The United Republic of Tanzania
Agriculture Sector Lead Ministries

4TH ANNUAL AGRICULTURAL POLICY CONFERENCE [AAPC]

Integrating Food and Nutrition Security into Economic Transformation and Industrialization Agenda:

How can agriculture be the driver rather than follower of economic transformation in Tanzania?

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SPATIAL INDICES FOR SUPPORTING EVIDENCE BASED SCALING OF SUSTAINABLE INTENSIFICATION TECHNOLOGIES IN TANZANIA

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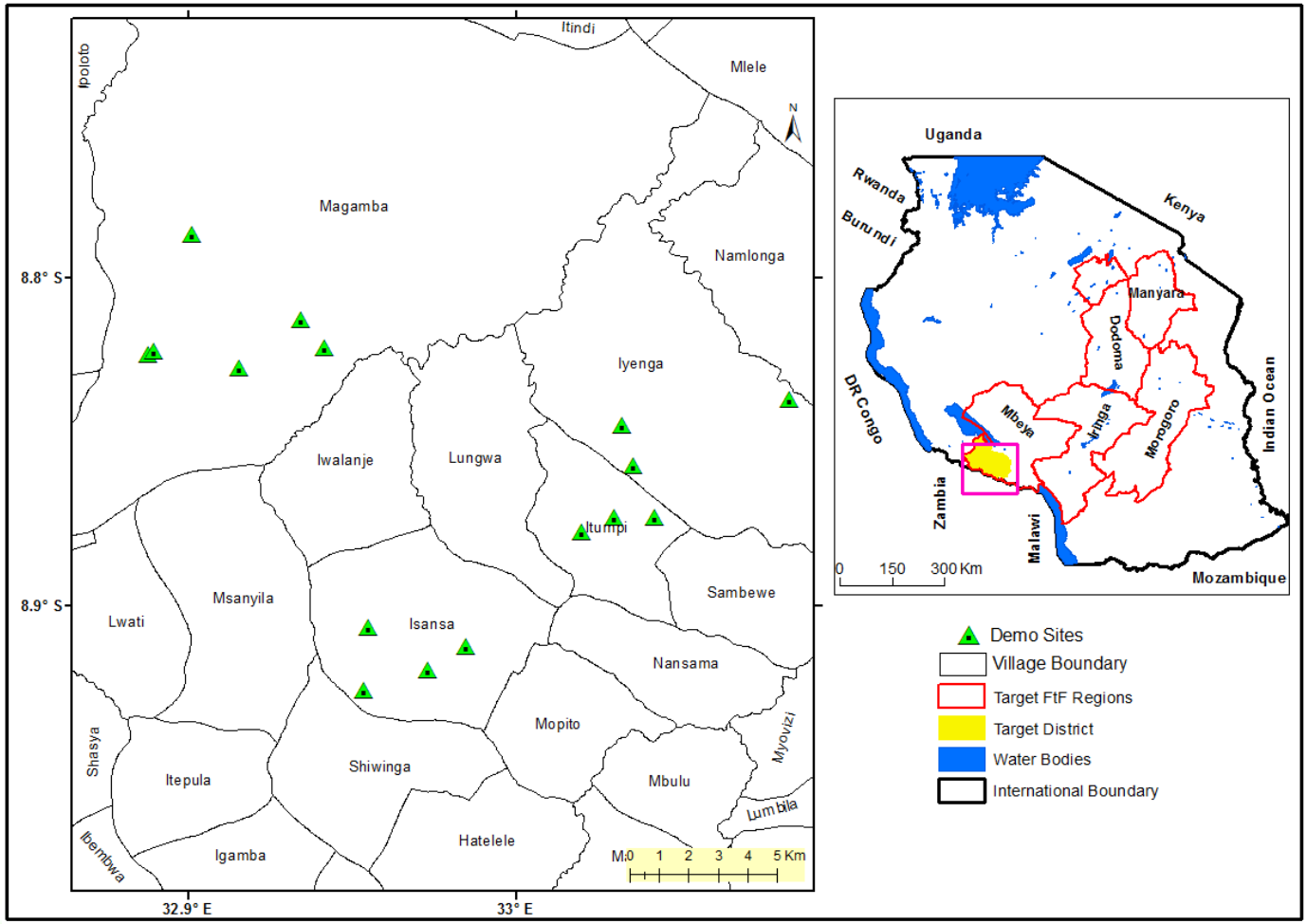
Introduction

