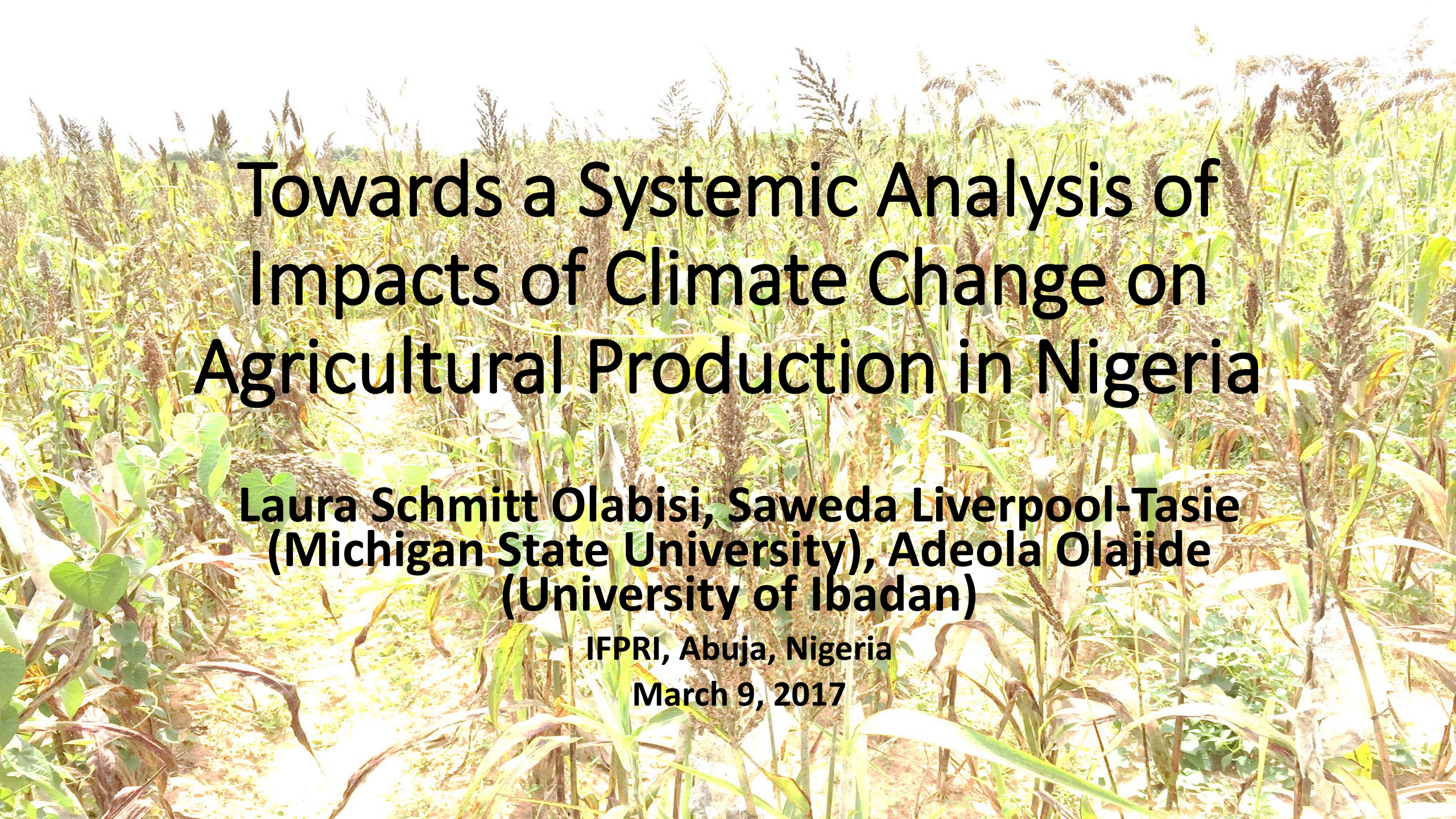


Towards a Systemic Analysis of Impacts of Climate Change on Agricultural Production in Nigeria

Laura Schmitt Olabisi, Saweda Liverpool-Tasie (Michigan State University), Adeola Olajide (University of Ibadan)

IFPRI, Abuja, Nigeria

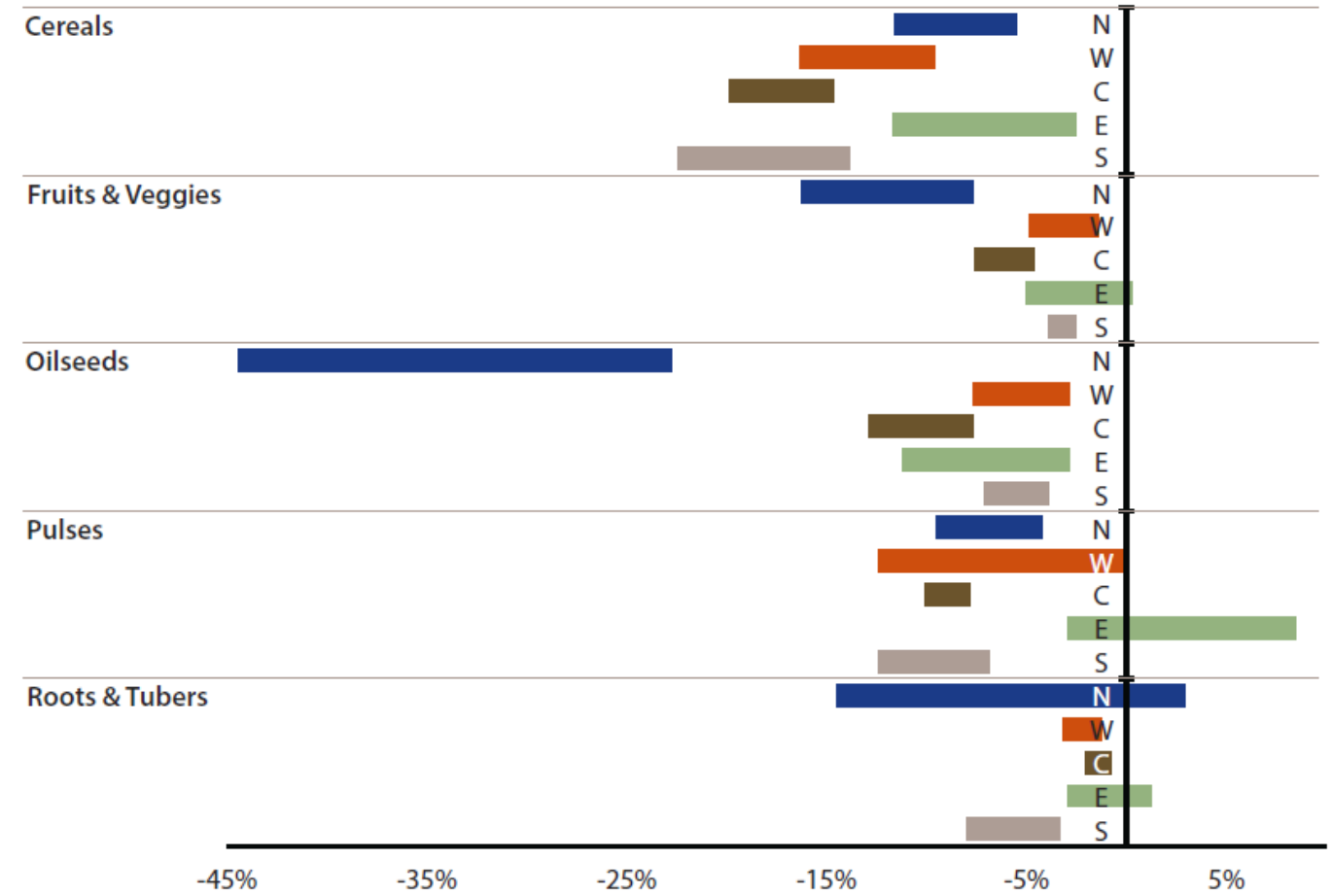
March 9, 2017

How will climate change impact agricultural production in Nigeria?

