the map classes and area will appear. The legend names can be modified at any time in this tab.

Submit legend

Edit class name for map value: 2

Non Forest

Edit class name for map value: 4

Water

Edit class name for map value: 11

Forest

Edit class name for map value: 12

Forest Secondary

Edit class name for map value: 13

Forest Swamp

Edit class name for map value: 31

Loss primary forest

Edit class name for map value: 32

Loss secondary forest

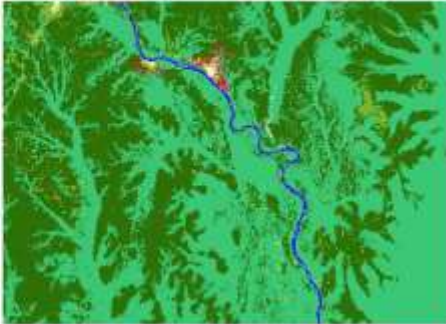
Edit class name for map value: 33

Loss swamp forest

Edit class name for map value: 34

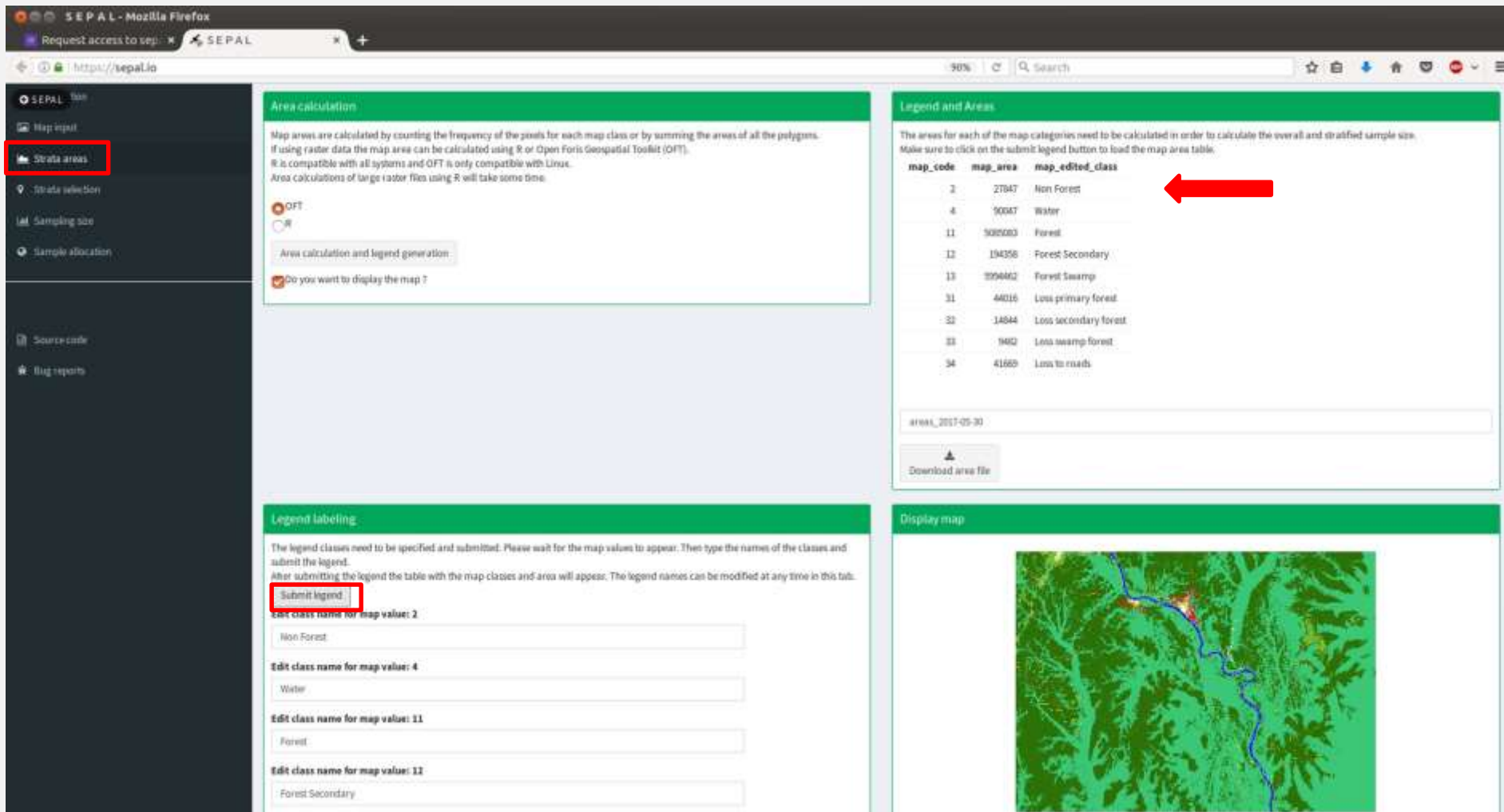
Loss to roads

Display map



STEP 2 Strata areas

Submit the legend : you can edit as much as you want but remember to SUBMIT
The classes name will be showing in later stage for data collection



The screenshot shows the SEPAL web application interface. The left sidebar contains a menu with the following items: SEPAL, Map input, **Strata areas** (highlighted with a red box), Strata selection, Sampling size, Sample allocation, Source code, and Bug reports. The main content area is divided into three sections:

- Area calculation:** This section explains that map areas are calculated by counting the frequency of the pixels for each map class or by summing the areas of all the polygons. It mentions that if using raster data, the map area can be calculated using R or Open Foris Geospatial ToolKit (OFT). It is compatible with all systems and OFT is only compatible with Linux. Area calculations of large raster files using R will take some time. There are radio buttons for OFT and R, with R selected. Below this is a button for 'Area calculation and legend generation' and a checkbox for 'Do you want to display the map?' which is checked.
- Legend and Areas:** This section contains a table with the following data:

map_code	map_area	map_edited_class
2	27847	Non Forest
4	90047	Water
11	5025003	Forest
12	194356	Forest Secondary
13	3994462	Forest Swamp
31	44016	Loss primary forest
32	14844	Loss secondary forest
33	1902	Loss swamp forest
34	41669	Loss to roads

A red arrow points to the 'map_edited_class' column. Below the table is a text input field with the value 'areas_2017-05-30' and a 'Download area file' button.
- Legend labeling:** This section explains that the legend classes need to be specified and submitted. It instructs the user to type the names of the classes and submit the legend. After submitting the legend, a table with the map classes and area will appear. The legend names can be modified at any time in this tab. There is a 'Submit legend' button (highlighted with a red box) and a table for editing class names for map values 2, 4, 11, and 12. The current values are 'Non Forest', 'Water', 'Forest', and 'Forest Secondary' respectively.