- Sustainable agricultural intensification (SAI) is one pathway for increasing food production in sub-Sahara Africa as it promotes:
  - Adoption of improved crop varieties
  - Good agronomic practices (GAPs)
  - Conserving natural resources
- Proper spatial targeting of SAI technologies needed to enhance:
  - Adoption of technologies
  - Efficient allocation of limited resources
  - Rational agricultural investment decisions
  - Reduce risks of technology failure

- Outline spatial indices developed to guide scaling-out of SAI technologies in Tanzania

Area of Focus in Tanzania

- Multi-location demo plots for improved maize varieties + mineral fertilizers



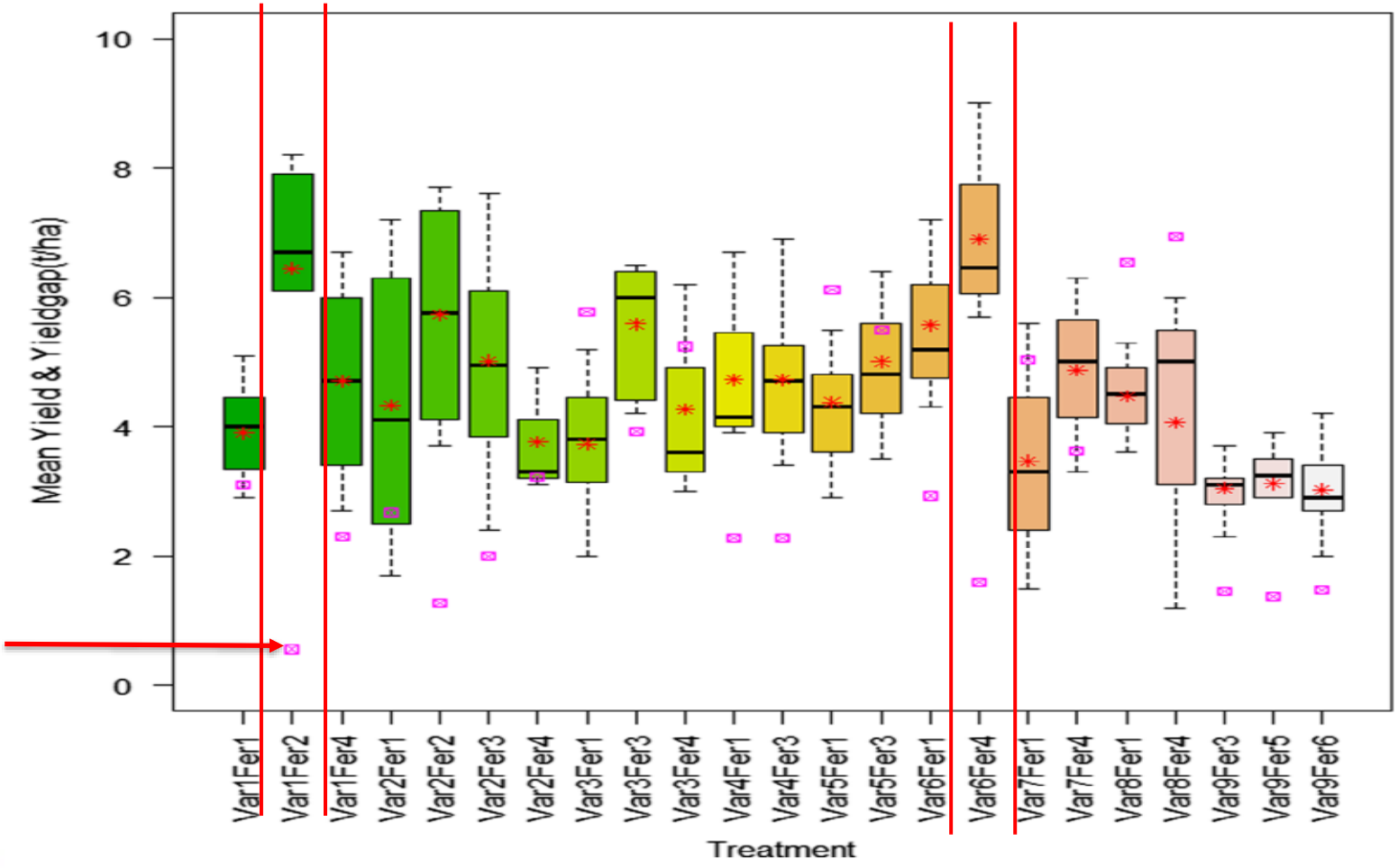
Data: Design of demo plots

- Combine improved varieties and fertilizer blends to identify best-bets

Variety	Potential yield (t/ha)	Optimal altitude (m)	Maturity (days)	Fertilizer applied	Treatment ID
