

Monitoring for climate change impacts on species, ecosystems, ecosystem services, people and agricultural services

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Tropical Ecology Assessment and Monitoring Network (TEAM)
Conservation International**

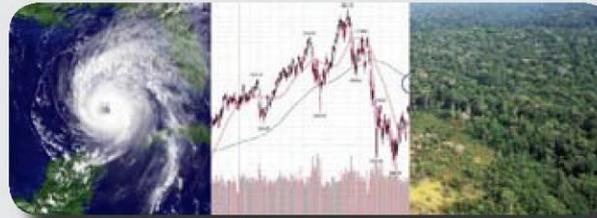


Early Warning System

Tropical biodiversity field observation data



Extrinsic data providers



Climate

Markets

Land cover



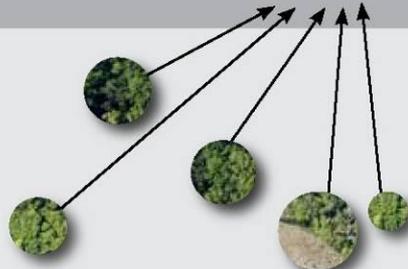
Data verification, archiving, standardization



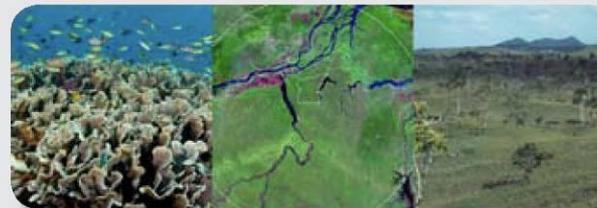
Threat analysis hub

OUTPUTS

1. Threat Level
2. Recommended action
3. Communication



Existing outposts from multiple institutions

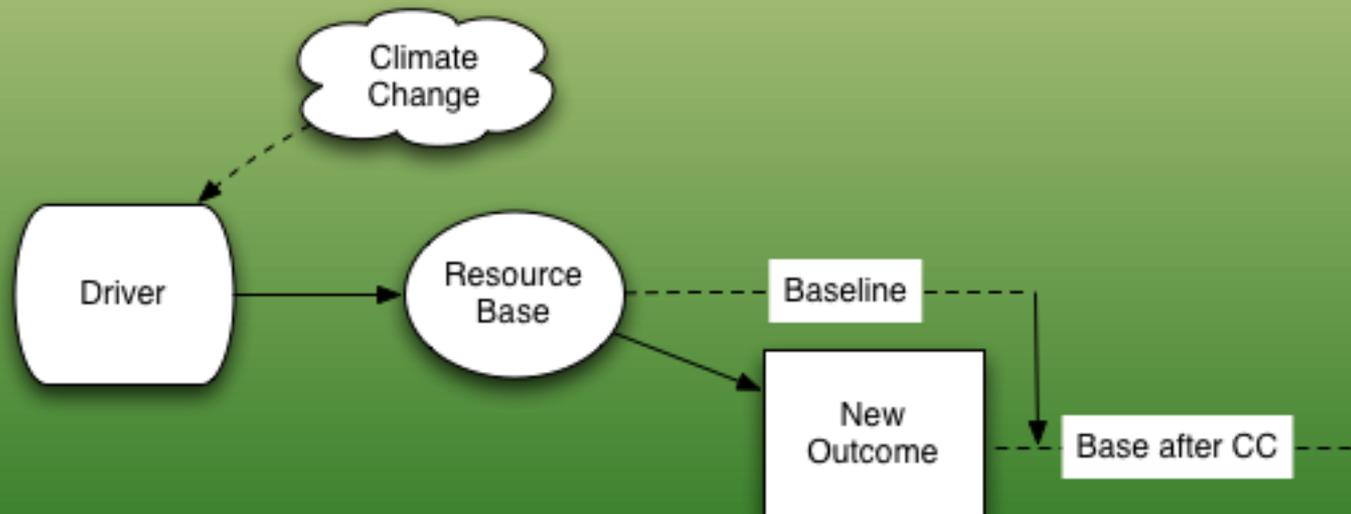


Other biodiversity field observation networks

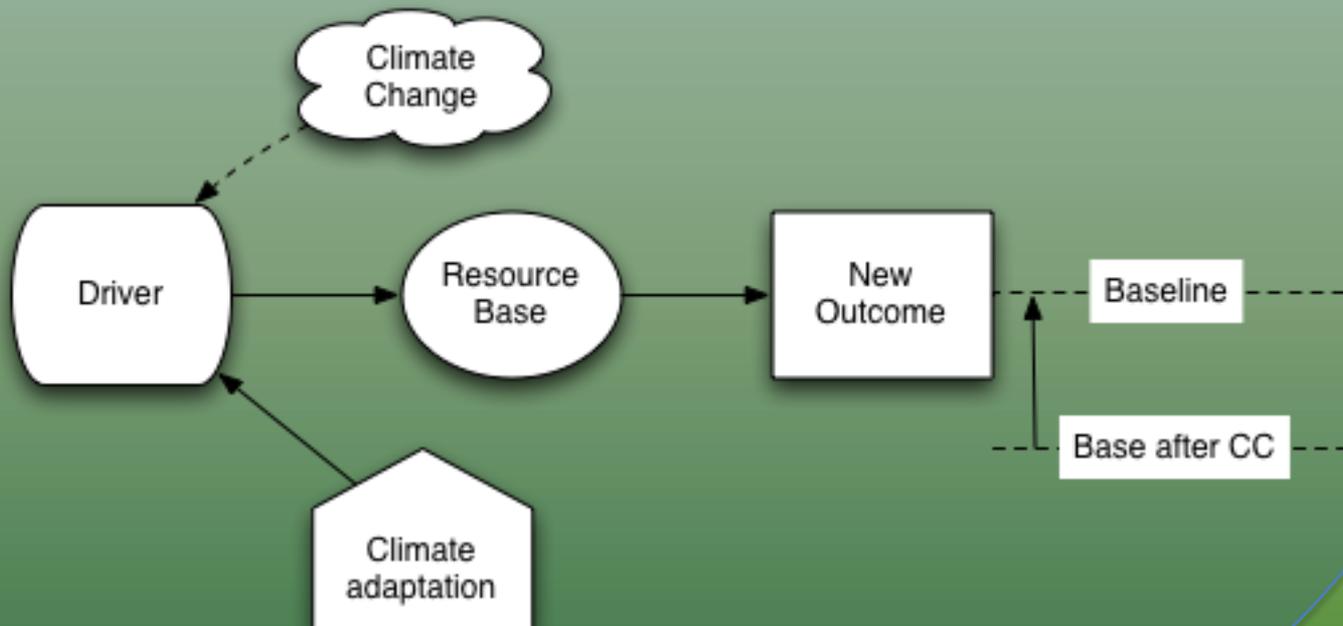
A NICE "NORMAL WORLD"



A WORLD WITH CLIMATE CHANGE



THE ROLE OF ADAPTATION



Monitoring and Evaluation
Framework

Monitoring for climate adaptation

- **Identify key drivers, resource bases and outcomes for monitoring and risk assessment**
- **Design interventions**
- **Design indicators that will inform how the system changes as a response to the intervention**
- **Decide on appropriate temporal and spatial scales to monitor indicators**

