FAO/OECD Expert Meeting on Greening the Economy with Agriculture (GEA)

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Contributions of AgMIP

Comments (Panel) by Nadine Brisson, INRA, on GEA and Food Availability

- Contributions of crop scientists, clearly in the first pillar "Food availability" with some elements for the third one "stabilization of food system".

- Some key features of the AgMIP project

  - Its goals: (1) to improve substantially the simulation tools that are used to characterize world food security due to climate change; (2) to assess future world food security utilizing the improved models; and (3) to enhance adaptation capacity in both developing and developed countries

  - Who is involved: AgMIP is led by Drs. Cynthia Rosenzweig (NASA), Jim Jones (University of Florida) and Jerry Hatfield (USDA-ARS). The leadership team also includes additional team leaders from NASA, the University of Florida, Oregon State University, IFPRI, CSIRO, and Wageningen University, with core coordination at Columbia University. AgMIP is building a transdiscipilinary community of crop modelers, climate scientists, economists, and information technology experts to address these important science and policy questions. There are nearly 300 scientists subscribed to the AgMIP list serve, with nearly 200 having participated in international and regional workshops on four continents. An ongoing AgMIP wheat model intercomparison currently enjoys the participation of 30 modeling groups and an AgMIP maize model intercomparison has been initiated.

  - Who pays: Funding for AgMIP activities follows a distributed structure based on similar climate intercomparisons that contribute to the IPCC, whereby developed/transitioning countries pay for their own participants and developing region participants are supported by development agencies. Initial support for AgMIP was provided by the USDA-ARS, and additional participation has been funded in Europe, Australia, and

South America. AgMIP received Generous DFID funding to support AgMIP participants from sub-Saharan Africa and South Asia.

- Project visibility
  - Large international call for participation for crop scientists, climate scientists, economists, and IT specialists to participate
  - Organizing global agricultural economic model intercomparison
  - Ongoing crop-specific model intercomparisons for wheat, maize, rice, sugarcane (others in formation)
  - Strong institutional support in key countries and regions (USA, UK, France, Australia, the Netherlands, Brazil, EU); ongoing discussions with other nations in Asia, South America, and elsewhere.
  - Project website: www.agmip.org
  - Building online clearing house to archive and disseminate results.
  - Consistent global approach encourages inter-regional comparisons and collaboration

- Two complementary aspects
  - Building on relevant tools to consistently estimate regional yields for global applications and make them available for wider utilization
  - Produce results on future (2050 —2100) productivity of the main agricultural world regions for main crops (wheat, maize, rice, sorghum, soybean, sugar cane)

- AgMIP is focused on yield and technical aspects of agriculture, with a primary focus on climate impacts and economic applications. AgMIP starts with 'bottom-up' local and regional production and scales up to mega-regions, nations, and global trade. The use of economic models provides a complementary 'top-down process that allows AgMIP to contribute to assessments of land use, with development of socioeconomic scenarios known as 'Representative Agricultural Pathways (RAPs). RAPs are necessary to take into account that land use is influenced by a wide array of soclo-political factors beyond food prices and expected yield.

- Uncertainty is one important issue for AgMIP and the wider community to be able to deliver a range of likely values and thus to contribute to more robust decision-making. AgMIP seeks to characterize explicitly uncertainty that comes from various sources:
  - The environment (soil, climate) especially climate change;
  - Crop management (inputs, genotypes, weed and disease control), also difficult to characterize in future scenarios;
  - Model errors and unresolved processes;
  - Errors coming from requisite down- and up-scaling;
  - Biases owing to methodological techniques (data processing, parameter estimation, etc.);

- AgMIP approximates model errors by using the climatologists' technique of ensemble modeling: i.e., by using not one but an ensemble of dynamic process crop growth models we merge diverse approaches to simulating key crop

processes to obtain more robust estimates of the uncertainty of simulated crop growth and production.

- AgMIP activities are organized by discipline, crop, and region in order to create a transdisciplinary integrated approach that involves the best scientists in contact with 'on-the-ground' farm and market realities.

- AgMIP uses various types of observed data: local data from research or extension services, experimental trials to test and calibrate the models, and regional statistics to upscale the local results and bridge the scale to national data required by economic models. Respect for the regional agricultural realities in terms of:
  - Crop management (preceding crop, sowing dates, fertilization...);
  - Genotype choices;
  - Yield objectives;
  - Climate challenges;
  - Market forces;

- Development of adaptation strategies in order either to:
  - Take advantage of climate change (e.g., Northern countries where warming may allow new crops; irrigated areas where elevated CO2 may increase water efficiency); or
  - Prevent its deleterious effects (e.g., drought in particular; also heat stress and increased extremes)

- The project also has multilateral capacity-building components since scientists from various environments actively test their models to improve simulation of cropping conditions in many agricultural regions. We hope that the resulting simulation tools will improve characterization of world-wide agricultural systems in the most relevant way.

- Main future challenges for global agriculture
  - Environment:
    - Mineral nitrogen- input reduction : sensitivity tests of crop models enables analysis of consequences of reduction/increase of N fertilization;
    - Idem for irrigation;
    - Idem for soil water;
    - Simulation of crops in many locations allows us to characterize range of crop potentials;
    - Climate stresses (temperature, rainfall, C02, extremes)

  - Productivity
    - Identification of possible progress in terms of yield in a realistic manner (yield gap) because of accounting for regional constraints;
    - Inclusion in a systematic way the uncertainties in the given values improves robustness of results for use in decision making;
    - Focus on climate extremes and inter-annual variabjjjy which is projected to increase with climate change with potential increases in system instability;
    - Local, regional, and global market pressures.

- About the gap between scientific results and societal needs:
    - A pragmatic project that includes both bottom-up and top-down processes; regional experts carry out regional simulations taking into account relevant production constraints;
    - Relevant sampling of the diversity of cropping conditions;
    - Not a linear approach but rather a web of crossed approaches: per region, per crop, per model, per discipline;
    - Organization of regional workshops where model developers test their models on local conditions.
- Gather the scientific community around common goals:
    - Improvement of the present estimates based on both single model and statistical approaches;
    - Use of ensemble of multiple models to secure range of results and enable the characterization of uncertainties;
    - Building of a world-widecommunity to develop tools capable of being mobilized quickly for many agricultural worldwide problems.