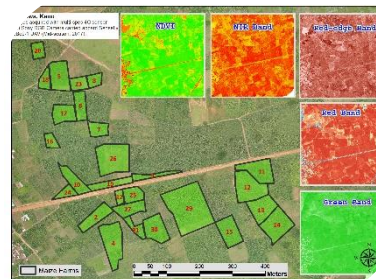


Old Problem, New Possibilities: Improving Reliability of Crop Yield Estimates in Smallholder Farming Systems (Nigeria).



AIARD Conference, Hilton Garden Inn, Washington, D.C.
5th June, 2018.

J. Adewopo, I. Mohammed, A. Kamara, P. Craufurd, B. Vanlauwe | Associate Scientist

Frequency of consumption of Staple Food Crops at the National level.

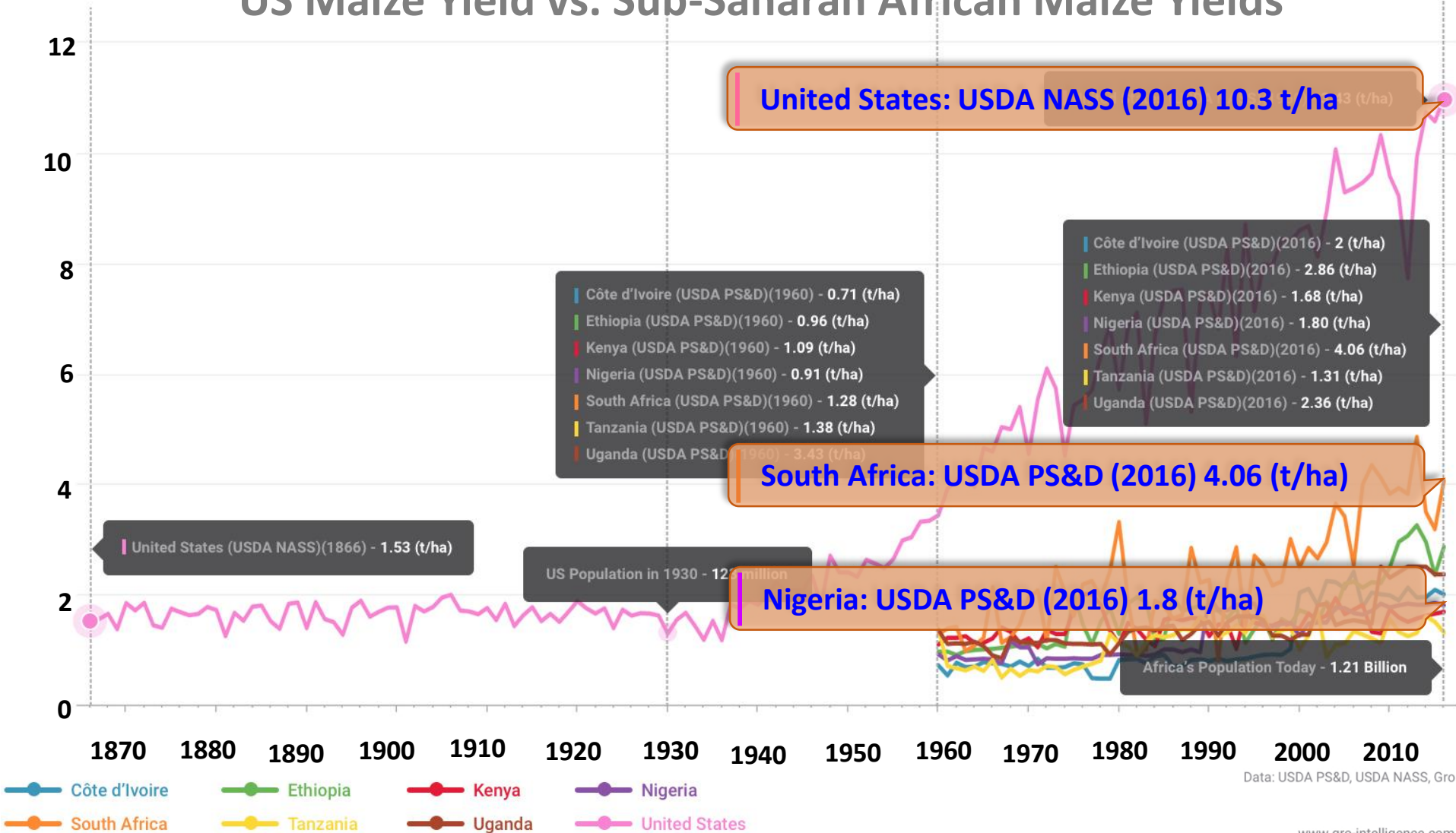
	Overall Percentage
Maize	20.1
Cassava	16.5
Rice	14.9
Cowpea grain	11.8
Groundnut	11.1
Yam	10.4
Sorghum	6.6
Plantain	5.9
Soybean	2.6

Source: IITA Nigeria Food Consumption and Nutrition Survey, 2003

Old Problem – The Challenge

(t/ha)

US Maize Yield vs. Sub-Saharan African Maize Yields





What does Agronomy at Scale Involve?

“agronomy” = “the science of soil management and crop production”

“at scale” = “at the required spatial extent and granularity to solve the problem”



What would this transformed landscape look like?

▪ Weak/No integration of spatial data

Developing solutions that contribute to the shift

▪ Extensive integration of **spatial data**

▪ Limited reach & Monitoring systems (adoption/yields)

▪ Reaching millions & **efficient monitoring systems** (adoption, yields)

▪ Limited Tech Availability

▪ Developing, Adapting, and Deploying **Techs**

*How to move towards this vision
How far to move?
Who to engage?*

1. No georeferencing of reported yield locations
2. Full reliance on unvalidated/unverified farmer reported yield data
3. Unknown/inaccurate area of farmlands surveyed



