CGIAR STANDING PANEL ON IMPACT ASSESSMENT

Remote Sensing for Impact Evaluation

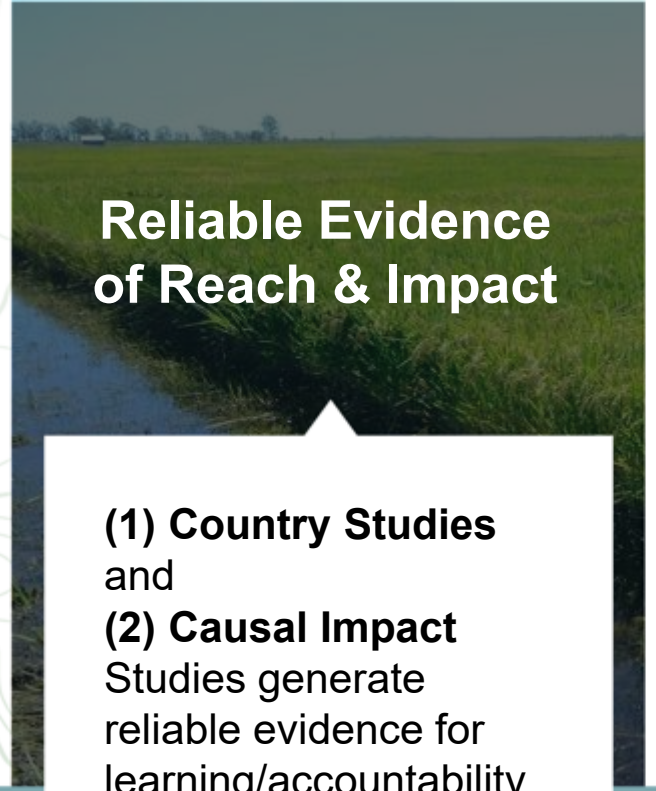
Webinar: GIS - A practical tool in evaluation

Paula Paz-Garcia, Remote Sensing Specialist, SPIA

October 15, 2026

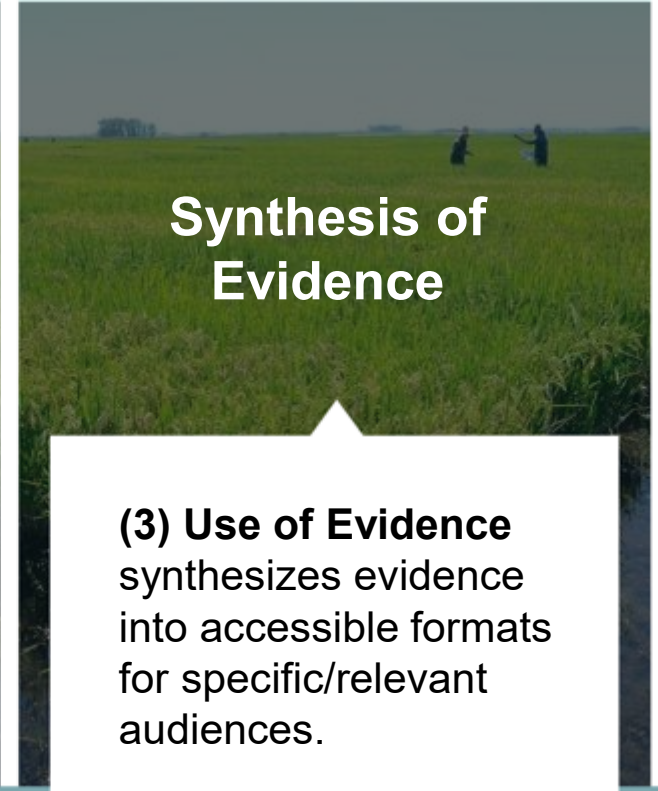
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SPIA's "Bounded" Approach to Use of Evidence



Reliable Evidence of Reach & Impact

(1) Country Studies
and
(2) Causal Impact
Studies generate reliable evidence for learning/accountability.



