THE UNIVERSITY of EDINBURGH
School of GeoSciences

BETTER DATA FOR GEOGRAPHIC TARGETING OF RESOURCES: THE ROLE OF EARTH OBSERVATION DATA FOR MAPPING SOCIAL AND ECONOMIC CONDITIONS.

EGU 2020

Dr. Gary R Watmough

Interdisciplinary Lecturer in Land Use and Socio-ecological Systems

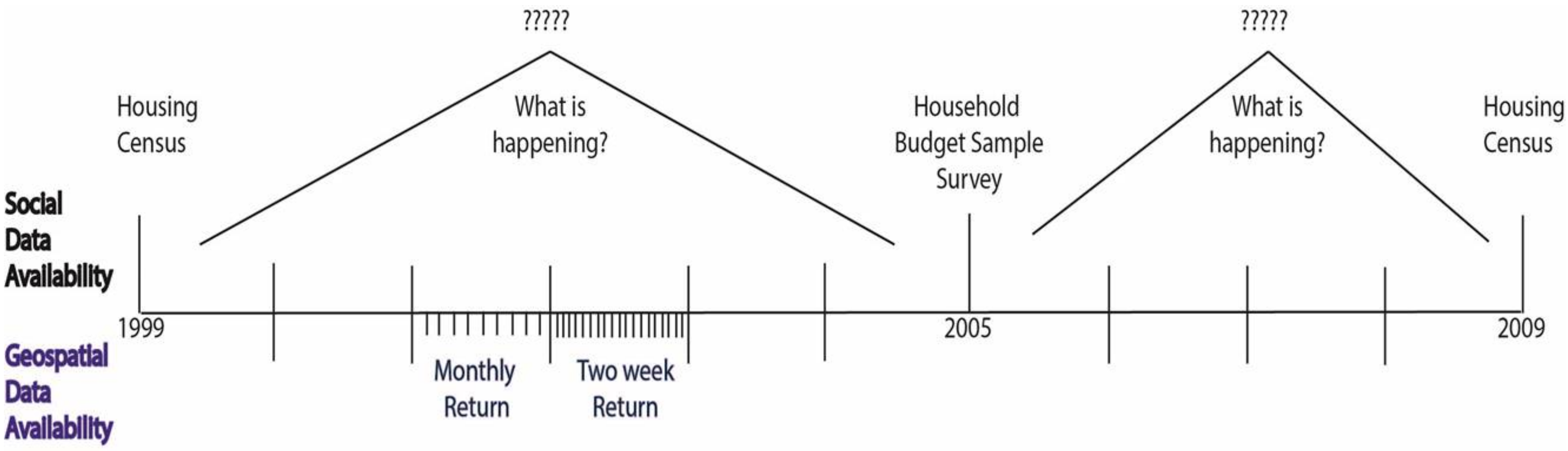
How to achieve the SDGs?

- Examining the role of Remote Sensing of land use and ecosystem services in mapping and monitoring deprivation
- Building evidence for socioeconomic indicators
- Monitoring socioeconomic aspects of SDGs:
  - Census – 10 years
  - Demographic and Health Survey - 5 years
  - Living Standards Survey – 5 Years
  - Consumption Survey - Annual

$253 Billion

Jerven (2014)

