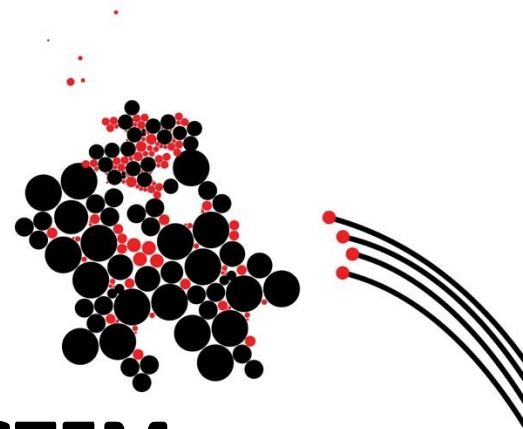


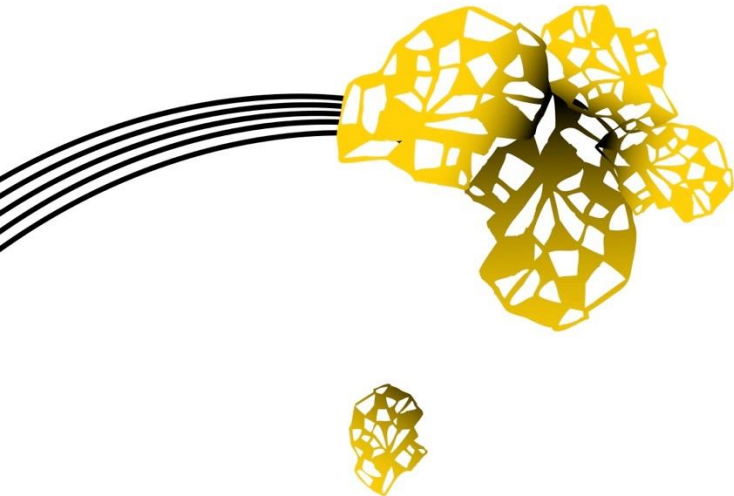
UNIVERSITY OF TWENTE.



AGGREGATE EFFECTS ON ECOSYSTEM SERVICES FROM CERTIFICATION OF TEA FARMING

Louise (Wieteke) Willemen, Neville Crossman,
Deanna Newsom, David Hughell, Johannes Hunink,
Jeff Milder

University of Adelaide, Rainforest Alliance, FutureWater



WORLD'S MOST CONSUMED BEVERAGE

SLM Incentives:

- Price premium for crop
- Improved access to markets
- Training, improved access to input

SLM practices

SLM uptake:

- Extension service
- Peers
- But..

- **Investment costs**
- **Implementation challenges**
- **Institutional, behavioral and cultural constraints**
- **Negative impacts on yield**



