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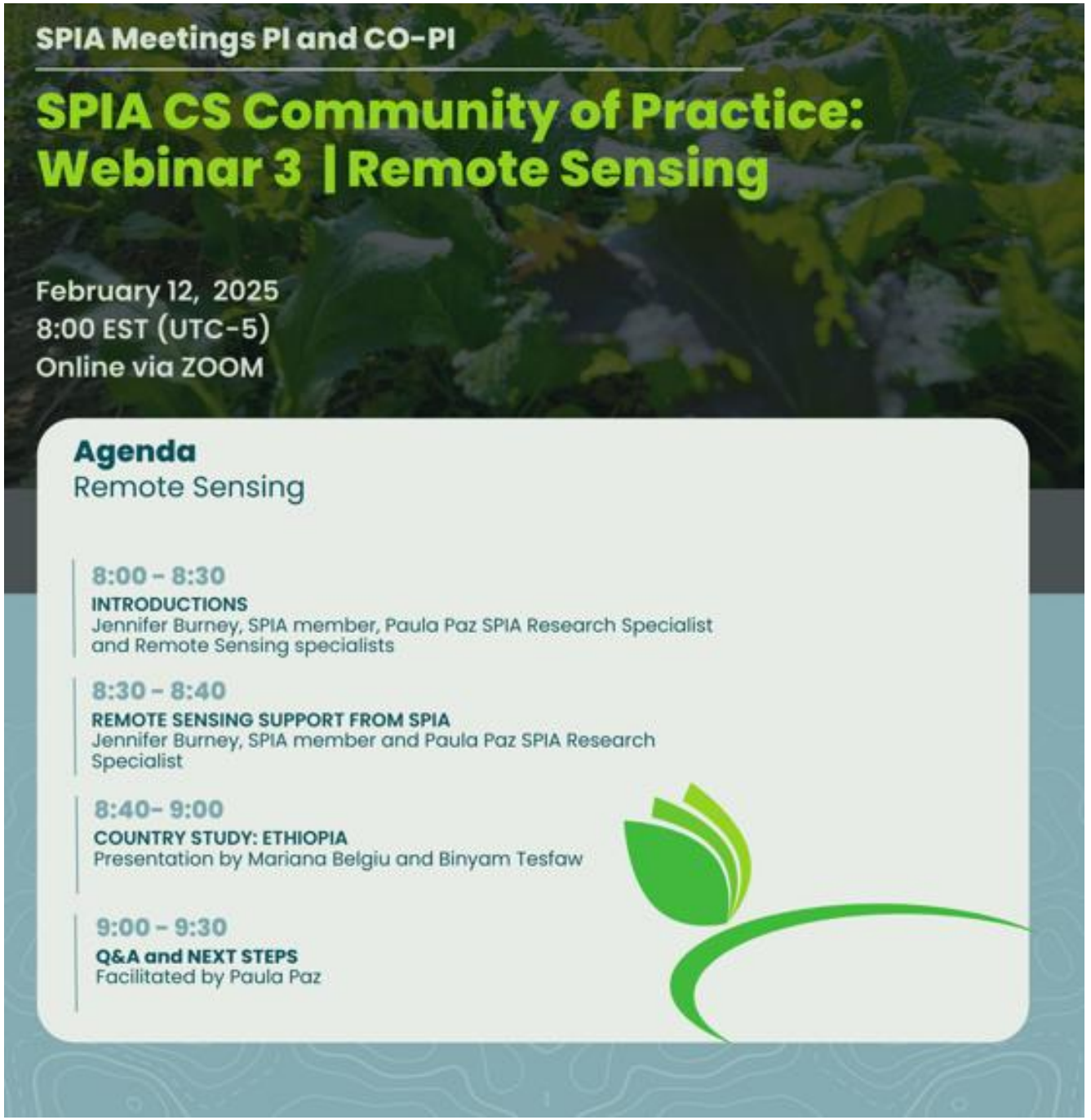
SPIA CS Community of Practice: Webinar 3 | Remote Sensing

Jennifer Burney , SPIA Member
Paula Paz, SPIA Research Specialist

Agenda



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Remote Sensing for Impact Evaluation of Agriculture and Natural Resource Management Research: Guidelines for Use in One CGIAR

Johanne Pelletier, Casey Maue, Mina Karasalo, Kelsey Jack, Julio Barros

https://shorturl.at/5qIVM

August 2023

CGIAR Standing Panel on Impact Assessment

Objective

- Identify best practices and challenges associated with using satellite EO data.
- Evaluate which outcome variables targeted by recent CGIAR initiatives could be measured by EO.
- Methodological consideration when using RS data for impact evaluation.
- 11 case studies of projects recently funded by SPIA to gather input on researchers' applications of EO for impact evaluation and lessons learned by case.