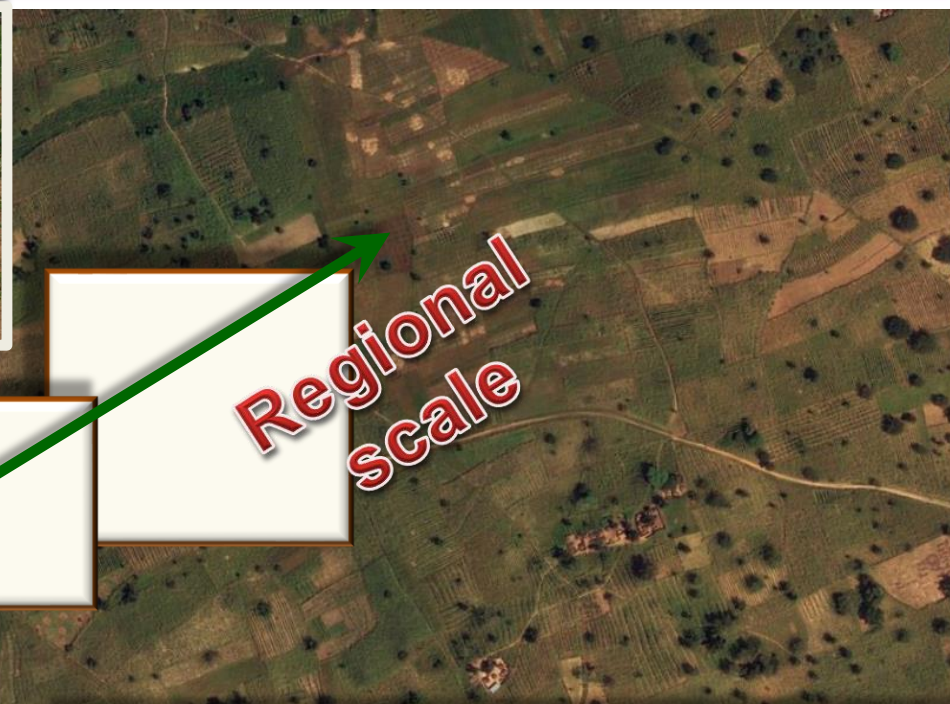
Collaborative Workshop on Crop Yield Estimation in Nigeria: Advancing Methods through Partnership

NAERLS- TAMASA -BUK-NASRDA

Date: Thursday 19th April 2018

Venue: Training Hall, NAERLS-ABU, Zaria

Old Problem – The Challenge



Advancing Maize-based Systems



8°30'38.9"E 11°42'24.3"N elev 812.79m, eye alt 2.0

- *Develop and promote innovative tools/methods for assessing and optimizing yield in smallholder maize-based systems.*



<https://www.pep-net.org/policy-impact-agricultural-technology-productivity-welfare-uganda>

**Taking Maize Agronomy to Scale in Africa
(TAMASA)**

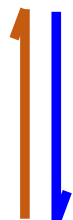
www.tamasa.cimmyt.org



**Target Countries for Maize-based system
Agronomy Intervention
BMGF (\$12 Million)**

Old Problem – The Goal

Potential Yield



Yield Gap (>50%*)

Realized Yield



- *Develop and promote innovative tools/methods for optimizing and assessing yield in smallholder maize-based systems.*

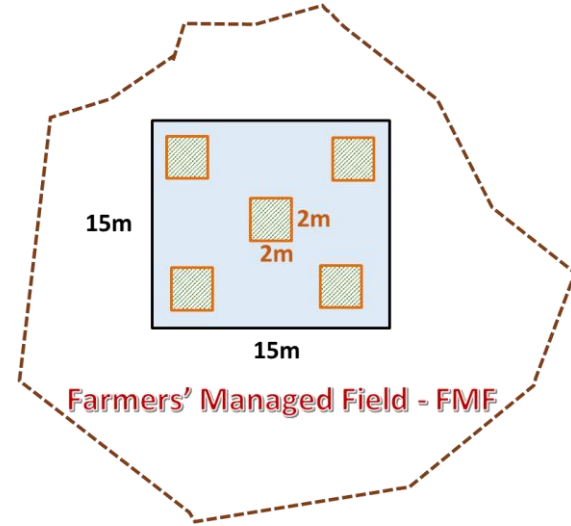
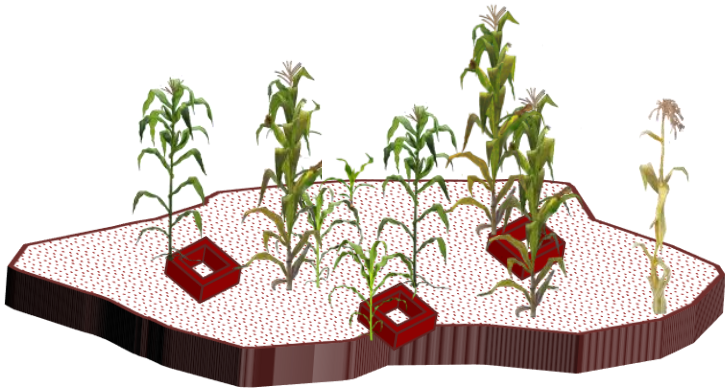
▪ **Non- (or minimally -) invasive**

▪ **Scalable (Space & Time)**

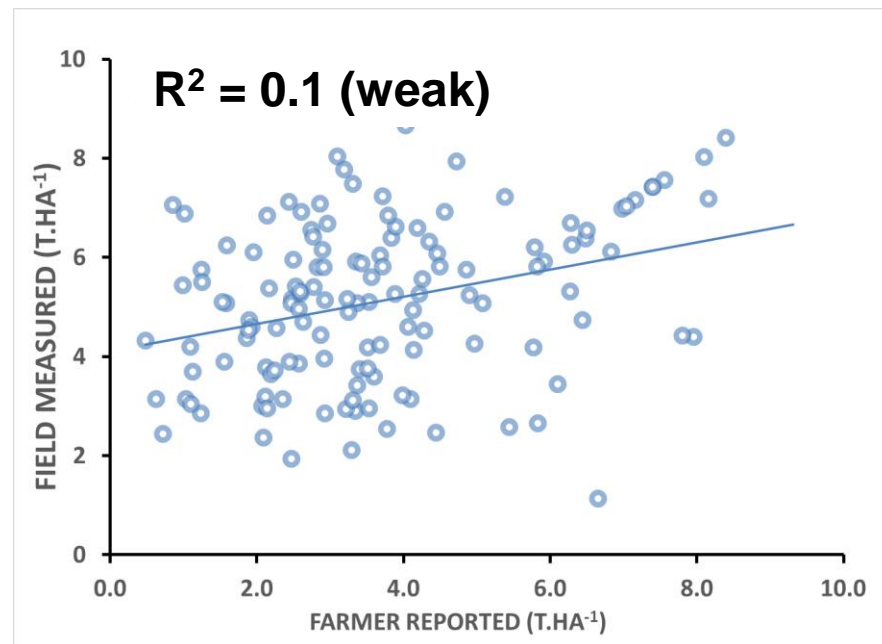
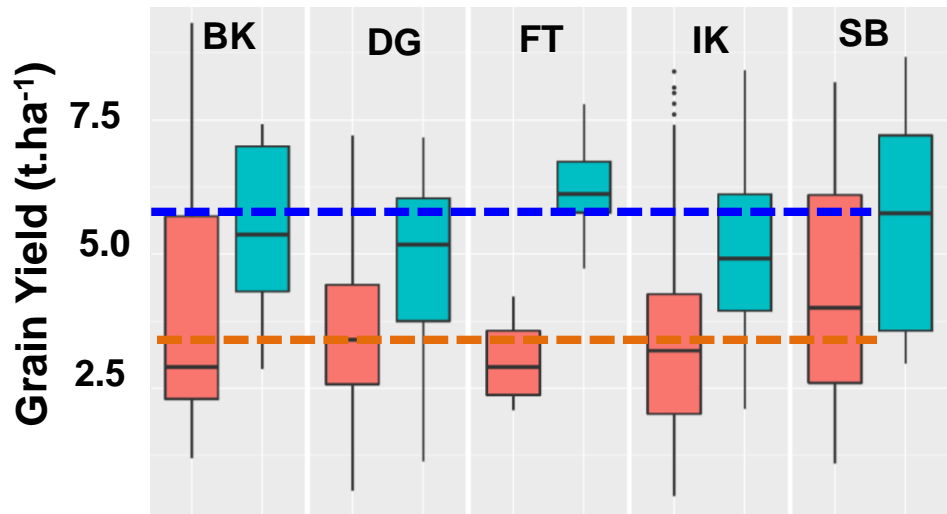
▪ **Spatially explicit**

