Tanzania Southern Highlands: creating a baseline for agriculture, nature and livelihoods

Sandy Andelman, Conservation International

Jan Dempewolf, Conservation International

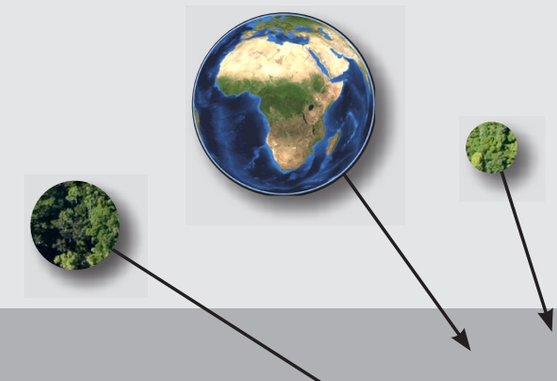
TEAM Network: Tropical Ecology, Assessment and Monitoring Network

Conservation International
Wildlife Conservation Society
Smithsonian Institution
Missouri Botanical Garden

near real time, ***open access*** data
www.teamnetwork.org

Early Warning System

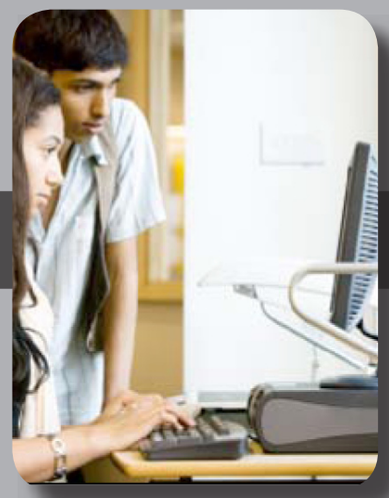
Standardized field measurements of climate and tropical biodiversity



External data sources

Climate Markets Land cover

Data verification, archiving, standardization

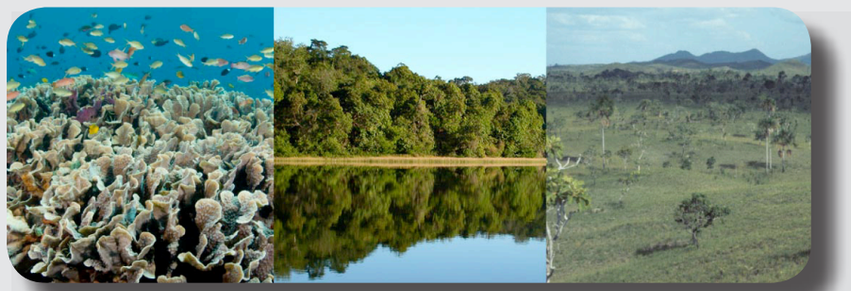


Threat analysis hub

OUTPUTS

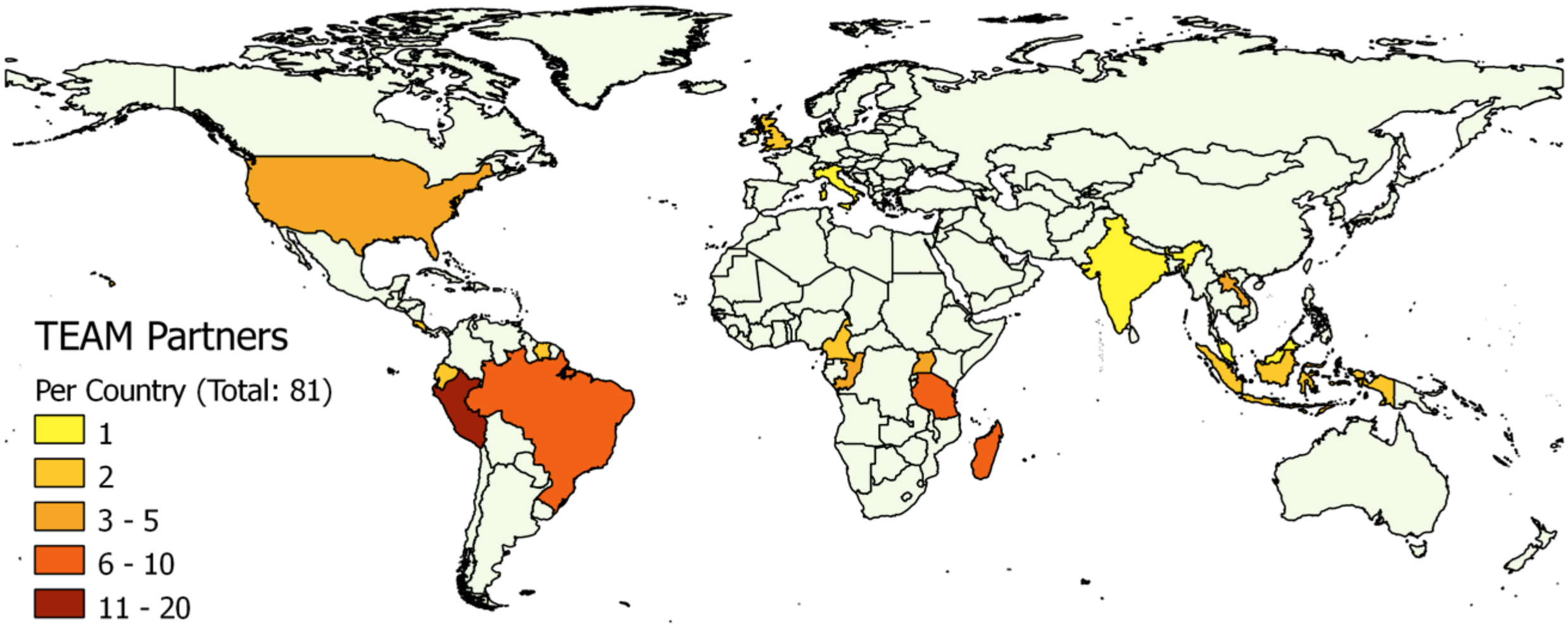
1. Threats
2. Future Scenarios
3. Advice to Policy Makers
4. Recommended Actions
5. Communication

Marine Lakes Savanna



Data from other observatory networks

TEAM: 81 partner institutions
18 countries



SUSTAINABLE Agriculture

unintended **consequences**

Thank you…..