Overview

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Remote Sensing for Impact Evaluation of Agriculture and Natural Resource Management Research: Guidelines for Use in One CGIAR

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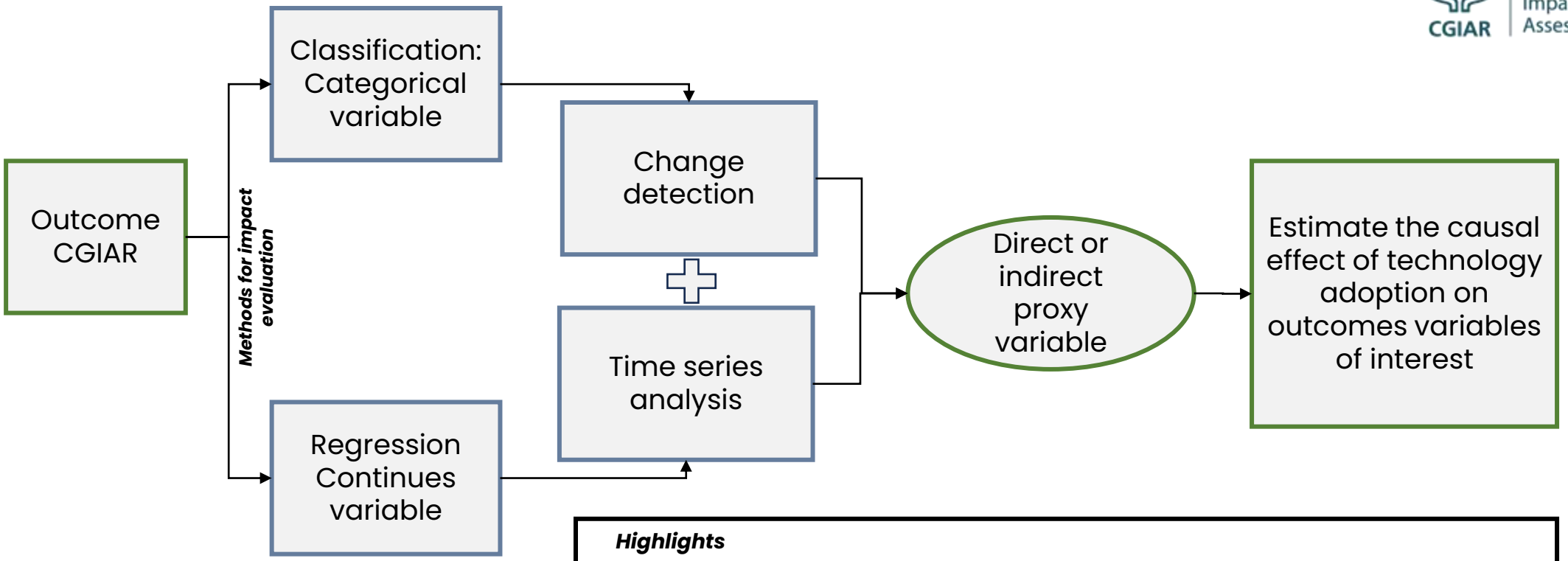
Methodology

Virtual interviews with research teams
– Analysis of transcript, proposal and reports.

Review of literature
– Recommendations , state of knowledge.

Expanding on targets from initiatives
– Looking at readiness level of EO measurements.



Highlights

- EO data available
- Pre-processing
- Measurement error for IE
- Scale and the modifiable area unit problem (MAUP)
- Reference data
- Validation of EO-based product
- Accounting for spatial correlation
- Transferability across landscape

Additional resources from the guidelines

Photo: N. Palmer/The Alliance

Impact evaluation in a nutshell
– Basic concepts

Remote Sensing in a nutshell
– Basic concepts

Case study project
– Impact evaluation 11 projects integrating a remote sensing component into their methodology. Data and method used are presented.

Lessons learned from case studies

EO data providers, data sets and Tools
– List of free and open data EO providers where readers can access and download EO data or directly perform their analysis.

Global indicators related to SDGs And CGIAR strategic goals

Satellite sensors and their characteristics
– Shows the most common satellite missions so that researchers can identify what they are looking for based on their specific goals.

