



Earth Observation and GIS Solutions: Potential Use Cases for the Bamboo Industry

Mapping and monitoring bamboo plantation

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The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) is part of CGIAR, a global research partnership for a food-secure future



Share details on geospatial techniques and lessons learned on the application for high-value commodities like coffee;

To discuss adoption of geospatial techniques to support natural capital opportunities, carbon, ecosystem services and regenerative agroforestry.



Mapping and scale

- Public data (free)
 - 30-10m, ~weekly image
 Allow large scale mapping. (world scale)
 - Not good for capturing small feature (bamboo growing

- Private data (\$)
 - 5m-30cm, on demand imagery
 - Better for more localized mapping
 - Allow to capture small feature
 - \odot Training samples gathering

- Drone/Groundwork (\$\$)
 - ~cm, Very high precision, can count tree and see growing tree
 - Limited spatial and temporal scales
 - Lidar imagery can measure tree sizes







Multi scale approach

Collect training and validation samples to train Al system

- Easy training sample: High resolution (google imagery)
- Hard training sample: Drone/groundwork

Global map and largescale monitoring Sentinel



Small scale monitoring High resolution imagery/drone



Typical AI systems need extensive training dataset before they can accurately map/monitor commodity.

Large training database can be collected using high resolution imagery

Difficult cases may need drone imagery or groundwork To be resolved





Multi scale approach

Collect training and validation samples to train Al system

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Large scale (coffee in purple).

Country scale commodity, location and stock, opportunity area for plantings, change, capture evidence of change

Example 1: Mapping visible soil area allow acquisition of high-resolution imagery to monitor crops grow

Example 2: Time series of rubber growing.



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- Lower resolution image area is powerful tool to get **large scale** information and to gather **evidence** of local change at reasonable cost.
- Enabling **targeted** precise analysis and greatly **lowering the cost** of acquiring very high-resolution imagery and need for groundwork.
- Mapping method need to be tuned to the objectives and map need to be validated







Exploring an Innovative Solution on Earth Observation, AI, and Cloud Computing

Cloud SEOS and Coffee Plantation Mapping in Timor Leste

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Overview

- The Asian Development Bank (ADB) is implementing TA 6672-REG: Empowering Developing Member Countries to Use Multispectral Satellite Images and Artificial Intelligence for Land Use and Coastal Planning, to provide technical assistance to multiple governments of ADB's Developing Member Countries (DMCs) in using Artificial Intelligence (AI) technology, satellite imagery, and Earth-observation (EO) data for project planning and implementation.
- Cloud SEOS (Cloud-based Satellite Earth Observation System) is a cloud-based solution that generate EO derived products and indicators
 - mapping, monitoring, and assessment across various domains, such as agriculture, land cover, and coastal applications,
 - leverage AI and machine learning technologies to enhance EO data analysis,
 - implement time series to allow getting insights for enhanced decision making,
 - build capacity to support and strengthen the use of EO services among DMCs.



- in 2024, AIT joined joined the initiative to support and promote the adoption of Cloud SEOS across ADB's DMCs
- the platform is currently undergoing transfer and deployment to AIT's server infrastructure.
- a case study on coffee plantation mapping in Timor Leste.



Land Cover and Crop Plantation Mapping: An Approach





Ground Data Collection using Mobile Apps

- Mobile apps: **Survey 123**, KoboToolbox, ODK Collect, etc.
- Customize surveys with various question types (text, numeric, multiple choice, etc.)
- Record crop locations, capture photos, and document key characteristics .
- Supports both online and offline data collection

-Please Select-

Shading trees density level ?*	
-Please Select-	•
Coffee species ?*	
-Please Select-	•
Farming condition ?*	
-Please Select-	•
Terrain ?*	
-Please Select-	•
Ownership ?	
-Please Select-	•





Ground Data Points and Drone Maps

Examples





DRONE MAP IN FATUQUERO SUCO, ERMERA DISTRICT



DRONE MAP IN FATUBOLU SUCO, ERMERA DISTRICT





DRONE MAP IN HUMBOE SUCO, ERMERA DISTRICT





EO Data Processing with Cloud SEOS



- Cloud SEOS is a cloud-based earth observation satellite processing environment.
- An operational system for agriculture and aquaculture monitoring decision support, with access to the European Union's Copernicus constellation and its associated services.



- Training data is generated from the intersection of global and open datasets, including Copernicus GLC, ESA World Cover, FROM-GLC, GLAD, and ESRI World Cover.
- Training data is enhanced and updated by Sentinel-2 time series, processed using the ML algorithm (LGBM).



- Land Cover and Coffee classification is performed on multitemporal Sentinel-1 and Sentinel-2 data using ML algorithm (LGBM), with results aggregated quarterly.
- Coffee classification focused on the forested areas to detect Albizia and Casuarina trees, under which coffee is cultivated.



• On-screen visualization with basic mapping capabilities.



Land Cover and Coffee Classification Maps

Examples



Land Cover Map in Timor Leste

Coffee Map in Timor Leste



Summary

- Cloud-based solution integrating field data, EO data and Al/machine learning
 - support automated processing and monitoring, enabling dynamic decision-support tools.
 - addresses the growing demand for accurate, timely, and scalable data, particularly for agriculture and crop management in Developing Member Countries (DMCs).
 - helps to overcome local capacity limitations and infrastructure constraints in EO data processing and analysis by leveraging cloud computing.
- Expand use cases to cover a wider range of tree and food crops, enhancing the platform's versatility and robustness.
- Strengthen partnerships and training programs to build national capacity.







Thanks!