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RESEARCH  
PROGRAM ON  
Policies,  
Institutions  
and Markets

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# Overview of the *BioSight* project on Sustainable Agricultural Intensification Strategies

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# Overview

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## The main things I will cover:

- Sustainable Intensification as a concept
- Important dimensions of SI to consider
- Overview of project activities
  - Key programmatic elements & approach
  - Activities in 2013
  - Partnerships & collaboration
  - Exciting directions for further work
- Goals of the workshop

# An Introduction to BioSight

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## **Strategic Policy Analysis at the Intersection of Food, Water, Land, Energy, and the Environment**

To better understand the complex dimensions of sustainable intensification (SI) and help producers and policy makers to address the inherent trade-offs around intensifying food production and maintaining environmental quality and well-being. We combine biophysical and economic modeling approaches within our quantitative analysis to capture some critical linkages.

# What is Sustainable Intensification?

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SI is an evolving concept which can broadly be defined as:

“...to increase food production from existing farmland in ways that place far less pressure on the environment and that do not undermine our capacity to continue producing food in the future.”<sup>1</sup>

<sup>1</sup> Garnett, T., M.C. Appleby, A. Blamford, I.J. Bateman, T.G. Benton, P. Bloomer, B. Burlingame, M. Dawkins, L. Dolan, D. Fraser, M. Herrero, I. Hoffman, P. Smith, P.K. Thornton, C. Toulmin, S.J. Vermeulen, and H.C.J. Godfray. 2013. “Sustainable Intensification in Agriculture: Premises and Policies.” *Science*, Vol 341 (5): 33 – 34.

# The “Montpellier” model for Sustainable Intensification

## Sustainability Measures

- Same or less land & water
- Efficient/prudent use of inputs
- Minimized GHG emissions
- Increased natural capital
- Strengthened resilience
- Reduced environmental impact

Source: Montpellier Panel (2013)