Synthesis of Evidence

(3) Use of Evidence
synthesizes evidence into accessible formats for specific/relevant audiences.

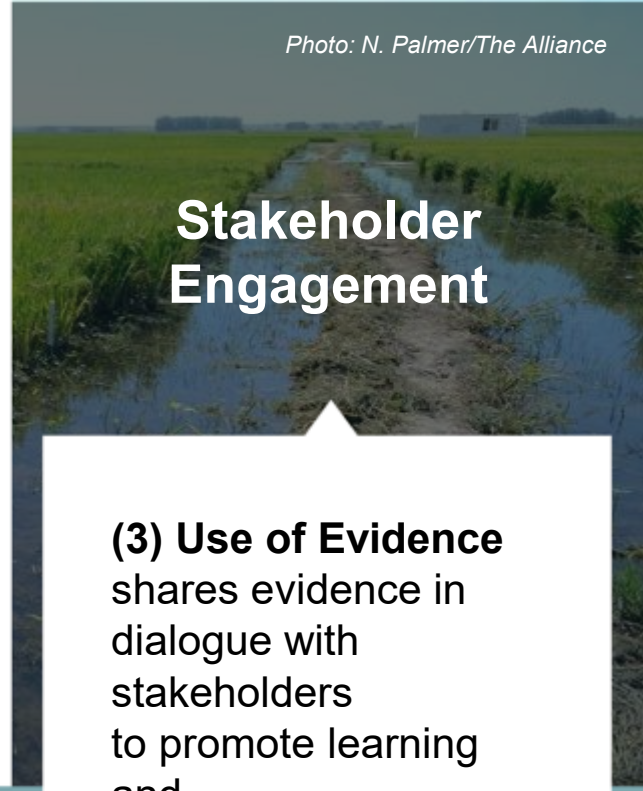


Photo: N. Palmer/The Alliance

Stakeholder Engagement

(3) Use of Evidence
shares evidence in dialogue with stakeholders to promote learning and enable prioritization.