Income

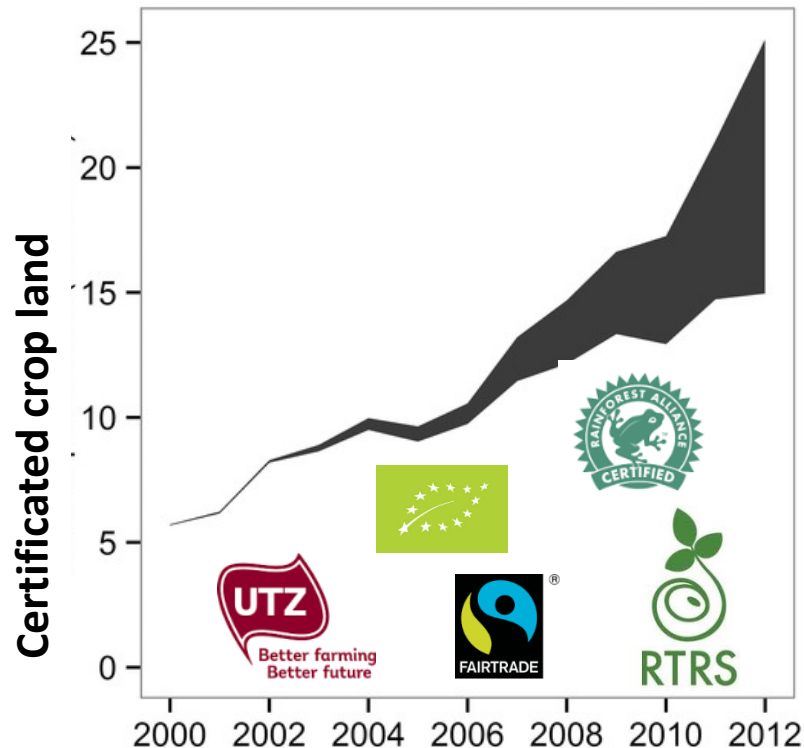
Runoff pollutes waterways

Decrease natural vegetation



CERTIFICATION: COMPLEMENTING POLICY

Private sector and civil society instrument → **environmental** conservation and improved livelihoods for rural **people**



Comply with Sustainable Agriculture Standard (SAN)

What is the evidence of impact, beyond farm level?