- Uncertainty
- Integrate local knowledge with international data/literature
- Feedback mechanisms
- Test policies/strategies
- Climate change in context of other changes

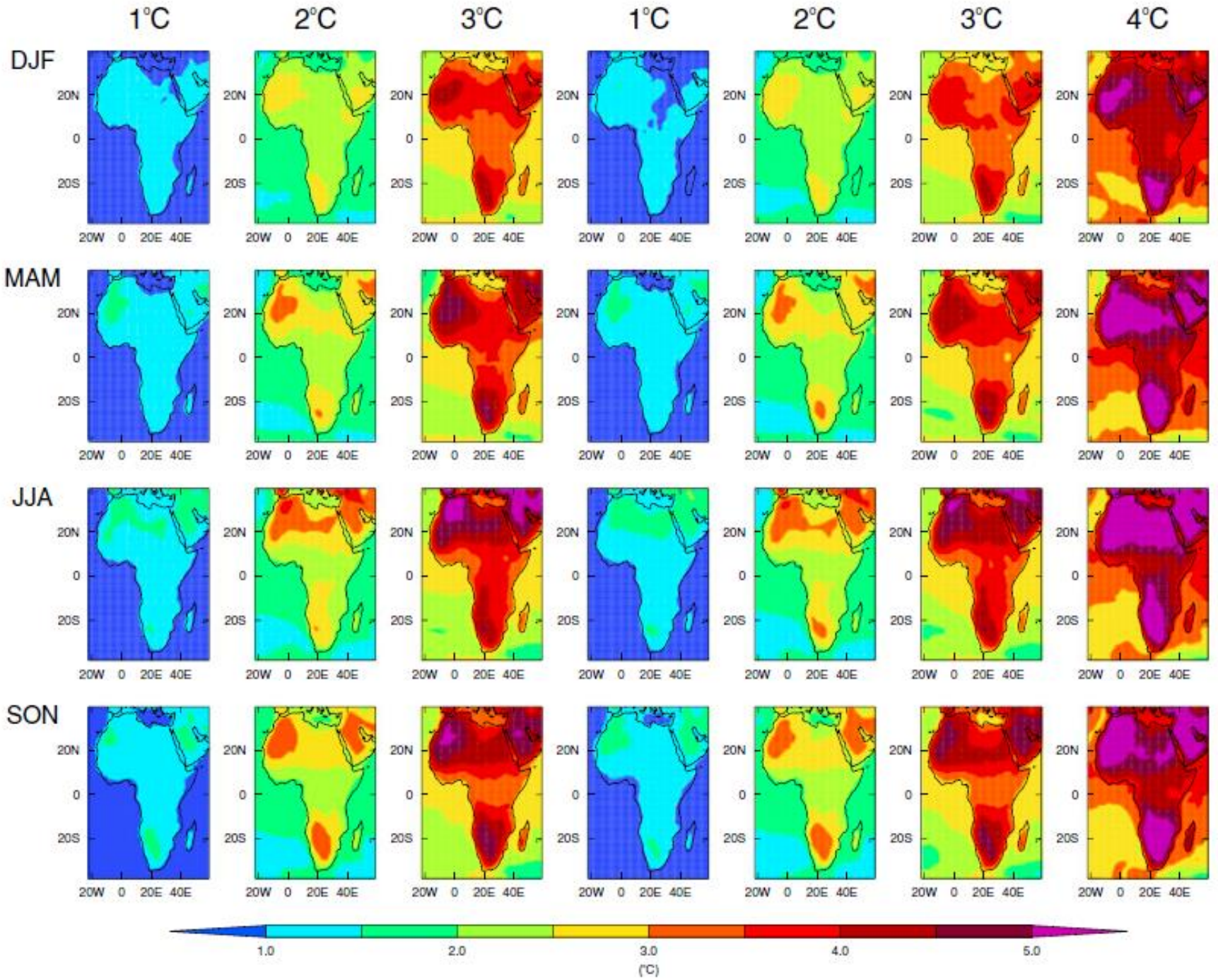
IFPRI IMPACT Model Results

FIGURE 2.5—RANGE OF CLIMATE CHANGE IMPACTS ON AGGREGATE COMMODITY YIELDS FOR RESAKSS REGIONS



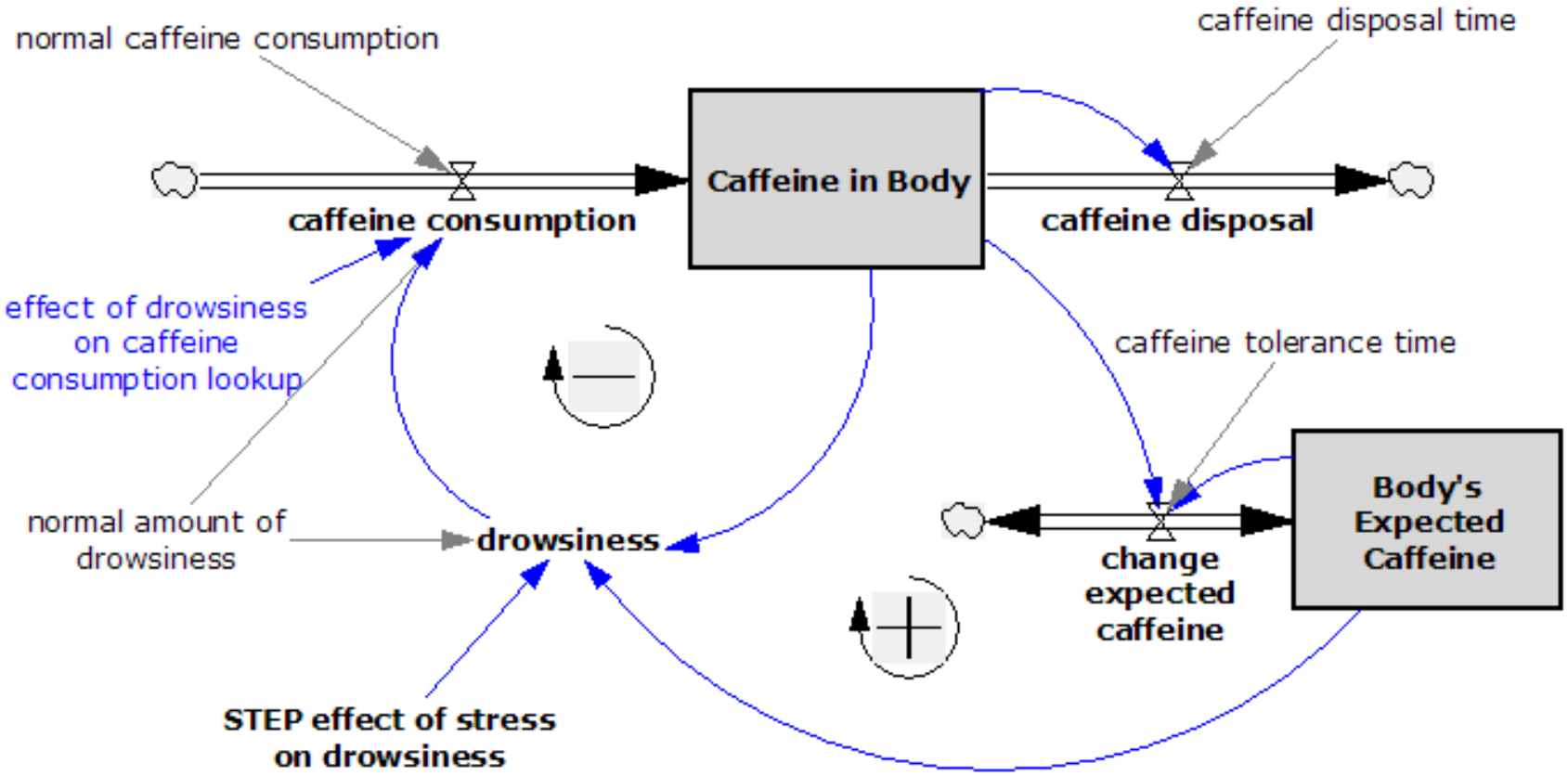
Source: Authors, IMPACT Baseline Projections 3.2, July 2015.