## INPUTS

### Indirect:

- Financial capital
- Knowledge
- Infrastructure
- Technology
- Markets

### Direct:

- Labor
- Water
- Inorganic chemicals and/or organic matter
- Biodiversity

FARMER  
& COMMUNITY

## OUTPUTS

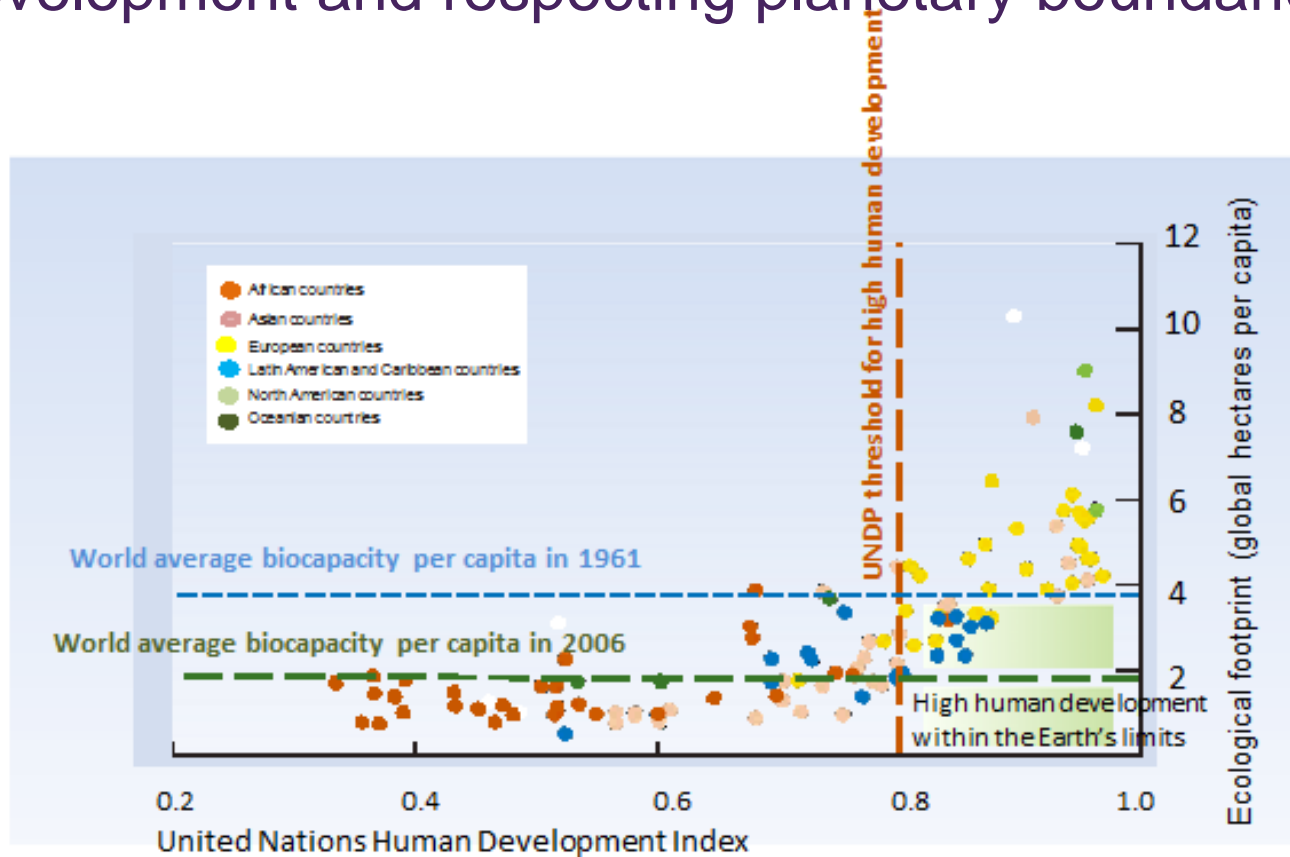
Production Income Nutrition

## Intensification Process

- Ecological
- Genetic
- Socio-economic

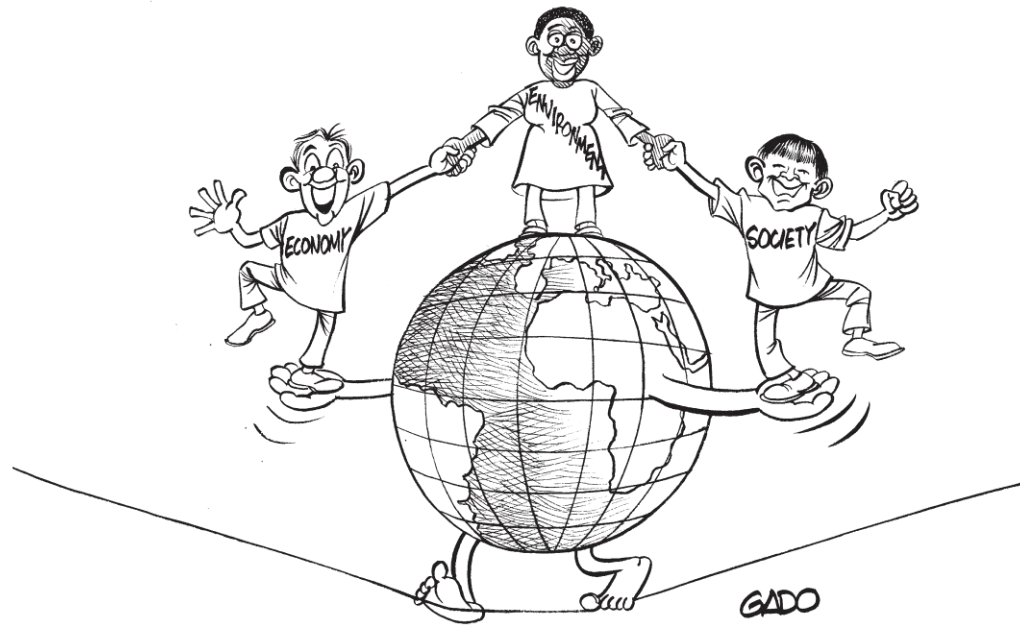
# Sustainable growth within resource limits

Trying to meet the twin challenges of increasing human development and respecting planetary boundaries