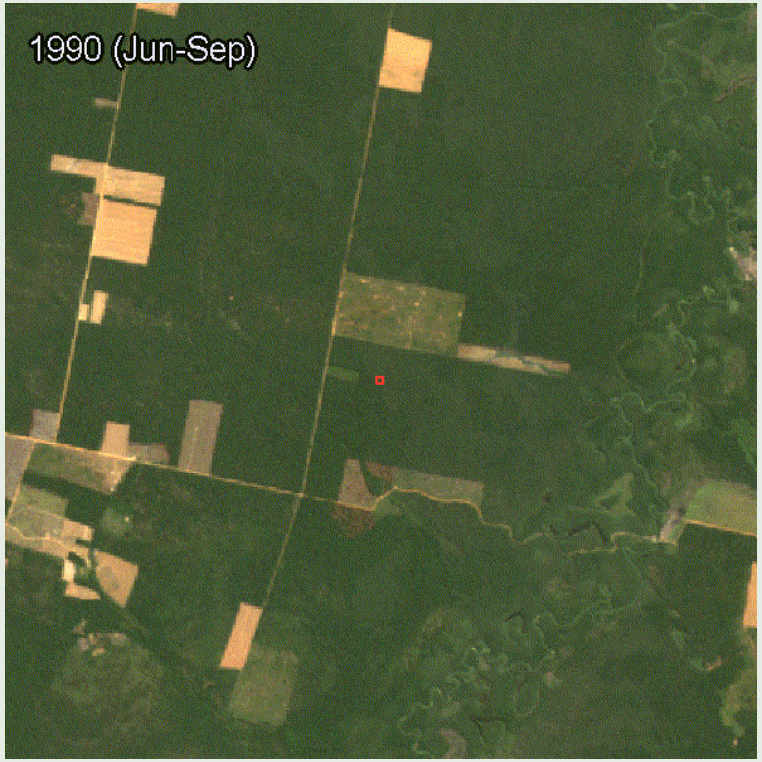
Remote sensing contributes here

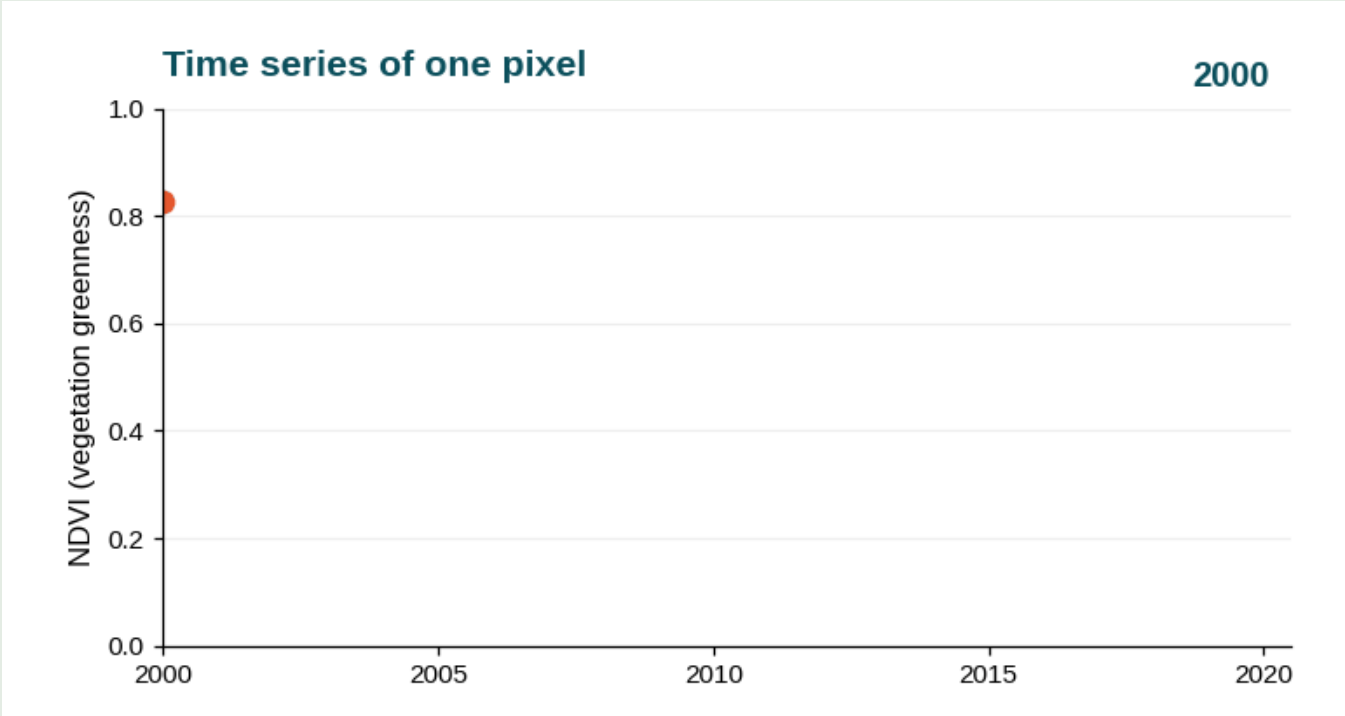
Reach — Measuring adoption at scale (e.g., conservation agriculture, AWD, improved varieties)

Impact — Measuring outcomes over time (e.g., land use, crop patterns, restoration)