No “universal” monitoring and evaluation system

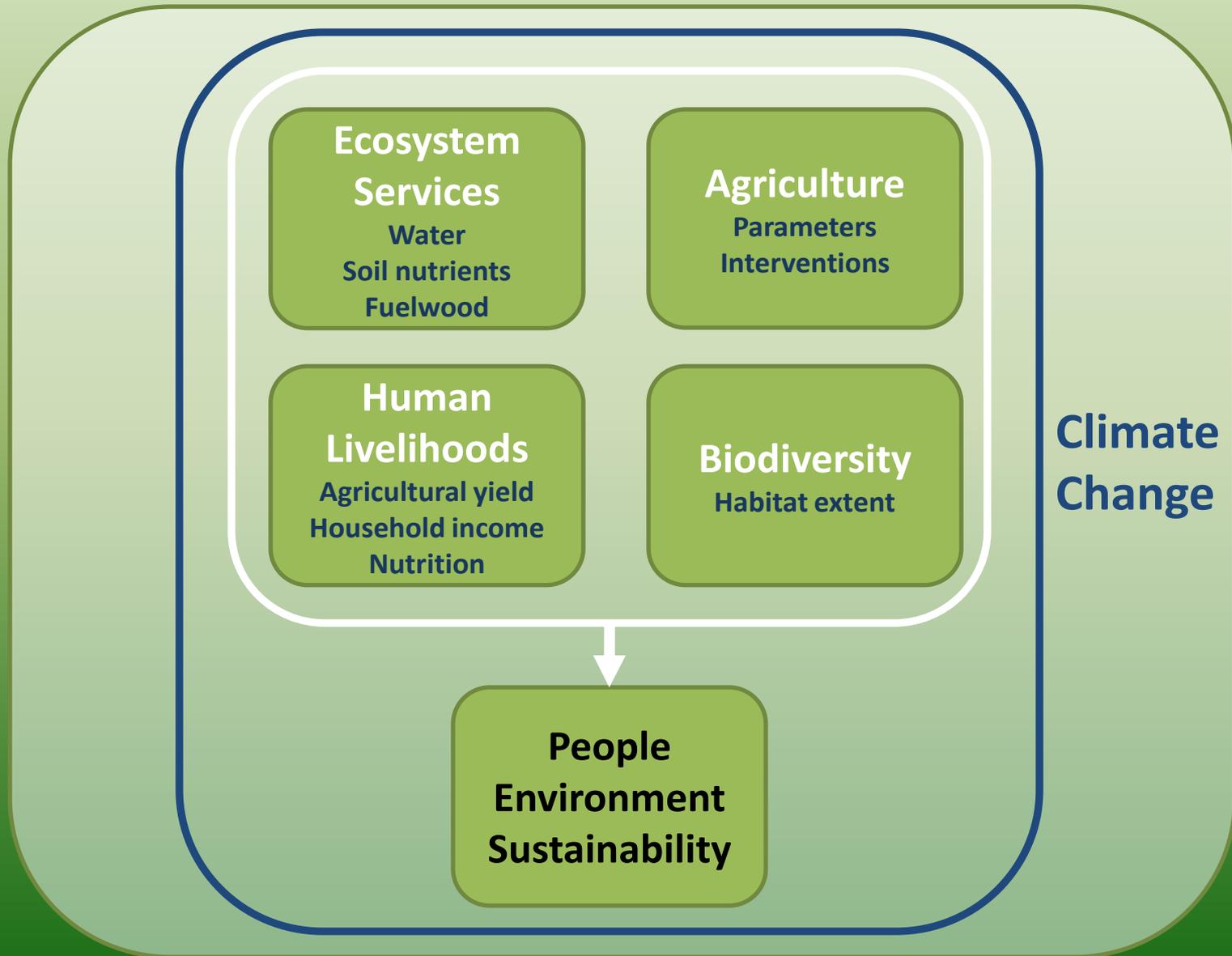
But there are a few categories:

Ecosystem Services
Agro-ecological Systems
Human Livelihoods
Natural Systems

Monitoring and evaluation system for AGRA

- Measure agriculture's human wellbeing and environmental outcomes
- Prevent unintended consequences
- Sustainability
- Conserve ecosystem services
- → Adaptation to climate change