Note: For North (N), West (W), Central (C), East (E), and Southern (S) ReSAKSS regions.



Source: R. James & R. Washington. 2013. Changes in African temperature and precipitation associated with degrees of global warming. *Climatic Change* 117: 859-872.

What is system dynamics modeling?



Key attributes: *feedback, stocks and flows, nonlinearity*

‘The one who models is the one who learns’

- Justice
- Buy-in
- Robust scientific conclusions
- Social learning

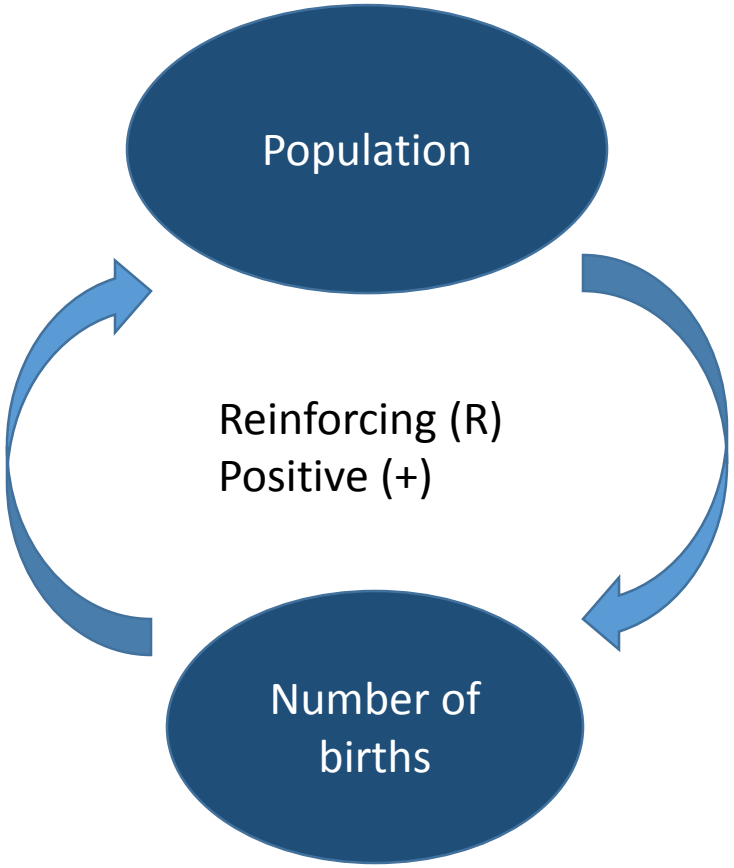
nature.org

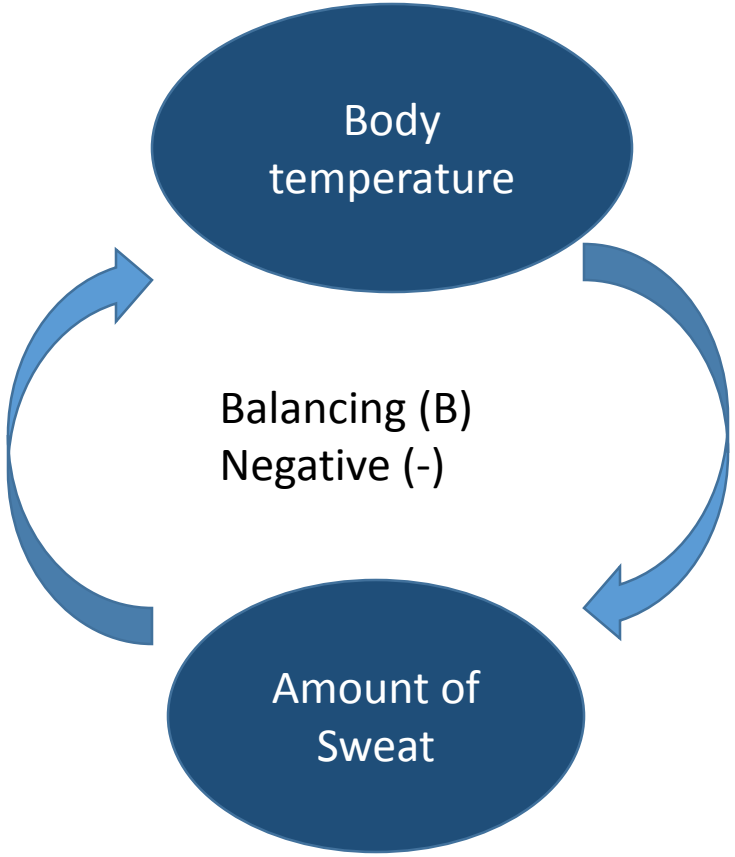
Types of Modeling Used in Participatory Research

- Scenario planning
- Fuzzy cognitive mappir
- Participatory GIS/mapp
- Role-playing games
- System dynamics
- Bayesian modeling
- Social network analysis
- Agent-based modeling
- Process-based modelir