The bottom right section is titled 'Display map' and shows a satellite map with a green overlay representing the forest area.

STEP 3 Select strata of interest and associated EUA

SEPAL Stratified estimator

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Strata areas

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What are the expected accuracies?

Some classes are identified easier than other classes. Usually common classes, which occupy the majority of the map, are the easiest to identify. Rare classes, such as land change classes, which occupy a small portion of the map area, can be very difficult to identify. This measure will influence the overall sample size.

More classes with lower confidence will increase the overall sample size

- Stable classes are expected to have high user accuracies and should be assigned a higher confidence. Here the value chosen is 0.9
- Rare classes are expected to have the lower user accuracies and should be assigned a low confidence. Here the value chosen is 0.7

Choose classes expected user's accuracies

high confidence (Expected UA = 0.9)

Non Forest Water Forest Forest Secondary Forest Swamp


low confidence (Expected UA = 0.7)

Loss primary forest Loss secondary forest Loss swamp forest

Loss to roads


Expected User's Accuracy (EUA) values for specific classes

High expected user accuracy



0.5 0.75 0.9 1

Low expected user accuracy



0.5 0.7 0.9 1

STEP 4 Sampling distribution

Tweak the standard error of overall accuracy & minimum sample size

Samples are allocated by minimum size first and the rest is distributed proportionally to strata size

SEPAL

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Sampling size

In the sampling design, the sample size for each map category is chosen to ensure that the sample size is large enough to produce sufficiently precise estimates of the area of the class (GFOI, 2013)

Standard error of expected overall accuracy

0.01

Minimum sample size per strata

50

☐ Do you want to modify the sampling size?

Formula to calculate the overall sample size

The equation below calculates an adequate overall sample size for stratified random sampling that can then be distributed among the different strata.

- N is number of units in the area of interest (number of overall pixels if the spatial unit is a pixel, number of polygons if the spatial unit is a polygon)
- S(O) is the standard error of the estimated overall accuracy that we would like to achieve
- W_i is the mapped proportion of area of class i
- S_i is the standard deviation of stratum i.

$$n = \frac{(\sum W_i S_i)^2}{[S(\bar{O})]^2 + (1/N) \sum W_i S_i^2} \approx \left(\frac{\sum W_i S_i}{S(\bar{O})} \right)^2$$

Distribution of samples

The computed overall size is : 904

Map Class	Proportional	Adjusted	Final
Non Forest	2	50	50
Water	7	50	50
Forest	401	277	277
Forest Secondary	15	50	50
Forest Swamp	473	327	327
Loss primary forest	3	50	50
Loss secondary forest	1	50	50
Loss swamp forest	0	50	50

Baseline of csv to export

sampling_2017-05-30

Download csv with sample design

STEP 5 Sample allocation

Click on “Generate sampling points” → wait (see task bottom right)

Download CEP project AND tabular data → saves to your computer (and backup in SEPAL workspace)

The screenshot shows the SEPAL Stratified estimator web application. The left sidebar contains navigation links: Introduction, Map input, Strata areas, Strata selection, Sampling size, **Sample allocation** (highlighted with a red box), Source code, and Bug reports. The main panel is titled 'Create a stratified random sample on the map' and includes a map of the Republic of Congo with sampling points. A red box highlights the 'Generate sampling points' button. The right-hand panel, titled 'Create a Collect Earth Project file (.cep) to start validation work', contains configuration options: 'Choose country name if you want additional national data for the samples' (set to 'Republic of Congo'), 'Number of operators' (set to '5'), 'Size of the interpretation box (in m)' (set to '30'), and 'Basename of sampling design files to export' (set to 'CE_2017-05-30'). Below these are three download buttons: 'Download as Collect Earth project (.cep)', 'Download as tabular data (.csv)', and 'Download as vector data (.shp)'. Two red arrows point to the first two buttons. A file download dialog is open in the foreground, showing the file 'CE_2017-05-30.cep' (BIN file, 641 KB) and asking what to do with it. The 'Save File' option is selected. At the bottom right, a progress bar indicates 'Generating random points'.

Report any bugs, it is work in progress

<https://github.com/openforis/accuracy-assessment>

SEPAL

Stratified estimator

- Introduction
- Map input
- Strata areas
- Strata selection
- Sampling size
- Sample allocation
- Source code
- Bug reports**

openforis/accuracy-as
accuracy-assessment
busted

This repository
Search
Pull requests
Issues
Marketplace
Gist

openforis / accuracy-assessment
Unwatch 0
Star 2
Fork 2

Code
Issues 0
Pull requests 0
Projects 0
Wiki
Settings
Insights

No description, website, or topics provided.

Add topics

154 commits
3 branches
0 releases
2 contributors

Branch: master
New pull request
Create new file
Upload files
Find file
Clone or download

Yelena update readme
Latest commit f2cef5d 29 minutes ago

Rscripts	added option to divide into groups	5 months ago
aa_analysis	desktop version direct launcher	12 days ago
aa_design	desktop version direct launcher	12 days ago
.gitignore	gitignore	7 months ago
README.md	update readme	29 minutes ago
direct_launch_analysis.bat	desktop version direct launcher	12 days ago
direct_launch_design.bat	desktop version direct launcher	12 days ago

README.md

Stamp date : 2016-11-01

Accuracy assessment design and analysis tool

The application functions with R, Rstudio and the Shiny package.

In a first step, the aa_design takes a geospatial map (raster or vector format) as input and outputs a file to perform validation on.

