

Tutorial for SEPAL workshop

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INTRODUCTION AND OBJECTIVES

Through a partnership agreement with Norway, FAO has developed a System for Earth Observation Data Access, Processing and Analysis for Land Monitoring (SEPAL), which helps countries access and process satellite data, for use in forest resources monitoring.

SEPAL is a big-data processing platform that combines super-computing power, open-source geospatial data processing software and modern geospatial data infrastructures like Google’s Earth Engine. SEPAL overcomes barriers of poor internet connections and low computing power or storage space on local computers and can also connect to and use data and outputs from FAO’s free and open-source software tools Open FORIS.

The Breaks for Additive Seasonal and Trend (BFAST) method enables to analyze the dynamics of satellite dense time series and overcome the major challenge to distinguish land-cover change from seasonal phenological variations. Verbesselt et al. (2010), Dutrieux et al. (2015) and DeVries et al. (2015) used this approach to demonstrate that time series can be decomposed into trend, seasonal, and remainder components and that the time and number of changes can be detected at high temporal resolution (i.e., 16 days), enabling detection of tree cover change and separation from phenology signal.

The same authors developed the bfastSpatial package (R language) which provides utilities to perform change detection analysis on time-series of spatial gridded data, such as the Landsat satellite imagery that cover our period of interest. In collaboration with the University of Wageningen, FAO has adapted the bfastSpatial package into a functional processing chain (https://github.com/yfinegold/runBFAST/) that uses both Google Earth Engine (GEE) for the preparation of the time series and SEPAL for the processing of the algorithm itself.

A training was developed for the benefit of the national stakeholders, the following specific results are expected

-The processing flow for the generation of activity data is updated with the latest versions of inputs

-The national team is operational in generating tree cover change products from dense time series analysis of satellite imagery

-The national team is operational in maintaining and updating the processing flow for the generation of activity data in an autonomous way

REQUIREMENTS  
All necessary data for the completion of this tutorial is available at <https://github.com/lecrabe/liberia_activity_data>

Background information on the OpenForis initiative [www.openforis.org](http://www.openforis.org/)

You can request Access to SEPAL with the following

1/ have-open a GMAIL account (in order to access Google Earth Engine functionality)

2/ get the account registered and white listed in Google Earth Engine <https://earthengine.google.com/signup/>

3/ open an account in SEPAL <https://tinyurl.com/sepal-access>

For a swift use of SEPAL, you should also install a FTP SSH client such as FileZilla (<https://filezilla-project.org/>) on your computer to allow for upload and download of data from and to the platform.

All materials in this tutorial are linked to the individual Standard Operating Procedures (SOP) that can be found under the [docs/](https://github.com/lecrabe/liberia_activity_data/tree/master/docs) section of the repository.

Workshop Activities

**Day 1**

Presentation of SEPAL + BFAST theory

Presentations were focused on the single date approach (recap hands-on with mosaic generation) versus time series approach for land cover monitoring

Explore BFAST analysis on single points

This step refers to **sop\_sepal\_bfast\_explorer**

Participants looked at the behaviour of BFAST, BFAST01 and BFASTMONITOR algorithms on several points in the country

Run BFAST Spatial on the test dataset

This step refers to **sop\_sepal\_analyze\_ts**

Participants ran the bfastspatial algorithm on the test dataset and downloaded the results.

Run BFAST Spatial on a customized area of interest

This step refers to **sop\_sepal\_generate\_ts** and **sop\_sepal\_analyze\_ts**

Participants hand drew areas of circa 5km side and gathered data to feed in the bfastspatial process.

Clone the repository

This step refers to **sop\_sepal\_terminal**

The address of the repository is <https://github.com/lecrabe/liberia_activity_data>

Create a tiling system

This step refers to **sop\_sepal\_rstudio**

Run **scripts/s0\_parameter.R** to initialize your folders

Run **scripts/ws\_20190415\_bfast/b1\_tiling\_system.R** to create a tiling system covering the country.

Download the KML results (under data/tiling) using FileZilla (**sop\_sepal\_filezilla**)

**Day 2**

Convert the KML into a Fusion Table

This step refers to **sop\_sepal\_fusion\_table**

Generate time series for one tile

This step refers to **sop\_sepal\_generate\_ts**

Use the fusion table identifier for one tile as specified in the file located under **docs/list\_fusion\_tables.txt**

Find a fusion table corresponding to a tile in the country

For example: 16ADAWOJt3IsMvUq7TOFonB7PEquaQUog6OC86CTh

Use 2007 as start date and 2016 as end date

Use NDMI as index

Analyze the time series

Start an instance #6

Follow the steps in **sop\_sepal\_analyze\_ts**

Leave all parameters as default

Test different indexes (NDMI, EVI, SAVI)

**Day 3**

Convert SHP to KML using QGIS

Open a shapefile and “Save As” KML layer

Use the SAE - Design to generate CEO file

Upload specific layers for Liberia

This step refers to **sop\_sepal\_filezilla**

You will need to upload the land cover map (Geoville, 2019) under the **data/lc\_map/** folder.

Prepare time series for national scale implementation

This step refers to **sop\_sepal\_rstudio** to generate a tiling system covering the whole country and splitting the tasks between the 13 users, **sop\_sepal\_fusion\_table** to convert the tiles into a fusion table & **sop\_sepal\_generate\_ts** to download the data.