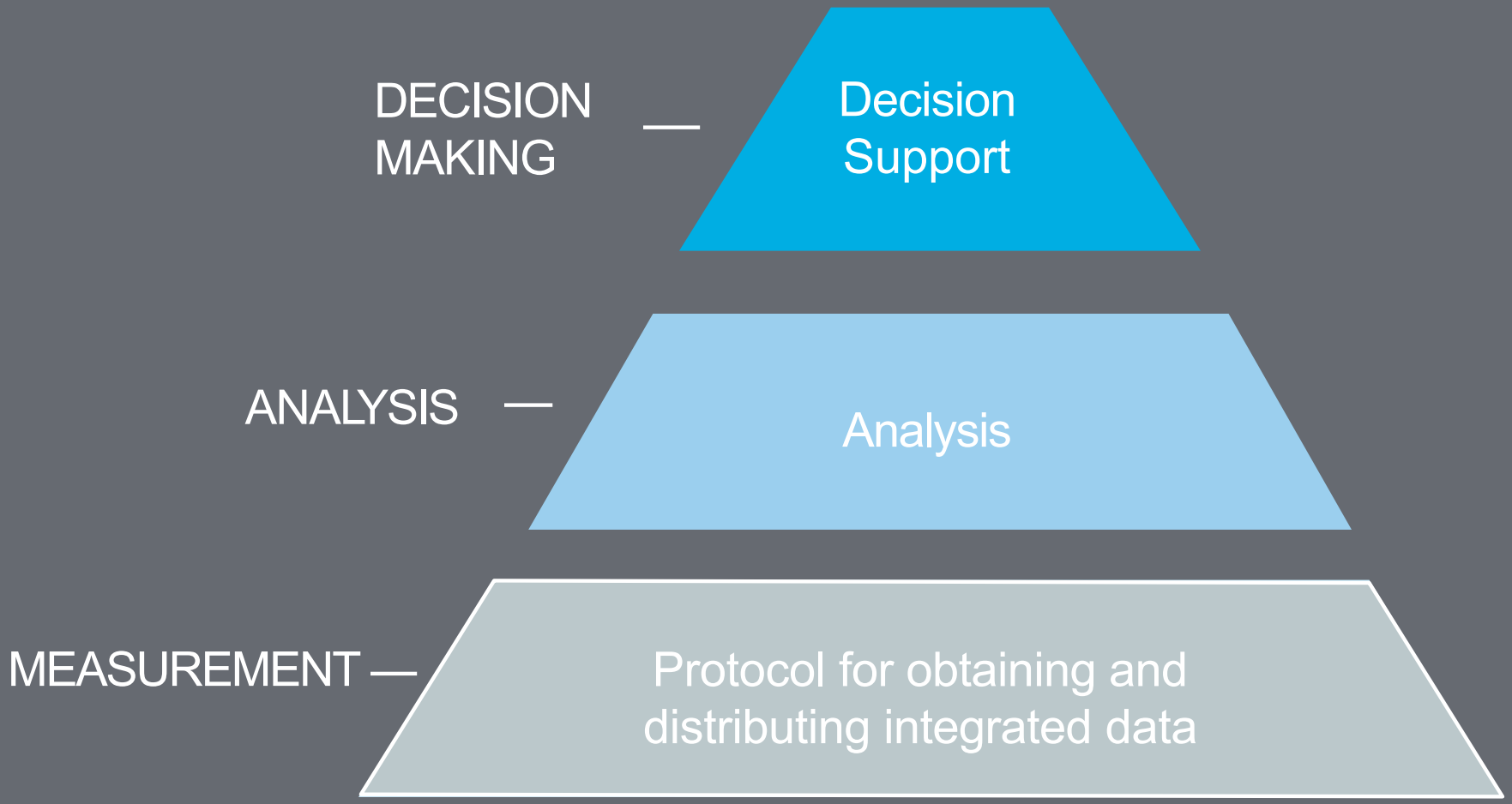

VITAL SIGNS
A monitoring system for agriculture, nature and human well-being
vitalsigns.org

WHAT IS VITAL SIGNS?

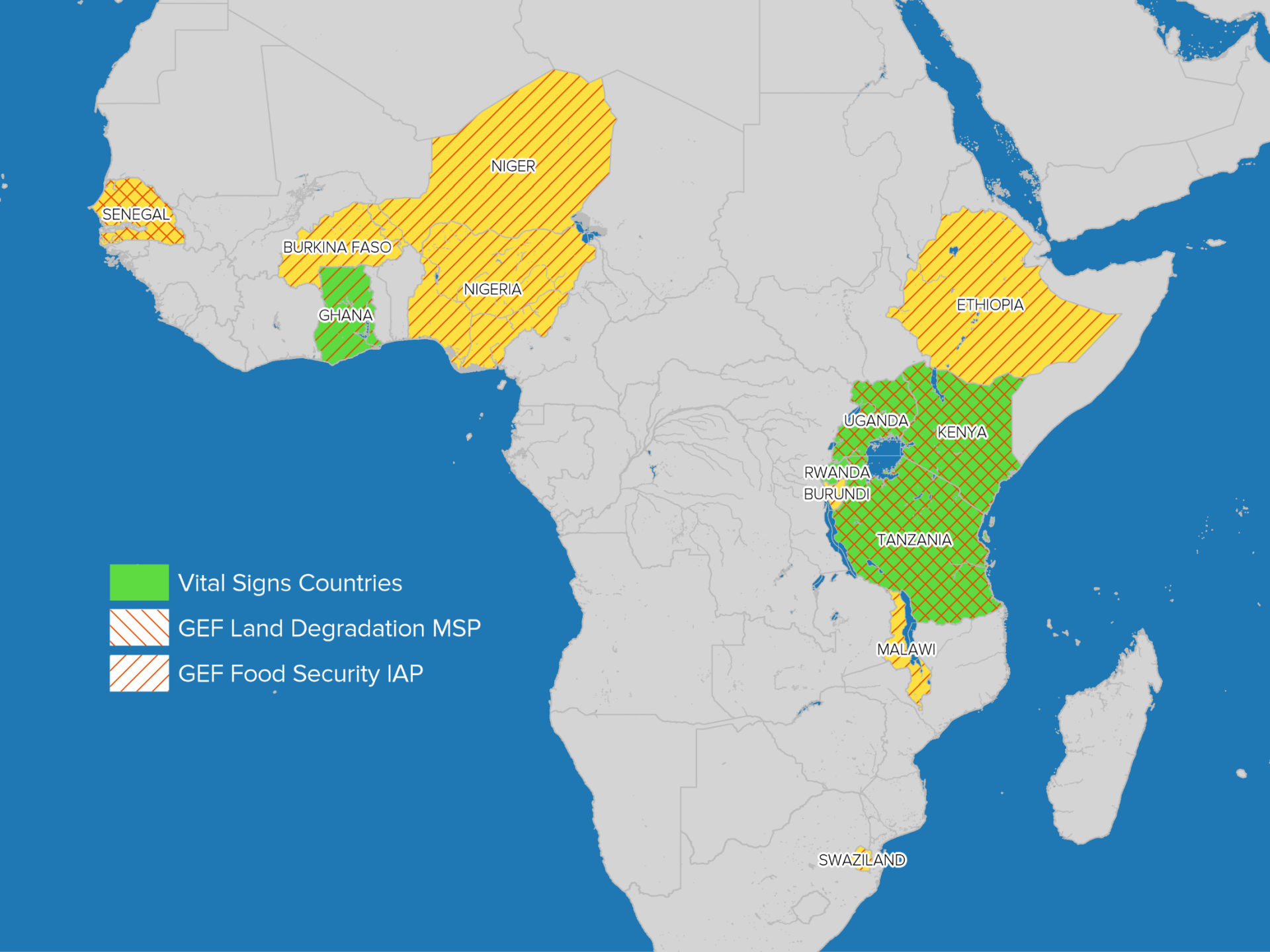
A system to generate data for managers and farmers to enable better decision-making in support of sustainable agricultural production

