AgMIP 7

Co-organized by IICA

SEVENTH GLOBAL WORKSHOP REPORT

of the Agricultural Model Intercomparison and Improvement Project

APRIL 24 - 26, 2018

INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE

SAN JOSÉ, COSTA RICA

ACKNOWLEDGEMENTS

The 7th Global Workshop of the Agricultural Model Intercomparison and Improvement Project (AgMIP) was hosted and co-sponsored by the Inter-American Institute for Cooperation on Agriculture as part of a long-term partnership envisioned by the AgMIP and IICA leadership. We appreciate greatly the collaboration reflected through the staff and scientists of both institutions in support of improved methods for agriculture now and in the future. In particular, we thank members of the Program and Abstracts Committees (A. Ruane, S. Asseng, R. Valdivia, C. Mutter (AgMIP); and, K. Marzal, D. Medina, K. Witkowski (IICA)) and the Organization and Communications Committees (C. Mutter, E. Mencos, G. Repucci (AgMIP); and, D. Medina, K. Marzal, M. Montoya, P. Sancho, I. Zuniga, J. Alpizar (IICA)). Major contributions for the workshop were provided by the Earth Institute, the University of Florida, and Oregon State University. Contributions of travel support for participants from Africa and South Asia were provided by the International Crops Research Institute for the Semi-Arid Tropics, Leibniz Centre for Agricultural Landscape Research, and the Potsdam Institute for Climate Impact Research. The Stockholm Environment Institute, the National Aeronautics and Space Administration and the United States Department of Agriculture supported selected plenary speakers. This workshop report was developed jointly by AgMIP and IICA, led by A. Evengaard, C. Mutter, and K. Witkowski with inputs from A. Ruane, G. Asrar, C. Rosenzweig, S. McDermid, D. Montenegro Ernst, J. Antle, K. Boote, G. Kruseman, L. Emberson, P. Craufurd, S. Homann-Kee Tui, A. Whitbread and edits of M. Philips and E. Mencos. It was published to www.agmip.org on August 15, 2018.

ACRONYMS

AgMIP (the Agricultural Model Intercomparison and Improvement Project)
Agri-SSP (Agricultural use of Single Superphosphate)
CC (Climate Change)
CGRA (AgMIP's Coordinated Global and Regional Assessments)
CM (Crop Models)
CTWN (carbon/temperature/water/nitrogen)
ET (Evapotranspiration)
EU (European Union)
GGCMI (AgMIP's Global Gridded Crop Model Intercomparison)
GHG (Greenhouse Gas)
ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)
IICA (Inter-American Institute for Cooperation on Agriculture)
ISIMIP (Inter-Sectoral Impact Model Intercomparison Project)
JRC (Joint Research Centre)
LAC (Latin American and Caribbean)
LTAR (Long-Term Agro-Ecosystem Research)
NAMA (Nationally Appropriate Mitigation Action)
NAP (National Adaptation Plan)
NASA (The National Aeronautics and Space Administration)
NDC (Nationally Determined Contributions)
NIFA (National Institute of Food and Agriculture, US Department of Agriculture)
NUTRI BASKET (the Nutri-Food Basket of ''Smart Food'' established by ICRISAT)
PeDiMIP (AgMIP's Pest and Disease Modeling Intercomparison Project)
RAP (Representative Agricultural Pathways)
RIA (Regional Integrated Assessments)
RRT (Regional Research Teams)
SCF (Standing Committee on Finances)
SDG (Sustainable Development Goals)
UNFCC (United Nations Framework Convention on Climate Change)
USDA (United States Department of Agriculture)

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EXECUTIVE SUMMARY

Approximately 150 researchers and stakeholders convened at the headquarters of the Inter-American Institute for Cooperation on Agriculture (IICA), in San José, Costa Rica from April 24-26, 2018 for the Seventh AgMIP Global Workshop (AgMIP7). Specific goals for the week included:

1. Demonstrating how AgMIP can help address major global and national challenges including the Sustainable Development Goals and climate change mitigation and adaptation planning.
2. Convening the agricultural modeling community and sharing AgMIP vision, latest findings, activities, and focus areas.
3. Identifying opportunities for major stakeholder-driven efforts related to Next Generation Tools, Coordinated Global and Regional Assessments, and Sustainable Farming Systems.
4. Bolstering AgMIP Initiatives in Latin America and the Caribbean; and
5. Planning AgMIP activities and outputs for the years ahead.

Through plenaries, working groups, dialogues, panels and side sessions, participants were brought up to date on the status of the many different AgMIP initiatives around the globe, shared cutting edge methods and findings, identified key science messages, discussed priorities and planned collaborative actions to further the goals of the consortium.

New areas of research and initiatives include better understanding plant response to changing carbon/temperature/water/nitrogen (CTWN) conditions, modeling the effects of ozone on crop production, modeling short term shocks/risks, developing monitoring and forecasting tools for agricultural systems, connecting stakeholder-driven integrated assessments across disciplines and scales, and expanding participation and efforts in Latin America and the Caribbean (LAC). Holding AgMIP7 in Latin America for the first time successfully encouraged participation of 20+ different researchers and stakeholders from the region. Participants identified goals and several next steps to advance LAC initiatives throughout AgMIP7 and in particular during the three LAC-focused side sessions (conducted mostly in Spanish).

Members of the AgMIP community recognized the need to better involve stakeholders (non-scientists) in the consortium and committed to action to ensure that information needs are being addressed and that the science produced is being applied in decision-making. This includes focusing on three key areas moving forward: supporting mitigation and adaptation planning and action, emphasizing the impacts of shocks in shorter timeframes, and better integrating food and nutrition security into the research.

INTRODUCTION

The Agricultural Model Intercomparison and Improvement Project (AgMIP) is a collaborative network of international scientists and stakeholders motivated to improve current and future food and nutrition security. The mission is to provide effective science-based information to facilitate agricultural decision-making in the face of current pressures stemming from climate extremes, climate change, and the drive for sustainable farming systems to achieve local-to-global food security. To do this AgMIP connects experts across disciplines, scales, methods, models, and institutions to identify and prioritize strategies for a more productive and resilient future.

Climate change is anticipated to significantly change the world's food systems in the coming decades. Negative effects will be exacerbated by increasing population and urbanization as well as demographic factors such as income, poverty, shifting dietary demand, and food insecurity. The availability and adequate access at all times to sufficient, safe, and nutritious food to maintain a healthy and active life around the world requires changes to agricultural system approaches, now and in the future. Farmers face complex challenges to achieve a consistent food supply to meet the demand of the growing and developing populations under the changing climatic conditions while achieving sustainability to enable the success of future farming systems. AgMIP contributed to solving these challenges by working to understand key processes and linkages across many agricultural system components while consistently connecting across scales.

AgMIP Global Workshops bring together the international community of scientists developing the next generation of integrated model systems to assess food security in a changing world, and engage with other stakeholders to inform decision making and action towards resilient and sustainable agricultural systems. The Seventh AgMIP Global Workshop (AgMIP7) was held at the Headquarters of the Inter-American Institute for Cooperation on Agriculture (IICA) in San José, Costa Rica from April 24-26, 2018.

This AgMIP7 Global Workshop Report includes a summary of the event with objectives of each session, key points made by speakers, results of working groups, future plans and next steps. The agenda, a list of participants, and links to abstracts and presentations are provided in the appendix to the report. Plenary presentations can also be viewed via links provided within the report text.

In keeping with its theme "Enhancing Resilience over Time and Space," the workshop provided the AgMIP and IICA communities an opportunity to convene and share the latest findings, activities and focus areas for the future. The event was organized around the three motivating AgMIP themes:

Next Generation Knowledge, Data, and Tools – new data, models, and advanced knowledge tools to ascertain sustainable production for the present and future.

Coordinated Global and Regional Integrated Assessments – linkages between international climate, markets, food policy and regional

Inter-American Institute for Cooperation on Agriculture

As the specialized agency for agriculture of the Inter-American System, IICA includes South America, Central America, the Caribbean, and North America and supports the efforts of its 34 Member States to achieve agricultural development and rural well-being. IICA provides direct technical cooperation focusing on strengthening institutions and public policies, capacity development, and knowledge management and use. The Institute promotes South-South cooperation, consensus building, stakeholder coordination, and the use of science based decision making to advance action towards agricultural health and food safety, improved natural resource management and resilience to climate change, competitiveness, inclusion and rural development.

adaptation planning, including nutritional quality in crop production.

Modeling for Sustainable Farming Systems – protocol-based research to study linked climate, crop and economic models with emerging technology and adaptations of interest to stakeholders to anticipate climate smart investments.

The specific goals of the workshop were to:

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3. Identify opportunities for major stakeholder-driven efforts related to Next Generation Tools, Coordinated Global and Regional Assessments, and Sustainable Farming Systems.
4. Bolster AgMIP Initiatives in Latin America and the Caribbean.
5. Plan AgMIP activities and outputs for the years ahead.

DAY 1

Welcome from IICA

Dr. Diego Montenegro Ernst, Director of Management and Regional Integration at IICA, provided a poignant opening to the workshop on behalf of Dr. Manuel Otero, Director General of IICA. He reminded participants of the essential role agriculture plays in generating income, employment and food in Latin America and the Caribbean (LAC) and other regions of the world. The sector is experiencing increasing competitiveness and working to strengthen its presence in international markets, foreseeing agriculture as essential to guarantee the global food supply and the planet's sustainability. But LAC, like many other regions in the world, is also facing many challenges. Water stress, soil degradation, extreme events, and high levels of

Dr. Diego Montenegro Ernst, Director of Regional Integration and Management at the Inter-American Institute for Cooperation on Agriculture (IICA) in San José, Costa Rica.

poverty and malnutrition threaten livelihoods and the wellbeing of society. Montenegro noted that innovative strategies for anticipating and addressing the challenges are urgently needed, that would be well addressed by "the 'winning partnership' of IICA and AgMIP", he noted. "The collaboration to organize and implement this workshop is one of many joint activities IICA and AgMIP are advancing to support countries in the development of science-based climate change adaptation and mitigation commitments, strategies, and plans for the agricultural sector". The address provided an enthusiastic start to the workshop.

Welcome from AgMIP

Members of the AgMIP Executive Committee (J. Antle, S. Asseng, H. Lotze-Campen, C. Rosenzweig and A. Whitbread) introduced themselves, set the charge for the workshop and presented the workshop topics to be elaborated in Day 1 Plenary. This was the first Global Workshop of the new, 6-member executive committee established in 2018 by the AgMIP Steering Council. It was also the first Global Workshop for a re-vitalized Steering Council that Ghassem Asrar and Jean-Francois Soussana will continue to lead.

The State of AgMIP and Challenges for Agricultural Decision Support

The first Plenary Session featured presentations about the State of AgMIP and Challenges for Agricultural Decision Support.

Dr. Ghassem Asrar, Director of the Joint Global Change Research Institute of Pacific Northwest National Laboratory at University of Maryland, College Park, and co-chair of the AgMIP Steering Council (with Jean-Francoise Soussana) addressed the role of agricultural research and the need for land-based carbon management. He noted how science and technology can contribute to effective implementation of multinational agreements that make particular reference to land use.

Dr. Asrar cited linkage between the Sustainable Development Goals (SDGs) and the Nationally Determined Contributions (NDCs). He addressed that a holistic approach may best achieve the objectives of both, commenting on how society,

Day 1 Opening Session. From left: Drs. Anthony Whitbread, Cynthia Rosenzeig, Ghassem Asrar, Diego Montenegro, Senthold Asseng and Hermann Lotze-Campen.

Dr. Ghassem R. Asrar.

the environment and economy are interrelated, and identifying key objectives and how they intersect within an SDG and NDC framework. Dr. Asrar gave some specific examples of climate-smart agriculture in Bangladesh, and how it helps to reduce poverty, and address other challenges at the intersection of environment and society. "Climate change and increased salinization are factors that are affecting the contribution of agriculture to Bangladesh's GDP'', he noted. "Integrated analyses and modeling is required to understand dynamic interactions and feedbacks within environment, food systems, socioeconomics, and the role of humans. This requires effective integration of data, models, analysis and stakeholder engagement in the developing phase while using appropriate science information and knowledge for decisions with a major focus on solutions'', Dr. Asrar added.

