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EOCap4Africa

1 How to conduct a Remote Sensing case study

c) Importance of Field (In-Situ) Data in Remote Sensing



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Learning Objectives



- 1) Define in situ (field) data and its role in remote sensing
- 2) Understand why ground data is essential for validation and accuracy
- 3) Identify different types of in situ data used in case studies
- 4) Recognize challenges and best practices for integrating field data

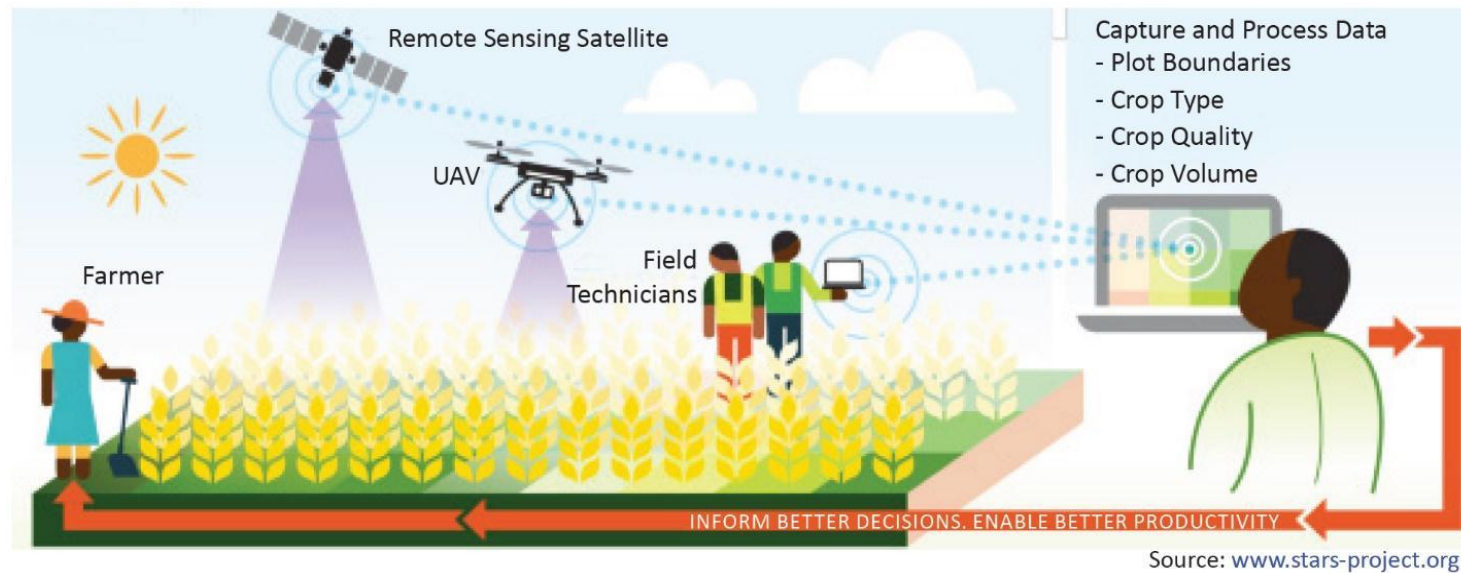
What is In-Situ Data

Definition

- Field data collected directly from the ground to provide real-world reference points
- Used to validate, calibrate, and enhance remote sensing analysis

Why is it Important?

- Remote sensing provides indirect measurements (e.g., NDVI for vegetation health)
- Field data confirms what is really happening on the ground



(Alkindi 2022)



The Role of In-Situ Data in Remote Sensing

Why remote sensing data only is not sufficient for your RS case study

- Atmospheric effects, sensor limitations, and data resolution can introduce errors
- Ground truthing helps improve classification accuracy
- Allows correlation between spectral values and real-world conditions

How in-situ data will enhance the values of your RS case study

- Step 1: Collect satellite data (e.g., Sentinel-2)
- Step 2: Identify study areas requiring ground validation
- Step 3: Conduct field surveys, record data, and take GPS-tagged photos
- Step 4: Compare field measurements with remote sensing results

Types of In-Situ Data

Which types of In-Situ Data can you think of?



(Zhang et al. 2022)



Types of In-Situ Data

Vegetation & Land Cover Surveys

- **Purpose:** Validate land classification (forest, agriculture, wetlands)
- **Example:** Using quadrats to measure tree canopy density

Soil & Moisture Measurements

- **Purpose:** Improve analysis of agricultural and hydrological studies
- **Example:** Ground sensors measuring soil moisture vs. satellite estimates

Water Quality Sampling

- **Purpose:** Validate satellite-based water turbidity, algae, and pollution levels
- **Example:** Taking pH and chlorophyll samples for lake monitoring