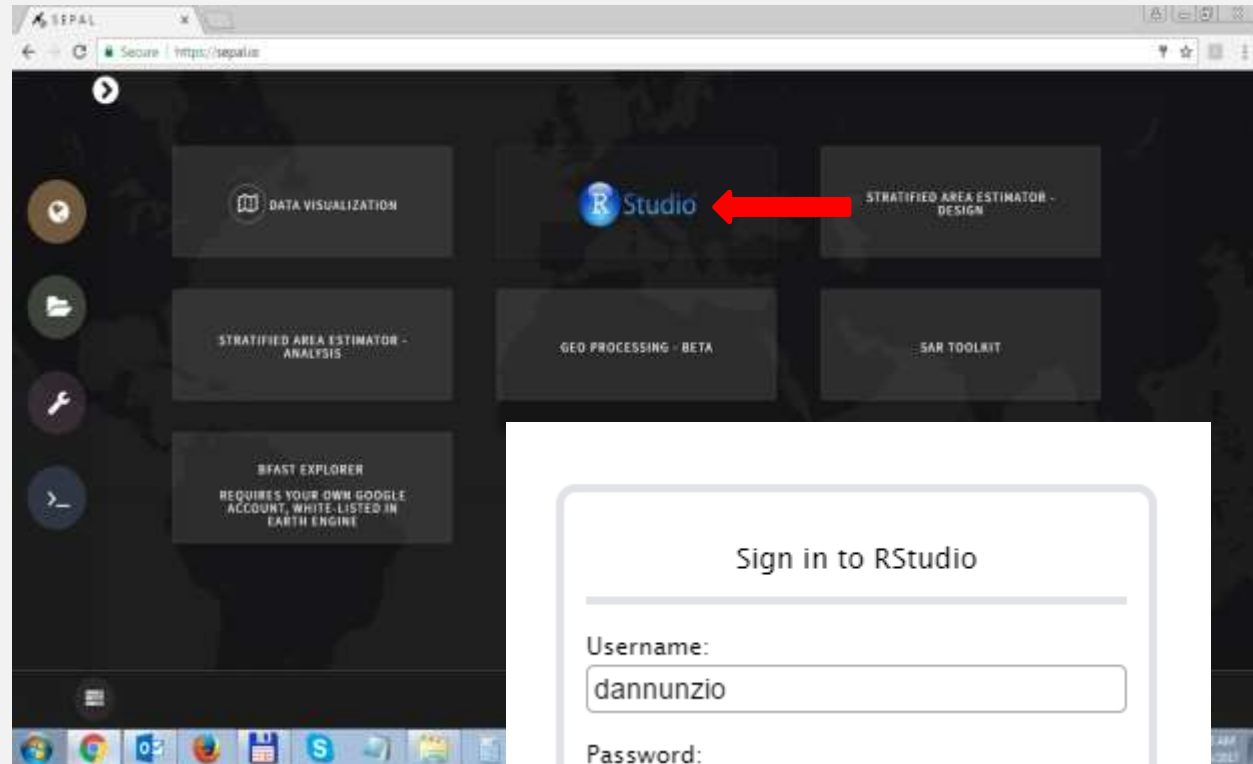
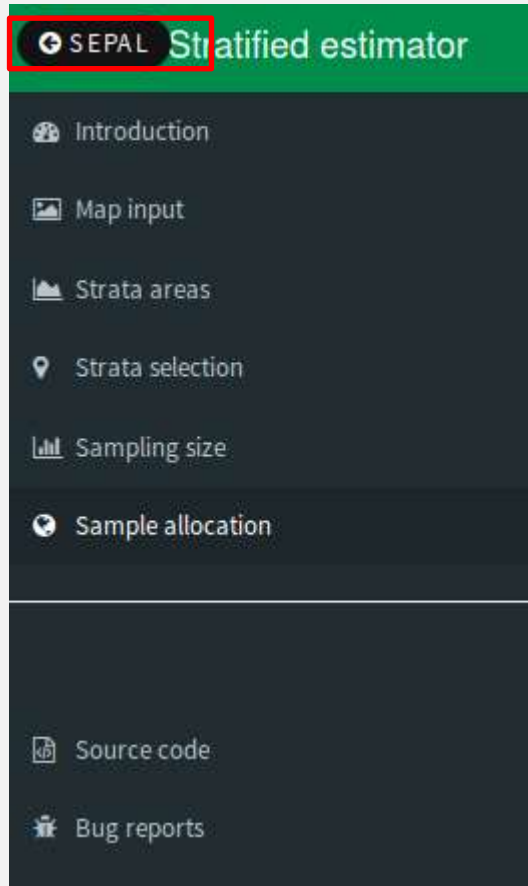
In a second step, the validation results are used by the aa_analysis to produce confusion matrix, compute accuracies, correct



How to upload your own map in SEPAL ?

Select RSTUDIO and sign in

Go back to tools



Sign in to RStudio

Username:
dannunzio

Password:

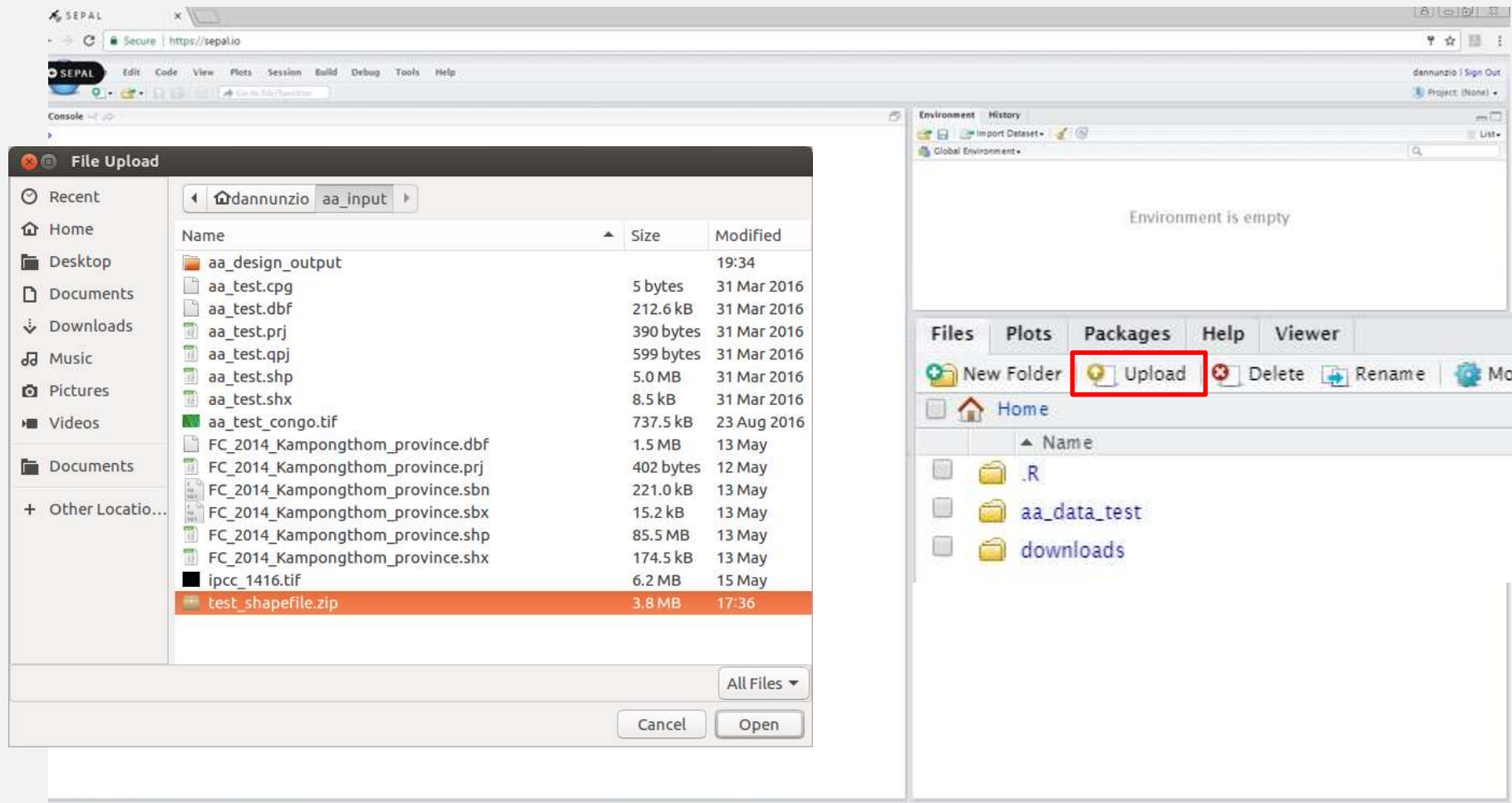
☐ Stay signed in

Sign In

Only lowercase
in the username

Upload data from your computer

If multiple files (e.g. shapefile), make a zip first



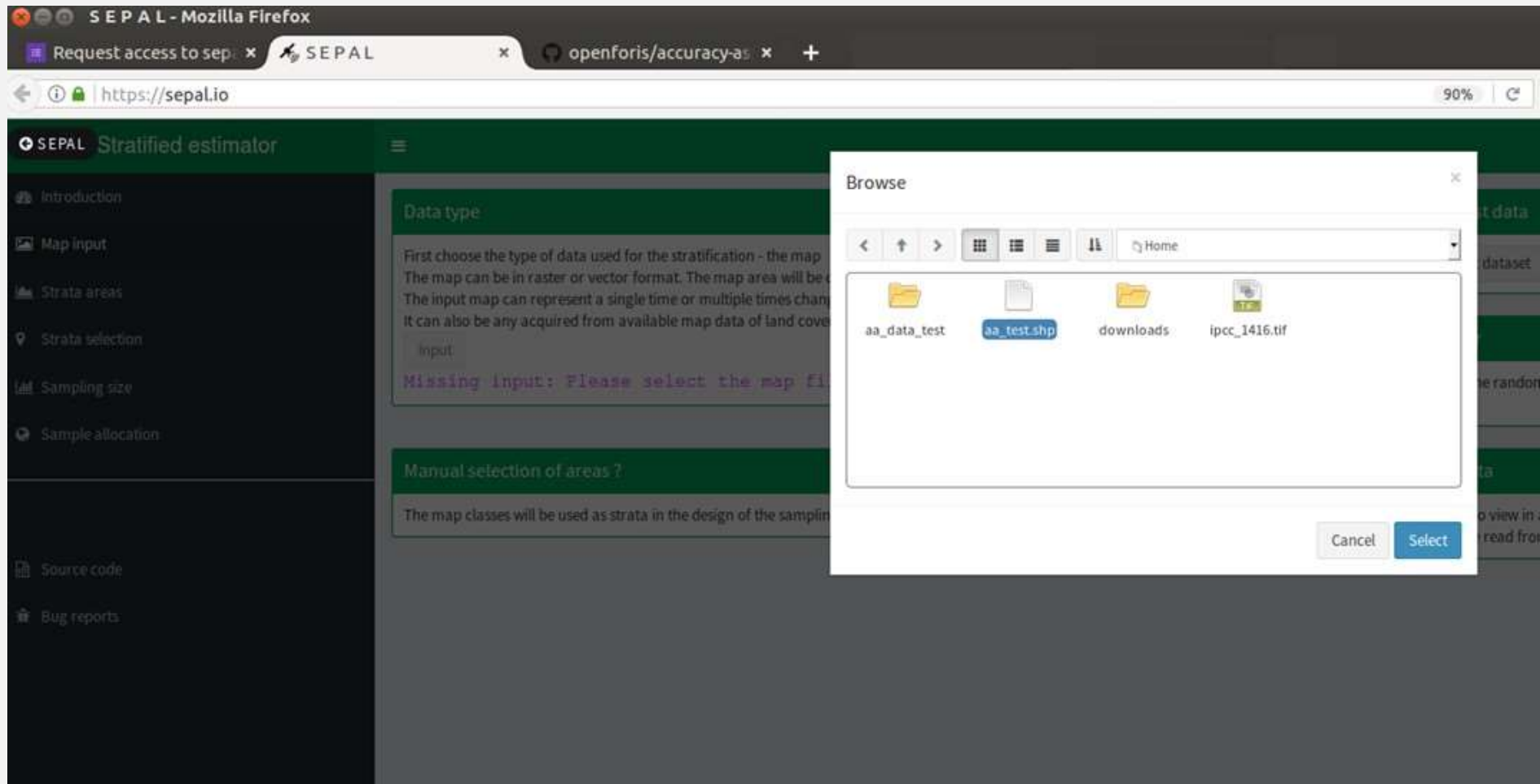
The screenshot displays the SEPAL web interface. On the left, a 'File Upload' dialog box is open, showing a file explorer view of the user's local file system. The 'Recent' tab is selected, and the file 'test_shapefile.zip' is highlighted. The dialog includes a sidebar with navigation options like 'Recent', 'Home', 'Desktop', 'Documents', 'Downloads', 'Music', 'Pictures', 'Videos', and 'Other Locations'. The main area shows a list of files with columns for 'Name', 'Size', and 'Modified'. The 'Upload' button in the dialog is highlighted with a red box.