Missing Data: Monitoring socioeconomic conditions

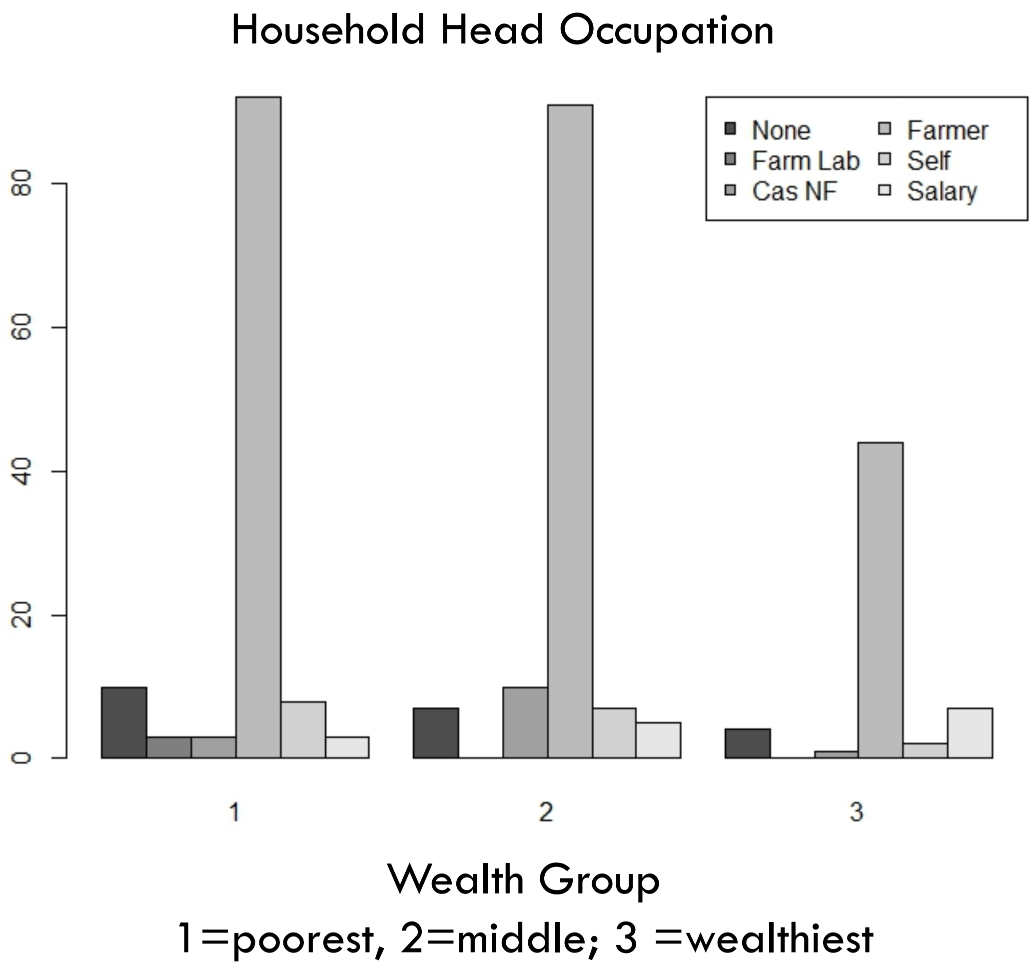


Cannot achieve SDGs if we rely on surveys once every five years.

Without annual data we can see changes have happened but can miss what drives these changes

Can remote sensing data help?

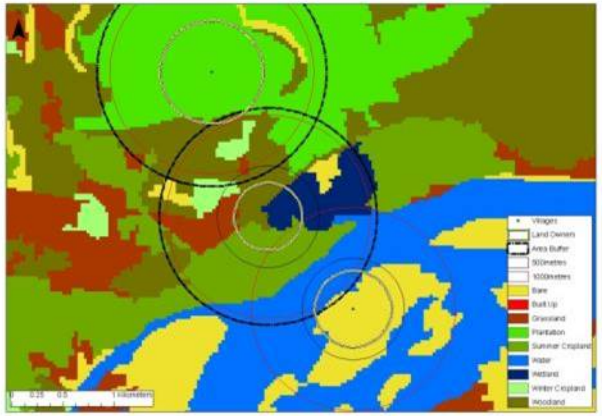
Link to environmental resources



In many rural areas of developing countries agriculture and environmental resources still contribute large amount to livelihoods.

So can we say something about socioeconomic conditions by mapping landscapes and changes in landscapes at fine spatial and temporal resolution?