Main Monitoring Elements



Questions

Planning

Prioritizing natural areas for protection

**Identify beneficial activities while
minimizing unintended consequences**

Effectiveness and Adaptive Management

**Environmental and human livelihood
consequences of particular actions**

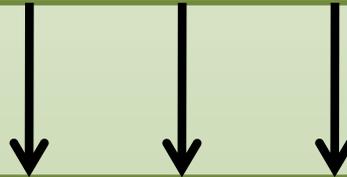
Tradeoffs

Sustainability

Information Layers

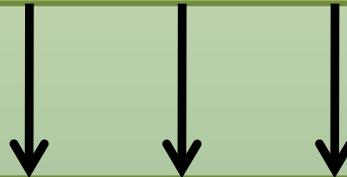
Measurements

Primary observations



Analytical outputs

Variables of system attributes



Decision layers

Synthetic, diagnostic indicators

System state and performance

Network Integration

**Alliance for a Green
Revolution in Africa (AGRA)**

Agricultural interventions

**African Soil Information
Service (AfSIS)**

Soil parameters

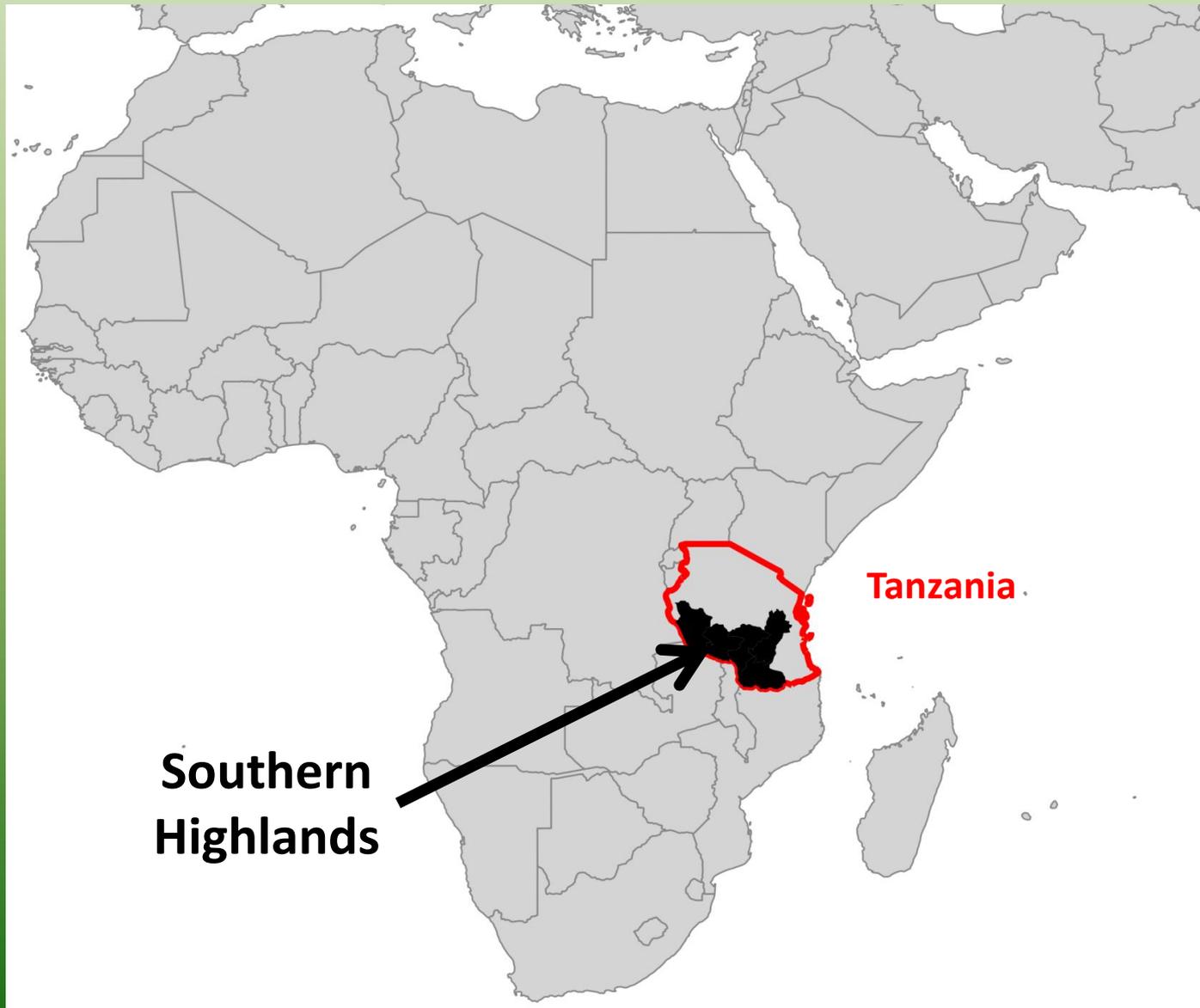
TEAM Forest Network

**Climate, Terrestrial Vertebrates,
Vegetation**

World Bank

Living Standards Measurement Study (LSMS)

Pilot in Southern Highlands, Tanzania



Monitoring Parameters

Ecosystem Services

Landscape structure & composition

Fuelwood

Water availability

Soil Nutrient balance

Soil organic carbon

Resilience

Climate

Human Livelihoods

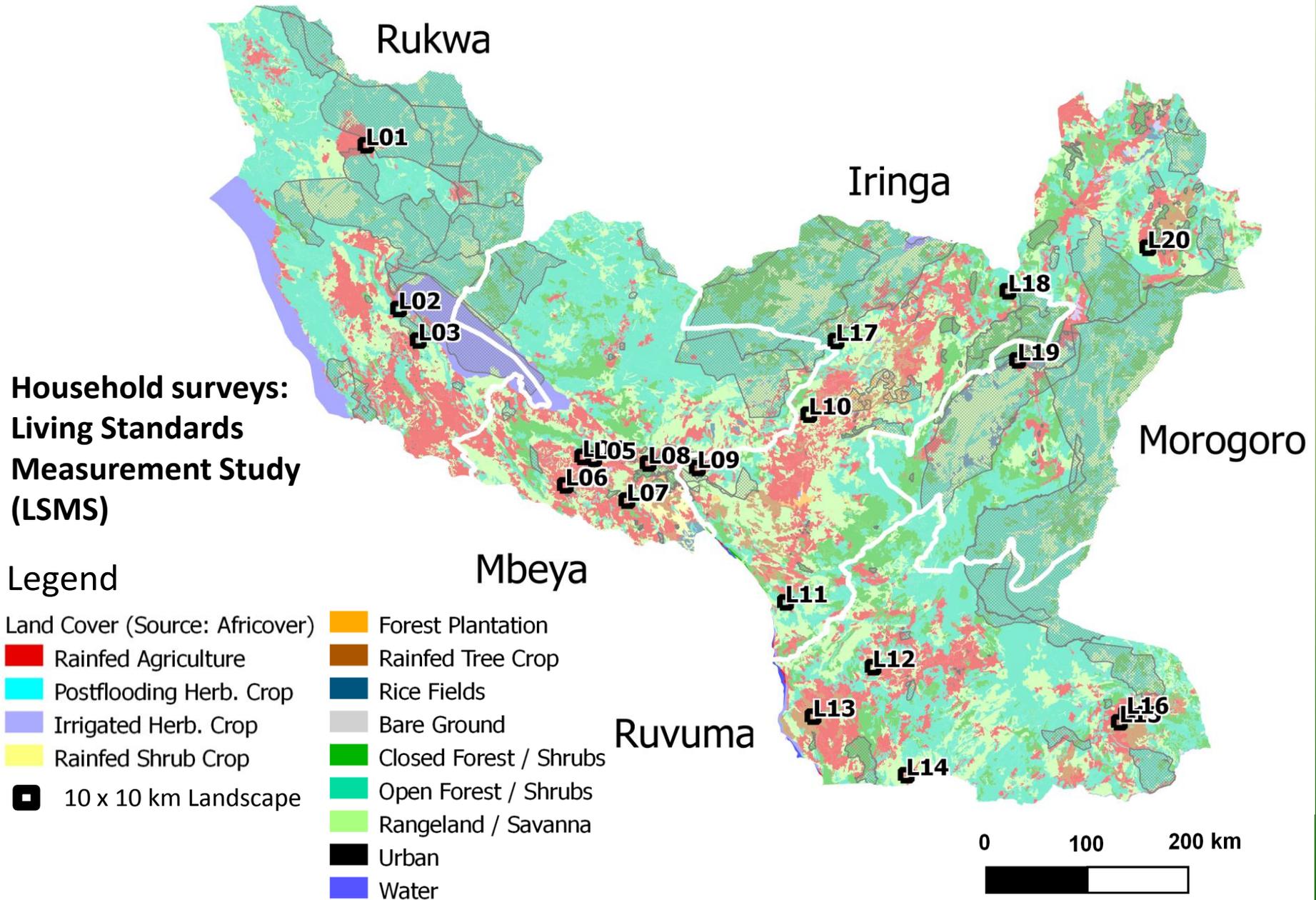
Household Income

Nutritional Status

Lessons Learned

- **Nested design for upscaling**
- Integration of socioeconomic surveys and biophysical measurements
- Complex and resource intensive
- Necessary expertise requires collaborations
- Long-term funding
- Community buy-in and short-term benefits
- Local capacity building
- Data management and dissemination