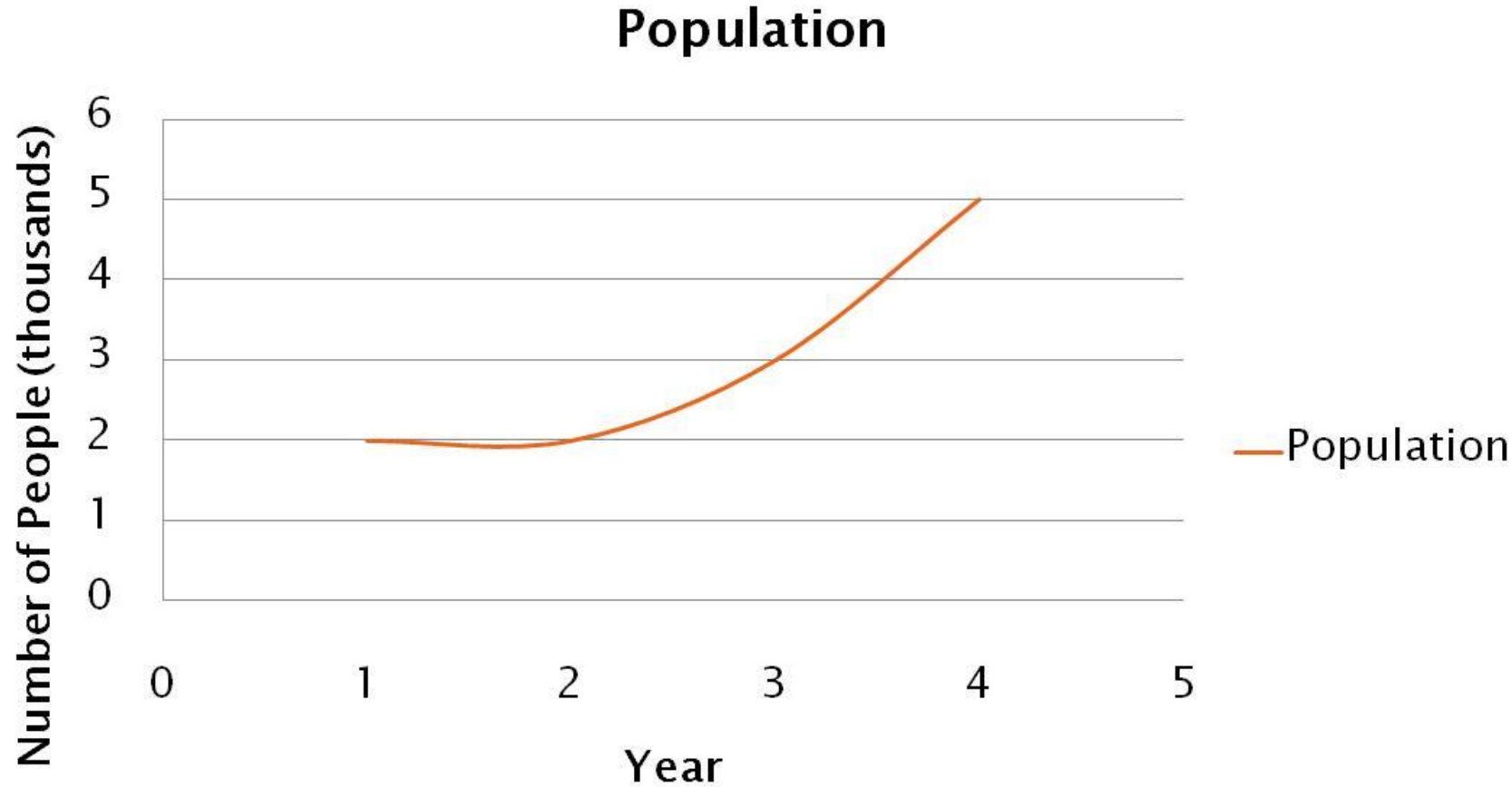
'Land Policies for Climate Change Adaptation in West Africa: A Multilevel Companion Modeling Approach'

