Harnessing the potential of remote sensing for tracking adoption of agricultural practices

Ground truth …. Or how to lie with maps?:

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Introduction

- Opportunities for using remote sensing to evaluate adoption and impact are expanding rapidly
- But huge challenges remain
- What are the developments or trends that are responding to these challenges?
- Ex-ante and ex-post impact assessment using remote sensing and spatial analysis

Ex-ante remote sensing and GIS tools and methods for evaluating adoption and impact

Targeting genotypes: targeting uses spatial analysis with land cover or land use derived from remote sensing

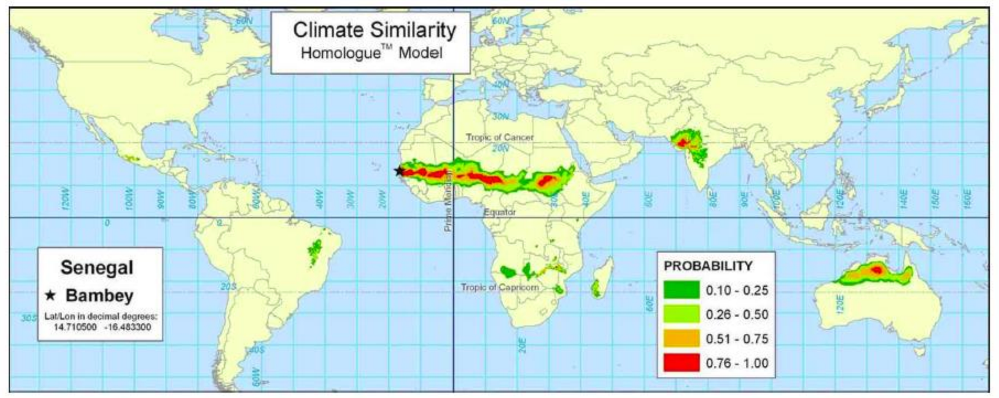


FIGURE 3 | The Homologue model showing areas similar in climate to Bambey, Senegal.

Hyman, G., Hodson, D. and Jones, P., 2013. Spatial analysis to support geographic targeting of genotypes to environments. *Frontiers in physiology*,*4*.

Annicchiarico,P., Bellah, F., Hand Chiai,T. (2006).Repeatable genotype x location interactions and its exploitation by conventional and GIS-based cultivar recommendation for durum wheat in Algeria. *Eur.J.Agron.* 24,

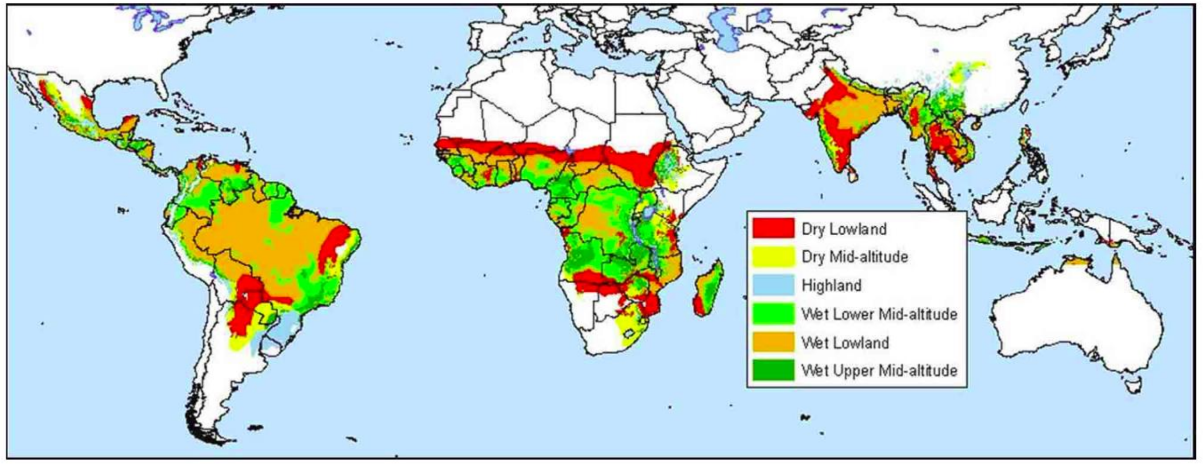
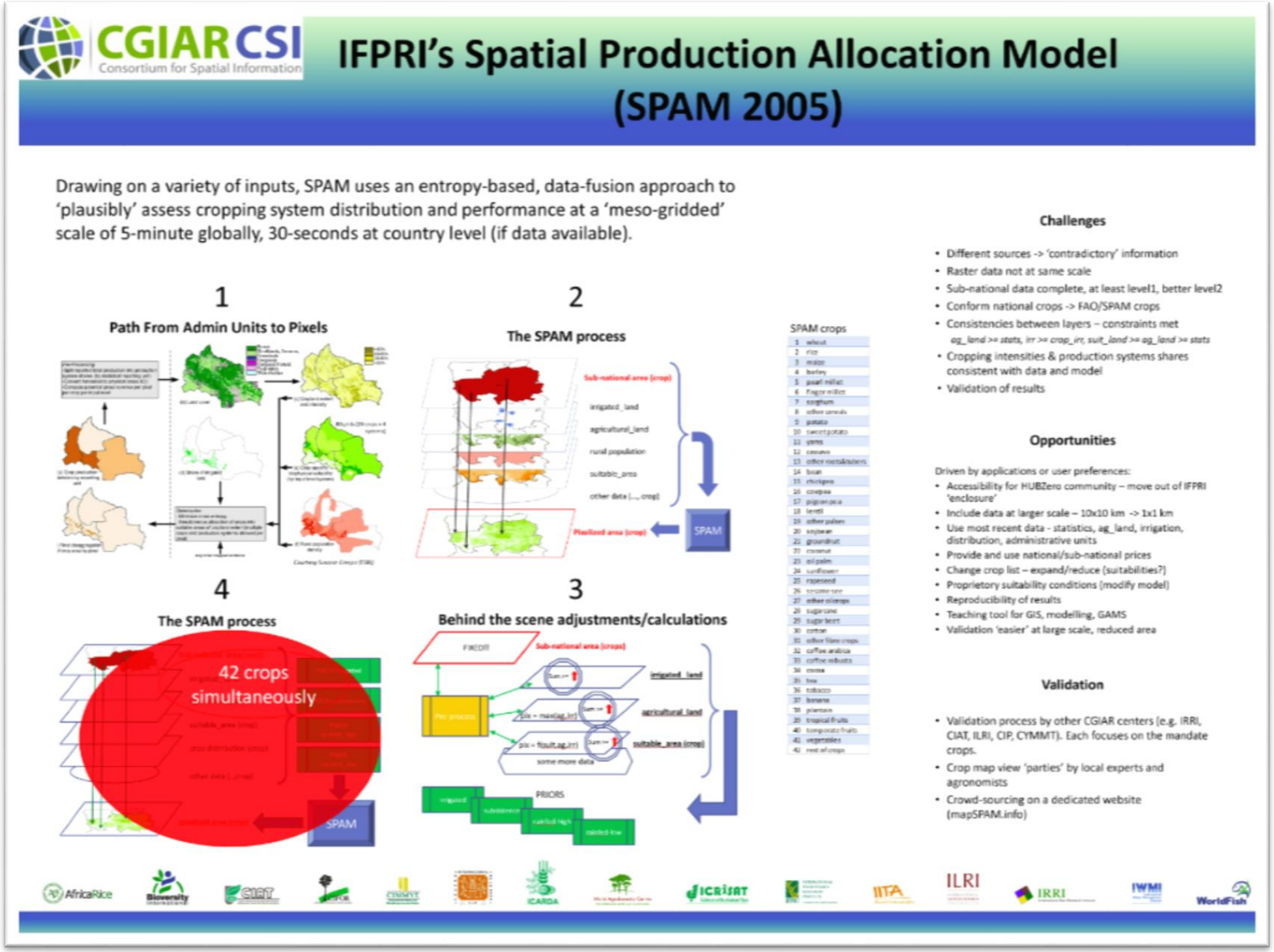


FIGURE 6 | Maize mega-environments.