Locations of Twenty 10 x 10 km Focus Landscapes

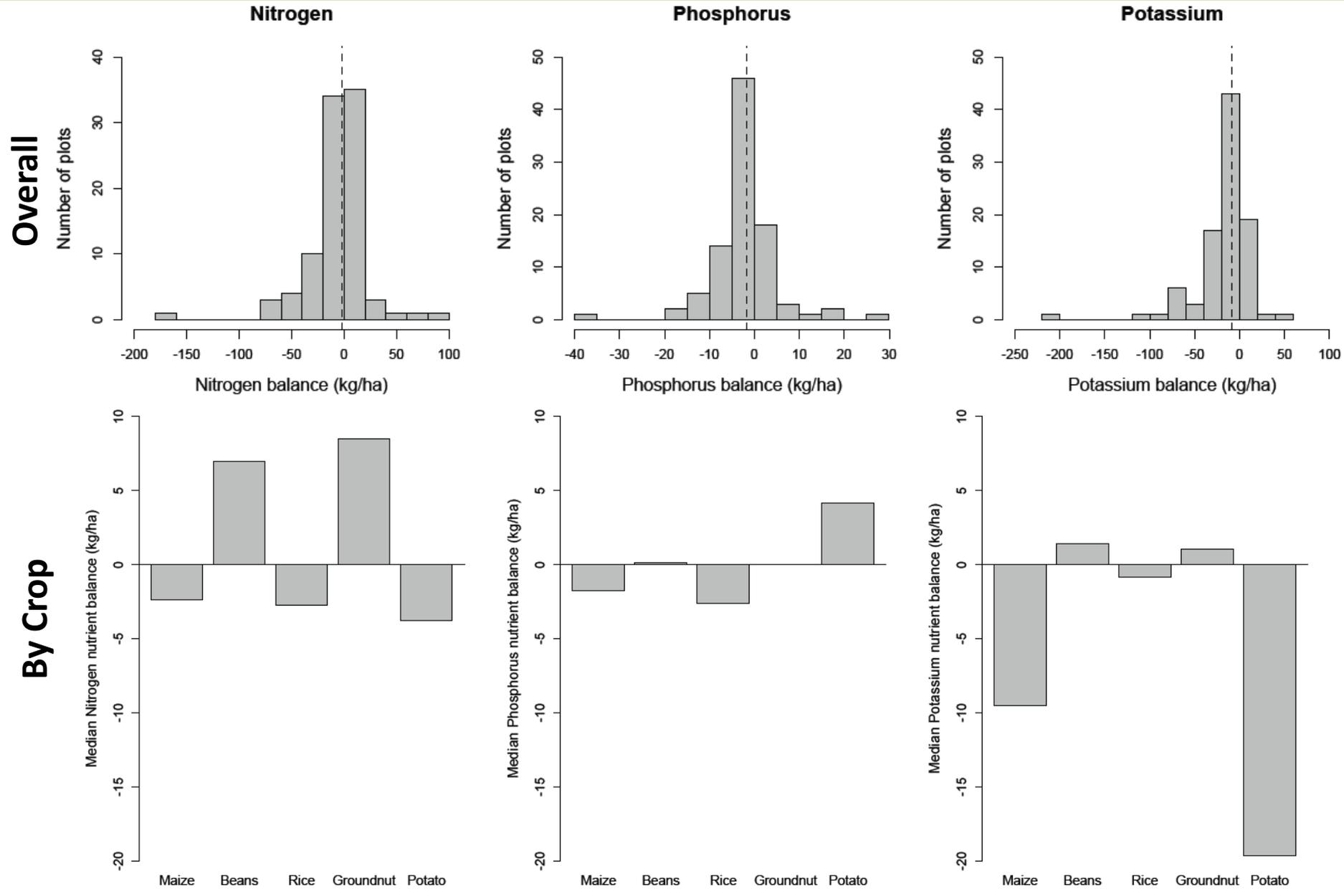


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Soil Nutrient Balance

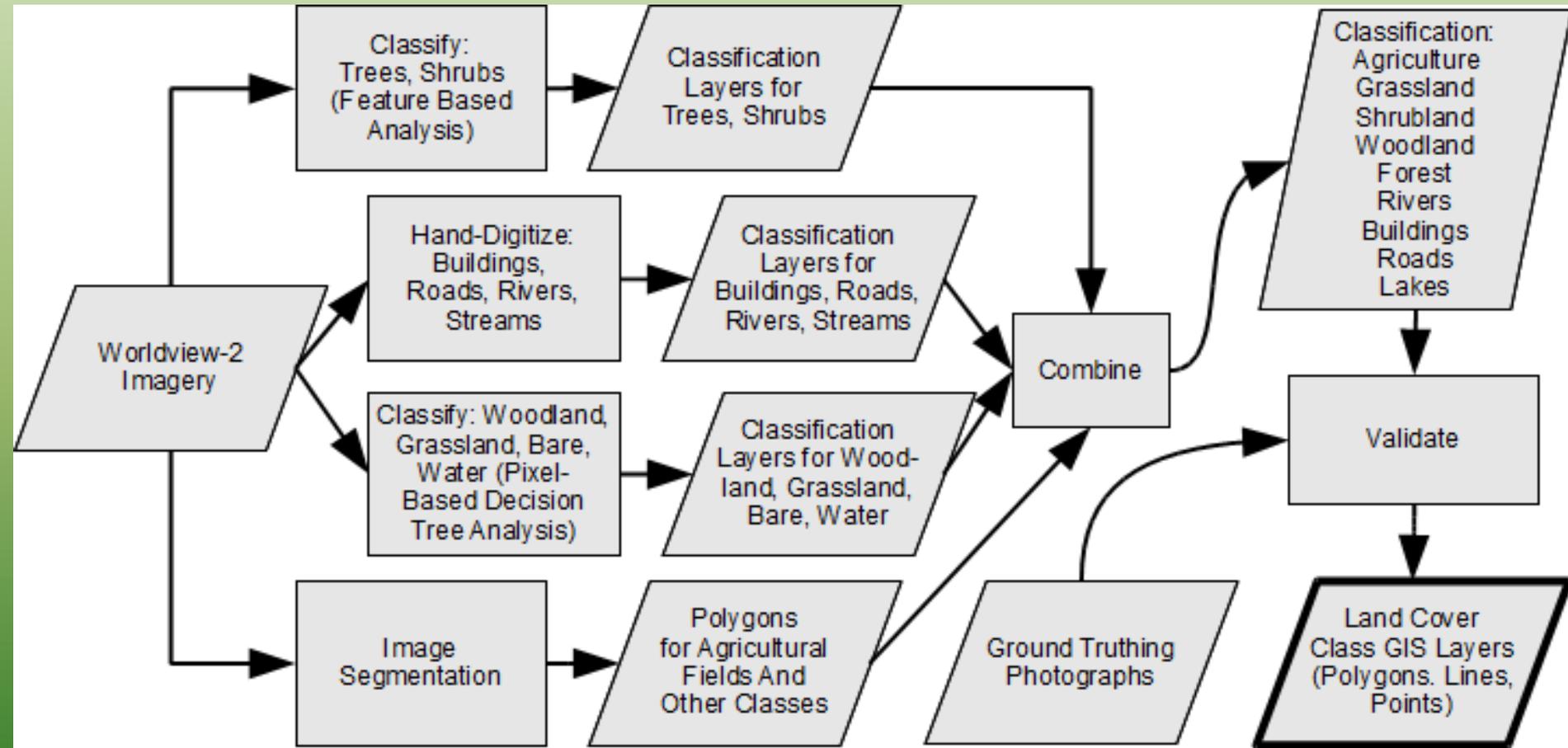
All Southern Highlands agricultural LSMS households