VITAL SIGNS SYSTEM



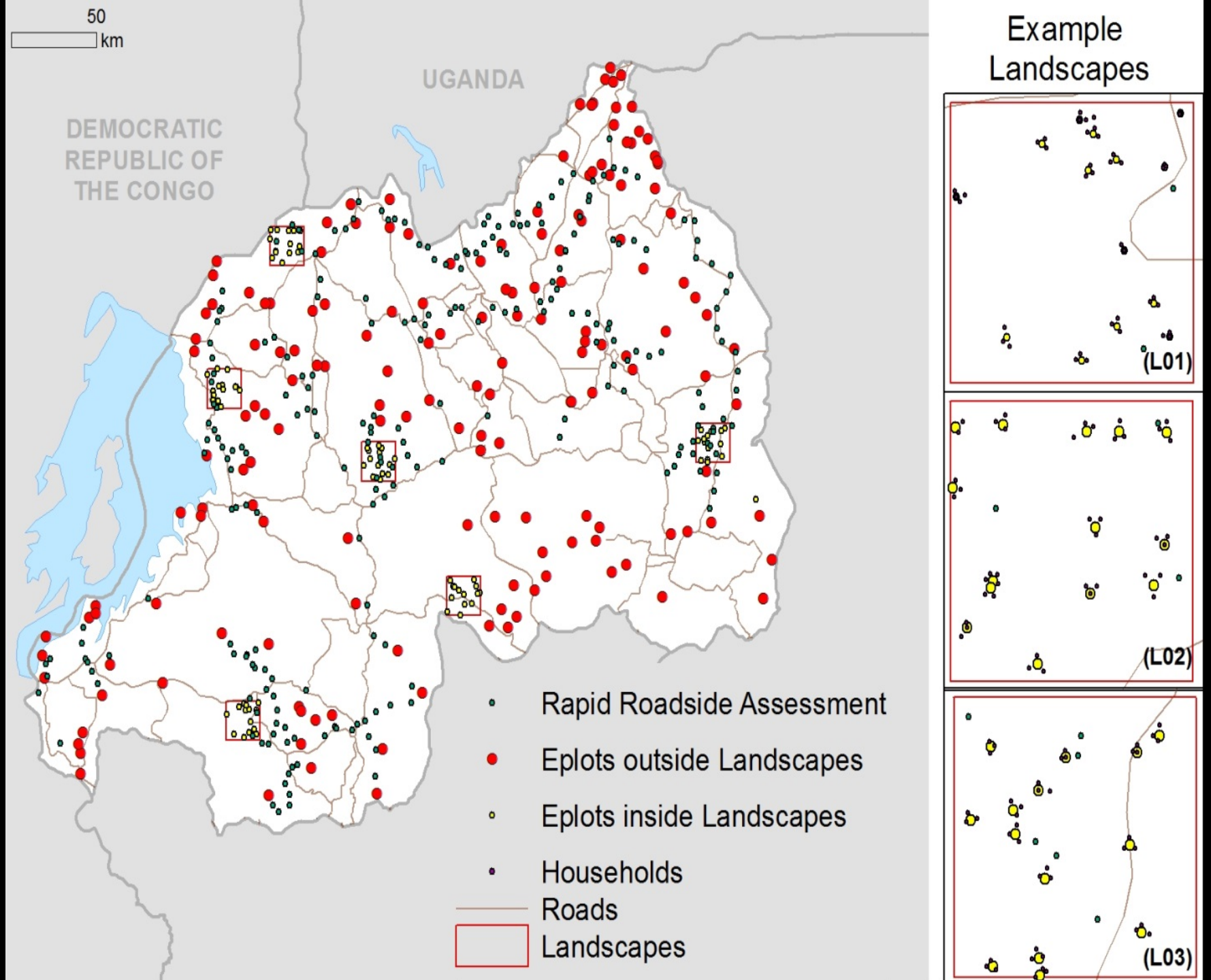
Why Vital Signs is important for Africa?

- Unprecedented growing **demand** for mineral extraction, increased agricultural output and energy resources.
- Interactions between Economic Development and conservation of natural capital are **poorly understood**
- Data currently **scattered** in many **different ministries** and many **different forms**
- Implementation and Monitoring of SDGs estimated to **cost $1 billion per year (UN)**


NIGER
SENEGAL
BURKINA FASO
NIGERIA
GHANA
ETHIOPIA
UGANDA
KENYA
RWANDA
BURUNDI
TANZANIA
MALAWI
SWAZILAND
Vital Signs Countries
GEF Land Degradation MSP
GEF Food Security IAP