Estimate the aggregate ecosystem service effect of tea certification

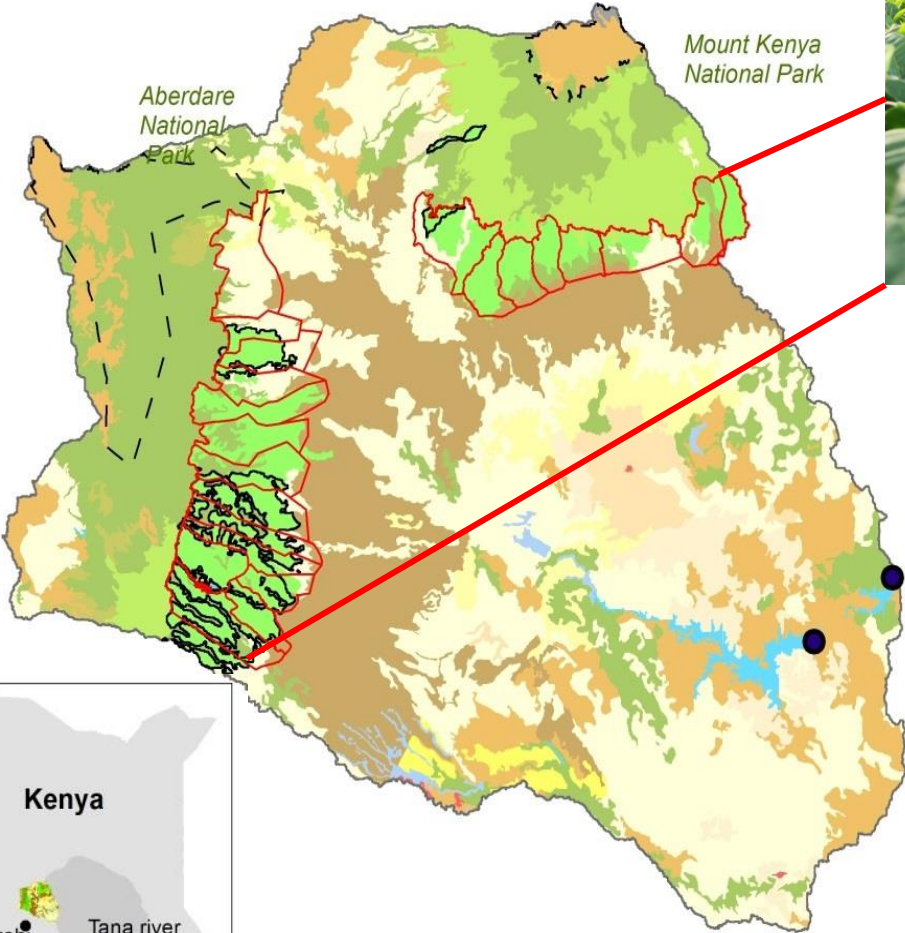
SETTING THE STANDARD



SAN Principles

1. Social and Environmental Management System
- 2. Ecosystem conservation** ← 2. Buffer zones (3-50 m) between crops and conservation areas and streams
3. Wildlife protection
4. Water Conservation
5. Fair treatment and good working condition for workers
6. Occupational Health and Safety
7. Community Relations
8. Integrated crop management
- 9. Soil management and conservation** ← 9. Fertilization based on needs. Erosion control and prevention by use of vegetation
10. Waste management

TANA BASIN KENYA



15 tea processing factories



Certification > 2010

ESTIMATING IMPACT

Pre-certification

Ecosystem services

Full certification

1. SWAT model, (MUSLE), calibrated
 2. InVEST model (RUSLE, Nutrients)
- input parameters:
- Farm survey
 - Fertilizer data factories

1. InVEST model (RUSLE, Nutrients)
- input parameters:
- Farm survey ($n=15$)
 - Fertilizer data factories ($n=15$)

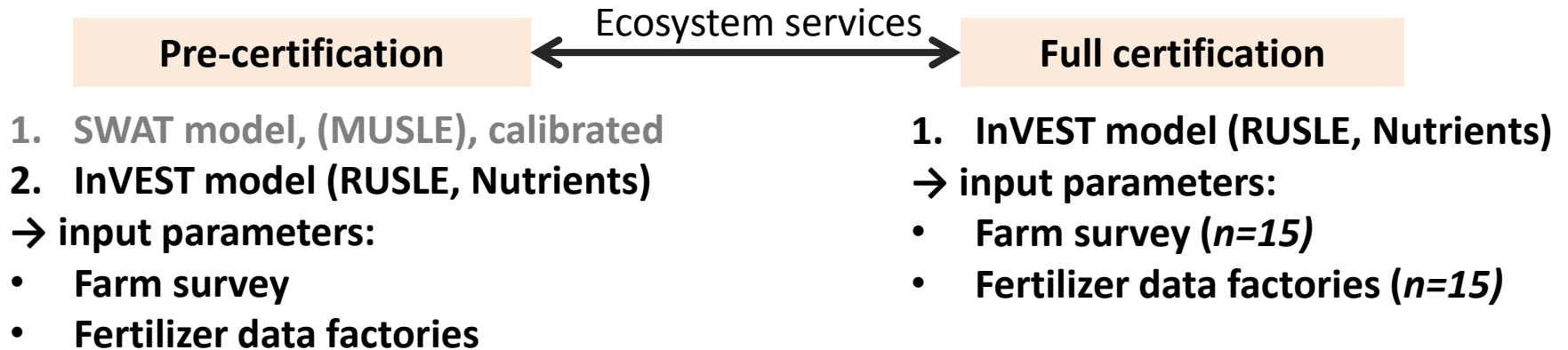


- Increase in soil conservation measures
- Increase cover of Napier grass on farm
- ~~No difference number of buffer zones~~
- Increase in fertilizer use