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Landscape Structure and Composition of 10 x 10 km Landscapes



Very high resolution image classification (Worldview 2, resolution of multi-spectral bands: 2 m)

Landscape Structure and Composition of 10 x 10 km Malangali Landscape



Legend

Building



Roads



Agriculture



Drainage Canal



Trees



Shrubs



Grass



Bare



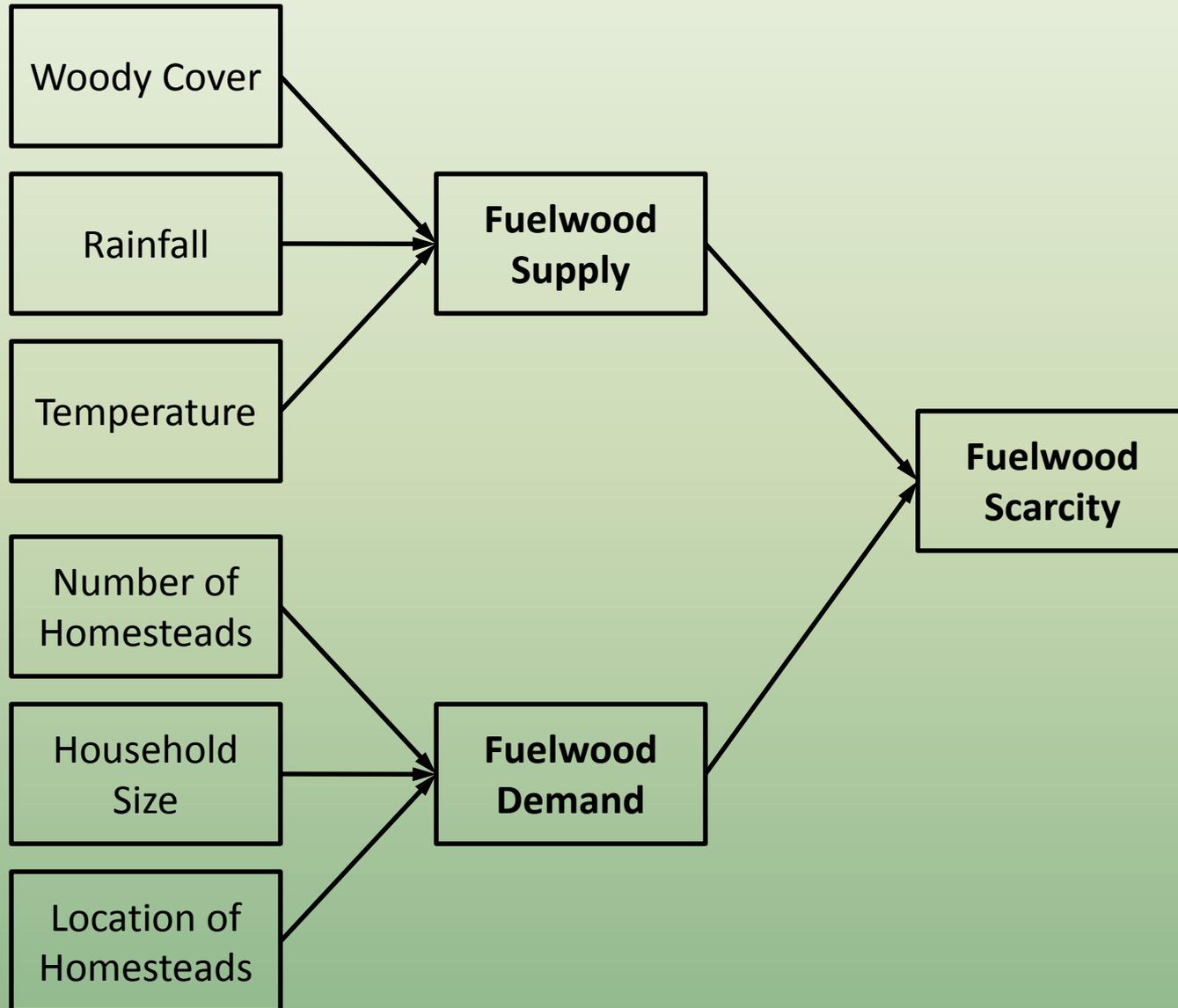
0

1

2 km



Fuelwood Scarcity

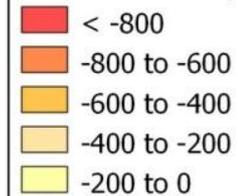


Fuelwood Scarcity



Legend

Fuelwood Scarcity 2010 (t/sqkm)



Buildings



Worldview-2 Satellite Image (2010)