Dr. Asrar also touched on the expected outcomes from agricultural research and the research funding opportunities available. The new initiatives of AgMIP include: calibration of existing models, the Impacts Explorer, Coordinated Global and Regional Assessments, Regional Economics Model Intercomparison, nutrition, low input systems, and a focus on the crop barley. Additional initiatives in development include extreme events and shocks, air pollution/radiation, monitoring and forecasting, risk assessment and intercropping.

Dr. Senthold Asseng, University of Florida, and Dr. Hermann Lotze-Campen, Potsdam Institute for Climate Impact Research, then shared an overview of the current state of AgMIP. They reminded the audience that AgMIP is a distributed program with focus on model intercomparison and future climate change impacts, and multiple crop and agricultural economics modeling groups around the world. AgMIP started in 2010 and now has nearly 1000 members and over 30 teams.

Drs. Asseng and Lotze-Campen emphasized key areas and learning of AgMIP so far, including:

- Tremendous interest within the agricultural research community for systematic, interdisciplinary, multi-model research and assessment.
- Median of crop model ensembles best reproduces observed yields.
- Crop responses to CO_2, temperature, water, and soil carbon interactions are key factors.
- Regional Integrated Assessments are extending methods for projecting changes in farm systems.
- Global crop yield impacts project greater vulnerability in lower latitudes and in earlier decades; model uncertainty has now been explicitly characterized.
- Limitations in fresh water may compound climate impacts in many regions.
- Agricultural prices are projected to experience upward pressure from climate change and mitigation.
- Food security impacts differ widely under different socio-economic pathways.
- Opportunity to build resilience, adapt, and mitigate if we can anticipate challenges by capturing cropping systems interactions.

Dr. Anthony Whitbread, Director of the Resilient Dryland Systems Program within the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), called for increased linkages with the CGIAR, a global research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources. ''It's all about Research for Development, and CGIAR play a key role in bringing the AgMIP messages to the stakeholders. My aim as an executive committee member is to encourage linkages with CGIAR - to connect researchers to crop physiologists (crop modeling) to influence our breeding programs, to bring in policy and economics research more strongly, to connect the CCAFS (one of the major funding programs around climate change and food security) to AgMIP, and to take advantage of the community of practice, capacity development,

tools, methods and the knowledge exchange'', he said.

Dr. Whitbread has been with AgMIP since he joined ICRISAT in 2014. As a prime contract holder of the DFID funded AgMIP project that ran from 2015-2017, Dr. Whitbread and his team worked closely with the AgMIP Coordination Unit at Columbia University to facilitate the work of seven regional teams across sub-Saharan Africa and South Asia. The purpose was to establish teams within each country (about 15 countries), that created and advanced a new method called regional integrated assessments. The method was co-developed with the teams by researchers from NASA, Columbia University, who also created, with partners at Wagening University, a results viewing tool called the impacts Explorer, University of Florida and Oregon State University. The teams built expertise using the new methods, which they used to explore and understand the climate change impacts and adaptation options (from biophysical and socio-economic standpoints), and co-designed adaptation pathways for agricultural systems with multiple stakeholders. The teams also worked with stakeholders to develop key messages from the results, which are featured in the viewing dashboards of The AgMIP Impacts Explorer.

Dr. Whitbread continued by emphasizing the strength and importance of stakeholder engagement: "Stakeholder engagement across scales from farmer to policy level is the actual method to achieve the impact and change.'' The CGIAR provides access to the network of stakeholders at a country level, as do organizations like IICA. "The AgMIP community of practice uniquely brings together the diverse teams of researchers, creates a platform for innovation, brings new science, and brings unprecedented linkages in collaboration between researchers in the developing world and researchers elsewhere.''

"Enhancing agricultural resilience over time and space is crucial in order to ensure both human and planetary health'', Dr. Cynthia Rosenzweig, climatologist at the NASA Goddard Institute for Space Studies and member of AgMIP's Executive Committee, said during the first day of the workshop. "AgMIP7 provides the opportunity to bring together the AgMIP community to strengthen agricultural resilience and mitigation in regard to food security and sustainability, now and in the future'', Dr. Rosenzweig added.

Cynthia Rosenzeig addressing the Plenary Session on the State of AgMIP and Challenges for Agricultural Decision Support.

Research Highlights and Opportunities (part 1)

The first Plenary Presentations were followed by a second session about Research Highlights and Opportunities (Part 1).

Dr. Pierre Martre, French National Institute for Agricultural Research (INRA), presented "*Model Improvements from Model Intercomparison''*. Martre described how model intercomparisons can lead to model improvements and explained that multi-model ensembles provide a means to reduce uncertainty and increase accuracy of projections. Crop models have now been tested with increased temperature, heat shocks, elevated CO_2, and drought, which has helped researchers identify model deficiencies and knowledge gaps. In terms of model improvements, a large part of the uncertainty in multi-model simulations can be explained by variations in temperature response functions. Martre further explained how more systematic evaluation of knowledge gaps is required to meet the demand for Agricultural model projections (CO_2, N, water [drought and flooding], etc.). This suggests that "NextGen Agricultural Systems'' models should be more transparent and allow more systematic intercomparison at the process level (which was further discussed on Wednesday in the Parallel Presentations Session 2: Advanced Computational Applications for Agriculture).

Co-principal investigator of AgMIP, Dr. John Antle, Oregon State University (OSU), presented "*Key Findings from Integrated Climate, Crop,*

Livestock, and Economic Assessments of Farming Systems in Sub-Saharan Africa and South Asia". Antle began his presentation by emphasizing the importance of engaging stakeholders and the people in the regions, stating, "The key findings from integrated climate, crop, livestock, and economic assessments of farming systems are built on climate impact and adaptation science for the people, by the people''. Regional Integrated Assessments are built on five iterative steps: define risks (multi-models), engage stakeholders (network of experts), co-design pathways (future economy and emissions), co-design adaptations (farm system changes), and assess impact (vulnerability and economics). The final step of assessing impacts, as well as the 3rd and 4th steps of co-designing pathways and adaptations – all lead back to the step of engaging stakeholders to ensure that their needs are met.

Dr. Antle also mentioned the range of climate impacts across Sub-Saharan Africa and South Asia, explaining that there are winners and losers in all regions and that vulnerability can be high even when average impacts are small or positive. In terms of Zimbabwe and its future agricultural systems through different Representative Agricultural Pathways (RAPs), it is clear that the future scenario will be based on the decisions that are made now. A pathway with a climate change adaptation package that motivates transformational changes in policy and technology, including drought and heat tolerant crop varieties, would improve outcomes more than a pathway that prioritizes solely economic development. Dr. Antle noted that a hot-dry future climate would negatively impact the future agricultural systems in Zimbabwe regardless of the development pathway chosen. However, the sustainable development pathway provided a framework for improving future incomes in regions where climate has detrimental effects on crop or livestock productivity. The adaptation packages could offset the impacts of climate change - but in some cases they would not be enough to lift communities out of poverty.

Dr. Alex Ruane, AgMIP Science Coordinator and Research Scientist at NASA Goddard Institute for Space Studies, New York, presented "*Impacts to Agricultural and Food Systems with Imposed Limits to Climate Change*''. Dr. Ruane addressed the 1.5 and 2.0°C global warming scenarios requested by 197 countries in the UN Framework Convention on Climate Change (UNFCCC), which seek stabilization levels with global mean temperature rise from pre-industrial conditions (1861-1880) limited to below 2°C with stabilization at 1.5°C warming (note that the year 2010 was already about 1°C above pre-industrial conditions). Dr. Ruane further explained the importance of understanding the difference between the 1.5 and 2 °C Worlds, the balance between the relative mitigation and adaptation burdens for the agricultural sector, and the sources of major uncertainties in assessments.

To do this Dr. Ruane led a team of climate, crop, and economics experts in AgMIP's first Coordinated Global and Regional Assessment (CGRA) connecting multiple disciplines, models (e.g. multiple GCMs, GGCMs, and global economic models), and scales (global, regional, and farm-level models) with consistent scenarios and passing of information between model components.

Dr. Ruane summarized the noteworthy findings as follows:

- First Coordinated Global and Regional Assessments (CGRA) implementation developed new infrastructure for multi-scale, multi-discipline, multi-model assessment.
- Direct impacts of 1.5 and 2.0 °C worlds can lead to substantial changes in prices and agricultural areas (differential impacts by crop species).
- CO_2 effects are a major source of uncertainty that can reverse signs of price and land use pressures.
- Market disruption from mitigation is larger than the resulting adaptation burden at these low climate stabilization levels.
- Regional analyses reveal pressures and opportunities that go against global perspective.

"We need to create an environment that supports transformation of farming systems, in areas such as semiarid Zimbabwe'', Dr. Sabine Homann-Kee Tui, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), stated at the beginning of her presentation *"Linking Integrated Assessments and Policy-Making to Enable Uptake"*. Homann-Kee Tui raised unprecedented challenges, local vulnerability relating to small land and herd sizes (low productivity), food insecurity, malnutrition and health, resource degradation, conflicts over biomass and water, rising global fragility and planetary boundaries. "Research is seeking new ways to

unlock opportunities, household dynamics, gender, nutrition and diversity, through market-led approaches that integrate profitability, equity, agency, towards managing sustainability transitions with wider food systems perspectives,'' she added. In terms of how this would be achieved, there needs to be guidance on relevant, effective, and outcome oriented transitions. Homann-Kee Tui described this briefly in three steps: One, diagnostics though integrated assessments and scenarios (characterize systems, define risks, assess impacts), two, engagement for influencing cross sectoral governance and policies (develop networks, co-design pathways, generate key massages), and three, outreach for accelerating change and perpetuating innovation (communicate, develop capacity).

Dr. Homann-Kee Tui concluded by summarizing the uptake of research recommendations by policy makers in four steps. Starting with policies, institutions and governance (politics, power and relationships, direction, demand, coordination), and shift in perceptions values and mind sets (emotional responses, enlightening systems and wholes). Followed by understanding multi-dimensional impacts (AgMIP methods, data, information), stakeholder engagement (AgMIP networks, cross-scale dialogue, capacity development), and next generation programs: nutrition sensitive agri-food systems, biomass reserves for mitigating conflicts, and equitable benefit sharing and safety nets. She concluded that thought is required to upscale science to support decision making at a larger scale. This could include, for example, using a broader set of indicators to assess sustainability challenges and drivers, sensitize and synchronize food demand and supply sides, and develop handy road maps with policy decision makers for desired trajectories and more.

The workshop shifted to parallel presentations session 1 and working group sessions for the afternoon.

