Representative Agricultural Pathways and Scenarios: A Trans-Disciplinary Approach to Agricultural Model Inter-comparison, Improvement and Climate Impact Assessment

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Pathways and Scenarios

• The global IAM and IAV communities need a ‘small’ set of possible future worlds for integrated assessment modeling and analysis (“reference scenarios”)
  ◦ Earlier version: “Special Report on Emissions Scenarios” (SRES) linked emissions to socio-economic development narratives and assumptions
  ◦ But in fact there are many socio-economic development pathways consistent with each emission trajectory

• IPCC process for new “pathway” concepts
  ◦ RCPs: Representative Concentration Pathways
  ◦ SSPs: Shared Socio-Economic Pathways
RCPs, SSPs and RAPs

Representative Ag Pathways
- economic & social development narratives
- soil & water resource trends
- agricultural technology trends
- prices and costs of production
- ag, mitigation & other policy
Representative Agricultural Pathways (RAPs): linking agriculture-specific pathways to SSPs

- 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 that can’t be modeled, but 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

- Adaptation and Mitigation Strategies
  - need meaningful level of detail on changes in systems:
    - system characterization (crop vs livestock, etc), crop and livestock varieties, crop mix, management (fertilization...
**AgMIP Regional IA Framework**: Parallel development of system design, data and modeling to couple crop & livestock models with economic impact models
Representative Agricultural Pathways

• Economic, social and bio-physical development narratives:
  - agricultural technology trends
  - prices and costs of production trends
  - agricultural, conservation, mitigation and other policies

• These “pathways” are combinations of economic, technology and policy drivers that represent a plausible range of possible futures.
• They are not meant to be predictions, but rather provide researchers with a range of plausible scenarios that can be used to simulate possible future outcomes in a consistent and transparent way.

RAPs narratives provide a framework in which qualitative information can be translated into model parameters (quantification!)
First meeting:
1. Start with a “Business as usual” (BAU) RAP
2. Team members identify key parameters that will likely be affected by higher level pathways and draft RAP narrative
3. Team members are assigned variables for research
4. Team members conduct research – use of templates for reporting and supporting documentation
5. Templates can be distributed to experts for feedback

Second meeting:
5. Team members report findings and discuss storylines for each variable
6. BAU RAP is finalized
7. Additional RAPs are identified
8. Process similar to BAU is carried out
9. Additional background research

Create Additional RAPs

Modelers develop scenarios

RAPs distributed to stakeholders and outside experts
Tools for RAPs development:

- **DevRAP matrix and software:** Construct RAPs narratives and quantify scenarios parameters for TOA-MD. Template to parameterize TOA-MD and document model scenarios

- **Reporting Templates:** Help team members document background information specific to drivers under research

- **Pathways summary trends table:** Helps to visually inform users about trends and magnitudes of key driver changes included in RAP narratives
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>VARIABLE / INDICATOR</th>
<th>Leader</th>
<th>RAP1</th>
<th>RAP2</th>
<th>RAP3</th>
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<tbody>
<tr>
<td>Prices from Global/ National Models</td>
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<td></td>
<td>Fossil Fuels</td>
<td>Antle</td>
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</table>

**Bio-Physical**
- Soil erosion
- Crop genetic improvement (yield potential)
- Water-energy-emitted land and energy
- Pests, weeds and diseases

**Institutional Policy**
- Subsidies
- Conservation programs
- Environmental regulation
- Governance (quality & functioning of laws & regulations)
- Climate policy

**Socio-Economic**
- Farm size-commercial size and small numbers
- Commodity prices

**Definition**
- No change
- Low Increase
- High Increase
- Small decrease
- Large decrease

**Arrows**
- Supply and demand from 2000 to 2050 from IFPRI report of “2011 global food security” (see Figure 2)
- Supply and demand from 2000 to 2050 for agricultural commodities to 2050”, IFPRI, 2010 (b, 2010)
- Supply and demand for Agricultural Commodities to 2050
- Trend Table
- See Figure 2
### AgMIP Regional Teams: RAPs development and implementation summary

<table>
<thead>
<tr>
<th>Regional Research Team</th>
<th>Location</th>
<th>RAPs type</th>
<th>Stakeholder involvement</th>
<th>Number of Model Scenarios</th>
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Note: This list includes RAPs reported by teams by October 30, 2013
n/a : Not reported
Acknowledgements:

- AgMIP Regional Teams for providing current RAPs status

- Regional Approaches to Climate Change (REACCH) Project (US Pacific Northwest) for their contribution to methodology for RAPs development

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Thanks!