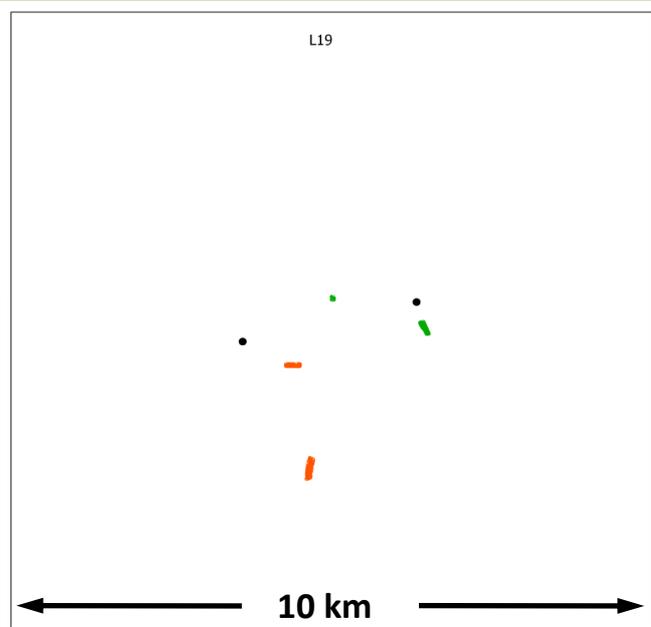
0 1000 2000 3000 Meters



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Soil Organic Carbon

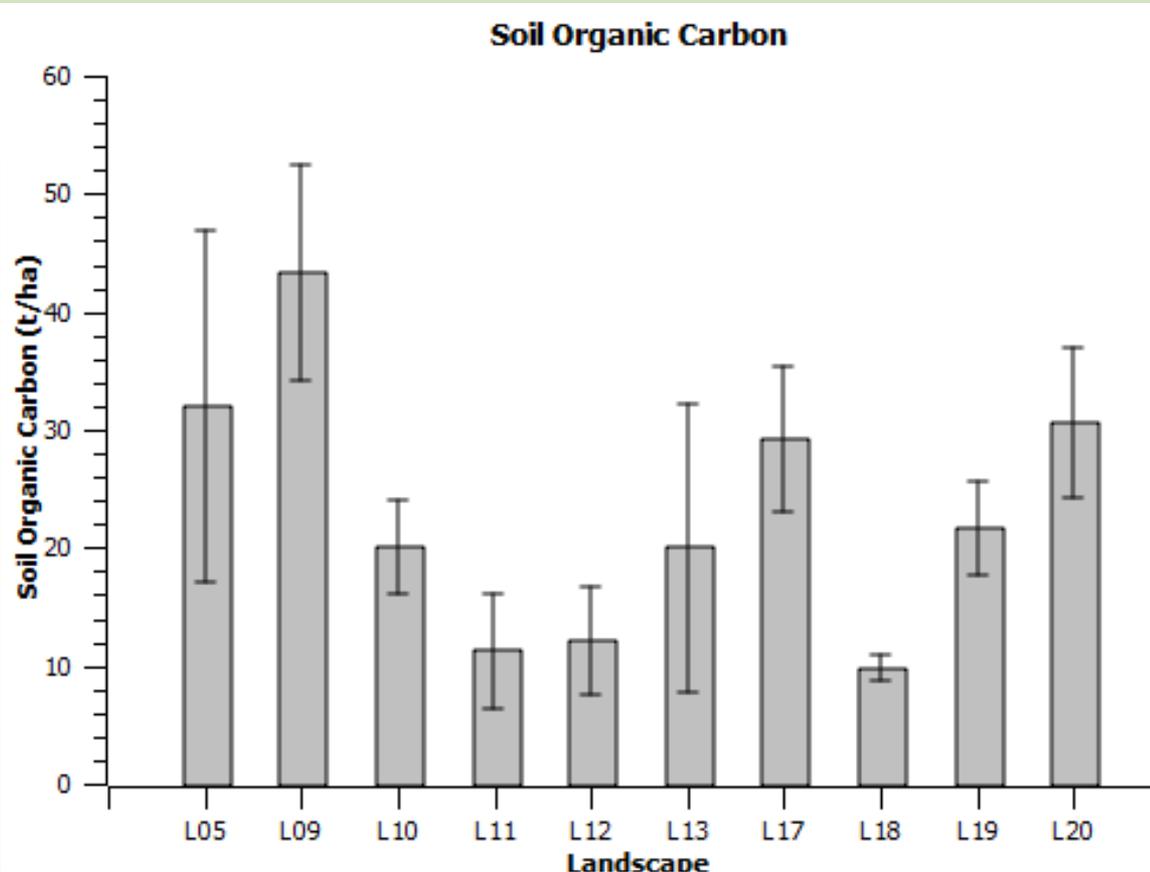


LSMS households (black), agricultural plots (green, red) in 10x10 km landscape



10 x 10 km site with sampling clusters

AfSIS (African Soil Information Service) 10x10 km landscape sampling design



Average soil organic carbon of agricultural plots sampled within each 10 x 10 km landscape. Soil samples were analyzed using near-infrared spectroscopy by ICRAF, Nairobi.

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Resilience Index of Variations of Net Primary Production (NPP) To Variations of Precipitation

Based on long-term averages and standard deviations for the years 2003-2009.

Resilience Index Calculation

$$R = \frac{1 + \left| \frac{P - \bar{P}}{P_s} \right|}{1 + \left| \frac{N - \bar{N}}{N_s} \right|}$$

R = Resilience (Current Year)

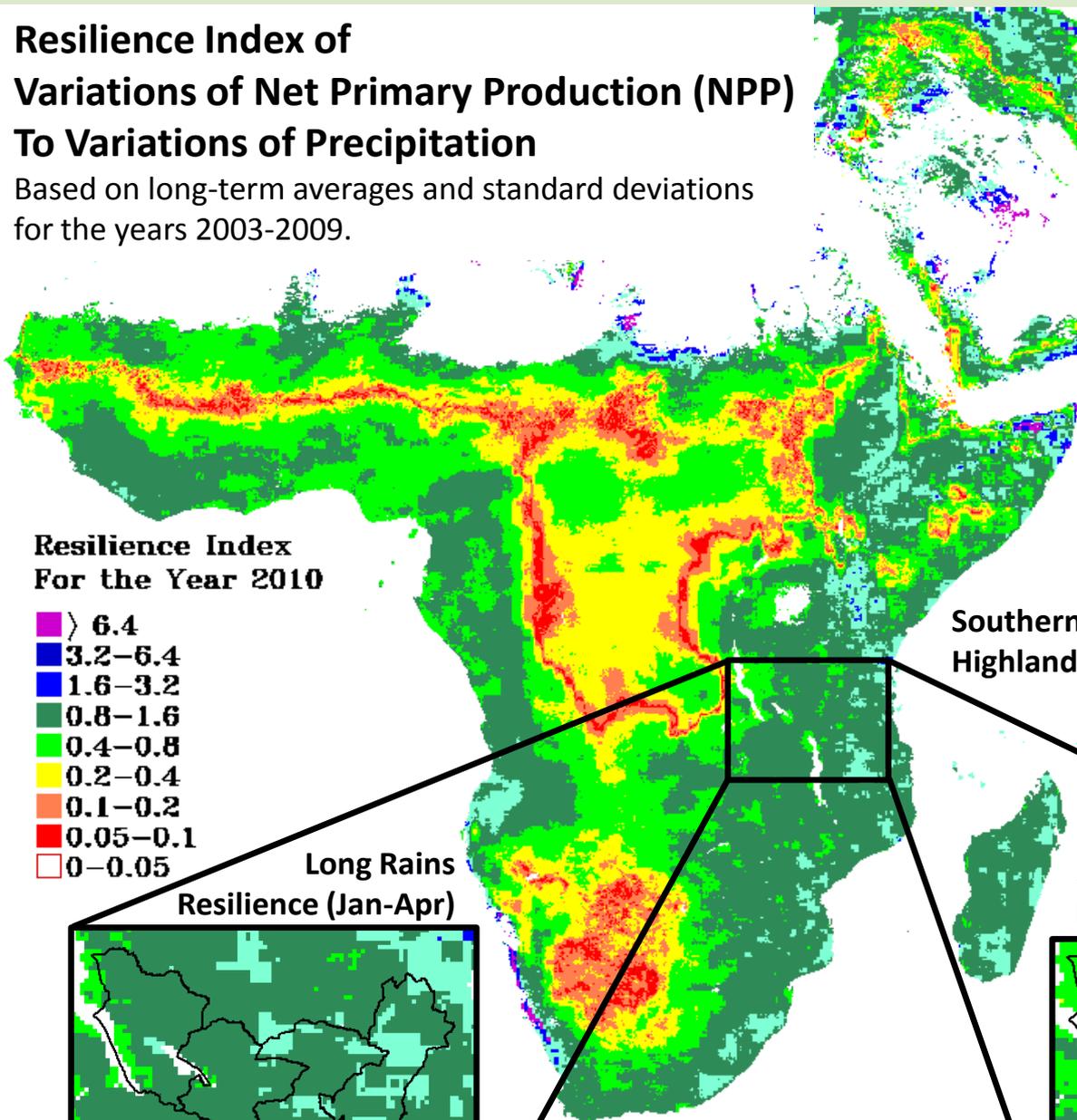
P = Precipitation (Current Year)