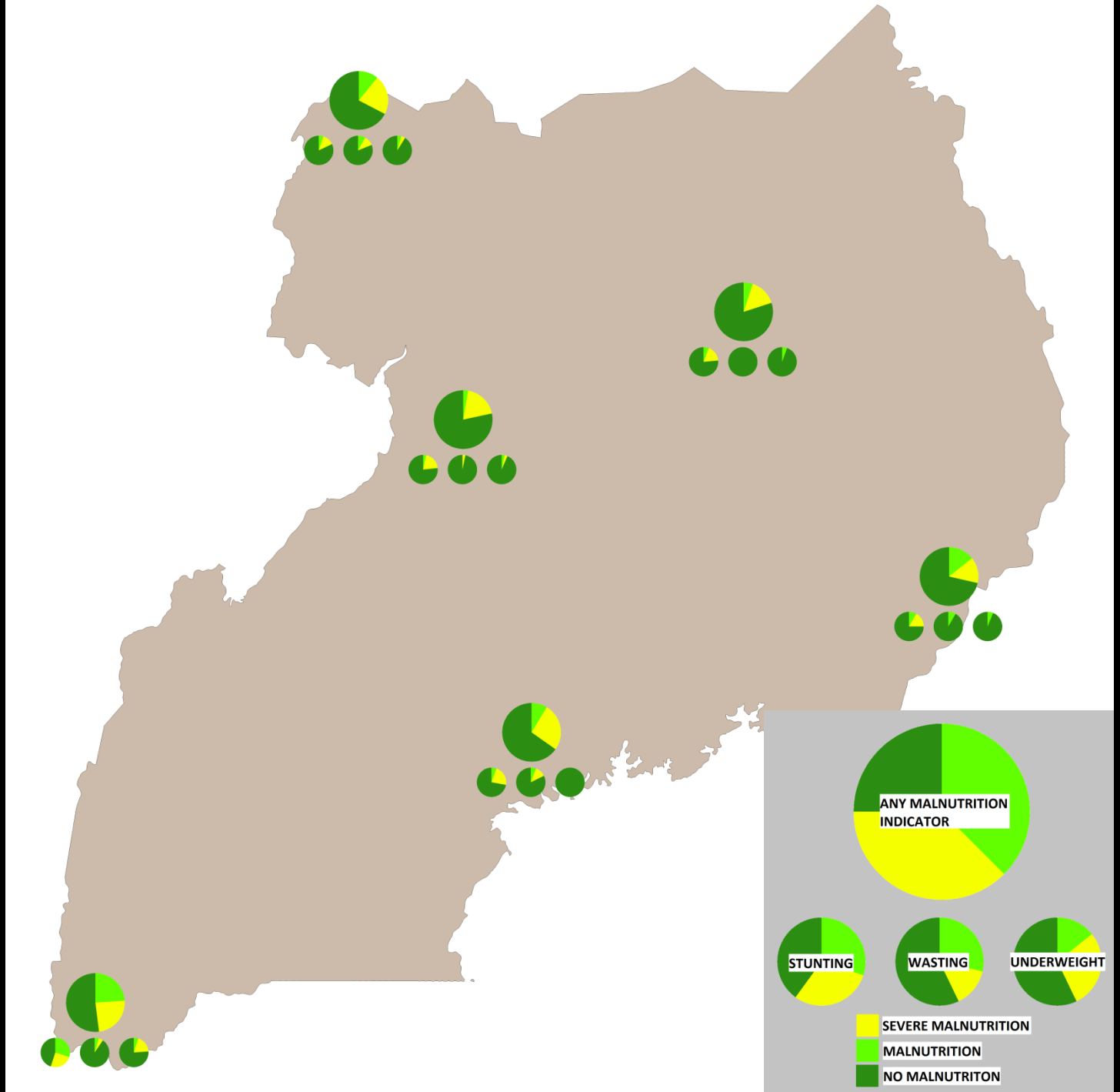
What Data We Have

- Soils
- Land Cover
- Household Data
- Agricultural Data
  - Yields
  - Inputs
  - Crops
- Weather Data


50
km
UGANDA
DEMOCRATIC
REPUBLIC OF
THE CONGO
Rapid Roadside Assessment
Eplots outside Landscapes
Eplots inside Landscapes
Households
Roads
Landscapes
Example
Landscapes
(L01)
(L02)
(L03)

Household Survey Data

- We have surveyed **804** households
  - Food consumption
  - Natural resource use
  - Fuelwood use
  - Items owned
  - Housing materials
  - Food security & Food scarcity
- And **6,677** individuals
  - Age
  - Education
  - Health and anthropometry
  - Labor and businesses


ANY MALNUTRITION INDICATOR
STUNTING
WASTING
UNDERWEIGHT
SEVERE MALNUTRITION
MALNUTRITION
NO MALNUTRITON

Agricultural Survey Data

- Visited **804** Households
  - Livestock
  - Farming implements
  - Extension services
  - Crop and livestock sales
- And **2,193** Agricultural Fields
  - Inputs and input history
  - Estimated yields and byproducts
  - Annual crops and Permanent crops

Biophysical Data

- Nationwide and nationally representative
- Samples from **1,334** field plots
- **49,588** trees measured and identified
- **7,670** subplots assessed for erosion
- **3,646** unique plant species identified
- ALL GEOLOCATED

Yields Data

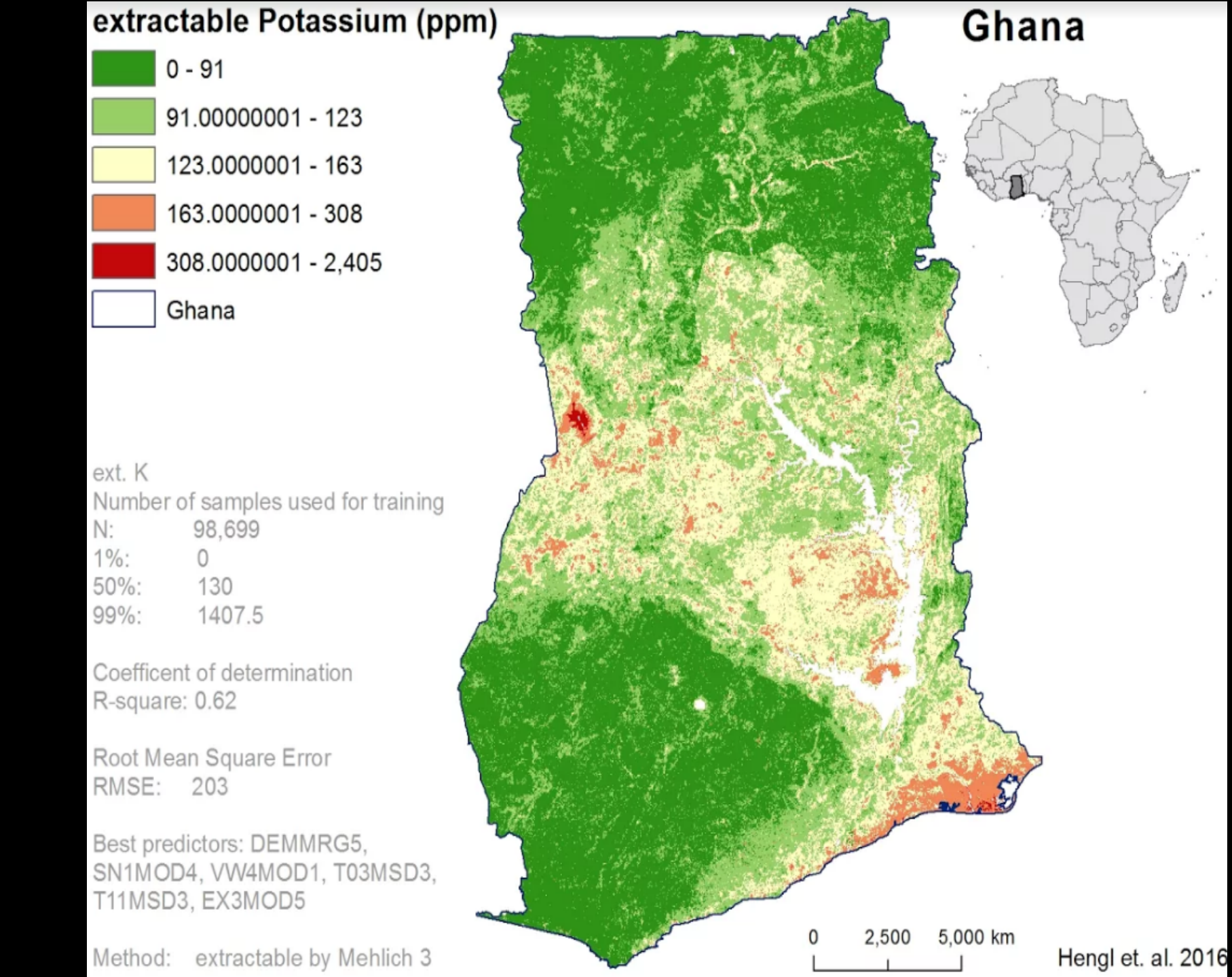
- Data on **212** verified yields samples
  - Maize and Rice
  - "Gold Standard" of yields data – very rare in Africa