On the right, the main interface shows the 'Environment' tab, which is currently empty. Below the environment view, there is a toolbar with buttons for 'New Folder', 'Upload', 'Delete', 'Rename', and 'More'. The 'Upload' button is also highlighted with a red box. The bottom panel shows a file explorer view with the following files:

Name
.R
aa_data_test
downloads

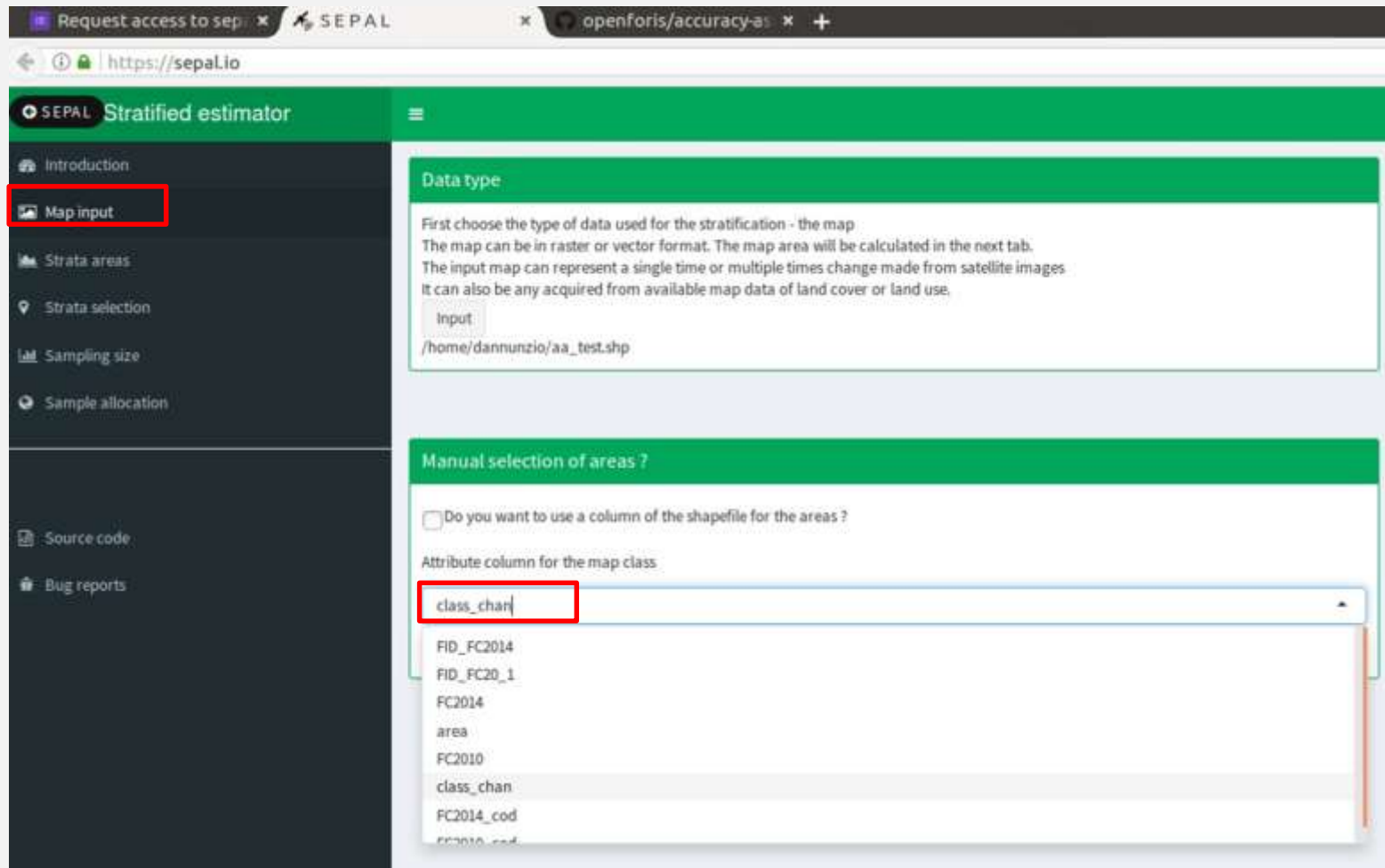
Go back to SAE – Design application

Your own map is available for use inside the application



Shapefile as input map

Select the right column for class attribute
Rest of the process is identical



Request access to sep... x SEPAL x openforis/accuracy-as x +

https://sepal.io

SEPAL Stratified estimator

- Introduction
- Map input**
- Strata areas
- Strata selection
- Sampling size
- Sample allocation

Source code

Bug reports

Data type

First choose the type of data used for the stratification - the map.
The map can be in raster or vector format. The map area will be calculated in the next tab.
The input map can represent a single time or multiple times change made from satellite images.
It can also be any acquired from available map data of land cover or land use.

Input:
/home/dannunzio/aa_test.shp

Manual selection of areas ?

☒ Do you want to use a column of the shapefile for the areas ?