\bar{P} = Precipitation Mean (Long-Term)

P_s = Precipitation Standard Dev. (Long-Term)

\bar{N} = NPP Mean (Long-Term)

N_s = NPP Standard Deviation (Long-Term)



Resilience Index For the Year 2010

- > 6.4
- 3.2-6.4
- 1.6-3.2
- 0.8-1.6
- 0.4-0.8
- 0.2-0.4
- 0.1-0.2
- 0.05-0.1
- 0-0.05

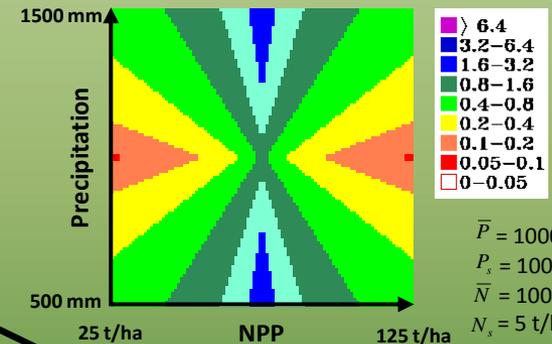
Long Rains Resilience (Jan-Apr)

Southern Highlands

Short Rains Resilience (Oct-Dec)

Data Sources: CMORPH, MODIS

Example Index Values



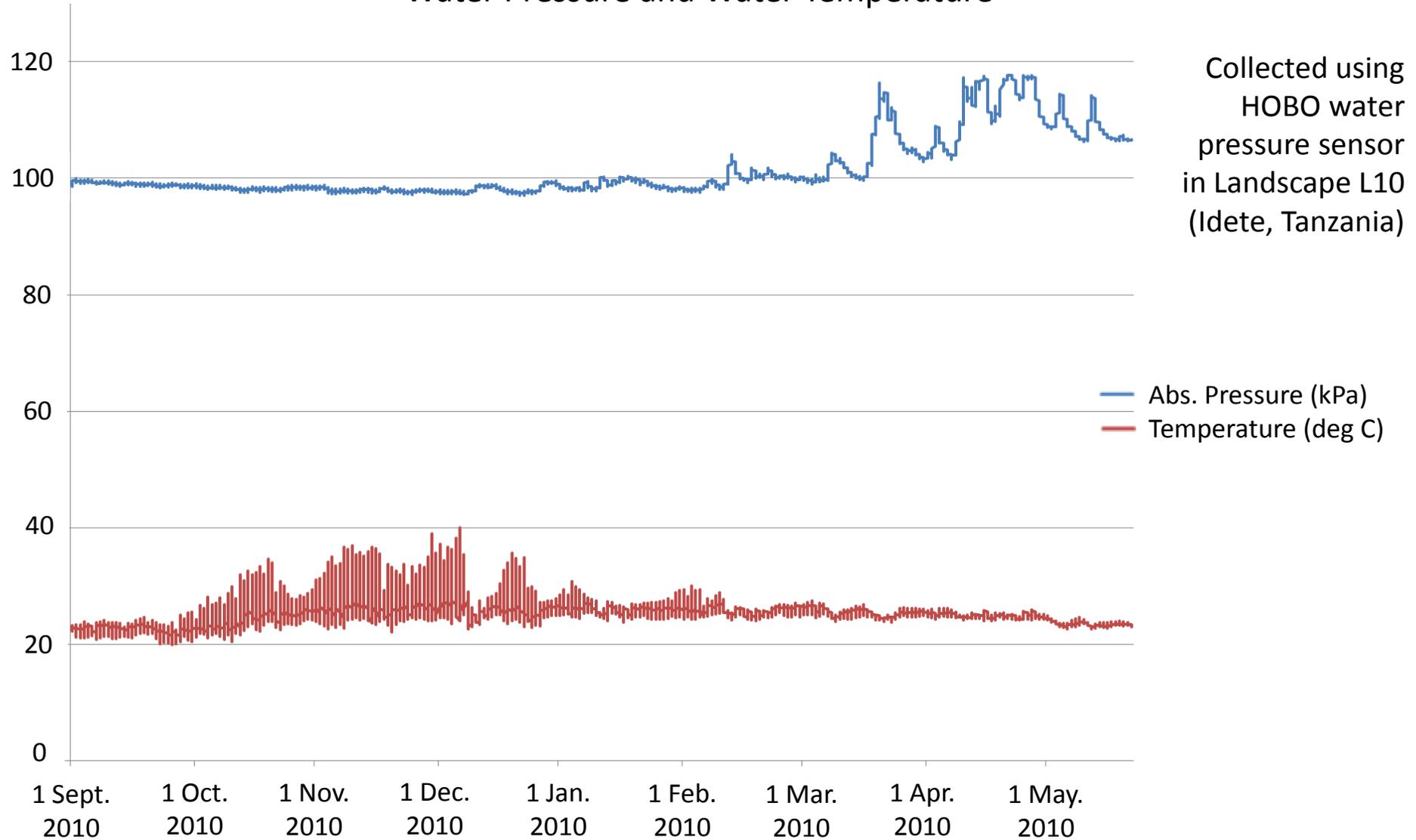
\bar{P} = 1000 mm
 P_s = 100 mm
 \bar{N} = 100 t/ha
 N_s = 5 t/ha