New Possibilities – Smartphones

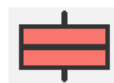
❑ #1. Can farmers' reported yield be trusted for national yield estimation?



#1. Can farmers' reported yield be trusted for national yield estimation?



BK – Bunkure
DG – Doguwa
FT – Funtua
IK – Ikara
SB - Soba



Farmer Reported



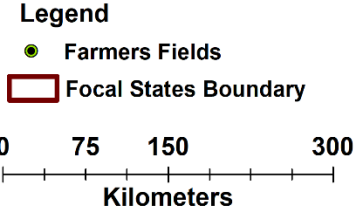
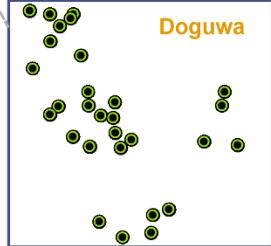
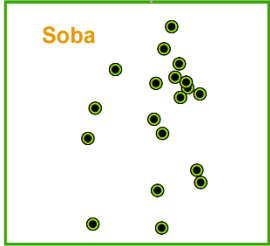
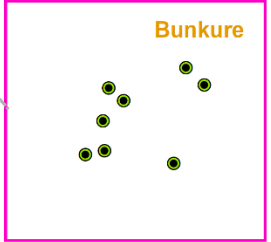
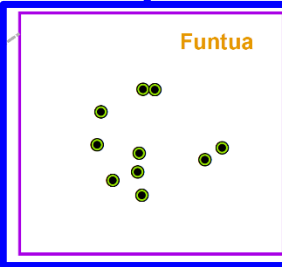
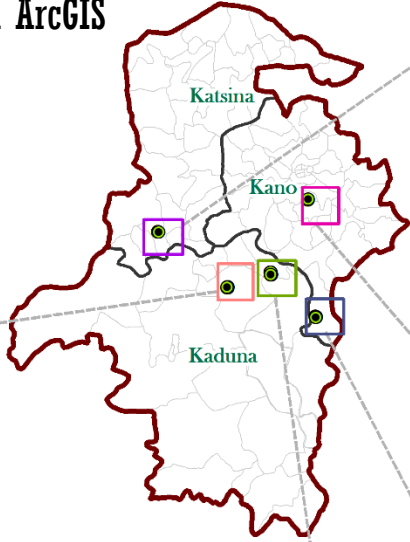
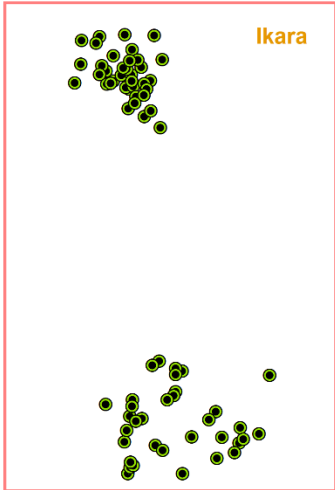
Field Estimated

New Possibilities – UAV??

❑ #2. How can we rapidly and accurately assess smallholder farm area?

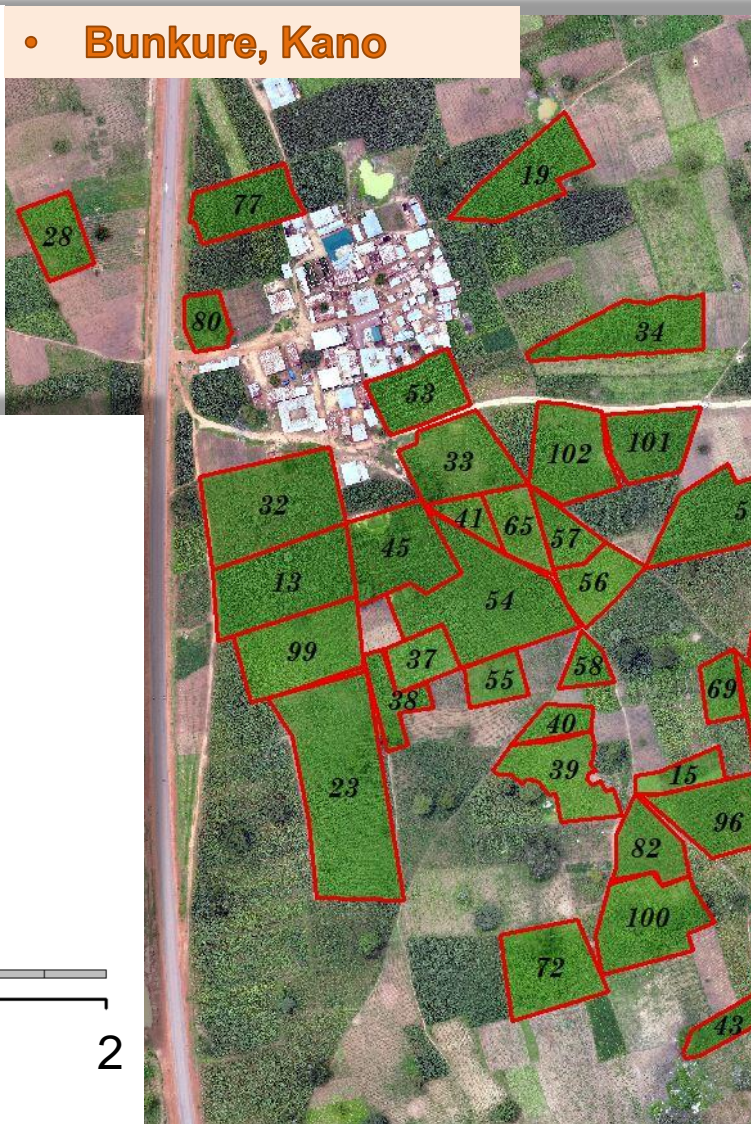
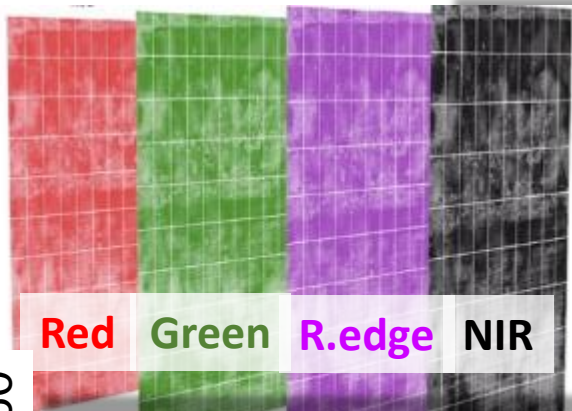