Bill and Melinda Gates Foundation

National Bureau of Statistics, Tanzania
Sokoine University of Agriculture (SUA), Tanzania
The World Bank
World Agroforestry Centre (ICRAF), Kenya
The Earth Institute, Columbia University, USA
Tanzania National Parks
Tanzania Wildlife Research Institute
Tanzania Department of Forestry and Beekeeping

framework
Tanzania workshop Jan 2010

Mlemba Abassy
Ruth DeFries
Rebbie Harawa
Matt Kryman
Ellen McCullough
Cheryl Palm
Prabhu Pingali
Francesco Rovero
Karyn Tabor

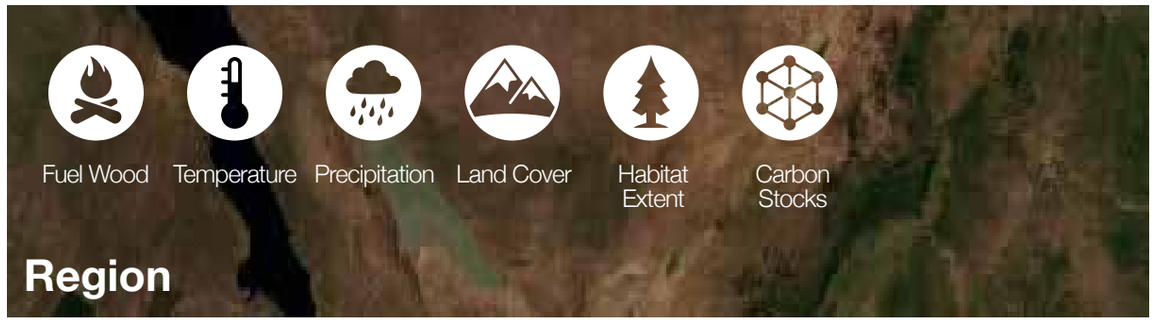
Sandy Andelman
Brendan Fisher
Celia Harvey
Dosteus Lopa
Eric Mungatana
David Panitz
Jennifer Price
Sara Scherr