HB614	7	>1500	180–190	DAP + Urea	Var1Fer1
				Minjingu Mazao+MTD	Var1Fer2
				YaramilaCereal + YaraBelaSulfan	Var1Fer4
PAN691	7	>1500	103	DAP + Urea	Var2Fer1
				Minjingu Mazao+MTD	Var2Fer2
				YaramilaCereal	Var2Fer3
				YaramilaCereal + YaraBelaSulfan	Var2Fer4
UH6303	10-Sep	1200–1800	92	DAP + Urea	Var3Fer1
				YaramilaCereal	Var3Fer3
				YaramilaCereal + YaraBelaSulfan	Var3Fer4
H625	6.0–8.0	1500–2400	180–240	DAP + Urea	Var4Fer1
				YaramilaCereal	Var4Fer3
H628	9.0–12.0	150–180	150–180	DAP + Urea	Var5Fer1
				YaramilaCereal	Var5Fer3
SC719	7–10	800–1500	145–153	DAP+ Urea	Var6Fer1
				YaramilaCereal + YaraBelaSulfan	Var6Fer4
UH615	8.0–9.0	1200–1800	85–92	DAP + Urea	Var7Fer1
				YaramilaCereal + YaraBelaSulfan	Var7Fer4
MERU513	11	800–1200	100 –110	DAP + Urea	Var8Fer1
				YaramilaCereal + YaraBelaSulfan	Var8Fer4
Staha	4.0–5.0	0–900	120	YaramilaCereal	Var9Fer3
				Minjingu Mazao + Urea	Var9Fer5
				NAFAKA plus + MTD	Var9Fer6