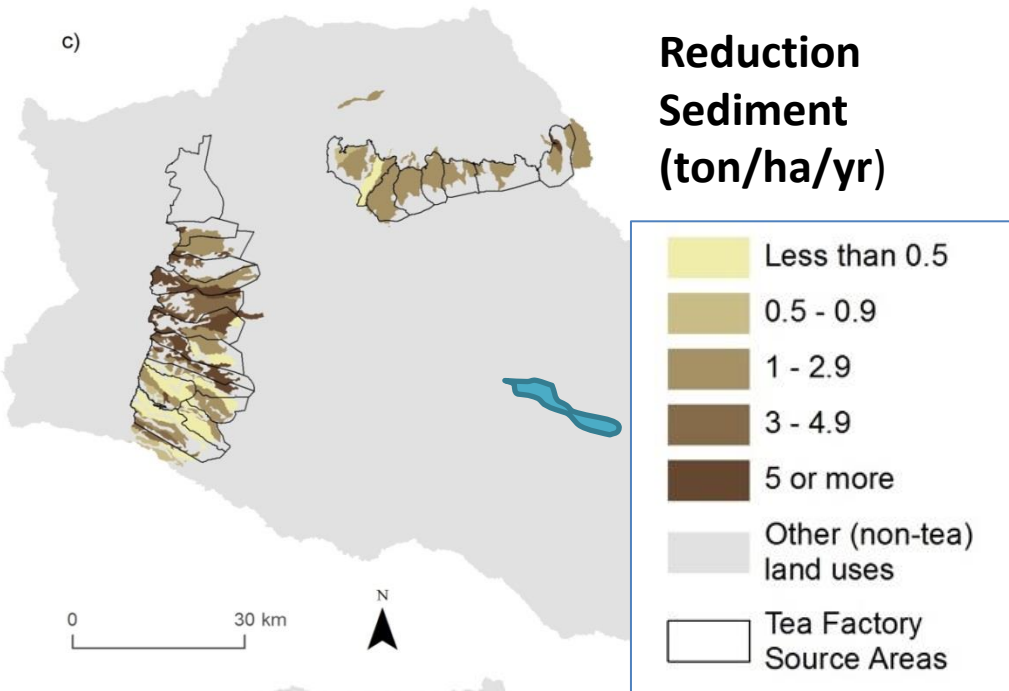
Buffer

ESTIMATING IMPACT



	Pre-certification	Full certification
C factor, tea farms	0.05	0.04
P factor, Soil conservation measures	1	0.85
Nitrogen application	172 kg/ha/yr	182 kg/ha/yr
Phosphorous application	33 kg/ha/yr	35 kg/ha/yr

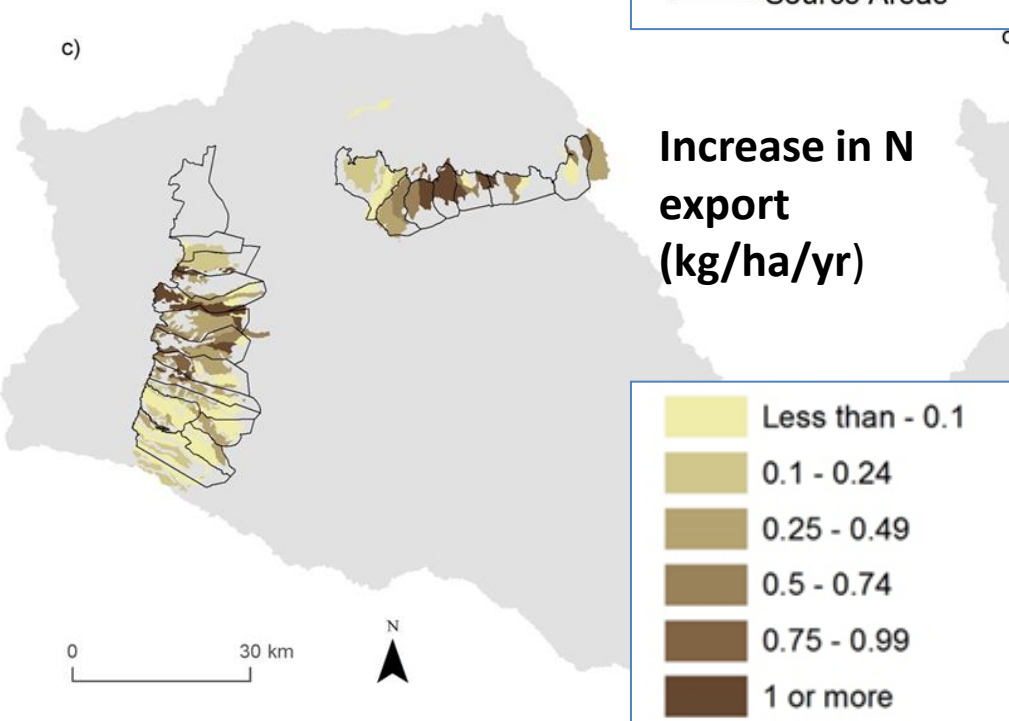
c)