Global crop distribution models combine land use derived from remote sensing with production statistics and other spatial data

- SPAM
- Monfreda et al.,
- Many others



You, Liangzhi, and Stanley Wood. "An entropy approach to spatial disaggregation of agricultural production." *Agricultural Systems* 90.1 (2006): 329-347.

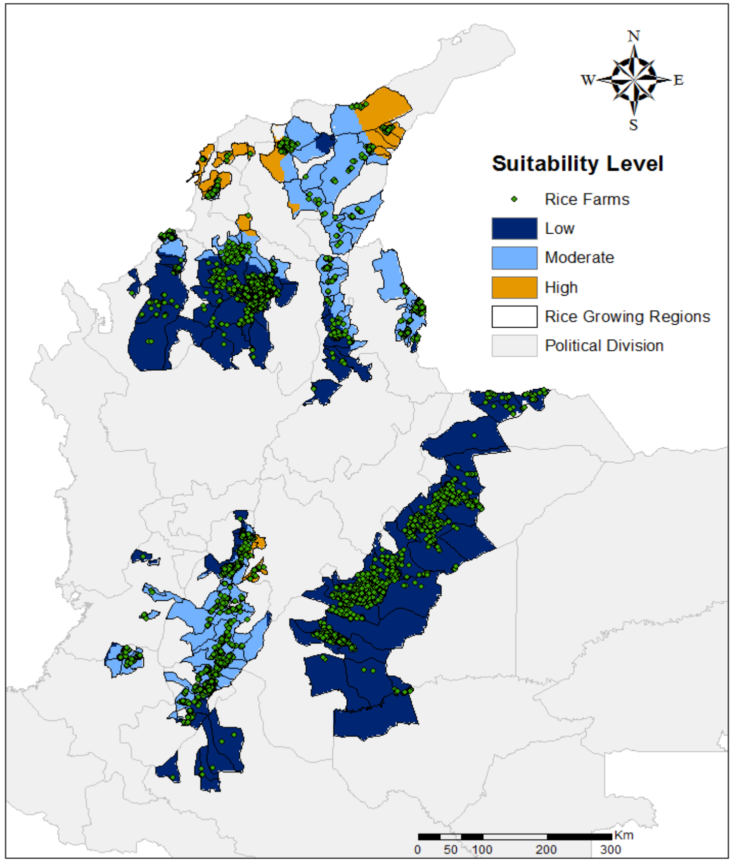
http://mapspam.info/methodology/

Finding the "sweet spot"

Where might alternate wetting and drying (AWD) systems be developed? Based on work from IRRI. Uses rainfall, temperature and radiation data from remote sensing

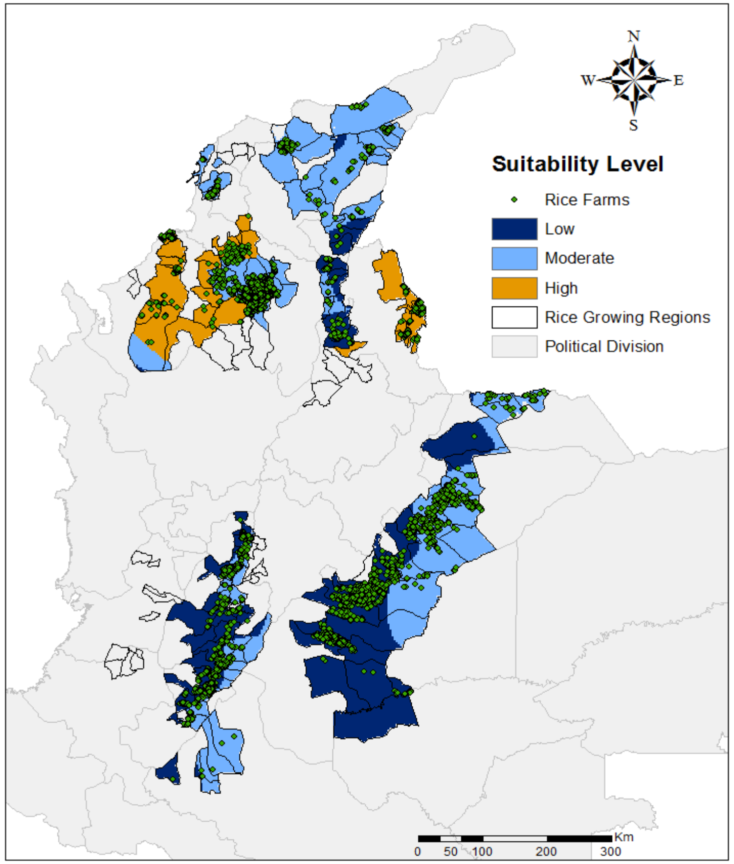
FEDEARROZ
FONDO NACIONAL DEL ARROZ

1st Semester



Suitability Level	Rice Farms Area (ha)	Area (%)
Low	131,216	63
Moderate	72,898	35
High	4,166	2

2nd Semester



Suitability Level	Rice Farms Area (ha)	Area (%)
Low	120,254	60
Moderate	64,136	32
High	16,034	8

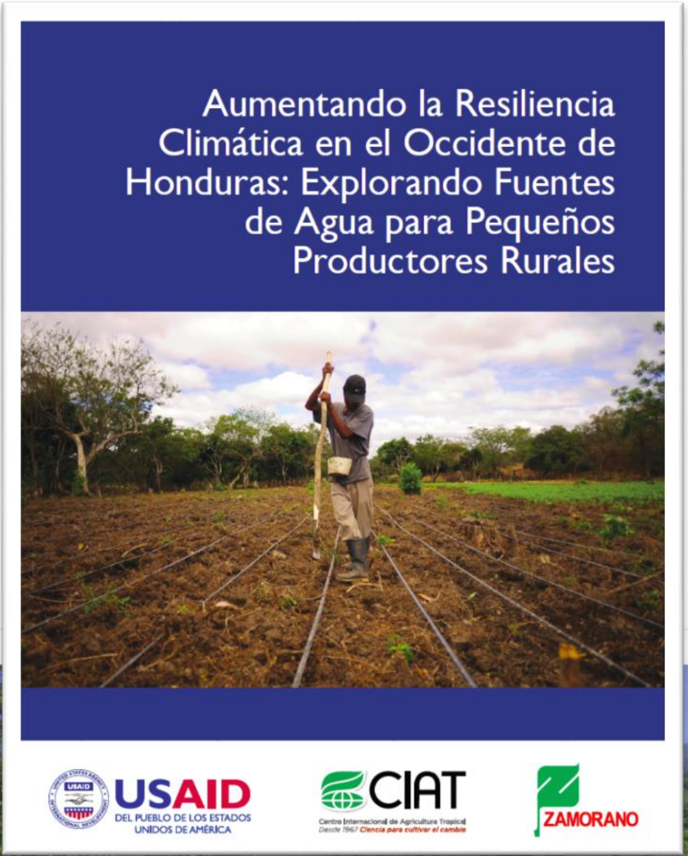
Colombia - Suitability Maps: Current Scenario

Conservation Agriculture?