TEAM Network: Nested Design Metrics

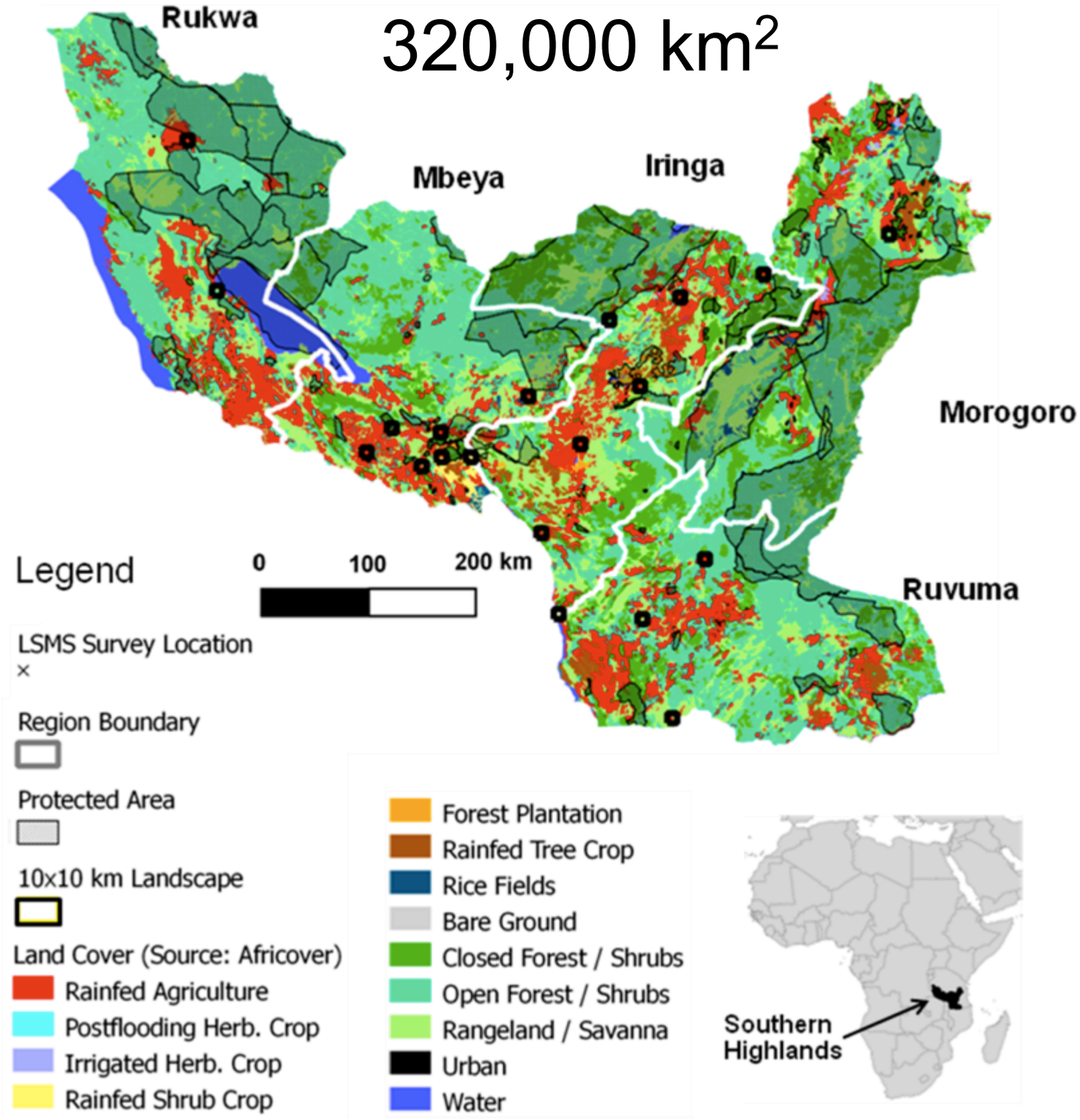
Measurements Taken Via Satellite

Measurements Taken with Cell Phones, Sensors and Via Satellites

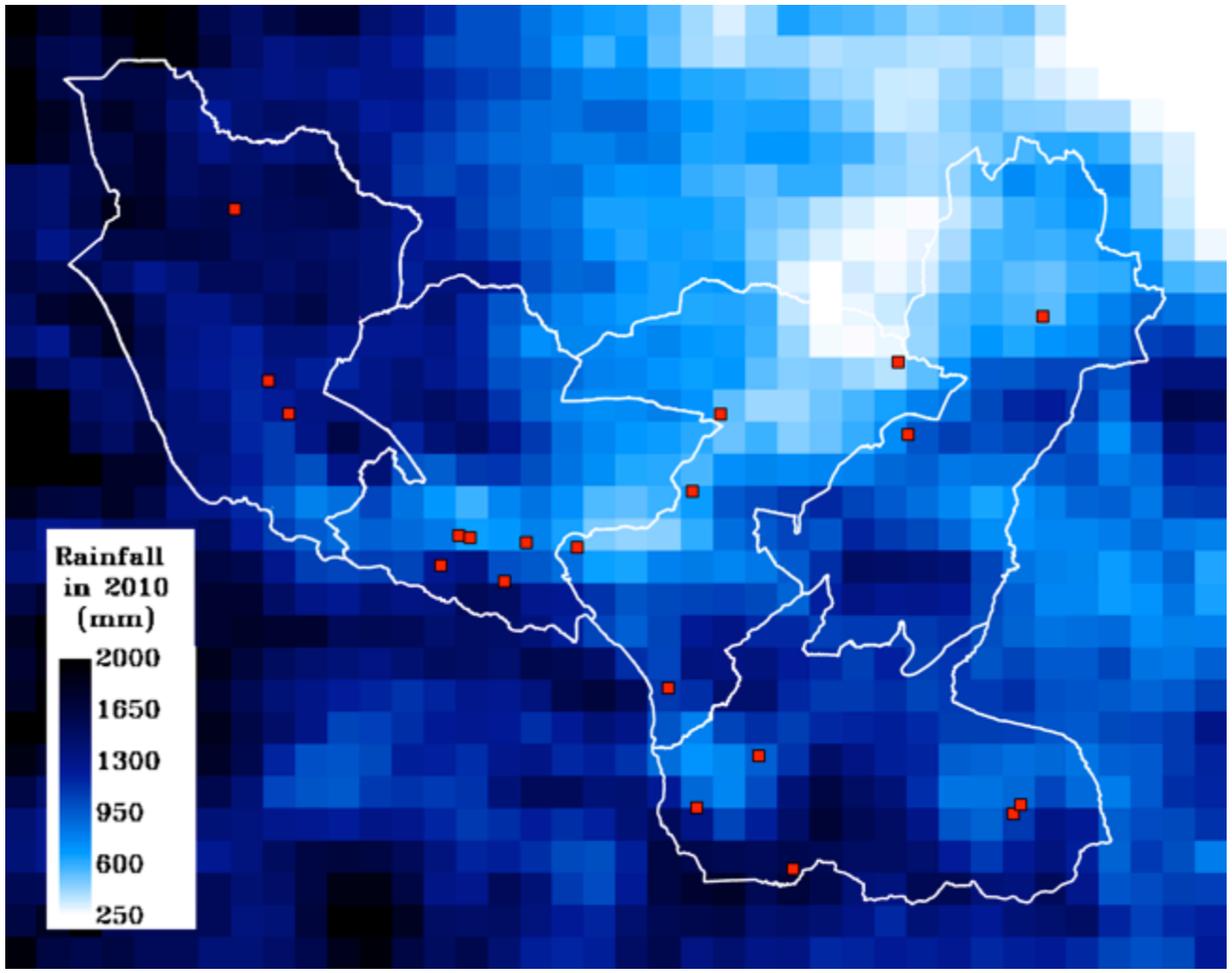
Measurements Taken with Cell Phones and Sensors