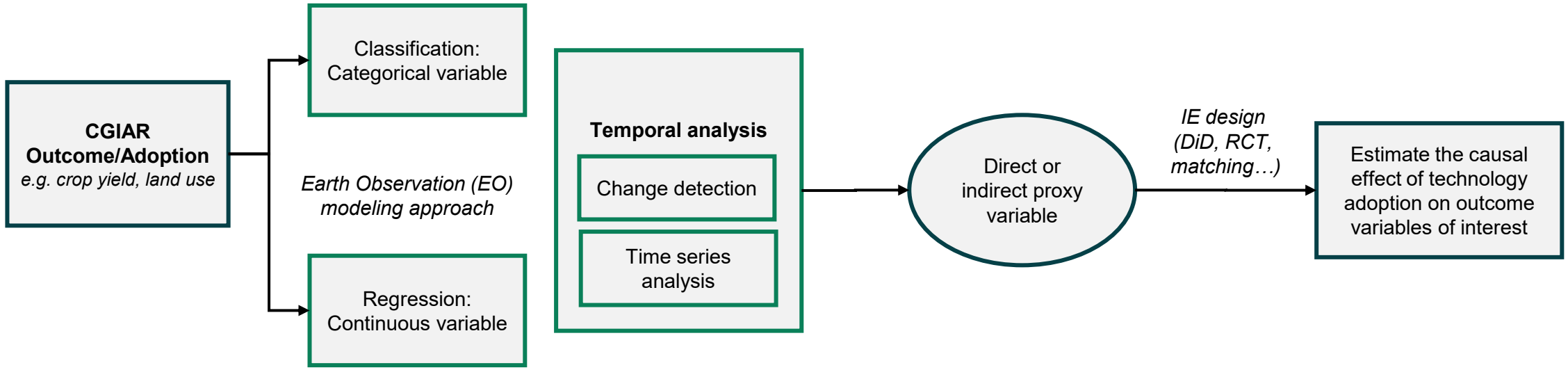
Remote sensing outputs (maps, time series) also make evidence easier to communicate to diverse audiences.

“Every pixel tells a story”