Barrios et al. Manuscript in preparation

Where could smallholders adopt water harvesting?

Monserrate, Fredy, et al. "Aumentando la resiliencia climática en el occidente de Honduras: explorando fuentes de agua para pequeños productores rurales." (2016).



Reservorio de cosecha de agua lluvia para uso agrícola, Lempira, Honduras.

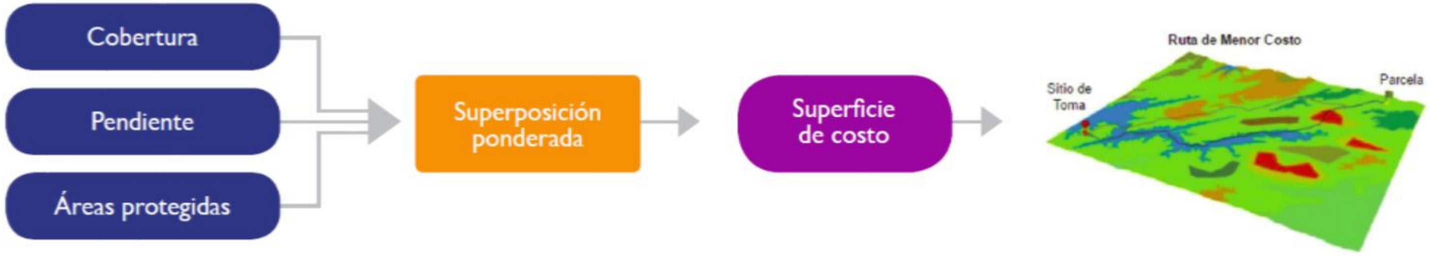
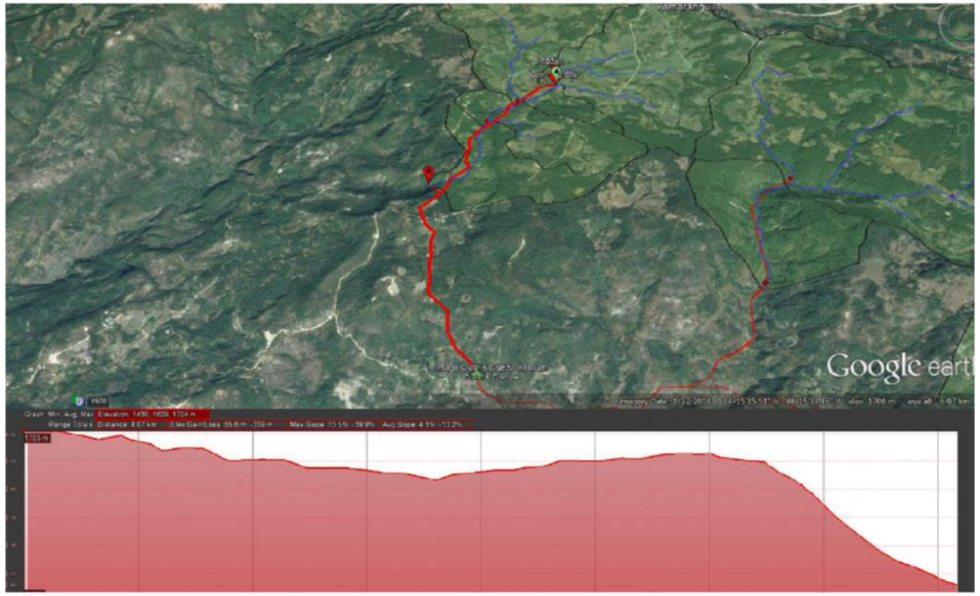
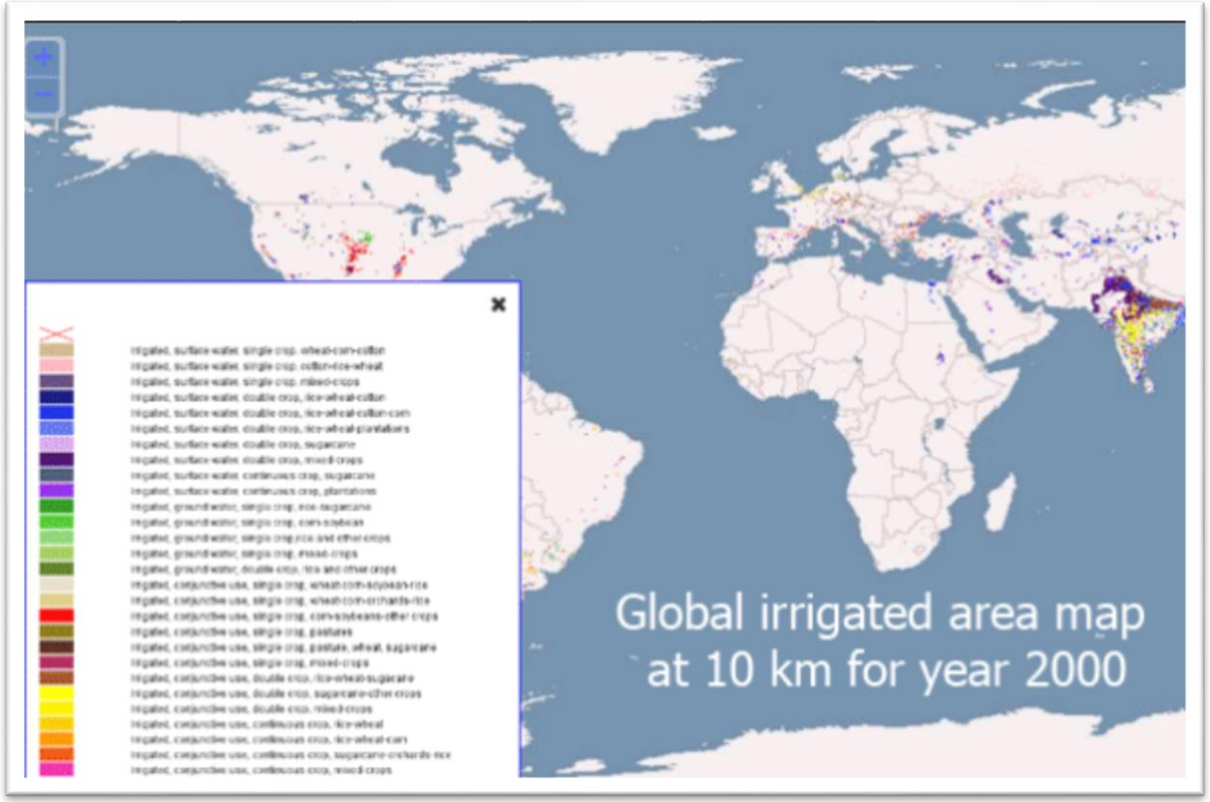