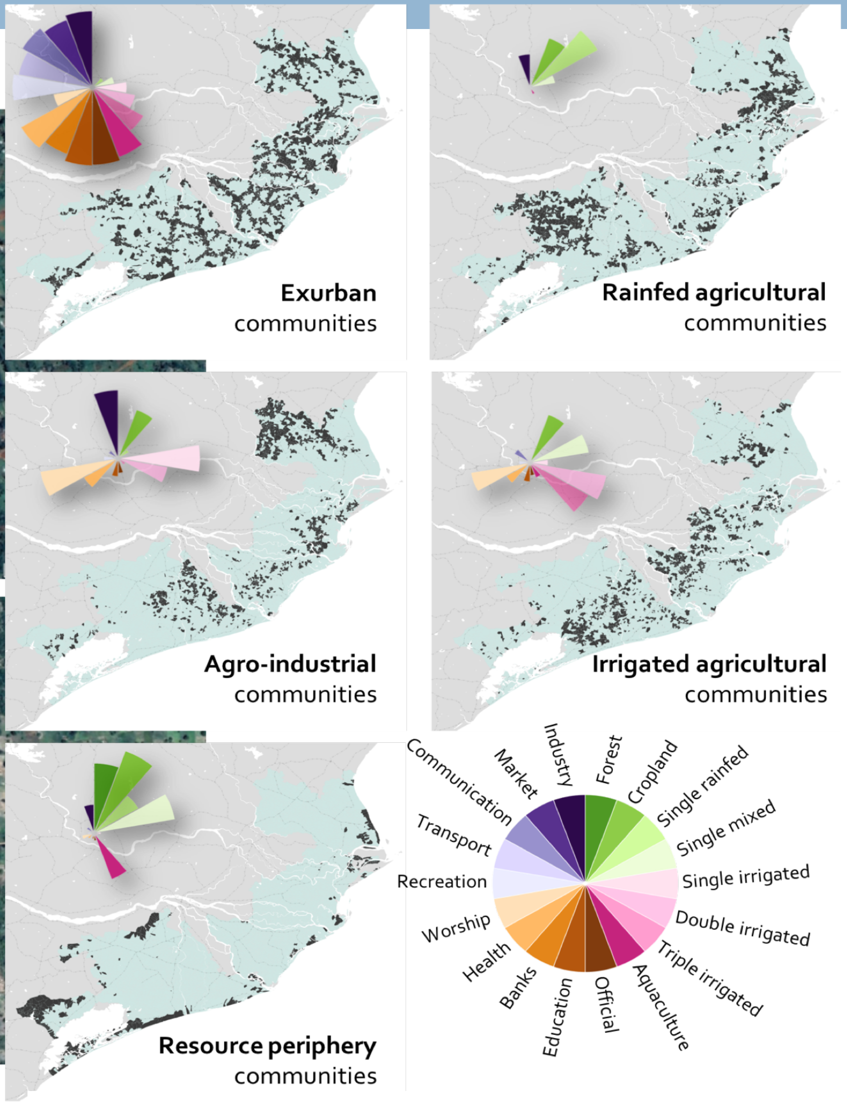
Past studies examining rural wellbeing using EO data



- 53 - 61% accuracy in Assam
  - Watmough et al. 2016
- 50-61% accuracy in Kenya
  - Watmough et al. 2019
- 30-50% accuracy in Sri Lanka
  - Engstrom et al. 2016
- 37-75% accuracy in SSA
  - Jean et al. 2016

- If can predict poverty from RS data can consider using it to fill some gaps in socioeconomic datasets