Parallel Presentations Session 1

The topics, session chair and presenters:

- **Global Agricultural Modeling for Development and Climate Analysis #1**

Session Chair*: Herman Lotze-Campen*

- Joining forces: linking AgMIP, ISIMIP and TWI2050 for assessing sustainable development pathways - *Herman Lotze-Campen*
- Reconciling global sustainability targets and regional action for food security and climate change mitigation – *Juliana Dias Bernardes Gil*
- Reconciling irrigated food production with environmental flows for Sustainable Development Goals implementation - *Jonas Jägermeyr*

- **Regional Assessments of Biophysical and Economic Systems #1**

Session Chair*: Sabine Homann-Kee Tui*

- Adaptation strategies for Cotton- Wheat Cropping System of Punjab Pakistan under Changing Climate Scenarios - *Ashfaq Ahmad Chattha*
- An integrated assessment of climate change impacts and adaptation in maize-based smallholder crop- livestock systems in Kenya - *John Antle*
- Will South Africa's staple basket run empty by 2050? - *Davide Cammarano*
- Influencing sustainability transitions for smallholder farming systems in Southern Africa – *Sabine Homann-Kee Tui*

- **Advances in Simulating Diverse Agricultural Systems**

Session Chair*: Dakshina Murthy Kadiyala*

- Introducing the CROPGRO Perennial Forage Model for Tropical and Temperate Grasses and Legumes - *Ken Boote*
- Climate change impacts and vulnerability of farm households in rainfed farming systems of Southern India - *Dakshina Murthy Kadiyala*
- Canopy temperature simulation for crop heat stress assessment: physical robustness environments and production conditions - *Heidi Webber*

- **Climate Change Impacts on Biophysical Systems #1**

Session Chair*: Senthold Asseng*

- Climate change impact on global wheat protein - *Senthold Asseng*
- European winter oil seed rate production under climate change - *Johannes Pullens*
- Adjusting Climate Model Bias for Agricultural Impact Assessment: the BAD-JAM project – *Stefano Galmarini*

- Climate change impact on Mexico wheat production - *Diego Pequeno*

Working Group Sessions

After lunch, the group split up into seven working groups, each with a different focus. The first working group session 1: Goal and Agenda Setting by Overarching Research included the topics and discussion leaders as follows:

- **Crop Model Intercomparison and Improvement** - *Frank Ewert & Jean-Louis Durand*
- **Utilizing Big Data and Next Generation Tools for Agricultural Decisions** - *Cheryl Porter, Sander Janssen & Gideon Kruseman*
- **Data Assimilation, Seasonal Agricultural Forecasting, and Risk Assessment** - *Alex Ruane, Joshua Elliott & Stefan Niemeyer*
- **Global Economics, Trade, and Land Use** - *Hermann Lotze-Campen & Keith Wiebe*
- **Integrated Assessments of Farming Systems and Implications for Decision Systems** - *Roberto Valdivia & John Antle*
- **Nutrition and Food Security Analyses and Assessments** - *Cynthia Rosenzweig & Marco Springman*
- **Characterizing Production Losses from Ozone, Pests, and Diseases** - *Lisa Emberson & Maurits van den Berg*

DAY 2

Day 2 provided opportunities for sharing research highlights and opportunities through presentations given in two plenary sessions, summarized below.

Research Highlights and Opportunities (part 2)

In the presentation entitled "*Current and Next Generation Climate Information for Agricultural Assessments"* Dr. Sonali McDermid, AgMIP Climate Team co-Lead and Professor from the New York University, and Dr. Alex Ruane, AgMIP Climate Team co-Lead and Research Scientist from the NASA Goddard Institute of Space Studies, provided an overview of historical and future climate products that have been used for both AgMIP GGCMI and RIAs. They also highlighted that although there are many climate-relevant output variables generated for future climate scenarios, they were not necessarily formulated for impacts applications.

Dr. McDermid further expanded on AgMIP efforts to increase the span of the modeling groups and discussed the integration in CMIP6 of more than 10 new modeling groups, higher resolution models and improved climate processes, which are relevant to climate-agricultural interactions.

Day 2: Research Highlights and Opportunities (part 2).

These will aid in identifying biases and bracketing systematic behaviors.

"There has been an increased focus on climate shocks and the climate models are rapidly approaching spatial and temporal scales needed to better represent extremes'' she stated. "There is also ongoing work to build a framework for drought risk assessments and disaster risk reduction''. Several AgMIP initiatives examine carbon dioxide, temperature, water, nitrogen, and adaptation sensitivity tests across multiple crops, models and farm systems.

In his presentation on "*Priorities in Modeling Developments*'', Dr. Ken Boote, Professor from the Agronomy Department of the University of Florida mentioned that more uncertainty is contributed from crop models than from GCM models. He further highlighted the priorities in crop model developments while summarizing the main findings from crop model intercomparisons and discussing the challenges regarding gridded Land-Surface models and Ecosystem models. "These models have detailed photosynthesis/conductance, but lack sufficient crop reproductive parameterization and soil fertility characterization. Crop responses to carbon dioxide, temperature and water remain key sources of uncertainty'' Dr. Boote said. He encouraged increased modeling by soil fertility types with an emphasis on low-input agricultural systems, and called for increased data sharing amongst crop modelers.

Dr. Dilys MacCarthy, University of Ghana, Ghana, and Dr. Heidi Webber, University of Bonn, Germany, focused on the impacts of 1.5 versus 2 °C increases on cereal yields in the West African Sudan Savanna in their presentation "*Recent Advancements in European and African Assessments''*. MacCarthy and Webber concluded that in future production systems and socio-economic conditions climate change would have a positive impact on farms in Nioro in the future. However, unless markets improve, this could be accompanied by lower prices for the cereals. As a result, climate change could mostly have a negative impact on Nioro farmers' livelihoods.

Dr. Christoph Müller from the Potsdam Institute for Climate Impact Research presented "*Main Messages from Global Gridded Model Analyses''* and summarized key messages, including various opportunities for designing emulators for different purposes such as feeding into Integrated Assessment Models. Müller observed that though AgMIP started as an opt-in initiative, analyses of stakeholders point to the need to build a strong and lasting community. There is now a need for clearer objectives in addition to creating funding opportunities. Müller laid out proposed future directions for AgMIP, which include substantially improving the representation of management systems, as well as diversifying analyses and research foci. He recommended moving away from results reporting multi-annual means and looking more at variability, vulnerability and extreme events instead of just mean changes. Müller also suggested to expand the focus areas and explore the broader use of the outputs for food systems, nutrition, risk, water use, water pollution and degradation.

Dr. Gideon Kruseman from the CGIAR presented "*Roles for Big Data in Agricultural Analyses''* and discussed the potential of Big Data and the Internet of Things, which play a major role in agricultural analyses. Because of the increased number of satellite products, we can compare detailed images showing properties related to crop inventory and crop health, even for inaccessible areas like Syria. "The Platform for Big Data in Agriculture at CGIAR aims to harness the capabilities of Big Data to accelerate and enhance the impact of international agricultural research for development,'' he said.

Research Highlights and Opportunities (part 3)

Dr. Stefan Niemeyer elaborated the significance of crop yield forecasting systems and their potential in AgMIP. Crop Yield Forecasting leads to reduction of risks associated with national food production systems, and leads to early understanding of the availability of commodity crops, for early warning of food insecure situations and commodity market information. The crop yield forecasts are used by market players such as producers, traders, brokers, processors and investors, market observer organizations such as FAO, AMIS, IGC, Tallage/Strategic Grains, market management organizations such as national governments or the European Commission, management of emergency situations such as that completed by the World Food Programme, and other national aid agencies. Dr. Niemeyer mentioned that the major users of the crop yield forecasting information are government/policy (22%) and research and development (24%). The forecasts

require timeliness, accuracy, reliability and transparency. The sources of information for crop yield forecasting include statistics, surveys, agro-meteorology, remote sensing, crop growth models, and expert judgement.

Dr. Lisa Emberson, Professor at the Centre Director of Stockholm Environment Institute in York spoke about air pollution (ozone and aerosol) effects on agricultural crops in her presentation on "*Characterizing Losses in Crop and Livestock System Models".* For the first time, results from the Ozone Modeling Group were presented at a global workshop by Dr, Emberson, who stated "The effect of ozone on agricultural crops involve the visible injury, reduction of biomass and yield, and alteration of the semi-natural species balance." She indicated that crop models could be developed to incorporate effects of air pollution on crop physiology, development, growth and yield and that this would improve assessments allowing the impacts of a combination of stresses (e.g. air pollution and climate change) to be considered in an integrated manner.

Dr. James Woodhill presented "*Foresight in Global Food Systems, Food Security & Policy"*, giving an introductory presentation to Foresight4food, an International Collaborative Initiative focused on processes of understanding and adapting to longer-term possible futures from a systems perspective. The initiative aims to enhance foresight and scenario analysis capability to enable better analysis and synthesis of key trends and possible futures in global food systems, and support more informed, strategic and systemic dialogue between the private sector, government, science and civil society. Dr. Woodhill further explained how all 17 Sustainable Development Goals connect to agriculture and food systems, emphasizing the importance of strengthening food systems foresight analysis at all scales and improving the linkages between scientific analyses and policy dialogue with stakeholders.

He indicated that the initiative would complement and not duplicate other initiatives and platforms, providing a neutral brokering role. Priority work areas include:

1. Communities of practice for food system foresight research and use.
2. Synthesis and analysis of existing foresight work.
3. Building a foresight resource portal, dash board and communication materials.
4. Creating a bridging hub for linking foresight users and providers to support global, regional and national foresight and dialogue processes.
5. Identifying and brokering foresight work on key gaps.

Dr. Jean-Francois Soussana presented "*Crop and Pasture Ensemble Model Simulations of Productivity and Emissions"*. Key results include that fact that staying within 2 °C above pre-industrial warming target cannot be achieved in the agricultural sector by 2030 without soil carbon sequestration, and food security is also threatened under both 1.5 and 2 °C scenarios. Dr. Soussana also reported that 49 countries have signed the Charter of the Global Research Alliance on Agricultural Greenhouse Gases. The following are priorities for a field scale framework of international coordinated modeling activities:

- Comparison of soil-plant-atmosphere models simulating GHG emissions, yield and soil carbon stock changes: assessing model performances for their predictive ability in current climate.
- Tests of model sensitivity to climate change: assessing GHG emissions, yield and soil carbon responses to changes in temperature, water and atmospheric CO_2.
- Comparison of soil models using long term bare fallows (LTBF): assessing model performances for their ability to estimate long-term soil carbon dynamics.
- Mitigation options: assessing the abatement potential of agricultural practices.

Dr. Hermann Lotze-Campen presented global economic trends and changes in trade in his presentation "*Global Economics, Shocks, and Regional Trade Instability". Dr.* Lotze-Campen began by presenting a recent publication by the economics team before explaining the scenario matrix, consisting of indicators for climate, focus (no climate change, climate change impacts, mitigation measures for 2 °C stabilization without residual climate change impacts, and mitigation measures for 2 °C stabilization + residual climate change impacts), and adaptation challenges (low, medium and high). He then presented the inputs from Global Gridded Crop Models and aggregation of crop model results before moving onto the insights related to changes in non-CO_2 emissions from agriculture by 2050, changes in global agricultural production by 2050, changes

in agricultural land use by 2050 (crop land and pasture land), changes in global agricultural prices by 2050 and changes in agricultural trade by 2050 (phase 1 results).

To conclude, Dr. Lotze-Campen went over next steps for AgMIP global economics research, including:

- Evaluation of regional results from global models for Sub-Saharan Africa, South Asia and Latin America (production, land use, prices, trade).
- Health implications from production and consumption changes.
- Integration of multiple climate impacts (crop yields, water availability, sea-level rise, labor productivity) (based on ISIMIP results).
- Wider range of mitigation options and policies (e.g. diet change, soil carbon management, compensation payments).
- Linking global and regional economic models.
- More differentiated assessment of food security impacts.
- Model improvements: shocks, short-term variability, and storage.

Women's Lunch

After the plenary session, a first Women's Lunch was held. Both women and men at the workshop were invited to sit together for a lunch discussion focused on topics of how women can be recognized for the roles they play, potential strategies to enhance participation, the success and influence of women, and what AgMIP could do to encourage their involvement (results reported in Workshop Results).