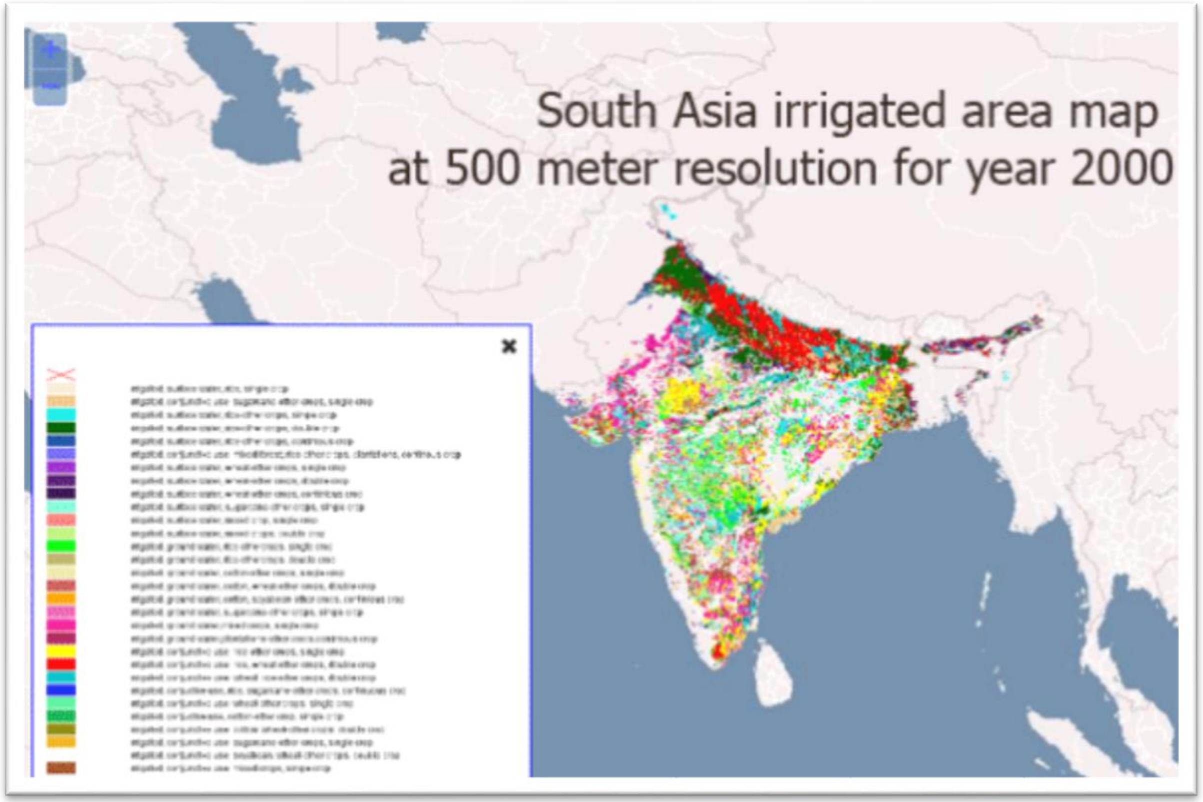
Figura 1-2. Diagrama general para determinar sitios de toma de agua. Fuente imagen (derecha): www.acolita.com



Ex-post remote sensing and GIS tools and methods for evaluating adoption and impact

Irrigation





Thenkabail, Prasad S., et al. "Global irrigated area map (GIAM), derived from remote sensing, for the end of the last millennium." *International Journal of Remote Sensing* 30.14 (2009): 3679-3733.

Natural resource monitoring-soil erosion

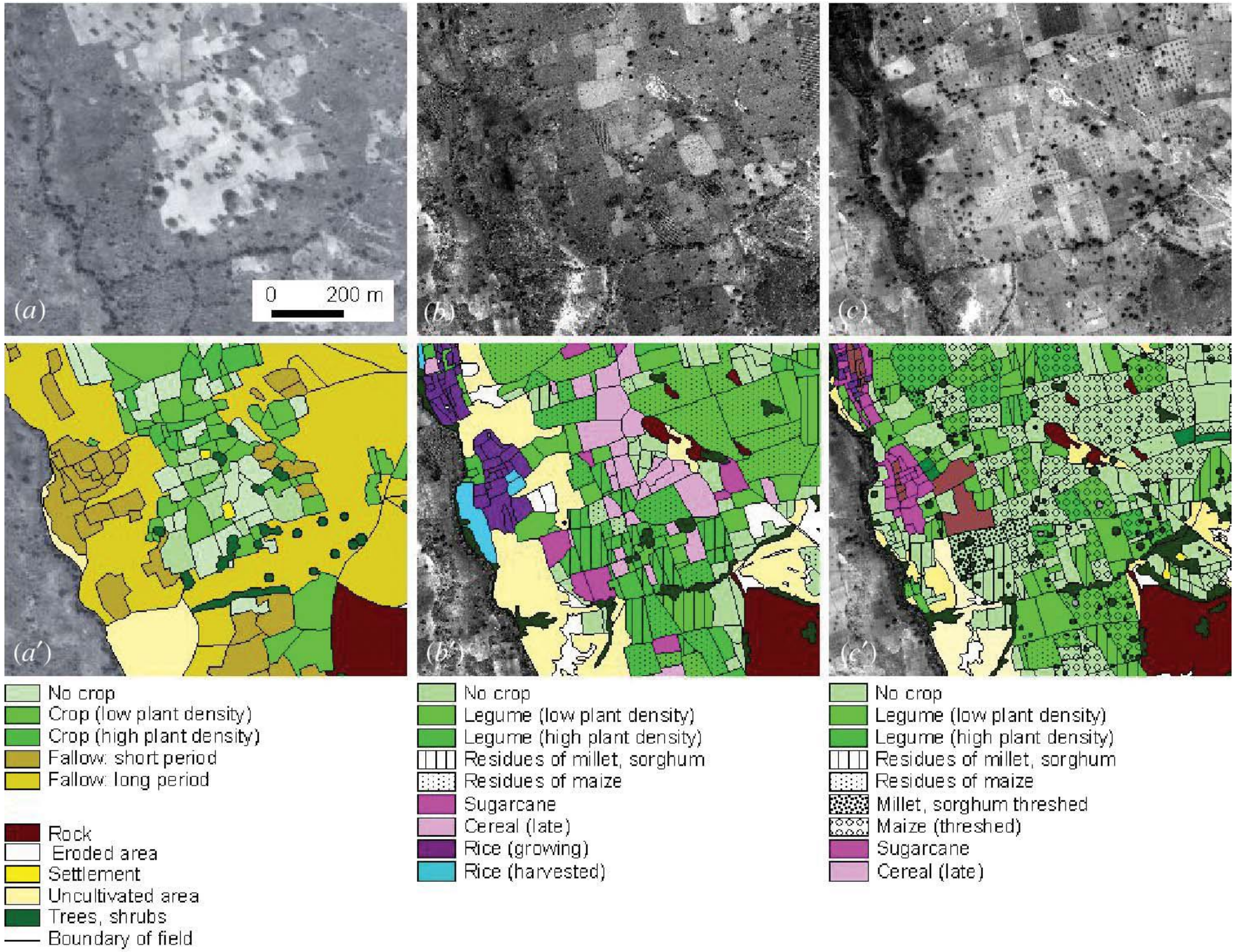
Kayawa, Nigeria

LULC using remote sensing data
).

