Experience with GLOBIOM for Climate Change Policies

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REDD-PAC & Climate change policies

A lot in common but not fully similar:

- Importance of:
  1. Consistency with wider climate policy approaches
     - IPCC scenarios
     - RCPs climate impacts
   Prerequisite for scientific outreach
  2. Developing tools informative for efficient policy design
     - Interaction with other mitigation policies
     - Leakage across land use activities
     - International reallocation effects

- Significant experience already acquired through GLOBIOM modelling
- Collaboration through a wide IIASA ESM network
GLOBIOM: Typical applications

- **Agricultural prospective**
  - Schneider et al. (2011) *Impacts of population growth, economic development, and technical change on global food production and consumption.* Agricultural Systems
  - Smith et al. (2010) *Competition for land,* Philosophical transactions
  - Applied scenarios such as Eastern Africa with CCAFS

- **Deforestation**
  - Mosnier et al. (2010) *Modeling impacts of development trajectories on forest cover in the Congo Basin*

- **Climate change mitigation**
  - Valin et al. (2010) *Climate change mitigation and food consumption patterns*

- **Biofuels**
  - Fuss et al. (2011) *A stochastic analysis of biofuel policies*
  - Mosnier et al. (2010) *Direct and indirect trade effects of EU biofuel targets on global GHG emissions*

- And several others...
REDD baseline in the IPCC scenario space?

![Graph showing SSP scenarios]

- **SSP 1**: Low Challenges
- **SSP 2**: Adaptation Challenges Dominate
- **SSP 3**: Mitigation Challenges Dominate
- **SSP 4**: Intermediate Challenges
- **SSP 5**: Sustainability Challenges

Increasing socio-economic challenge for mitigation vs. Increasing socio-economic challenge for adaptation.

## SSPs: Beyond quantitative scenario drivers

<table>
<thead>
<tr>
<th>SSP Element</th>
<th>Country Income Groupings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land use change regulation, e.g. forest protection</strong> (consistent with Env. Policy?)</td>
<td>Low: strong, Med: weak, High: weak, medium, strong</td>
</tr>
<tr>
<td><strong>Agriculture</strong></td>
<td></td>
</tr>
<tr>
<td>Crop yield increase</td>
<td>rapid: Med: medium, Low: slow, medium, rapid</td>
</tr>
<tr>
<td>Total calories per capita (incl. food waste?)</td>
<td>low: Med: medium, Low: high</td>
</tr>
<tr>
<td>Animal share</td>
<td>low: Med: medium, Low: high</td>
</tr>
<tr>
<td>Trade liberalisation (cf. Trade, globalisation)</td>
<td>rapid: Med: medium, Low: slow</td>
</tr>
<tr>
<td>Livestock systems change (e.g. increase in feed conversion rates)?</td>
<td>rapid: Med: medium, Low: slow, medium, rapid</td>
</tr>
<tr>
<td>Water use efficiency?</td>
<td>high: Med: low</td>
</tr>
<tr>
<td>Baseline bioenergy demand?</td>
<td>high: Med: low</td>
</tr>
</tbody>
</table>
GLOBIOM modelling, SSPs, RCPs

- Pop & GDP are exogenous drivers of demand structure in GLOBIOM
- Other RAPs characteristic likely to be taken into account in a systematic approach (work on productivity projections)
- Connexion to mitigation policies through a matrix approach

Source: Matrix from Arnell et al., 2011
Experience from IIASA ESM

- Impact, Adaptation, Vulnerability (Working Group II)
  - AgMIP (Agricultural Models Intercomparison and Improvement Project)
    - Focus on food production and food security
    - More cross-model direction
  - ISI-MIP (Intersectoral Impact Model Intercomparison Project)
    - Focus on all impacts (GLOBIOM mostly food security and land use)
    - More cross-scenario direction
  - Asia vulnerability to climate change with GLOBIOM+EPIC

- Integrated Assessment Community (Working Group III)
  - Collaboration with MESSAGE model to provide RCPs baseline and mitigation pathways with biomass potential contribution
Impact of Climate Change (WG II)

Relative Difference in Means (2050/2100) in Wheat Yields
[Data: Tyndall, Afi Scenario, simulation model: EPIC]

**rel diff means**

(wwht)
Mitigation policies (WG III)

- Investigation of different mitigation strategies
  - Abatement possible through system shifts
    - Crops (subsistence, low input, high input, irrigated)
    - Livestock (grass fed, mixed extensive, mixed intensive)
    - Different biofuel policies (1st / 2nd generation, high yield crops/plantations)
  - Add-on technologies
  - Role of reallocation and trade policies
  - Increased productivity pathways
## GHG sources consistent with IPCC rules

<table>
<thead>
<tr>
<th>Sector</th>
<th>Source</th>
<th>GHG</th>
<th>Reference</th>
<th>Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>Above and below ground biomass</td>
<td>CO₂</td>
<td>IIASA G4M Model (Kindermann et al., 2008)</td>
<td>2 / 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tier 3: Austria</td>
<td></td>
</tr>
<tr>
<td>Other vegetation</td>
<td>Above and below ground biomass</td>
<td>CO₂</td>
<td>Ruesch and Gibbs (2008)</td>
<td>1 / 2</td>
</tr>
<tr>
<td>Crops</td>
<td>Fertilizers</td>
<td>N₂O</td>
<td>EPIC runs output/IFA + IPCC EF</td>
<td>2 / 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tier 3: EU</td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>Rice methane</td>
<td>CH₄</td>
<td>Average value per ha from EPA</td>
<td>1</td>
</tr>
<tr>
<td>Livestock</td>
<td>Enteric fermentation</td>
<td>CH₄</td>
<td>RUMINANT (ILRI) + Livestock systems</td>
<td>2</td>
</tr>
<tr>
<td>Livestock</td>
<td>Manure management</td>
<td>N₂O, CH₄</td>
<td>RUMINANT (ILRI) + Livestock systems</td>
<td>2</td>
</tr>
<tr>
<td>Livestock</td>
<td>Manure grassland</td>
<td>N₂O</td>
<td>RUMINANT (ILRI) + Livestock systems</td>
<td>2</td>
</tr>
<tr>
<td>UNDER PROGRESS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td>Soil organic carbon</td>
<td>CO₂</td>
<td>Not at global level. Good information available for EU through EPIC</td>
<td>2 / 3</td>
</tr>
</tbody>
</table>
Emission response to productivity

Havlik et al., forthcoming
Thank you for your attention

Questions...

- www.globiom.org