System dynamics modeling: feedback

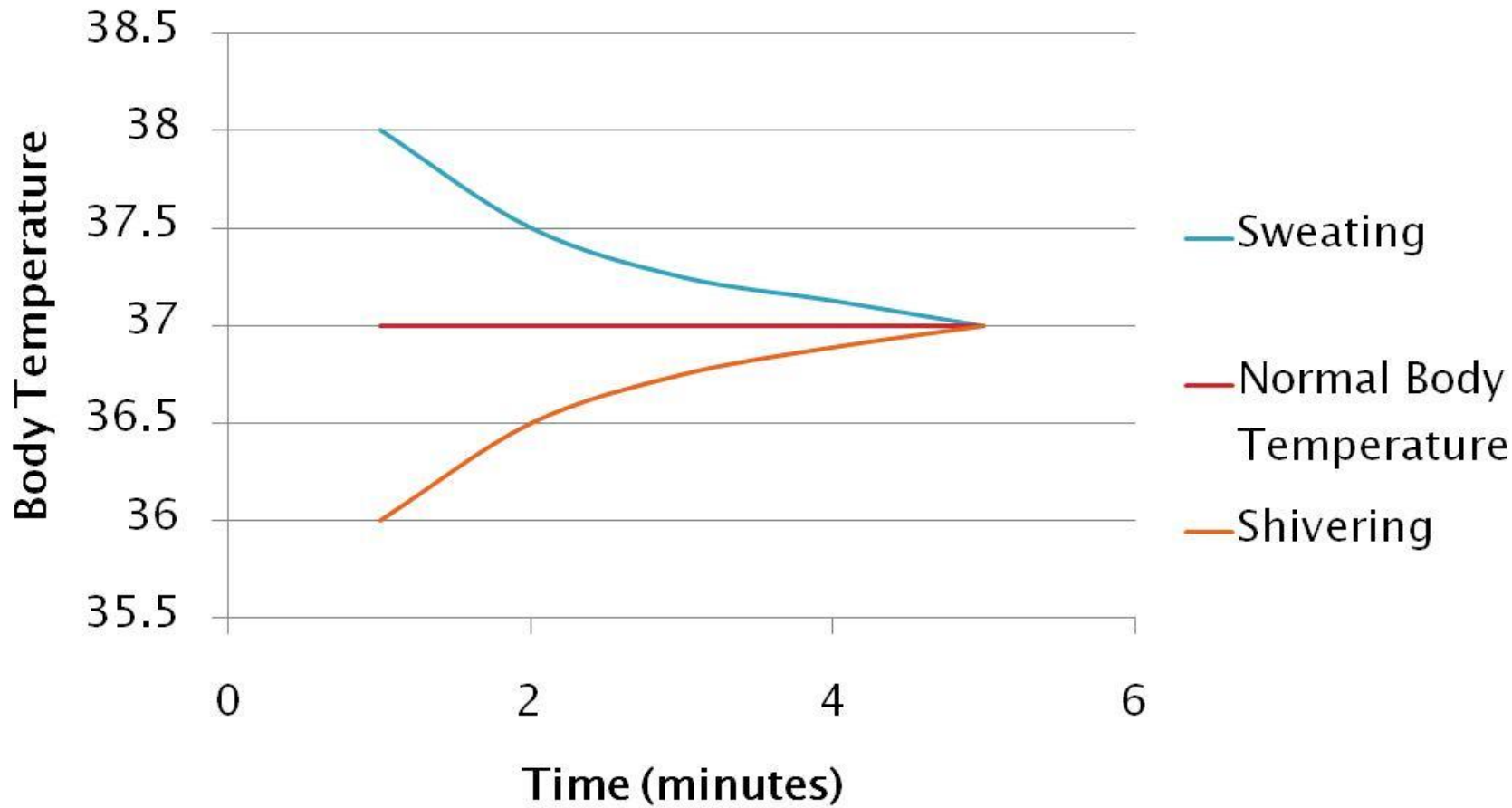




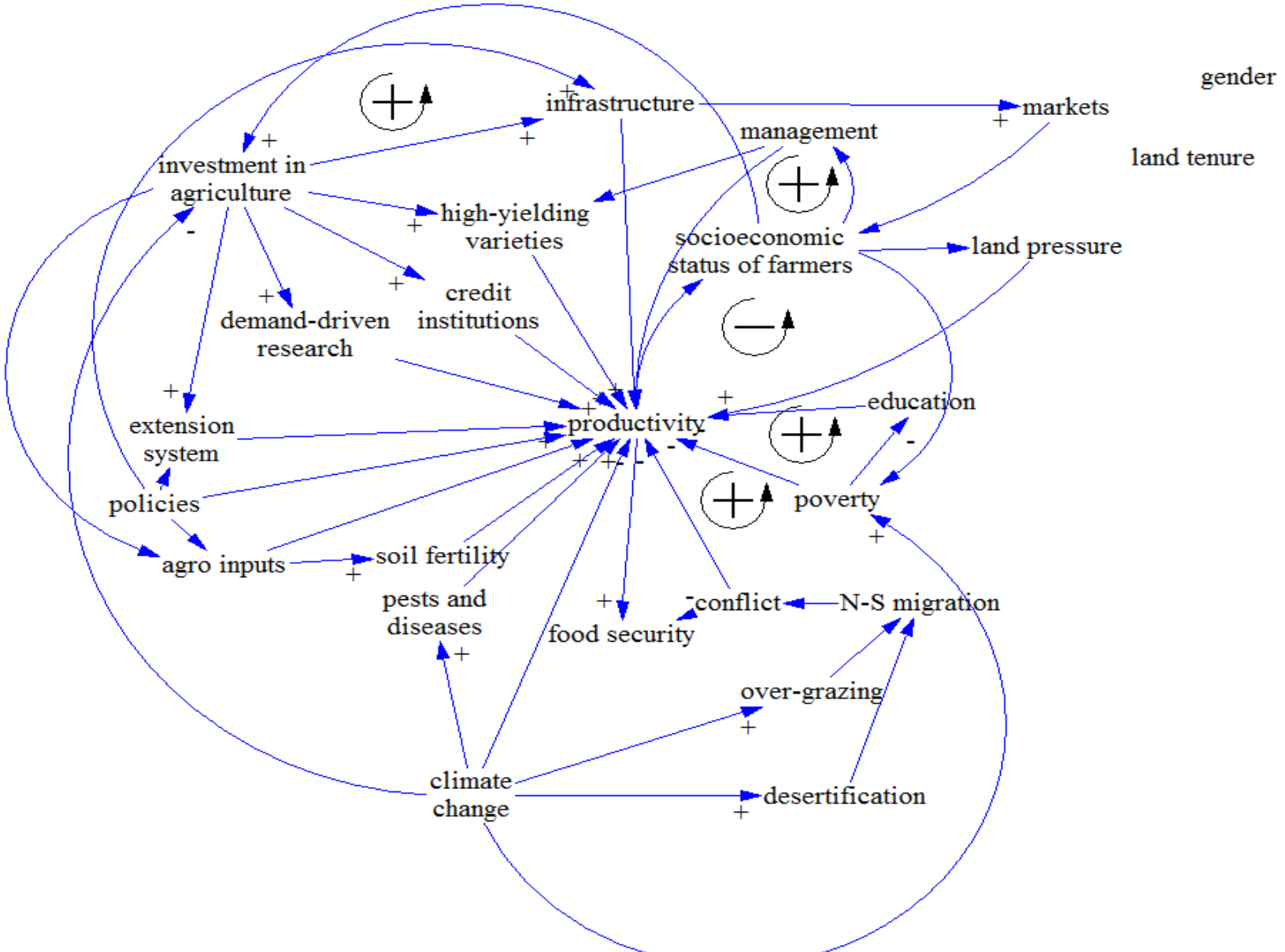
Systems with reinforcing loops tend to exhibit exponential growth