Drone: Sensefly eBee-1 UAV (Fixed Wing)
Sensor: Multi-spectral 4C Camera Sensor + RGB
Mission Planning: e-Motion and ArcGIS



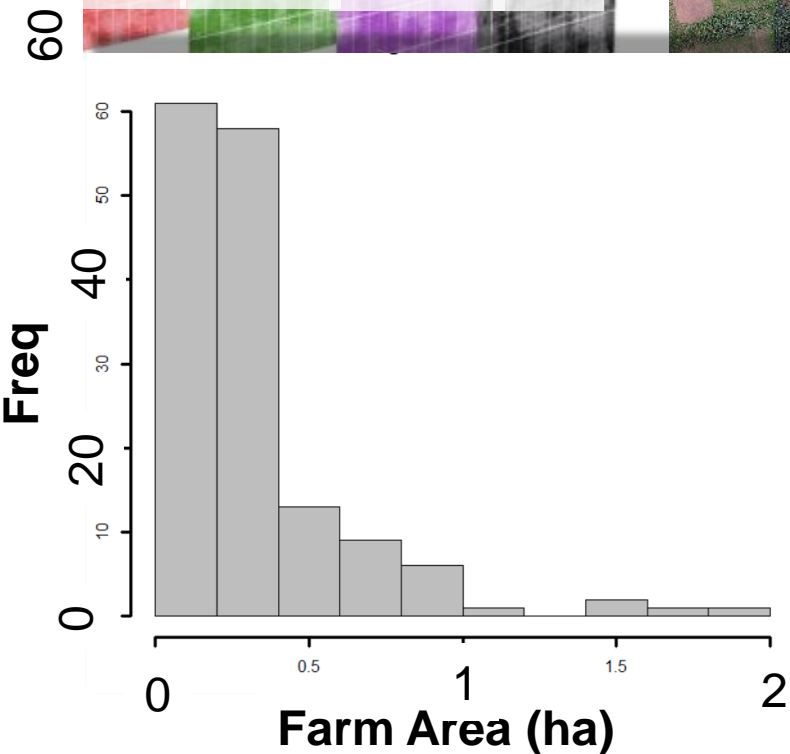
❑ #2. How can we rapidly and accurately assess smallholder farm area?

• **Bunkure, Kano**



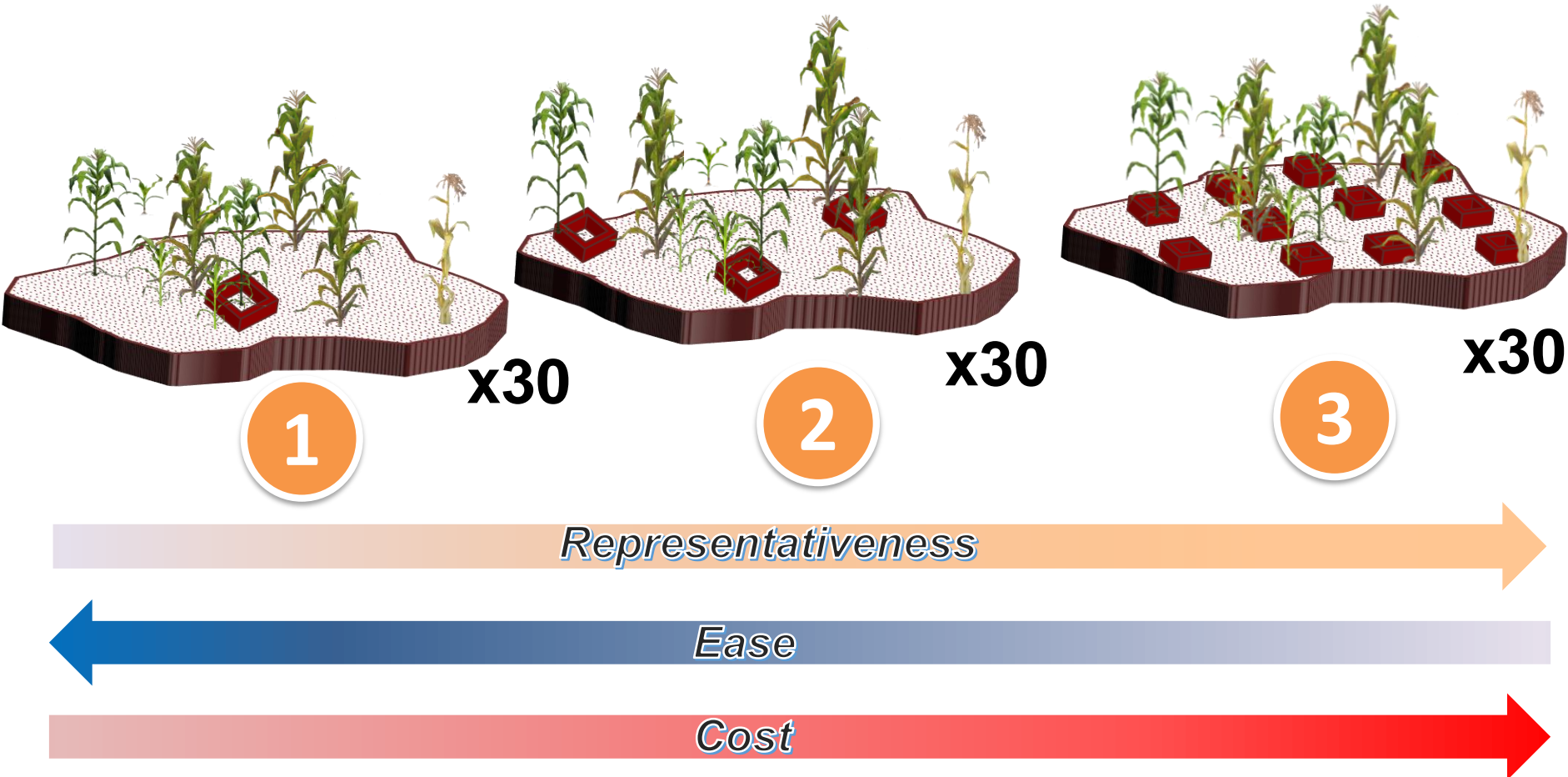
Summary Statistics (ha)