a) Aerial photograph
(3 December 1962)

b) IKONOS
(2 September 2000)

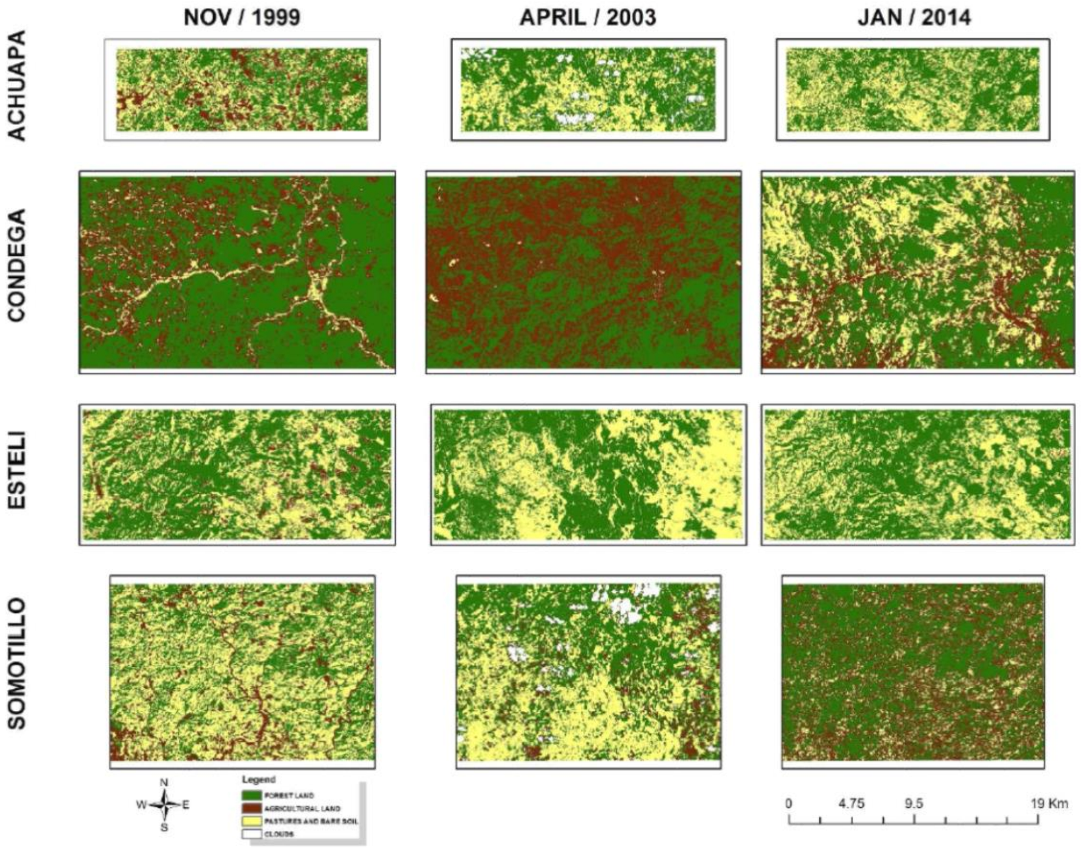
c) QuickBird
(29 December 2006)



Junge, B., et al. 2011. Use of remote sensing and GIS for improved natural resources management: case study from different agroecological zones of West Africa. *International Journal of Remote Sensing.* 31:23,6115-6141.

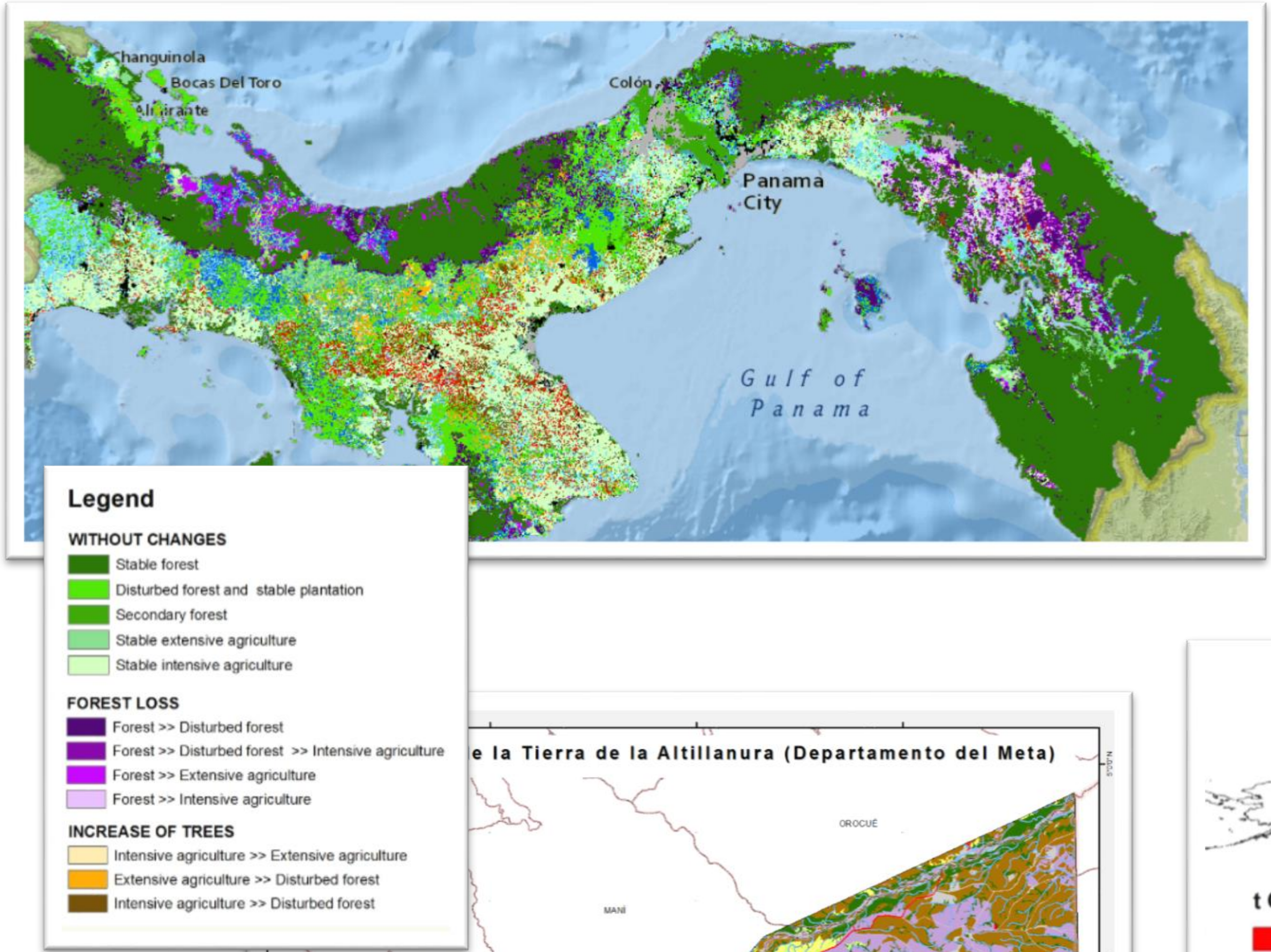
Slash and mulch agroforestry systems (Quesungual) in Central America