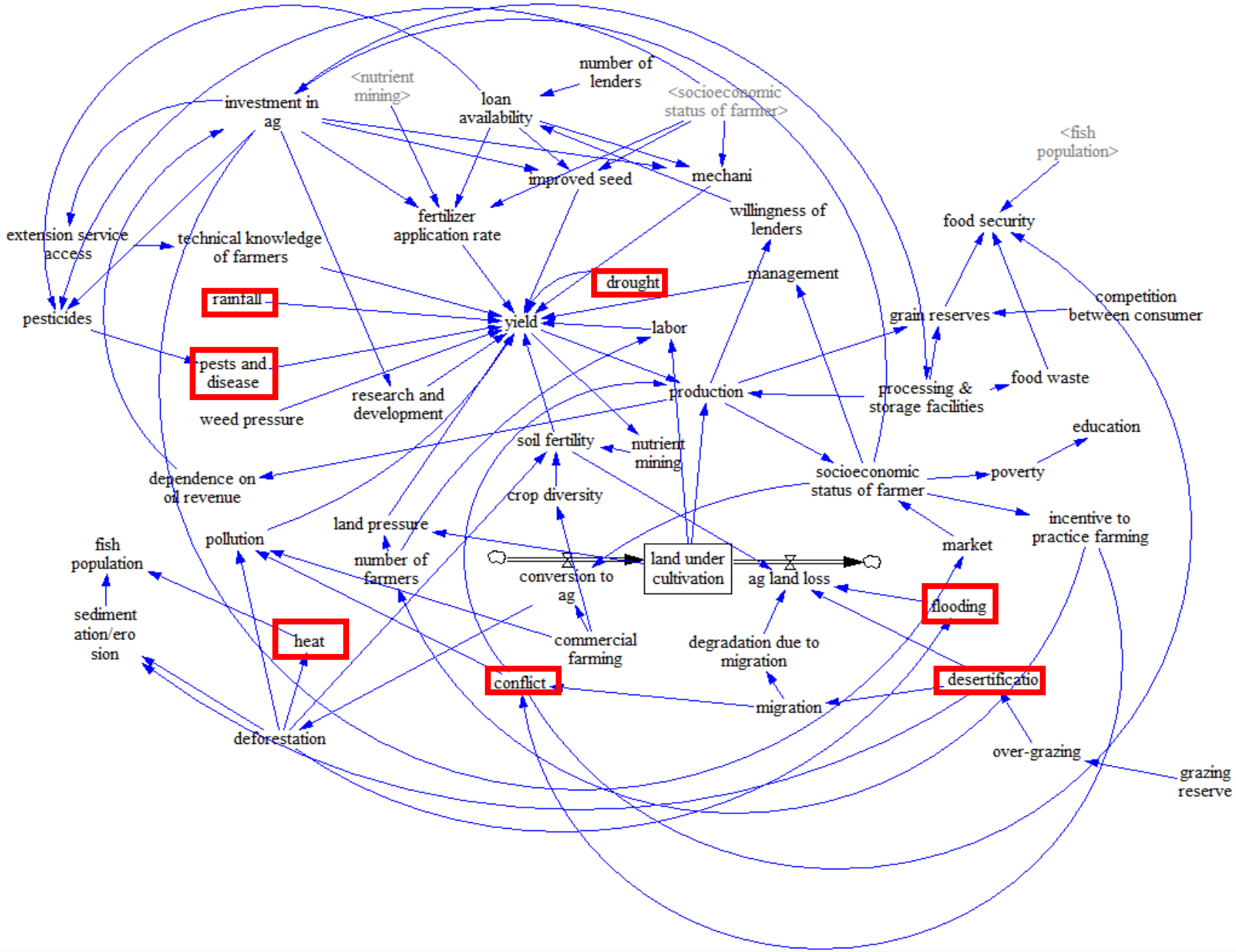


Systems with Balancing Loops tend to achieve equilibrium



11 Groups, 5 Regions, 37 Participants

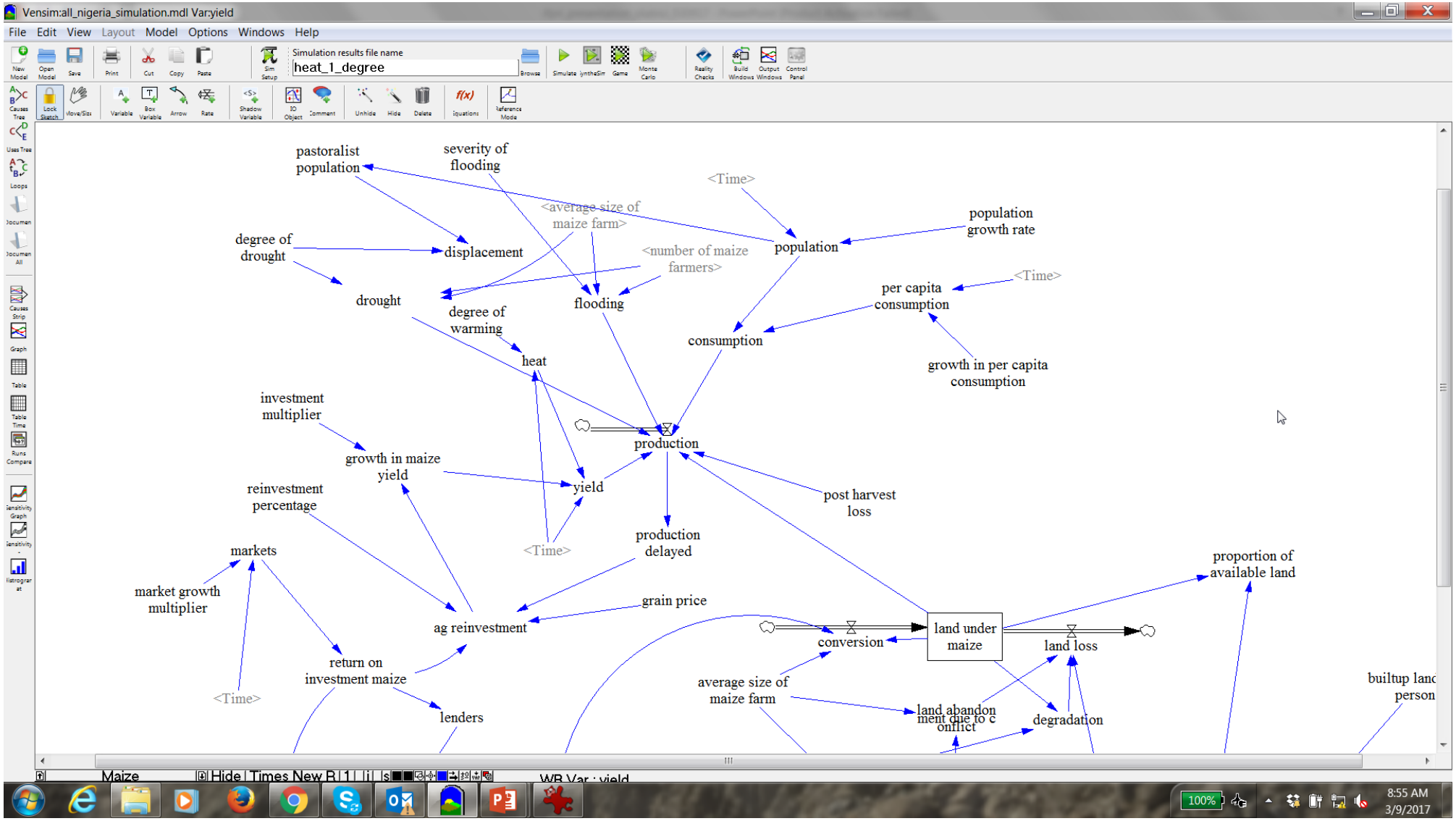



investment in ag
<nutrient mining>
loan availability
number of lenders
<socioeconomic status of farmer>
improved seed
mechani
fertilizer application rate
willingness of lenders
extension service access
technical knowledge of farmers
<fish population>
food security
drought
management
rainfall
pesticides
yield
labor
grain reserves
competition between consumer
pests and disease
production
processing & storage facilities
food waste
research and development
weed pressure
soil fertility
nutrient mining
education
dependence on oil revenue
socioeconomic status of farmer
poverty
crop diversity
incentive to practice farming
land pressure
pollution
market
fish population
number of farmers
land under cultivation
conversion to ag
ag land loss
flooding
sedimentation/erosion
heat
commercial farming
degradation due to migration
conflict
desertificatio
migration
deforestation
over-grazing
grazing reserve

Model

- Scale
  - National
  - ~2 representative states (Kaduna? & South-South)
- Crops
  - Maize, cassava, rice, ?
- Stakeholder consultation
  - Academics, state ministers, private sector, farmer orgs