Mean	0.329744
Median	0.239938
Mode	0.279963
Range	1.860254
Minimum	0.042927
Maximum	1.903182



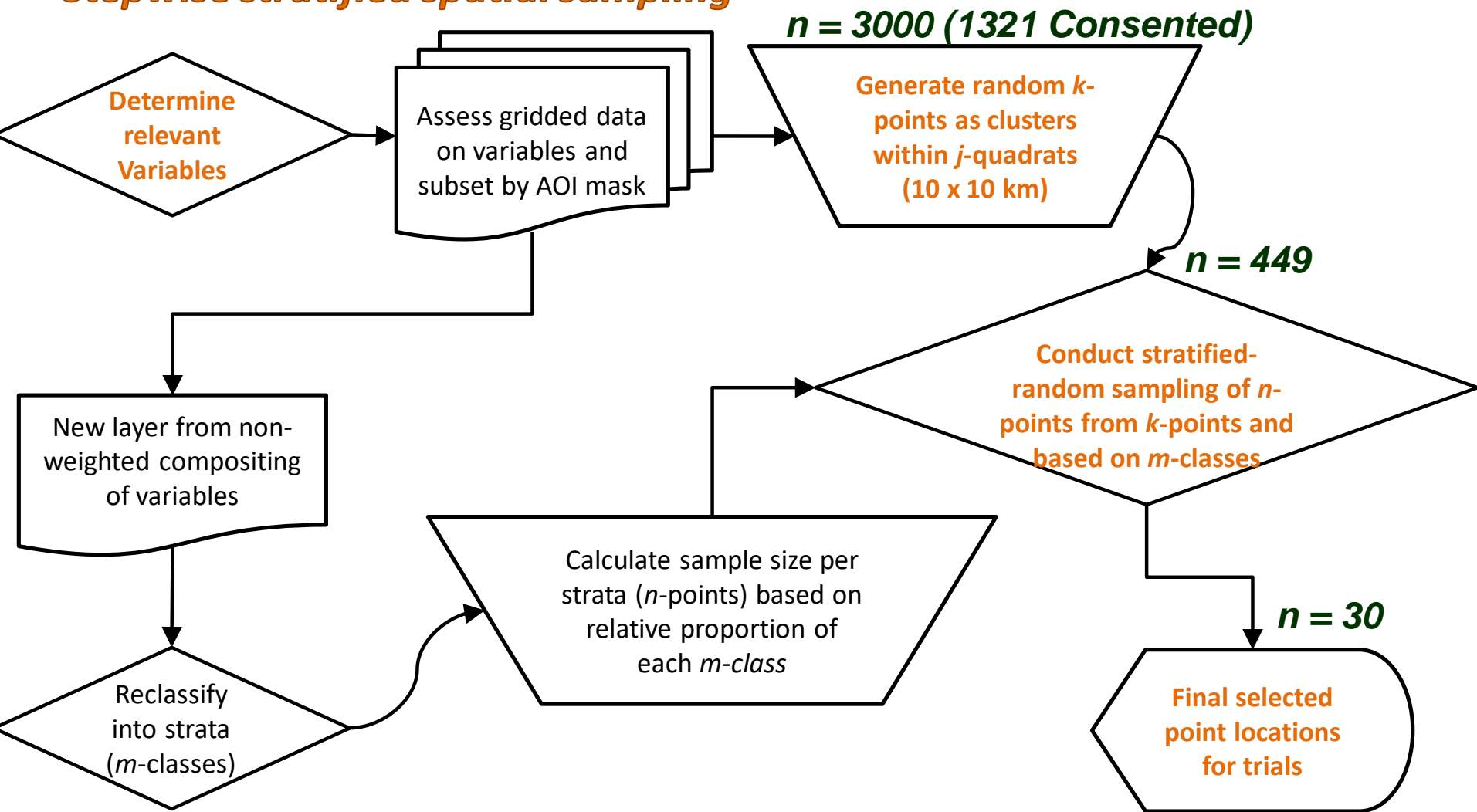
New Possibilities – GIS

#3. Can yield-targeting technologies be reliably tested at fewer locations?