Parallel Presentations Sessions 2 & 3

Next, the 2nd and 3rd round of parallel presentations were held, including ten section topics and presenters:

- **Resolving Crop Losses (including Pests, Diseases, Weeds, Ozone)**

Session Chair: *Merle Isabelle*

- Toward a regional early warning system network for coffee leaf rust and associated socio- economic crises - *Jacques Avelino*
- Air Quality and Agriculture – Critical pollutants, risk assessment and response - *Lisa Emberson*
- Modeling the effects of multiple diseases on wheat growth and yield - *Kurt Christian Kersebaum*
- Identification of microclimatic variables determining the appearance of the

Group photo of the women at AgMIP7.

symptoms of a leaf disease: case of the coffee leaf rust - *Merle Isabelle*
- Crop diseases and pests: from crop losses to biocomplexity - *Kurt Christian Kersebaum*

- **Advanced Computational Applications for Agriculture**

Session Chair: *Gideon Kruseman*
- The Agricultural Model Exchange Initiative - *Pierre Martre*
- Making messy socio-economic data FAIR - *Gideon Kruseman*
- Shared protocols and data template in agronomic trials - *Davide Cammarano*
- AgMIP Data Interoperability: Moving beyond Regional Integrated Assessments - *Cheryl Porter*
- Mobile phone based advisories for smallholder farmers; lessons from the field - *Peter Craufurd*
- Evolving the AgMIP Impacts Explorer - *Sander Janssen*

- **Data Assimilation and Seasonal Forecasting of Agricultural Shocks**

Session Chair: *Meridel Phillips*
- Crop Yield Predictions - Multi- scale Statistical Model for Intra- season Forecasts Applied to Corn in the US - *Yiqing Cai*
- The Agricultural Productivity Indicator Analysis System (APIAS) - *Meridel Phillips*
- Crop and crop management identification from space for national-scale modeling - *Claas Nendel*
- EOFSAC: A Multidisciplinary Consortium to Enhance Food Security and Agriculture through Earth Observations - *Roberto Cesar Izaurralde*

- **Regional Assessments of Biophysical and Economic systems #2**

Session Chair: *Ibrahima Hathie*
- Assessing adaptation costs in irrigated agriculture integrating hydrological and crop simulation models: case study from central Chile - *Francisco Meza*
- Rice-Wheat farming in the Indo- Gangetic Plains in the 2050s: Can Sustainable Agricultural Pathways offset Climate Change Vulnerabilities? - *Nataraja Subash*
- Climate change impacts and vulnerability of fallow-chickpea based farm households in India: Assessment using Integrated modeling approach - *Dakshina Murthy Kadiyala*
- Impacts of 1.5 versus 2.0°C on West African cereal yields - *Heidi Webber*
- Climate change impacts on current and future agricultural systems in the semi-arid regions of West Africa - *Ibrahima Hathie*

- **Modeling the Causes and Cascading Impacts of Food Shocks**

Session Chair: *Fulu Tao*
- New crop modeling technique for improving model performance under climate change and stress simulations - *Ioannis Droutsas*
- Contribution of crop model structure, parameters and climate projections to uncertainty in climate change impact assessments - *Fulu Tao*
- Elucidating Thermal Death of Cereal Grain Crops to Ensure Life - *Gerard W Wall*
- Improved temperature response functions in crop models reduced the uncertainty of wheat yield projections - *Pierre Martre*

- **Nutrition and Food Security Metrics and Scenarios**

Session Chair: *Bhimanagouda Patil*
- Sustainable diets in a global context - *Pauline Scheelbeek*
- Modeling the Effect of Environmental Conditions on Health-promoting Compounds of Melons - *Bhimanagouda Patil*
- The health burden of red and processed meat consumption - *Marco Springmann*
- The effect of environmental change on yields and nutritional quality of fruits, vegetables & legumes, and their relevance for food & nutrition security - *Pauline Scheelbeek*

- **Crop Model Intercomparison in Diverse Systems**

Session Chair: *Kenneth Boote*
- Testing multiple rice crop models against free-air CO2 enrichment and chamber experiments to improve yield responses to elevated CO2 and temperature - *Kenneth Boote*
- A Summary of Research Activities from the AgMIP Potato Crop Modeling Intercomparison Pilot - *David Fleisher*
- How reliable are current crop models to simulate canola growth and seed yield? - *Ward Smith*

- **Soil Nutrient and Water Management Strategies**

Session Chair: *Claas Nendel*

- Coupling crop and soil organic matter models to assess crop resilience to climate change and variability by the adoption of conservationist management systems - *Marcelo Galdos*
- The Global Microlysimeter Network to inform crop models on nitrogen mineralisation of soils - *Claas Nendel*
- Prediction of Evapotranspiration and Yields of Maize - *Bruce Kimball*
- Backward simulation of nitrogen fertilizer effect on maize growth and yield - *Haishun Yang*
- Land degradation and food security: impacts and adaptation options - *Alvaro Calzadilla*

- **Climate Change Impacts on Biophysical Systems**

Session Chair: *Velingiri Geethalakshmi*

- Climate change impact on the yields of cereals in smallholder settings in West Africa: The case of Nioro, Senegal and Navrongo, Ghana - *Dilys MacCarthy*
- Evolving climate resilient crop systems through integrated climate and crop modeling: A case study from Tamil Nadu - *Velingiri Geethalakshmi*
- Field warming experiments constrain global crop yield reductions under Paris' global warming targets - *Xuhui Wang*

- **Global Agricultural Modeling for Development and Climate Analysis #2**

Session Chair*: Abigail Snyder*

- A Systems Approach to Characterize the Tradeoff between Food Security and Environmental Impacts - *Anjuli Jain Figueroa*
- Crop yield change and feedbacks on land-use and management over the 21st century - *Sam Rabin*
- Agricultural response functions for integrated assessment models based on the C3MP data set - *Abigail Snyder*
- Agricultural adaptation: constraints and compensation opportunities to changes in temperature, precipitation and CO2 - a global multi-model analysis - *Florian Zabel*

World Walking Café

As a final activity, the Walking World Café took place on the evening of the second workshop day. Participants enjoyed appetizers and refreshments while examining an exhibition of posters with topics and presenters as follows:

Costa Rican hats and scarves were given out to all workshop participants as they enjoyed a glimpse of Costa Rican culture through the lively and capturing music and dance performance. (Photo by: Santiago Meira)

- **Global Agricultural Modeling for Development and Climate Analysis**
  - Climate impacts on Canadian productions of major crops for global warming levels of 1.5, 2.0 and 2.5 degrees C - *Budong Qian*

- **Regional Assessments of Biophysical and Economic Assessments**
  - Impacts and management strategies under climate change on maize yield - *P. C. Sentelhas*
  - BioMA Studio for Latin America and the Caribbean - *Maurits van den Berg*
  - Crop modeling in Latin America and the Caribbean: State of the art of development and applications for climate change impacts and adaptation assessments - *Maurits van den Berg*
  - CLIMANDES Project: Climate services for decision making in the Andean areas of Cusco and Puno, Peru - *Irene Trebejo*
  - The missing link - adding a spatial component to AgMIP's Regional Integrated Assessments (RIA) to upscale and map the impact of climate on crop production and economics - *Davide Cammarano*
  - Argentine proposal for the generation of new models in the Pampas Region - *Sebastian Leavy*
  - Proposal for Social Development of the Pampas Region - *Sebastian Leavy*

- **Climate Change Impacts on Biophysical Systems**
  - Sensitivity analysis of maize grain yield to changes in climate elements, CO2, and nitrogen fertilizer - *F.D. Bender*
  - Global crop production: adaptation options to temperature increase - *Sara Minoli*
  - Simulating the yield response of potato crops to projected climate scenarios for southern Chile using SUBSTOR- POTATO - *Patricio Sandana*
  - Simulating the yield response of wheat crops to projected climate scenarios for southern Chile - *Patricio Sandana*
  - Preliminary Results of a Simulation-Based Wheat Yield Forecast Framework for the US Southern Great Plains - *Phillip D. Alderman*
  - InfoCrop DSS aided adaptation to climatic risks in agriculture: Case study from farmer's fields in India - *S. Naresh Kumar*
  - Modeling Drought Tolerance in Caribbean Root Crops under Present and Future Climates - the Case of Jamaican Sweet Potato - *Jane Barker- Cohen*
  - Adjusting Climate Model Bias for Agricultural Impact Assessment: the BAD-JAM project - *Stefano Galmarini*

- **Advanced Computational Applications for Agriculture**
  - Assimilation of the BioMA Platform, as a tool for the climate change impacts studies on agricultural crops. Environmental Bases for Local Food Sustainability Project (BASAL), Cuba - *Ranses Vázquez*
  - Assimilation of the BioMA Platform, as a tool for the climate change impacts studies on agricultural crops. Environmental Bases for Local Food Sustainability Project (BASAL), Cuba - *Ranses Vázquez*
  - The AgMIP Impacts Explorer - *AgMIP Coordination Unit*

- **Data assimilation and Seasonal Forecasting of Agricultural Shocks**
  - Assimilating remote sensing observations in a sunflower crop model under uncertainty on soil properties - *Ronan Trépos*
- **Modeling the Causes and Cascading Impacts of Food Shocks**
  - Implications of future climate variability on food security: a model-based assessment of climte-induced crop price volatility impacts - *Hermann Lotze-Campen*

- **Crop Model Intercomparison in Diverse Systems**
  - Comparing the performance of SUBSTOR and CropSyst in five potato varieties under different model calibration strategies - *Victor García-Gutiérrez*

- **AgMIP Leaders Forum Activity Summaries**
  - AgGRID, Wheat, Water, WASCAL, SugarCane, Rice, Regional Economics, PeDiMIP, Ozone, Maize ET, Maize, MACSUR, Low Input Smallholder Systems, Data Interoperability, BioMA, Crop Model Calibration, CGRA, C3MP, Canola, Impacts Explorer, AgMIP Structure.

DAY 3

Research Planning and Opportunities

In his presentation entitled "*Regional Priorities for Current and Future Challenges",* Dr. Peter Craufurd noted the significance of the AgMIP community contributions to research that tests decision strategies through regional integrated assessments. "Stakeholders need to know about this and why it is important,'' he said. Dr. Craufurd advised that the relevance of development information to climate change, mitigation, health and nutrition agendas, in both public and private sectors, needs to be clearly articulated with particular attention to the following five factors: what are the priorities?, what is AgMIP's comparative advantage?, who are the key partners?, what are the key messages? and what is the value proposition for investors?

"AgMIP needs to emphasize the "Pull'' in the "Push and Pull'' of research'', Dr. Cynthia Rosenzweig emphasized in her presentation on the "C*hallenge to Parallel Sessions for Work Planning"*. "Push'' is research-driven work and "Pull'' is stakeholder-driven work. "Pull'' includes societally relevant multi-model assessments and application pathways that AgMIP has introduced and would like to continue. "Pull'' also includes products that are developed with inputs from stakeholders such as outlooks, policy briefs, visualization tools like the Impacts Explorer, and peer-reviewed papers. Three suggested focus areas were presented for AgMIP "Pull'' research:

- AgMIP's mitigation and adaptation work should focus on helping countries fulfill the commitments they made under the Paris Agreement of 2015.
- An increased focus on shocks and climate variability will help stakeholders project short-term agricultural risks, especially droughts and floods, and improve seasonal yield forecasting.
- Helping farming systems deliver healthy food while tackling climate change is necessary to achieve food and nutrition security.

Rosenzweig concluded her remarks with a challenge for the Working Groups to identify how they can "contribute to the three 'Pull' focus areas and what 'Push' research areas are your top priorities? What other stakeholder-driven 'Pull' activities would your group want to pursue?'' The presentations of Craufurd and Rosenzweig provided motivation for the Working Group sessions to follow.

Working Group Session 2

Regional Integration of Models and Disciplines and discussion leaders included:

- **Latin America and the Caribbean** - *Kelly Witkowski, Francisco Meza & Roberto Valdivia*
- **Asia and Australia** - *N. Subash & Peter Thorburn*
- **Africa** - *Dilys MacCarthy & Sabine Homann-Kee Tui*
- **Europe** - *Ignacio Perez, Davide Cammarano & Claas Nendel*
- **North America** - *Bruno Basso and Senthold Asseng*

Working Group Session 3

Discussion of Protocols, Plans, and Goals for AgMIP8. Topics and discussion leaders included the following:

- **Crop Model Intercomparison and Improvement** - *Frank Ewert & Jean- Louis Durand*
- **Utilizing Big Data and Next Generation Tools for Agricultural Decisions** - *Cheryl Porter, Sander Janssen & Gideon Kruseman*
- **Data Assimilation, Seasonal Agricultural Forecasting, and Risk Assessment** - *Alex Ruane, Joshua Elliott & Stefan Niemeyer*
- **Global Economics, Trade, and Land Use** - *Hermann Lotze-Campen & Keith Wiebe*
- **Integrated Assessments of Farming Systems and Implications for Decision Systems** - *Roberto Valdivia & John Antle*
- **Nutrition and Food Security Analyses and Assessments** - C*ynthia Rosenzweig and Marco Springman*
- **Characterizing Production Losses from Ozone, Pests, and Diseases** - *Lisa Emberson & Maurits van den Berg*

RESULTS

The Seventh AgMIP Global Workshop proved to be a successful platform for combining experts within relevant fields and discussing actions of

enhancing agricultural resilience as well as laying out the protocols, plans and goals for AgMIP8. Key results from the workshop are presented below, organized by research topic, region, special session, or side session.