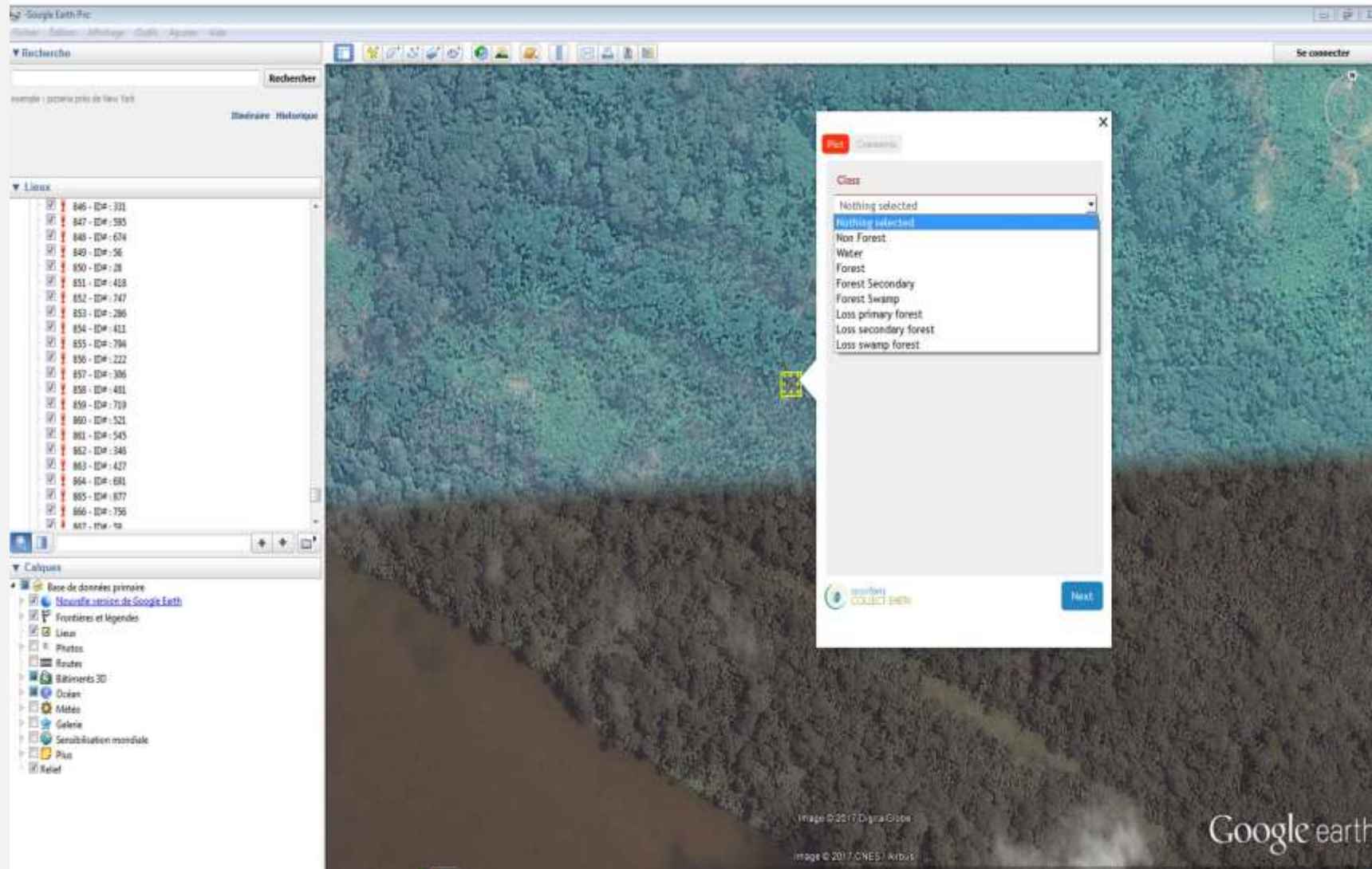
Attribute column for the map class

class_chan

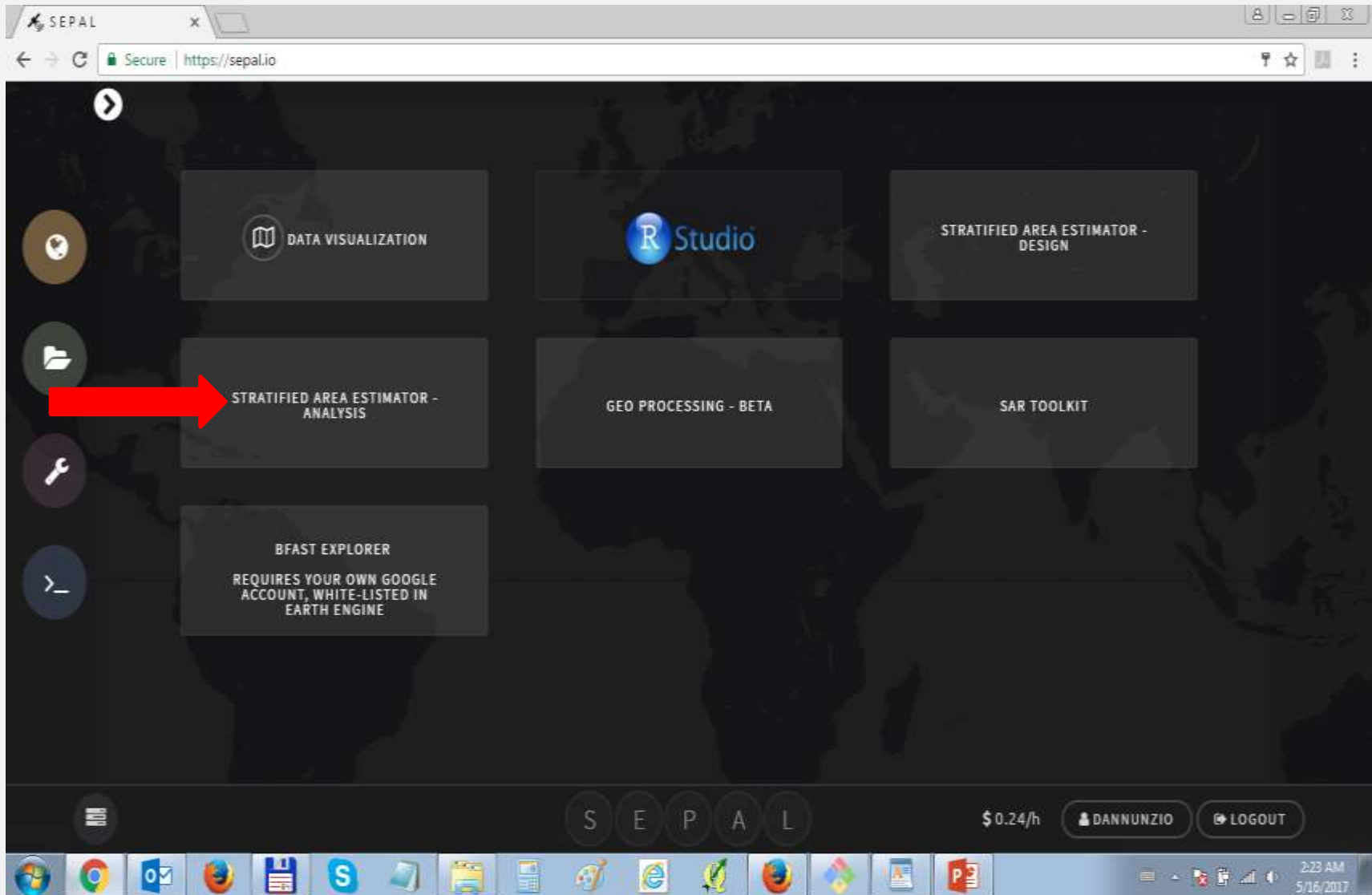
- FID_FC2014
- FID_FC20_1
- FC2014
- area
- FC2010
- class_chan
- FC2014_cod
- FC2010_cod