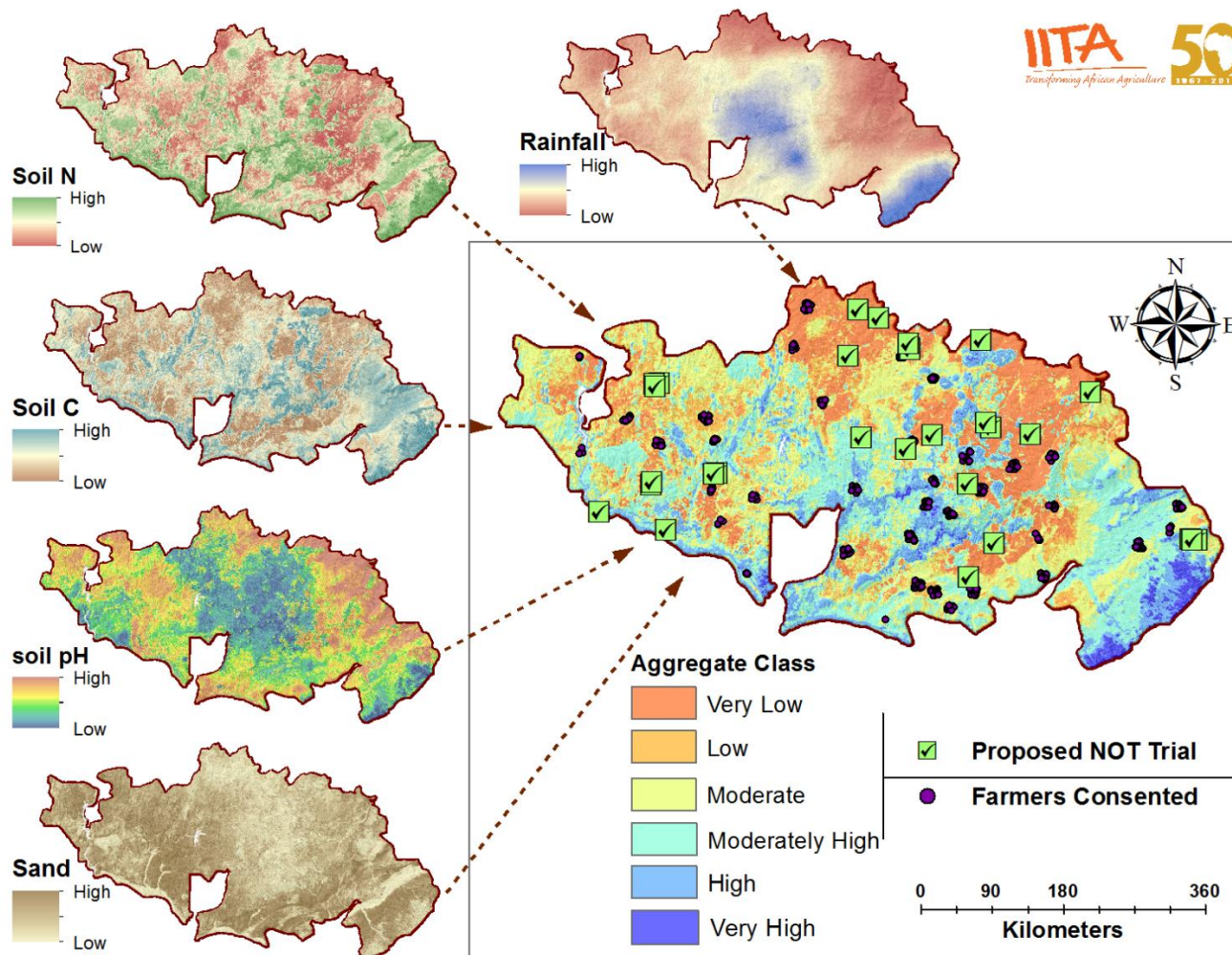
❑ #3. Can yield-targeting technologies be reliably tested at fewer locations?

• *Stepwise stratified spatial sampling*



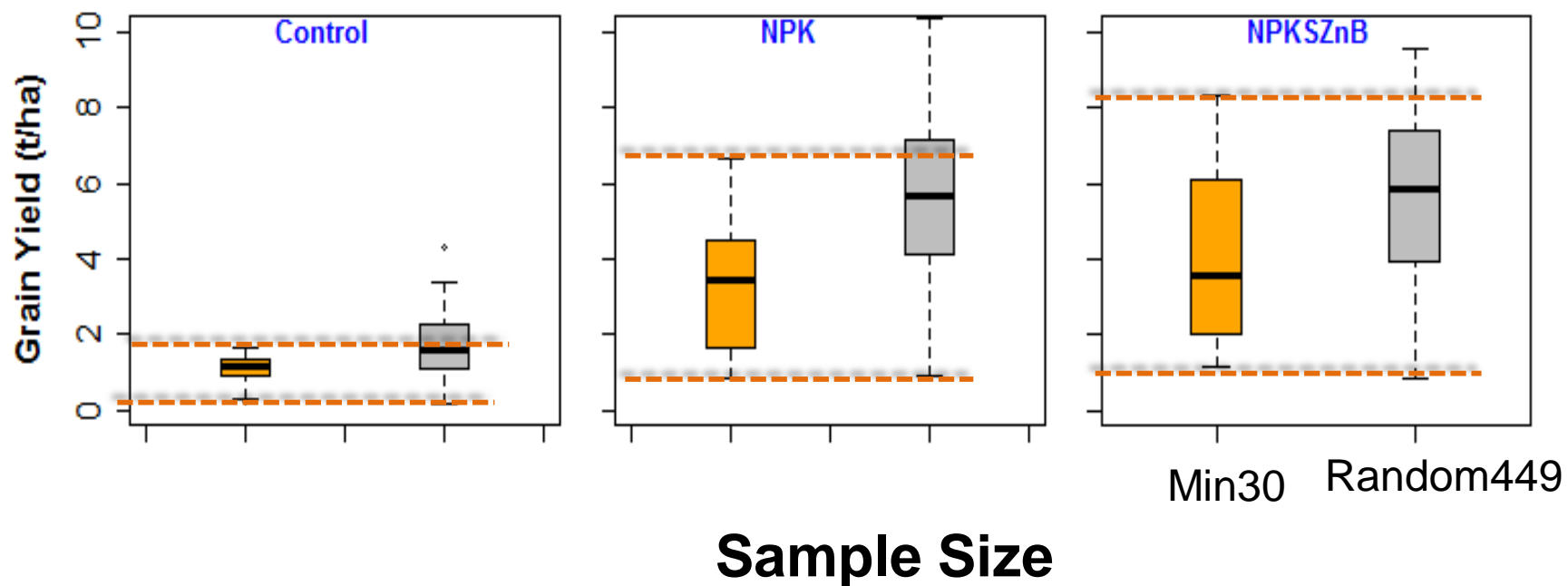
New Possibilities – GIS

#3. Can yield-targeting technologies be reliably tested at fewer locations?



#3. Can yield-targeting technologies be reliably tested at fewer locations?