Data: Identifying Best-bets from Demo plots

- Best-bets are variety and fertilizer package with lowest yield gap in demos



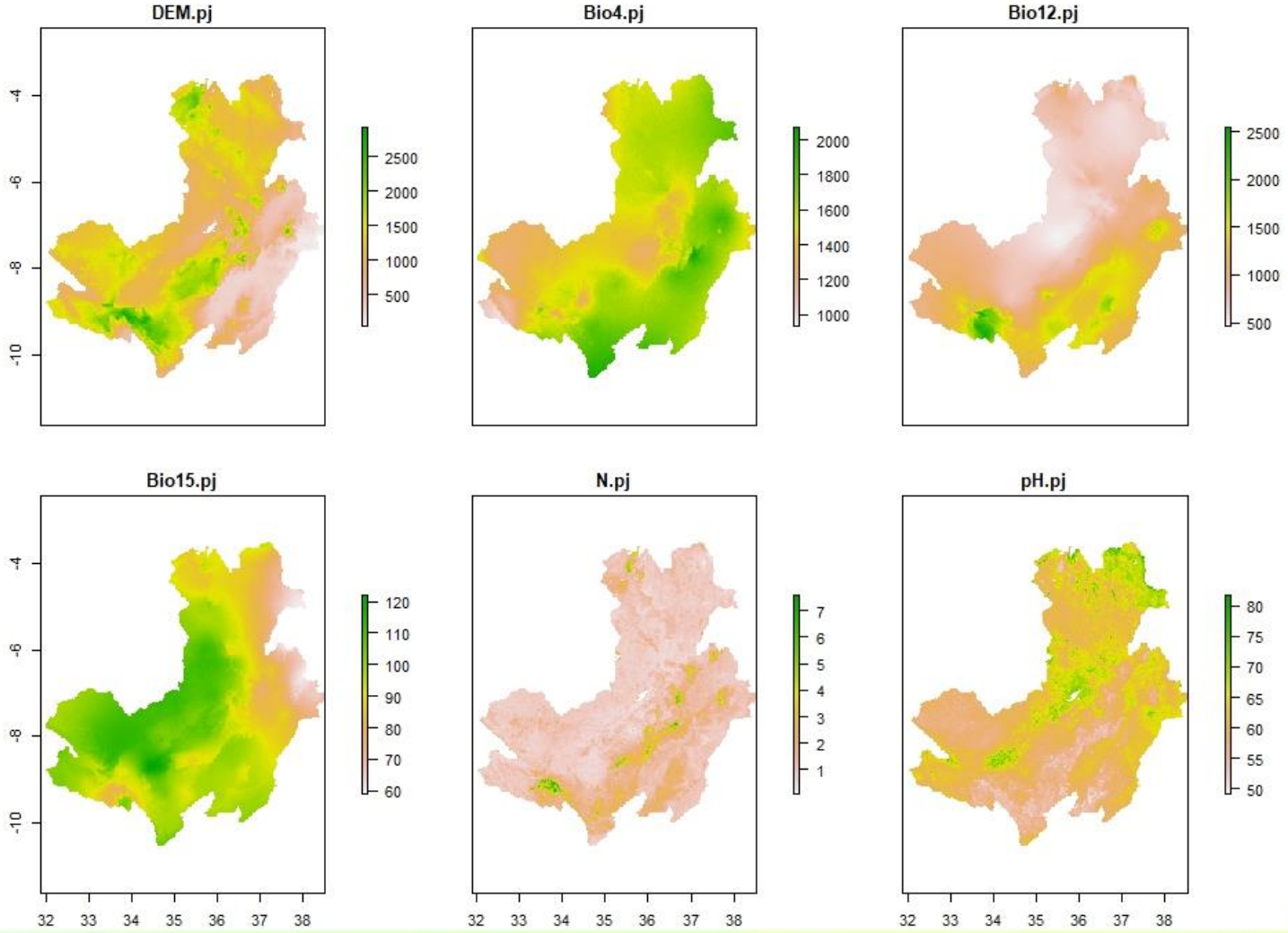
Lowest yield gap

Selected remote sensing Data

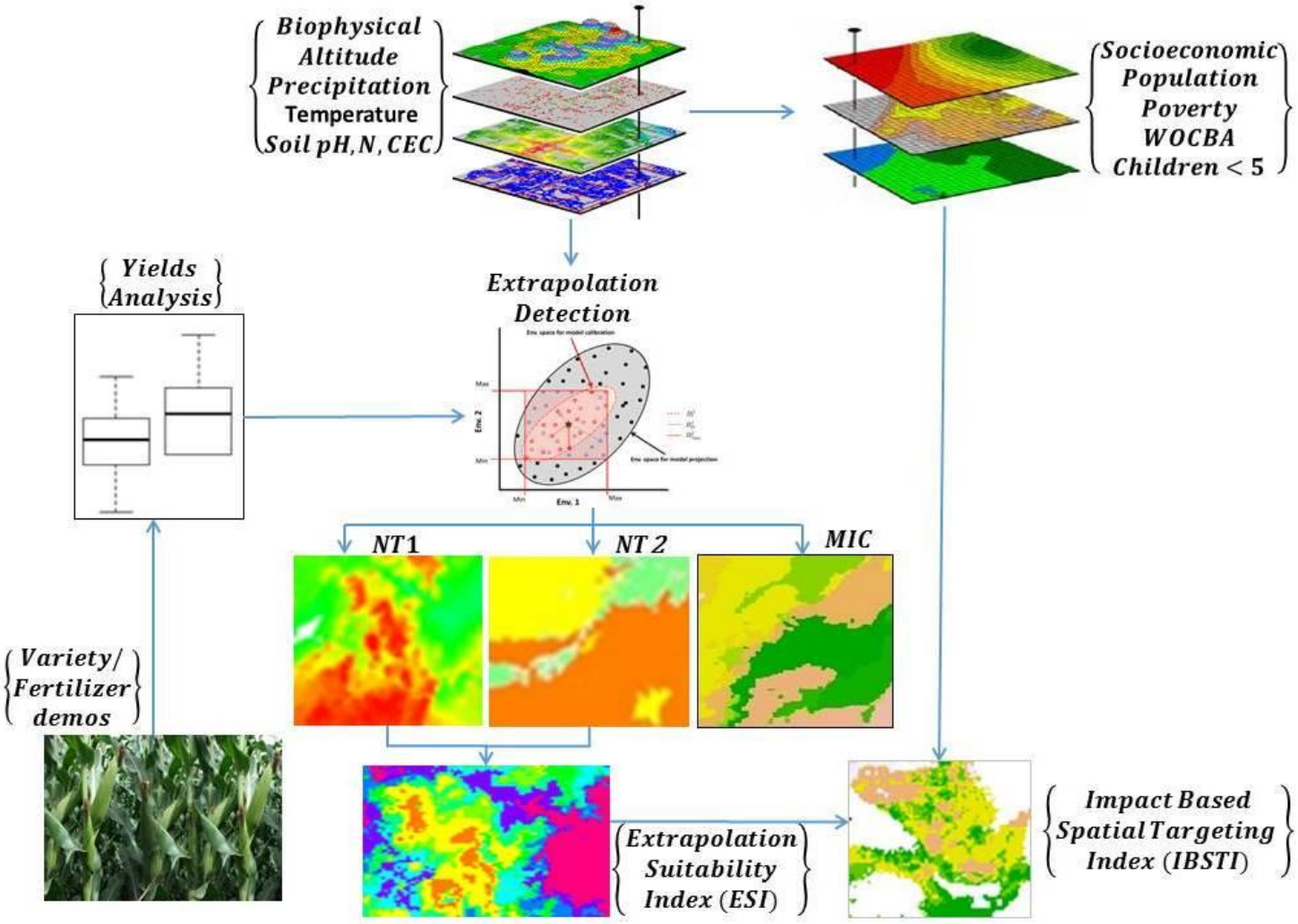
- Freely available high spatial and temporal resolution remote sensing data

Code	Variable name	Original Resolution	Reference
Biophysical			
Bio1	Annual mean temperature (C°)	1 km	(Hijmans et al. 2005)
Bio4	Temperature seasonality	"	"
Bio12	Annual precipitation (mm)	"	"
Bio15	Precipitation seasonality (C.V)	"	"
DEM	Elevation (m)	30 m	ASTER (METI and NASA 2011)
Slope	Slope (degrees)	30 m	Generated from DEM
BLD	Bulk density (fine earth) t m^{-3}	250 m	(Hengl et al. 2017)
CEC	Cation Exchange Capacity ($cmol^{+}$/kg)	"	"
SOC	Soil organic carbon (fine earth) (g kg^{-1})	"	"
pH	Soil pH	"	"
Socio-economic			
Poptot	Total human population	100 m	(WorldPop 2016)
Pov	Poverty index (< $1.25)	100 m	"
PopPov	Population living below poverty line (< $1.25)	100 m	Generated from Poptot*Pov
WOCBA	Women of childbearing age (WOCBA)	100 m	"
CU5	Children under 5 years	100 m	"
Auxilliary data			
LULC	Land use land cover (cultivated area, wetlands, water-bodies)	30 m	(Chen et al. 2015)
Prot	Protected areas	–	UNEP-WCMC (2015)
Admin	Administrative data (Level 1–3)	–	TNBS (2016)