Vensim® PLE Plus Software

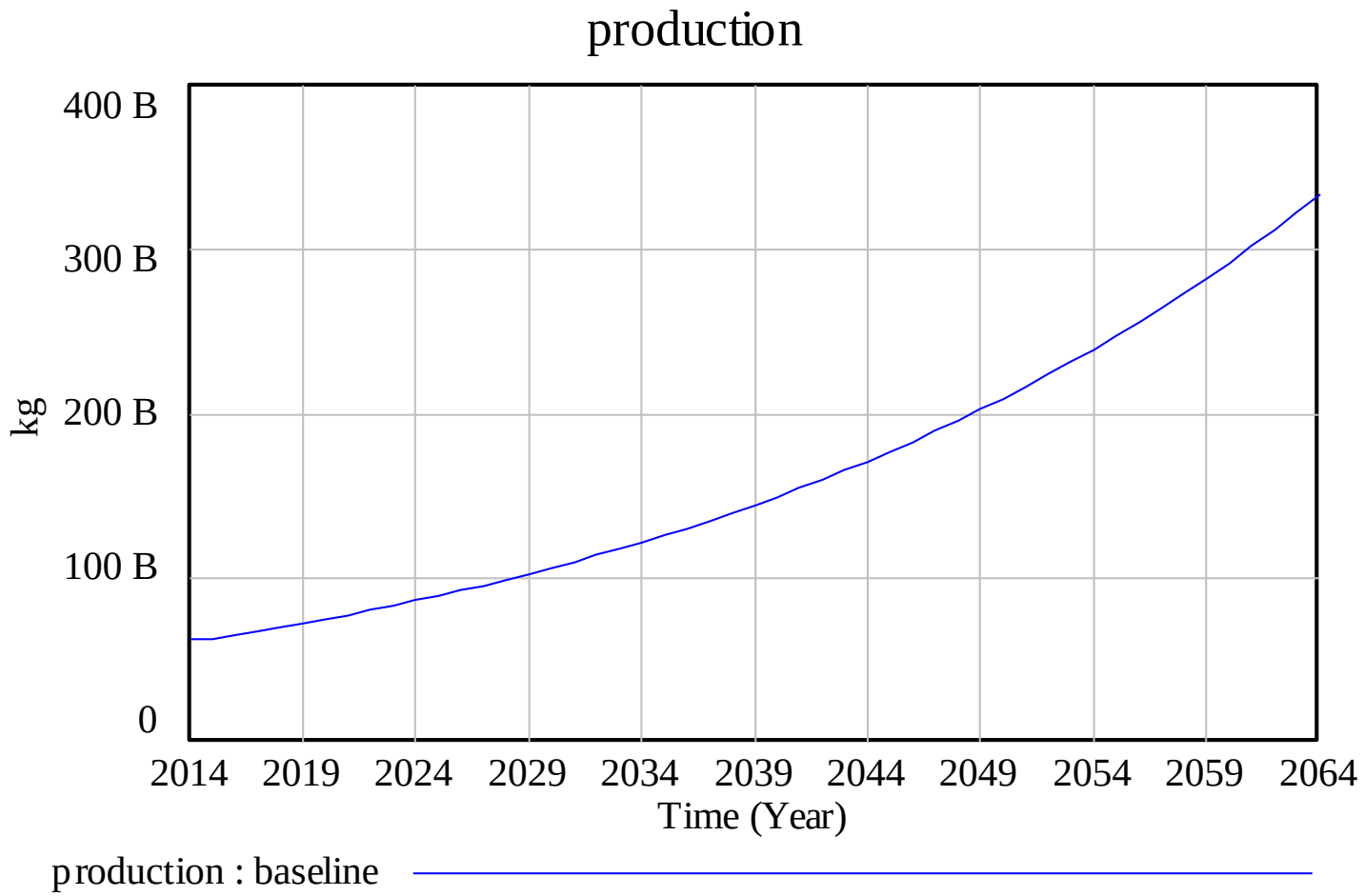


Available for free download at www.vensim.com

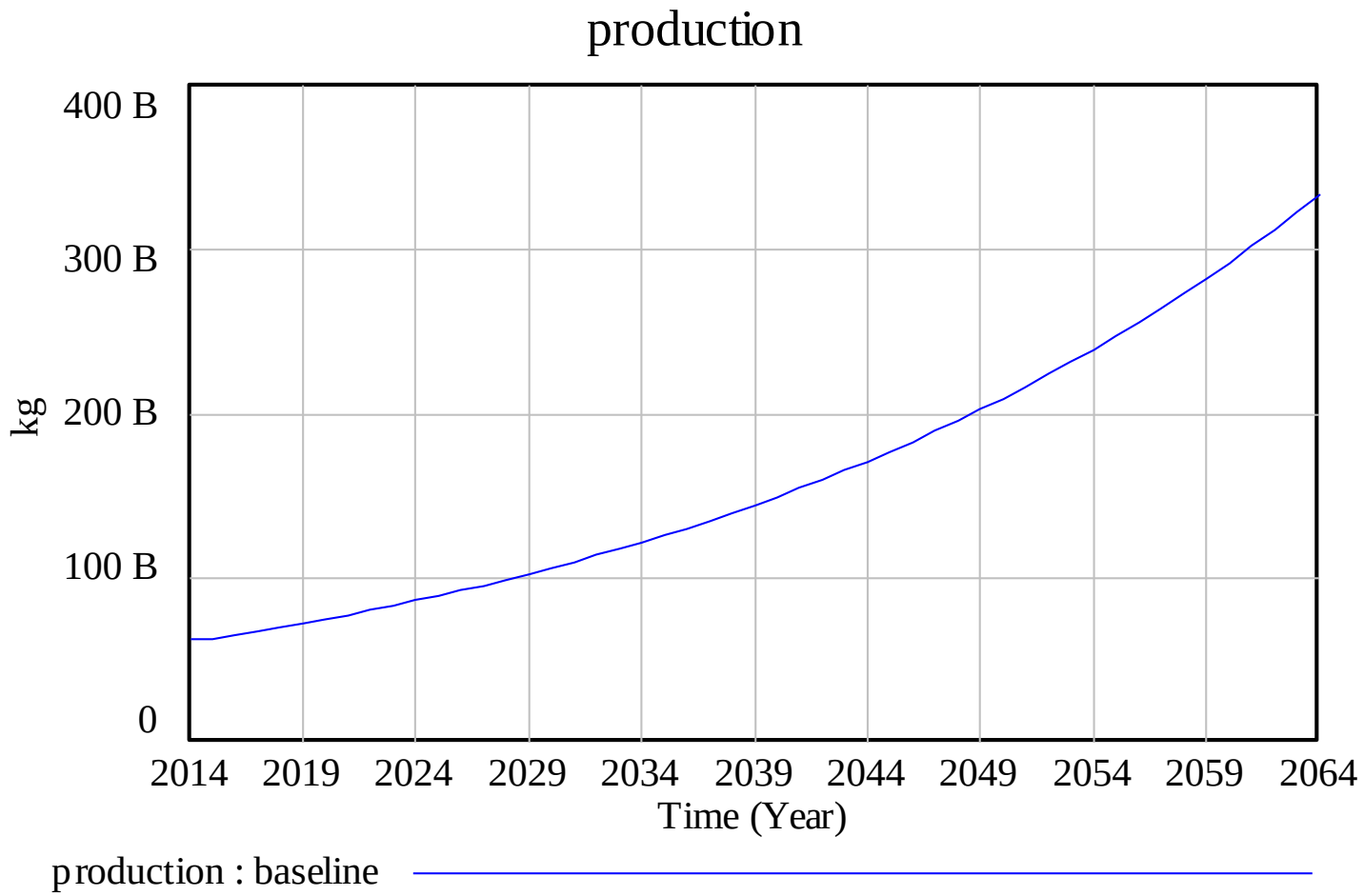
Drivers

- Maize yield increase * Area in maize = production
- Number of people farming * proportion growing maize*avg. farm size=Area in maize
- Population*Per capita consumption=Maize consumption
- Net production = production - consumption
- Heat →Lower Yield
- Drought, Flooding, Land Conflict → Reduce productive area

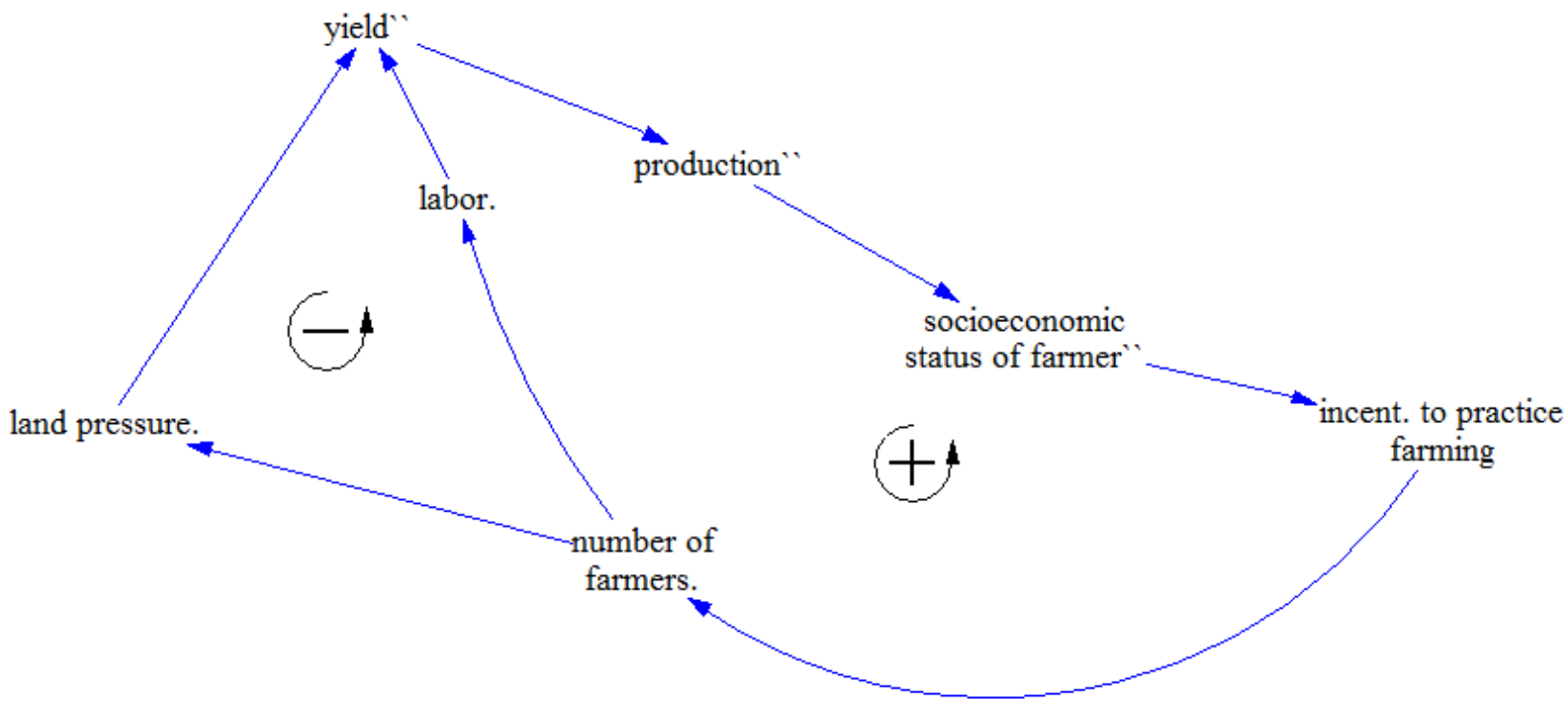
Results: maize excess production (national)