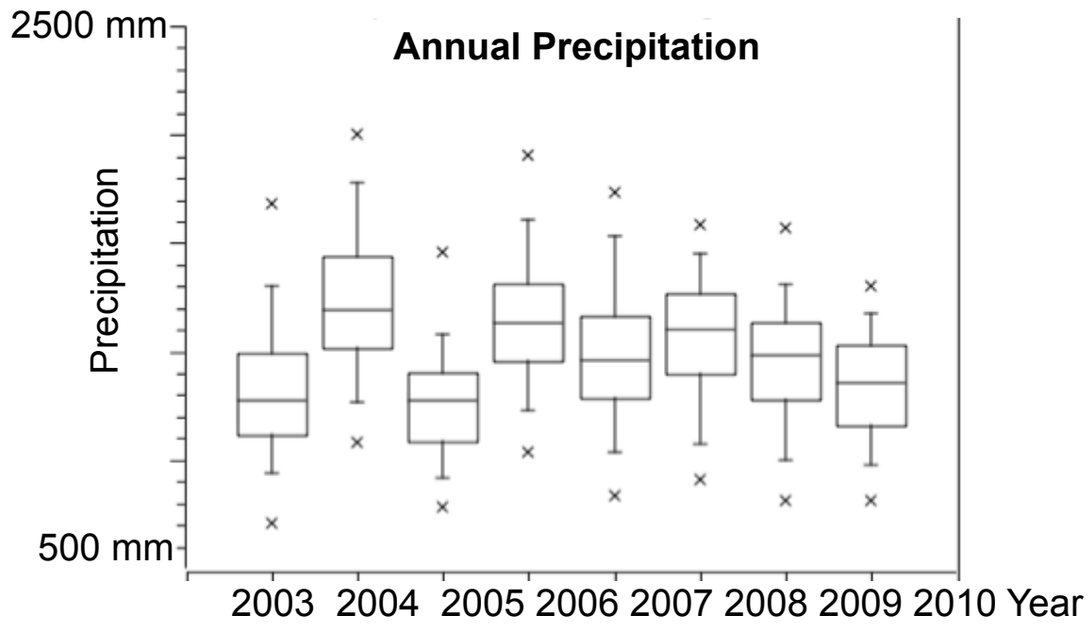
southern highlands Tanzania

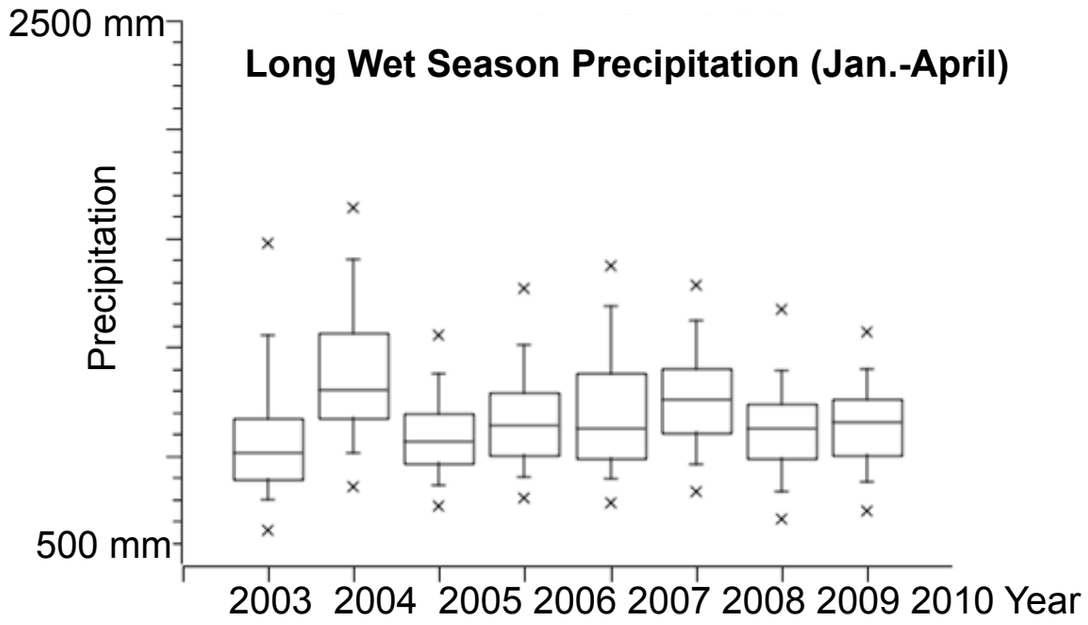


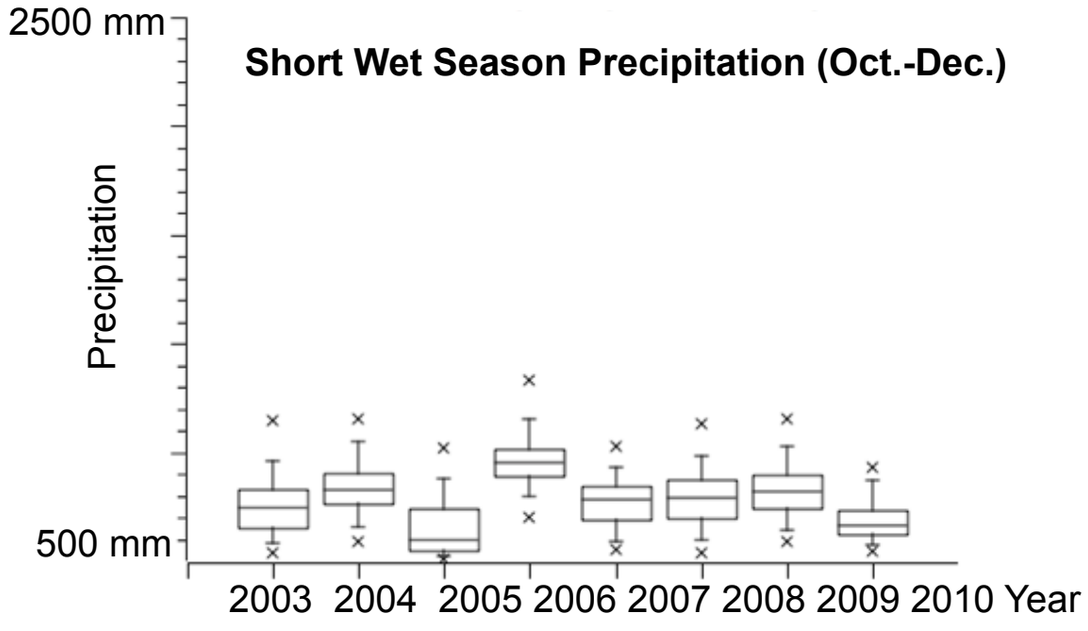
Rainfall in 2010 (mm)
Southern Highlands of Tanzania



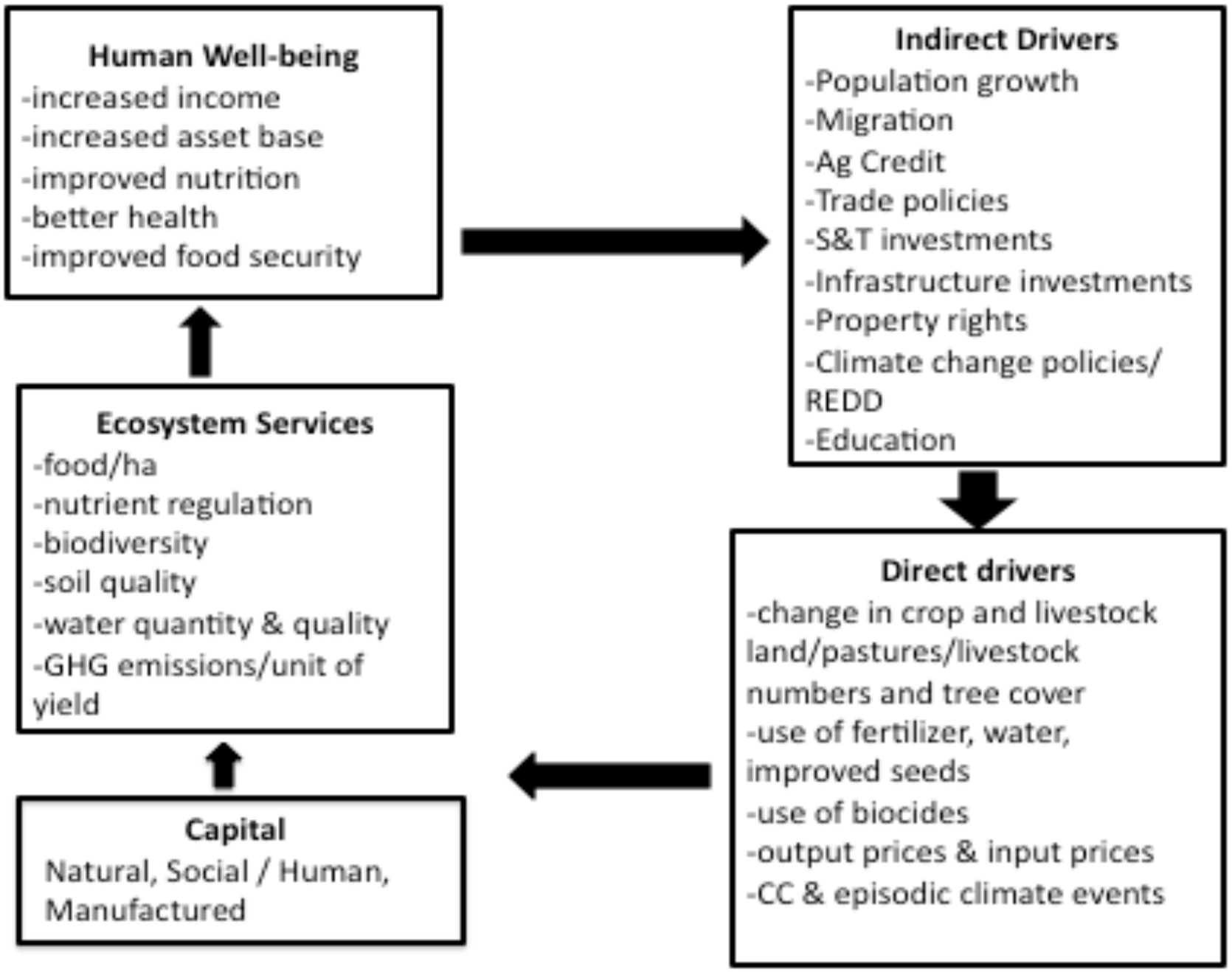
Red Squares: 10 x 10 km Landscapes
Resolution: Approx. 30 km
Data Source: CMORPH