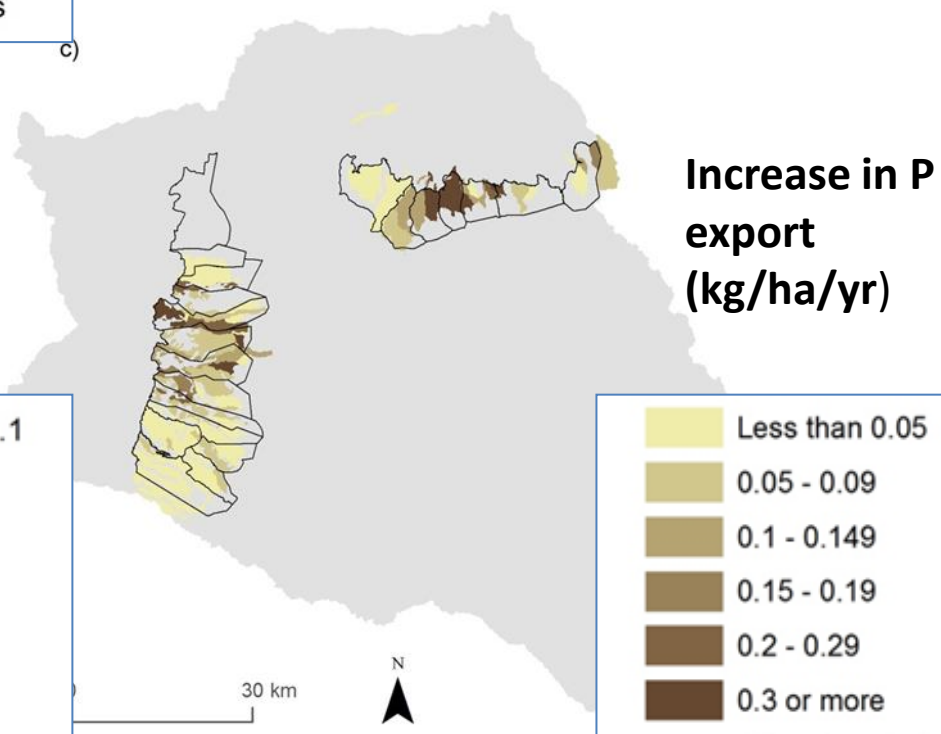
Ecosystem services:

- Erosion prevention: + 184 tons/yr
(-2.3% sediment Masinga reservoir)
- Nitrogen retention: - 30 tons/yr
- Phosphorus retention: - 6 tons/yr

c)



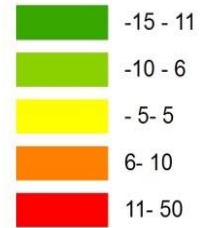
c)