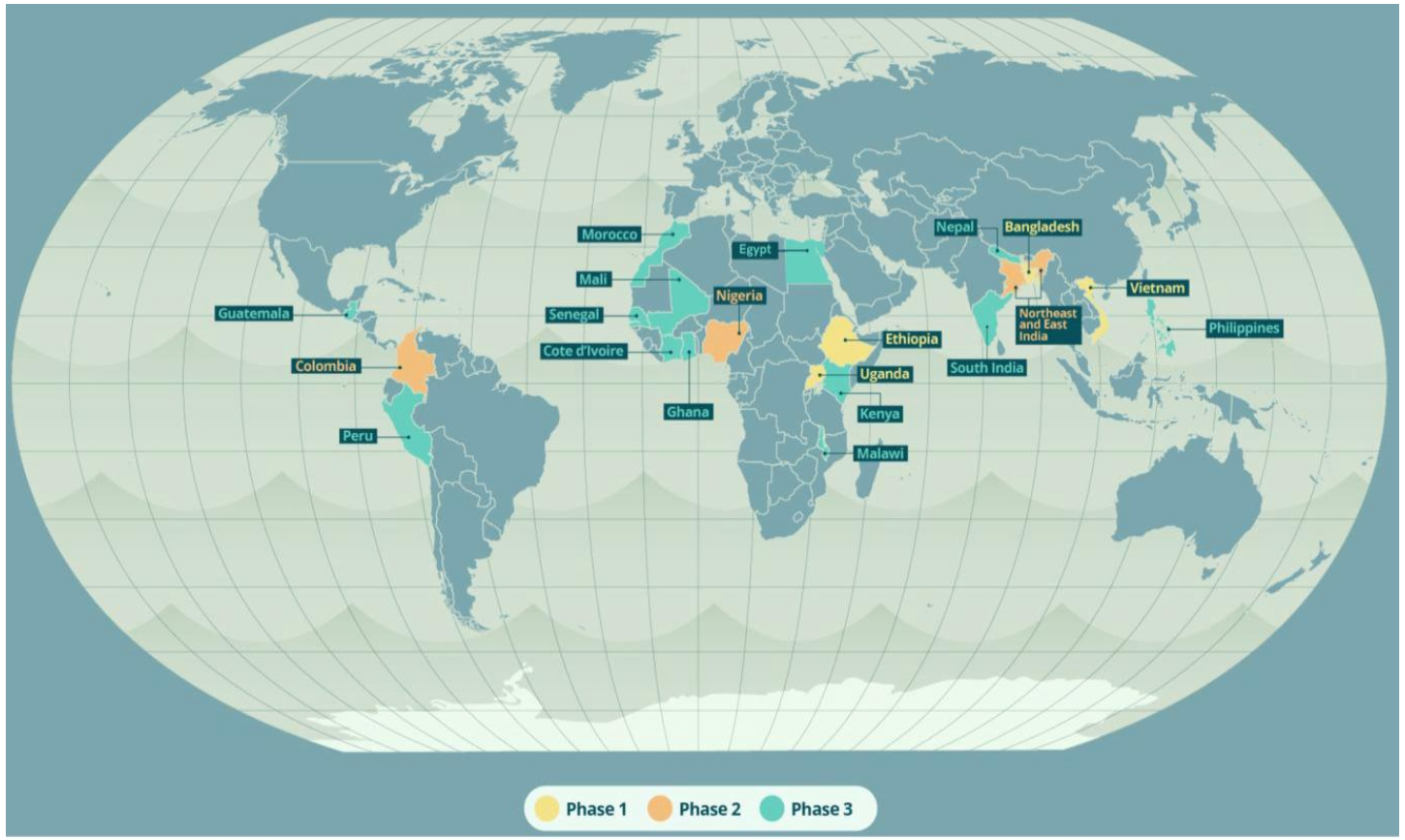
Workflow for Remote Sensing application



Key considerations

EO data	EO data availability	Pre-processing	Reference data	Validation of EO-based products
Impact evaluation	Measurement error in Impact Evaluation	Spatial correlation	Scale and the modifiable areal unit problem (MAUP)	Transferability across landscape

Cross-Cutting Insights from Country Studies



Innovation

Improved Varieties & Livestock

- Stress-Tolerant Varieties, Drought-Tolerant Maize
- Improved forages

Natural Resource Management

- Alternate Wetting and Drying (AWD)