Complexity: different methods across space and time



Berchoux et al. 2019 Landscape and Urban Planning

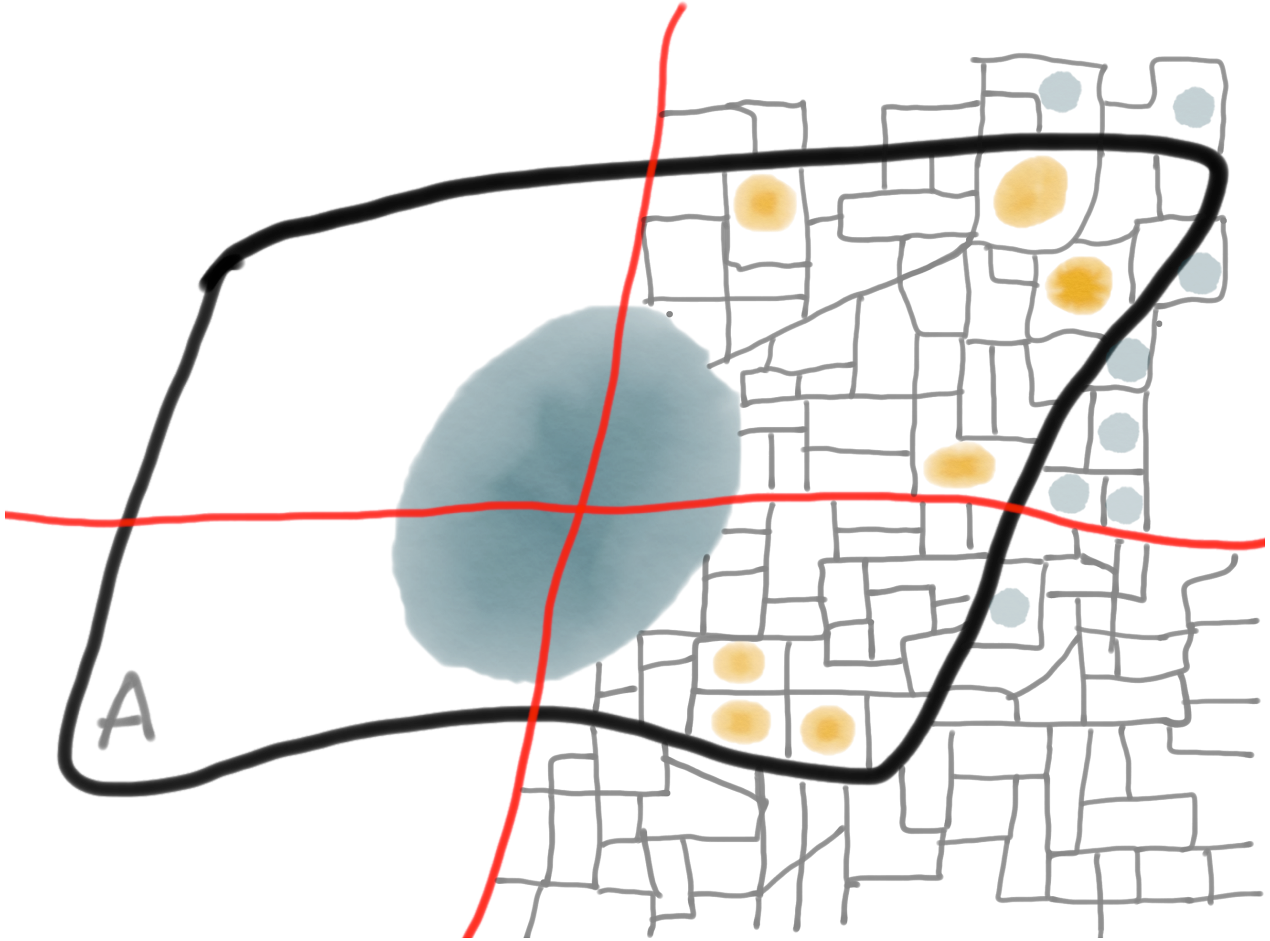
Communities and regions differ

Some are isolated, some well connected,

some rely on agriculture some on forestry

Need to consider this when using EO data to estimate socioeconomic conditions as we need to identify different characteristics in data.

Complexity



Watmough & Marcinko (in review)

Existing approaches do not always consider complexity.

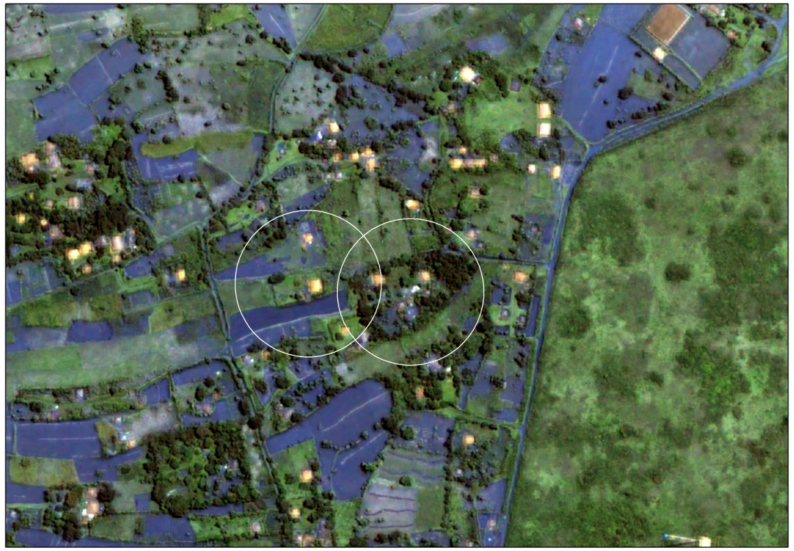
The village boundary (black line) would be the extent of the analysis so anything within this polygon would be considered as part of the model to estimate poverty/wellbeing anything outside of the black line would be considered to belong to a different village or if not in a village boundary may be ignored. The fields with blue dots are owned by households belonging to village A but are outside of the boundary so these would be dropped from the analysis whilst fields inside the village boundary with orange dots are owned by households in neighbouring villages but these would be linked to village A in the statistical models

Multi-level approaches needed

Double (or worse) counting…

If using radial buffer zones around communities can end up with the same environmental resources linked to multiple households even though only one household is benefitting from these resources.

Watmough et al. 2019 tried to overcome this and had some success but complex to implement.