Data: Gridded Remote Sensing data

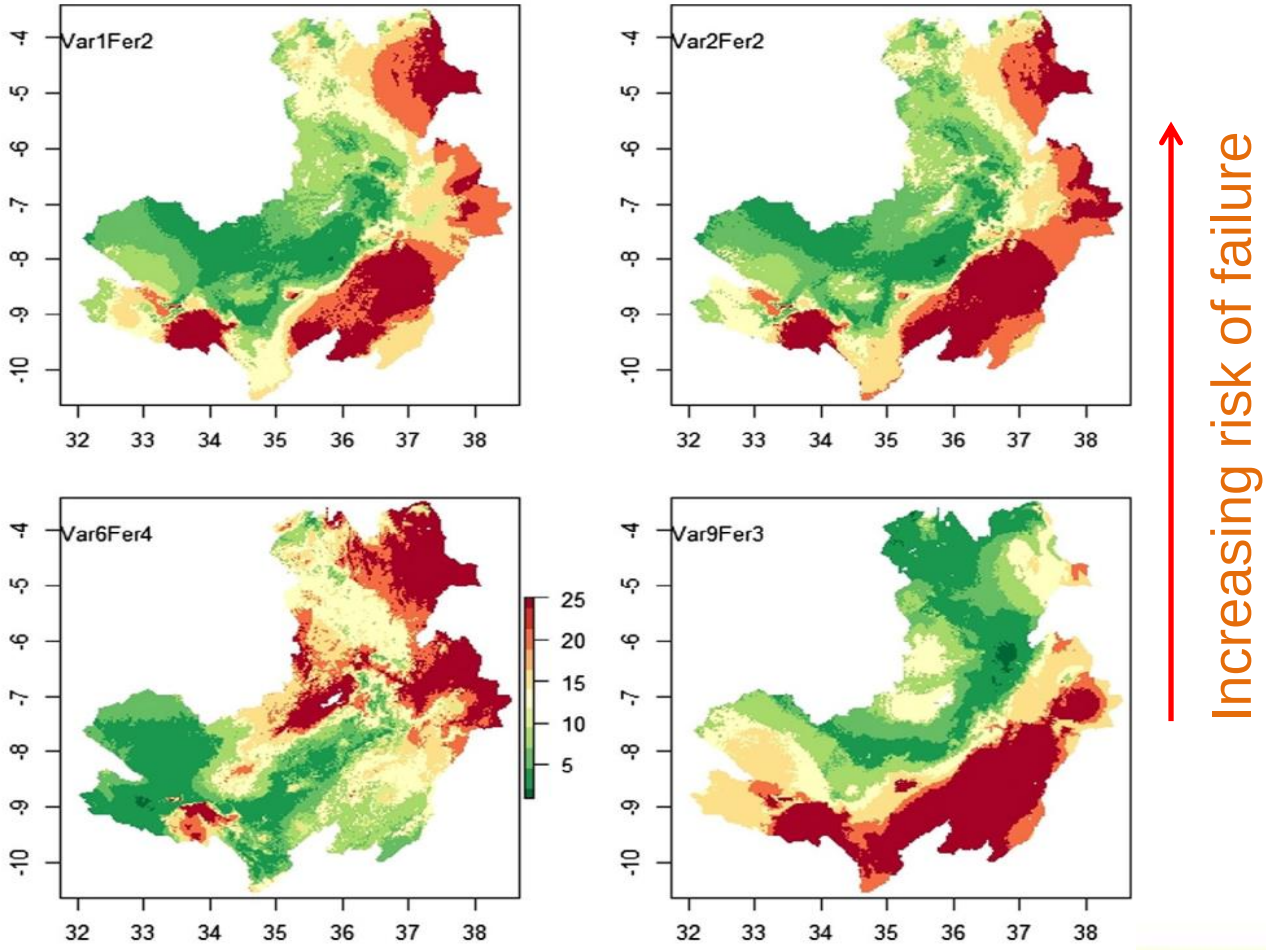


Developing spatial targeting indices



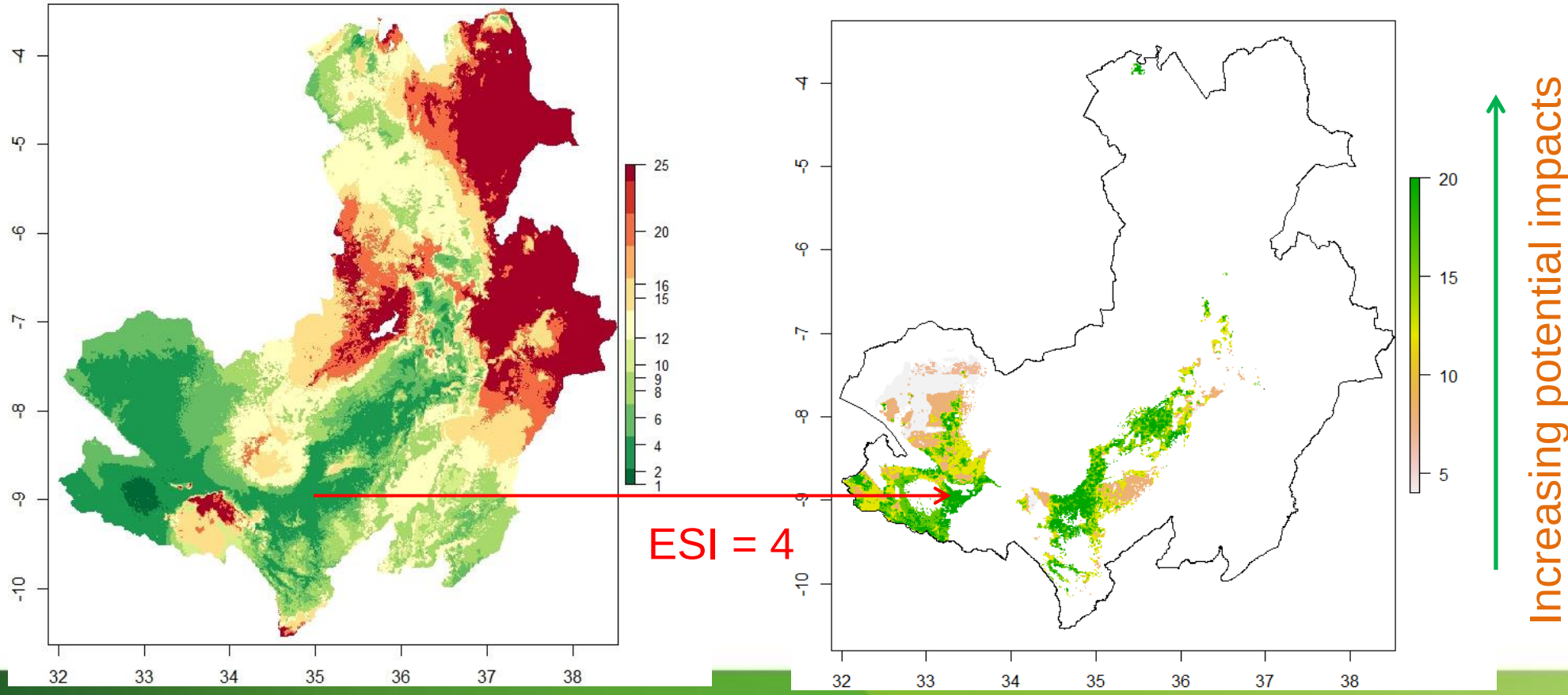
Results: Extrapolation Suitability Index (ESI)

- Higher ESI values indicates more risk of extrapolating agronomic technologies
- Scaling programs should prioritize low risk areas
- ESI guide extension agencies to identify suitable sites for scaling out agronomic technologies
- Help agro-dealers estimate potential demand of inputs