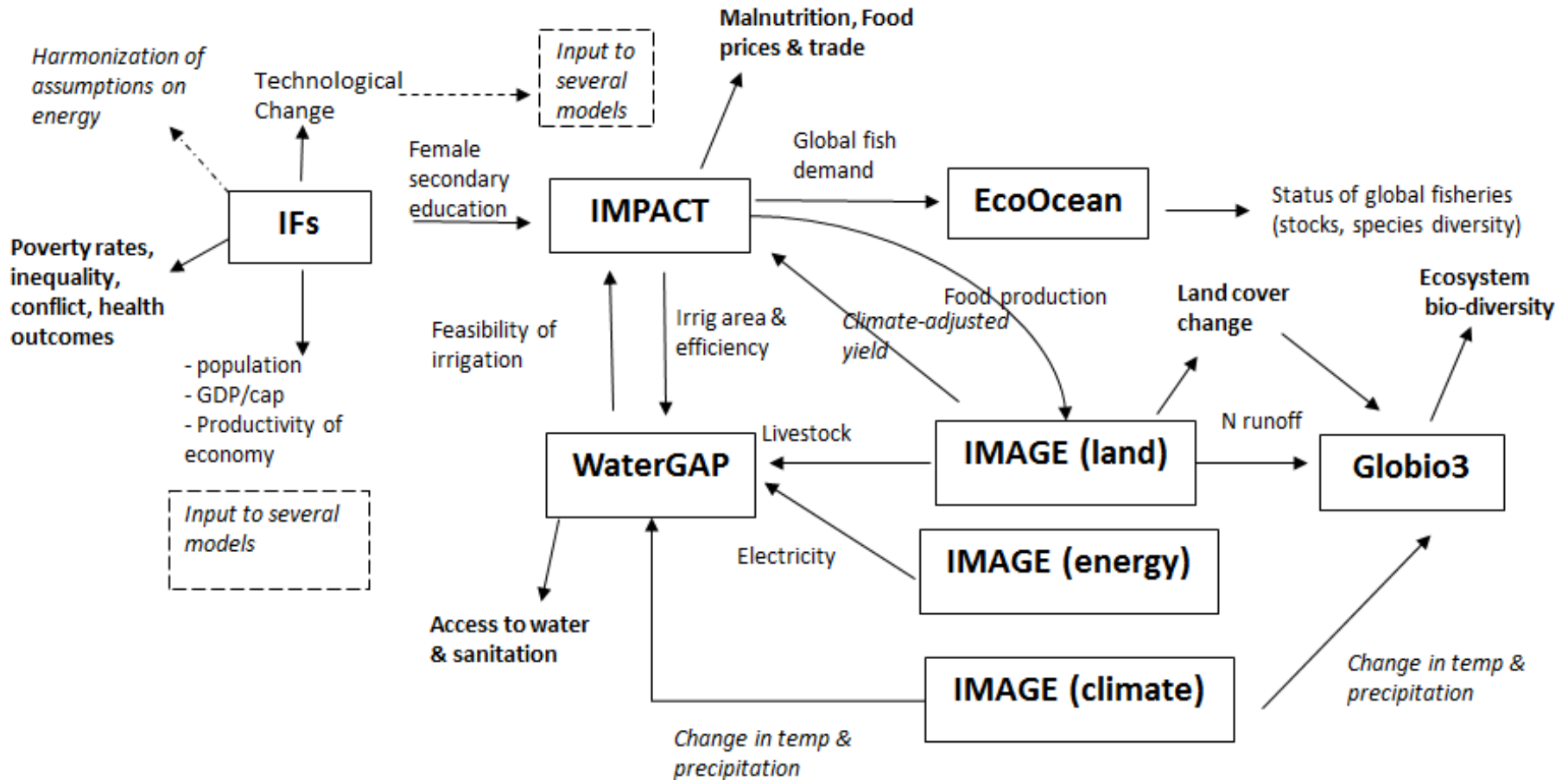
Source: Global Footprint Network (2010), UNDP (2009)

# The “happy balance” b/w economic growth, environmental quality & societal well-being



Pictorial representation of the “Sustainability First” scenario used in the UNEP Global Environmental Outlook 4<sup>th</sup> Assessment (2007)

# Key modeling linkages in GEO-4



Linking global-level models can be tricky & difficult.....



# Key programmatic elements of BioSight

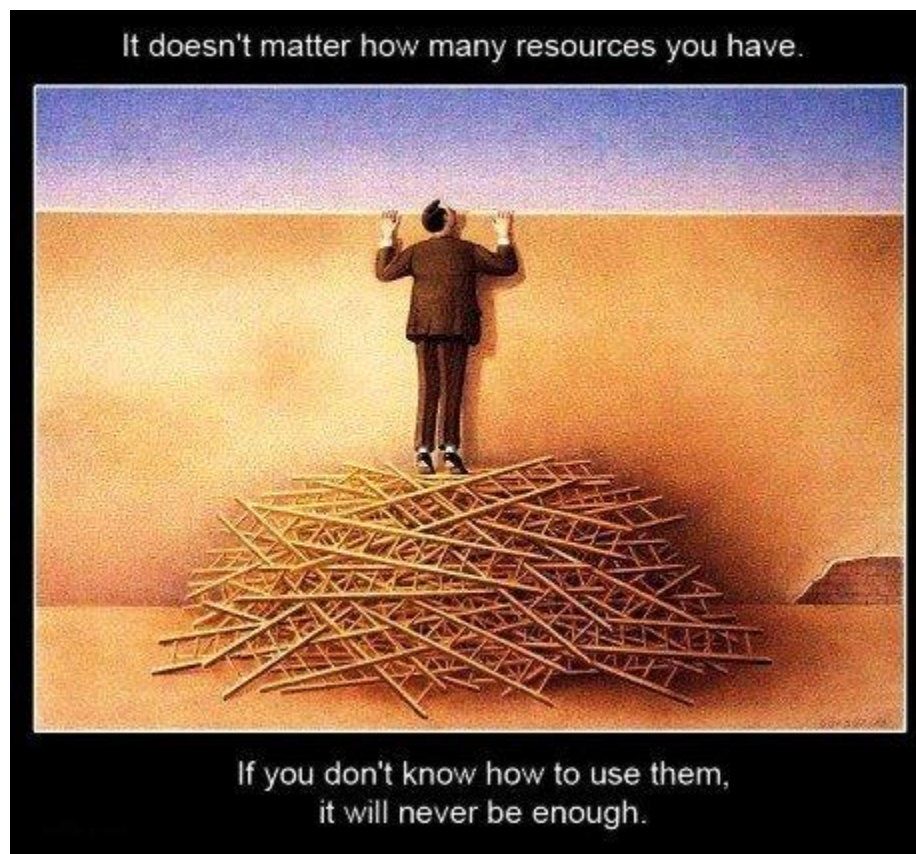
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In this project we seek to:

- Create better linkages b/w economic & biophysical approaches that look at intensification of crop, livestock, fish & forestry production – and important tradeoffs & implications for environment & HWB
- Build knowledge- and decision-support tools to help stakeholders navigate complex issues around SI and the nexus of food, water, land, energy & ESS
- Engage with partners inside and outside the CGIAR to create actionable strategies around SI that apply to a variety of regions, farm systems & agro-ecologies

# Why?

## Because...



# How we are trying to do this

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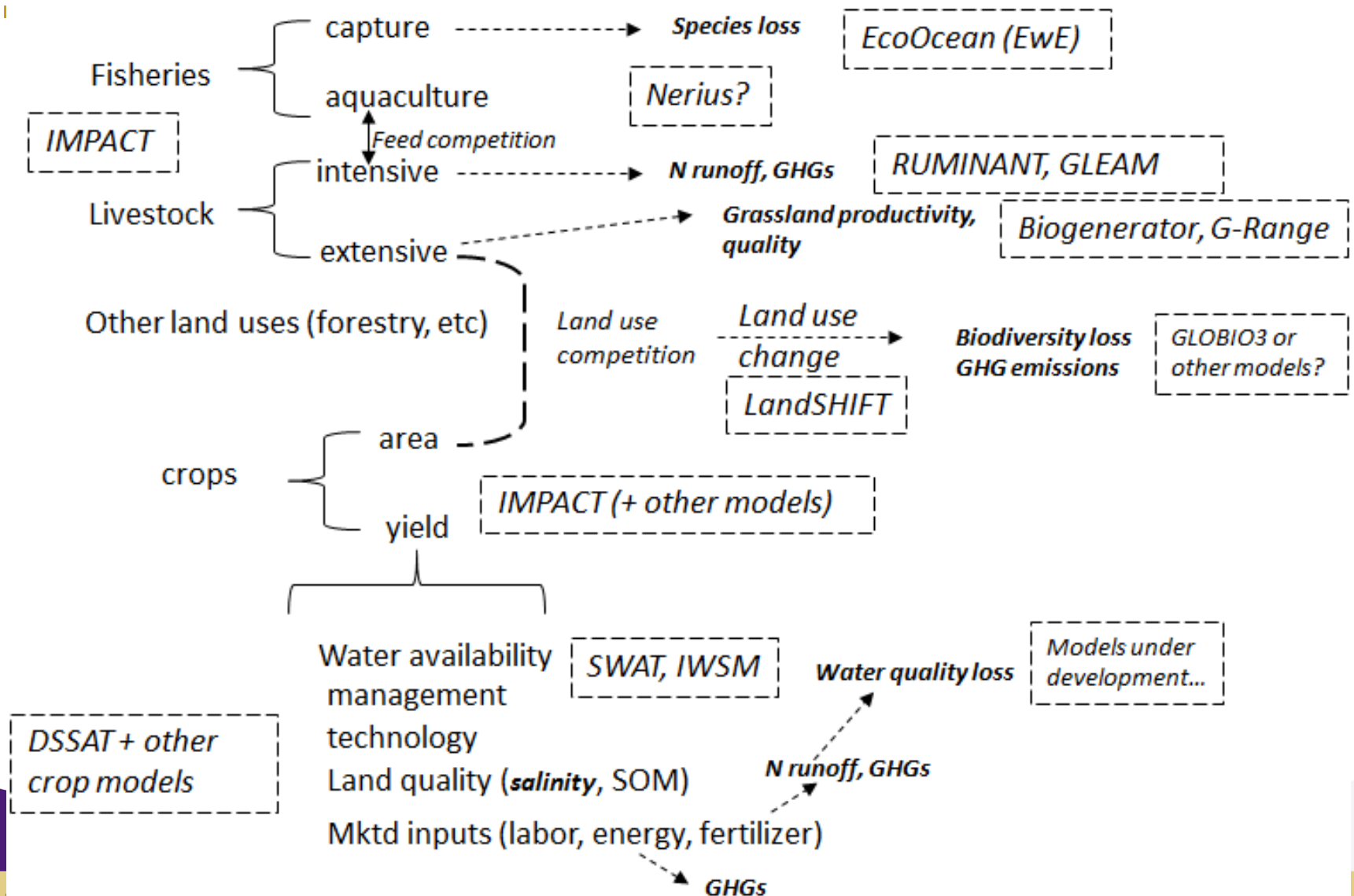
## Data