Types of In-Situ Data

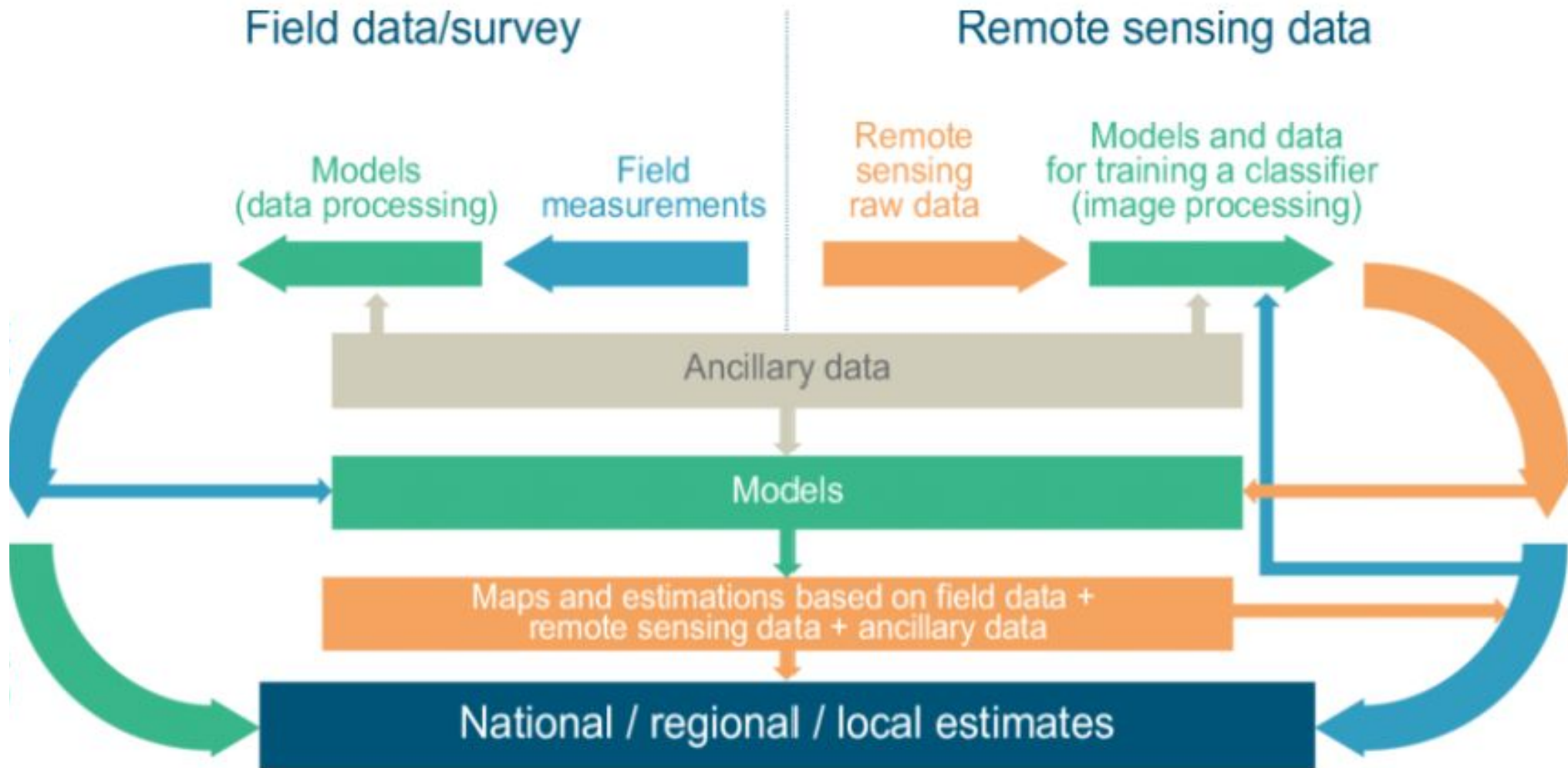
Climate & Weather Data

- **Purpose:** Provide real-time atmospheric corrections for satellite data
- **Example:** Temperature, humidity, and wind speed logs from weather stations

GPS & Drone Surveys

- **Purpose:** Provide high-resolution reference images for validating satellite classifications
- **Example:** Drones capturing ultra-high-resolution imagery of deforestation sites

Combining In-Situ and Satellite Data



(Morales-Hidalgo et al. 2017)



Challenges in Collecting and Using In-Situ Data

Time-Consuming & Expensive

- Requires field teams, specialized equipment, and travel costs.

Data Collection Errors

- Inconsistent sampling methods can introduce biases.

Scalability Issues

- Field surveys cover limited areas, whereas satellites provide regional/global coverage

Weather & Environmental Barriers

- Remote areas, harsh terrain, and seasonal access limitations



Best Practices for Using In-Situ Data

Use standardized protocols

- Follow global methodologies for data collection (e.g., FAO Land Cover Classification)

Ensure spatial alignment

- Match field data coordinates with satellite imagery

Automate data collection

- Use GPS, sensors, and mobile apps for accuracy

Combine multiple data sources

- Improve validation by integrating drone imagery, government datasets, and historical records

Document metadata

- Record who collected data, when, and under what conditions



Choose In-Situ Data for your own Case Study

Within the next 20 minutes:

- Think of at least **three types of in-situ data** you can use to make your case study better!
- Go outside, **take your phone with you**, and do some in-situ sampling (GPS tagged pictures, Quick Capture [needs to be prepared by supervisor])



Summary & Key Takeaways

In situ data is essential for validating remote sensing analysis

Ground truthing improves classification accuracy and interpretation

Challenges include **cost, errors, and limited coverage**, but best practices help improve reliability

Sources



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Thank you for your attention!

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