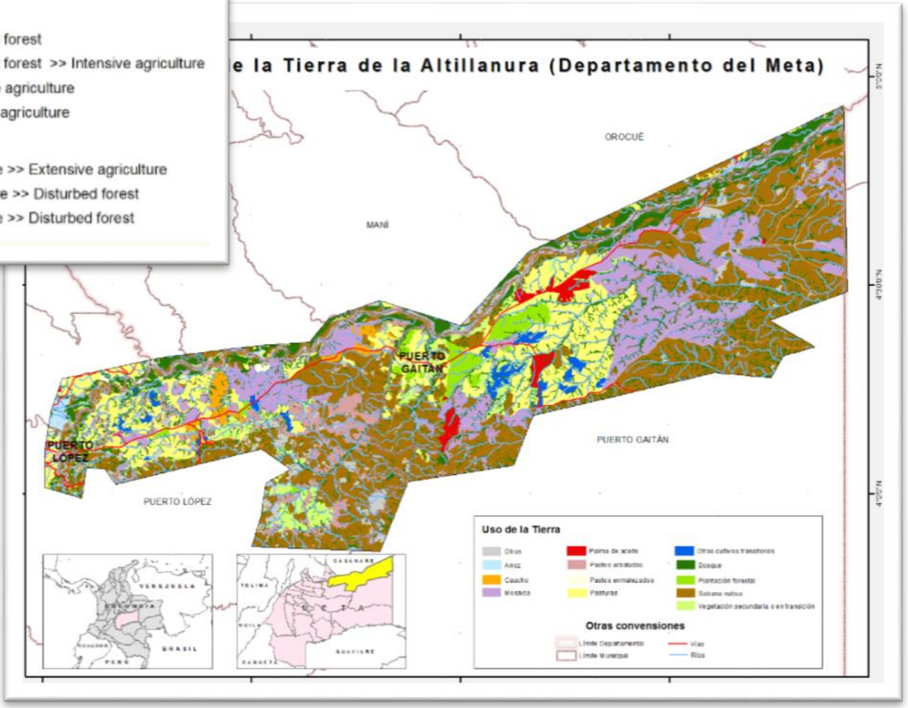
Example of the Quesungual slash and mulch agroforestry system
162x122mm (220 x 220 DPI)

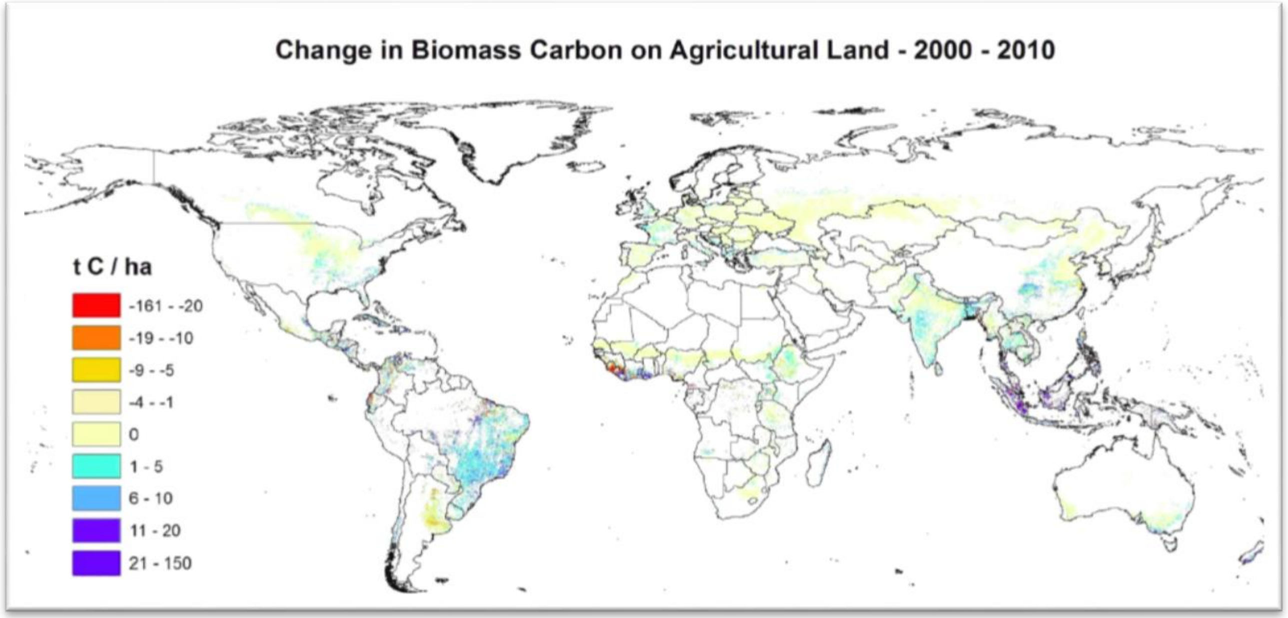


Summary of land cover changes in four sites in Nicaragua
279x215mm (300 x 300 DPI)

Remote sensing can identify agroforestry, but adoption is difficult to determine







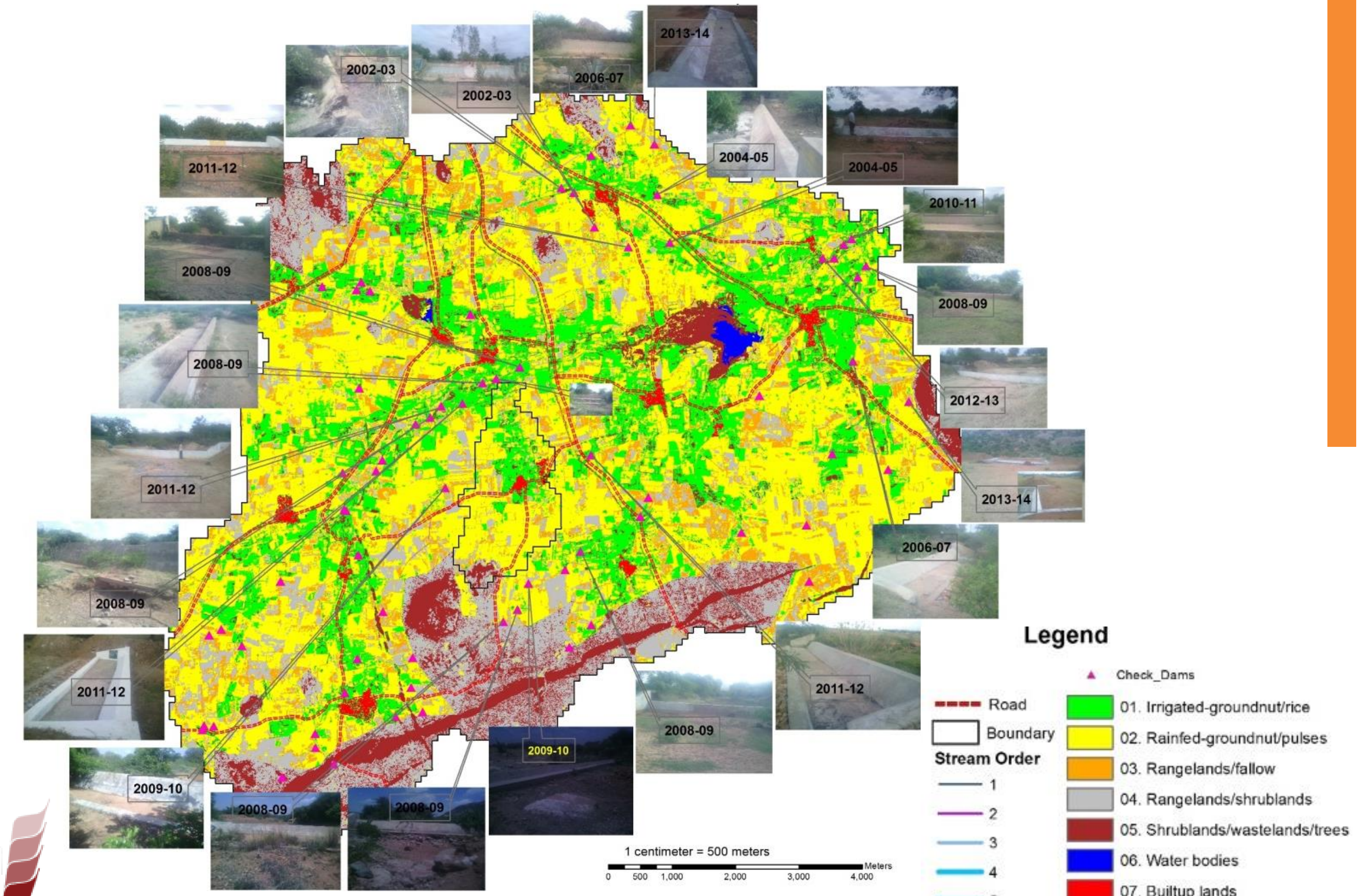
ZOMER, Robert J., et al. Global Tree Cover and Biomass Carbon on Agricultural Land: The contribution of agroforestry to global and national carbon budgets. *Scientific Reports*, 2016, vol. 6.