Online tutorials on open source remote sensing software
– Description and GUI/Programming language.

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Photo: G. Smith/The Alliance

RS for impact evaluation

	Innovation	Data	Method
Adoption	• Conservation agriculture (CA) – India • Faidherbia aldiba fertilizer tree – Zambia • Alternative wetting and drying (AWD) - Vietnam	**RS** • Course resolution: MODIS – 250m, 500m. • Medium resolution (30-10m): Landsat, Sentinel. • High resolution (5 – < 1m) : Planet, Worldview, UAV, LIDAR	**Data management** pandas, xarray, COG (Cloud Optimized GeoTIFF), GeoPandas
Outcomes	• Index-based livestock insurance (IBLI) – Kenya and Ethiopia • Restauration of the commons – India • Sorghum and millet upscaling project – Mali • Direct seed marketing program – Ethiopia	**Vectorial** • WDPA, Tiger, GAUL.	**Code tools** jupyter, colab, geemap, rgee
Both adaptation and Outcomes	• Demi-lune (DL) rainwater harvesting technique. - Niger • Happy seeder (direct-seeders for wheat sowing) - India • Stress-tolerant rice varieties (STRVs) - Bangladesh • Improved forages - Ethiopia	**Geodata available** • Climate and atmosphere: NOAA, OMI, Sentinel 5P. • Land cover and land use • Fires	**ML Frameworks** scikit learn, PyTorch, TensorFlow

Note: 11 case studies impact evaluation projects integrating a remote sensing component into their methodology

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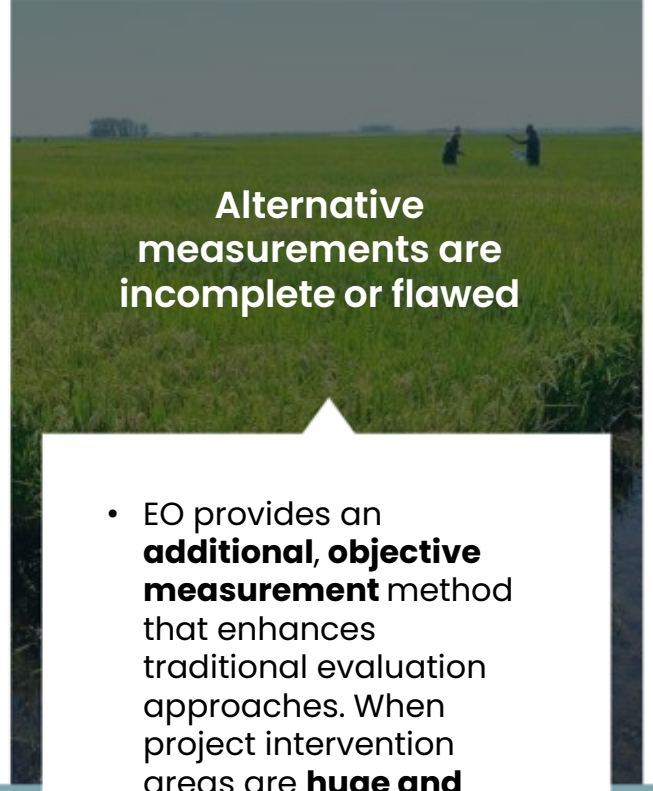
What is the Potential Contribution of Remote Sensing for Impact Evaluation?