Land Use/Land Cover

- Data on **8,515** georeferenced land cover points recorded for ground-truthing classifications
- **20** classified images of 10x10km landscapes

Soils

- We have **3,139** samples from biophysical plots
  - Georeferenced
- We have **955** from farmer's fields
  - Can be related to yields, field agricultural history
- Of those, **1,905** analyzed using spectroscopy
  - Covering **52** variables, including texture, macro- and micro-nutrients, and organic carbon


extractable Potassium (ppm)
0 - 91
91.00000001 - 123
123.0000001 - 163
163.0000001 - 308
308.0000001 - 2,405
Ghana
Ghana
ext. K
Number of samples used for training
N: 98,699
1%: 0
50%: 130
99%: 1407.5
Coefficent of determination
R-square: 0.62
Root Mean Square Error
RMSE: 203
Best predictors: DEMMRG5, SN1MOD4, VW4MOD1, T03MSD3, T11MSD3, EX3MOD5
Method: extractable by Mehlich 3
0 2,500 5,000 km
Hengl et. al. 2016

Weather

- We have **8** Weather stations constantly collecting data and transmitting to data
  - Temperature
  - Relative Humidity
  - Pressure
  - Solar Radiation
  - Wind Speed
  - Precipitation
- Every half hour

Other Datasets

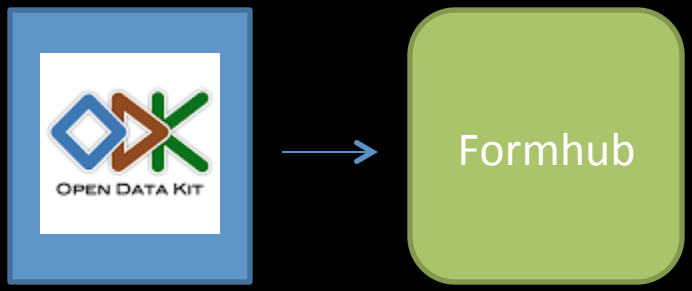
- CHIRPS rainfall data
- Landsat
- LSMS-ISA
- AfSIS
- Protected area locations
- WHO reference tables

The Data Flow - Open Data Kit

- Open source data collection toolkit
- Works on Android devices
- Very customizable