RESEARCH BY TOPIC:

Crop Model Intercomparison Group *(Frank Ewert and Jean-Louis Durand)*

The crop model intercomparison group discussed how the predictive capacity under climate change in low input (water, nitrogen) farming systems can be improved by crop model intercomparison. In the session, 23 modeling groups expressed their willingness to participate. The previous model inter-comparisons focused on crop processes and not as much on soil processes. Emphasis will be put on the ability of models to accurately account for climate change and soil fertility interactions. Future plans include generating a simulation protocol, low information calibration, high information calibration and starting a CTWN analysis (carbon/temperature/water/nitrogen) in 2018-2019.

Utilizing Big Data and Next Generation Tools for Agricultural Decisions *(Cheryl Porter, Gideon Kruseman and Sander Janssen)*

The main objective of the working group for big data and next generation tools is to define how AgMIP modeling should look in five years using big data resources. Actions on data interoperability for the Big Data & Next Generation Tools working group include:

- Open Data Journal for Agricultural Research as a data-catalogue with descriptive meta-data
- Related to CGIAR Big Data program
- SOLACE is collecting data and curating from past EU projects

Plans for 2018-2019 are potentially to set precision farming as a fourth priority area, and to make socio-economic data a priority combined with guidelines on data interoperability.

Seasonal Agricultural Forecasting, Data Assimilation, and Risk *(Alex Ruane, Stefan Niemeyer and Phillip Alderman)*

Parallel session participants.

The working group aim was to explore and showcase opportunities to improve in-season yield forecasting by adding and/or improving the use of crop models (CM), connecting remote sensing into retrospective and forecast systems and identifying data/methodological best practices for this, and assessing agricultural risk factors and interventions. Recent noteworthy findings suggest that there currently is little use of process-based crop modeling in yield forecasting and that several relevant existing AgMIP results create opportunities. Plans for 2018-2019 include gathering information on the forecasting community through a survey, defining an experiment for hindcasting: suitable events of yield impacts (potentially building on AgMIP's GGCMI), defining specific case studies for uptake, exploring the seasonal weather forecast skill and the different hazard responses in models.

Global Economics, Trade and Land Use *(Hermann Lotze-Campen)*

The overall focus centered on challenges to food security in 2030, 2050 and 2100 under different socio-economic scenarios. From the stakeholder "pull'' perspective, there is need to advance understanding of climate change effects vs. mitigation effects, food security and health implications. From the scientists "push" perspective, there is need to advance technical "decomposition'' studies to understand model sensitivities, as well as CGRA (Coordinated Global and Regional Assessments) contributions. Recent noteworthy findings indicate that by 2050, global price changes from ambitious mitigation (RCP2.6) are larger than from direct climate impacts (RCP6.0); higher prices may increase

food insecurity; diet change is very important for reducing mitigation costs from non-CO_2 taxation and with regional teams; food security impacts need to be further studied. Plans for 2018-2019 are to conduct regional analyses in Sub-Saharan Africa, South Asia, and Latin America/Caribbean, study the health impacts from diet change; multiple climate impacts from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP; e.g. crops, water, labor productivity, sea-level rise); prepare ERA-NET AXIS (assessment of cross-sectoral climate impacts and pathways for sustainable transformation) proposal; and, to finalize the decomposition exercise/paper.

Integrated Assessments of Farming Systems and Implications for Decision Systems *(John Antle and Roberto Valdivia)*

The working group for Integrated Assessments of Farming Systems and Implications for Decision Systems presented future focus topics that included review of AgMIP Approach to Regional Integrated Assessments (RIA); a review of the Coordinated Global and Regional Assessments (CGRA) approach; potential for extension of RIAs to include Food & Nutrition Security; and linkages to big data. Future plans presented also included to carry out RIAs linked to global model scenarios and, do an inventory of regional teams and projects.

Nutrition and Food Security Analyses and Assessments *(Marco Springmann, Pauline Scheelbeek and Cynthia Rosenzweig)*

The Nutrition and Food Security Analyses and Assessments working group focuses on planning of joint assessments of global and regional adaptation and mitigation actions and consequences for food security and public health. Plans for 2018-2019 include three main missions: First, to link to global assessments (with Global Econ Team) for both dietary implications of deep mitigation pathways and economic plus mitigation impacts of healthy diets; second, to link to regional assessments (with RRTs) for the sections of health impacts of regional adaptation and mitigation actions, regional dietary pathways, and health impacts of dietary interventions; and third, to link to globally gridded crop models (with GGCMI) for climate impacts in nutrition-sensitive crops (fruits and vegetables).

Characterizing Production Losses from Ozone, Pests, and Diseases *(Lisa Emberson, Frank Dentener and Maurits van den Berg)*

The AgMIP Ozone Group initiated an activity to share information on the development of models capable of estimating the effect of ozone on crop growth and yield, and its interplay with other growth limiting factors. The activity brings together ozone-impact and crop-modeling experts, designs joint modeling protocols and experiments, and collects calibration and evaluation empirical data. Recent noteworthy findings for the ozone working group indicate that global crop modeling efforts are needed to understand the scale of ozone pollution impacts on global agriculture and the effectiveness of policy to reduce emissions of ozone precursors. The calibration and evaluation of such crop models using empirical datasets is imperative to give confidence to risk assessments to inform policy. Plans for 2018-2019 are to finalize empirical datasets, develop ozone crop modeling protocols, develop, calibrate and test ozone crop models, perform crop modeling risk assessment model ensembles at the global scale, and publish a peer-reviewed paper.

PeDiMIP Working Group *(S. Bregaglio, M. Donatelli, R. Magary and S. Savary)*

PeDiMIP (the Pest and Disease Modeling Intercomparison Project) addresses the massive losses in yield, natural resources and harvest quality caused by pests and diseases in the world's agricultural systems. The mission is to improve agricultural models for pests and diseases, as well as to enhance the scientific and technological capabilities for assessing impacts of climate variability and change. Current research foci are: To improve pest and disease models; linking pest and diseases to crop models to assess crop losses; and, building a database suitable to validate simulated crop loss. Recent noteworthy findings includes the implementation of damage mechanisms in four crop models for wheat diseases, and the identification of potential data sets across Europe. Plans for 2018-2019 include a networked modeling effort on diseases and pests of wheat; model intercomparison using a citrus black spot case study; modeling of pests and diseases (dynamics and crop losses) in perennials such as grapevine and coffee; and, planning for a future PeDiMiP Workshop where priorities and directions will be reviewed.

RESEARCH REGIONS:

Latin America and the Caribbean *(Kelly Witkowski Roberto Valdivia, and Francisco Meza)*

The Latin America and Caribbean (LAC) working group held three sessions throughout the week to define stakeholder needs and the desired impact of AgMIP in the LAC, and to contextualize the current use of - and demand for - modeling outputs to inform the planning processes in the region. Topics covered included the extent of current use of modeling tools, existing modeling capacities, ongoing research and priorities for the region. In addition, the session also focused on assessing the types of modeling outputs that are required to support existing or upcoming planning processes in Latin America. A need was identified to increase the use of modeling tools to help inform project interventions, NDCs & NAPs, and direct government interventions. An effort must be made to ensure practical information is available for farm-level interventions to address both current and future challenges. There is also need to clarify scales and "translation" mechanisms. Plans for 2018-2019 include a regional assessment for potato production in the Andes; developing a diagnostic of activities/projects in the regions, implementation of capacity building and multi-disciplinary trainings to support RIA; and, developing a funding strategy.

Asia and Australia *(Australia: Peter Thorburn. India: Subash Nataraja Pillai, Geethalakshmi Vellingiri, Soora Naresh Kumar and Dakshina Murthy Kadiyala)*

The working group presented issues in India related to adaptation being primary and mitigation considered as a co-benefit. Other issues involve crop diversification in monocropped areas, incentivizing specialty crops like minor millet, overuse of ground and surface water, and the need for NUTRI BASKET by ICRISAT. The working group further mentioned that Australia has significant climate variability and the Standing Committee on Finances (SCF) could help them adjust. Mitigation is of primary interest of farmers in Australia and nutrition and food security is important as 80% of the produce is exported. China is one of the world's biggest emitters and mitigation is important. Important to notice is that China's nutritional security issues connect to their large imports from the global market. Expansion of arid and semi-arid areas sheds light on concerns of ecosystem changes. For the future, the working group aims to identify push mechanism related questions and topics of what pressing problems require a scientific solution, conduct single crop to cropping system analysis – developing local experiences to run the model, and expanding AgMIP activities to new crops and extreme events (primary and secondary impacts). To address stakeholder "pull", goals include to link with national economists and economic modelers who need the information coming from AgMIP to better understand the impacts of shocks on crops and livelihoods, etc.

Regional Teams in Africa *(Dilys MacCarthy and Sabine Homann-Kee Tui)*

Regional integration of models and disciplines for "push" areas (the science-driven work) include sequence analyses in cropping systems for better representation of GHG emissions and other factors for better simulation of mitigation; and increased study of low input systems. This includes better understanding of CTWN interactions under low productivity systems; nitrogen dynamics and risk; broader inclusion of crops (and nutrition), farmer response functions, adaptation and complexity, and sustainability pathways; and, comparative advantage and modeling requirements. "Pull" areas (the stakeholder-driven work) include:

- Mitigation and adaptation (key to mitigation in Africa is soil carbon sequestration combatting degradation).
- Contribute to the website on ISIMIP Impact sectors, support national challenges and programs, e.g. livestock and mitigation in Zimbabwe (NAMA).
- Support research for national adaptation plans and help governments on project plans. For the focus area shocks and the short term**,** there is limited availability of reliable meteorological data, e.g. the European Space Agency climate and weather services in terms of accessibility and validation.
- Big data platform on official weather data for verification, and quantifying weather shocks on crop responses.

For the focus area of food and nutrition security, priorities include developing a food security yield gap atlas, looking more into crop models and

nutrition, and alternative analyses such as diet pathways and market equilibrium analyses.

CGRA Europe *(Ignacio Perez Dominguez)*

CGRA Europe met to discuss stages of different activities while highlighting similarities and differences. Some of their recent noteworthy findings include 5 GCM and 2 climate scenarios plus 6 CMs readily set up for EU-27 on a 25 km grid for further activities, JRC study on global shocks impacting European economy, and Agri-SSP (RAP) development. Plans for 2018-2019 include aligning activities under one common funding scheme.

AgMIP North America *(Bruno Basso and Senthold Asseng)*

Through advances in the AgMIP platform and community, AgMIP North America aims to address the impact of changes in land use, climate, soil, and management on the resiliency, adaptation and mitigation potential of North American agricultural systems across multiple spatial and temporal scales. The working group's general emphasis is on soil dynamics (adaptation/mitigation) and rotations, major crops and fruits and vegetables (nutrition), extreme events (drought/floods) and links to irrigation, yield forecasts, and pest/diseases/ozone. Further emphasis areas include linking with socio-economic modeling and to Canada and Mexico. Stakeholder focus involves: extension, farmer, state and federal policy maker (USDA), Long-Term Agro-Ecosystem Research (LTAR) sites, and AgriFood Canada. Next steps for AgMIP North America are to continue discussions and pursue funding, launch an AgMIP North America Consortium as partnership between academic, USDA and other public and private partners, and apply for National Institute of Food and Agriculture (NIFA) Workshop grant.