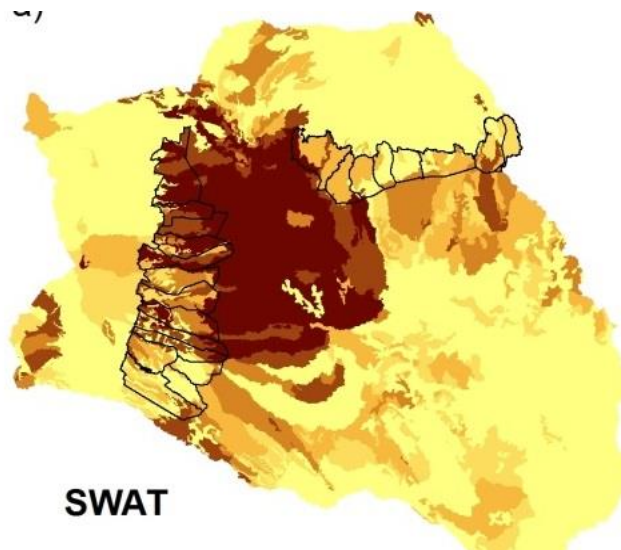
CAPTURING THE PAST

Tea Factory Source Areas
Upper Tana

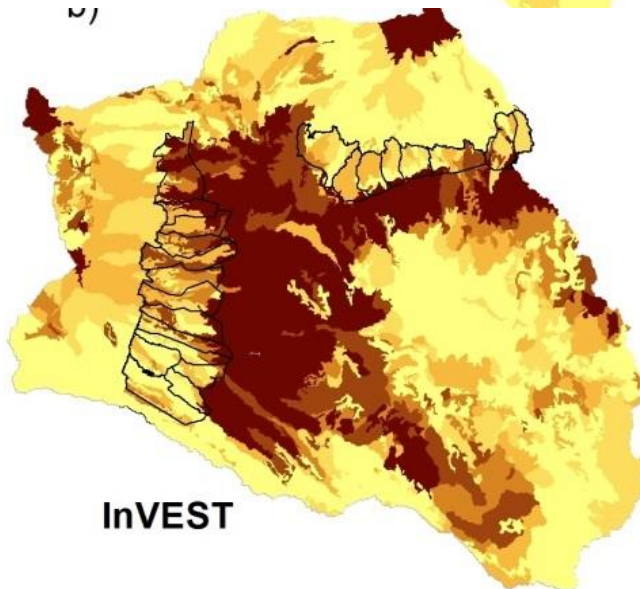
SWAT-Invest difference
(ton/ha/year)



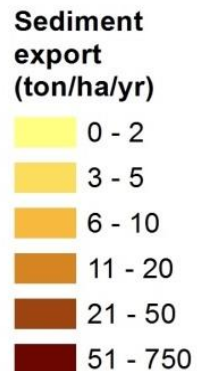
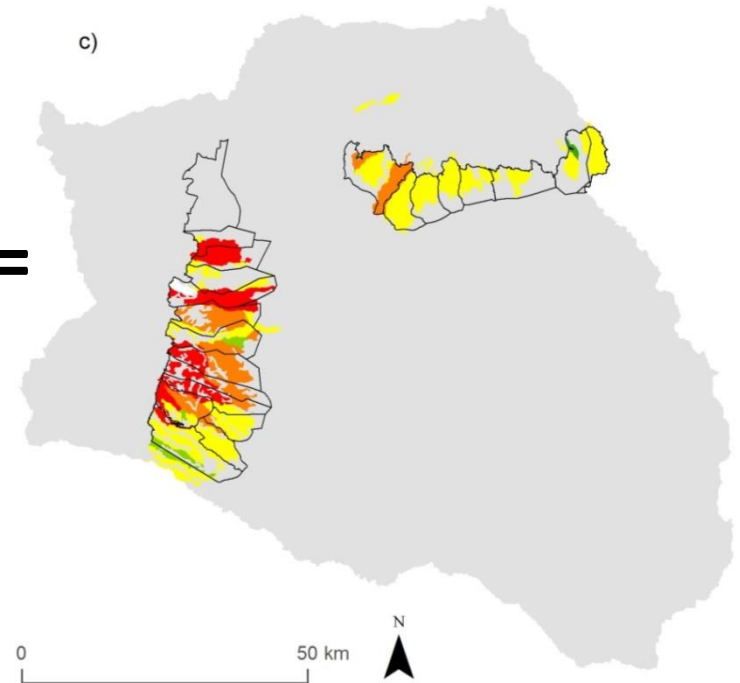
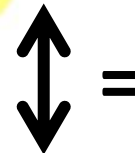
Field measures -
SWAT Model
R2= 0.9
Pre-certification