Tracking of NRM technologies

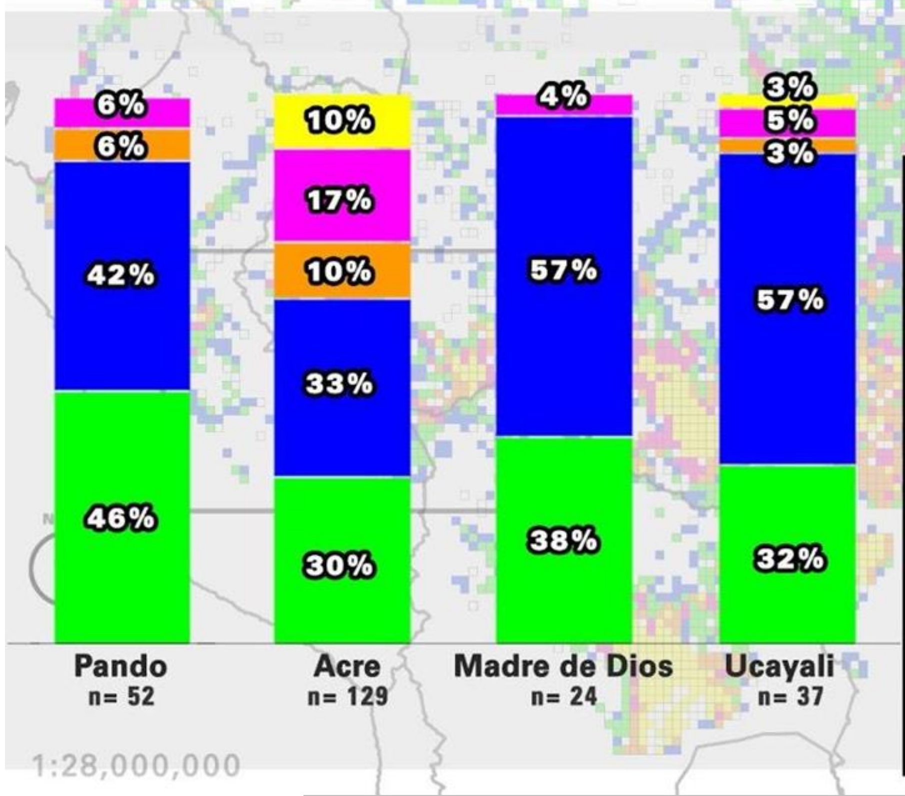
Adoption of water harvesting structures

Courtesy of Muralli Gumma, ICRISAT.

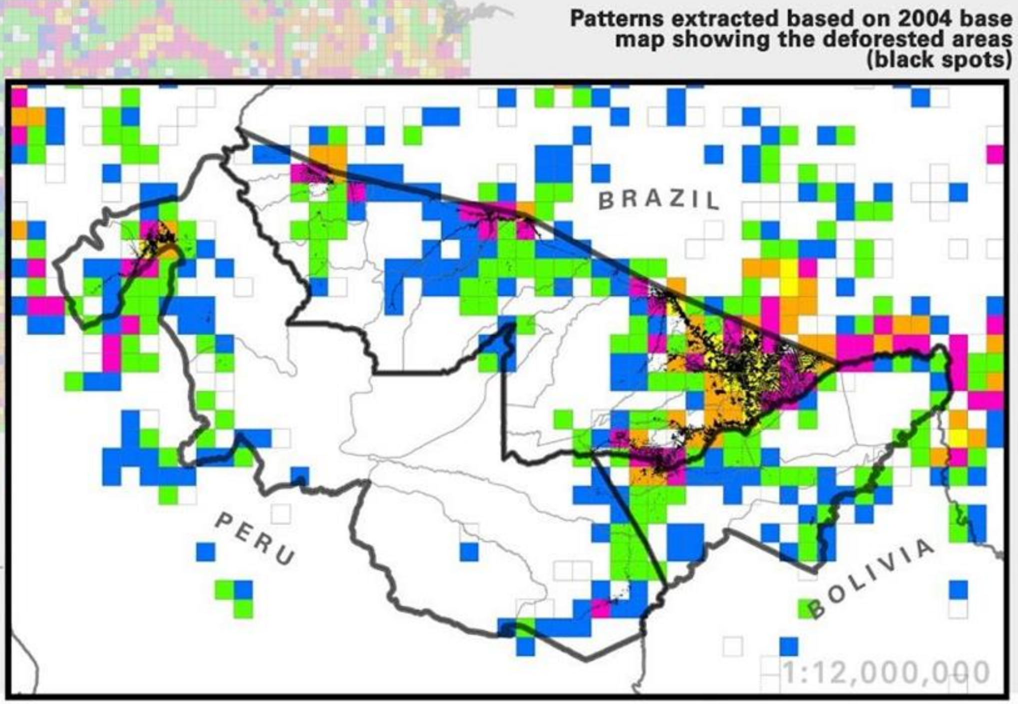
Ahmed, I. et al., 2016. Land use and agricultural change dynamics in SAT watersheds of southern India. *Current Science*. 110(9):1704-1709.