Conceptual Framework

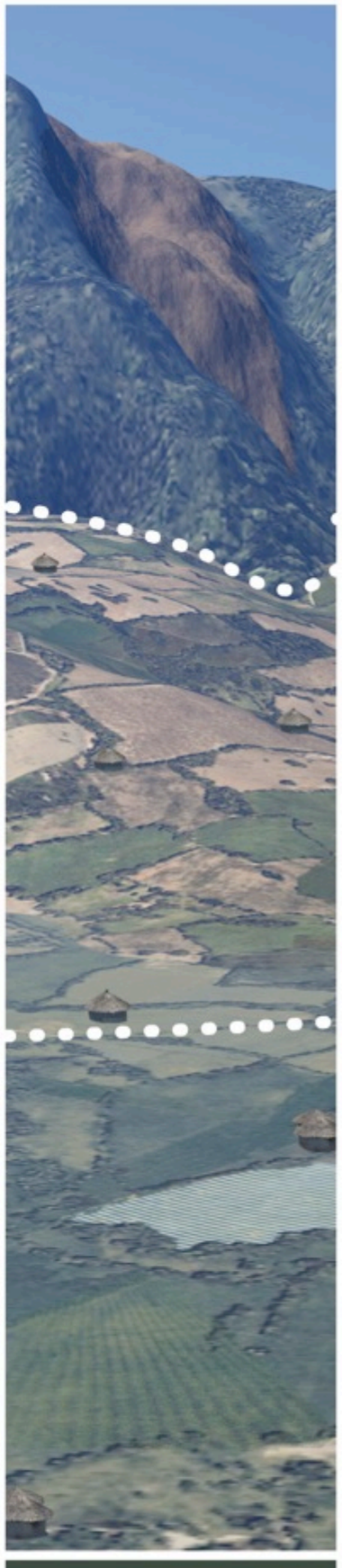


modified from MEA

Upper Slopes: Tree Planting

Mid Slopes: Maize Intensification

Lowlands/Wetlands: Rice Intensification

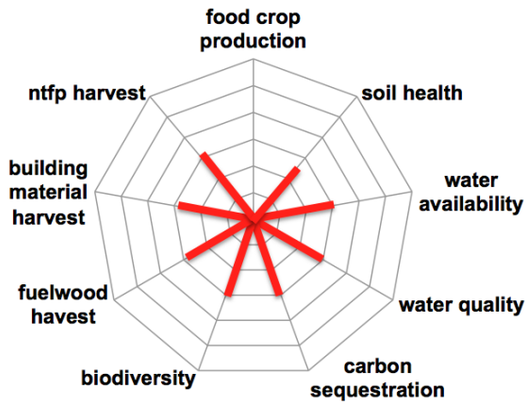


Agricultural Intervention

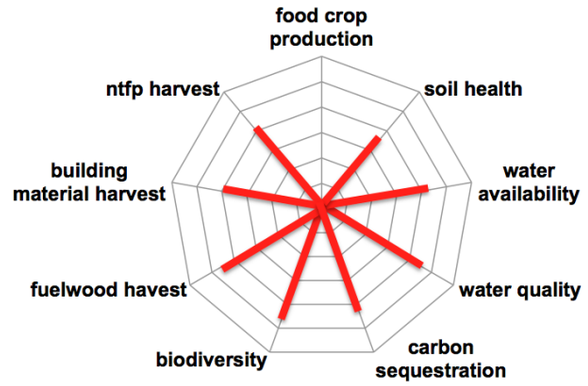
Current

Under intensification

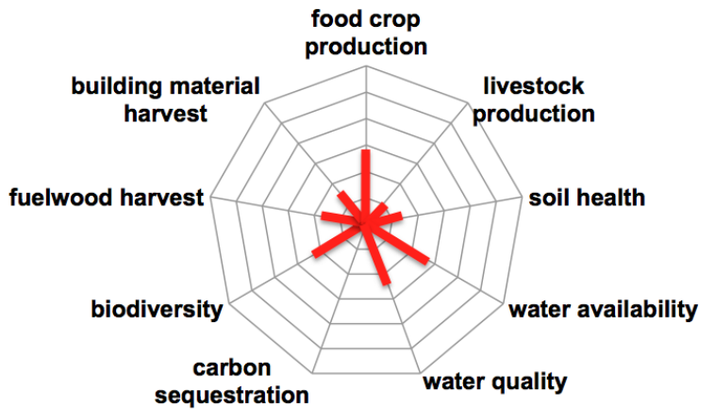
Uplands



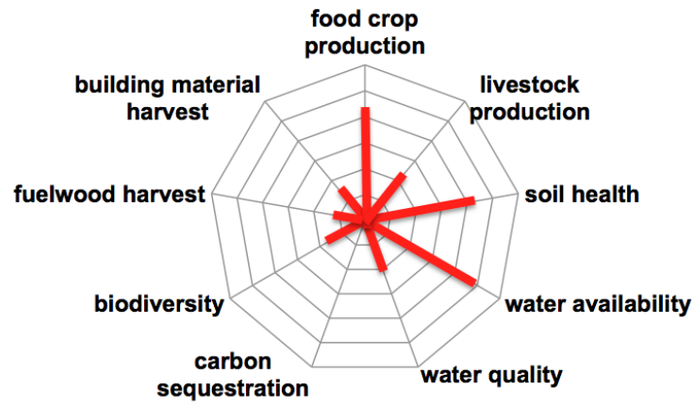
reforestation



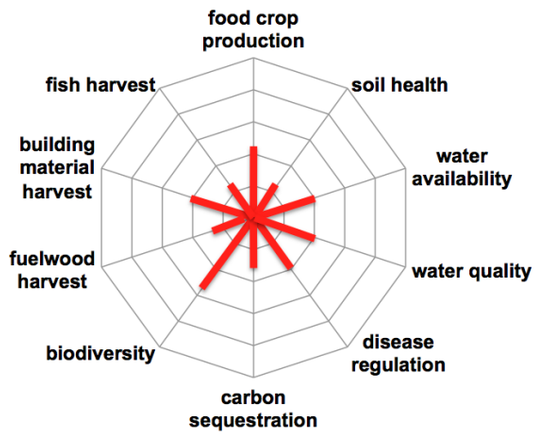
Mid-slope



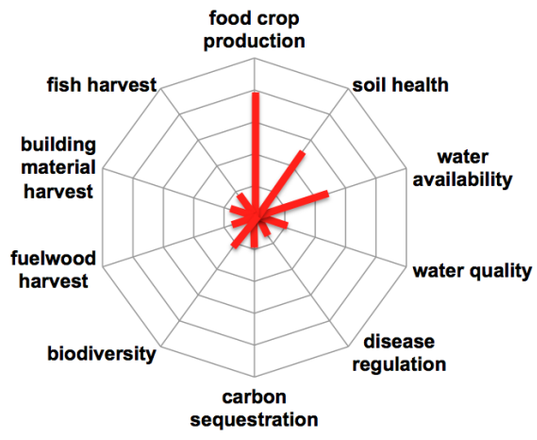
maize



Lowlands/wetlands



