Combining geo-spatial data with traditional evaluation techniques

Serving Society with Space Data
Web series, 16 September 2020
Space Enabled Research Group (Massachusetts Institute of Technology) and Secure World Foundation

Hansdeep Khaira
Evaluation Officer
Independent Office of Evaluation
IFAD

Independent Office of Evaluation

IFAD
Investing in rural people

Organization of the presentation

- Use of geo-spatial data within the evaluation
  - Why
  - How
- Challenges
- Lessons learned, potential extensions, and future work

Project evaluation

Developmental goal

- Increase assets and incomes of rural farmers

Project objective

- Rehabilitation of dilapidated irrigation canals to bring water to farms and increase agricultural production

Objective of evaluation

- Measure the economic changes in the lives of project beneficiaries using income and changes in agricultural production

Approach

- Ex-post quasi-experimental impact evaluation using a household survey

Use of space data

Used in combination with household (HH) survey for:

- Sample selection
- Validate the results of household survey i.e. triangulation of data

Use of geospatial data for Sampling

Use: for selecting comparison (control) group

Challenge

No random assignment at baseline.

Lack of adequate baseline data.

Solution: Match on cluster level (village) geo-spatial characteristics*:*

- Average elevation
- Distance to a primary road
- Distance to a secondary road
- Distance to a tertiary road
- Area of the district
- Koppen climate classification

Use of geospatial data for validating results of household survey

Purpose. To triangulate results from household survey for key outcome variable – assess the change in agricultural land area due to project interventions.

Objective of analysis. Estimating magnitude & significance of difference in land cover based on temporal variations (between project baseline 2012 and endline 2015) using a counterfactual (project treated v/s non-treated areas).

The normalised difference vegetation index (NDVI) was used to estimate the change (estimating change in 'greenness' of targeted land area)

Use of geospatial data for validating results of household survey

Data: Analysis was performed using 250-m NASA MODIS NDVI product (8 days) from 2004 to 2016 (Freely available using Google Earth)

The **methodology** applied is derived from the "**Before/After Control/Impact 'BACI' contrast** presented in a recent research paper.

The rationale was that project interventions will cause a **different pattern of change** from before to after the treatment compared with similar areas not treated by the project.

R program was used to run the algorithm

Use of geospatial data for validating results of household survey

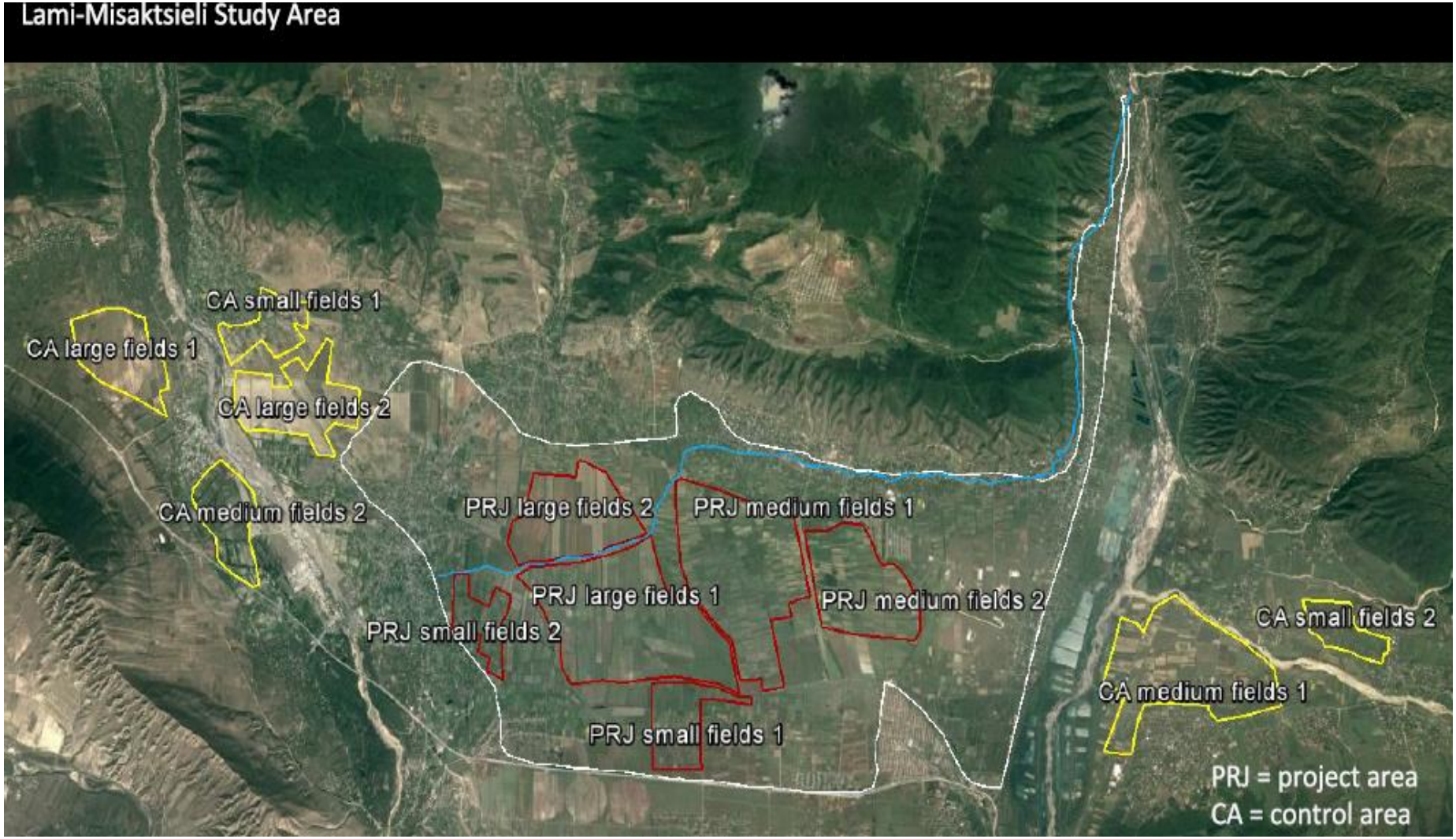
Sampling strategy. Five irrigation schemes. Farm plots split into three sizes: small (< 2ha), medium (2-10ha) large (> 10ha) - to understand better the effect on different types of farmers.