Watmough et al. 2019

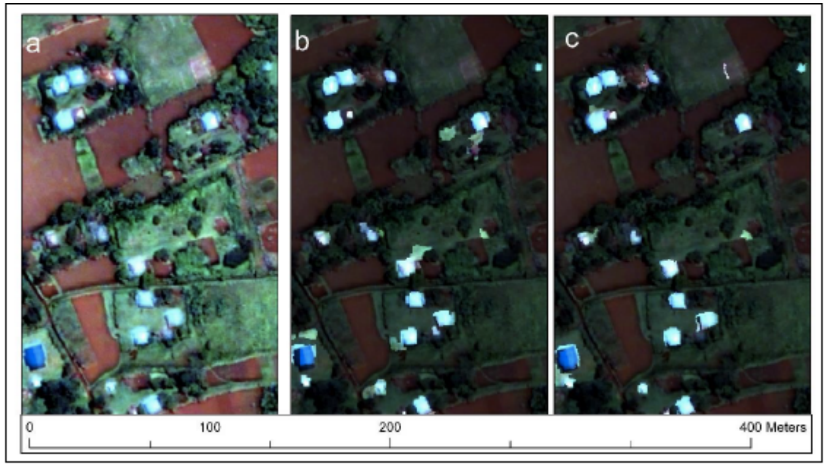
So need multiple EO data sources…

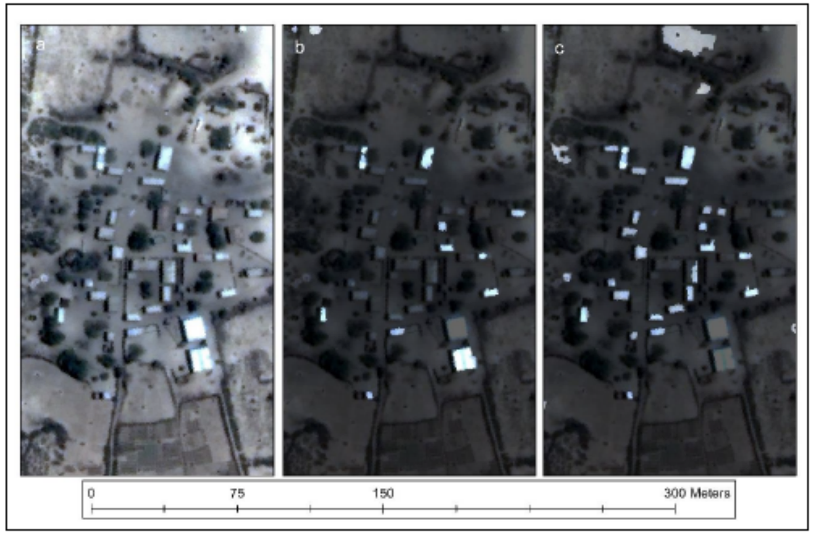
Level	Metric	Source	Proxy for
1 Homestead	% cover of; trees, grass, water, agriculture	Hi-res LULC map	Natural and Physical Capitals
1 Homestead	% cover of building, building area (m^2)	Hi-res LULC map	Financial &/or human capital
2 Agriculture	% cover of Agriculture	Hi-res LULC map	Physical Capital
3 CPR Resources	% cover of woodland, grassland, water	Hi-res LULC map	Natural Capital
3 CPR resources	Number of homesteads	Hi-res LULC map	Social capital
4 Village	Distance to all weather road	Hi-res LULC map	Physical capital
4 Village	Annual Length of Growing Season in 2005 and 2006	MODIS NDVI time series	Physical Capital