The Data Flow - Formub

- Web Application in Django
- Open Source

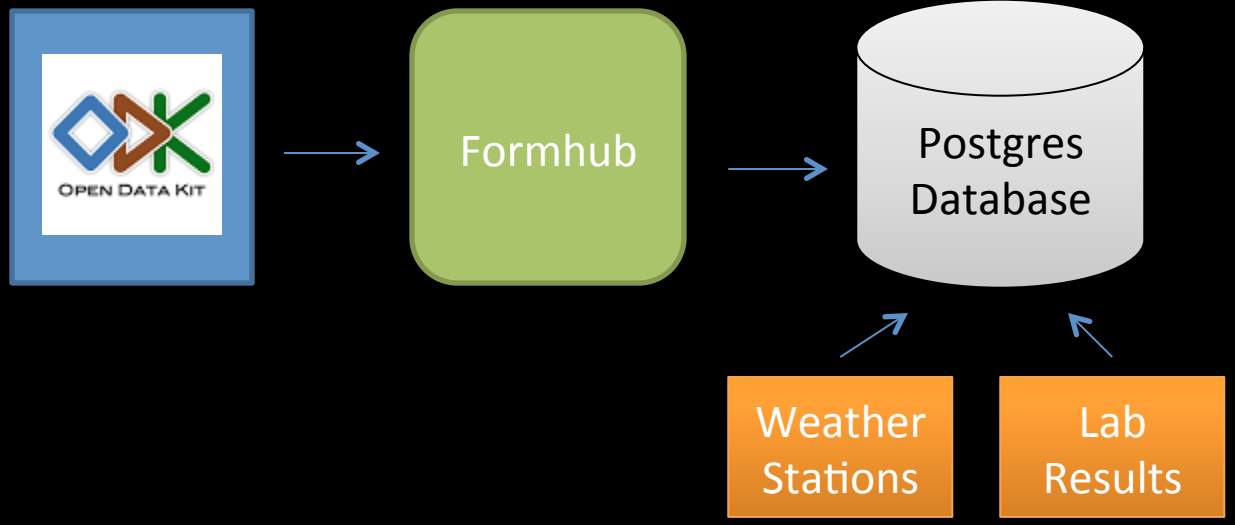


The Data Flow - Database

- Postgres Database
- PostGIS enabled
- Relational

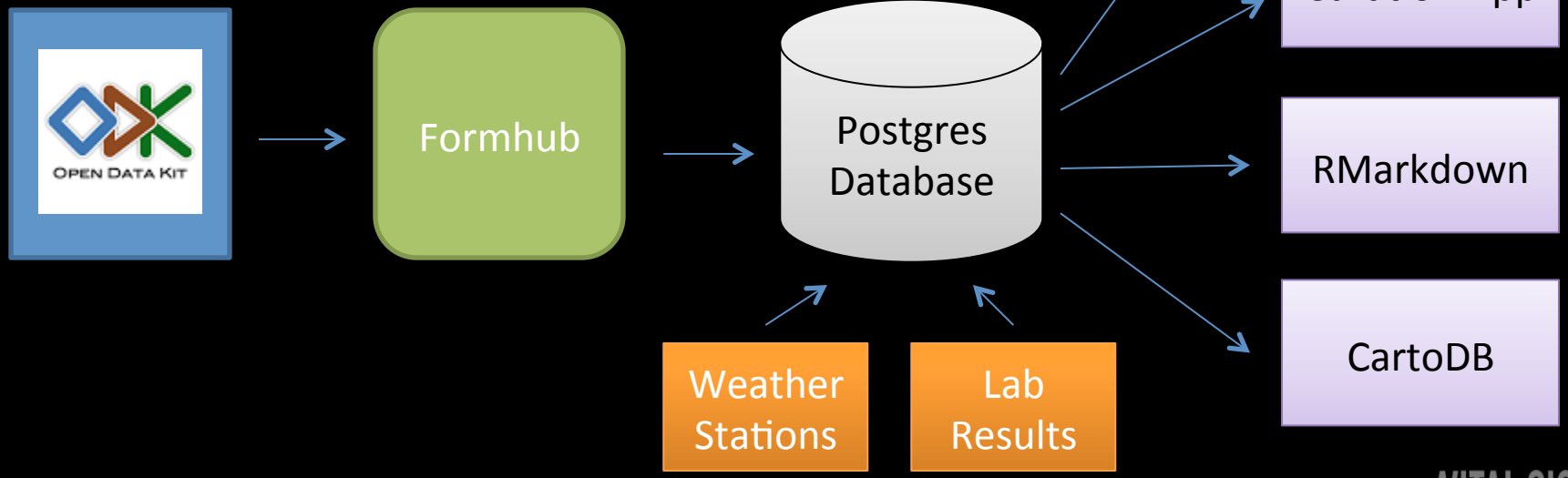
The Data Flow - Other Sources

- Lab results for soil and water data
- Weather station data every 30 minutes

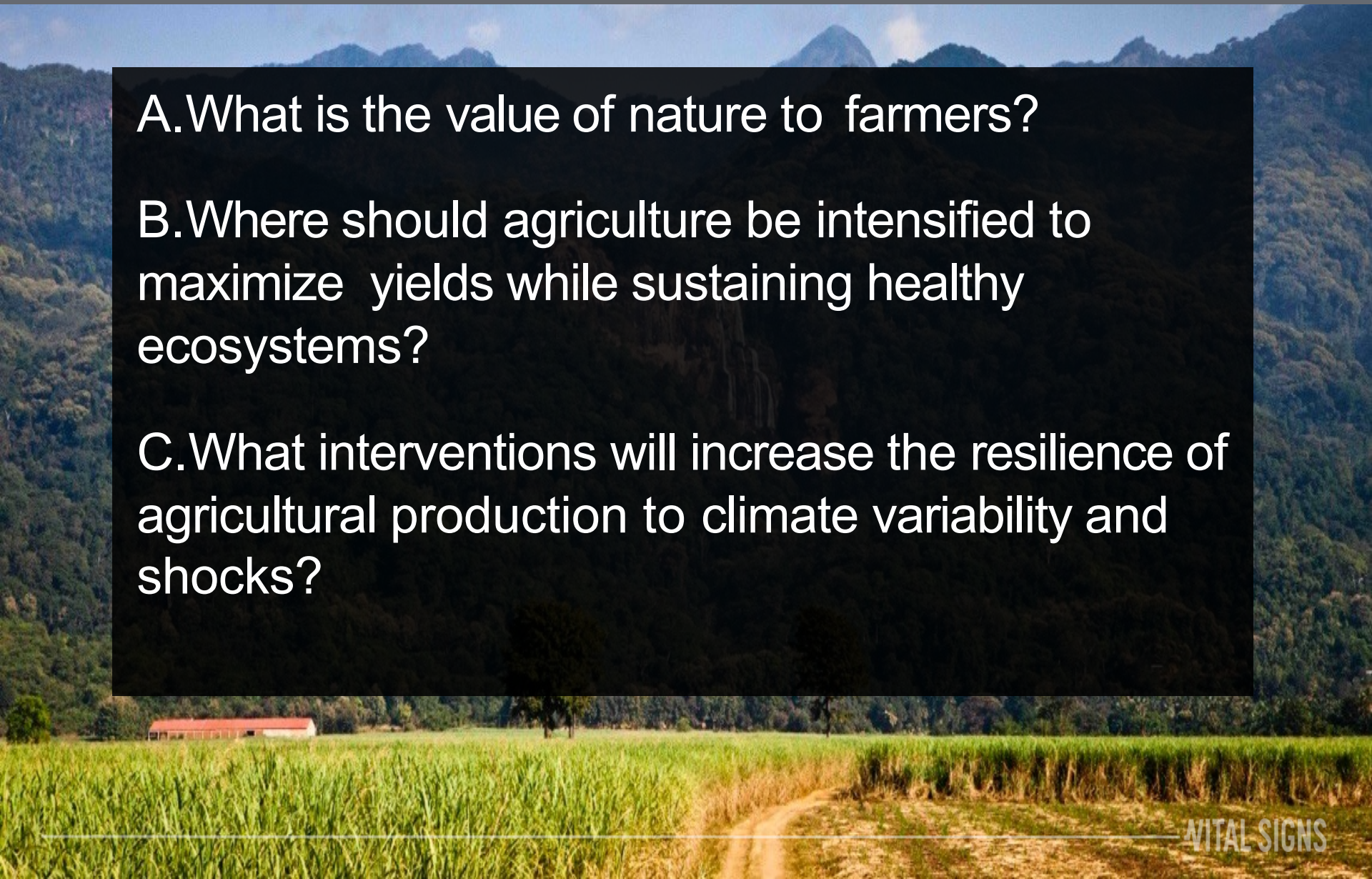


The Data Flow - Applications

- Applications draw from the postgres database



QUESTIONS VITAL SIGNS CAN ANSWER

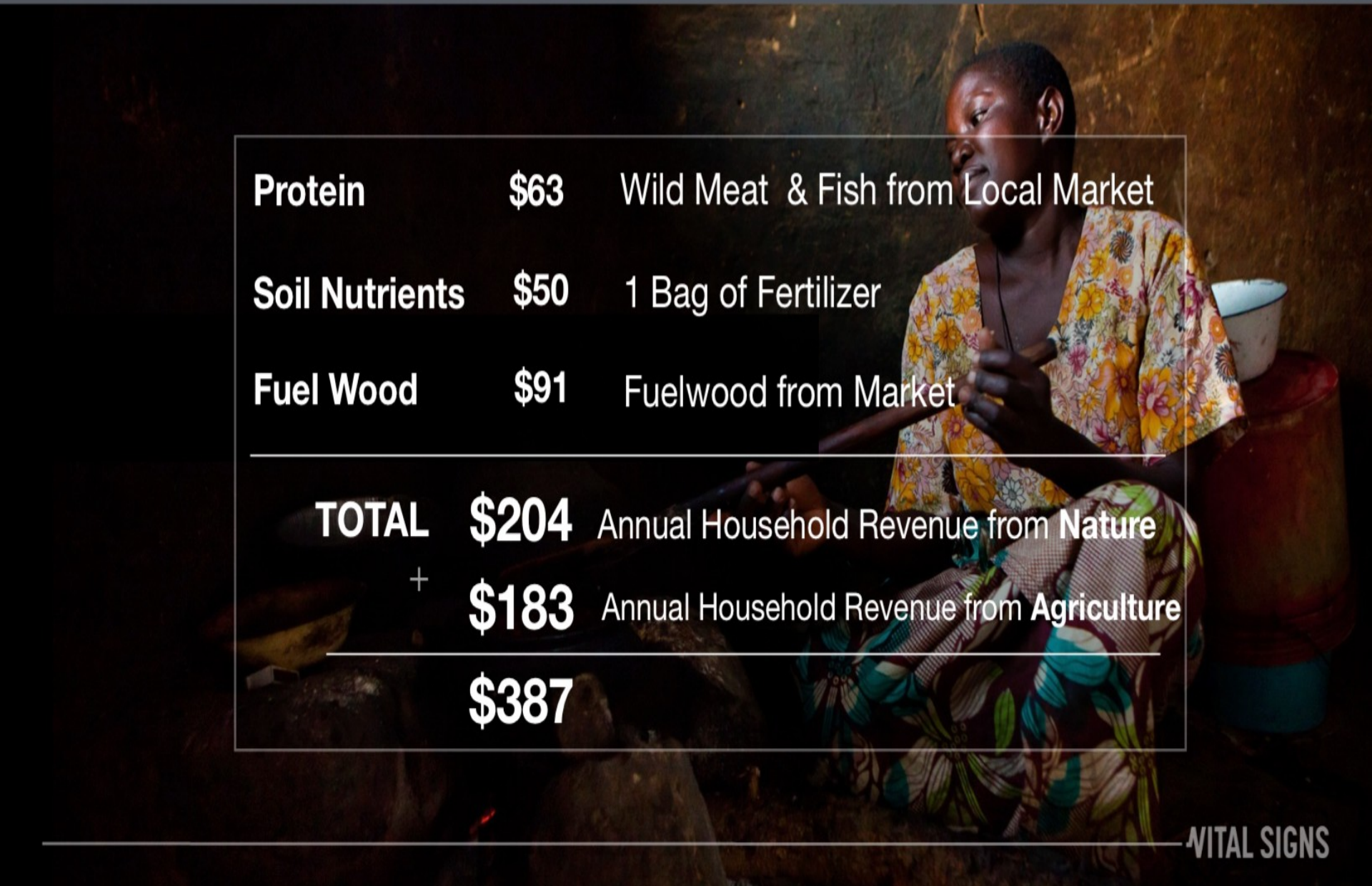


A. What is the value of nature to farmers?

B. Where should agriculture be intensified to maximize yields while sustaining healthy ecosystems?

C. What interventions will increase the resilience of agricultural production to climate variability and shocks?

WHAT IS THE VALUE OF NATURE TO FARMERS?



