The AgMIP Framework to Evaluate Agricultural Pathways

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Views expressed are those of the author, and don’t necessarily represent those of NASA
Global and Regional Resilience

All Maize Production (1000s of kg)

Top Regions Accounting for 90% of World Maize Production

Data from Monfreda et al., 2002
The Agricultural Model Intercomparison and Improvement Project (AgMIP)
Provide effective science-based agricultural decision-making models and assessments of climate variability and change and sustainable farming systems to achieve local-to-global food security.
AgMIP Approach Enables Testing of Farm and Policy Strategies

Rosenzweig et al., 2013 AgForMet
Current AgMIP Activities
Rosenzweig et al., 2015; Climate Change and Agroecosystems, Volume 3 Part 1

Visit www.agmip.org for more information and to sign up for AgMIP listserv
Yield impacts most severe in tropical regions

Modeled Changes in Corn Yield (2080s – present)

5 GCMs, 7 GGCMs; hatched = 70% agreement in sign of change

Rosenzweig et al., 2013
Global Economics Models Suggest Upward Pressure on Prices

Effects of climate change on agricultural prices
(2050 RCP8.5 relative to results without climate change in 2050)

Source: Model results as of February 15, 2013

Note: All changes relative to the reference scenario for the same year.
AgMIP Focus Areas

Sustainable Farming Systems

NextGen Knowledge Products Improved Models Data

Stakeholders

AR6 Coordinated Global and Regional Agricultural Assessments
Constructing a Regional Modeling Framework
Sustainable Farming Systems

Resource and Technology Inputs

Environmental Social and Economic Outcomes
Benefits of Regional Integrated Assessment Approach

• Involves local experts from all disciplines but maintains connection to global markets and pressures
  ➢ More attention to calibration toward local conditions
  ➢ Greater interest in analysis by participating regions

• Better awareness of relevant datasets by including local partners

• Greater engagement with stakeholders in project and scenario design as well as dissemination of results

• Examines impacts across distribution of farm systems (rather than assuming all farms are represented within a given grid box or polygon)

From Antle et al.
Representative Agricultural Pathways
Storylines of our Agricultural Future
Q1: What is the sensitivity of current agricultural production systems to climate change? This question addresses the isolated impacts of climate changes assuming that the production system does not change from its current state.

Q2: What are the benefits of adaptation in current agricultural systems? This question addresses the benefit (e.g., economic and food security resilience) of potential adaptation options to current agricultural systems given current climate.

Q3: What is the impact of climate change on future agricultural production systems? Assessment of climate impacts on the future production system, which will differ from the current production system due to development in the agricultural sector.

Q4: What are the benefits of climate change adaptations? Assessment of the benefits of potential adaptation options in the future production system.
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Pessimistic RAP1.1 If there is no change of mindset and way of doing business, food security situation will continue to worsen</th>
<th>Optimistic RAP 1.2 Favorable conditions for private and public investments in the agricultural sector will be created</th>
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</thead>
<tbody>
<tr>
<td>Degradation</td>
<td>+++ Extractive land use</td>
<td>- - Investments in NRM, secure ownership</td>
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<tr>
<td>Size of cultivated land</td>
<td>- - Lack of labor, limited investment options</td>
<td>- - Intensified production on less land</td>
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<td>Herd size</td>
<td>- - Shift towards goats</td>
<td>+ + Improved feed and management</td>
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<tr>
<td>Input prices</td>
<td>+ + + Lack of local manufacturing and raw material</td>
<td>+ + More players in processing industry against higher demand for inputs</td>
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<tr>
<td>Input use</td>
<td>- - - Lack of affordability and returns</td>
<td>+ + Market incentives, investment security, appropriate support</td>
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<tr>
<td>Crop income</td>
<td>- - - Low local production and competition with cheap imports</td>
<td>++ Increased income from higher production</td>
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<tr>
<td>Livestock income</td>
<td>- - - Competition with cheap imports</td>
<td>++ High and unmet demand for livestock products Improved quality production</td>
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<tr>
<td>Crop – livestock product imports</td>
<td>+ + + While national production is declining, the demand actually increases</td>
<td>+/- Large potential to produce vs climatic risks (droughts, no national reserves)</td>
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<td>Off-farm income</td>
<td>- - - Alternative income options are also limited</td>
<td>- - High farm productivity will keep more people in agriculture</td>
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</table>

Table shown as an example, please do not cite.

Masikati et al.; AgMIP: CLIP RRT -Zimbabwe
## AgMIP Regional Research Teams RAPs Trends Table: SSA (AgMIP, Phase I)

### Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>CLIP – R1 Zimb</th>
<th>CLIP – R2 Zimb</th>
<th>CLIP – R1 Mozamb</th>
<th>CLIP – R2 Mozamb</th>
<th>East Africa Embu, KE</th>
<th>West Africa R1 Nioro</th>
<th>West Africa R2 Nioro</th>
<th>SAAMIP South Africa</th>
<th>SAAMIP Namibia</th>
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<td>Soil degradation</td>
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<td>Improved crop use</td>
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### Direction and magnitude

- No change
- Small increase
- Moderate increase
- Large increase
- Small decrease
- Moderate decrease
- Large decrease
- Not included in RAP or under revision

**SSP2, period 2050**
Linking Agriculture-Specific Pathways to SSPs: Representative Agricultural Pathways (RAPs)

- **Hierarchical structure (nested approach)**

  - SSPs: Framework for development of sectoral (e.g. agricultural) global and regional scenarios.
    - Global RAPs: Global Economic Models and other non-modeled global socio-economic conditions:
      - GDP, population & policy and trade, etc
    - Regional RAPs: Allow us to include key drivers are likely to affect future bio-physical and socio-economic conditions:
      - ag productivity trends, land use, policy, regional development
      - farm size, system-specific productivity & management, infrastructure, etc

**AgMIP:**

*Developing and implementing Representative Agricultural Pathways and Scenarios (RAPS)*
AgMIP’s Community and Integrated Framework as Resources for Sustainable Solutions
Rising temperatures reduce global wheat production

Chapter 8

The AgMIP Coordinated Climate-Crop Modeling Project (C3MP): Methods and Protocols

A Global Network and Overlapping Assessments

Grids = Global and regional crop models; Polygons = Food-producing units

TOA-MD has 100+ users around the world; ~800 AgMIP Participants
Concluding Thoughts
AgMIP Projects and Partners use cutting-edge model, data, and IT approaches to understand resilience, sustainability, and productivity of farming systems and agricultural economies in support of stakeholder decisions from regional to global scales.

Models can be used for both climate change and broader sustainability studies.

The AgMIP community has grown in the last 5+ years, and participants are eager to demonstrate the use of models for the testing of sustainable solutions and informed decision making.

AgMIP tools could play a role in identifying and prioritizing sustainable approaches in diverse communities.

Also:
AgMIP is planning a Coordinated Global and Regional Assessment of Climate Change Impacts on Agriculture and Food Security with an aim to inform the IPCC Sixth Assessment Report.
Thanks!

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