Data collection : soon in CEO available in SEPAL

<http://www.openforis.org/tools/collect-earth.html>



Select SAE – ANALYSIS tool



Similar structure

Only 3 steps

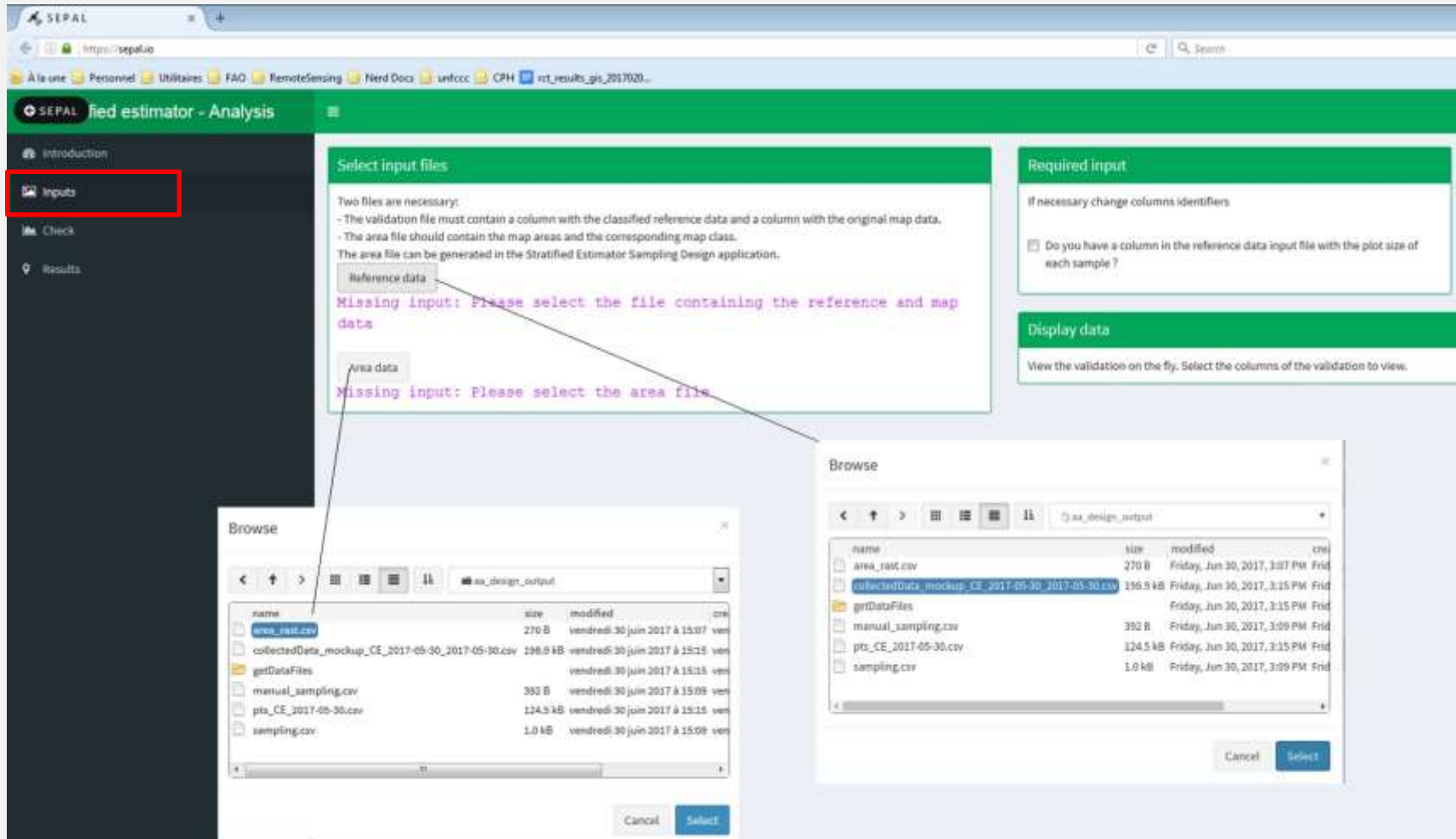
The screenshot shows the web application 'SEPAL fied estimator - Analysis' in a browser window. The interface is divided into several sections:

- Header:** A green bar with the title 'SEPAL fied estimator - Analysis' and a language dropdown menu.
- Left Sidebar:** A dark grey sidebar with navigation links: 'Introduction', 'Inputs', 'Check', and 'Results'.
- Main Content Area:**
 - Description:** A text box explaining the tool's purpose: 'This interactive tool analyzes results from a stratified design sampling to estimate areas. It also compares the results with those from a theoretical simple random design sampling. The objective of this tool is to provide a simple user interface for generating a probability dataset with stratified random sampling. For support ask Open Foris support forum'.
 - How to use the tool ?** A section with instructions: 'You have to go through all the steps in the left panel, in this order: 1. Select the files containing the results of the sampling data collection and the strata areas 2. Check that inputs match 3. Compute areas, display graphs and export results'.
 - Disclaimer:** A section stating: 'FAO declines all responsibility for errors or deficiencies in the database or software or in the documentation accompanying it for program maintenance and upgrading as well as for any damage that may arise from them. FAO also declines any responsibility for updating the data and assumes no responsibility for errors and omissions in the data provided. Users are, however, kindly asked to report any errors or deficiencies in this product to FAO.'
- Footer:** Logos for SEPAL, UN-REDD PROGRAMME, and OPENFORIS.

Two input files are needed

Reference vs Map file
Strata area file

Both are located next to the map:
“aa_data_test/aa_design_output/”



The screenshot shows the SEPAL web interface for the 'Stratified estimator - Analysis' module. The 'Inputs' tab is selected in the sidebar. The main content area displays the 'Select input files' step, which requires two files: a reference data file and an area data file. Both files are missing, as indicated by the messages: 'Missing input: Please select the file containing the reference and map data' and 'Missing input: Please select the area file'. Two 'Browse' dialog boxes are open, showing the file selection process. The first dialog shows the 'area_rast.csv' file selected. The second dialog shows the 'collectedData_mockup_CE_2017-05-30_2017-05-30.csv' file selected.

Select input files

Two files are necessary:

- The validation file must contain a column with the classified reference data and a column with the original map data.
- The area file should contain the map areas and the corresponding map class.

The area file can be generated in the Stratified Estimator Sampling Design application.

Reference data

Missing input: Please select the file containing the reference and map data

Area data

Missing input: Please select the area file

Required input

If necessary change columns identifiers

☐ Do you have a column in the reference data input file with the plot size of each sample?