- Optimizing sample size for nutrient response trials



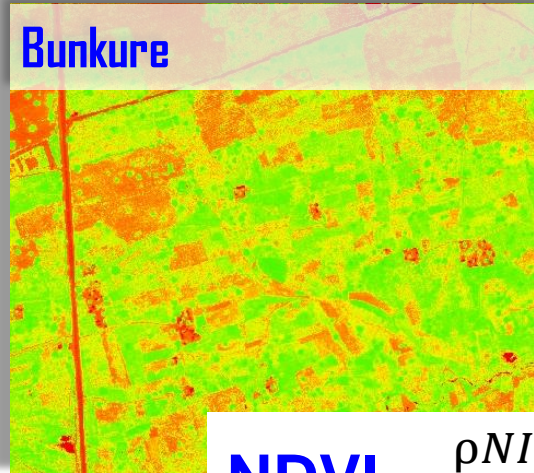
- Similar understanding of nutrient response with fewer sampling locations!

#4. Can we assess yield variability with remotely-sensed agronomic variables?

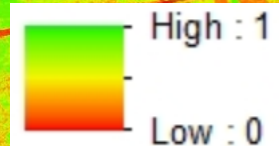
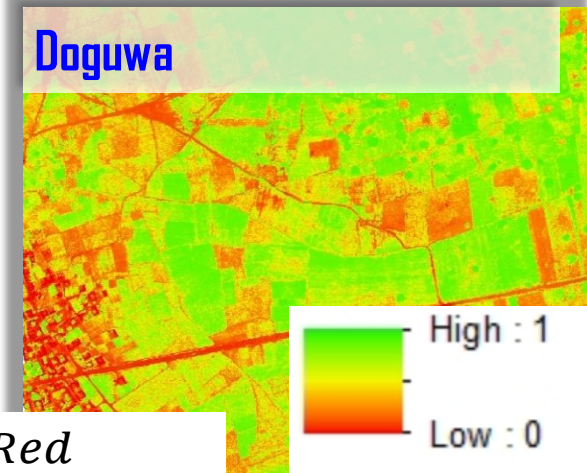
- **Trimble Greenseeker (NDVI)**



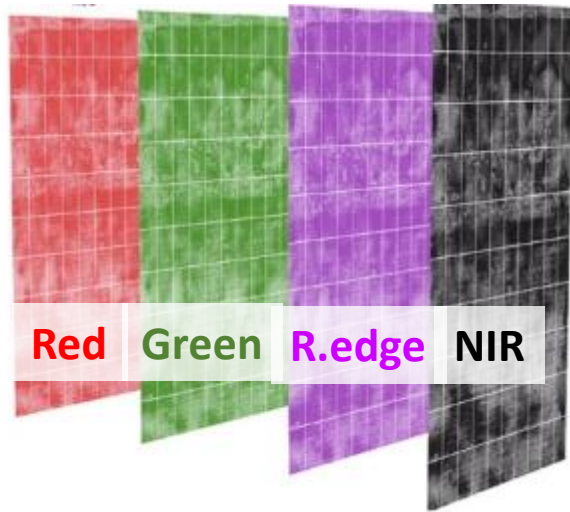
Bunkure



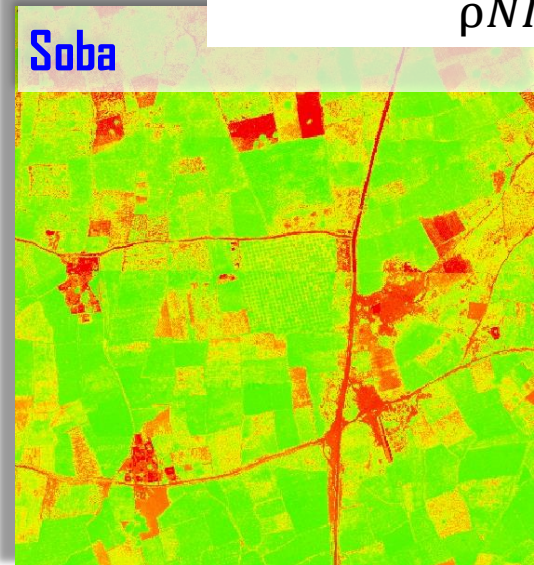
Doguwa



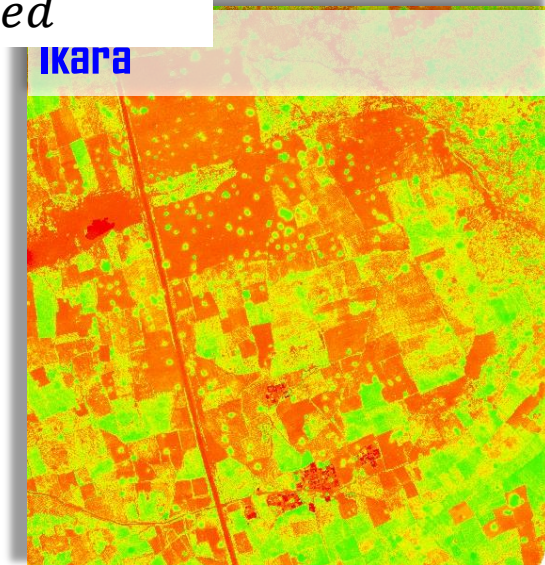
$$NDVI = \frac{\rho NIR - \rho Red}{\rho NIR + \rho Red}$$