- Enhance and integrate a range of diverse data sources, including data on:
  - Land-use patterns
  - Water use and water quality
  - Household and household decision making models
  - Spatially explicit, high-resolution data, which characterize farming/production systems

## Multi-level Analytical Tools

- Landscape, national, regional, and global levels
- Micro- and macro-level capabilities

# Key modeling linkages under consideration



# BioSight activities in 2013

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Some key highlights from our activities in 2013:

- Kicked off project in April 2013
- Initiated detailed background studies to better understand some key issues around SI
- Start designing some training modules around
  - Systems dynamics modeling
  - Micro- and macro-level GAMS-based models
- Begin exploring interesting possibilities around
  - Ag production & water quality modeling
  - Modeling of livestock across various systems
  - Agent-based modeling approaches
  - Building better databases to support spatial-level quantitative work

# Detailed background papers

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- Improving the representation of institutions within bio-economic models of agricultural intensification
- On the state-of-the-art in integrated biophysical-econ models and their application to SI issues
- Survey of land use modeling approaches relevant to SI issues (esp those dealing w/hhold decisions)
- Defining better indicators of environmental impacts
- Exploring alternative frameworks for agent-based models and how they can be applied to study SI
- Looking at the sustainability of water in the context of agricultural intensification

# Thinking carefully about gender

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- This is a challenge for all of us – as many of our models ignore this dimensions
- Trying to creatively use the data that we have on the micro-level to understand gender differences in technology adoption & other key behavior
- Have talked with gender experts at IFPRI & elsewhere about how to better link with their work – and are planning work for 2014
- Challenges us to think carefully about how gender enters into the decision-making or the impacts we're trying to represent through our modeling work

# Trying more flexible modeling approaches

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- In this project we're trying to explore better ways of quantifying the decisions of producers and their impacts on the environment
  - Agent-based methods to see where between-agent interactions can really make a difference in system-level outcomes
  - Systems dynamics methods that capture some of the important feedbacks that can be critical for understanding system-level outcomes – and important eco-system interactions
- Whereas some models focus on the equilibrium – we might need to explore the dynamics and transitions in between them as well



# Key partnerships

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This topic is bigger than just IFPRI – and calls for strategic partnerships to carry out coordinated and focused trans-disciplinary work

Partnerships we have begun/exploring:

- CGIAR – ILRI, ICRAF, CIAT, Bioversity
- Other Int'l Ag Research Centers – CIRAD
- Research universities
  - U Calif, U Illinois, U Kassel, GMU, OSU
- Advanced research institutes
  - NUPI, Fisheries Center (UBC, U Arkansas)
- Regional ag research organizations – CORAF
- Various partners at the national level

# Lots of exciting possibilities ahead...

- Better linking crop modeling to economic production analysis and equilibrium market models
- Linking the implications of fertilizer and input use on water quality and ecosystems impact
- Better quantifying the environmental impacts of crop area expansion on other land cover types
- Doing more analysis of household-level trade-offs and understanding how to influence the decision of agents
- Linking the work done on intensification to the mitigation and adaption work done in climate-change work
- Digging deeper into livestock & fishery linkages

# Goals of the Workshop

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1. Discuss the body of work that has been generated in the last months to better understand its scientific implications – for the topic of SI and for the work of the project
2. Contextualize the work of *BioSight* within other research activities that are going on
3. Start to synthesize and pull together the insights gained from our work, so far, so we can focus on the most promising elements
4. Start to solidify some important partnerships that we can carry forward for future work

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**Thank You!**

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# Extra slides

# Drivers of change and trade, environment & welfare linkages