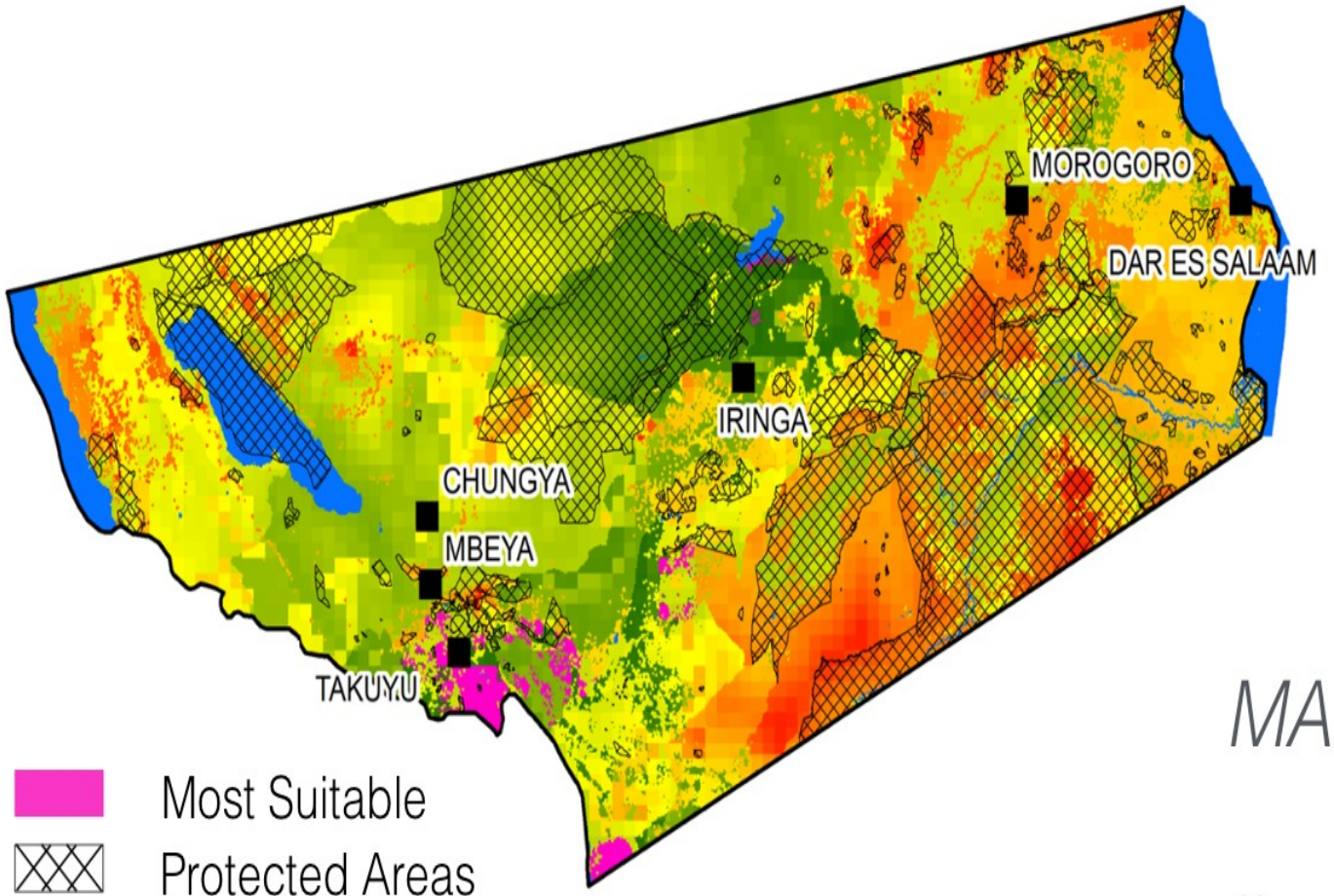
Protein	**$63**	Wild Meat & Fish from Local Market
Soil Nutrients	**$50**	1 Bag of Fertilizer
Fuel Wood	**$91**	Fuelwood from Market
TOTAL	**$204**	Annual Household Revenue from **Nature**
+	**$183**	Annual Household Revenue from **Agriculture**
	$387	

Where should agriculture be intensified to maximize yields while sustaining healthy ecosystems?

- Population
  - Current
  - Future
- Natural Capital
  - Forest Cover
  - Protected Areas
- Infrastructure
  - Agro-dealers
  - Roads
- Yield Gaps
- Anticipated Climate Changes
  - Temperature
  - Precipitation

Nijbroek, Ravic P., and Sandy J. Andelman. "Regional Suitability for Agricultural Intensification: A Spatial Analysis of the Southern Agricultural Growth Corridor of Tanzania." *International Journal of Agricultural Sustainability* (September 15, 2015): 1–17.