Selection of non-treated sites based on:

- Similar land cover;
- Geographic proximity;
- Not subjected to intervention;
- Randomly selected.

Project-supported irrigation schemes

Project & control areas of a selected scheme



Results

Perimeter name	Zone	BACI index (contrast)	Relative contrast %	P-value	Before and After Time-frame
Does-Grakali	full area	**-0.0052**	-0.73	0.0080061	2011-13vs2014-16
Does-Grakali	medium fields	**-0.0155**	-2.16	0.0002820	2011-13vs2014-16
Does-Grakali	small fields	**-0.0067**	-0.89	0.2066130	2011-13vs2014-16
Lami-Misaktsieli	full area	0.0024	0.34	0.0000150	2011-13vs2014-16
Lami-Misaktsieli	large fields	**-0.035**	-4.9	0.0892510	2011-13vs2014-16
Lami-Misaktsieli	medium fields	0.0203	2.89	0.0000470	2011-13vs2014-16
Lami-Misaktsieli	small fields	0.0036	0.48	0.0004710	2011-13vs2014-16
Karagaji	full area	0.0216	2.98	0.0001090	2012-14vs2015-16
Karagaji	small fields	-0.0031	-0.41	0.0058530	2012-14vs2015-16
Metehki	full area	0.0065	0.85	0.2082250	2012-14vs2015-16
Metehki	small fields	**-0.0113**	-1.45	0.0001110	2012-14vs2015-16
Dzevera-Shertuli	full area	0.0043	0.61	0.0145280	2013-15vs2016
Dzevera-Shertuli	medium fields	0.0595	9.24	0.3925540	2013-15vs2016
Dzevera-Shertuli	small fields	**-0.0044**	-0.63	0.0140050	2013-15vs2016

Negative BACI contrasts (in **bold**) - **Positive impact**

Green background is used to highlight negative BACI contrasts that are significant at the 0.05 P-value

Light green background is used to highlight negative BACI contrasts that are very close to significant 0.05 P-value

Grey background indicates a non-significant/no BACI effect.

Conclusions

- The results obtained from geo-spatial analysis were similar to those from HH survey (i.e. minor increase in area of crop production).

- Both geo-spatial analysis and HH surveys showed positive project effect on smallholder farmers.

- Based on the success of geo-spatial analysis it was later used by us as a standalone method (and not just for triangulation)

Challenges and lessons learned

- Accurate geographic **coordinates** are a key prerequisite in monitoring and evaluation of specific areas (i.e. non-national level). But these may not always be easily available unless there is a good M&E system (national, project) in place.
- While downloading of data is free, specific technical **skills** are required to use it
- The application of the methodology to a complex environment such as an irrigated area can face **significant challenges** in explaining the change (change in vegetation greenness or switch of cropping patterns).
- **A well-designed field visit is essential to explain the confounding factors** (e.g. crop rotation, crop change, field context etc.).

End of presentation

Thank you.