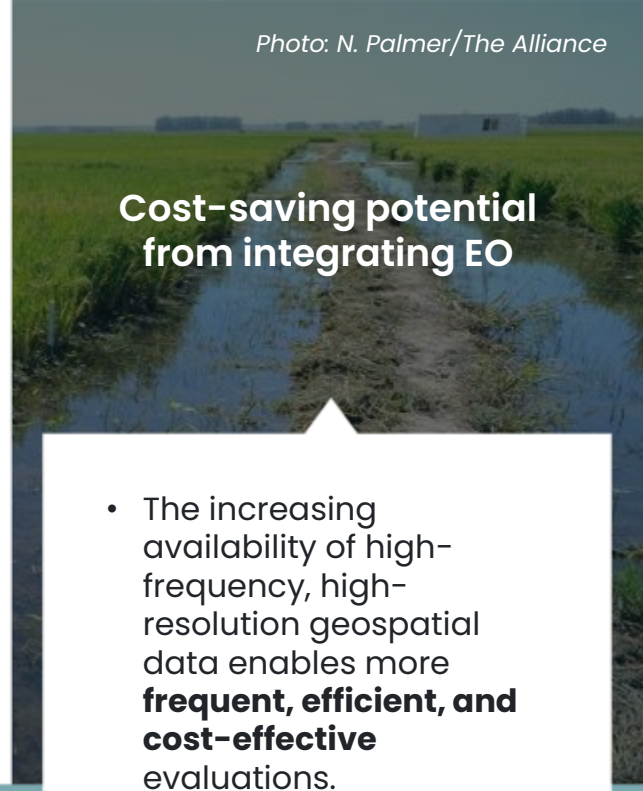
Alternative measurements don't exist

- EO provides **a viable solution** for impact evaluation in cases where no direct measurement data exist.
- Enables the measurement of key **variables (direct or indirect)** necessary for assessing the adoption and outcomes of an innovation.
- **Historical and current** satellite data for time series and change detection analysis



Alternative measurements are incomplete or flawed

- EO provides an **additional**, **objective measurement** method that enhances traditional evaluation approaches. When project intervention areas are **huge and hardly inaccessible**, doing evaluation by means of in-situ sampling alone can become very expensive.
- Remote sensing data can serve to **validate a conventional** survey-based or field-based measurements, **improving the rigor** of impact evaluations.



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Cost-saving potential from integrating EO

- The increasing availability of high-frequency, high-resolution geospatial data enables more **frequent, efficient, and cost-effective** evaluations.
- Developing remote sensing-based evaluation methods requires **expertise, model calibration, and validation** with ground-truth data.
- Once validated, remote sensing-based models can be **scaled and replicated** over large areas and timeframes with minimal additional costs.

Challenge and Limitation

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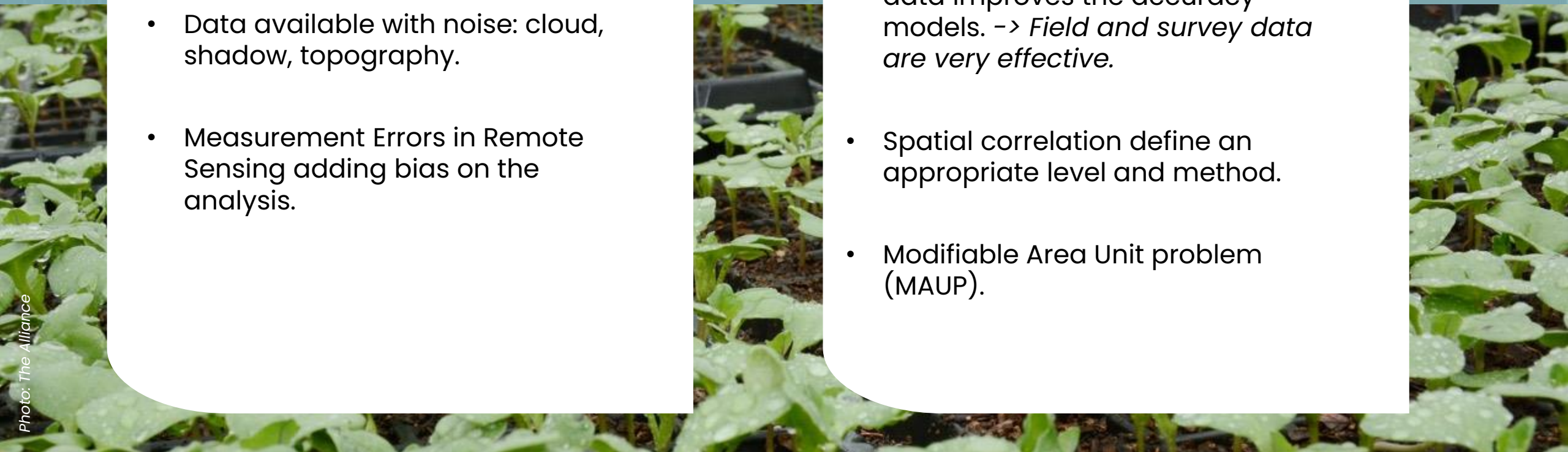
Limitation

- Low precision for individual fields.
- Data available with noise: cloud, shadow, topography.
- Measurement Errors in Remote Sensing adding bias on the analysis.

Challenge

- Need high-quality, easily accessible training and validation data improves the accuracy models. -> *Field and survey data are very effective.*
- Spatial correlation define an appropriate level and method.
- Modifiable Area Unit problem (MAUP).