rice



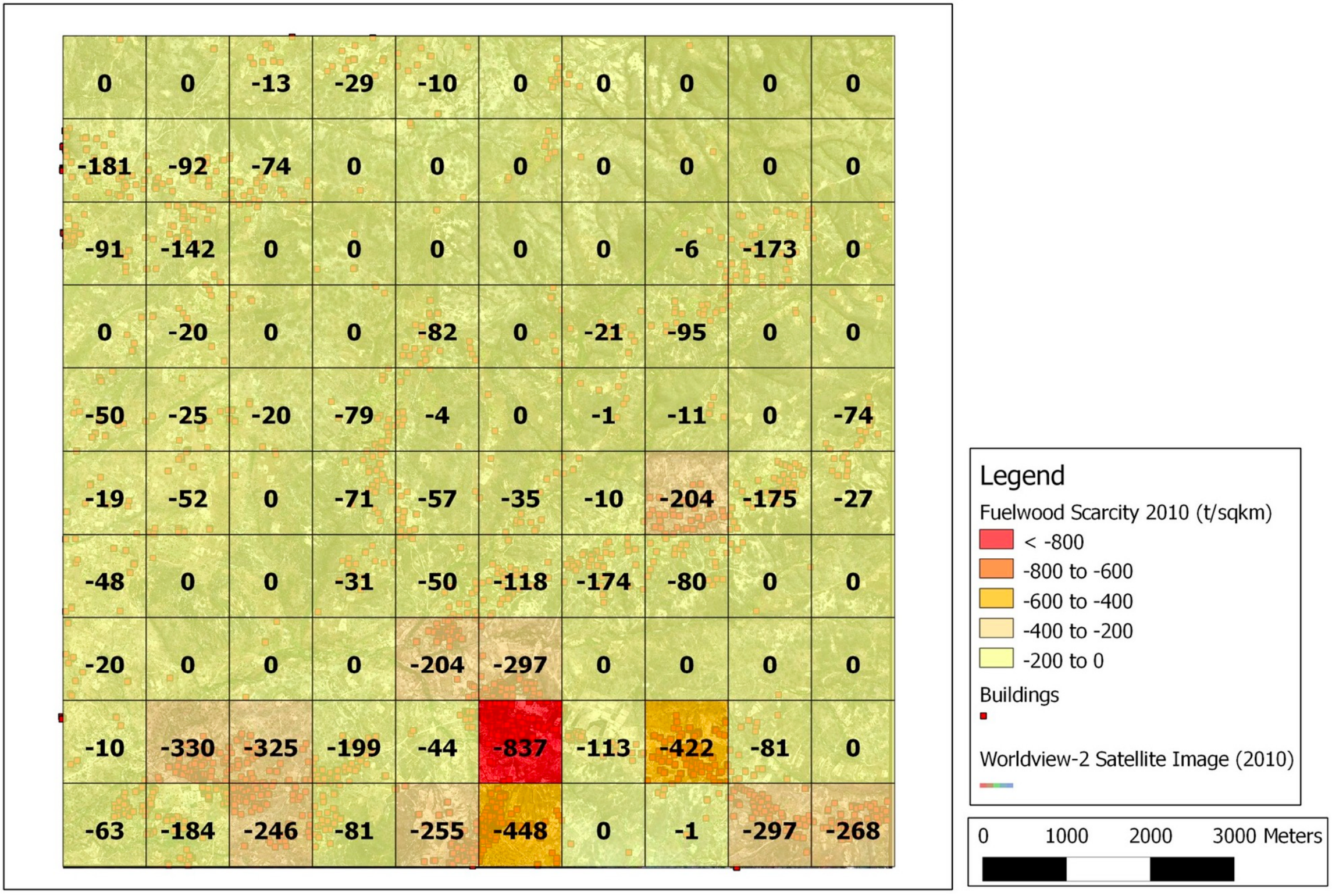
landscape

14.3%
agriculture

100 km²

Legend
Agriculture
WV2 Satellite Image (2010)

2010: fuelwood shortage throughout landscape 10



Resilience Index: Resilience of NPP, Household Income….. to Climate Variation

Net Primary Production (NPP) in relation to Variation in Precipitation

NPP Anomaly / Precipitation Anomaly

Resilience Index Calculation

$$R = \frac{1 + \left| (P - \overline{P}) / P_s \right|}{1 + \left| (N - \overline{N}) / N_s \right|}$$

R = Resilience (Current Year)
P = Precipitation (Current Year)