Soba

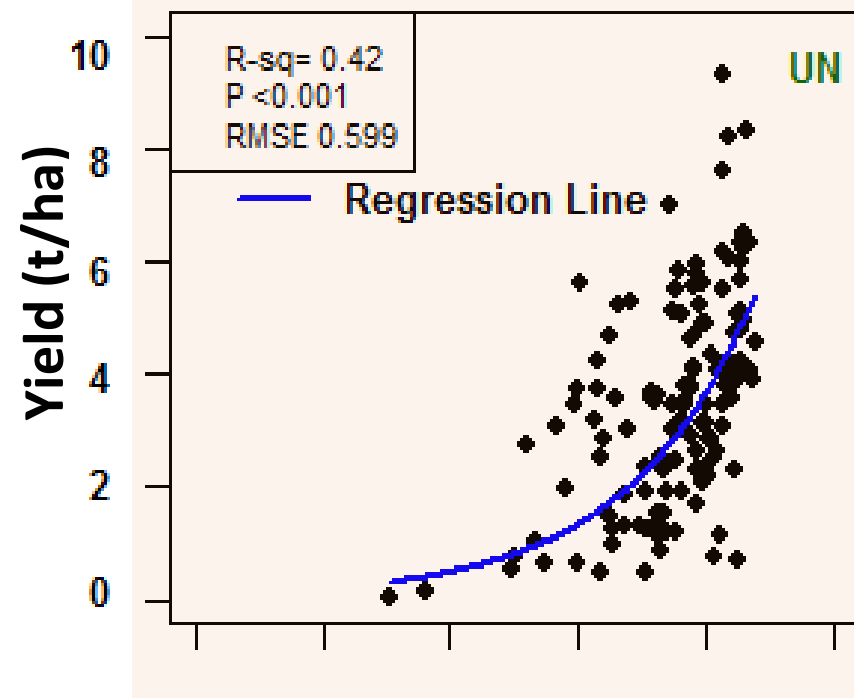


Ikara

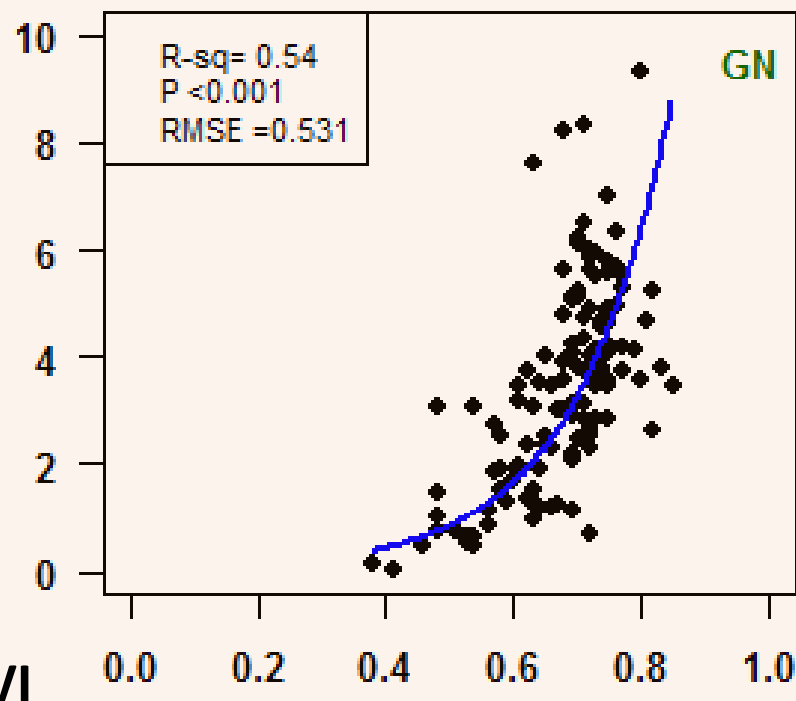


- Rapid assessment of yield variability

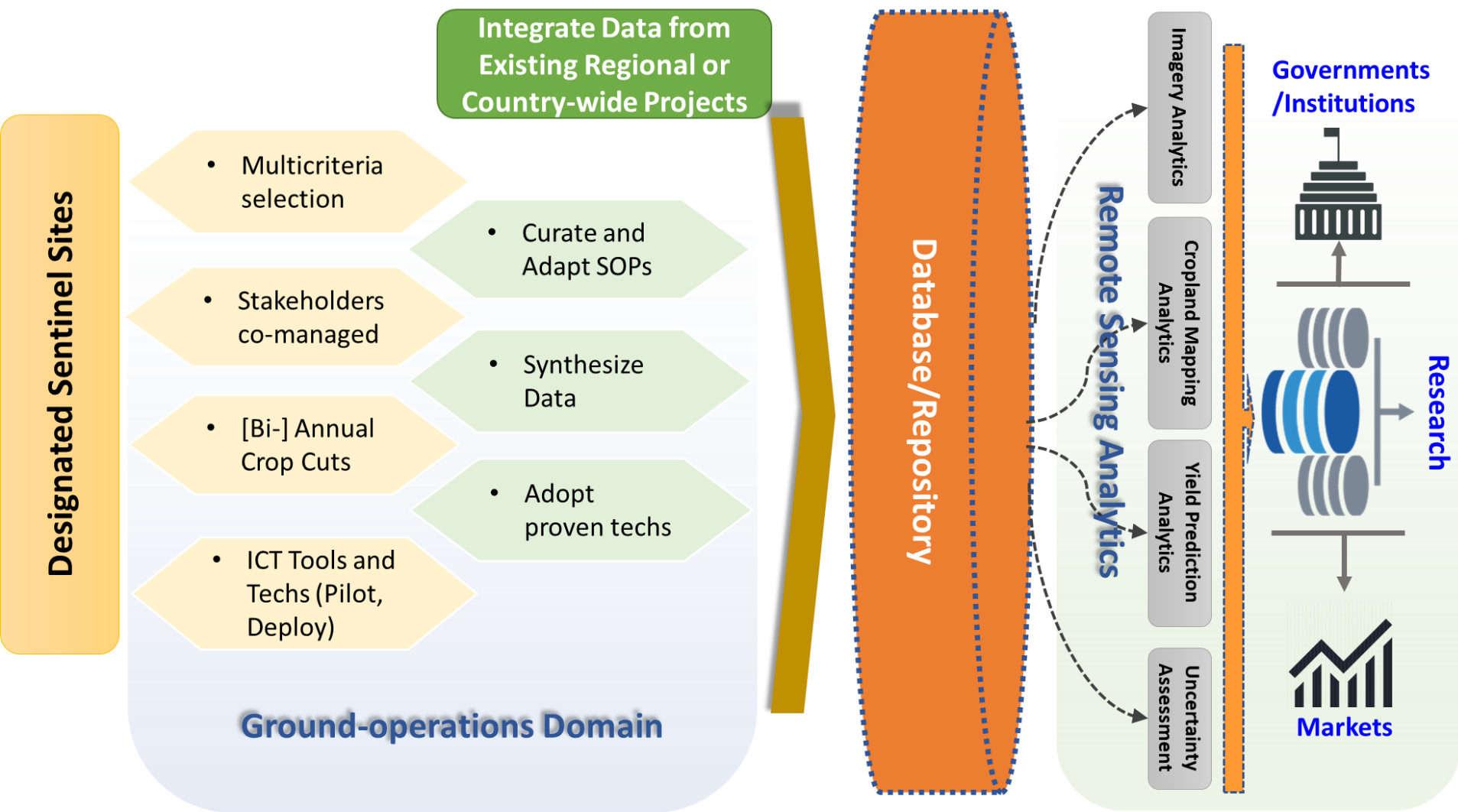
UAV-derived in NOT plots



Greenseeker-measured in NOT plots



- UAV-borne and Proximal Sensors can be used to estimate yield estimation in controlled conditions



 **Thank you.** 

Julius B. Adewopo | j.adewopo@cgiar.org

TAMASA
Taking Maize Agronomy to Scale in Africa