Parallel session participants.

SPECIAL SESSIONS:

The AgMIP Impacts Explorer Demonstration and User Feedback *(Amanda Evengaard)*

Feedback and user testing was conducted on the three portals of the Impacts Explorer Tool. Participants self selected, and included individuals who identified as contributing science perspectives. Overall there was appreciation for the high quality of the visuals, ease of use, professional appearance and layout of the platform, as well as its contribution towards communication and sharing of modeling results. At the same time, users felt easier access to explanations of terminology is needed. A more visible icon menu would benefit the Regional Summaries, as would improve navigation among portals. Users felt the tool will be most useful for connecting with policy, governments, development organizations (involved in scaling), researchers, country level donors, students/universities in the region (e.g., for use as case studies), climate change organizations, and possibly also commercial farmers. Recommended areas for improved functionality included adding an option to download/upload data (visualize results and compare to existing regions); incorporate additional regions and farming systems; including a teaching tool for students; allowing all users to download reports; analysis of risk by groups (elaborate on risk analysis), and, enabling assessment of the cost benefit of implementation of different interventions. Plans for 2018-2019 include adding new cases, new indicators, new analyses, and/or upload of similar types of assessments with different indicators, subject to interest and level of funding.

Women in AgMIP *(Carolyn Mutter and Cynthia Rosenzweig)*

During the first-ever AgMIP Women's Lunch, a discussion was held concerning how women can be better recognized in roles they provide, adopt strategies for success, influence processes in their institutions and evolve at AgMIP. The main conclusions from the discussions were that AgMIP would benefit from mentoring of women in the navigation of their careers, teaching strategies for enhancing their visibility in their

organizations, and identifying ways to ensure women's voices are heard in scientific discussions often dominated by men. Potential strategies identified to enable women to influence processes in their institutions include the promotion of AgMIP in colleges and universities by giving talks, hosting events, sponsoring students in AgMIP projects, and promoting education and hiring of women in engineering, agronomy, and modeling. Strategies for how women can evolve at AgMIP include increasing the number of women leading AgMIP sessions, inviting more women to participate in AgMIP events, recruiting women to lead AgMIP teams and to participate in the Executive Committee and Steering Council, allowing written questions to encourage participation at workshops, and inviting women leaders to share experiences (including challenges they faced and how to persevere).

AgMIP-IICA Partnership

Leaders of IICA and AgMIP convened at AgMIP7 to discuss possible areas of collaboration beyond the co-organization of the Workshop. Areas of interest include activities relating to Regional Integrated Assessments (RIA) in IICA countries; advancement of jointly prepared proposal concepts; and, exploration of opportunities for students. A follow-on discussion held at the Columbia University Earth Institute in New York City in June of 2018 revisited the discussion points and led to agreement on specific areas for collaborative development. The exploration of RIA-related activities will focus initially on locations in the Caribbean and dry corridor of Central America, starting with regional discussions emphasizing longer-term outlooks, including scenario discussions and Representative Agricultural Pathways. Concept briefs are being developed by IICA, AgMIP and partners to enable approaches to prospective funders. Exploration of pathways and processes for future internships of Columbia University masters or doctoral student in IICA member states is underway; as is exploration of pathways and processes for students from those countries to be considered for graduate programs at Columbia University, including the Earth Institute.

SIDE SESSIONS:

The workshop provided the opportunity for participants to self-organize for side sessions reflecting different interest and focus areas. The side events were conducted on the days preceding and following the main workshop, and consisted of mini-workshops, presentations, training sessions, round tables, and general discussions organized by the side event leaders.

Model Calibration *(Daniel Wallach, Taru Palusuo, Sabine Seidel and Peter Thorburn)*

This side session was held to discuss objectives of a calibration activity. A paper from Phase 1 has already been published, and new participants joined the activity during the workshop. Future plans for 2018-2019 include sending out dataset to participants for Phase 2, and analysis of the Phase 2 results.

Maize Evapotranspiration Group *(Bruce Kimball and Ken Boote)*

The main objective of this group is to conduct an intercomparison of 29 Maize models to predict eight year of maize eddy covariance ET data from Ames, Iowa. One of the main findings presented was that the models have a huge variation in their ability to simulate ET. The future plans include finishing a paper from the first round of activity, and to do the second round with both Maize and Wheat Teams with lysimeter data from Bushland, Texas and eddy covariance data from France.

Anticipating Agricultural Risk *(Alex Ruane)*

The main objective of the session was to explore capabilities of agricultural models to assess how hazards can cause production shortfalls and how they affect the society. In addition, it is important to ascertain stakeholder needs and common resources related to agricultural risk. The session also aimed to scope out agricultural drought risk assessment framework. One of the main findings was that multi-model approaches are useful for characterizing risk across diverse systems and populations. The risk group concluded that there is a need to identify food security teleconnections behind production shortfalls, and AgMIP is uniquely situated to explore risk and recommend resilience-building interventions. Future plans include contributing to UNISDR reports, developing risk assessment framework components, connecting with trade network modeling experts, and using models to explore the wide variety of hazard responses identified by participants as critical to current and future resilience.

Better Modeling and Planning - Researchers and Stakeholders working together *(Roberto Valdivia and Sabine Homann-Kee Tui)*

The team met to discuss how researchers can support policy decision making, set priorities for research and development, and to define actionable strategies towards farming futures facing complexity and uncertainty. The experience of working with stakeholders to co-design agricultural pathways and identify adaptation strategies was tested using integrated assessments. Pathways and scenarios are powerful tools for estimating impacts of climate change on vulnerable farm populations and addressing key challenges in agriculture. The team worked on co-designing improved management, mitigation and adaptation options which can contribute to national and regional decision processes, aligned with the Sustainable Development Goals. This session facilitated dialogue between researchers and stakeholders for improving impacts of agricultural research and decision making. One of the main findings was that funding should include a 'post' project period to support implementation of science-based policy/technology interventions. The research also gave insight to appropriate ways to 'translate' scientific results that is understandable and usable by stakeholders. Future plans for 2018-2019 include fundraising, continuity and advancement of influencing decision processes.

Low Input (water, nitrogen) *(Marc Corbeels and Gatien Falconnier)*

The mission involved crop model intercomparisons to improve predictive capacity under climate change in low input (water, nitrogen) cropping systems. Four sites across Africa with contrasting ago-ecologies and soil conditions were selected where data on crop phenology, yield, LAI, in-season soil moisture, soil mineral N and plant N are available. Recent noteworthy findings are that 23 modeling groups are willing to participate, previous model inter-comparisons were focused on crop processes and not much on soil processes, and that emphasis will be put on the ability of models to accurately account for climate change and soil fertility interactions. Plans for 2018-2019:

- May: simulation protocol available for discussion with modeling groups.
- June: low information calibration & CTWN starts.
- August: high information calibration & CTWN starts.

Global Gridded Crop Modeling Intercomparison (GGMI) *(Joshua Elliot and Christoph Müller)*

The global gridded crop modeling intercomparison pushes forward to analyze Phase 2 outputs and identify research priorities for Phase 3 (in collaboration with ISIMIP). Recent noteworthy findings include that the Global Gridded Crop Modeling Intercomparison team needs external support to analyze all the data they have (the modelers have limited resources beyond simulations), and they need to better prepare for integration with individual modelers' research agendas (and funding). Plans for 2018-2019 includes:

- Finalize publications for phase 1.
- Develop global crop model emulators.
- Understand response patterns across models and regions.
- Describe potential of irrigation and growing season adaptation.

AgMIP Leaders Forum Side Session Summary

The AgMIP Leaders Forum (consisting of Co-Leaders of AgMIP's 30+ research initiatives and regional activities) met at IICA following the conclusion of the workshop. The group initially discussed main impressions from the main AgMIP7 sessions, including strengths and weaknesses of the agenda, major new developments (such as the formation of new air pollution and seasonal forecasting teams), opportunities to build collaborations in Latin America and the Caribbean, and priorities for follow-up organizational activities. The Leaders Forum then elucidated two major areas of focus in AgMIP's 5-year plan: (1) the need for more information on national scales, and (2) the need for stakeholder-driven research agendas related on specific decision support needs (with increased emphasis on the 'pull' of stakeholder requests over the 'push' of cutting-

Parallel session participants.

edge science products). The group also discussed a joint analysis of decision scales within the agricultural modeling community, helping to identify the various components that were needed within any scale and the linkages across temporal and spatial scales that would prioritize applications-oriented model development. Breakout sessions enabled participants to flesh out specific criteria for and/or examples of stakeholder-driven research products as well as ideas for prototype projects.

Latin American and Caribbean Modeling and Assessments Activities Session *(Kelly Witkowski & Roberto Valdivia)*

This side session was held on Friday, followed the AgMIP7 workshop. Building on the analysis from the two LAC focused sessions held earlier in the week, this final regional session focused on specific goals, next steps and requirements from advancing research using the integrated assessment methodology. It also considered various initiatives and opportunities for collaboration and funding. Following plenary presentations and discussions of data, models, interoperability, expertise, stakeholders, and funding, the participants self selected into Caribbean, Andean, Central American, and Southern South American breakout groups. Each group brainstormed and drafted initial concepts for collaboration, identifying research impact, objective, products, activities, stakeholders, technical expertise, and initial steps required to establish momentum. The groups then reconvened to present concept summaries in a closing plenary. Concept summaries are being converted to 1-page briefs for sharing with prospective research, production, stakeholder, or funding partners in the regions.

CONCLUSIONS

The leaders and participants of AgMIP7 workshop presentations, sessions and discussions have provided a basis on which AgMIP can continue to contribute key advancements to address major global and national challenges in food and nutrition security at present and in the future. With renewed commitment to identifying and addressing specific needs and uses of agricultural system syntheses, AgMIP scientists are increasingly able to help national and regional planners implement Sustainable Development Goals and prioritize actions to achieve climate change mitigation and adaptation planning.

The reported and planned areas of work all contribute to AgMIP's commitment to Next Generation Tools Knowledge and Data, Coordinated Global and Regional Assessments, and Modeling for Sustainable Farming Systems. The IICA venue fostered feeling of familiarity and support among participants. It also enabled the bolstering of AgMIP initiatives in Latin America and the Caribbean, as well as the advancement of plans for AgMIP activities and outputs across the research regions and topic areas for the coming years.

AgMIP greatly appreciates the guidance of its Leaders in prioritizing its actions. Steering Council co-chair Dr. Jean-Francois Soussana took the opportunity of closing sessions to share perspectives on strategy, reach to national governments, communication and capacity building, partnerships, resource mobilization, and the need to identify demand-driven research areas.

AgMIP is a vibrant community united by the common goal of working together to foster research focused on agricultural resilience. To sustain its own resilience, AgMIP may need stronger commitments of institutions, better positioning of some of its initiatives and formal agreements with key partners. "AgMIP growth must include highly focused work as well as the continued advancement of integrated knowledge," Dr. Soussana challenged. He encouraged increased involvement to actions to drive forward progress, including a willingness of individuals to take leadership roles, and of teams to engage processes that will further AgMIP initiatives and collaborations. He emphasized

the continued need for highly visible research product outlets (e.g. IPCC reports) as well as the need for community building and cross-fertilization with other initiatives.

NEXT STEPS

Members of AgMIP recognized the need and committed to action to better involve stakeholders (non-scientists) in the consortium to ensure that information needs are being addressed and the science produced is being applied in decision-making. This includes increased efforts in three key areas: mitigation and adaptation planning and action, emphasizing the impacts of shocks in shorter timeframes, and better integrating food and nutrition security into the research.