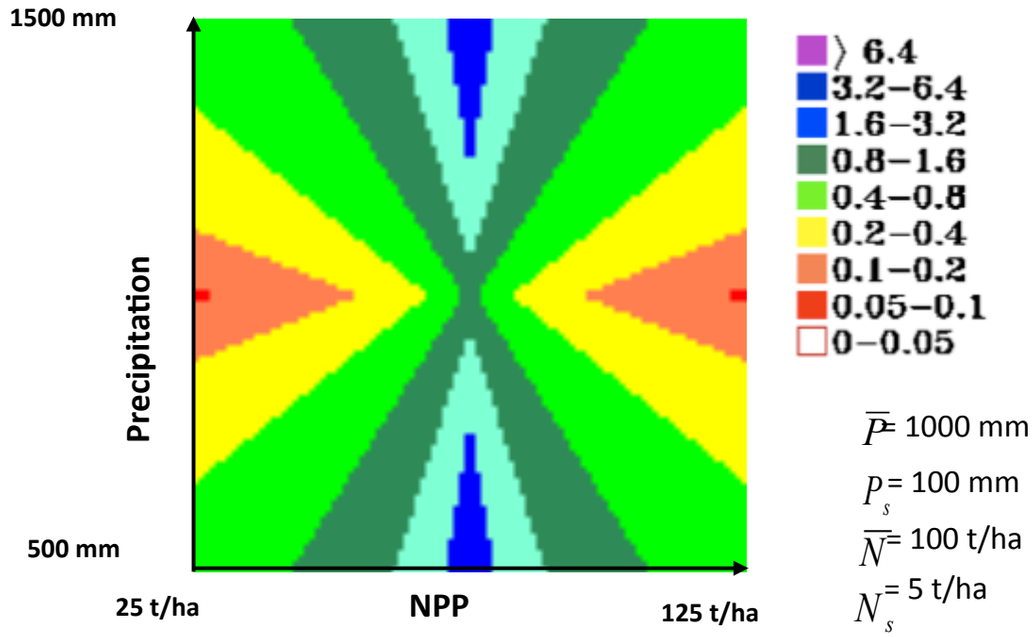
$\overline{P}$ = Precipitation Mean (Long-Term)

P_s = Precipitation Standard Dev. (Long-Term)

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

N_s = NPP Standard Deviation (Long-Term)

Example Index Values



$\overline{P}$ = 1000 mm

P_s = 100 mm

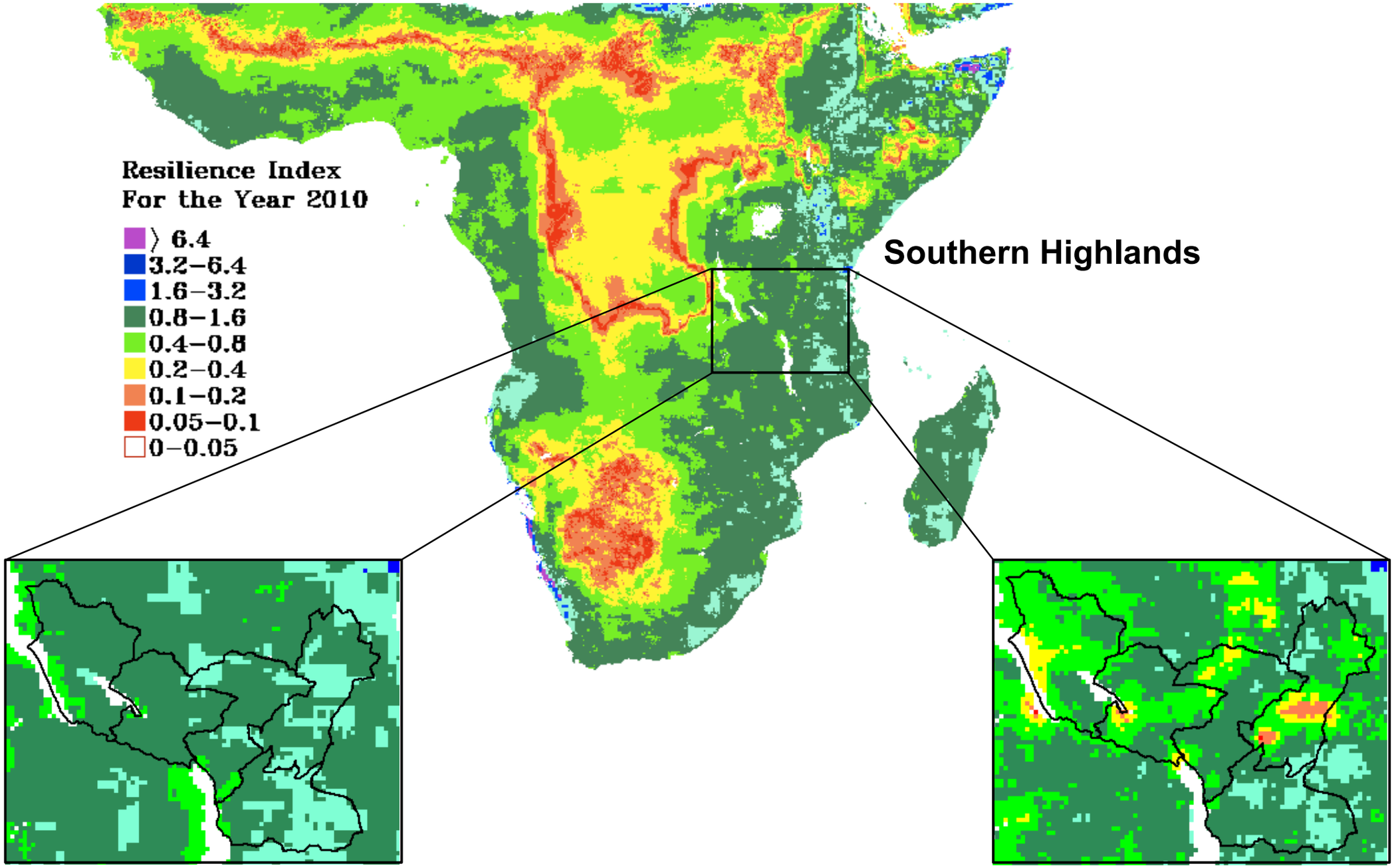
$\overline{N}$ = 100 t/ha

N_s = 5 t/ha

Resilience Index: Resilience of Net Primary Production (NPP) to Variation in Precipitation

