Using SEPAL, Google Earth Engine and Collect Earth Online to produce a Land Cover Map of Gambia for the year 2023

This course has been developed as part of the FAO Geospatial Technical Assistance to the International Fund for Agricultural Development (IFAD)'s project UTF/GAM/047/GAM Resilience of Organizations for Transformative Smallholder Agriculture (ROOTS).

Geospatial information for sustainable food systems. **Banjul, 16-17 January 2024**

For additional information, refer to the publication and video on the related project available here:

A framework for monitoring geospatial indicators of the Resilience of Organizations for Transformative Smallholder Agriculture project

Land Cover as a fundamental spatial information for sustainable resilient agriculture in the Gambia

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IFAD
Investing in rural people

COURSE CONTACT INFORMATION

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COURSE DESCRIPTION

This study material will guide you from zero all the way to generating your own land cover map of Gambia for year 2023 using **Sepal** and **GEE**, including collecting training data and interpreting them in **Collect Earth Online** and finally performing an accuracy analysis to evaluate the quality of your map.

STUDY MATERIAL

The study material has been selected from the online **facilitated course "Forest and land monitoring for climate action – SEPAL"** available on the FAO e-learning Academy at this link. Register and Login if you want to access the full course. This content has been enhanced with specific documentation, meticulously crafted to support the development of the 2023 Land Cover (LC) map for Gambia.

For each study module, you will find a link to a brief instructional video along with its corresponding notes. These notes are conveniently located in the **NOTES** folder for easy access and reference.

EXERCISES

We highly recommend that you engage with the following modules and complete the exercises prior to attending the in-person training sessions. Active participation and hands-on learning are the most effective methods for absorbing new information.

There are five exercises designed to reinforce the concepts taught in each module. These exercises will guide you through the process of creating your own Land Cover (LC) map of Gambia for the year 2023. It's important to note that most of these exercises build upon each other, requiring one or more input files generated as outputs from the preceding exercise. For your convenience, each exercise's required inputs are readily available in their respective input folders, labeled accordingly (e.g., 'Ex2_input').

MODULE PRIORITY

The material has been designed to be user-friendly and follows a step-by-step approach, ensuring that you can cover the entire training curriculum before the in-person sessions.

However, if you find it challenging to study all the modules, please prioritize your learning using the following hierarchy:

Modules in RED are REQUIRED.
Modules in GREEN are RECOMMENDED.
MODULES in MAGENTA are OPTIONAL.

Selected Modules:

M1: Introduction to SEPAL.

Small introductory video available here
Watch video from 00:00 to 11:40 → Corresponding NOTES_1 from **page1** to **page20**

M2: Setting up SEPAL.

Watch video from 11:40 to 18:40 → Corresponding NOTES_1 from **page21** to **page30**
Small introductory video on Setting up Google Earth Engine available here

M3: SEPAL's basics and interface

Watch video from 18:40 to 24:00 → Corresponding NOTES_1 from **page31** to **page40**

M4: Create a mosaic using SEPAL.

Watch video from 24:10 to 31:40 → Corresponding NOTES_1 from **page41** to **page49**
Exercise 1: Prepare a Cloud-free Optical Mosaic of Gambia for 2023 Wet Season using Landsat 8/9.

M5: Classification with SEPAL

Watch video from 33:10 to 42:05 → Corresponding NOTES_1 from **page60** to **page69**
Exercise 2: Create a Land Cover Map of Gambia for the year 2023.
Ex2_input: CSV file of the legend ready to use in SEPAL

M6: Area Estimation with SEPAL: Sample Design

Watch video from 22:51 to 41:26 → Corresponding NOTES_2 from **page26** to **page31**
Exercise 3: Generate Land Cover Points to Calibrate the Machine Learning Model using a Stratified Random Design.
Ex3_input: TIFF file of the Land Cover Map that was created in Exercise 2.

M7: Area Estimation with SEPAL: Response Design

Watch video from 41:26 to 48:57 → Corresponding NOTES_2 from **page32** to **page34**
Exercise 4: Visual Interpretation in CEO of the Points generated in SEPAL with Stratified Random Design.
Ex4_inut: CSV file with 4184 plots/points generated in the Stratified Random Design during Exercise 3, ready to use in CEO.

M8: Area Estimation with SEPAL: Analysis

Watch video from 48:57 to 52:50 → Corresponding NOTES_2 from **page35** to **page36**
Exercise 5: Accuracy Analysis of the Land cover map of Gambia for year 2023 generated in Exercise 2 using the training points generated in Exercise 3 and visually interpreted in Exercise 4.
Ex5_input:

> 1- ceo-RandomChanges.csv: CSV file with 4184 plots/points generated in the Stratified Random Design during Exercise 3, and Visually interpreted in Exercise 4.
> 2- area_lc_gambia_2023.csv: CSV file with area distribution for LC class that you produced in Exercise 3.

3- Confusion_Matrix.xlsx: CSV file of the Confusion Matrix that we will generate and discuss in Exercise 5.

Additional Study Material:

Within the "NOTES" folder, you will also find the following resources:

LC_legend.ppt: This presentation illustrates the method we used to select the Land Cover (LC) classes for Gambia, based on the Western Africa Reference System. To properly visualize it, please ensure to download it first.

LC_Mapping Process.ppt: This presentation details the comprehensive process we employed to create the LC map of Gambia for the year 2023 using Google Earth Engine (GEE). To properly visualize it, please ensure to download it first. Or you can visualize the PDF version without animations.

lc_gambia_2023_OnePager: This is a concise One Pager containing key information about the LC mapping process for Gambia for the year 2023.

Machine Learning Models: A visual document which provides a straightforward comparison of the pros and cons of different machine learning models. If you want to learn more about Random forest model we suggest you watch the following videos:

- StatQuest: Random Forests Part 1 - Building, Using and Evaluating
- StatQuest: Random Forests Part 2: Missing data and clustering

lc_gambia_2023_Process: A brochure that describes the primary steps involved in the Land Cover Mapping process. You can also watch the video published on FAO youtube channel describing the LC mapping of The Gambia for the year 2023.