The AgMIP steering council and executive committee members accordingly identified the following recommendations of next steps:

- Reach out to national actors and governments to identify demand driven research areas, with communication and capacity building and partnerships and resource mobilization to follow.
- Identify how AgMIP can grow while being focused and further integrating knowledge.
- Focus on the drivers of progress including: leadership and funding, major research outlets (e.g. IPCC reports), community building and cross-fertilization with other initiatives.
- Establish means for better communicating with stakeholders AgMIP science and why it is important.
- When engaging public or private sectors in development, climate change, mitigation, and health & nutrition agendas, address questions of: priorities, comparative advantages, key partners and messages, and value proposition.
- Address issues that may be limiting AgMIP, including ways to achieve stronger commitments of key institutions, ways to better position AgMIP initiatives that may be in competition with others, and benefits of formal agreements between AgMIP and its key partners.

Holding AgMIP7 in Costa Rica encouraged participation of more than 20 individual researchers and stakeholders from the Latin America and Caribbean (LAC) region. The involvement of regional researchers from teams in Sub-Saharan Africa and South Asia greatly enriched the discussions and facilitated learning about integrated assessments, including stakeholder roles in guiding the research.

During the three LAC-focused side sessions and throughout the broader event, participants identified goals and several next steps to advance the initiative in the region. Medium term goals include 1) Enhance AgMIP activities in the region, 2) Close the gap between science and decision making for climate action in the agricultural sector to ensure the efficacy of investments made and facilitate the design and implementation of public policy instruments (National Adaptation Plans, Nationally Determined Contributions, etc.), and 3) Develop the capacities of researchers, technicians, communicators, and stakeholders to achieve this.

Specific action items in LAC for the next year include:

- Prepare a short chapter on LAC integrated assessment activities for the forthcoming AgMIP book synthesizing the advances to date.
- Conduct a baseline survey to identify existing capacities, resources and initiatives in LAC.
- Work with sub-regional institutions to develop and implement multi-country proposals based on the initial ideas defined during the workshop.
- Elaborate both a short and longer-term funding strategy to enable AgMIP activities in the region.
- Develop capacities in the region, both for researchers on integrated modelling and for stakeholders on the application and use of modelling outputs. This includes both in-person and virtual events (eg: online training course on TOA-MD (potentially expanded to include other models).
- Organize virtual exchanges with representatives from South East Asia and Africa to learn from their experiences developing RAPs and RIAs, to inform the planning processes in LAC.

APPENDIX 1: AGENDA

Day 1 - Tuesday April 24TH – Plenary and Working Groups

Plenary Presentations: State of AgMIP and Challenges for Agricultural Decision Support

9:15am-9:30am **1. IICA Welcome -** *Dr. Diego Montenegro Ernst on behalf of Dr. Manuel Otero*
9:30am-9:50am **2. Challenges from Latin America Perspective** - *Manuel Otero*
9:50am-10:10am **3. Challenges from Global Perspective: Addressing IPCC and SDG Targets** - *Ghassem Asrar*
10:10am-10:30am **4. State of AgMIP** - *Senthold Asseng & Hermann Lotze-Campen*
10:30am-10:45am – **5. Workshop Charge** - *Cynthia Rosenzweig & Anthony Whitbread*

10:45am-11:15am **Break**: Refreshments and Poster Viewing

Plenary Presentations: Research Highlights and Opportunities (Part 1)

11:15am-11:35am **1. Model Improvements from Model Intercomparison -** *Pierre Martre*
11:35am-11:55am **2. Key Findings from Integrated Climate, Crop, Livestock, and Economic Assessments of Farming Systems in Sub-Saharan Africa and South Asia** - *John Antle*
11:55am-12:15pm **3. Impacts to Agricultural and Food Systems with Imposed Limits to Climate Change** - *Alex Ruane*
12:15pm-12:35pm **4. Linking Integrated Assessments and Policy-Making to Enable Uptake** - *Sabine Homann-Kee Tui*
12:35pm-12:45pm **Discussion**

12:45pm-1:00pm **Charge for the Afternoon Parallel and Working Group Sessions**

1:00pm-2:00pm **Lunch**: Self-Organized Discussion Groups – Poster Viewing

2:00pm-3:20pm **Parallel Presentations Session 1**
1A: Global Agricultural Modeling for Development and Climate Analysis #1
1B: Regional Assessments of Biophysical and Economic Systems #1
1C: Advances in Simulating Diverse Agricultural Systems
1D. Climate Change Impacts on Biophysical Systems #1

3:20pm-3:50pm **Break**: Refreshments and Poster Viewing

3:50pm-5:30pm **Working Groups Session 1 Goal and Agenda Setting by Overarching Research Topic:**
W1: Crop Model Intercomparison and Improvement - *Frank Ewert & Jean-Louis Durand*
W2: Utilizing Big Data and Next Generation Tools for Agricultural Decisions - *Cheryl Porter, Sander Janssen & Gideon Kruseman*
W3: Data Assimilation, Seasonal Agricultural Forecasting, and Risk Assessment - *Alex Ruane, Joshua Elliott & Stefan Niemeyer*
W4: Global Economics, Trade, and Land Use - *Hermann Lotze-Campen & Keith Wiebe*
W5: Integrated Assessments of Farming Systems and Implications for Decision Systems - *Roberto Valdivia & John Antle*
W6: Nutrition and Food Security Analyses and Assessments - *Cynthia Rosenzweig and Marco Springman*
W7: Characterizing Production Losses from Ozone, Pests, and Diseases - *Lisa Emberson & Maurits van den Berg*

5:30pm-6:00pm **Plenary Wrap-up: Wrap up & Check on Day 1 Goals and Introduce Day 2 Objectives**

Day 2 - Wednesday April 25TH – Plenary and Parallel Sessions

Plenary Presentations: Research Highlights and Opportunities (Part 2)

9:00am-9:15am **1. Harmonizing Climate Scenarios for Multiple Applications** - *Sonali McDermid*
9:15am-9:30am **2. Priorities in Crop Modeling Developments** - *Ken Boote*
9:30am-9:45am **3. Recent Advancements in European and African Assessments** - *Heidi Webber & Dilys MacCarthy*
9:45am-10:00am **4. Main Messages from Global Gridded Model Analyses** - *Christoph Müller*
10:00am-10:20am **5. Roles for Big Data in Agricultural Analyses** – Giddeon Kruseman & *Andrew Jarvis*
10:20am-10:30am **Discussion**

3:30pm-4:00pm **Break**: Refreshments and Poster Viewing

Plenary Presentations: Research Highlights and Opportunities (Part 3)

11:00am-11:15am **1. The Role of Agricultural Models in Seasonal Forecasting Systems** - *Stefan Neimeyer*
11:15am-11:30am **2. Characterizing Losses in Crop and Livestock System Models** - *Lisa Emberson*
11:30am-11:45am **3. Foresight in Global Food Systems, Food Security & Policy** - *James Woodhill*
11:45am-12:00pm **4. Crop and Pasture Ensemble Model Simulations of Productivity and Emissions** - *Jean-Francois*

Soussana

10:00am-10:20am **5. Global Economics, Shocks, and Regional Trade Instability** - *Hermann Lotze- Campen*
10:20am-10:30am **Discussion**

12:30pm-12:40pm **Overview and Introduction of Afternoon Sessions**

12:40pm-1:00pm **Workshop Photos - All - Women - Under 40 - Over 60**

1:00pm-2:00pm **Lunch: Self-Organized - Poster Viewing – Women's Lunch**

2:00pm-3:30pm **Parallel Presentations Sessions 2**
2A: Resolving Crop Losses (including Pests, Diseases, Weeds, Ozone)
2B: Advanced Computational Applications for Agriculture
2C: Data Assimilation and Seasonal Forecasting of Agricultural Shocks
2D: Regional Assessments of Biophysical and Economic systems #2
2E: Modeling the Causes and Cascading Impacts of Food Shocks

3:30pm-4:00pm **Break**: Refreshments and Poster Viewing

4:00pm-5:15pm **Parallel Presentations Sessions 3**
3A: Nutrition and Food Security Metrics and Scenarios
3B: Crop Model Intercomparison in Diverse Systems
3C: Soil Nutrient and Water Management Strategies
3D. Climate Change Impacts on Biophysical Systems
3E: Global Agricultural Modeling for Development and Climate Analysis #2

5:15pm-5:45pm **Plenary Wrap-up: Wrap Up & Check on Day 2 Goals Introduce Day 3 Objectives**

5:45pm-6:15pm **Break**: Refreshments, Appetizers, and Introduction to the Walking World Café

6:15pm-7:30pm **Walking World Café** (See figure for more information)
Global Agricultural Modeling for Development and Climate Analyses
Regional Assessments of Biophysical and Economic Systems
Climate Change Impacts on Biophysical Systems
Advanced Computational Applications for Agriculture
Data Assimilation and Seasonal Forecasting of Agricultural Shocks
Modeling the Causes and Cascading Impacts of Food Shocks
Crop Model Intercomparison in Diverse Systems
AgMIP Leaders Forum Activity Summaries

Day 3 - Thursday April 26TH – Plenary and Working Groups

Plenary: **Research Planning and Opportunities**
9:00am-9:20am **Regional Priorities for Current and Future Challenges** - *Peter Craufurd*
9:20am-9:30am **Challenge to Parallel Sessions for Work Planning** - *Cynthia Rosenzweig*

9:30am-11:00am **Working Groups Session 2 Regional Integration of Models and Disciplines**
W8: Latin America and the Caribbean - *Kelly Witkowski, Francisco Meza & Roberto Valdivia*
W9: Asia and Australia - N. Subash & Peter Thorburn
W10: Africa - *Dilys MacCarthy & Sabine Homann-Kee Tui*
W11: Europe - *Ignacio Perez, Davide Cammarano & Claas Nendel*
W12: North America - *Bruno Basso and Senthold Asseng*

11:00am-11:30am **Break**: Refreshments and Poster Viewing

11:30am-1:00pm **Working Groups Session 3 Discussion of Protocols, Plans, and Goals for AgMIP8**
W1: Crop Model Intercomparison and Improvement - *Frank Ewert & Jean- Louis Durand*
W2: Utilizing Big Data and Next Generation Tools for Agricultural Decisions - *Cheryl Porter, Sander Janssen & Gideon Kruseman*
W3: Data Assimilation, Seasonal Agricultural Forecasting, and Risk Assessment - *Alex Ruane, Joshua Elliott & Stefan Niemeyer*
W4: Global Economics, Trade, and Land Use - *Hermann Lotze-Campen & Keith Wiebe* - CARIBE
W5: Integrated Assessments of Farming Systems and Implications for Decision Systems - *Roberto Valdivia & John Antle*
W6: Nutrition and Food Security Analyses and Assessments - *Cynthia Rosenzweig and Marco Springman*
W7: Characterizing Production Losses from Ozone, Pests, and Diseases - *Lisa Emberson & Maurits van den Berg*

1:00pm-2:00pm **Lunch**: Self Organized Discussion Groups – Poster Viewing

2:00pm-3:30pm **Working Groups Session 3 Discussion of Protocols, Plans + Goals for AgMIP8, continued**

W1: Crop Model Intercomparison and Improvement - *Frank Ewert & Jean- Louis Durand*

W2: Utilizing Big Data and Next Generation Tools for Agricultural Decisions - *Cheryl Porter, Sander Janssen & Gideon Kruseman*

W3: Data Assimilation, Seasonal Agricultural Forecasting, and Risk Assessment - *Alex Ruane, Joshua Elliott & Stefan Niemeyer*

W4: Global Economics, Trade, and Land Use - *Hermann Lotze-Campen & Keith Wiebe*

W5: Integrated Assessments of Farming Systems and Implications for Decision Systems - *Roberto Valdivia & John Antle*

W6: Nutrition and Food Security Analyses and Assessments - *Cynthia Rosenzweig and Marco Springman*

W7: Characterizing Production Losses from Ozone, Pests, and Diseases - *Lisa Emberson & Maurits van den Berg*

3:30pm-4:00pm **Break**: Refreshments and Poster Viewing

4:00pm-5:30pm **Plenary Wrap-up: Workshop Integration and AgMIP Research Agenda**

1. **Reports back from Work Sessions** (5 minutes each) - *WG Session Rapporteurs*
2. **Perspectives from AgMIP Scientific Steering Committee** - *Jean-Francois Soussana & Ghassem Asrar*
3. **Discussion**
4. **Closing Comments from IICA**
5. **Closing Comments from AgMIP**