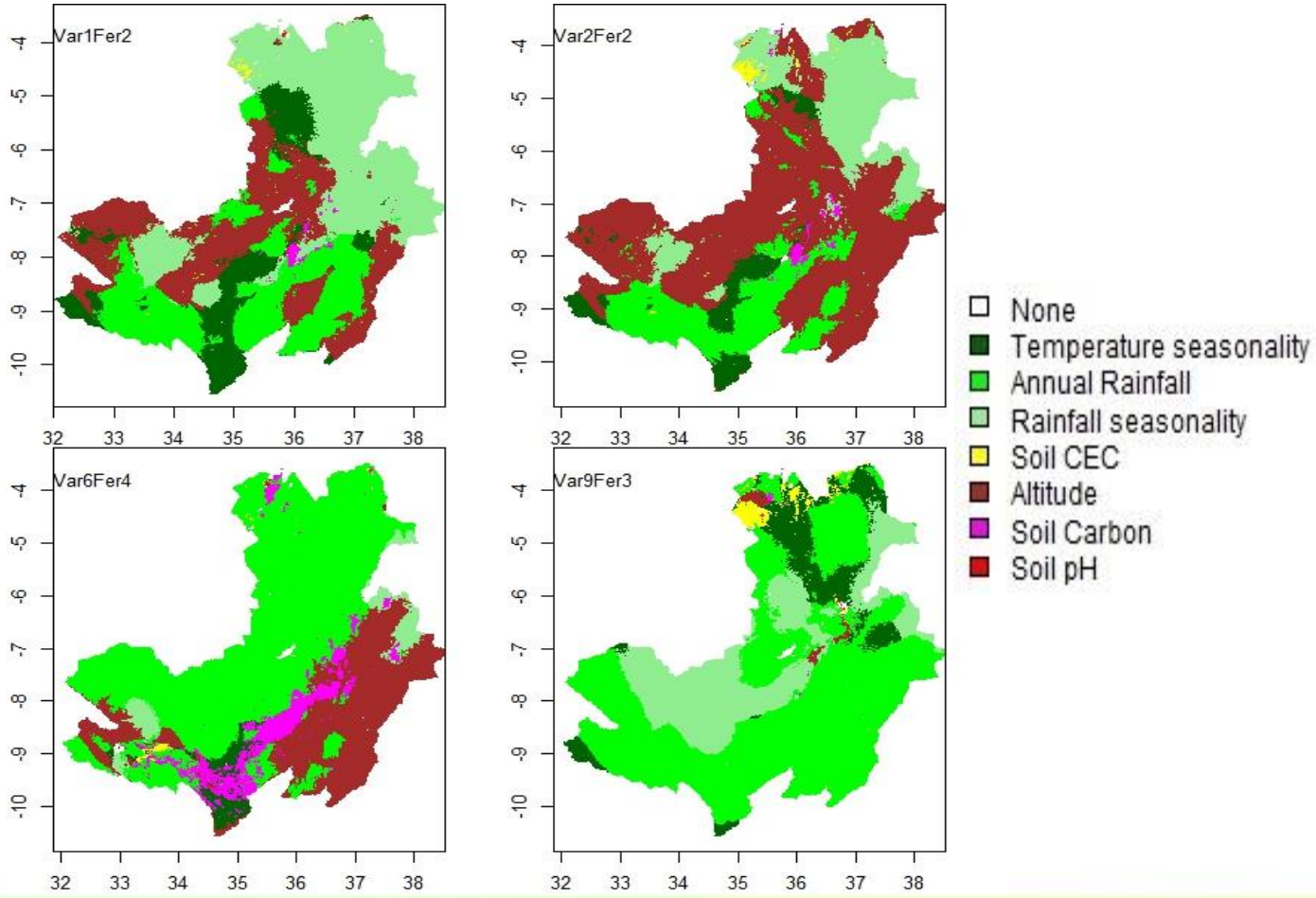
Impact Based Spatial Targeting Index (IBSTI)

- Targeting suitable zones with high IBSTI maximize potential impact of scaling out a technology package while rationalizing investment of limited resources



Spatial distribution of limiting factors

- Improves targeting of remedial actions such as irrigation & soil amendments



Relevance to agricultural policy

- ESI map is a simple method for visualizing risk associated with extrapolating technologies beyond the environmental conditions observed in the trial sites
- IBSTI identify priority intervention sites within the derived suitable classes to maximize the potential impact of scaling a technology
- Limiting factor maps support targeting of remedial measures to address limiting factor that hinder a technology to achieve full potential

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Enhancing partnership among Africa RISING, NAFAKA and TUBORESHE CHAKULA Programs for fast tracking delivery and scaling of agricultural technologies in Tanzania

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