Results: maize excess production (national)



Labor/land pressure feedback loops (reinforcing & balancing)



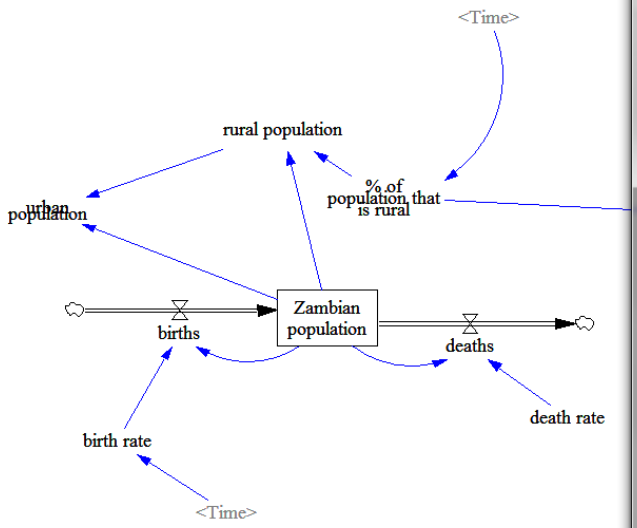
Conclusions

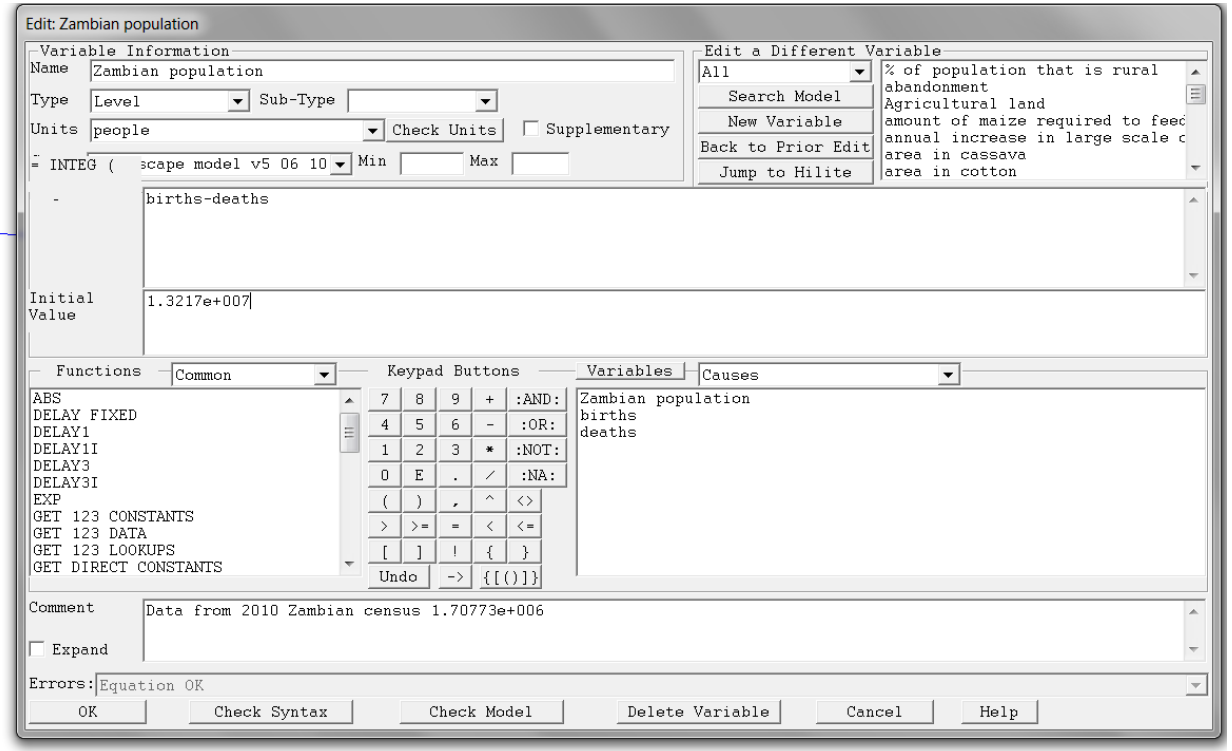
According to Local Experts…

- Nine reinforcing FB loops keeping Nigerian agriculture in ‘low productivity trap’
- Climate change may impact Nigerian ag. through heat, precip. changes, drought, flooding, pests & diseases, conflict
- Other types of environmental degradation important

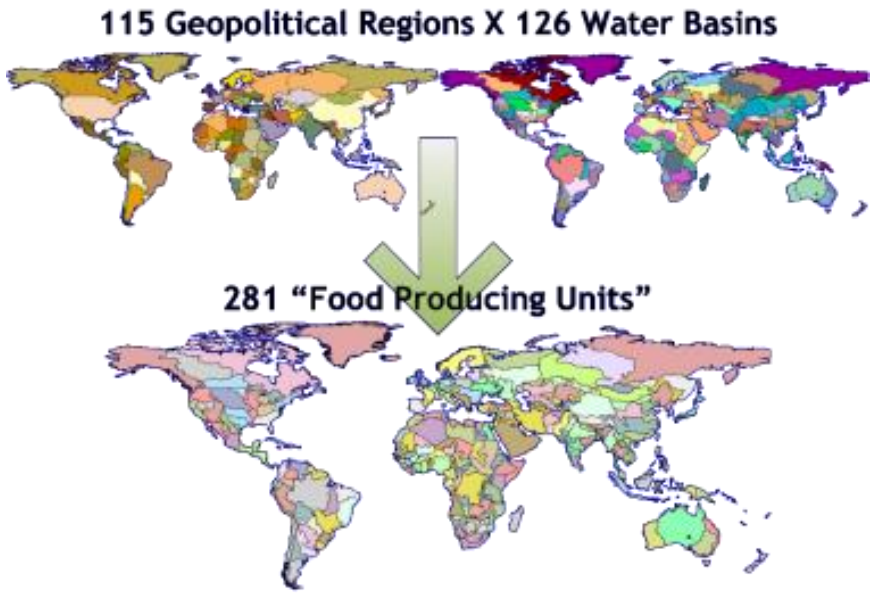
Next Steps

Quantitative SD





IFPRI IMPACT Model



Acknowledgments

INNOVATION LAB FOR FOOD SECURITY POLICY

Workshop participants!

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USAID FROM THE AMERICAN PEOPLE

MICHIGAN STATE UNIVERSITY

IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

…Questions?