Display data

View the validation on the fly. Select the columns of the validation to view.

Browse

name	size	modified	cre
area_rast.csv	270 B	Friday, Jun 30, 2017, 3:07 PM	Frid
collectedData_mockup_CE_2017-05-30_2017-05-30.csv	196.9 kB	Friday, Jun 30, 2017, 3:15 PM	Frid
getDataFiles		Friday, Jun 30, 2017, 3:15 PM	Frid
manual_sampling.csv	392 B	Friday, Jun 30, 2017, 3:09 PM	Frid
pts_CE_2017-05-30.csv	124.5 kB	Friday, Jun 30, 2017, 3:15 PM	Frid
sampling.csv	1.0 kB	Friday, Jun 30, 2017, 3:09 PM	Frid

Check point location

SEPAL field estimator - Analysis

Introduction

Inputs

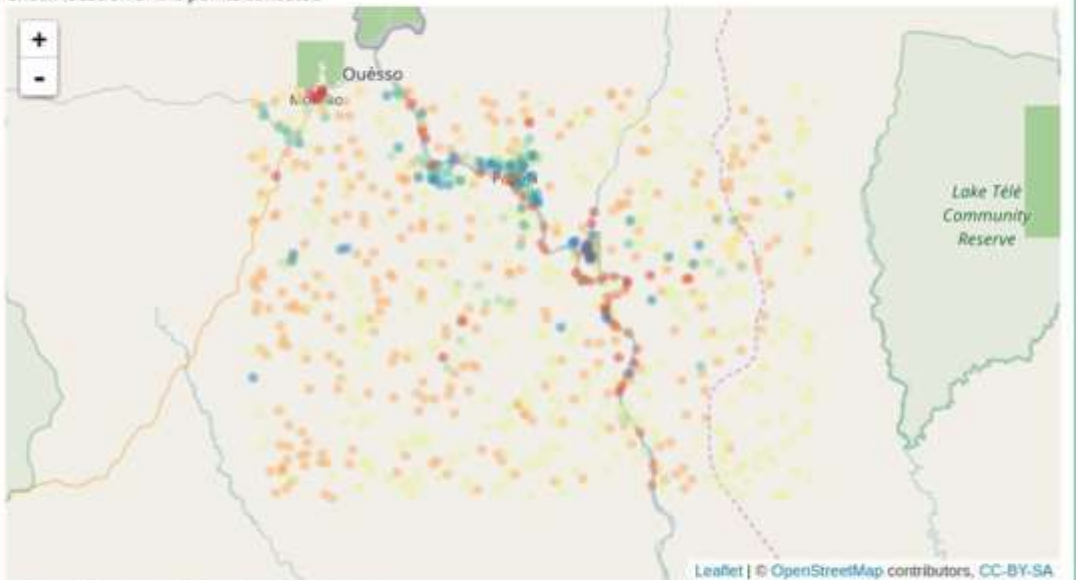
Check

Results

Check inputs

View samples

Check that columns contain the right information
Check location of the points collected



Choose the column with the X coordinate

location_x

Choose the column with the Y coordinate

location_y

Get results and download

You can filter by one field (e.g. CONFIDENCE)

SEPAL

Secure https://sepal.io

Apps FAQ_mail

SEPAL field estimator - Analysis

Introduction

Inputs

Check

Results

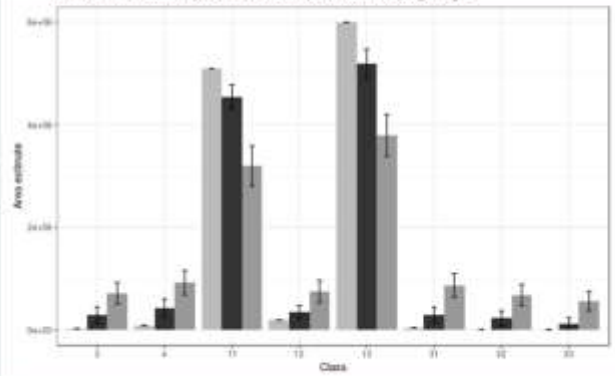
Confusion Matrix

	2	4	11	12	13	31	32	33
2	27	2	1	0	3	0	0	0
4	1	36	0	2	1	1	0	0
11	5	6	182	3	3	1	3	3
12	0	1	0	33	1	2	0	0
13	6	8	2	4	211	9	6	2
31	0	0	0	2	0	37	1	0
32	0	1	1	0	2	0	30	1
33	3	0	1	0	1	1	0	27

Download confusion matrix as tabular data (.csv)

Graph

Area estimates from map, stratified and simple random sampling designs



Sample design

- Map grid point
- Stratified random
- Simple random

Area estimates

Stratified and simple random area estimations and accuracies.

Area estimates for stratified random sample and simple random sample

Class	Number of samples	Stratified random area estimate	Stratified random confidence interval	Simple random area estimate	Simple random confidence interval
2	42	394293	157172	717794	210203
4	54	427903	177044	922879	236070
11	187	4542543	233134	3195896	389258
12	44	350679	127901	751975	214808
13	222	5185297	279336	3794058	468567
31	51	295930	146744	671608	229974
32	40	232905	141971	683614	205461
33	27	100000	100000	100000	100000

Filter data

You can filter the data on one of the columns (i.e. Confidence in visual interpretation)

☒ Do you want to filter the data?

Columns to filter:

confidence

Values to filter from column: confidence

TRUE

FALSE

Get results and download

You can filter by one field (e.g. CONFIDENCE)

SEPAL

Secure https://sepal.io

Apps FAQ_mail

SEPAL field estimator - Analysis

Introduction

Inputs

Check

Results

Confusion Matrix

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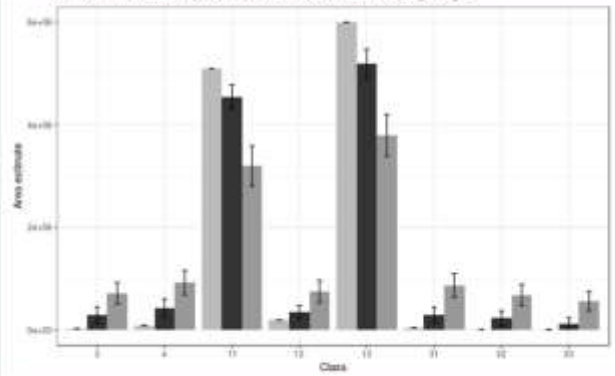
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