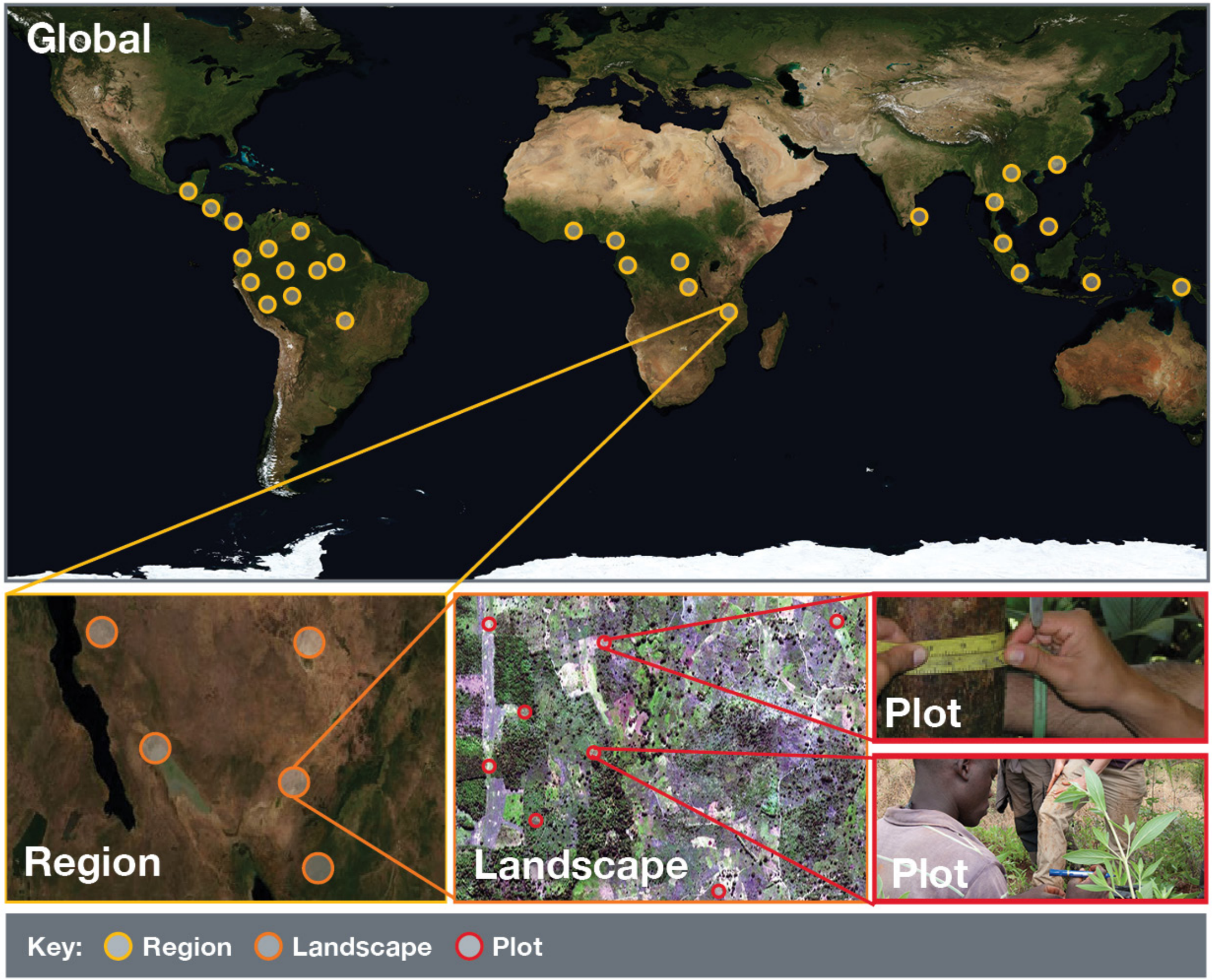
Based on long-term averages and standard deviations for the years 2003-2010

Data Sources: CMORPH, MODIS



Long Rains Resilience (Jan-Apr)

Short Rains Resilience (Oct-Dec)


Global
Region
Landscape
Plot
Plot
Key: Region Landscape Plot

Sampling Hierarchy

Level	Role	Characteristics	Indicative Numbers
Integrated, landscape-scale monitoring	Understanding spatial structure and mechanistic linkages between drivers, AI, AMP, ES and changes in HWB	Cover > 10,000 km^2, highly integrated, intensive sampling and data sets for agriculture, ES and HWB	~10 per continent
Measurement and calibration sites	In situ measurements to calibrate RS variables; trends in variables	Leverages existing observation sites and systems; representative of the range within a "type," e.g., bioclimatic zone; not statistically unbiased; frequent measurement of variables	~100's
Sample sites	In situ measurement of variables not observable through RS, calibration and validation of RS measures, status and trends of system indicators	Infrequent measurements at permanent plots or locations; potential for data collection via cell phone; large, statistically unbiased sample	~1,000's
Remote sensing, e.g., MODIS, Landsat, Spot,	Spatial and temporal interpolation at resolutions of up to 1 day and 30 meters; status and trends of key metrics and indicators	Frequent, complete coverage; most observations indirect	N/A

Elements	Purpose and Outcomes
Stakeholder engagements: local, sub-national, national, regional global	Align system with needs and create enabling environment. Train users. Coordinate resources, agree data sharing policies
Data Assimilation Models, with sufficient resolution for regional application. Reduced-form crop production and ecosystem service models, pulling in remote sensing, real and projected climate data and observed yields and social information in near-real time	1. Scenario generation – where are the key areas? 2. Design tool for sample scheme 3. Interpolation tool for observations 4. Optimisation/tradeoff studies
Synthetic Indicators, analytical and **decision support framework**	Interpretation of measurements and model outputs in a way that informs multiple user needs
Measurements: in situ, social and economic. Household surveys, national/subnational ag, popn and economic stats+ disaggregation algorithms. Protocols designed, tested and accepted.	Spatially-resolved population, income levels, health status, nutrition, dependence on ecosystems and agriculture, education
Measurements: in situ biophysical 1) once-off (characterisation) and 2) repeated measurement. Protocols designed, tested and accepted.	Provides the hydrological, climatic, soil and vegetation parameterisation and drivers for models. Tracks key variables for outcome monitoring eg for water, carbon and biodiversity. Provides rich set co-registered set for hypothesis generation and testing
Measurements derived from remote sensing (satellite, airborne and ground-based). 1) National wall-to-wall, and 2) detailed site characterisation. Land cover and change, FAPAR etc .	Extrapolation in space and time Cost-effective monitoring of those variables that are amenable to remote sensing
Capacity building. Programme-embedded, nationally-accepted, network implemented. 1) Users 2) Professionals 3) Students and Postdocs 4) Technicians 5) trained lay people	System becomes locally-owned and operated by end of project
Information systems. Web-accessible database and information system is the core, but supports multiple output avenues: self-help; synthesis reports; briefing notes and presentations etc	Information is accessible, when needed, in a form that is readily assimilated