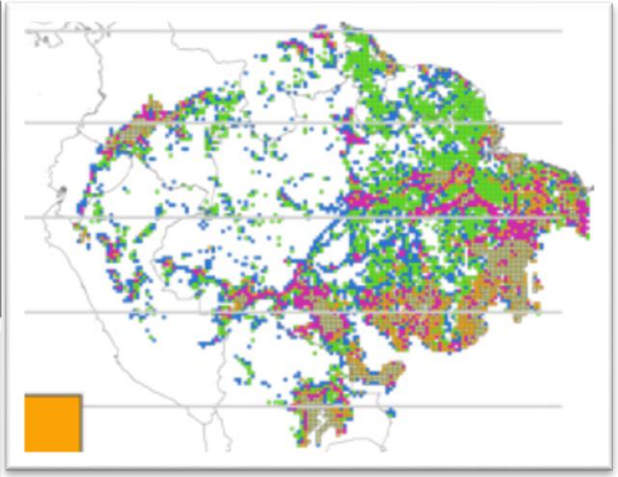


Patterns derived from remote sensing in the Amazon



Landscape metrics aggregated by 25km² cells





- Finding: Consolidated pattern in Acre (BR) may indicate forest loss due to commercial agriculture -

Chickpea expansion in Andhra Pradesh, India

Links image analysis to field surveys

Gumma et al., 2016. Satellite imagery and household survey for tracking chickpea adoption in Andhra Pradesh, India. Int'l Journal of Remote Sensing. 37(8):1955-1972.

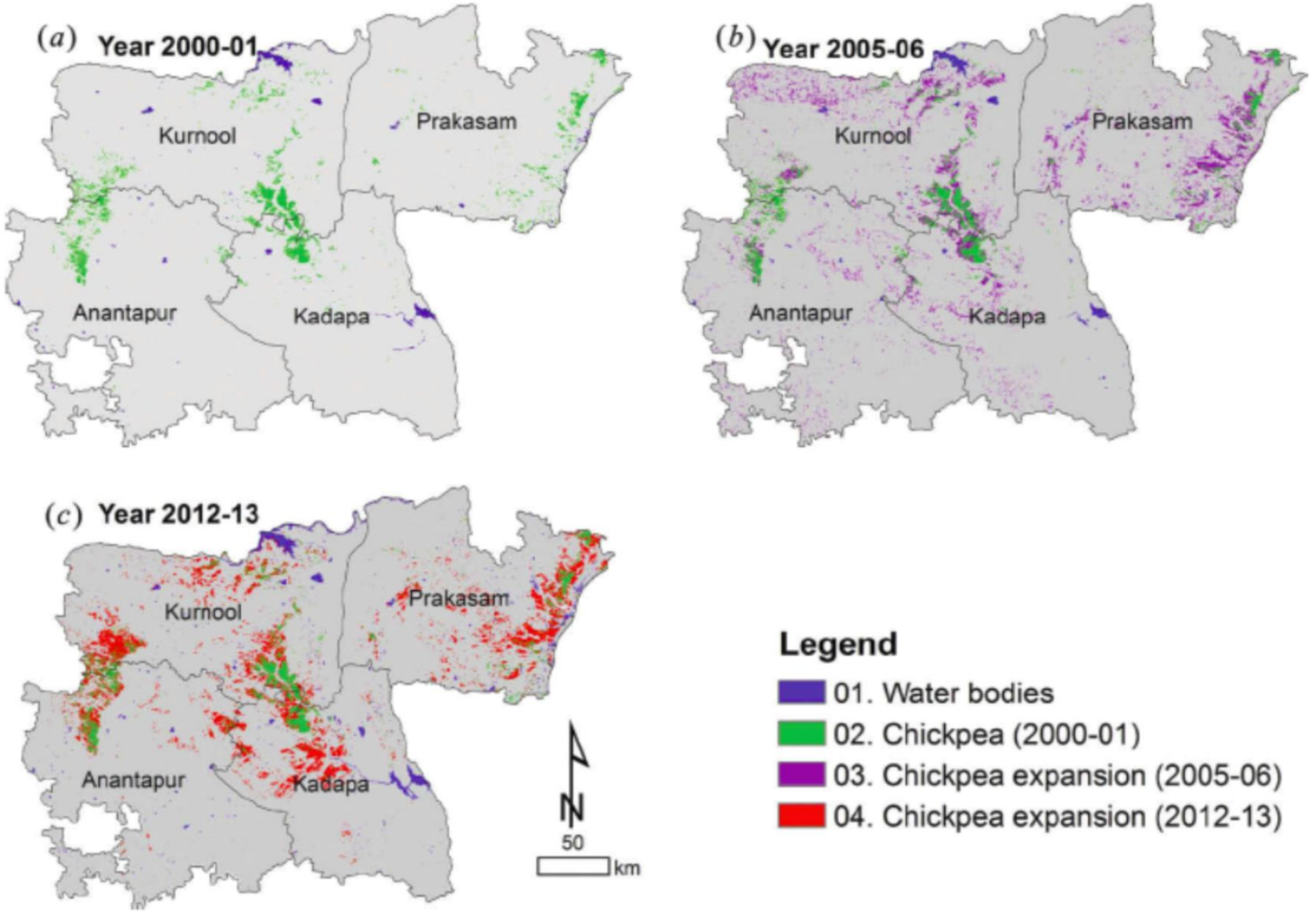
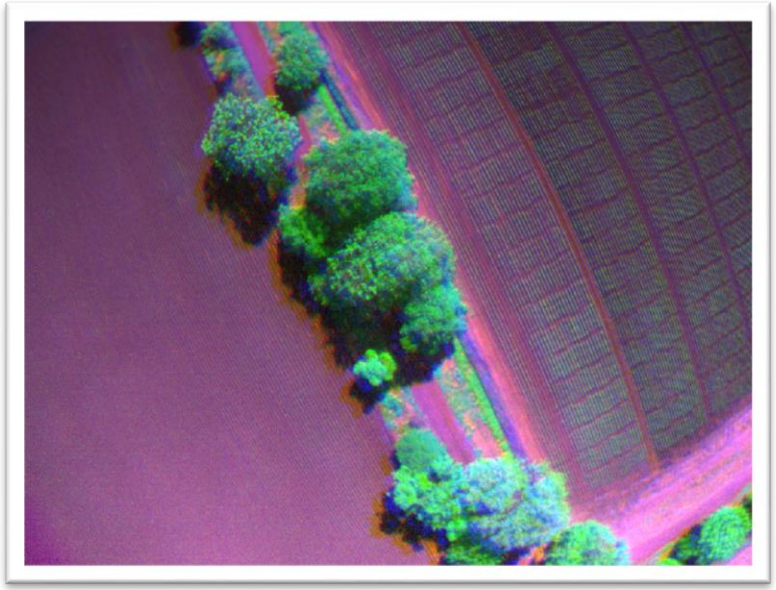


Figure 6. Spatial distribution of chickpea and expansion of chickpea cropped area from 2000–2001 to 2012–2013.

Drones



Other efforts and applications of RS for analysis of adoption

- No-till agriculture
- Residue and cover crop analysis
- Crowdsourcing (e.g. Geo-wiki)

Summary

- Irrigation, conservation agriculture, no-till agriculture, crop rotations, AWD are key applications
- Drones
- Very high resolution imagery
- Image analysis cannot capture the human intention part of the patterns that we see on the ground (e.g. Agroforestry)
- Crowdsourcing
- Combining image analysis with field survey

Thank you….