Lessons Learned

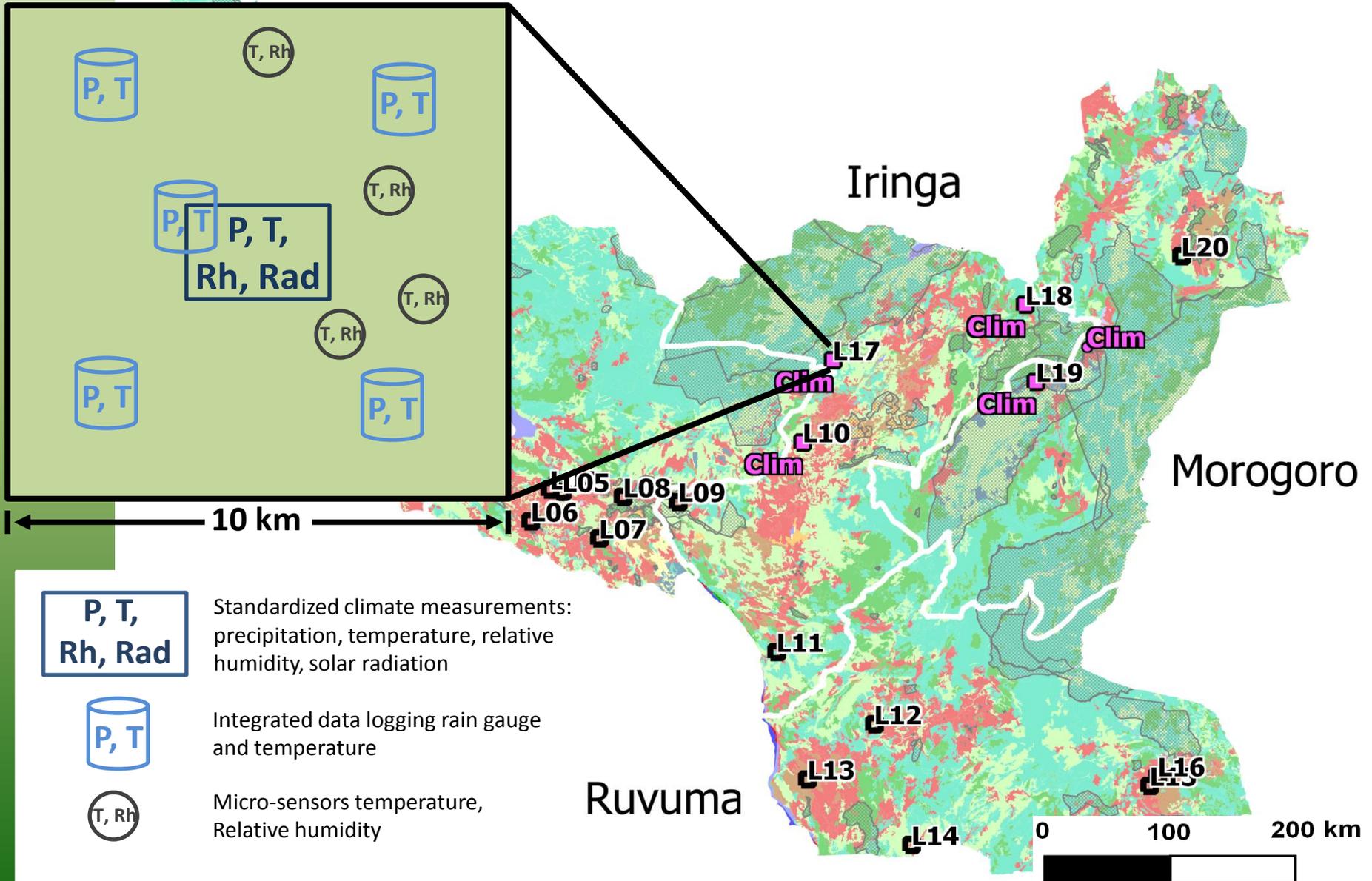
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Water Availability

Water Pressure and Water Temperature



Four Landscapes with Climate Stations

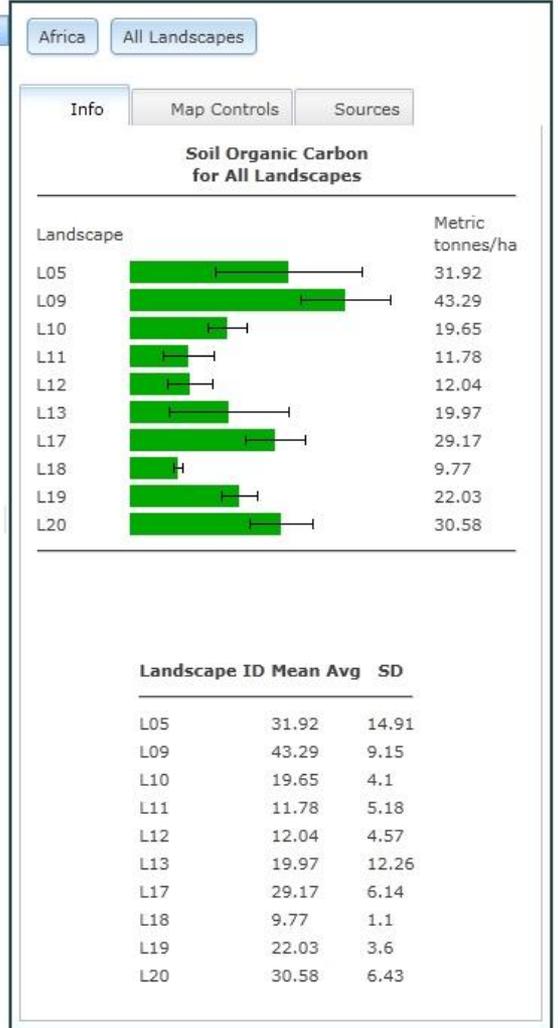
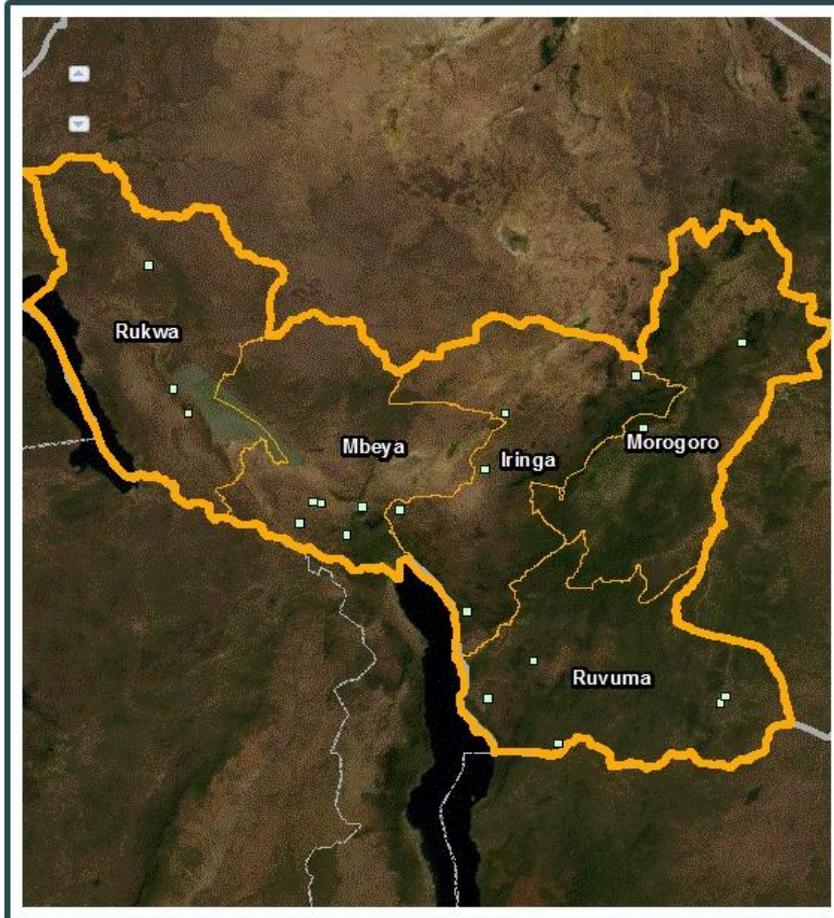


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- **Data management and dissemination**

Data management system and dissemination through web portal

--Select Indicator-- Soil Organic Carbon All LandScapes





TEAM FOREST NETWORK
<http://www.teamnetwork.org>

TEAM AGRICULTURE LANDSCAPES
<http://www.teamnetwork.org/en/agriculture-nature-livelihoods>

Thank You