Watmough et al. 2019

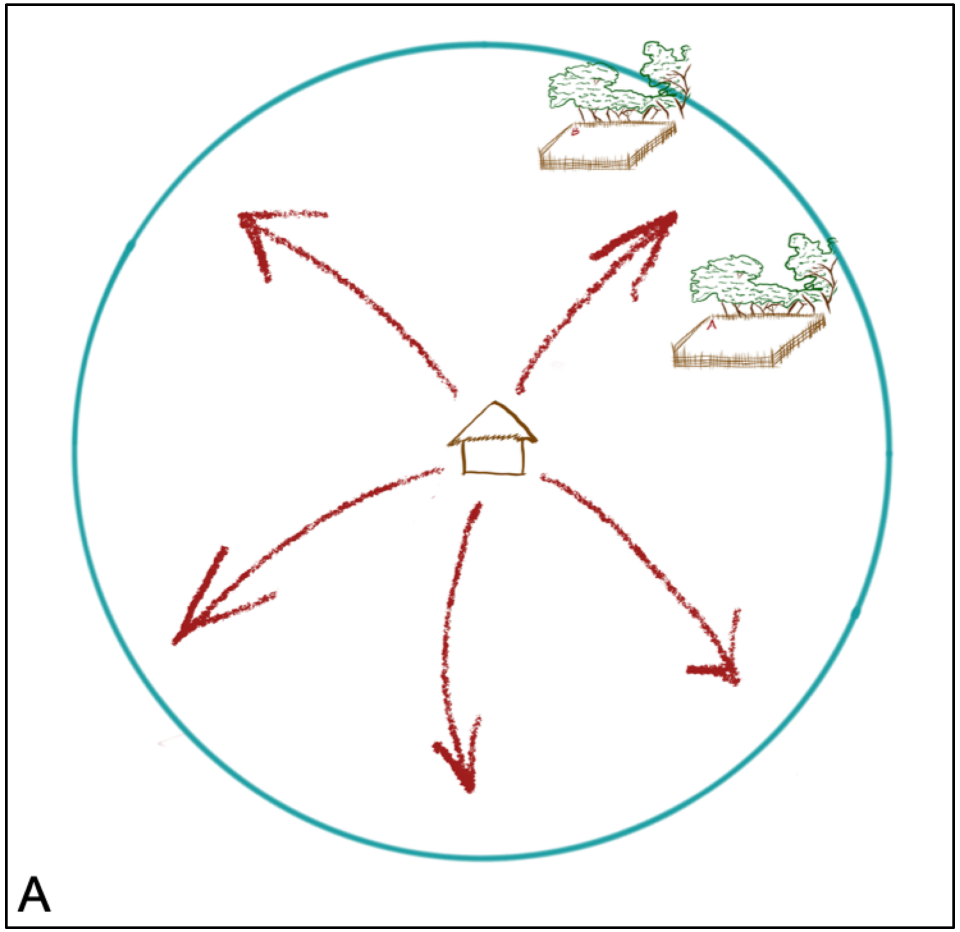
What should we look for?

- Standardised approaches?
- Standardised metrics from EO data?
- Buildings are not seasonal so should be consistent overtime.
  - Is this something to focus on?
  - Roof material type might be better but what about change over time, once have a good roof it doesnt change?
- Need other ideas for measuring change in socioeconomics from EO data





Next steps: How people interact with the land?



We often look at how far households travel to fields or to collect fire wood and use this to identify the area around the households that should be considered.

But its unlikely households travel 5 km in any direction as fields could be in one particular direction.

Can we use volunteered geographic data or mobile phone tracking to identify household movements? Is this ethical?

It would certainly help refine the models.

Watmough & Marcinko (in review)

Summary

- Cannot achieve SDGs if we rely on surveys once everyone 5 years.
- EO data increasingly used to look at wellbeing from space
- But need to think how this can be used to policy
- Power to provide data at high frequency and in fine spatial resolution to support decision making.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 656811

References

- Berchoux, T., et al. (2019b). Landscape and Urban Planning Agricultural shocks and drivers of livelihood precariousness across Indian rural communities. *Landscape and Urban Planning*, 189, 307–319. https://doi.org/10.1016/j.landurbplan.2019.04.014
- Engstrom, R., et al. (2017). Poverty from Space: Using High-Resolution Satellite Imagery for Estimating Economic Well-Being, *Policy Research working paper; no. WPS 8284; Washington, D.C. : World Bank Group*. Retrieved from http://econ.worldbank.org.
- Jean, N., et al. (2016). Combining satellite imagery and machine learning to predict poverty. *Science*, *353*(6301).
- Jerven, M. (2014). Data for Development. Assessment Paper: Benefits and Costs of the Data for Development Targets for the Post-2015 Development Agenda. *Data for Development Working Paper,* September 16, 2014.
- Watmough & Marcinko (in review) Towards achieving the UN's Data Revolution: Combining Earth Observation and socioeconomic data for geographic targeting of resources for the Sustainable Development Goals, Chapter 14 in Dunn & Balaprakash (eds) *Data Science applied to Sustainability Analysis*, Elsevier.
- Watmough, G. R., et al. (2016). Understanding the Evidence Base for Poverty-Environment Relationships using Remotely Sensed Satellite Data: An Example from Assam, India. *World Development*, *78*. https://doi.org/10.1016/j.worlddev.2015.10.031
- Watmough, G. R., et al. (2019). Socioecologically informed use of remote sensing data to predict rural household poverty. *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.1812969116