B. WHERE SHOULD AGRICULTURE BE INTENSIFIED TO MAXIMIZE YIELDS WHILE SUSTAINING HEALTHY ECOSYSTEMS?



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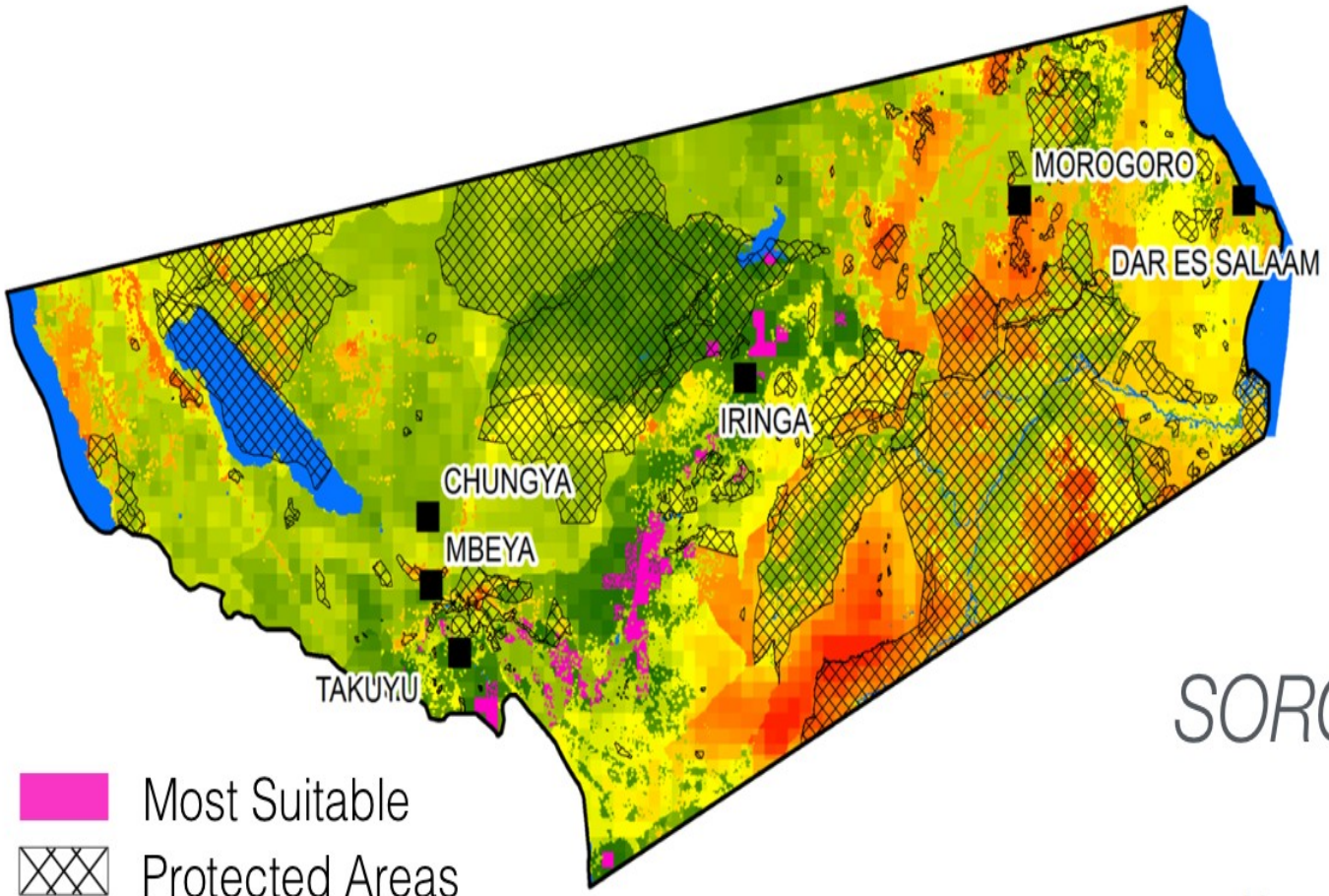

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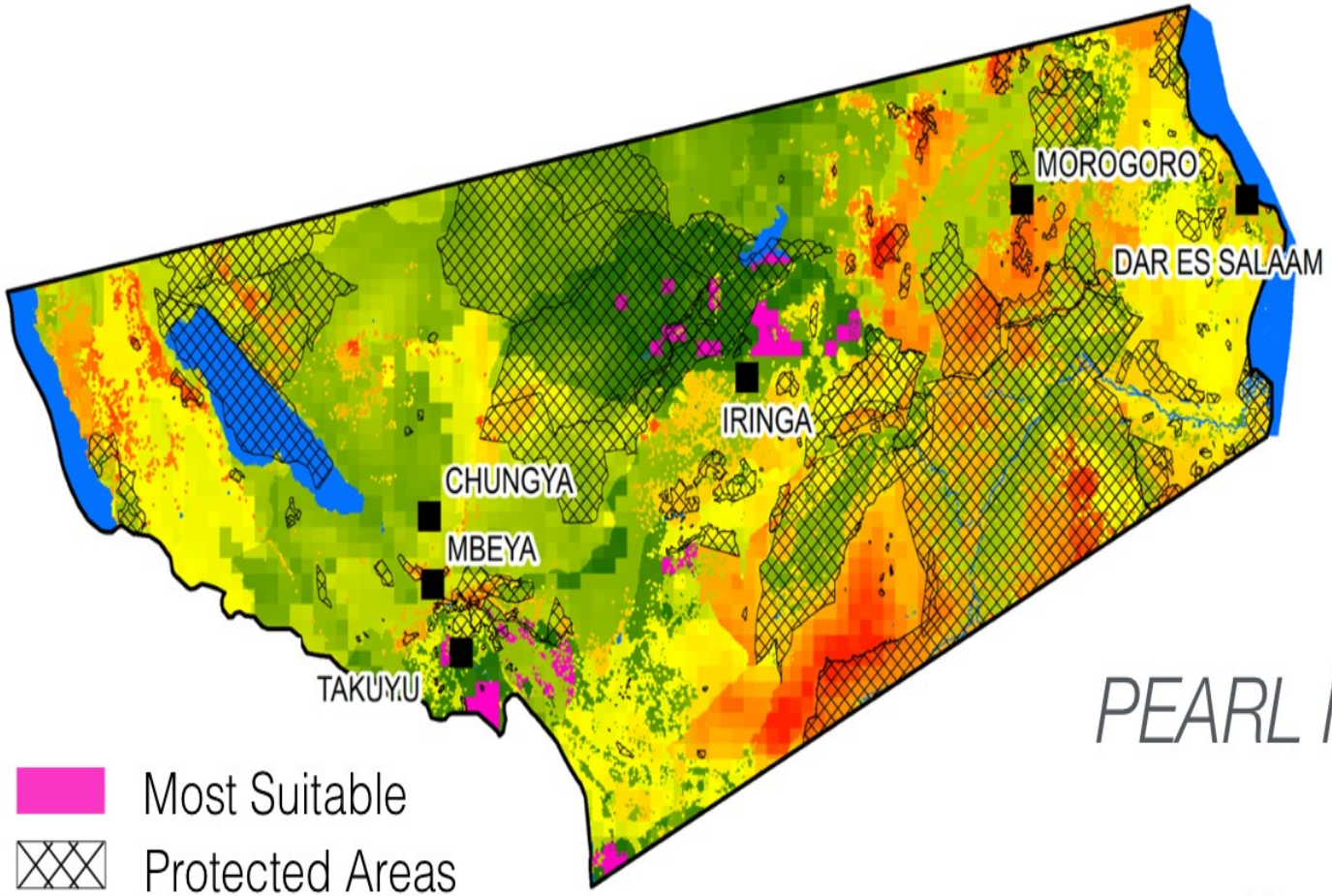