SWAT Model -
InVEST Model
R2= 0.64
Pre-certification

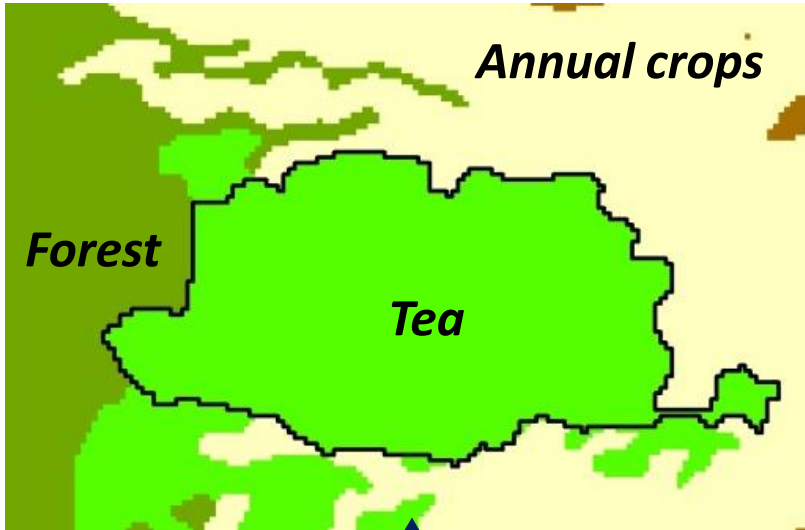


InVEST application error

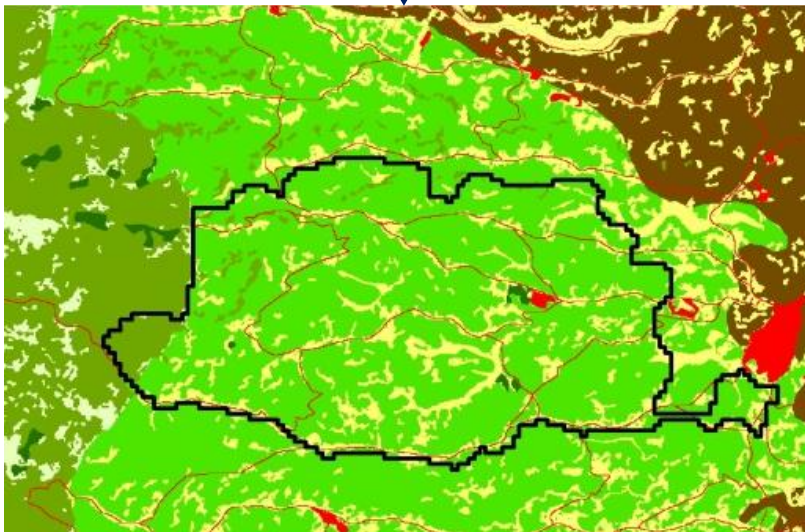


CAPTURING SLM

Used land cover



Test land cover



0 2.5 5 Kilometers

Erosion: 1.5 x higher

N: 10 x higher

P: 8 X higher

But: % change certification similar

Measuring & learning from certification effects

- **The good:** certification action → SDGs
- **The bad:** Farm level activities are hard to capture with common ES-GIS tools:
 - Relative effect was similar
- **The next:** improvements possible
 - Spatial information on SLM actions/ crop area: RS!
 - Monitoring: Collaboration certification programmes

Eskerrik asko!

L.L.Willemen@utwente.nl





References

- Tayleur, C., A. Balmford, G. M. Buchanan, S. H. M. Butchart, H. Ducharme, R. E. Green, J. C. Milder, F. J. Sanderson, D. H. L. Thomas, J. Vickery, and B. Phalan. 2017. Global Coverage of Agricultural Sustainability Standards, and Their Role in Conserving Biodiversity. *Conservation Letters* **10**:610-618