- Conservation agriculture / zero tillage
- Agroforestry practices

Case study: Happy Seeder project, India

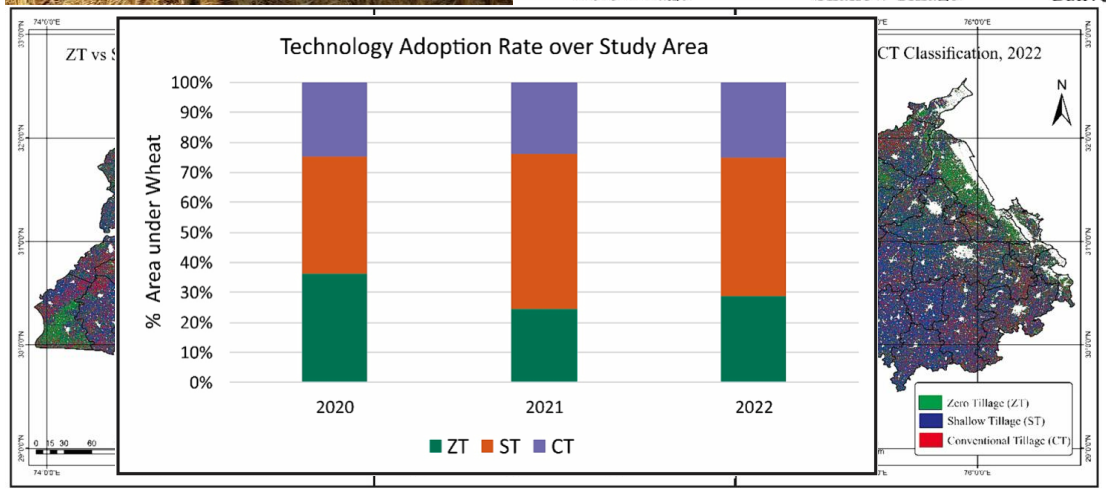
Contents lists available at ScienceDirect
International Journal of Applied Earth Observation and Geoinformation
journal homepage: www.elsevier.com/locate/jag

Detecting and quantifying zero tillage technology adoption in Indian smallholder systems using Sentinel-2 multi-spectral imagery

Monish Vijay Deshpande [a,b], Dhanyalekshmi Pillai [a,b,*], Vijesh V. Krishna [c], Meha Jain [d]







Can we see from space whether a farmer tilled the field?