APPENDIX 2: PARTICIPANTS

FIRST NAME	LAST NAME	INSTITUTION
Ashfaq	Ahmad	University of Agriculture Faisalabad Pakistan
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Ligia	Cordoba	Secretaría Ejecutiva del Consejo Agropecuario Centroamericano
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Juliana	D. B. Gil	Wageningen University
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Guillermo	Detlefsen	CATIE
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Jean-Louis	Durand	INRA
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Hermann Lotze-Campen
Cynthia Rosenzweig
Anthony Whitbread

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Bioenergy MIP:
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David Le Bauer

Canola MIP:
Enli Wang

Global Economics MIP:
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Hermann Lotze-Campen

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Maize Model Improvement:
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Yan Zhu
Lloyd T. Wilson
Roberto Confalonieri

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Montserrat Salmeron Cortasa
Ken Boote

Wheat MIP:
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Frank Ewert
Heidi Webber

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Yan Zhu

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Reimund Rotter
Marc Corbeels
Heidi Webber

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Kelly Witkowski

North America:
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Bruno Basso

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Nataraja Subash
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Berta Alicia	Olmedo Vernaza	Comité Regional de Recursos Hidráulicos
Bhimanagouda	Patil	Texas A and M University
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LEADERS FORUM: Topic

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Medha Devare

Aggregation and Scaling:
Frank Ewert

AgGRID:
Christoph Müller
Joshua Elliot

Climate Projections:
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Sonali McDermid

Crop Modeling:
Peter Thorburn
Ken Boote

Fruits and Vegetables:
Senthold Asseng

Grasslands Modeling:
Jean-Francois Soussana
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Information and Communications Technologies:
Sander Janssen
Cheryl Porter

Low-input Farming Systems:
Marc Corbeels
Cheryl Porter

Model Calibration:
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Model Uncertainty:
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Linda Mearns

Nutrition Modeling:
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Adam Drewnowski

Regional Economic Modeling:
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Roberto Valdivia

Regional Integrated Assessments:
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John Antle
James Jones
Alex Ruane
Roberto Valdivia

Representative Agricultural Pathways:
Roberto Valdivia
John Antle

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Irene	Trebejo Varillas	SENAMHI
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Haishun	Yang	University of Nebraska - Lincoln
Florian	Zabel	Ludwig-Maximilians-University Munich

Stakeholder Unit:
Wendy-Lin Bartels
Amy Sullivan

LEADERS FORUM: Topic Crosscutting

Coordinated Climate-Crop Modeling Project (C3MP):
Alex Ruane
Sonali McDermid

Coordinated Global and Regional Assessments:
Cynthia Rosenzweig
Alex Ruane

Ozone Modeling:
Frank Dentener
Frank Ewert
Lisa Emberson
Maurits Van den Berg

Soils and Crop Rotations Modeling:
Bruno Basso
L.T. Wilson

Water Resources Modeling:
Jonathan Winter

APPENDIX 3: ABSTRACTS + PRESENTATIONS

View Abstracts of Presentations here.

View Presentation Links: here.

- Welcome from IICA
- State of AgMIP
- Research Highlights and Opportunities (part 1)
- Research Highlights and Opportunities (part 2)
- Research Highlights and Opportunities (part 3)
- Research Planning Opportunities
- Working Group Reports
- Special Session Reports
- Side Session Reports

- AgMIP7 Presentation Videos:
    - AgMIP7 Day 1 (part 1)
    - AgMIP7 Day 1 (part 2)
    - AgMIP7 Day 2 (part 1)

- Additional AgMIP7 Videos:
    - Why did you decide to participate in AgMIP?
    - What are the objectives of your participation in AgMIP and, in particular, during this week?
    - How has AgMIP's work helped to inform decision making in your country?
    - Why do you think it is important to invest in integrated models and use them?
    - What are the main associated opportunities to this job?
    - How your participation in this global AgMIP network has benefited staff and professionally?
    - What new ideas or information did you obtain during the AgMIP7 workshop?
    - What's next?

APPENDIX 4: SIDE SESSION AGENDA

April 23, 2018 Monday Morning 9 am – 1 pm		
NAME	**DESCRIPTION**	**SESSION INFORMATION**
Global Gridded Crop Model Intercomparison	The AgMIP GRIDded crop modeling initiative (AgGRID) will meet to discuss various ongoing projects such as the Global Gridded Crop Model Intercomparison (GGCMI) phase 1 and 2, regional projects, the nuclear winter project and future plans (phase 3 with ISIMIP)	**Contact:** Christoph Müller: cmueller@pik-potsdam.de Joshua Elliot: joshuaelliott@uchicago.edu **Participants:** GGCMI members to continue underway work sessions. Others by permission of Co-Leads only. **Size:** 15-20 persons
Modeling Latin American – bridging the gaps between supply and demand of information for decision making **Modelaje en América Latina: cerrando las brechas entre la generación y la demanda de información para la toma de decisiones**	This session will help contextualize the current use and demand of modelling outputs to inform the planning processes in the region. The session will provide information on the extent of the use of modelling tools, modelling capacities and research priorities for the region, based on previous experiences. In addition, the session will focus on assessing the types of modelling outputs that are required to support existing or upcoming planning processes in Latin America. Esta sesión se enfocara en contextualizar el estado actual del uso y la demanda de resultados de estudios de modelaje para informar los procesos de planificación en la región. La sesión proveerá información sobre el nivel de utilización de herramientas de modelaje, capacidades actuales y prioridades de investigación para la región, basado en experiencias previas. Adicionalmente, la sesión se enfocará en evaluar qué tipos de resultados de modelaje se requieren para apoyar procesos actuales o futuros de planificación en América Latina.	**Contact:** Daniela Medina: daniela.medina@iica.int Kelly Witkoski: kelly.witkowski@iica.int **Participants:** Open to people with previous experience in modelling and or adaptation planning in the agricultural sector of any country in Latin America. **Size**: 20-25 persons **supporting document** **Contact:** Daniela Medina: daniela.medina@iica.int Kelly Witkowski: kelly.witkowski@iica.int **Participants:** Abierto a personas con experiencias y conocimientos en herramientas de modelaje y o planificación para la adaptación en el sector agropecuario en cualquier país de América Latina **Size:** 20-25 personas **supporting document**
The AgMIP calibration activity	The purpose of the AgMIP calibration activity is to compare and evaluate calibration approaches for crop models, in view to providing guidelines. In phase 2, underway, all participants will calibrate their model using the same phenology data. The session will discuss progress to date and plan for the future. The session is open to all interested persons. Even if you have not signed up for phase 2, but are interested in the problem of crop model calibration, you are cordially invited to attend and take part in discussions (and possibly decide to participate in the activity).	**Contact:** Daniel Wallach: Daniel.wallach@inra.fr Taru Palosuo taru.palosuo@luke.fi Sabine Seidel sabine.seidel@uni-bonn.de Peter Thorburn Peter.Thorburn@csiro.au **Participants:** Open **Size:** 10-15 persons **Supporting document**

April 23, 2018 Monday Morning 9am – 1pm, continued		
NAME	**DESCRIPTION**	**SESSION INFORMATION**
AgMIP-ET-Maize and CTW Session	The Maize team has intercompared 29 Maize models in their ability to predict 8-yr of maize ET data from Ames, Iowa. The models show huge variation in their ability to simulate ET. In this session, to be conducted with available members of the CTW team, we will analyze results, identify most successful approaches, and establish priorities for the next phase of research.	**Contact:** Bruce Kimball: Bruce.Kimball@ARS.USDA.GOV Ken Boote: kjboote@ufl.edu **Participants:** this session is intended for the Maize Team and the CO2, Temp, and Water (CTW) Team. Others may participate with permission of the Co-Leads only. **Size:** 10 persons
April 23, 2018 Monday Afternoon 2 pm – 6 pm		
Anticipating Global and Regional Agricultural Risk	While drought affects many sectors, the agricultural sector and larger food system form a fundamental basis of a drought risk framework that links across sectors, scales, disciplines, and populations. In this session we will consider multi-model frameworks for assessing drought risk that could impact local farms, international markets, and water resources. The intent is to agricultural sector losses and food insecurity throughout society.	**Contact:** Alex Ruane: alexander.c.ruane@nasa.gov **Participants:** global gridded model experts and others **Size:** 10-20 persons
Better Modeling and Planning – how Researchers and Stakeholders work together for improved understanding and outcomes	How can researchers support policy decision making, setting priorities for research and development, actionable strategies towards farming futures facing complexity and uncertainty? We will share experiences from working with stakeholders to co-design agricultural pathways and identify adaptation strategies tested using integrated assessments. Pathways and scenarios are powerful tools for estimating impacts of climate change on vulnerable farm populations and address key challenges in agriculture. Co-designing improved management, mitigation and adaptation options contributes to national and regional decision processes, aligned with Sustainable Development Goals. This session will facilitate dialogue between researchers and stakeholders for improving impacts of agricultural research and decision making.	**Contact:** Roberto Valdivia: Roberto.valdivia@oregonstate.edu Sabine Homann-Kee Tui: s.homann@cgiar.org **Participants:** The session is open: We invite researchers and stakeholders to share their experience, expectations and requirements for modelling in the agricultural sector contributing to national decision and planning processes. **Size:** 10-20 persons
AgMIP-Wheat	The AgMIP-Wheat team will discuss recent progress, the new phase on extreme high yielding crops, possible new side activities and next steps.	**Contact:** Senthold Asseng: sasseng@ufl.edu and Pierre Martre: pierre.martre@inra.fr **Participants:** This session is for AgMIP-Wheat members only, with others attending by permission of Co-Leaders only (est. 20 persons)

April 23, 2018 Monday Afternoon 2 pm – 6 pm, continued		
Crop Modeling of Low-Input Smallholder Systems	In this session, we discuss and outline the intercomparison of crop models (as many as possible) for three datasets from three experiments (three locations) in Sub-Saharan Africa. The crop is maize. We will present the datasets and define the model parameterization and model runs with the different levels of input information for the three experiments. A list of crop models will be identified, and the climate change scenarios for the final model simulations will be discussed and defined.	**Contact:** Marc Corbeels: corbeels@cirad.fr Bruno Basso: basso@msu.edu **Participants:** This session is open to persons interested in applying crop model to datasets from sub Saharan Africa. **Size:** 10-20 persons

April 27, 2018 Friday Morning 9 am – 1 pm		
NAME	**DESCRIPTION**	**SESSION INFORMATION**
Latin America Modeling and Assessment Activities	This session will involve participants from any country of Central or South America with aspirations to establish AgMIP Integrated Assessments in your region. We will review the requirements of integrated assessment research, and discuss various initiatives and opportunities, including EuroClima+ and others.	**Contact:** Daniela Medina: daniela.medina@iica.int Kelly Witkowski: kelly.witkowski@iica.int **Participants:** open **Size:** 20 persons
April 27, 2018 Friday Session 9 am – 3 pm		
Joint Session, Executive Committee and Research and Region Leaders Forum	This session pertains to the underway, joint development of an AgMIP 5-year Strategic Plan. The Plan will be informed by accomplishments across AgMIP Activities and Research Themes. It will also be motivated by recognized challenges or deficiencies that must be collectively addressed in the agricultural systems modeling community to bring modeling to a higher plateau of capability and use. In addition to accelerating the capabilities of model systems to simulate future outcomes for research purposes, AgMIP is also committed to establishing the best possible information on current and likely future agricultural systems with consideration of societal goals, planning and decisions.	**Contact:** Alex Ruane: alexander.c.ruane@nasa.gov Carolyn Mutter: czm2001@columbia.edu **Participants:** Current Activity Leaders, Executive Committee and Steering Committee Members, Steering Committee Co-Chairs. Others by permission only, as space allows. **Size:** 25-30 persons

AgMIP's mission is improve substantially the characterization of world food security as affected by climate variability and change, and to enhance adaptation capacity in both developing and developed countries.

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