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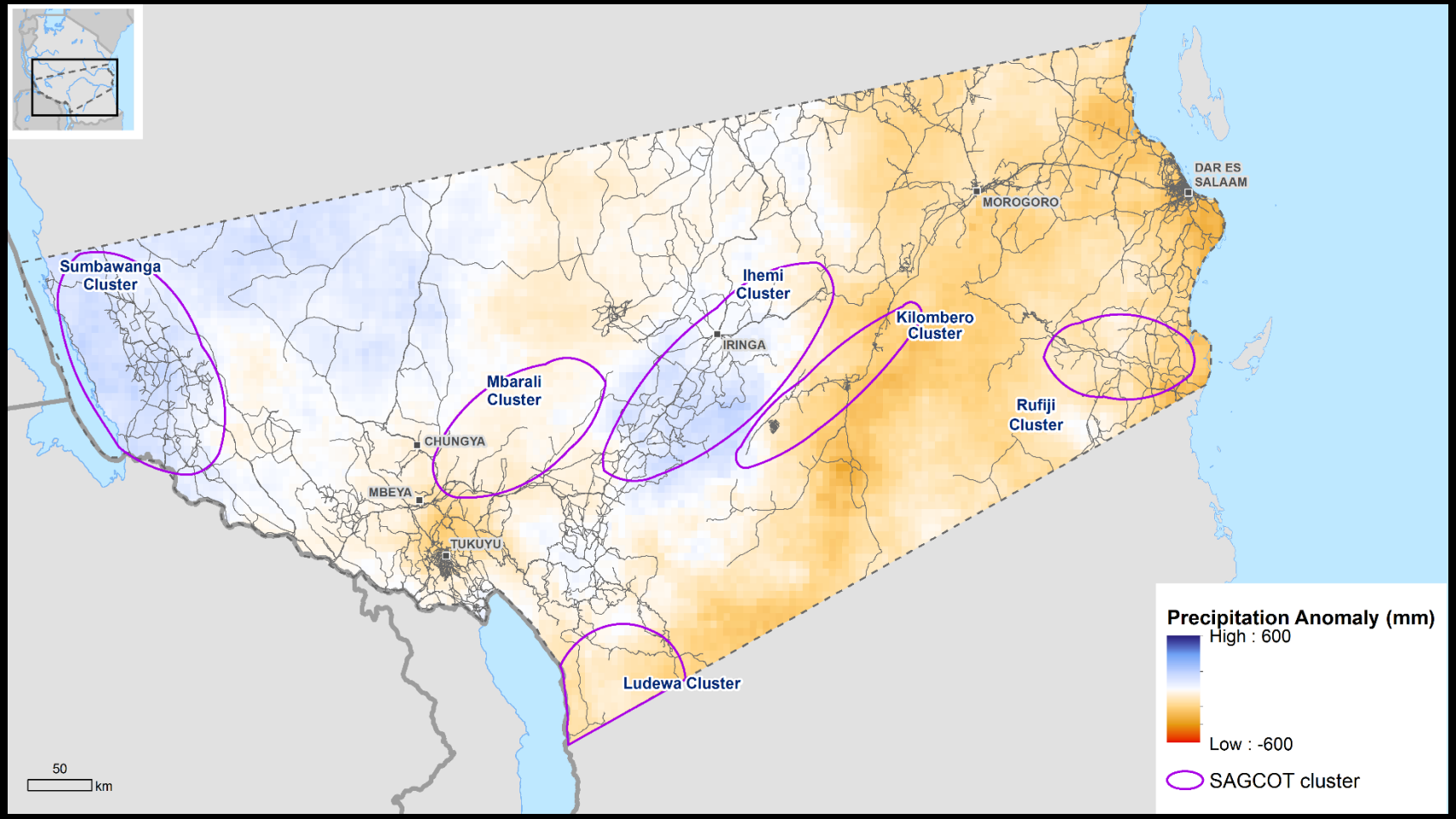
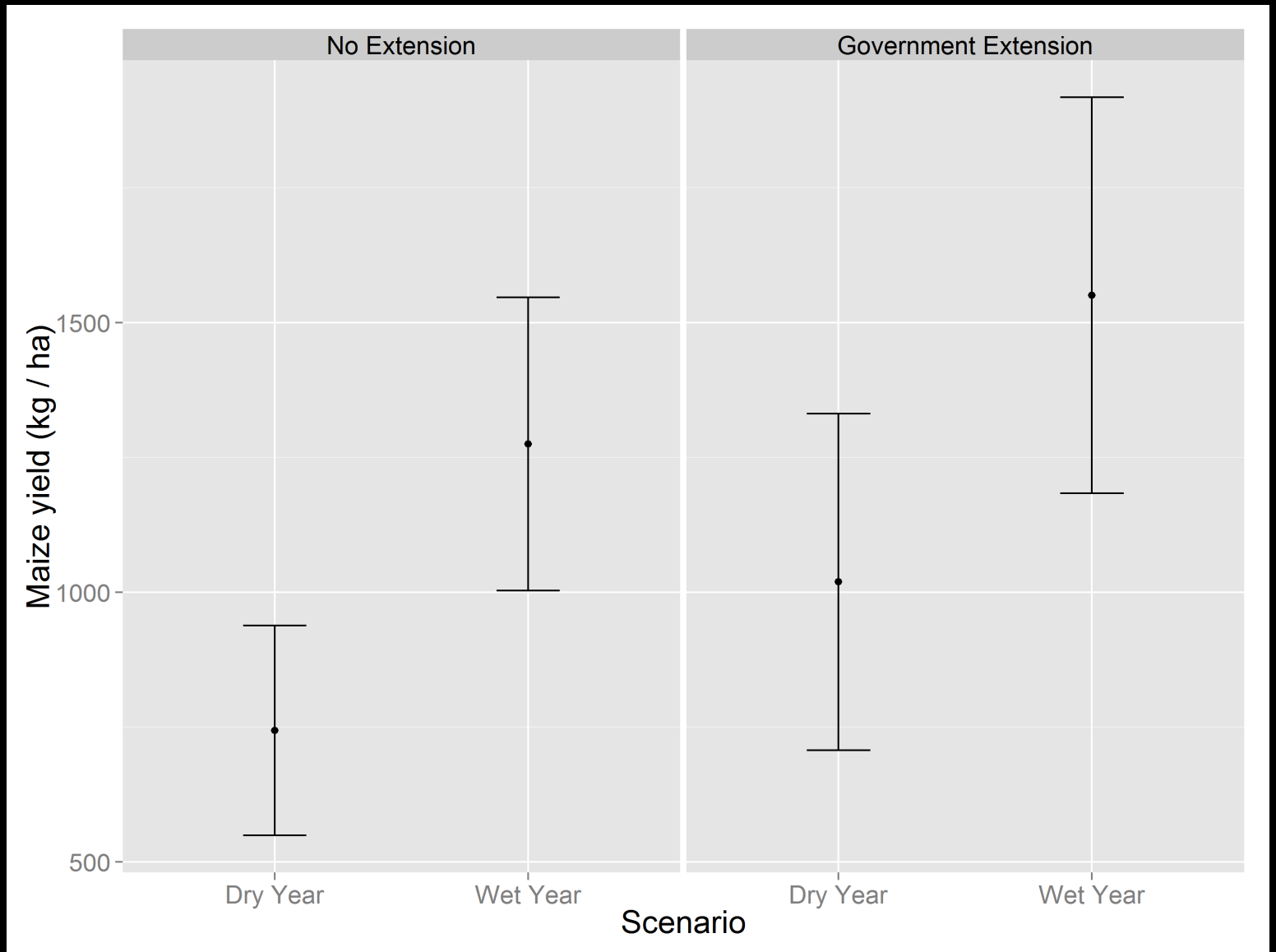
C. WHAT INTERVENTIONS CAN INCREASE RESILIENCE OF AGRICULTURE TO CLIMATE VARIABILITY & SHOCKS?

Rainfall Anomaly



Effect of Extension Services on Maize Yields



THANK YOU

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INTERNATIONAL