- **Innovation:** Zero tillage (ZT): wheat sown directly into rice residue (e.g., Happy Seeder), avoiding residue burning. Shallow (ST) and conventional tillage (CT) also tracked.
- **Approach:** Early-season Sentinel-2 (10 m) and two-step change detection with random forest; 81% accuracy. Trained on 2022 field data from 122 villages and 426 GPS-mapped plots.
- **Result:** Tillage adoption mapped across Punjab, 2020–2022, revealing year-to-year shifts (e.g., ZT −33%, ST +29% in 2021).
- **Why it matters:** Measures adoption at large spatial and temporal scales.

Deshpande, M. V., Pillai, D., Krishna, V. V., & Jain, M. (2024). Detecting and quantifying zero tillage technology adoption in Indian smallholder systems using Sentinel-2 multi-spectral imagery. International Journal of Applied Earth Observation and Geoinformation, 128, 103779. https://doi.org/10.1016/j.jag.2024.103779

South Asia: Stress-Tolerant Rice

Can we evaluate impact when there is no baseline data?

- **Innovation:** Flood-tolerant rice, released in Bangladesh in 2010.
- **Approach:** 20 years of MODIS maps (2002–2021): rice area trained on Google Earth reference points, past floods reconstructed with a deep-learning model trained on Sentinel-1 radar. EVI as a yield proxy + district seed data; event study, DiD.
- **Result:** Geospatial evidence suggests that flood-tolerant rice increases productivity in Bangladesh – but only for very specific flood depths.
- **Why it matters:** EO can rebuild a missing baseline, but results are highly sensitive to how flooding is measured.


Contents lists available at ScienceDirect

Journal of Development Economics

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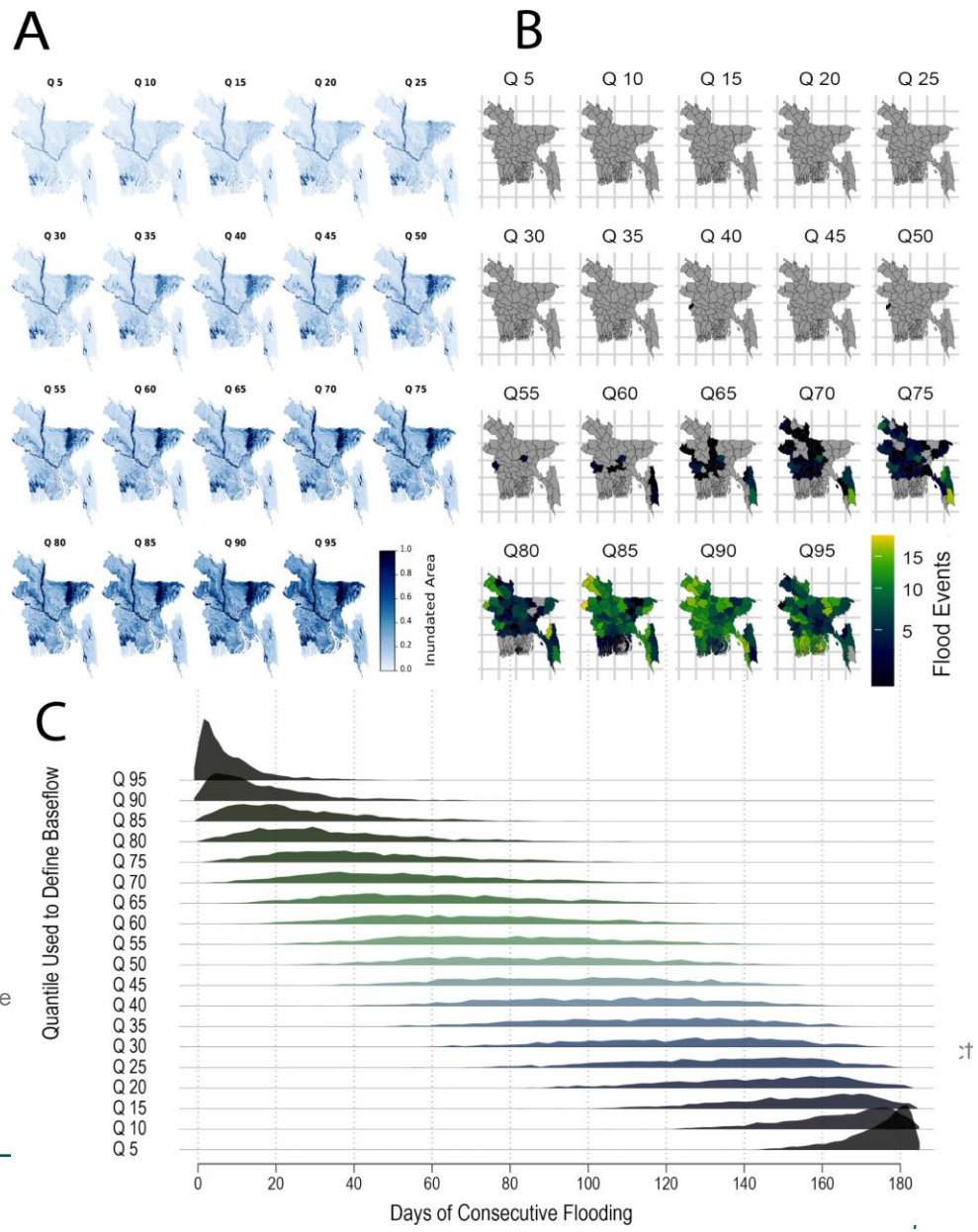
ELSEVIER