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Remote sensing projects 2025

Country study 25	RS product objective	Thematic	Country study 24	RS product objective
Vietnam	Farmers' practices, such as crop rotations, residue burning, no-till, AWD, etc.	AWD	Vietnam	Evaluate the adoption of AWD as a water saving practice in rice production.
		Residue burning/ Zero tillage	India	Evaluate the environmental spillover related to evidence of burning.
	Land use types, such as crops/varieties grown, agricultural and landscape diversity, forest cover, etc.	LULCC	Mali	Evaluation of LULCC: tree cover, cropland extent, landscape composition and configuration.
Bangladesh	Characterization of production practices, land use changes, crop diversification and fallows diversification , typology of cropping systems	Crop mapping	Mali	Evaluation of LULCC: tree cover, cropland extent, landscape composition and configuration.

Remote sensing projects 2025

Country study 25	RS product objective	Thematic	Country study 24	RS product objective
Ethiopia	Intercropping Mapping and monitoring.	LULCC	Mali	Evaluation of LULCC: tree cover, cropland extent, landscape composition and configuration.
	Mapping and monitoring fodder crop	Crop mapping	Ethiopia	Spillover of adoption: Measure of land use, biomass production and tree cover change.
Uganda	Pilot of agroforestry detection	Agroforestry	Zambia	Mapping the distribution of the Faidherbia albida fertilizer tree species
India	Identify and monitor areas planted with flood-tolerant rice varieties.	Flood-tolerant rice	Bangladesh	Provide evidence of Stress-tolerant rice varieties adoption by measuring the impacts on post-flood vegetation greening, compared with sites that were not adopted.
	Monitoring zero tillage	Zero tillage	India	Map area of zero tillage and conventional tillage.

Remote sensing projects 2025

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Country study 25	RS product objective	Thematic	Country study 24	RS product objective
Colombia	Predict the adoption of certain CGIAR innovations, such as silvopastoril systems or agroforestry.	Agroforestry	Zambia	Mapping the distribution of the Faidherbia albida fertilizer tree species
Nigeria	Use RS to monitor land use changes and the effectiveness of conservation practices over large areas.	LULCC	Mali	Evaluation of LULCC: tree cover, cropland extent, landscape composition and configuration.
Nigeria	Predict plot boundaries, crop type, yields of certain crops including maize using satellite imagery.	Crop mapping	Ethiopia	Focusing on maize: agricultural productivity, timing of planting.

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Community of Practice: Remote sensing

Remote Sensing Webinar, 12/02/25

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Community of Practice for RS

Main objective

- Facilitate the sharing of best practices and innovative methodologies in remote sensing.
- Promote the development and dissemination of tools and workflows for remote sensing applications.
- Build capacity among researchers and professionals through structured training, workshops, and webinar.
- Encourage interdisciplinary collaboration to integrate remote sensing with complementary fields.

- Focusing on creating a repository or platform for knowledge exchange.
- Highlighting toolkits, software, and standardized workflows for various contexts.
- Emphasizing synergies with field data collection, machine learning, agricultural sciences, and impact evaluation.

CoP: **Key activities**

Webinars and workshop	○ Organizing events to showcase new technologies, methods and applications for Impact Evaluation.
	○ Short talks or presentation on projects related to RS for impact assessment on CGIAR initiatives.
	○ Call monthly to showcase study by project.
Online platform to share resources	○ Maintaining a platform for member interaction, make questions, and resource sharing (ASANA).
	○ Develop a shared library of RS resources, including tutorials, datasets, code repositories (e.g. GEE, GitHub)
Collaboration projects and encourage networking	○ Promote the creation of collaborative projects, such as developing scripts to analyze a common environmental problem. Create synergy.
	○ Facilitate connections among members so they can collaborate on scientific publications.

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To get started, please fill out this form: https://forms.gle/8sA8ENKry3mRgYbQA

Subject	Question 1	Question 2	Question 3
User	What is the **name** (or names) of the specific members/ partners/ users or participants group?	What is the **background** information for the members/ partners/ users or participants group?	
Coverage	Which **country** (or countries) does this COP cover? Include sub-national geography, if relevant.		
User needs	What is the **situation/objective** being addressed?	What is the **need** the members/ partners/ users or participants groups identified?	What did the members/ partners/ users or participants groups do **before** this partners COP? Please be specific.
Resources	Do you have any **communications materials, reports** (e.g. success stories), documentation, etc. that might share more insight and context for this CoP?		

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Q&A session

Remote Sensing Webinar, 12/02/25


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