Regular article

Impact evaluations in data-scarce environments: The case of stress-tolerant rice varieties in Bangladesh ☆,☆☆

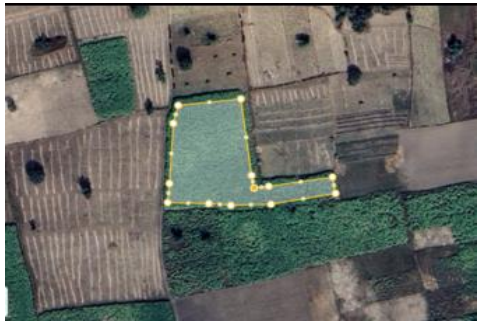
Jeffrey D. Michler [a], Dewan Abdullah Al Rafi [b], Jonathan Giezendanner [c], Anna Josephson [a], Valerien O. Pede [d], Elizabeth Tellman [e]

Michler, J.D., Al Rafi, D.A., Giezendanner, J., Josephson, A., Pede V.O., & Tellman, E. (2026). Impact evaluations in data-scarce environments: The case of stress-tolerant rice varieties in Bangladesh. Journal of Development Economics, 179, 103648. https://doi.org/10.1016/j.jdeveco.2025.103648



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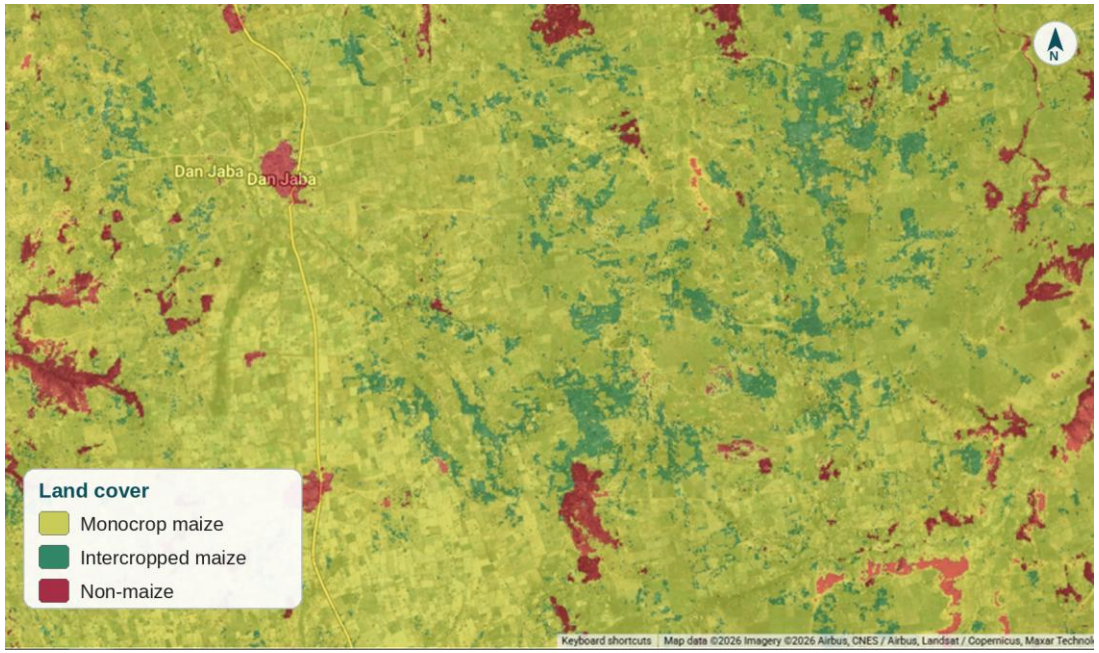
Ongoing country study, Phase 2: Nigeria



Monocrop maize (reference polygon)



Intercropped maize (reference polygon)



Where is maize grown, how much does it yield, and how hard does drought hit?

- **Focus:** Maize in Nigeria, as part of SPIA's Phase 2 country study.
- **Approach:** Sentinel-2 time series and embeddings classified with RF / XGBoost; MODIS NDVI, LST and rainfall anomalies for drought. Trained and validated with Google Earth reference polygons and TAMASA yield data (CIMMYT).
- **Outputs:** Maize area, maize yield predictions and % of maize cropland affected by drought.
- **Why it matters:** Spatial outcome measures that can be linked to household survey data, but intercropping and small fields make maize harder to classify.

Takeaways: what remote sensing can contribute?

Alternative measurements do not exist

1

Filling data gaps

Provides wall-to-wall spatial and temporal coverage where survey data don't exist.

E.g. Nigeria: maize and drought mapping

2

Historical reconstruction

Enables historical reconstruction of land use, crop patterns and flood events.

E.g. Bangladesh rice

Alternative measurements are incomplete or flawed

3

Validating survey data

Offers an independent measure to detect and correct errors in self-reported data (e.g., yields, cultivated area).

E.g. India: zero tillage, Nigeria

Cost-saving potential from integrating EO

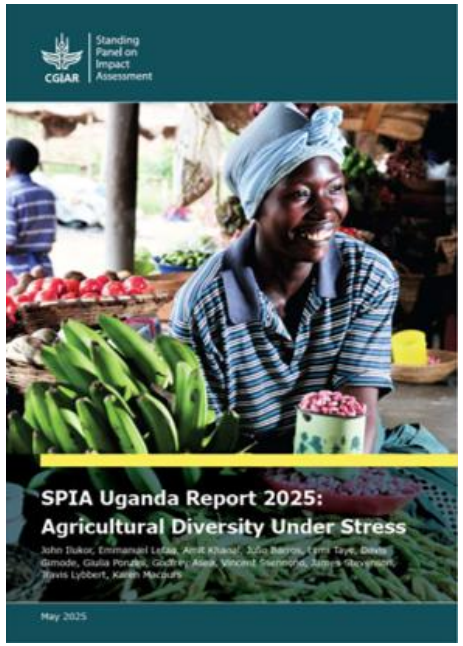
4

Remote monitoring

Supports cost-effective monitoring in inaccessible or conflict-prone areas.

Links of interest

SPIA reports
All publications



Scan to open

Remote sensing for IE
Guidelines for One CGIAR (2023)



Scan to open

SPIA blog on remote sensing
Insights from the country studies



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